Commodity Currencies Revisited*

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Abstract

I build a "commodity strategy" for exchange rate forecasting that conditions on changes in the global prices of commodity indices. First, I document that commodity prices have significant out-of-sample predictive ability for the future exchange rates of several commodity exporters and importers on the daily frequency. However, unlike the findings of Chen, Rogoff and Rossi (2010), I report that the reverse forecasting regression does not survive out-of-sample testing. Second, I find a significant cross-sectional spread in both spot and excess returns of 6% p.a. between the currencies that are predicted to appreciate and those that are predicted to depreciate by the "commodity strategy". More importantly, the returns appear to be uncorrelated to those of popular exchange rate strategies such as the carry trade and currency momentum. Furthermore, the spread in returns is not explained by traditional risk factors; however, it is partly accounted for by the strategy's high transaction costs. "Net profitability" can be restored by either implementing a simple market timing rule or by investing in developed markets with low costs and high liquidity.

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1 Introduction

Commodity prices and exchange rates are linked in fundamental ways[1]. However, little is known about how this relationship evolves in the cross-section[2]. In this paper, I show that commodity prices contain significant information about the cross-section of future currency returns. I begin by showing that daily changes in commodity price indices can be used to forecast day-ahead movements in exchange rates. I then construct a trading strategy that takes a long (short) position in currencies that are expected to appreciate (depreciate), based on prior day's commodity price movements. I find that the returns on this long-short portfolio are approximately 6 per cent per annum. Portfolio returns peak in the heart of the recent financial crisis. They also appear to be uncorrelated with returns on other popular strategies such as the carry trade and currency momentum. Unlike existing studies of the commodity-currency relationship[3], I report out-of-sample (OOS) forecasting ability for the exchange rate using information from lagged commodity returns; on the contrary, the reverse forecasting regression does not survive OOS testing – that is, exchange rates do not forecast future commodity prices. Furthermore, the forecasting relationship between commodity price movements and currency returns weakens significantly as the forecasting period is lengthened from the daily level to the weekly and monthly levels. Together, these results suggest that although the information in commodity price movements is not reflected in exchange rates instantaneously, it does eventually get incorporated into currency prices after some time.

In recent years, commodity prices have reached all-time highs which have been followed by significant drops, the most notable one occurring towards the end of 2008. The increase in the popularity of commodity investing during the past decade has also been remarkable, rendering the study of the interrelation between commodities and other asset markets an important endeavour. The theoretical relationship between commodity prices and currencies relies on simple intuition: for commodity exporters, fluctuations in world commodity prices explain a large share of movements in their terms of trade (Bidarkota and Crucini (2000)). This is, in turn, a key determinant to exchange rate fluctuations (De Gregorio and Wolf (1994), Chinn and Johnston (1996), Montiel (1997). Recently, Ready, Roussanov and Ward (2013), provide a new theory for the relationship between exchange

[1]Research work by Chen and Rogoff (2003), Cashin Cespedes and Sahay (2004), and Chen, Rogoff and Rossi (2010), among others, link changes in world commodity prices with national real exchange rates of commodity exporting countries (commodity currencies), through the terms of trade channel and establish a long-run relationship between the two variables.

[2]There is a growing literature that deals with the cross-section of currency returns following the landmark work of Lustig and Verdelhan (2007). See also Lustig, Roussanov, and Verdelhan (2011) and Menkhoff, Sarno, Schmeling and Schrimpf (2012a) among other studies.

[3]Chen, Rogoff and Rossi (2010) argue that "commodity currency exchange rates have remarkably robust power in predicting global commodity prices, both in-sample and out-of-sample, and against a variety of alternative benchmarks". The authors maintain that the reverse relationship is significantly less powerful. Clements and Fry (2006) report similar results.

rates and commodities, and report that a commodity-based strategy explains a substantial portion of the carry-trade risk premia, and all of their pro-cyclical predictability with commodity prices and shipping costs. Overall, the literature studying the relationship between exchange rates and commodity prices documents the existence of an empirical link, but the direction of predictability remains largely unclear.

One of the key contributions of the present paper is the study of the economic structure of "commodity forecasted" returns in FX markets by gathering information from a large cross section of exchange rates. The evidence on the predictive ability of commodities in the cross-section of currencies is very limited as the literature has generally focused on time-series studies. In this context, it is natural to employ the portfolio approach given its emerging popularity and success in the study of currency behaviour. In my empirical analysis, I follow the recent literature (Lustig and Verdelhan (2007), Lustig, Roussanov, and Verdelhan (2011)) and Menkhoff, Sarno, Schmeling and Schrimpf (2012a)), and sort currencies into portfolios according to the predictions of the proposed commodity strategy. I start by forming currency portfolios where an investor is long in currencies with the highest predicted returns and short in currencies with the lowest predicted returns. I take the view of a U.S. investor and employ exchange rates against the U.S. dollar (USD). The data cover the period between January 2000 and November 2011, and I study a cross-section of 25 currencies. Throughout the empirical exercise I employ tradable commodity price indices in order to circumvent potential liquidity issues[4]. Then, as in Lustig, Roussanov, and Verdelhan (2011), I cross-sectionally relate the returns of the commodity strategy to a set of risk factors.

I employ daily, weekly and monthly data, as unlike most fundamental variables, commodity prices allow the possibility of finer sampling. Higher frequency data present the advantage of resolving empirical pitfalls such as temporal aggregation[5]. The motivation to look at the daily horizon is also driven by the empirical finding that short-term predictability has been extremely elusive throughout the exchange rate literature. Apart from the studies of currency order flow, a high frequency, almost contemporaneous, relationship between the exchange rates and fundamentals has only been reported by the literature of macroeconomic news announcements (Andersen, Bollerslev, Diebold and Vega (2003) and Faust, Rogers, Wang and Wright (2007). The recent work of Ferraro, Rogoff and Rossi (2012) is probably the first to document out-of-sample exchange rate predictability in the short run, using fundamental information (oil prices) that arrives at high frequency. Nevertheless, their analysis is primarily focused on the forecasting ability of oil prices, for the Canadian dollar. On the other

[4]These indices provide a benchmark for investment in the commodity markets while serving as a measure of commodity performance over time. They are available to market participants of the Chicago Mercantile Exchange.

[5]As Alan Taylor (2001) observes, "*if we suspect that the actual adjustment horizon is of the order of days, then monthly and annual data cannot be expected to reveal it*".

hand, their results regarding a handful of commodity currencies paint a mixed picture when it comes to out-of sample forecasting.

In line with the literature on commodity currencies, I document a strong relationship between commodities and exchange rates; I find that commodity prices have significant out-of-sample (OOS) predictive ability for the future exchange rates for 16 out of 25 commodity exporters and importers, on the daily frequency. The OOS predictive ability of lagged commodity prices for the exchange rate weakens when moving from the daily to the weekly frequency and almost disappears in the monthly frequency, which is consistent with the temporal aggregation argument. Commodity prices also Granger-cause exchange rates in 20 out of 44 cases on the daily frequency, but the relationship becomes weaker on weekly and monthly frequencies. However, unlike the findings of Chen, Rogoff and Rossi (2010), I report that the reverse forecasting regression provides weaker Granger-causality evidence in all cases and does not survive out-of-sample testing. This result is mainly attributed to the larger country sample under examination. I report that the proposed "commodity strategy", when implemented daily, leads to economically significant, unconditional spot excess returns that appear uncorrelated to popular FX strategies such as the carry trade and currency momentum. In addition, a sub-sample exercise reveals that the strategy works well across the sample period but displays even stronger performance during the crisis period.

Currency markets are among the most liquid in the world, displaying large transaction volumes and low transaction costs, while their participants are to a large extent professional investors, facing no short-selling constraints. Hence, if markets are efficient, any information that is contained in commodity price movements should be reflected in exchange rates instantaneously. In order to account for these high returns, I explore whether the "commodity strategy" is affected by (i) measures of risk that have been found to fare well in the exchange rate literature, such as global FX volatility risk and currency momentum (e.g. see Menkhoff, Sarno, Schmeling and Schrimpf (2012a and b)), (ii) risk factors motivated by the equity market literature and (iii) transaction costs. I find that the returns cannot be explained in a linear asset pricing framework (Ang, Hodrick, Xing, and Zhang (2006)) by standard measures of exchange rate risk; nevertheless, factors such as the interest rate and the equity market appear to negatively correlate with the strategy returns. However, the impact of transaction costs is non-trivial; adjusting returns for bid-ask spreads can erode profitability completely. This is particularly true when the strategy is implemented using a number of emerging market currencies which display large bid-ask spreads which act as barriers to arbitrage activity. The exploitability problem can, however, be circumvented if the investor trades only developed market currencies, which showcases the validity of the strategy for different exchange rate panels. In essence, the ordered portfolios need not necessarily be skewed towards currencies with high transaction costs.

I also investigate the performance of a simple market timing strategy. I next turn to mispricing: when there is slow information diffusion / limited attention, it takes time for information to be transmitted from one asset class to another (Daniel, Hirshleifer, and Teoh (2002), Hirshleifer and Teoh (2003) and Lim and Teoh (2010)). Since prices should eventually reflect information, return predictability should fade away with the passage of time. My findings suggest that this is indeed the case; return predictability using lagged commodity prices holds at the daily level, but weakens significantly at the weekly and monthly level.

My work also contributes to the literature that investigates the relationship between exchange rates and fundamentals. The link between exchange rates and economic fundamentals has been elusive, especially for short horizons, and various anomalies have emerged throughout the years[6]. Commodity currencies have been known to offer an attractive laboratory for the study of this link[7]. The relationship between currencies and commodities was first observed by Amano and Norden (1993) and Gruen and Kortian (1996). Despite the likely omission of other explanatory variables, a simple, empirical model of commodity prices and exchange rates has shed some light on the relationship between commodities and expected exchange rate returns. Chen and Rogoff (2003) document that the US dollar price of commodity exports has a significant effect on the real exchange rates of Australia, New Zealand, and to a lesser extent, Canada. Follow-up work by Cashin, Cespedes and Sahay (2004), among others, provides evidence of a long run relationship between real exchange rates and real commodity prices for approximately one third of the commodity-exporting countries in their sample. An important strand of this literature has also focused on the forecasting power of commodities for the exchange rate, reporting limited predictability success, except for the recent work of Ferraro, Rogoff and Rossi (2012), who find robust evidence at the daily frequency. At the same time, currencies are found to forecast commodity price changes with relative success. Clements and Fry (2006) find less evidence that currencies are affected by commodities than that commodities are affected by the commodity currencies. In the same lines, Chen, Rogoff and Rossi (2010) argue that "commodity currency exchange rates have remarkably robust power in predicting global commodity prices, both in-sample and out-of-sample, and against a variety of alternative benchmarks", although the reverse relationship is found to be significantly less powerful. Their theoretical explanation is that exchange rates are forward looking, while commodity price fluctuations are more prone to short-term demand imbalances.

[6]The puzzles in exchange rate economics relate to the most prominent fundamental models, namely the Uncovered Interest rate Parity (UIP), Purchasing Power Parity (PPP) and Monetary Fundamentals model (MF), and have been extensively studied by finance scholars (Obstfeld and Rogoff (2000)).

[7]As Chen, Rogoff and Rossi (2010) observe, a simple model of exchange rates and commodities is less impaired by endogeneity issues as compared to other exchange rate models that employ standard macroeconomic fundamentals.

Overall, a careful reading of the literature on commodity currencies suggests that commodity prices emerge as a variable of significance for the exchange rate. Along these lines, there could exist a positive or negative price of commodity risk. I deviate from the traditional approach motivated by the observation that, so far, it has yet to be established whether a currency investor could benefit from the information embedded in commodity price changes extracting information from the cross-section of returns. I go beyond earlier work on commodity currencies by exploring the cross-sectional dimension in an asset pricing framework and by extending the country panel to include both commodity exporters as well as importers in order to study whether the documented relationship holds for commodity currencies only,

The remainder of the paper is organized as follows. Section 2 sets the framework employed in the construction of the proposed commodity strategy. Section 3 describes the data and presents the results of the Granger-causality tests and the out-of-sample forecasting exercise. Section 4 presents descriptive statistics for the formed currency portfolios and compares the commodity strategy to the carry trade. Section 5 presents the results from the asset pricing exercise. Section 6 discusses the potential importance of other factors such as the interest rate and the equity market. In Section 7, I report the robustness checks and presents a simple market-timing exercise. Section 8 concludes.

2 Framework for the Commodity Strategy

As primary commodities dominate the exports of several countries, fluctuations in world commodity prices potentially explain a non-trivial share of movements in their terms of trade (Bidarkota and Crucini (2000)). At the same time, terms of trade fluctuations have long been considered a key determinant of real exchange rates (De Gregorio and Wolf (1994), Chinn and Johnston (1996), Montiel (1997)). Research work by Chen and Rogoff (2003) and Cashin Cespedes and Sahay (2004) link changes in world commodity prices with national real exchange rates of commodity exporting countries through the terms of trade channel and establish a long-run relationship between the two variables. The intuition is simple: for commodity exporters, whose size in the world commodity market is relatively small to justify the assumption that they are a price-taker in that market, fluctuations in world commodity price movements generally explain a large share of movements in their terms of trade, which in turn is a key determinant to the exchange rate fluctuations[8]. As improve-

[8]Ready, Roussanov and Ward (2013), using a model of the shipping industry to model trade costs, provide a new theory for the relationship between exchange rates and commodities, and report that a commodity-based strategy explains a substantial portion of the carry-trade risk premia, and all of their pro-cyclical predictability with commodity prices and shipping costs. They show that the differences in average interest rates and risk exposures between countries that are net importers of basic commodities and commodity-exporting countries can be explained by appealing to a natural economic mechanism, trade costs. However, their empirical strategy is static; hence, their results are of different nature than those of the present study.

ment in the terms of trade through an increase of export prices will lead to currency appreciation, deterioration in the terms of trade through an increase of import prices will cause depreciation of the currency. Following this line of reasoning, I argue that commodity price movements are of great importance to commodity importers as well.

Figure 1, shows that the link between commodity prices and the terms of trade of commodity exporters is tight. Specifically, the terms of trade of Canada display an evident comovement with the price of brent and natural gas; the same is true for the terms of trade of Mexico and the price of brent and silver and for the terms of trade of Brazil and the price of brent and agriculturals. What is of particular interest is the evolution of the terms of trade of Japan, a major commodity importer, with the price of brent.

FIGURE 1 ABOUT HERE

Japan's terms of trade are worsening with the rise of brent price and vice versa. Naturally, the exchange rate of big "net importers" is also prone to commodity price shocks through the terms of trade channel. It follows that one can study the link between exchange rates and commodity prices by exploiting information from a larger cross-section of countries irrespective of their trade balance.

Since the scope of my analysis is to compile a country panel that consists both of commodity importers and exporters, it is important to be accurate about the commodities that could have an actual impact on the exchange rate of each country. The estimation equation is based on a standard model of commodity prices and exchange rates, with the difference that I allow the regressions to be country-specific, according to the most "important" commodity imports or exports for each country. I therefore distinguish among 25 different specifications of the basic regression equation by including on the RHS of the equation the commodities that account for five per cent - or above - of the total gross domestic product (GDP) of each country, according to data collected from the United Nations Commodity Trade Statistics Database, for which there exist tradable commodity index series (see Table 1.):

$$\Delta s_{k,t+1} = a_k + \sum_{m \in M} \beta_{k,m} \Delta P_{t,m} + u_{k,t+1}, \tag{1}$$

where $\Delta s_{t+1} \equiv s_{t+1} - s_t$, s_t denotes the logarithm of the spot exchange rate (foreign price of domestic currency, with US dollar being the domestic currency) at time t, k stands for the country, ΔP_t is the commodity price change, m denotes a commodity that constitutes five per cent or more of the country's GDP, M is the total of all commodities that are important for each country, and u_{t+1} is the forecast error. By including commodities individually, instead of constructing an index, I allow the exchange rate to respond differently to individual commodity price changes. Furthermore, Bidarkota and Crucini (2000), find that variation in the world prices of three or fewer key exported commodities account for 50% or more of the annual variation in a country's terms of trade.

TABLE 1 ABOUT HERE

Table 1 also reports the betas of the full sample estimation of equation (1) along with their statistical significance. An increase in the price of commodity exports always coincides with an appreciation of the foreign currency and this is a statistically significant result. However, a price increase of commodity imports - an increase in the price of brent for a net brent importer for instance - does not necessarily correspond to foreign currency depreciation; the USA being the biggest brent importer bares a heavier burden of the crude price increases through a relatively bigger deterioration of their terms of trade, leading most of the times to an appreciation of the foreign currency (all exchange rates are quoted versus the US dollar). However, the coefficient for Japan (another large brent importer) is negative, suggesting that a rise in the price of crude coincides with a depreciation of the Japanese yen the following period.

As an additional preliminary check, the currencies are ranked in terms of their betas from an estimated regression of the currencies on the composite Spot Commodity Index from the Standard & Poors, Goldman Sachs Commodity Index spot price series (formerly the Goldman Sachs Commodity Index series)[9], by using both the US dollar and the British pound as a numeraire. This constitutes the only non-country specific estimation and it is employed for purely illustrative purposes. The rankings are displayed in Table 2. In both cases, the commodity currencies populate the top of the table, corresponding to betas which are higher in value, providing a first indication that the estimated relationship between currencies and commodities yields meaningful estimates. In other words, commodity currencies respond on average "more aggressively" to commodity price changes.

TABLE 2 ABOUT HERE

3 Data and Empirical Analysis

The present section details the currency and price data used in the empirical exercise. The data for spot exchange rates and 1-month forward exchange rates versus the US dollar (USD) and the British

[9] This index tracks the prices of major physical commodities for which there are active, liquid futures markets.

pound (GBP) (via triangular arbitrage) cover the sample period from January 2000 to November 2011, and are obtained from Reuters (via Datastream). The reason I choose to restrict my sample to the past decade is that I wish to restrict the periods of inflation and exchange rate turmoil, relevant for some of the countries in my sample prior to 2000. The empirical analysis is carried out at the daily, weekly, and monthly frequency and I work in logarithms of spot and forward exchange rates. My panel comprises the following 25 countries: Australia, Brazil, Bulgaria, Canada, Chile, Croatia, Czech Republic, Euro area, Hungary, India, Indonesia, Israel, Japan, Mexico, New Zealand, Norway, Philippines, Poland, Russia, Singapore, South Africa, Sweden, Switzerland, Thailand and the United Kingdom.

With respect to the commodity price series, I employ the Standard & Poors, Goldman Sachs Commodity Index spot price series (formerly the Goldman Sachs Commodity Index series) which serve as a benchmark for investment in the commodity markets, for the following commodities: agriculturals, aluminium, brent crude, copper, energy, gold, industrial metals, livestock, natural gas, precious metals, silver and wheat. I construct the commodity shares using data from the United Nations Commodity Trade Statistics Database.

3.1 Granger-Causality Tests and Out-of-Sample Forecasts

In the present section, I examine the in-sample and out-of-sample forecasting ability of commodity prices for the exchange rate and vice versa, following the findings of Chen, Rogoff and Rossi (2010). For this purpose, I look at the relationship between exchange rates and commodity prices both in terms of Granger-causality and out-of-sample forecasting ability relative to the random walk (RW), given its prevalence as a benchmark in the exchange rate literature.

3.1.1 Do Commodity Prices Contain Information about Exchange Rates?

I first study the empirical evidence on in-sample Granger-causality, following the traditional testing procedure. The analysis includes one lag of each of the explanatory and dependent variables, but the overall picture is not altered with the inclusion of additional lags. Table 3 reports the results, for the daily frequency, based on a standard Granger-causality regression of the type:

$$\Delta s_{t+1} = \beta_0 + \beta_1 P_t + \beta_2 \Delta s_t + u_{t+1}$$

for the 25 exchange rates and their corresponding commodity price indices. The table reports the p-values for the test of the null hypothesis that $\beta_0 = \beta_1 = 0$, so a number below 0.05, for instance, implies evidence in favor of Granger-causality (at the 5 per cent level). In general, Granger-causality tests find some evidence of commodity prices Granger-causing exchange rates as the null of no Granger-causality is rejected for 20 out of the 44 cases. The results for the weekly and monthly frequency are reported in Tables 1 and 2 of the Appendix. In general, the results appear weaker in lower frequencies. In particular, commodity prices are found to Granger-cause exchange rates only 21% percent of the times on the weekly frequency and 14% of the times on the monthly frequency. What is striking though, is that commodity importers constitute a non-trivial part of the subsample of the countries for which IS predictability is detected. This is a robust finding across frequencies.

TABLE 3 ABOUT HERE

I complement this part of the analysis with an out-of-sample forecasting exercise. In particular, I estimate the country-specific regressions using a rolling window of three years. As Chen, Rogoff and Rossi (2010) note, one should keep in mind that many commodity exporters experienced major changes in policy regimes and / or market conditions. Hence, the importance of allowing for time-varying parameters should not be undermined. For this purpose, I estimate each model using the first 780 data points (three years of data) for the initial one-period-ahead forecast to be generated. Subsequently, the first data point is discarded while an additional data point at the end of the sample is added and the model is re-estimated. For each of the models described above I construct a one-day-ahead forecast at each step. The data from January 2000 to December 2002 are employed for estimation and the rest are saved for out-of-sample forecasting. The out of sample forecasts, hence, refer to the period between January 2003 and November 2011.

I report results relative to the random walk benchmark due to its significance in the exchange rate literature. I report the difference between the mean square forecast error (MSFE) of the "commodity price model" and the MSFE of the RW benchmark, re-scaled by their variability. I further present the t-statistics of the test of equal forecasting performance (Clark and West, 2006) to compare the two nested models. A t-statistic greater than +1.282 (for a one-sided 0.10 test) or +1.645 (for a one-sided 0.05 test) implies that the larger model contains out-of-sample forecasting power for the dependent variable.

Table 4 shows that commodity prices have some forecasting ability for exchange rates, even out-of-sample on the daily frequency. The "commodity price model" outperforms the RW benchmark in forecasting exchange rate changes for 16 out of 25 countries. This number falls to 8 for the weekly frequency and to 3 for the monthly frequency (Appendix tables 3 and 4).

Overall, the evidence in favour of in-sample predictability and OOS forecasting power of commodity prices for the exchange rate, at daily frequency, is quite striking. The findings however are not robust moving to weekly and monthly lower frequencies suggesting ephemeral predictability, in line with the results of Chen, Rogoff and Rossi (2012). However, it appears that the daily forecasting power of commodity prices for the exchange rate is a general result which is not unique to oil prices and / or commodity exporters.

TABLE 4 ABOUT HERE

3.1.2 Do Exchange Rates Contain Information about Commodity Prices?

I repeat the Granger-causality test and the out-of-sample exercise in order to test for the reverse relationship, i.e. if exchange rates contain information about commodity prices.

The Granger-causality regression is now of the type:

$$\Delta P_{t+1} = \beta_0 + \beta_1 \Delta s_t + \beta_2 \Delta P_t + u_{t+1}$$

Again, Table 5 reports the results of the p-values for the test of the null hypothesis that $\beta_0 = \beta_1 = 0$. In this instance, Granger-causality tests report little evidence of exchange rates Granger-causing commodity prices as the the null of no Granger-causality is rejected only for six out of the 44 cases.

TABLE 5 ABOUT HERE

In addition, the out-of-sample analysis shows little evidence of exchange rate changes forecasting commodity price changes better than the RW benchmark. Table 6 shows that exchange rates have little forecasting ability for brent prices out-of-sample. The “exchange rate model” outperforms the RW benchmark in forecasting brent price changes for only 3 out of 25 countries. The predictive ability of the exchange rate for other commodity prices -not reported here to conserve space but available upon request - paints a similar picture.

TABLE 6 ABOUT HERE

Both exercises are repeated in weekly and monthly frequencies. The results appear robust across frequencies and are reported in Tables 5 through 8 of the Appendix.

3.2 Commodity Portfolios and Descriptive Statistics

The present section moves beyond statistical predictability. Given the long-established relationship between commodities and currencies and the encouraging results of the previous section on the daily frequency, a natural step is to investigate the economic structure of "commodity forecasted" returns in FX markets, gathering information from the cross section of currency returns. Remarkably, the evidence on the predictive ability of commodities in the cross-section of currencies is very limited, as the literature has generally focused on time-series studies.

Following Lustig and Verdelhan (2007), I sort currencies according to the forecasted returns of the commodity strategy and allocate them to portfolios. Unlike their work, I focus on daily investment horizons and perform the exercise using both spot and excess returns. In both cases, Portfolio 1 contains the currencies with the highest sell signal and Portfolio 5 contains the currencies with the highest buy signal. I further construct an Average Portfolio that contains all the currencies and a Corner Portfolio which essentially invests in the long-short strategy: Portfolio 5 - Portfolio 1. A typical example is the following. Let us consider a US investor who builds a portfolio by allocating her wealth among 25 assets that are identical in all respects except for the currency of denomination (GBP, CHF, JPY, CAD, AUD, NZD, SEK, NOK, EUR, ZAR, SGD, CZN, HUF, INR, IDR, MXN, PHP, THB, PLN, BRL, RUB, HRK, ILS, BGN, and CLP). The main objective of the analysis is, to determine whether there is economic value in predicting the FX returns using commodity price changes as a criterion for portfolio selection. The investor rebalances her portfolio on a daily basis by taking a long position on the five currencies that she expects to appreciate the most, simultaneously shorting the five currencies that she projects to depreciate the most, over the horizon of one day. Each day she takes two steps. First, she uses the respective model to forecast the cumulative long-short portfolio return. Second, conditional on the forecast, she dynamically rebalances her portfolio following the long-short strategy described above. The return from domestic riskless investing is proxied by the 1-month US Eurodeposit rate. All portfolios are equally weighted and the excess returns for each one of them are calculated as follows:

$$r_t = \ln(S_{t+1}) - \ln(F_t) \tag{2}$$

where F_t is the one-day forward exchange rate.

In order to measure the economic value of each strategy, I rely on the Sharpe Ratio, which is a commonly used measure of economic value in the context of mean-variance analysis. In assessing the profitability of the dynamic strategies, at this stage, the effect of transaction costs is not taken into consideration.

The descriptive statistics for the seven commodity portfolios are displayed in Table 7 for the spot (Δs_{t+1}) and excess return ($\ln(S_{t+1}) - \ln(F_t)$) cases. The results show that there appears to be high economic value associated with the Corner Portfolio strategy. Additionally, the returns and the Sharpe Ratios of the strategies are monotonically increasing as one moves from Portfolio 1 to Portfolio 5, using either the spot or excess returns series. There is not a clear monotonic pattern regarding the standard deviations, and the skewness and kurtosis measures. However, one can observe that the extreme values with respect to the second, third and fourth moments consistently appear in Portfolios 1 and 5.

TABLE 7 ABOUT HERE

At this point one should note that the inspection of Table 7 reveals something more important. Although the Average Portfolio's Spot Return is lower than the Average Portfolio's Excess Return, (2.89% versus 4.67%), the Corner Portfolio's Spot Return is greater than the Corner Portfolio's Excess Return (6.03% versus 5.32%), which is in stark contrast to what the literature in carry trades tells us about the return nature of the carry strategy. This result offers a clear, first indication that the returns to the commodity strategy are potentially uncorrelated with the returns to standard exchange rate strategies such as the carry trade. In order to test for this, as a first step, I construct five carry trade portfolios with the exchange rates sorted into portfolios according to their lagged forward premium, as in Lustig and Verdelhan (2007).

4 Comparing the Commodity Strategy to Carry Trade

It is of great importance to know whether the constructed commodity strategy does nothing more than simply replicating the nature of returns of other popular exchange rate strategies such as the carry trade. My findings point out that is not the case.

For this purpose, I build a standard carry trade strategy and repeat the portfolio formation process. The currencies are again allocated to five portfolios based on their forward discounts at the end of period t. Sorting on forward discounts is equivalent to sorting on interest rate differentials since Covered Interest Parity holds closely in the data at the frequency analyzed in this paper (see e.g. Akram, Rime, and Sarno (2008)). I re-balance the portfolios at the end of each day. This is repeated day by day during the corresponding period. Currencies are ranked from low to high:

Portfolio 1 contains currencies with the lowest and portfolio 5 contains currencies with the highest interest rates. Daily excess returns for holding foreign currency k, say, are again computed as before.

The properties of carry trade-sorted portfolios are displayed in Table 8. The table presents descriptive statistics for the seven portfolios (as before, Portfolios 1-5, Average and Corner Portfolio) for both spot and excess returns.

TABLE 8 ABOUT HERE

The upper panel of Table 8 displays the results for the spot carry trade returns; a first observation is that there is not a monotonically increasing pattern in average returns. The Corner Portfolio appears to be loss-making, yielding an annualized return of -1.23%. The higher moments of the return distribution also present a mixed picture with no pattern emerging. This does not necessarily constitute a puzzling finding since the literature on carry trades focuses on the study of excess returns. Indeed, an inspection of the lower panel of Table 8, which presents the excess returns for the carry trade strategy, reveals that the returns and Sharpe Ratios of the carry trade and commodity corner portfolios are comparable. However, the higher moment patterns appear to be quite dissimilar. In particular, the carry trade strategy, when implemented on excess returns, displays almost monotonically increasing annualized standard deviations moving from Portfolio 1 to 5. Skewness also displays a decreasing pattern.

Furthermore, Table 9, presents the correlation coefficients between the spot returns to the commodity strategy and the spot returns to the carry trade strategy[10]. Correlations are reported between corresponding portfolios. It is evident that despite the fact that correlations between the spot returns for Portfolios 1-5 are positive and quite substantial in magnitude, there is a marginally negative correlation of -0.084 between the returns of the two corner portfolios. Therefore, the returns to the two strategies are clearly uncorrelated; in fact, there should exist diversification benefits when the commodity strategy is used in conjunction with the carry trade strategy.

TABLE 9 ABOUT HERE

Finally, following Menkhoff et al. (2012b), I double-sort currencies into two portfolios depending on whether their lagged forward discount is above or below the panel median, and subsequently into two portfolios according to their forecasted value with respect to the commodity strategy regression.

[10] Correlation coefficients between the excess returns to the commodity strategy and the carry trade strategy are equal to the second decimal digit and are not, therefore, reported seperately.

The rebalancing frequency is always daily. The results of this exercise appear in Table 10. An inspection of the findings reveals that it makes a big difference whether the commodity strategy is implemented in high or in low interest rate currencies. In particular, in the high interest rate currency environment, the strategy yields negative returns while in the low interest rate currency environment the revenues amount to a positive return of 4.42% per annum. Likewise, the carry trade appears to be profitable only in the subsample of the currencies that are predicted to depreciate by the commodity strategy. In contrast, the carry trade is loss making in the subsample of the currencies that are predicted to appreciate by the commodity strategy.

TABLE 10 ABOUT HERE

Once again, the results do not indicate a positive relationship between the commodity strategy and the carry trade. However, it seems that one cannot easily achieve greater returns than those of the corner portfolios of the two strategies taken individually by following a double-sorting strategy which further reinforces the possibility of a hedging relationship between the two strategies.

As a natural step, in the following section I try to identify common factors in the cross-section of the commodity strategy's currency returns (spot and excess).

5 Empirical Results

5.1 Common Factors in Currency Returns

Following Lustig, Roussanov and Verdelhan (2011) who employ a data-driven approach following the Arbitrage Pricing Theory of Ross (1976), I conduct a principal component analysis on Portfolios 1-5 of the commodity strategy. The results, portrayed in Table 11 (Panels I and II), show that the first two factors explain 87 per cent of the return variation of the commodity portfolios. The first 5 rows of the two panels reveal the factor loadings of the five commodity portfolios on principal components 1-5. The first principal component accounts for 75 per cent of the return variation. As in Lustig, Roussanov and Verdelhan (2011), who study the principal component analysis of the carry trade, the first principal component can be viewed as a level factor given that the loading of the portfolios always lies between 42 per cent and 47 per cent. The second principal component, accounts for 12 percent of the common variation. The loadings increase in a monotonic fashion across portfolios for the second principal component, which behaves in the same way as the "slope factor" of Lustig, Roussanov and Verdelhan (2011) and is hence, the sole candidate risk factor which can account for the cross-section of commodity portfolio returns. As in Lustig, Roussanov and Verdelhan (2011), I employ the average currency return as my first factor, which I denote DOL. The correlation of the first principal component with DOL is found to be 0.99 which again constitutes a standard result.

TABLE 11 ABOUT HERE

5.2 Asset Pricing Methodology

This section briefly summarizes my approach to cross-sectional asset pricing. I rely on a standard SDF approach (Cochrane (2005)) as well as on a traditional Fama MacBeth two-pass OLS methodology (Fama and MacBeth (1973)) to estimate the factor risk prices and portfolio betas.

5.2.1 SDF Approach

The no-arbitrage relation holds so that risk-adjusted currency excess returns have a price of zero and satisfy the Euler equation:

$$E[m_{t+1}rx^i_{t+1}] = 0,$$

where $m_t = 1 - b'(h_t - em)$, is the linear SDF , h stands for the risk factor vector, b is the SDF parameter vector and em stands for the vector of factor means.

The setting suggests:

$$E[rx^i] = \lambda'\beta_i,$$

a beta pricing model, in which expected excess returns depend on factor risk prices λ and risk quantities β_i for each portfolio i, where $\lambda = \sum_h b$ (Cochrane (2005)).

The Euler Equation is estimated using the generalized method of moments (GMM) of Hansen (1982). I do not use instruments apart from a constant vector of ones. The factor means em and the elements of the covariance matrix of h are estimated simultaneously with the SDF parameters via adding the respective moment conditions to the asset pricing moment conditions implied by the Euler equation. The one-step specification allows one to sufficiently account for estimation uncertainty as Burnside (2009) notes.

Tables 14-15 present β and λ estimates with Newey and West (1987) standard errors, cross-sectional R^2s,and the Hansen-Jagannathan (HJ) distance metric (Hansen and Jagannathan (1997)) with simulated p-values.

5.2.2 Fama MacBeth Approach

I also employ the FMB two-pass OLS methodology for consistency. A constant is not included in the second stage of the FMB regressions, i.e. I do not allow a common over- or under-pricing in the cross-section of returns. In line with the findings of Menkhoff et al. (2012a), since DOL has basically no cross-sectional relation to the strategy's portfolio returns, it seems to serve the same purpose as a constant that allows for a common mispricing. I report standard errors with Newey and West (1987) adjustment.

5.3 Asset Pricing Results

5.3.1 Carry HmL as a Pricing Factor

It follows from the previous section that the Corner Portfolio of the carry trade strategy (henceforth termed CHML for simplicity) should be tested as a candidate second factor for the pricing kernel. Panels A1 and B1 of Table 12 present the cross-sectional pricing results of the tests using the commodity portfolios 1-5 as test assets and DOL and CHML as factors.

The results indicate that the DOL factor is highly correlated with the returns of Portfolios 1-5. The betas on the DOL factor are all close to one in value, and statistically significant. The betas of the CHML factor decline, although not monotonically, from 0.11 for Portfolio1 to 0.02 for Portfolio 5. They are statistically significant for three out of five portfolios. While the R^2s for the five regressions are large, this result is not surprising as sorting portfolios on the basis of the commodity price predictions produces a monotonic ordering of the expected returns. The R^2s of the cross-sectional regression are in the range of 0.28 but the factor risk price λ for CHML is negative.

5.3.2 The Volatility Proxy

Following Menkhoff et al. (2012a) and Burnside, Eichenbaum and Rebelo (2011), I employ a measure of global currency volatility, denoted by VOL. The measure is effectively the average sample standard deviation of the daily log changes in the values of the currencies versus the USD. It is measured monthly and is given by the following formula:

$$\sigma_t^{FX} = \frac{1}{T_t} \sum_{\tau \in T_t} \left[\sum_{k \in K_\tau} \left(\frac{|r_\tau^k|}{K_\tau} \right) \right],$$

where K denotes the number of available currencies on day τ and T_t denotes the total number of trading days in month t.

Keeping DOL as a first factor and replacing CHML by innovations to global FX volatility (henceforth termed VOL) the pricing kernel yields the results detailed in Panels A2 and B2 of Table 12. The VOL factor does not fare well in terms of coefficients' significance or monotonicity patterns for Portfolios 1-5. In addition, the cross-section results reveal that the VOL factor, clearly, does not price the cross section of commodity portfolio returns.

5.3.3 Exchange Rate Momentum

I further examine a momentum factor for the exchange rate. In line with the results of Menkhoff et. al. (2012b), I form five portfolios on the basis of the currencies' lagged returns over the past month which are held for one month. The constructed factor is essentially the momentum long-short portfolio i.e. Portfolio 5-Portfolio 1. The results for the Momentum Factor (FXMOM) are presented in Panels A3 and B3 of Table 12. Similarly to the Volatility Proxy, the Momentum Factor does not yield significant coefficients, neither does it price the cross-section of commodity portfolio returns.

TABLE 12 ABOUT HERE

5.3.4 The Fama-French Factors

Finally, a employ a comprehensive set of factors that relate to the equity market motivated by the findings of Chen and Tsay (2011). In particular, I collect six different factors computed on a daily basis from Kenneth French's website and namely the Equity Market (MKT), Small minus Big (SMB), High minus Low (EHML), Equity Momentum (EMOM), Short-Term Reversal (STREV) and Long-Term Reversal (LTREV) factor. Table 13 summarizes the results of the asset pricing exercise when the Fama-French factors are employed.

The Fama-French factors, in general, fare a lot better than the standard exchange rate factors in explaining the cross section of commodity returns with the market factor being the best. In particular, the betas of the MKT factor decline, almost monotonically, from Portfolios 1 to Portfolio 5; furthermore, they are statistically significant for three out of five portfolios. In addition, the R^2 of the cross-sectional regression is large. Nevertheless, as in the case of CHML, the price of risk appears to be negative The SMB factor is probably the least successful, displaying little significance and no patterns for portfolios 1-5 and no significance and zero R^2 in the cross section. EHML also fares poorly, while EMOM, on the other hand, gives good cross section results but provides less information in the individual portfolio regressions. Last but not least, STREV and LTREV appear to contain some information about the cross section of commodity returns while providing some meaningful spreads in the individual portfolio regressions.

TABLE 13 ABOUT HERE

However, despite the number of candidate variables examined, I do not manage to identify a risk factor that prices the cross section of the test assets, as the price of risk, λ, is never correctly signed and statistically significant.

5.4 Discussion

The asset pricing results of the previous section appear rather inconclusive. Although it is possible to identify few factors that contain some information about the constructed commodity strategy, they tend to display a negative correlation with a plausible risk factor. Also, according to the results of the previous section, exchange rate returns stemming from a simple commodity strategy appear to be negatively related to the returns from other popular exchange rate strategies such as the carry trade. How does this finding fit in the commodities literature?

Gorton and Rouwenhorst (2006) note that commodities display high Sharpe ratios and low correlations with other asset classes. They suggest that this argument is compatible with the theory of backwardation and market segmentation. Bessembinder and Chan (1992) further maintain that variables that have predictive power over bond and stock returns and namely Treasury bill yields, equity dividend yield and the "junk" bond premium, are also able to forecast commodity returns. They attribute the negative correlation between commodities and other asset classes to a certain extent to different behaviour over the business cycle. Hence, it could be that the proposed commodity strategy appears to be unrelated to the equity market portfolio, as well as to the carry trade, because of this low correlation between commodities and equities, as well as between the short rate and commodity future returns respectively. This hypothesis is also in line with the findings of Büyükşahin, Haigh and Robe (2008), who report that commodities provide benefits to equity investors in terms of portfolio diversification. The authors also find that even during the more recent years that investors have sought bigger exposure to commodities, there has not been an increase in the comovement between the returns on the two investments.

Last but not least, Frankel (2006) pushes for the existence of a negative relationship between interest rates and commodity prices. He argues that interest rates are transmitted into commodity currencies through the “extracting decision”, the carrying cost of inventories and through financial speculation in commodity markets

The issue, however, remains that the asset pricing exercise does not allow us to identify a priced factor of the proposed commodity strategy. In other words, the results indicate that the returns of the strategy cannot be understood as compensation for risk. Therefore, the unconditional excess returns of the commodity strategy should either be attributed to some market inefficiency or to existing limits to arbitrage. In this context, a mispricing story is also of relevance: when there is slow information diffusion / limited attention, it takes time for information to be transmitted from one asset class to another (Daniel, Hirshleifer, and Teoh (2002), Hirshleifer and Teoh (2003) and Lim and Teoh (2010)). Since prices should eventually reflect full information, return predictability should fade away with the passage of time. My findings point towards this direction; return predictability holds at the daily level, but weakens significantly at the weekly and monthly level. The empirical results of this paper are not adequate to fully address this issue; however, the following section further explores some of the aforementioned arguments.

6 Robustness

6.1 Sub-sample Analysis

In order to establish that my results are not driven by a spike in correlations during the global financial crisis, I divide the sample into two sub-samples around the crisis period. The first sub-sample contains observations up to the end of June 2007 and the second sub-sample contains observations between July 2007 until the end of the sample. I then calculate descriptive statistics for spot and excess returns as before. The descriptive statistics for the seven commodity portfolios are displayed in Tables 14 and 15 for the spot and excess return cases respectively. The results suggest that the monotonic ordering of the five portfolios persists across sub-samples. Additionally, the Sharpe Ratios of the strategies are higher in the post-crisis period for both the spot and excess returns series, indicating that the proposed strategy behaves as a fundamental strategy. Again, there is not a clear monotonic pattern regarding the standard deviations, and the skewness and kurtosis measures. However, once more, the extreme values with respect to the second, third and fourth moments consistently appear in Portfolios 1 and 5 for both sub-samples.

TABLES 14 & 15 ABOUT HERE

At this point, it would be also interesting to look at the coevolution of the spot and excess cumulative returns of the commodity strategy with the carry trade. Figure 2 is indicative of the previously detected negative relationship between the two strategies.

FIGURE 2 ABOUT HERE

6.2 Exploitability of the Commodity Strategy

My analysis has so far ignored the exploitability of the proposed commodity strategy. This is an important concern given that the rebalancing frequency is daily and the employed currency universe includes emerging market currencies which are known to display high bid-ask spreads. In order to address this issue, I calculate net spot returns for the five portfolios based on the commodity strategy predictions, for all 25 currencies, by adjusting spot returns for bid-ask spreads. Following Goyal and Saretto (2009) and Menkhoff et al. (2012), I employ the 50% of the quoted bid-ask spread as the actual spread. This is still a conservative choice given that Gilmore and Hayashi (2011) report that actual transaction costs stemming from bid-ask spreads probably constitute a lot less than 50% of the quoted bid-ask spread. Table 16 display the results of this exercise for spot and excess returns.

TABLE 16 ABOUT HERE

I find that, at first glance, it does not seem possible to exploit the information arising from the commodity strategy. The spot returns to Portfolios 1-5 are all negative and, hence, economically unappealing. In the light of these results, there does not appear to be any need to construct the corner portfolio as it will evidently be loss making. However, the inspection of Tables 18 and 19 reveals some additional information. In particular, the monotonicity of portfolio returns is slightly disrupted compared to the results of Table 7. Furthermore, Portfolio 1 appears to fare particularly badly when transaction costs are incorporated, for both the spot and excess return cases, indicating a higher participation of emerging market currencies.

Figures 3 and 4 indicate the relative participation of currencies in Portfolios 1 and 5. A first observation is that both portfolios are dominated by commodity exporters suggesting consistency of the strategy mechanics. The second remark pertains to the fact that emerging market currencies (such as the South African Rand, the Brazilian Real, the Chilean Peso and the Mexican Peso), which display on average higher bid-ask spreads, constitute a non-trivial portion of these portfolios.

FIGURES 2 & 3 ABOUT HERE

A natural step will therefore be to carry the analysis in the developed market space. This will act as an additional robustness check by showcasing whether the predictability of the commodity strategy is mainly driven by less liquid currencies, and most importantly, by shedding more light in the exploitability issue.

6.3 The Commodity Strategy in Developed Markets

For this part of the analysis, I restrict my currency universe to GBP, CHF, JPY, CAD, AUD, NZD, SEK, NOK, EUR, SGD, CZN, and HRK versus the USD. Again, I sort the currencies according to the forecasted returns of the commodity strategy and reallocate them to three portfolios this time, on a daily basis, for both the spot and excess return cases. Following the same logic as before, Portfolio 1 contains the currencies with the highest sell signal and Portfolio 3 contains the currencies with the highest buy signal. The Average Portfolio contains all the currencies and each portfolio is equally weighted. Given that the exploitability of the strategy is the key focus here, I also report spot and excess returns net of transaction costs. The results, displayed in Tables 17 and 18, paint a much brighter picture; not only is the commodity strategy valid for developed markets but one can also make a net excess return of 3 per cent annually by investing in the "long portfolio".

TABLES 17 & 18 ABOUT HERE

The portfolios again display monotonically increasing annualized returns when one moves from Portfolio 1 to Portfolio 3. The reported standard deviations are slightly higher compared to the benchmark case when all 25 currencies are employed. Although there is no clear skewness and kurtosis pattern, Portfolio 3 displays almost zero skewness and a coefficient of kurtosis close to three, unlike Portfolio 1, the returns of which are positively skewed but leptokurtic.

In the case of developed markets, the number of test assets falls to three, undermining the validity of asset pricing tests. However, I look at the correlation of the first two principal components of the portfolio returns between the developed markets case and the full country panel is striking: The correlation between the first principal components amounts to 0.95 and the correlation between the second principal components is as high as 0.76. This points towards the direction that the nature of the returns in the full sample is similar to that in the developed markets case.

6.4 Extension: a Simple Market-Timing Exercise

Given the daily rebalancing and the high transaction costs of the strategy, it would be of great interest to see if an investor could profit by timing her trades, assuming in this case uncertainty risk. For this purpose, I study the return profile of a market-timing version of the commodity strategy, where the investor trades only if the expected return of the long-short strategy exceeds the observed transaction costs of the currencies involved, on the previous day. In this instance, the investor trades, roughly, two thirds of the time. The results for the excess returns case, net of transaction costs, are presented in Table 19.

TABLE 19 ABOUT HERE

The results indicate that the employment of this very simple rule makes it possible to recover the returns of the strategy after the incorporation of transaction costs. However, one must note that in this case the investor assumes additional uncertainty risk.

7 Conclusion

The present paper proposes a novel strategy for the exchange rate that employs changes in the global prices of tradable commodity indices to forecast currency returns, which I term "commodity strategy". First, I document that commodity prices have significant in-sample and out-of-sample forecasting ability for the future exchange rates of several commodity exporters and importers at the daily frequency. However, unlike some of the findings of the recent international finance literature[11], the reverse relationship appears to be weaker in-sample and does not survive out-of-sample testing. Second, I find a significant cross-sectional spread in both spot and excess returns of 6% per annum between the currencies that are predicted to appreciate and those that are predicted to depreciate by the "commodity strategy". At the same time, the returns appear to be uncorrelated to popular exchange rate strategies such as the carry trade and currency momentum. The strategy works across different sub-samples and fares particularly well during the crisis period - when carry trades collapsed - consistent with the behaviour of fundamental strategies which benefit from the "flight to quality" during financial turmoils. The aforementioned findings have important implications for an investor's currency portfolio allocation decisions, and the latter could benefit from taking into account commodity price movements when investing in currencies.

The relationship between commodity prices and exchange rates is also found to be relevant for a broader set of currencies besides this of commodity currencies. I argue that this is consistent with the theory that commodity price fluctuations serve as an observable and exogenous terms-of-trade shock for a small open exporter or importer. Despite the emergence of potentially important variables, a priced factor for the proposed commodity strategy remains to be identified. The empirical results of the present work fall sort of detecting the source of risk for which the investor gets compensated by the returns of the commodity strategy and future work in this area is highly encouraged, as factors such as the interest rate and the equity market appear to negatively correlate with the strategy returns. However, the impact of transaction costs is non-trivial; adjusting returns for bid-ask spreads can erode profitability completely when the strategy is implemented using a number of emerging market currencies which display large bid-ask spreads which act as barriers to arbitrage

[11] For instance, see Chen, Rogoff and Rossi (2010).

activity. Nevertheless, the ordered portfolios need not necessarily be skewed towards currencies with high transaction costs; the investor can recover profitability, to some extent, by trading only developed market currencies. I also explore the exploitability issue by implementing a simple market timing rule. By trading roughly two thirds of the time I find that it possible to recover the returns of the strategy after the incorporation of transaction costs.

Given that return predictability holds at the daily level, but weakens significantly at the weekly and monthly level, the issue of mispricing emerges as another possibility. In line with the literature of limited investor attention (Daniel, Hirshleifer, and Teoh (2002), Hirshleifer and Teoh (2003) and Lim and Teoh (2010)), it might be that it takes time for information to be transmitted from commodity prices to exchange rates. This could be a plausible explanation for the documented return predictability; ultimately, the proposed strategy involves frequent rebalancing, while the existence of transaction costs acts as a barrier to arbitrage for a number of currencies. Since prices should eventually reflect full information, return predictability indeed fades away with the passage of time.

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Tables

Table 1: Countries and Commodities

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.25***	0.09***	0.23***	0.12***
Brazil	Agriculturals	Brent		
	0.15***	0.10***		
Bulgaria	Copper	Energy	Brent	
	0.09***	0.06***	0.05***	
Canada	Natural Gas	Brent		
	0.02***	0.09***		
Chile	Copper	Brent		
	0.12***	0.04***		
Croatia	Natural Gas	Brent		
	0.01**	0.06***		
Czech Republic	Brent			
	0.08***			
Germany	Brent			
	0.06***			
Hungary	Brent			
	0.10***			
India	Precious Metals	Brent		
	0.05***	0.03***		
Indonesia	Natural Gas	Brent		
	0.01*	0.02***		
Israel	Brent			
	0.03***			
Japan	Brent			
	-0.02*			
Mexico	Silver	Brent		
	0.07***	0.07***		
New Zealand	Livestock	Aluminium	Brent	
	0.09***	0.20***	0.10***	
Norway	Natural Gas	Industrial Metals	Brent	
	0.02***	0.19***	0.11***	
Philippines	Brent			
	0.02***			
Poland	Brent			
	0.10***			
Russian Federation	Natural Gas	Brent		
	0.01**	0.05***		
Singapore	Brent			
	0.04***			
South Africa	Gold	Brent		
	0.28***	0.11***		
Sweden	Brent			
	0.10*			
Switzerland	Industrial Metals	Brent		
	0.09***	0.04***		
Thailand	Brent			
	0.01***			
United Kingdom	Brent			
	0.06***			

This table presents the commodities that form a 5% (or greater) share of a country's GDP, according to data collected from the United Nations Commodity Trade Statistics Database, for which there exist tradable commodity index series.Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) level.

Table 2: Currency Beta Rankings versus the USD and GBP

CURRENCY	BETA	CURRENCY	BETA
USD_AUD	0.184***	GBP_BRL	0.150***
USD_ZAR	0.168***	GBP_AUD	0.127***
USD_PLN	0.165***	GBP_MXN	0.127***
USD_HUF	0.161***	GBP_CAD	0.125***
USD_NZD	0.155***	GBP_ZAR	0.123***
USD_BRL	0.150***	GBP_PLN	0.101***
USD_NOK	0.146***	GBP_CLP	0.101***
USD_SEK	0.142***	GBP_NZD	0.096***
USD_CAD	0.131***	GBP_RUB	0.091***
USD_CZN	0.123***	GBP_NOK	0.085***
USD_MXN	0.104***	GBP_HUF	0.084***
USD_HRK	0.091***	GBP_SEK	0.080***
USD_GBP	0.090***	GBP_INR	0.078***
USD_BGN	0.089***	GBP_SGD	0.075***
USD_EUR	0.089***	GBP_PHP	0.073***
USD_CLP	0.081***	GBP_IDR	0.073***
USD_RUB	0.073***	GBP_ILS	0.069***
USD_CHF	0.059***	GBP_THB	0.065***
USD_SGD	0.052***	GBP_CZN	0.063***
USD_INR	0.042***	GBP_GBP	0.059***
USD_ILS	0.041***	GBP_HRK	0.043***
USD_IDR	0.033***	GBP_BGN	0.041***
USD_PHP	0.030***	GBP_EUR	0.040***
USD_THB	0.023***	GBP_CHF	0.024***
USD_JPY	-0.022*	GBP_JPY	0.016

This table presents the rankings of the currencies versus the USD (left panel) and the GBP (right panel) according to the betas from the regression of the nominal exchange rates on the GSCI index. Asterisks denote statistical significance at the 1% (***), 5% (**) and 10% (*) level. Returns are daily and the sample period is 01/2000-11/2011.

Table 3: Pairwise Granger-Causality Tests: Commodities to Currencies

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.004***	0.002***	0.062*	0.159
Brazil	Agriculturals	Brent		
	0.012**	0.239		
Bulgaria	Copper	Energy	Brent	
	0.072*	0.173	0.477	
Canada	Natural Gas	Brent		
	0.182	0.013**		
Chile	Copper	Brent		
	0.221	0.268		
Croatia	Natural Gas	Brent		
	0.058*	0.092*		
Czech Republic	Brent			
	0.830			
Germany	Brent			
	0.560			
Hungary	Brent			
	0.855			
India	Precious Metals	Brent		
	0.000*	0.046**		
Indonesia	Natural Gas	Brent		
	0.201	0.000***		
Israel	Brent			
	0.026**			
Japan	Brent			
	0.218			
Mexico	Silver	Brent		
	0.682	0.006***		
New Zealand	Livestock	Aluminium	Brent	
	0.805	0.679	0.444	
Norway	Natural Gas	Industrial Metals	Brent	
	0.052*	0.260	0.001***	
Philippines	Brent			
	0.001***			
Poland	Brent			
	0.394			
Russian Federation	Natural Gas	Brent		
	0.295	0.003***		
Singapore	Brent			
	0.005***			
South Africa	Gold	Brent		
	0.562	0.989		
Sweden	Brent			
	0.371			
Switzerland	Industrial Metals	Brent		
	0.542	0.697		
Thailand	Brent			
	0.049**			
United Kingdom	Brent			
	0.092*			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that commodity price changes do not Granger-cause exchange rate changes, indicating evidence of Granger-causality.

Table 4: Out-of-Sample Predictive Ability: Commodities to Currencies

MSFE Difference Between the "Commodity Price Model" and the Random Walk					
Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	0.025	0.030*	0.024	0.024	0.036**
t-statistic	1.202	1.562	1.273	1.093	1.815
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	0.021	0.019	0.001	0.029*	0.043**
t-statistic	0.999	0.936	0.051	1.380	2.047
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	0.037**	0.057***	0.058***	0.028**	0.054***
t-statistic	1.759	2.760	2.775	1.364	2.608
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	0.015	0.105***	0.052***	0.040**	0.094***
t-statistic	0.735	5.027	2.480	1.906	4.529
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	0.025	0.031*	0.091***	0.048**	0.010
t-statistic	1.185	1.489	4.351	2.319	0.470

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the commodity-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)

Table 5: Pairwise Granger-Causality Tests: Currencies to Commodities

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.363	0.022**	0.458	0.181
Brazil	Agriculturals	Brent		
	0.003***	0.839		
Bulgaria	Copper	Energy	Brent	
	0.080*	0.709	0.646	
Canada	Natural Gas	Brent		
	0.689	0.506		
Chile	Copper	Brent		
	0.515	0.912		
Croatia	Natural Gas	Brent		
	0.388	0.350		
Czech Republic	Brent			
	0.450			
Germany	Brent			
	0.981			
Hungary	Brent			
	0.207			
India	Precious Metals	Brent		
	0.347	0.754		
Indonesia	Natural Gas	Brent		
	0.773	0.163		
Israel	Brent			
	0.717			
Japan	Brent			
	0.244			
Mexico	Silver	Brent		
	0.093*	0.153		
New Zealand	Livestock	Aluminium	Brent	
	0.029**	0.562	0.202	
Norway	Natural Gas	Industrial Metals	Brent	
	0.833	0.418	0.772	
Philippines	Brent			
	0.186			
Poland	Brent			
	0.228			
Russian Federation	Natural Gas	Brent		
	0.096*	0.770		
Singapore	Brent			
	0.487			
South Africa	Gold	Brent		
	0.977	0.628		
Sweden	Brent			
	0.282			
Switzerland	Industrial Metals	Brent		
	0.479	0.662		
Thailand	Brent			
	0.672			
United Kingdom	Brent			
	0.711			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that exchange rate changes do not Granger-cause commodity price changes, indicating evidence of Granger-causality.

Table 6: Out-of-Sample Predictive Ability: Currencies to Commodities (Crude)

MSFE Difference Between the "Exchange Rate Model" and the Random Walk					
Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	-0.008	0.004	0.017	0.005	-0.008
t-statistic	-0.382	0.172	0.838	0.254	-0.397
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	0.003	-0.013	0.0165	-0.006	0.004
t-statistic	0.143	-0.635	0.790	-0.290	0.196
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	-0.010	0.010	0.003	-0.018	0.002
t-statistic	-0.456	0.473	0.120	-0.877	0.087
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	-0.017	0.017	-0.011	0.014	0.031*
t-statistic	-0.815	0.794	-0.544	0.668	1.499
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	0.009	-0.036	0.028*	-0.013	0.032*
t-statistic	0.431	-1.712	1.351	-0.637	1.553

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the exchange-rate-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)

Table 7: Descriptive Statistics: Commodity Strategy, Spot and Excess Returns

Spot Returns					
(Commodities Strategy)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-0.24%	9.69%	-0.31	9.56	-0.21
Portfolio 2	2.58%	8.43%	0.10	8.77	0.09
Portfolio 3	2.70%	8.53%	0.07	3.90	0.10
Portfolio 4	3.64%	8.69%	-0.08	2.99	0.21
Portfolio 5	5.79%	9.66%	-0.14	4.73	0.41
Portfolio Avg	2.89%	7.79%	-0.02	4.07	0.14
Portfolio Corner	6.03%	9.32%	0.02	3.98	0.45

Excess Returns					
(Commodities Strategy)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	2.29%	9.69%	-0.30	9.56	0.05
Portfolio 2	4.28%	8.43%	0.11	8.79	0.29
Portfolio 3	4.05%	8.53%	0.08	3.90	0.26
Portfolio 4	5.09%	8.69%	-0.07	2.98	0.38
Portfolio 5	7.61%	9.66%	-0.13	4.72	0.60
Portfolio Avg	4.67%	7.79%	-0.02	4.08	0.37
Portfolio Corner	5.32%	9.32%	0.02	3.97	0.38

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 5 contains currencies with the highest predicted return according to the commodity strategy. All returns are in US dollar. Portfolio Avg denotes the average return of the five currency portfolios and Portfolio Corner denotes a long-short portfolio that is long in Portfolio 5 and short in Portfolio 1. Returns are daily and the sample period is 01/2003-11/2011.

Table 8: Descriptive Statistics: Carry Trade, Spot and Excess Returns

Spot Returns

(Carry Trade Strategy)	RET	STDEV	SKEW	KURT	Sharpe Ratio
Portfolio 1	3.69%	7.39%	0.35	3.38	0.25
Portfolio 2	4.38%	9.00%	0.12	2.77	0.29
Portfolio 3	3.59%	9.21%	0.04	6.82	0.19
Portfolio 4	0.34%	8.59%	-0.81	7.47	-0.17
Portfolio 5	2.46%	9.64%	-0.39	4.59	0.07
Portfolio Avg	2.89%	7.79%	-0.02	4.07	0.14
Portfolio Corner	-1.23%	8.49%	-0.47	4.83	-0.36

Excess Returns

(Carry Trade Strategy)	RET	STDEV	SKEW	KURT	Sharpe Ratio
Portfolio 1	2.89%	7.39%	0.35	3.39	0.15
Portfolio 2	4.55%	9.00%	0.13	2.78	0.31
Portfolio 3	4.90%	9.21%	0.05	6.83	0.34
Portfolio 4	3.06%	8.59%	-0.80	7.47	0.15
Portfolio 5	7.94%	9.64%	-0.38	4.60	0.64
Portfolio Avg	4.67%	7.79%	-0.02	4.08	0.37
Portfolio Corner	5.04%	8.49%	-0.47	4.83	0.38

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on time $t-1$ forward discounts. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest forward discounts while Portfolio 5 contains currencies with the highest forward discounts. All returns are in US dollar. Portfolio Avg denotes the average return of the five currency portfolios and Portfolio Corner denotes a long-short portfolio that is long in Portfolio 5 and short in Portfolio 1. Returns are daily and the sample period is 01/2003-11/2011.

Table 9: Correlation of Commodity Strategy and Carry Trade Returns

Commodity Str./Carry Trade	**1**	**2**	**3**	**4**	**5**	**Avg**	**Corner**
1	0.64						
2		0.79					
3			0.85				
4				0.77			
5					0.73		
Avg						1	
Corner							-0.08

This table displays correlation coefficients between portfolio returns. In particular it shows correlation coefficients between spot returns (or excess returns as the results remain the same at the second decimal digit) based on the proposed commodity strategy and forward discount-sorted portfolio returns. The returns are based on five portfolios and a long-short portfolio for both the commodity strategy and the carry trade. I only report correlations for corresponding portfolio pairs.

Table 10: Commodity Strategy and Carry Trade: Double Sorts

	Carry Trade and Commodities		
	Commodity Low	**Commodity High**	**D_Commodity**
FD Low	1.84%	6.26%	4.42%
FD High	6.01%	5.09%	-0.92%
D_FD	4.17%	-1.17%	-5.34%

This table shows annualized mean spot returns for double-sorted portfolios. All currencies are first sorted on lagged forward discounts into two portfolios along the median. Then, currencies within each of the two groups are allocated into two commodity portfolios depending on their predictions of the proposed commodity strategy. Therefore, row FD Low stands for the 50% of all currencies with the lowest lagged forward discount whereas FD High stands for the 50% of all currencies with the highest lagged forward discounts. Columns Commodity Low, and Commodity High stand for the 50% of all currencies with the lowest, and the highest predictions of the commodity strategy, respectively. Column D_Commodity denotes the return difference between high and low commodity portfolios (Commodity Low, Commodity High) for each subgroup of currencies while row D_FD shows the return difference between the forward discount-sorted portfolios for each commodity subgroup. The lower-right cell gives the return difference between the commodity high minus low portfolios of each forward discount category. Returns are daily and the sample period is 01/2003-11/2011.

Table 11: Principal Components

Panel I: Spot Returns					
	1	2	3	4	5
Portfolio 1	0.43	-0.53	0.59	-0.43	0.03
Portfolio 2	0.45	-0.44	-0.22	0.72	0.21
Portfolio 3	0.47	-0.03	-0.56	-0.31	-0.60
Portfolio 4	0.46	0.41	-0.22	-0.30	0.70
Portfolio 5	0.42	0.60	0.49	0.35	-0.33
% Var.	75%	12%	5%	4%	3%
Panel II: Excess Returns					
	1	2	3	4	5
Portfolio 1	0.43	-0.53	0.59	-0.43	0.03
Portfolio 2	0.45	-0.44	-0.22	0.72	0.20
Portfolio 3	0.47	-0.03	-0.56	-0.32	-0.60
Portfolio 4	0.46	0.41	-0.22	-0.30	0.70
Portfolio 5	0.42	0.60	0.49	0.34	-0.33
% Var.	75%	12%	5%	4%	3%

This table reports the principal component coefficients of the commodity portfolios 1-5. The last row displays the share of the total variance (%) explained by each common factor. Returns are daily and the sample period is 01/2003-11/2011.

Table 12: Asset Pricing Exercise: Currency Factors

	Panel A1 (Spot Returns)				**Panel B1 (Excess Returns)**			
				Factor Prices and Loadings				
GMM	**DOL**	**CHML**	**R2**	**HJ**	**DOL**	**CHML**	**R2**	**HJ**
b	12.085	-23.374	0.28	0.040	12.439	-15.132	0.15	0.043
s.e	7.134	18.182		0.210	7.134	18.197		0.240
lambda	0.000	-0.001			0.000	0.000		
s.e	0.000	0.001			0.000	0.011		
FMB								
lambda	0.000	-0.001	0.28		0.000	0.000	0.15	
HAC NW	0.000	0.000			0.000	0.000		
				Factor Betas				
PF	**a**	**DOL**	**CHML**	**R2**	**a**	**DOL**	**CHML**	**R2**
1	0.000	1.014	0.111	0.72	0.000	1.014	0.111	0.72
HAC NW	0.000	0.027	0.020		0.000	0.027	0.020	
2	0.000	0.932	0.019	0.75	0.000	0.932	0.019	0.75
HAC NW	0.000	0.025	0.017		0.000	0.025	0.017	
3	0.000	1.019	-0.073	0.83	0.000	1.020	-0.073	0.83
HAC NW	0.000	0.018	0.017		0.000	0.018	0.017	
4	0.000	1.009	-0.073	0.78	0.000	1.009	-0.074	0.78
HAC NW	0.000	0.024	0.014		0.000	0.024	0.014	
5	0.000	1.026	0.016	0.69	0.000	1.026	0.016	0.69
HAC NW	0.000	0.030	0.027		0.000	0.030	0.027	

This table reports the results from the GMM and Fama-McBeth asset pricing procedures b denotes the vector of factor loadings and *lambda* is the market prices of risk. $HAC\ Newey-West$ standard errors are reported. I also report the R^2s, and the Hansen-Jagannathan distance measure, $HJ-Dist$, with its p-value. Spot and Excess returns used as test assets (Panels A and B respectively). I do not include a constant in the second step of the FMB procedure. OLS estimates of the factor betas, R^2s and $HAC\ Newey-West$ standard errors are also reported for the Fama-McBeth time series regressions. DOL stands for the average currency return, CHML stands for the corner portfolio of the carry trade strategy, VOL is the measure of global currency volatility a la Menkhoff et. al. (2012a), and FXMOM denotes the momentum. Factor. Returns are daily in panels A1 and B1, and monthly in panels A2, B2, A3, and B3. The sample period is 01/2003-11/2011.

Table 12. Asset Pricing Exercise: Currency Factors (cont.)

	Panel A2 (Spot Returns)				**Panel B2 (Excess Returns)**			
	Factor Prices and Loadings							
GMM	**DOL**	**VOL**	**R2**	**HJ**	**DOL**	**VOL**	**R2**	**HJ**
b	9.078	169.626	0	0.200	14.174	267.367	0	0.190
s.e	10.384	296.888		0.180	10.604	310.988		0.280
lambda	0.002	0.000			0.004	0.001		
s.e	0.003	0.001			0.007	0.002		
FMB			0					
lambda	0.002	0.000			0.004	0.001	0	
HAC NW	0.001	0.001			0.001	0.001		
	Factor Betas							
PF	**a**	**DOL**	**VOL**	**R2**	**a**	**DOL**	**VOL**	**R2**
1	-0.004	1.124	0.141	0.75	-0.003	1.122	0.105	0.75
HAC NW	0.004	0.078	0.837		0.004	0.077	0.822	
2	0.000	0.913	0.071	0.82	0.000	0.913	0.087	0.82
HAC NW	0.004	0.031	0.842		0.004	0.031	0.838	
3	-0.001	1.003	0.139	0.86	-0.001	1.003	0.152	0.86
HAC NW	0.003	0.046	0.553		0.003	0.045	0.546	
4	0.006	0.989	-1.134	0.83	0.006	0.990	-1.096	0.83
HAC NW	0.003	0.051	0.534		0.003	0.050	0.526	
5	-0.001	0.971	0.784	0.69	-0.001	0.973	0.753	0.69
HAC NW	0.005	0.072	1.045		0.005	0.072	1.035	

	Panel A3 (Spot Returns)				**Panel B3 (Excess Returns)**			
	Factor Prices and Loadings							
GMM	**DOL**	**FXMOM**	**R2**	**HJ**	**DOL**	**FXMOM**	**R2**	**HJ**
b	1.273	-14.359	0	0.170	4.632	-6.859	0	0.170
s.e.	6.533	11.839		0.380	5.594	9.225		0.310
lambda	0.002	-0.015			0.004	-0.009		
s.e.	0.002	0.014			0.007	0.012		
FMB			0					
lambda	0.002	-0.015			0.004	-0.009	0	
HAC NW	0.001	0.012			0.001	0.006		
	Factor Betas							
PF	**a**	**DOL**	**FXMOM**	**R2**	**a**	**DOL**	**FXMOM**	**R2**
1	-0.003	1.123	0.018	0.75	-0.002	1.123	0.015	0.75
HAC NW	0.001	0.061	0.043		0.001	0.059	0.038	
2	0.000	0.901	-0.058	0.83	0.000	0.891	-0.082	0.83
HAC NW	0.001	0.036	0.032		0.001	0.030	0.023	
3	0.000	1.006	0.042	0.86	-0.001	1.007	0.038	0.86
HAC NW	0.001	0.035	0.022		0.001	0.036	0.023	
4	0.000	1.034	0.052	0.83	0.000	1.032	0.040	0.82
HAC NW	0.001	0.048	0.040		0.001	0.050	0.044	
5	0.003	0.937	-0.053	0.69	0.003	0.948	-0.012	0.69
HAC NW	0.002	0.069	0.055		0.002	0.068	0.038	

Table 13: Asset Pricing Exercise: Fama-French Factors

	Panel A1 (Spot Returns)				Panel B1 (Excess Returns)			
Factor Prices and Loadings								
GMM	**DOL**	**MKT**	**R2**	**HJ**	**DOL**	**MKT**	**R2**	**HJ**
b	23.293	-0.210	0.74	0.036	23.236	-0.176	0.66	0.035
s.e	12.868	0.139		0.470	12.574	0.135		0.480
lambda	0.000	-0.326			0.000	-0.266		
s.e	0.000	0.270			0.000	0.242		
FMB								
lambda	0.000	-0.326	0.73		0.000	-0.265	0.66	
HAC NW	0.000	0.094			0.000	0.079		
Factor Betas								
PF	**a**	**DOL**	**MKT**	**R2**	**a**	**DOL**	**MKT**	**R2**
1	0.000	1.023	0.000	0.71	0.000	1.022	0.000	0.71
HAC NW	0.000	0.029	0.000		0.000	0.029	0.000	
2	0.000	0.931	0.000	0.75	0.000	0.931	0.000	0.75
HAC NW	0.000	0.026	0.000		0.000	0.026	0.000	
3	0.000	0.993	0.000	0.83	0.000	0.993	0.000	0.83
HAC NW	0.000	0.021	0.000		0.000	0.020	0.000	
4	0.000	1.009	0.000	0.78	0.000	1.008	0.000	0.78
HAC NW	0.000	0.026	0.000		0.000	0.026	0.000	
5	0.000	1.045	0.000	0.69	0.000	1.046	0.000	0.69
HAC NW	0.000	0.031	0.000		0.000	0.031	0.000	

This table reports the results from the GMM and Fama-McBeth asset pricing procedures b denotes the vector of factor loadings and *lambda* is the market prices of risk. $HAC\ Newey-West$ standard errors are reported. I also report the R^2s, and the Hansen-Jagannathan distance measure, $HJ-Dist$, with its p-value. Spot and Excess returns used as test assets (Panels A and B respectively). I do not include a constant in the second step of the FMB procedure. OLS estimates of the factor betas, R^2s and $HAC\ Newey-West$ standard errors are also reported for the Fama-McBeth time series regressions. DOL stands for the average currency return, MKT stands for the Market factor, SMB stands for the small minus big factor, EHML denotes the high minus low equity factor, EMOM stands for the equity momentum factor, STREV stands for the short-term reversal factor, and LTREV stands for the long-term reversal factor. Returns are daily and the sample period is 01/2003-11/2011.

Table 13. Asset Pricing Exercise: Fama-French Factors (cont.)

	Panel A2 (Spot Returns)				Panel B2 (Excess Returns)			
	Factor Prices and Loadings							
GMM	**DOL**	**SMB**	**R2**	**HJ**	**DOL**	**SMB**	**R2**	**HJ**
b	4.243	0.163	0	0.041	7.349	0.108	0	0.038
s.e	4.623	0.509		0.320	4.642	0.512		0.380
lambda	0.000	0.055			0.000	0.037		
s.e	0.000	0.185			0.000	0.206		
FMB								
lambda	0.000	0.056	0		0.000	0.037	0	
HAC NW	0.000	0.168			0.000	0.137		
	Factor Betas							
PF	**a**	**DOL**	**SMB**	**R2**	**a**	**DOL**	**SMB**	**R2**
1	0.000	1.049	0.000	0.71	0.000	1.049	0.000	0.71
HAC NW	0.000	0.031	0.000		0.000	0.031	0.000	
2	0.000	0.937	0.000	0.75	0.000	0.937	0.000	0.75
HAC NW	0.000	0.025	0.000		0.000	0.025	0.000	
3	0.000	0.997	0.000	0.83	0.000	0.997	0.000	0.83
HAC NW	0.000	0.021	0.000		0.000	0.021	0.000	
4	0.000	0.986	0.000	0.78	0.000	0.986	0.000	0.78
HAC NW	0.000	0.025	0.000		0.000	0.025	0.000	
5	0.000	1.031	0.000	0.69	0.000	1.032	0.000	0.69
HAC NW	0.000	0.031	0.000		0.000	0.031	0.000	

	Panel A3 (Spot Returns)				Panel B3 (Excess Returns)			
	Factor Prices and Loadings							
GMM	**DOL**	**EHML**	**R2**	**HJ**	**DOL**	**EHML**	**R2**	**HJ**
b	-12.971	0.869	0.1	0.049	-5.570	0.651	0.07	0.045
s.e	23.682	1.131		0.360	21.572	1.029		0.370
lambda	0.000	0.286			0.000	0.216		
s.e	0.000	0.371			0.000	0.338		
FMB								
lambda	0.000	0.288	0.1		0.000	0.217	0.07	
HAC NW	0.000	0.278			0.000	0.276		
	Factor Betas							
PF	**a**	**DOL**	**EHML**	**R2**	**a**	**DOL**	**EHML**	**R2**
1	0.000	1.050	0.000	0.71	0.000	1.050	0.000	0.71
HAC NW	0.000	0.033	0.000		0.000	0.033	0.000	
2	0.000	0.940	0.000	0.75	0.000	0.940	0.000	0.75
HAC NW	0.000	0.025	0.000		0.000	0.025	0.000	
3	0.000	0.994	0.000	0.83	0.000	0.994	0.000	0.83
HAC NW	0.000	0.021	0.000		0.000	0.021	0.000	
4	0.000	0.987	0.000	0.78	0.000	0.987	0.000	0.78
HAC NW	0.000	0.026	0.000		0.000	0.026	0.000	
5	0.000	1.029	0.000	0.69	0.000	1.030	0.000	0.69
HAC NW	0.000	0.030	0.000		0.000	0.031	0.000	

Table 13. Asset Pricing Exercise: Fama-French Factors (cont.)

	Panel A4 (Spot Returns)				Panel B4 (Excess Returns)			
				Factor Prices and Loadings				
GMM	**DOL**	**EMOM**	**R2**	**HJ**	**DOL**	**EMOM**	**R2**	**HJ**
b	18.291	0.616	0.45	0.046	18.291	0.616	0.45	0.046
s.e	15.757	0.674		0.500	15.757	0.674		0.500
lambda	0.000	0.606			0.000	0.606		
s.e	0.000	0.713			0.000	0.713		
FMB								
lambda	0.000	0.628	0.448		0.000	0.628	0.4482	
HAC NW	0.000	0.291			0.000	0.291		
				Factor Betas				
PF	**a**	**DOL**	**EMOM**	**R2**	**a**	**DOL**	**EMOM**	**R2**
1	0.000	1.048	0.000	0.71	0.000	1.048	0.000	0.71
HAC NW	0.000	0.031	0.000		0.000	0.031	0.000	
2	0.000	0.937	0.000	0.75	0.000	0.937	0.000	0.75
HAC NW	0.000	0.024	0.000		0.000	0.024	0.000	
3	0.000	0.995	0.000	0.83	0.000	0.995	0.000	0.83
HAC NW	0.000	0.021	0.000		0.000	0.021	0.000	
4	0.000	0.988	0.000	0.78	0.000	0.988	0.000	0.78
HAC NW	0.000	0.025	0.000		0.000	0.025	0.000	
5	0.000	1.033	0.000	0.69	0.000	1.033	0.000	0.69
HAC NW	0.000	0.029	0.000		0.000	0.029	0.000	

	Panel A5 (Spot Returns)				Panel B5 (Excess Returns)			
				Factor Prices and Loadings				
GMM	**DOL**	**STREV**	**R2**	**HJ**	**DOL**	**STREV**	**R2**	**HJ**
b	15.290	-0.356	0.55	0.043	16.055	-0.265	0.44	0.041
s.e	10.315	0.305		0.380	9.666	0.265		0.370
lambda	0.000	-0.303			0.000	-0.253		
s.e	0.000	0.537			0.000	0.681		
FMB								
lambda	0.000	-0.302	0.55		0.000	-0.237	0.44	
HAC NW	0.000	0.121			0.000	0.102		
				Factor Betas				
PF	**a**	**DOL**	**STREV**	**R2**	**a**	**DOL**	**STREV**	**R2**
1	0.000	1.041	0.000	0.71	0.000	1.040	0.000	0.71
HAC NW	0.000	0.029	0.000		0.000	0.029	0.000	
2	0.000	0.935	0.000	0.75	0.000	0.935	0.000	0.75
HAC NW	0.000	0.024	0.000		0.000	0.024	0.000	
3	0.000	0.998	0.000	0.83	0.000	0.998	0.000	0.83
HAC NW	0.000	0.020	0.000		0.000	0.020	0.000	
4	0.000	0.994	0.000	0.78	0.000	0.994	0.000	0.78
HAC NW	0.000	0.023	0.000		0.000	0.023	0.000	
5	0.000	1.033	0.000	0.69	0.000	1.034	0.000	0.69
HAC NW	0.000	0.030	0.000		0.000	0.031	0.000	

Table 13. Asset Pricing Exercise: Fama-French Factors (cont.)

	Panel A6 (Spot Returns)				**Panel B6 (Excess Returns)**			
				Factor Prices and Loadings				
GMM	**DOL**	**LTREV**	**R2**	**HJ**	**DOL**	**LTREV**	**R2**	**HJ**
b	9.374	0.784	0.64	0.040	11.454	0.639	0.55	0.040
s.e	5.942	0.673		0.460	5.741	0.623		0.430
lambda	0.000	0.232			0.000	0.188		
s.e	0.000	0.195			0.000	0.184		
FMB								
lambda	0.000	0.232	0.645		0.000	0.188	0.55	
HAC NW	0.000	0.073			0.000	0.068		
				Factor Betas				
PF	**a**	**DOL**	**LTREV**	**R2**	**a**	**DOL**	**LTREV**	**R2**
1	0.000	1.047	0.000	0.71	0.000	1.046	0.000	0.71
HAC NW	0.000	0.030	0.000		0.000	0.030	0.000	
2	0.000	0.936	0.000	0.75	0.000	0.936	0.000	0.75
HAC NW	0.000	0.024	0.000		0.000	0.024	0.000	
3	0.000	0.997	0.000	0.83	0.000	0.997	0.000	0.83
HAC NW	0.000	0.021	0.000		0.000	0.021	0.000	
4	0.000	0.988	0.000	0.78	0.000	0.987	0.000	0.78
HAC NW	0.000	0.024	0.000		0.000	0.024	0.000	
5	0.000	1.032	0.000	0.69	0.000	1.033	0.000	0.69
HAC NW	0.000	0.030	0.000		0.000	0.030	0.000	

Table 14: Descriptive Statistics: Commodity Strategy, Spot Returns: Before and After the Crisis

Spot Returns: Before the Crisis					
(**Commodities Strategy**)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	2.52%	6.43%	-0.6	1.94	-0.04
Portfolio 2	3.47%	5.21%	-0.5	3.17	0.13
Portfolio 3	4.80%	6.28%	-0.09	1.21	0.32
Portfolio 4	5.72%	7.35%	-0.05	1.45	0.4
Portfolio 5	8.52%	8.08%	-0.13	1.24	0.71
Portfolio Avg	5.01%	5.64%	-0.21	0.97	0.4
Portfolio Corner	6.00%	7.33%	0.15	1.53	0.44

Spot Returns: After the Crisis					
(**Commodities Strategy**)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-1.91%	12.16%	-0.08	6.86	-0.22
Portfolio 2	2.61%	10.81%	0.26	5.83	0.17
Portfolio 3	1.42%	10.36%	0.18	2.97	0.06
Portfolio 4	2.33%	9.89%	-0.01	2.96	0.15
Portfolio 5	4.01%	11.05%	-0.03	4.94	0.29
Portfolio Avg	1.69%	9.51%	0.11	3.07	0.09
Portfolio Corner	5.92%	10.99%	-0.04	3.37	0.46

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy, for two sub-samples, before and after the crisis outbreak. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 5 contains currencies with the highest predicted return according to the commodity strategy. All returns are spot returns in US dollar. Portfolio Avg denotes the average return of the five currency portfolios. Returns are daily and the sub-sample periods are 01/2003-06/2007 and 07/2007-11/2011.

Table 15: Descriptive Statistics: Commodity Strategy, Excess Returns: Before and After the Crisis

Spot Returns: Before the Crisis					
(**Commodities Strategy**)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	5.06%	6.43%	-0.60	1.92	0.36
Portfolio 2	4.95%	5.21%	-0.50	3.16	0.42
Portfolio 3	5.82%	6.28%	-0.09	1.19	0.49
Portfolio 4	6.78%	7.35%	-0.04	1.44	0.54
Portfolio 5	9.92%	8.08%	-0.13	1.23	0.88
Portfolio Avg	6.51%	5.64%	-0.20	0.95	0.66
Portfolio Corner	4.86%	7.33%	0.14	1.53	0.28

Spot Returns: After the Crisis					
(**Commodities Strategy**)	**RET**	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-0.57%	12.17%	-0.19	6.88	-0.11
Portfolio 2	3.59%	10.80%	0.18	5.59	0.26
Portfolio 3	2.23%	10.36%	0.13	2.89	0.14
Portfolio 4	3.35%	9.89%	-0.06	2.87	0.26
Portfolio 5	5.23%	11.06%	-0.11	4.92	0.40
Portfolio Avg	2.77%	9.52%	0.05	2.98	0.21
Portfolio Corner	5.80%	11.01%	-0.03	3.38	0.45

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy, for two sub-samples, before and after the crisis outbreak. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 5 contains currencies with the highest predicted return according to the commodity strategy. All returns are excess returns in US dollar. Portfolio Avg denotes the average return of the five currency portfolios. Returns are daily and the sub-sample periods are 01/2003-06/2007 and 07/2007-11/2011.

Table 16: Descriptive Statistics: Commodity Strategy, Net Spot and Excess Returns

Commodities Strategy: Net Spot Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-9.86%	9.96%	-0.23	8.38	-1.17
Portfolio 2	-3.98%	8.78%	0.06	7.67	-0.66
Portfolio 3	-2.86%	8.80%	0.07	3.40	-0.53
Portfolio 4	-3.03%	9.08%	-0.11	2.51	-0.53
Portfolio 5	-2.18%	9.98%	-0.12	4.26	-0.40
Portfolio Avg	-4.38%	8.14%	0.00	3.42	-0.76

Commodities Strategy: Net Excess Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-7.83%	9.81%	-0.23	9.05	-0.98
Portfolio 2	-2.60%	8.61%	0.08	8.25	-0.51
Portfolio 3	-1.73%	8.67%	0.1	3.50	-0.41
Portfolio 4	-1.82%	8.92%	-0.09	2.66	-0.41
Portfolio 5	-0.77%	9.85%	-0.14	4.46	-0.26
Portfolio Avg	-2.95%	7.96%	0.03	3.62	-0.60

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy, this time incorporating transaction costs which amount to the 50% of the quoted bid-ask spread. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 5 contains currencies with the highest predicted return according to the commodity strategy. All returns are in US dollar. Portfolio Avg denotes the average return of the five currency portfolios. Returns are daily and the sample period is 01/2003-11/2011.

Table 17: Descriptive Statistics: Commodity Strategy, Spot and Net Spot Returns: Developed Markets

Commodities Strategy: Spot Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	0.51%	10.11%	0.19	6.69	-0.13
Portfolio 2	4.11%	9.85%	0.17	3.03	0.23
Portfolio 3	7.20%	10.08%	-0.01	3.43	0.53
Portfolio Avg	3.94%	9.23%	0.27	3.73	0.23
Commodities Strategy: Net Spot Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-3.64%	10.10%	0.19	6.68	-0.54
Portfolio 2	0.57%	9.85%	0.17	3.03	-0.13
Portfolio 3	2.47%	10.09%	-0.02	3.46	0.07
Portfolio Avg	-0.20%	9.23%	0.26	3.73	-0.22

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy, this time also incorporating transaction costs (Net Spot Returns panel) which amount to the 50% of the quoted bid-ask spread. I also report annualized Sharpe Ratios. Portfolio 1 contains one third of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 3 contains currencies with the highest predicted return according to the commodity strategy. All returns are spot returns in US dollar. Portfolio Avg denotes the average return of the three currency portfolios. Returns are daily and the sample period is 01/2003-11/2011.

Table 18: Descriptive Statistics: Commodity Strategy, Excess and Net Excess Returns: Developed Markets

Commodities Strategy: Excess Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	0.87%	10.05%	0.2	6.73	-0.09
Portfolio 2	4.79%	9.75%	0.19	3.28	0.31
Portfolio 3	7.45%	10.01%	-0.01	3.55	0.56
Portfolio Avg	4.37%	9.14%	0.28	3.92	0.28
Commodities Strategy: Net Excess Returns					
	RET	**STDEV**	**SKEW**	**KURT**	**Sharpe Ratio**
Portfolio 1	-3.35%	10.09%	0.19	6.72	-0.51
Portfolio 2	0.85%	9.76%	0.2	3.17	-0.1
Portfolio 3	2.88%	10.04%	-0.01	3.51	0.11
Portfolio Avg	0.13%	9.18%	0.28	3.83	-0.18

The table reports mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted daily on the predictions of the proposed commodity strategy, this time also incorporating transaction costs (Net Excess Returns panel) which amount to the 50% of the quoted bid-ask spread. I also report annualized Sharpe Ratios. Portfolio 1 contains one third of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 3 contains currencies with the highest predicted return according to the commodity strategy. All returns are excess returns in US dollar. Portfolio Avg denotes the average return of the three currency portfolios. Returns are daily and the sample period is 01/2003-11/2011.

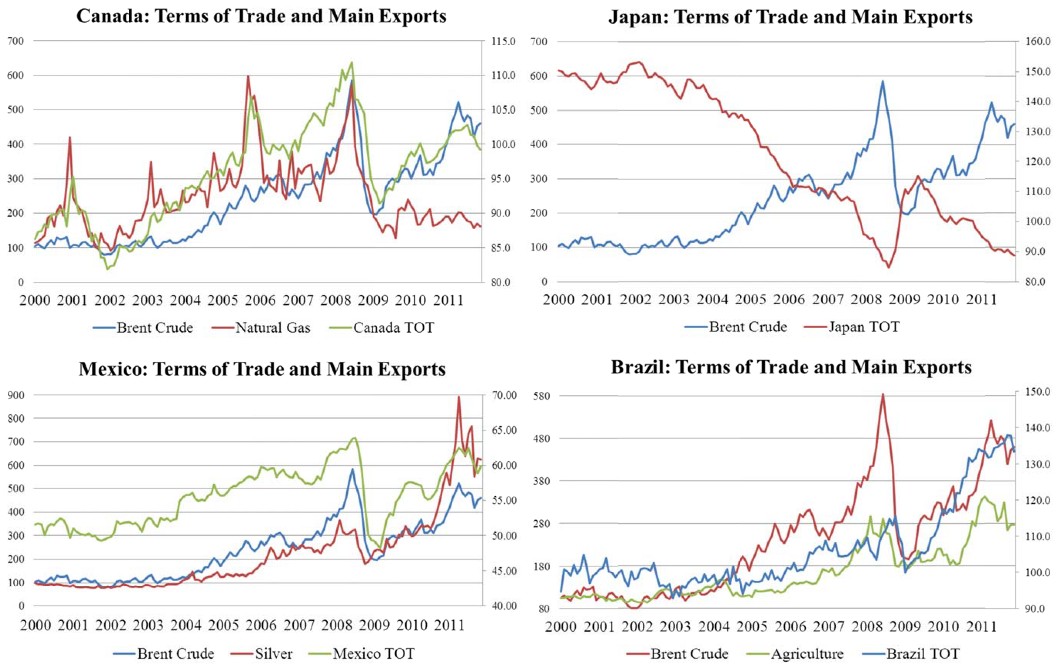
Table 19: Descriptive Statistics: Commodity Strategy with Market Timing, Net Excess Returns

Commodities Strategy with Market Timing: Net Excess Returns					
	RET	*STDEV*	*SKEW*	*KURT*	*Sharpe Ratio*
Portfolio 1	1.29%	7.95%	-0.31	13.23	0.02
Portfolio 2	5.05%	6.88%	0.28	11.97	0.57
Portfolio 3	5.07%	6.84%	0.29	5.67	0.58
Portfolio 4	5.45%	6.91%	0.04	4.73	0.63
Portfolio 5	5.93%	7.79%	-0.09	7.52	0.62
Portfolio Avg	4.56%	6.31%	0.13	6.05	0.54
Portfolio Corner	4.64%	7.53%	0.24	8.59	0.47

The table reports net mean returns, standard deviations (both annualised), skewness, and kurtosis of currency portfolios sorted on the predictions of the proposed commodity strategy according to the market-timing criterior that the expected returns should be greater than the observed transaction costs of the currencies in question at the previous period. Transaction costs amount to the 50% of the quoted bid-ask spread. I also report annualized Sharpe Ratios. Portfolio 1 contains the 20% of all currencies with the lowest predicted return according to the commodity strategy while Portfolio 5 contains currencies with the highest predicted return according to the commodity strategy. All returns are excess returns in US dollar. Portfolio Avg denotes the average return of the five currency portfolios. Returns are daily and the sample period is 01/2003-11/2011.

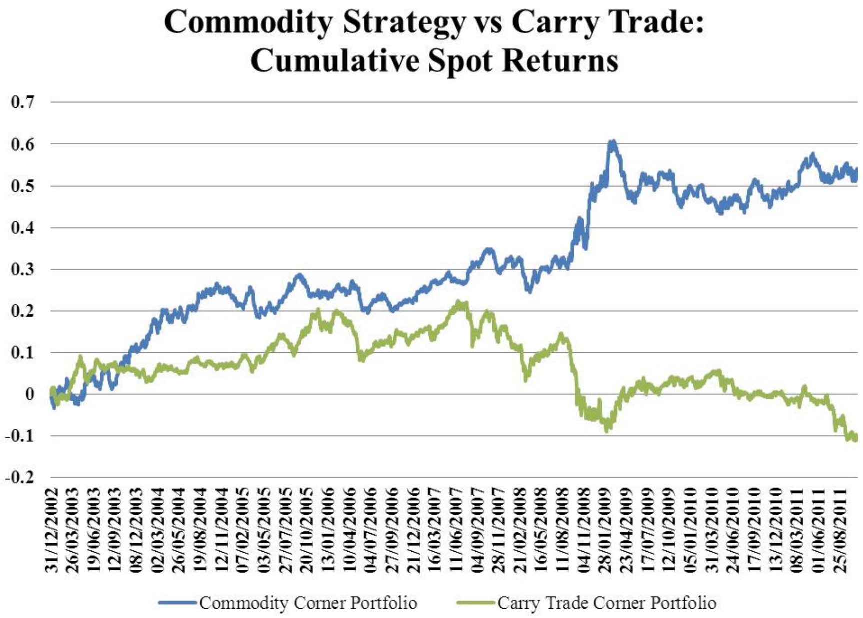
Figures

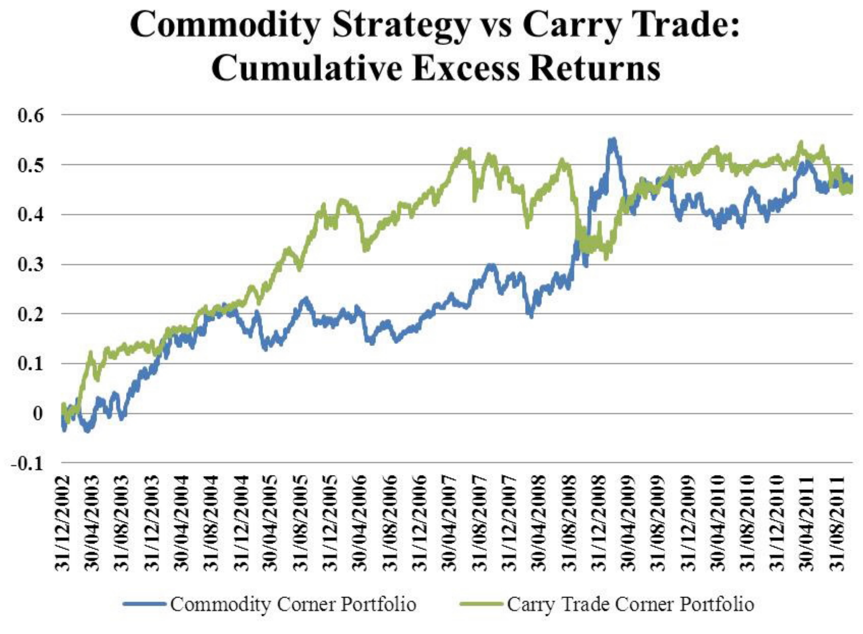
Figure 1. Commodity Prices and Terms of Trade



This figure shows the evolution the terms of trade of Canada, Japan, Mexico and Brazil with the commodity prices of their most important expors and imports, and in particular, brent crude, natural gas, silver and agriculturals. The sample period ranges between 2000 and 2011.

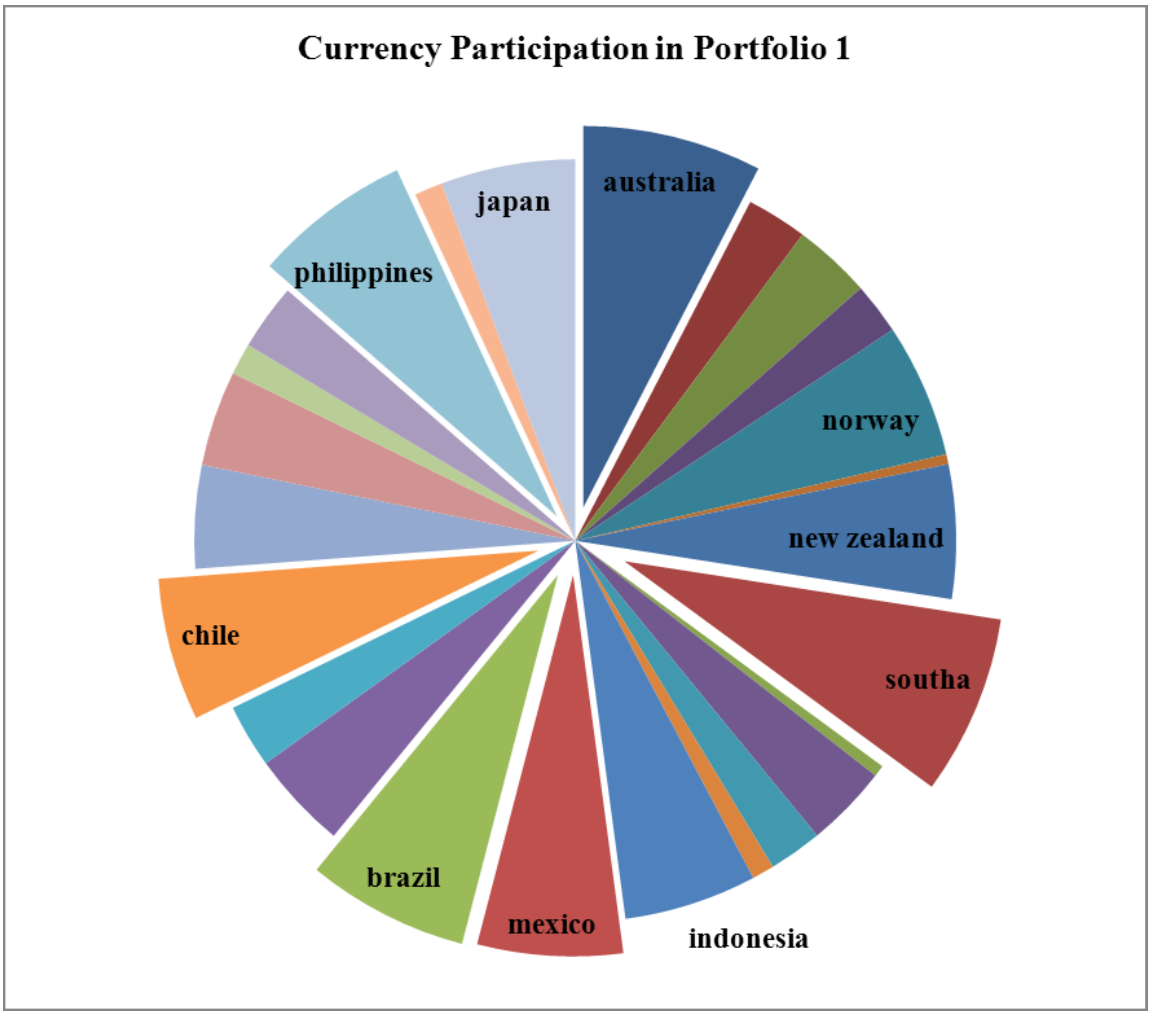
Figure 2: Commodity Strategy versus the Carry Trade: Co-evolution of Spot and Excess Returns





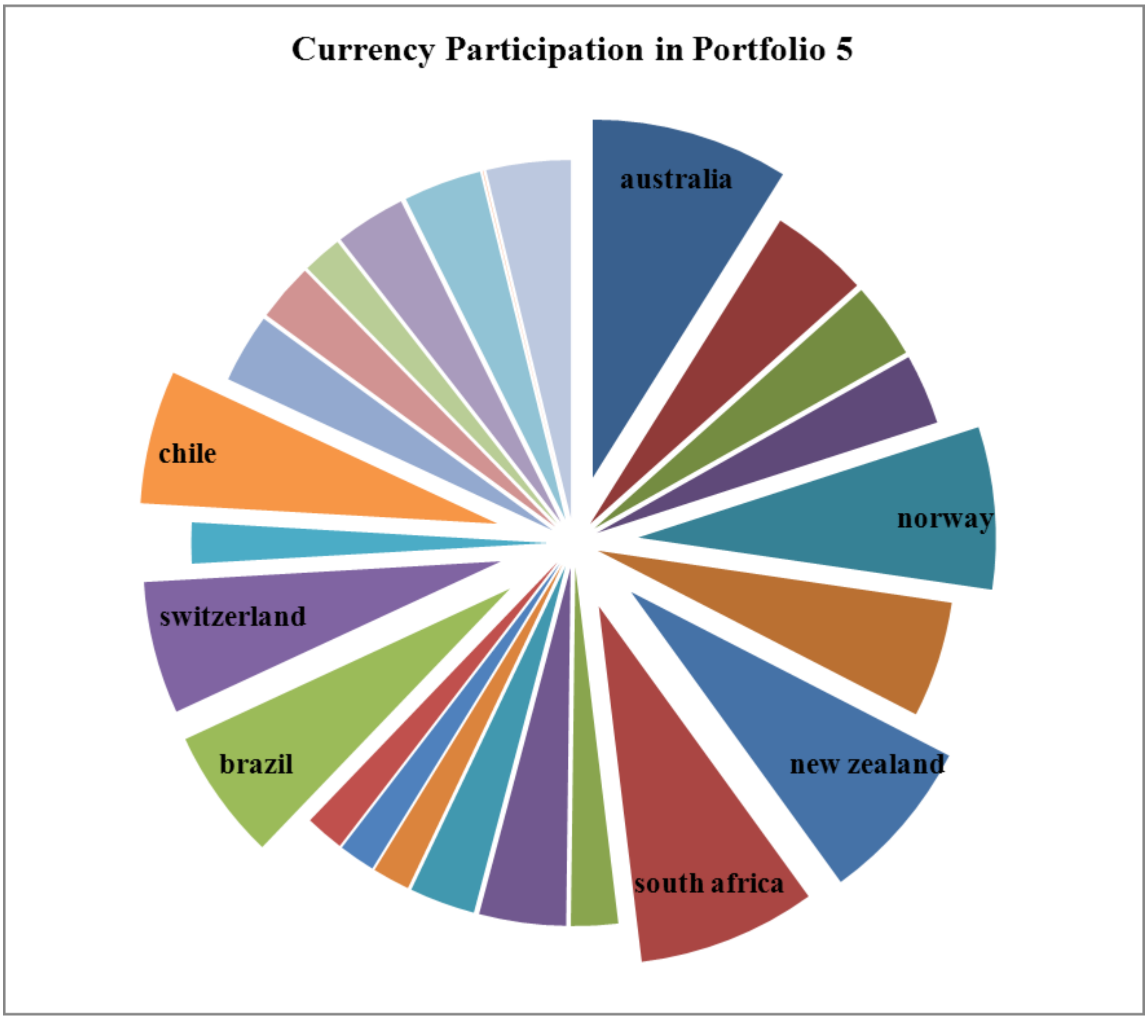
This figure displays the co-evolution of the cumulative spot and excess returns of the commodity strategy with the carry trade. Returns are daily and the sample period ranges between December 2002 and November 2011.

Figure 3. Country Participation in the “Short Portfolio”



This figure dislpays the relative paricipation of currencies in the "short portfolio" i.e. Portfolio 1.which in theory contains the currencies which are expected to depreciate the most at each point in time according to the commodity strategy. The portfolio composition is not indicative about the depreciation of the currencies over the sample period 01/2003-11/2011 as a whole. It rather suggests that the currencies that stand out are predicted to depreciate more with the price fall of their most important commodity exports (or with the price rise of their most important commodity imports).

Figure 4. Country Participation in the “Long Portfolio”



This figure dislpays the relative paricipation of currencies in the "long portfolio" i.e. Portfolio 5.which in theory contains the currencies which are expected to appreciate the most at each point in time according to the commodity strategy. The portfolio composition is not indicative about the appreciation of the currencies over the sample period 01/2003-11/2011 as a whole. It rather suggests that the currencies that stand out are predicted to appreciate more with the price rise of their most important commodity exports (or with the price fall of their most important commodity imports).

Appendix

Table 1: Pairwise Granger-Causality Tests: Commodities to Currencies

Weekly Frequency

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.940	0.063*	0.101	0.084*
Brazil	Agriculturals	Brent		
	0.3510	0.818		
Bulgaria	Copper	Energy	Brent	
	0.754	0.338	0.5000	
Canada	Natural Gas	Brent		
	0.274	0.311		
Chile	Copper	Brent		
	0.016**	0.217		
Croatia	Natural Gas	Brent		
	0.628	0.768		
Czech Republic	Brent			
	0.876			
Germany	Brent			
	0.663			
Hungary	Brent			
	0.811			
India	Precious Metals	Brent		
	0.013**	0.036**		
Indonesia	Natural Gas	Brent		
	0.301	0.236		
Israel	Brent			
	0.943			
Japan	Brent			
	0.285			
Mexico	Silver	Brent		
	0.888	0.345		
New Zealand	Livestock	Aluminium	Brent	
	0.317	0.446	0.316	
Norway	Natural Gas	Industrial Metals	Brent	
	0.827	0.049**	0.288	
Philippines	Brent			
	0.315			
Poland	Brent			
	0.552			
Russian Federation	Natural Gas	Brent		
	0.164	0.005***		
Singapore	Brent			
	0.491			
South Africa	Gold	Brent		
	0.683	0.567		
Sweden	Brent			
	0.361			
Switzerland	Industrial Metals	Brent		
	0.026**	0.139		
Thailand	Brent			
	0.085*			
United Kingdom	Brent			
	0.969			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that commodity price changes do not Granger-cause exchange rate changes, indicating evidence of Granger-causality.

Table 2: Pairwise Granger-Causality Tests: Commodities to Currencies

Monthly Frequency

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.247	0.133	0.747	0.747
Brazil	Agriculturals	Brent		
	0.512	0.494		
Bulgaria	Copper	Energy	Brent	
	0.414	0.120	0.336	
Canada	Natural Gas	Brent		
	0.310	0.136		
Chile	Copper	Brent		
	0.684	0.949		
Croatia	Natural Gas	Brent		
	0.854	0.197		
Czech Republic	Brent			
	0.055*			
Germany	Brent			
	0.293			
Hungary	Brent			
	0.037			
India	Precious Metals	Brent		
	0.239	0.952		
Indonesia	Natural Gas	Brent		
	0.829	0.839		
Israel	Brent			
	0.216			
Japan	Brent			
	0.801			
Mexico	Silver	Brent		
	0.442	0.499		
New Zealand	Livestock	Aluminium	Brent	
	0.797	0.125	0.216	
Norway	Natural Gas	Industrial Metals	Brent	
	0.602	0.546	0.322	
Philippines	Brent			
	0.335			
Poland	Brent			
	0.031**			
Russian Federation	Natural Gas	Brent		
	0.343	0.196		
Singapore	Brent			
	0.109			
South Africa	Gold	Brent		
	0.121	0.016*		
Sweden	Brent			
	0.321			
Switzerland	Industrial Metals	Brent		
	0.380	0.155		
Thailand	Brent			
	0.238			
United Kingdom	Brent			
	0.001***			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that commodity price changes do not Granger-cause exchange rate changes, indicating evidence of Granger-causality.

Table 3: Out-of-Sample Predictive Ability: Commodities to Currencies

MSFE Difference Between the "Commodity Price Model" and the Random Walk, Weekly Frequency

Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	0.044*	0.017	0.006	0.069*	0.041
t-statistic	1.378	0.652	0.178	1.528	0.993
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	0.039	0.029	0.027	0.057*	0.060*
t-statistic	1.060	0.907	0.732	1.439	1.600
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	0.029	0.052*	0.028	0.046	0.013
t-statistic	0.982	1.322	0.670	1.198	0.376
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	0.128***	0.085**	0.065**	0.007	-0.071
t-statistic	2.628	2.084	1.734	0.162	-1.348
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	0.052*	0.059	-0.031	0.042	-0.066
t-statistic	1.534	1.231	-0.802	1.343	-1.380

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the commodity-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)

Table 4: Out-of-Sample Predictive Ability: Commodities to Currencies

MSFE Difference Between the "Commodity Price Model" and the Random Walk, Monthly Frequency					
Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	-0.061	0.111	-0.108	0.004	0.161**
t-statistic	-0.815	0.776	-1.192	0.042	1.746
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	-0.032	0.112*	0.036	-0.017	0.027
t-statistic	-0.333	1.426	0.490	-0.353	0.387
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	0.208**	0.062	0.053	0.119	0.103
t-statistic	2.052	0.950	0.670	0.771	0.734
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	0.006	0.011	-0.052	0.032	-0.030
t-statistic	0.123	0.114	-0.490	0.320	-0.370
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	-0.172	-0.033	0.118	-0.115	-0.165
t-statistic	-1.964	-0.435	1.149	-1.246	-1.852

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the commodity-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)

Table 5: Pairwise Granger-Causality Tests: Currencies to Commodities

Weekly Frequency

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.228	0.286	0.101	0.627
Brazil	Agriculturals	Brent		
	0.8315	0.061*		
Bulgaria	Copper	Energy	Brent	
	0.821	0.636	0.653	
Canada	Natural Gas	Brent		
	0.839	0.605		
Chile	Copper	Brent		
	0.508	0.126		
Croatia	Natural Gas	Brent		
	0.945	0.669		
Czech Republic	Brent			
	0.526			
Germany	Brent			
	0.473			
Hungary	Brent			
	0.934			
India	Precious Metals	Brent		
	0.695	0.328		
Indonesia	Natural Gas	Brent		
	0.963	0.114		
Israel	Brent			
	0.962			
Japan	Brent			
	0.060*			
Mexico	Silver	Brent		
	0.509	0.891		
New Zealand	Livestock	Aluminium	Brent	
	0.537	0.023**	0.120	
Norway	Natural Gas	Industrial Metals	Brent	
	0.858	0.629	0.930	
Philippines	Brent			
	0.053*			
Poland	Brent			
	0.726			
Russian Federation	Natural Gas	Brent		
	0.169	0.379		
Singapore	Brent			
	0.328			
South Africa	Gold	Brent		
	0.492	0.657		
Sweden	Brent			
	0.489			
Switzerland	Industrial Metals	Brent		
	0.375	0.267		
Thailand	Brent			
	0.089*			
United Kingdom	Brent			
	0.525			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that commodity price changes do not Granger-cause exchange rate changes, indicating evidence of Granger-causality.

Table 6: Pairwise Granger-Causality Tests: Currencies to Commodities

Monthly Frequency

Country	Commodity Indices			
Australia	Gold	Wheat	Aluminium	Brent
	0.247	0.133	0.747	0.747
Brazil	Agriculturals	Brent		
	0.512	0.494		
Bulgaria	Copper	Energy	Brent	
	0.414	0.120	0.336	
Canada	Natural Gas	Brent		
	0.310	0.136		
Chile	Copper	Brent		
	0.684	0.949		
Croatia	Natural Gas	Brent		
	0.854	0.197		
Czech Republic	Brent			
	0.055*			
Germany	Brent			
	0.293			
Hungary	Brent			
	0.037			
India	Precious Metals	Brent		
	0.239	0.952		
Indonesia	Natural Gas	Brent		
	0.829	0.839		
Israel	Brent			
	0.216			
Japan	Brent			
	0.801			
Mexico	Silver	Brent		
	0.442	0.499		
New Zealand	Livestock	Aluminium	Brent	
	0.797	0.125	0.216	
Norway	Natural Gas	Industrial Metals	Brent	
	0.602	0.546	0.322	
Philippines	Brent			
	0.335			
Poland	Brent			
	0.031**			
Russian Federation	Natural Gas	Brent		
	0.343	0.196		
Singapore	Brent			
	0.109			
South Africa	Gold	Brent		
	0.121	0.016*		
Sweden	Brent			
	0.321			
Switzerland	Industrial Metals	Brent		
	0.380	0.155		
Thailand	Brent			
	0.238			
United Kingdom	Brent			
	0.001***			

This table reports p-values for the Granger-causality test. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively of the null hypothesis that commodity price changes do not Granger-cause exchange rate changes, indicating evidence of Granger-causality.

Table 7: Out-of-Sample Predictive Ability: Currencies to Commodities

MSFE Difference Between the "Exchange Rate Model" and the Random Walk, Weekly Frequency					
Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	0.007	0.038	0.048	0.034	0.048
t-statistic	0.176	0.910	1.128	0.842	1.233
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	0.077**	-0.026	0.028	0.042	0.048
t-statistic	1.855	-0.677	0.645	1.102	1.257
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	0.057*	0.039	0.025	0.045	0.023
t-statistic	1.410	1.005	0.517	0.940	0.449
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	-0.010	0.001	0.005	-0.019	0.027
t-statistic	-0.260	0.032	0.109	-0.408	0.601
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	0.092**	0.008	-0.023	0.055*	-0.010
t-statistic	2.046	0.145	-0.471	1.524	-0.239

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the commodity-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)

Table 8: Out-of-Sample Predictive Ability: Currencies to Commodities

MSFE Difference Between the "Exchange Rate Model" and the Random Walk, Monthly Frequency					
Country	Australia	Poland	Hungary	Sweden	Norway
MSFE difference	0.046	0.101	0.057	-0.108	0.022
t-statistic	0.434	0.923	0.609	-1.233	0.213
Country	Czech Republic	New Zealand	South Africa	Germany	Bulgaria
MSFE difference	-0.057	-0.063	0.152*	-0.059	0.020
t-statistic	-0.509	-0.619	1.508	-0.568	0.161
Country	Canada	Croatia	Indonesia	Mexico	Brazil
MSFE difference	0.107	0.046	0.108	0.077	0.105
t-statistic	0.911	0.503	0.999	0.907	0.909
Country	Switzerland	Russian Federation	Chile	Israel	India
MSFE difference	-0.079	0.140*	-0.028	0.129*	-0.136
t-statistic	-0.823	1.4	-0.32	1.39	-1.342
Country	Singapore	Thailand	Philippines	United Kingdom	Japan
MSFE difference	0.183**	0.022	0.156	0.018	0.153*
t-statistic	1.709	0.206	1.599	0.185	1.478

The table reports re-scaled MSFE differences between the model and the random walk forecasts. Positive values imply that the model forecasts better than the random walk. Asterisks denote rejections of the null hypothesis that random walk is better in favour of the alternative hypothesis that the commodity-based model is better. Asterisks denote rejection at the 1% (***), 5% (**) and 10% (*) significance levels respectively. Clark and West (2006) t-statistics are also presented below (one-sided test)