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FX strategies in periods of distress[1]

This article presents an overview of widely practised short-term multicurrency investment strategies such as carry trade, momentum and term spread strategies. We provide evidence on their downside risk properties and illustrate their performance over historical episodes of financial market turmoil. We show that the strategies exhibit substantial tail risks and that they do not perform uniformly during distress periods in global markets. Interestingly, equity market investments feature even greater downside risk.

JEL classification: F31, G11, G15.

Nowadays, market participants and researchers view foreign exchange (FX) as a distinct asset class. Trading activity in many currencies has surged with the rise of electronic trading networks and the emergence of dedicated FX investors and hedge funds.[2] Over the last decade, there has also been a growing interest in trading strategies that rely on the continued presence of attractive short-term investment opportunities in FX markets. The widespread availability of financial products based on FX carry and momentum strategies suggests fund managers and other investors use them widely.[3] The most prominent example is the carry trade, which is a bet that higher-yielding currencies will not depreciate enough against lower-yielding currencies to outweigh the interest differential (or carry). A second example is FX momentum strategies. These are bets that currencies that appreciated the most in the recent past (so-called "winners") will continue to do so for a few months, and that currencies that depreciated the most in the recent past (so-called "losers") will continue to do so for a short time period.

Given these features of today's FX markets, a better and more detailed understanding of the properties and risks associated with widely followed

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[2] See King et al (2011) for a discussion of these developments.

[3] See Deutsche Bank (2007). Pojarliev and Levich (2010) provide empirical evidence that these investment strategies are widely followed by currency fund managers.

investment strategies is paramount for gauging effects on price dynamics and for assessing potential financial vulnerabilities.

We focus on risk-return profiles of FX strategies …

In this feature, we provide an overview of typical FX investment strategies and illustrate how they work. The strategies we consider are standard carry trade, momentum and term spread strategies. The last of these are refined carry trades that, in addition to interest rate differentials, also take into account expected macroeconomic conditions as reflected by the steepness of the yield curve (Ang and Chen (2010)). Our main focus is on illustrating the risk-return profiles of the different strategies. Besides analysing their behaviour under normal market conditions, we take a closer look at the downside risks involved, especially tail risks. We find that even though FX investment strategies have fared rather well, short-term downside risks to investors can still be quite substantial. This is an important aspect given the short-term nature of the typical strategies deployed in these markets. One bad month can be sufficient to wipe out one to two years of average returns. We also show, however, that investments in equities expose investors to even larger downside risks.

The article proceeds as follows. We first provide an overview of some of the most popular FX investment strategies before discussing their risk-return profile. We then take a specific look at some extreme events in the lower tail of the return distribution, illustrate the strategies' performance during both recent and historical episodes of severe market stress (such as the Asian crisis and the recent financial crisis) and provide a comparison with other risky assets over the same period. In a separate box, we discuss possible economic drivers of the returns generated by these investment strategies and emerging themes in the literature. The final section concludes.

FX investment strategies

Carry trade

… such as carry trade and momentum

A carry trade involves borrowing in currencies with low interest rates (called funding currencies) and investing in those with high interest rates (the target currencies). Examples of recently attractive target currencies are the Brazilian real, the South African rand and the Australian dollar. Popular funding currencies included most recently the US dollar and historically also the Japanese yen or the Swiss franc. If the target currency does not depreciate vis-à-vis the funding currency during the life of the investment, then the investor earns at least the interest differential. This strategy does not work if uncovered interest parity (UIP) holds. The UIP condition states that higher-yielding currencies will tend to depreciate against lower-yielding ones at a rate equal to the interest differential so that expected returns are equalised in a given currency. Under UIP, any interest differential is expected to be fully offset by currency movements.

A large body of empirical literature documents that UIP fails almost universally at short- and medium-term horizons (Froot and Thaler (1990), Sarno (2005)). Indeed, in many cases the relationship is precisely the opposite of that predicted by UIP: currencies with high interest rates tend to appreciate

while those with low interest rates depreciate. This failure of UIP is so well established that the phenomenon is called the "forward premium puzzle". The failure of UIP is no secret to investors, hence the popularity of carry trades. This strategy has become so commonplace that the market has created tradable benchmarks for it and has introduced structured FX instruments referencing these benchmarks. In our analysis below, we mimic a typical carry trade strategy readily available to investors.[4] The carry trade puts upward pricing pressure on target currencies and downward pressure on funding currencies. This could result in amplification of underlying exchange rate moves. In addition, it may also result in more rapid exchange rate moves when carry trade investors unwind their positions.

Momentum strategies

Momentum strategies rely on short-term trends …

Momentum strategies are also known as "trend-following" strategies. They have been quite profitable across several asset classes (Asness et al (2009)), including equity markets worldwide, commodities and corporate bonds.

We consider portfolios of currencies where an investor buys (takes a long forward position) in currencies with high past excess returns ("winners") and sells (takes a short forward position) in currencies with low past excess returns ("losers"). By design, momentum strategies may potentially perpetuate past directional moves in exchange rates. This could result in amplification as well as delayed but more abrupt exchange rate moves.

… are long past "winners" and short past "losers" …

In our implementation, which mimics typical currency momentum strategies as performed by practitioners, we rely on past performance as measured over short-term horizons of one and three months.[5] This family of FX momentum strategies draws on information from the entire cross section of tradable currencies.[6] The idea is to go long in a portfolio of winner currencies and go short in a portfolio of loser currencies. Currency momentum therefore has a distinct cross-sectional focus, which distinguishes it from other trading strategies that also exploit short-term trends but focus on individual exchange rates (eg Neely et al (2009)).[7]

... and are multicurrency

The momentum strategy is somewhat of a chameleon when compared to the carry trade. The portfolio of winner currencies might at the same time contain both high interest rate currencies, such as the New Zealand dollar, and

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[4] There is also an expanding literature exploring the economic drivers of the returns generated by this strategy (for recent contributions, see eg Brunnermeier et al (2009), Burnside et al (2011a), Lustig et al (2011) and Menkhoff et al (2011a)).

[5] Menkhoff et al (2011b) show that FX momentum strategies with relatively short formation periods (up to six months) and monthly rebalancing of FX momentum portfolios tend to be the most profitable. They also dissect the differences between carry trade and momentum strategies in close detail and show that the strategies and their properties are indeed very different. This implies that the two phenomena require different explanations.

[6] Similar strategies have also been considered by Okunev and White (2002), Burnside et al (2011b) and Menkhoff et al (2011b).

[7] See Menkhoff and Taylor (2007) and Neely and Weller (2011) for comprehensive surveys of the literature on so-called "technical trading rules" in foreign exchange markets.

low interest rate ones, such as the Japanese yen or the Swiss franc: It all depends on their short-term behaviour in the immediate past. More recently, currencies in the short portfolio have included the Hungarian forint, the Polish zloty and the euro. One distinguishing feature of the momentum strategy is that the long-short combination requires more frequent rebalancing than the carry trade and thus results in a less stable currency composition over time. As a result, transaction costs are potentially large (Menkhoff et al (2011b)). Hence we report all our performance measures and results with transaction cost adjustments based on quoted bid-ask spreads.

Yield curve slope or term spread strategies

Term spread strategies are refined carry trades …

Term spread strategies are also long-short investment strategies guided by relative yield curve steepness. They represent a class of FX investment strategies where predictive signals for exchange rates are based on the entire yield curve (Ang and Chen (2010)) and can be best thought of as a refined version of the carry trade. Differentials in yield curve slopes across countries convey information about differences in term premia. This additional forward-looking information is neglected by standard carry trade investors, who only consider the short end of the yield curve when deciding which currencies to buy and sell. The simple form of term spread strategy involves going long in currencies with low term spreads (the Australian dollar and the Swedish krona are recent examples) and short currencies with high term spreads (recently sterling and the Mexican peso).

… based on both interest differentials and relative yield curve slopes

Risk-return profiles for different strategies

To explore the nature of the risk faced by investors, we follow recent work by Kroencke at al (2011) and draw on a broad cross section of currencies. The cross section includes most of the major currencies for the developed and emerging economies. We cover the period January 1985–September 2011 for a total of 25 currencies, all measured against the US dollar (USD).[8] This set of currencies broadly corresponds to the investment universe deployed in typical FX investment vehicles available to investors and covers over 95% of global FX turnover (King and Rime (2010)).[9]

We build portfolios of currencies to implement these strategies in line with current practice in industry and research (Lustig and Verdelhan (2007)). In each month, we sort currencies according to either (a) forward discount / lagged interest rate differential vis-à-vis the United States (Carry trade); (b) lagged past performance over one or three months (Momentum 1 and Momentum 3); or (c) the term spread differential (Term spread strategy). The

[8] Quantitatively similar results hold when considering alternative base currencies such as the euro, sterling and the Swiss franc (Kroencke et al (2011) or Menkhoff et al (2011b)).

[9] The sample covers the currencies of Australia, Brazil, Canada, Chinese Taipei, Denmark, the euro area, France, Germany, Hungary, India, Indonesia, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Poland, Russia, Singapore, South Africa, Sweden, Switzerland and the United Kingdom against the USD.

strategies are then implemented through long forward positions in the 25% of currencies with the highest value of the specific signal defined by each strategy and short forward positions in the 25% of currencies with the lowest value of this signal. The portfolios are rebalanced monthly and we compute excess returns for equally weighted portfolios.

Here the *excess return* is what is left after borrowing in USD at the US interest rate, converting into foreign currency, investing in the foreign money market and finally converting back to USD at the end of the investment period. Specifically, the excess return to a long FX forward position at time t is given by $f(t) - s(t+1)$, where $s(t)$ is the logarithm of the spot rate (defined as units of foreign currency per USD), and $f(t)$ denotes the log forward rate. Put differently, the excess return is the return to selling the USD forward and buying it back at the future spot rate.

Returns

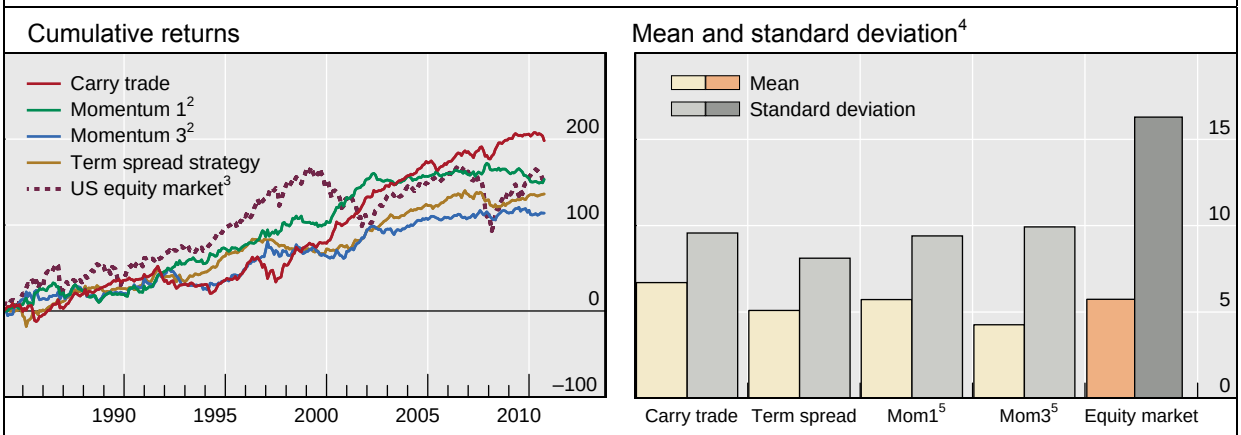
FX strategies have generated high returns …

Returns for the FX strategies considered here have been larger than or on a par with those for equities during the examined period (Graph 1). For benchmark purposes, we compare the FX strategies with the return to the aggregate US equity market in excess of the US one-month T-bill rate.[10] The annualised average monthly return on a carry trade portfolio was 7.4% during the period, while the momentum strategy yielded an average of 5.7% per year compared to 5.9% for US equities. Moreover, the return volatility for the FX strategies is fairly low compared to that for the equity market.

Returns from FX strategies are not normally distributed. As is typical for financial returns, the return distributions have heavier tails than a normal distribution. The return distribution for both the carry trade and the term spread

Returns for selected FX strategies[1]

January 1985–September 2011



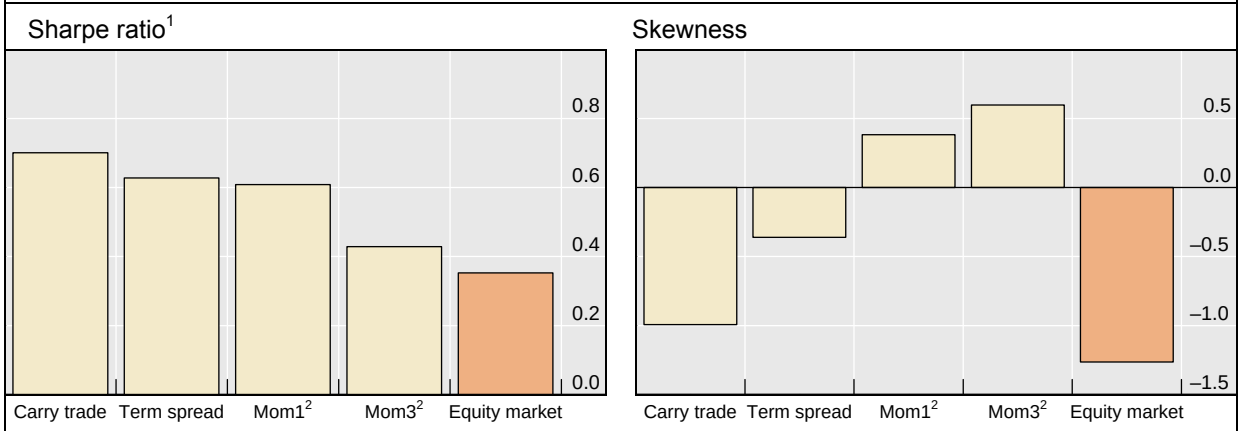
[1] Cumulated log excess returns, in per cent. [2] Momentum 1 refers to a momentum strategy based on one-month past performance and Momentum 3 to a momentum strategy based on three-months past performance. [3] Return on CRSP aggregate US equity market portfolio (incl dividends) in excess of the one-month T-bill rate. [4] Annualised. [5] Momentum 1 and Momentum 3 respectively; see footnote 2.

Sources: Bloomberg; Datastream; Global Financial Data; Professor Kenneth French's website; authors' calculations. Graph 1

[10] We use the broad equity index by the Center for Research in Security Prices (CRSP).

Return characteristics of FX strategies

January 1985–September 2011



[1] Annualised. [2] Momentum strategy based on one-month past performance (Mom1) and on three-months past performance (Mom3) respectively.

Sources: Bloomberg; Datastream; Global Financial Data; Professor Kenneth French's website; authors' calculations. Graph 2

strategy are negatively skewed (Graph 2, right-hand panel), ie large losses are more likely than large gains. The negative skew reflects the presence of occasionally large negative monthly returns in the range of about 8–12%. This squares well with the evidence presented elsewhere (Gyntelberg and Remolona (2007), Brunnermeier et al (2009)). This skew can be considered as a proxy for what we call downside risk, but we consider some more refined measures below. In contrast, both of the momentum strategies have positive skew, and hence feature a slightly higher frequency of positive returns.

Risks

We consider three standard measures of risk: (1) volatility; (2) value-at-risk (VaR); and (3) expected shortfall (Table 1). Volatility of returns is the most common measure of risk in financial markets and would be most appropriate for symmetric and normal return distributions. VaR is defined as the capital needed to cover a certain level of losses over a given holding period and at a

Risk measures and returns for different investment strategies

January 1985–September 2011, in per cent

Strategy type	Mean excess return (per annum)	Volatility[1] (per annum)	1% VaR[2] (monthly)	1% expected shortfall[3] (monthly)
Carry trade	7.4	9.9	6.7	8.1
Momentum – 1 month[4]	5.7	9.4	7.9	9.9
Momentum – 3 months[4]	4.3	9.9	8.6	10.7
Term spread	5.1	8.1	6.4	7.6
US equity market[4]	*5.9*	*16.3*	*9.1*	*10.3*

[1] Standard deviation of returns (annualised, in per cent). [2] The 1% VaR for a random variable x is defined as the 1% percentile of the distribution. [3] The 1% expected shortfall is the expected loss given the loss exceeds the 1% VaR. Both VaR and expected shortfall are estimated using an extreme value theory approach following the method suggested by Gilli and Këllezi (2006). [4] Momentum strategy based on one-month past performance and three-months past performance respectively. [5] Return on CRSP aggregate US equity market portfolio (incl dividends) in excess of the one-month T-bill rate.

Sources: Datastream; Global Financial Data; Professor Kenneth French's website; BIS calculations. Table 1

given confidence level. It is a standard measure of risk when return distributions feature small probabilities of large losses. Expected shortfall is the (estimated) expected loss in situations where losses exceed a 1% VaR level. Both VaR and expected shortfall are measures that focus on downside risk.

Returns versus risk

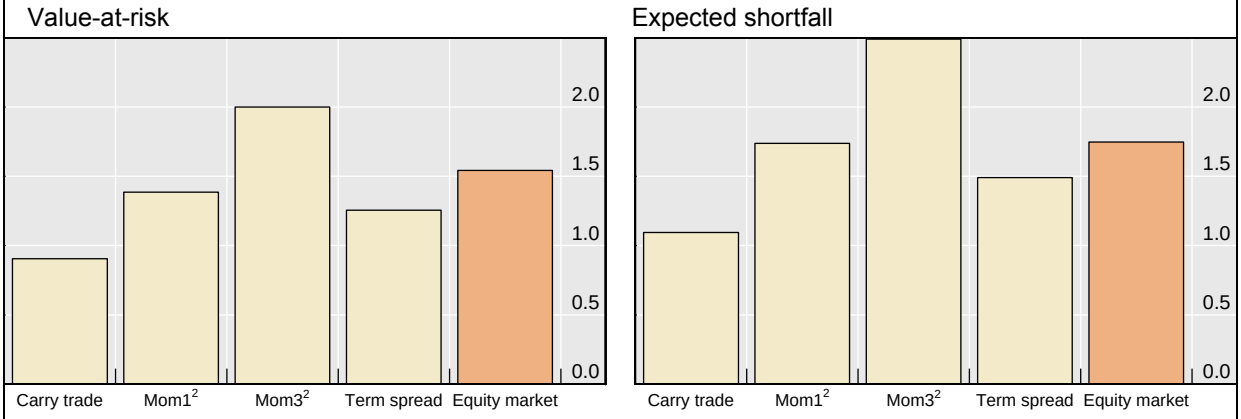
The most prominent measure of return per unit of risk is the Sharpe ratio, which is the ratio of average excess return per unit of volatility. It is also often termed the reward-to-risk ratio. The Sharpe ratios for the FX strategies are clearly higher than those for equities (Graph 2, left-hand panel).[11] The reason is that although the mean excess returns for the FX strategies and equities are roughly the same, the FX strategies have much lower return volatility (Table 1 and Graph 1).

… but also feature substantial downside risks

While the Sharpe ratios suggest that the FX strategies have very attractive risk-return profiles, they do not account for downside risks, which can be substantial. That said, the FX strategies are less risky on the downside relative to the equity market (Table 1). This is illustrated in Graph 3, which compares the VaR and expected shortfall estimates. Interestingly, the carry trade strategy has the lowest monthly downside risk measures among the strategies considered here. Nevertheless, although the downside risks are smaller for the carry trade and the term spread strategies, a single bad month can still be sufficient to wipe out the return obtained over a whole year. For momentum strategies, the situation is even more extreme, with losses over a single month potentially wiping out about two years of returns.

For FX strategies, one bad month can cost as much as one to two years' worth of returns

Years required to recoup a one-month extreme loss[1]



[1] Years of mean monthly excess returns required to recoup 1% probability of VaR and expected shortfall losses. Calculated as the loss measure divided by average annualised monthly excess returns. [2] Momentum strategy based on one-month past performance (Mom1) and on three-months past performance (Mom3) respectively.

Sources: Bloomberg; Datastream; Global Financial Data; Professor Kenneth French's website; authors' calculations. Graph 3

[11] Sharpe ratios for equities are sensitive to the sample period due to the high variability of equity returns. This makes it difficult to pin down the value of the historical equity premium precisely. Computing the Sharpe ratio for the US equity market for a longer period over the post-WWII sample (January 1947–August 2011) gives a value of 0.47. This value has been the subject of a large literature on the "equity premium puzzle". Returns to FX investment strategies present a challenge to researchers of even greater magnitude.

Performance during actual periods of market distress

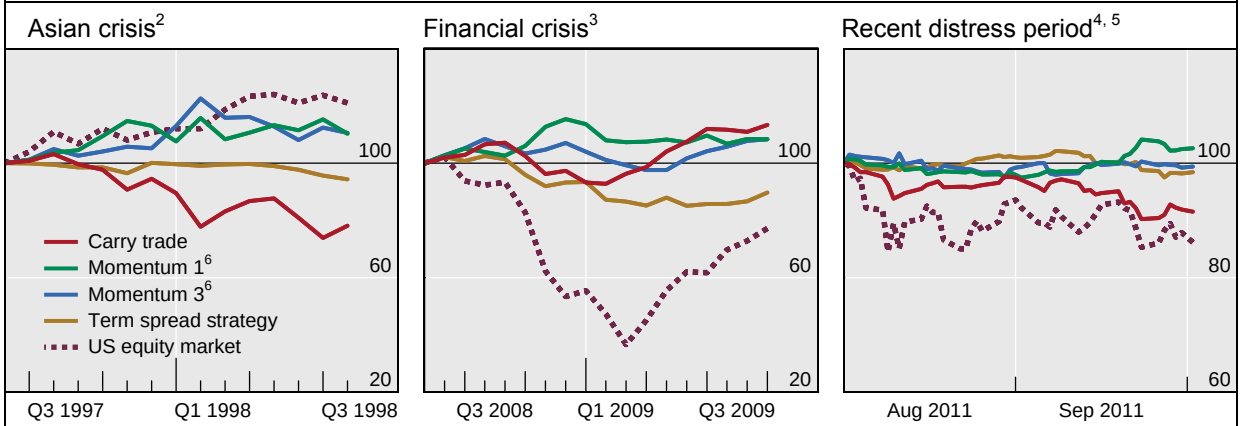
The Asian crisis was bad for carry trade investors

We now turn to the selected periods of market distress and discuss the returns in the bad tail of the distribution. This exercise is particularly interesting since the recent literature on carry trades emphasises the importance of market-wide distress. The focus is on measures of funding or market illiquidity and systematic volatility risk.[12] We consider the Asian crisis (1997–98) and the latest financial crisis (2008–09). In addition, we take a closer look at the two recent months of August and September 2011.

The Asian crisis was clearly not a good period for carry trade investors, as depicted by Graph 4 (left-hand panel). The largest monthly loss for our simulated carry trade strategy was about –12% in January 1998. During this period, the Deutsche mark, Japanese yen, Dutch guilder and Swiss franc were all attractive as funding currencies while the South African rand, Indonesian rupiah and Mexican peso were targets. While carry trades suffered severe losses, other FX investment strategies either did not exhibit such a poor performance (as in the case of the term spread strategy) or actually yielded positive returns (as in the case of the two momentum strategies). It is also worth noting that, in contrast to Asian equity markets, US equities actually performed rather well during the Asian crisis.

The 2008–09 financial crisis is a telling example of a severe period of market stress or tail event. In the run-up to the crisis, currencies such as the South African rand, Brazilian real and New Zealand dollar featured prominently as attractive target currencies.[13] Primary funding currencies were the Swiss franc and Japanese yen. As shown by Graph 4 (centre panel), the carry trade suffered severe losses during the crisis. The most negative return to our

Cumulative returns during periods of market distress[1]



[1] First observation indexed to 100. [2] Cumulative returns, May 1997–July 1998. [3] Cumulative returns, April 2008–September 2009. [4] Cumulative daily returns. [5] US equity cumulative daily returns on price index. [6] Momentum strategy based on one-month past performance and on three-months past performance respectively.

Sources: Bloomberg; Datastream; Global Financial Data; Professor Kenneth French's website; authors' calculations. Graph 4

[12] See eg Brunnermeier et al (2009), Christiansen et al (2011), Lustig et al (2011) and Menkhoff et al (2011a).

[13] See Galati et al (2007), Gyntelberg and Remolona (2007) and McGuire and McCauley (2009).

Drivers of carry and currency momentum

Research on the economic drivers of carry trade returns has seen significant advances over the past several years. It has been established that it is difficult to explain carry trade returns purely as compensation for risk exposure with standard risk factors – that is, conventional asset pricing models based on covariance risk with, for instance, the broader market or business cycle factors (Burnside et al (2011a)). This has led researchers to emphasise aspects such as funding market constraints and crash risk (Brunnermeier et al (2009)), and to argue that currencies share a common risk factor (Lustig et al (2011) and that carry trade premia are compensation for systematic volatility and liquidity risks (Menkhoff et al (2011a)).[①]

In addition to work based on observable risks, an alternative explanation is that carry trade returns might be a compensation for the risk of rare disasters with significant losses which do not occur in-sample (Burnside et al (2011a)).[②]

Whereas the literature on carry trades is meanwhile quite extensive, much less is known about the potential drivers of currency momentum.[③] This is especially so for FX momentum strategies relying on a broad cross section of currencies that have been introduced more recently. Recent empirical studies suggest that currency momentum returns cannot be successfully explained by the risk types that seem plausible for carry trades (Burnside et al (2011b), Menkhoff et al (2011b)). This research also documents that the anatomy of carry trade returns is very different from that of currency momentum returns.

There is evidence that momentum returns in part reflect the gradual incorporation of news into prices and a resulting return drift, as shown in Menkhoff et al (2011b).[④] In addition, this research also points to country-specific risks, transaction costs and other forms of limits to arbitrage as likely explanations for the continued presence of momentum returns. Our finding of substantial downside risks for the currency momentum strategies presented in the main text squares well with this explanation. Following momentum strategies can expose investors to potentially painful short-term losses, as illustrated in the main text. This may discourage market participants from taking aggressive positions to trade momentum profits away (Shleifer and Vishny (1997)). Arbitrage capital might therefore move slowly, which could possibly explain why an apparent market anomaly like FX momentum continues to exist (Duffie (2010)).

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① There is also empirical evidence that carry returns co-vary more strongly with the equity market in volatile periods (Christiansen et al (2011)). ② This explanation is often referred to as the peso problem (Krasker (1980)). ③ Okunev and White (2002) were to our knowledge the first academic researchers to document the profitability of momentum strategies relying on a broad cross section of currencies. Most other earlier research on trading strategies which exploit short-term trends focused on individual exchange rates. Menkhoff and Taylor (2007) and Neely and Weller (2011) comprehensively review this literature on so-called technical trading rules. A major aim in much of this work has been to determine which rules work best and how stable they are over time (Neely et al (2009)). ④ This finding – which was first established for equities by Jegadeesh and Titman (2001) – suggests that momentum profits across asset classes may share a common root.

diversified portfolio mimicking a typical carry trade investment strategy was –6% in October 2008, which coincided with a major jump in the VIX and other measures of volatility over this period.

Carry trades rebounded quickly after the 2008–09 crisis …

During the latest crisis, the carry trade first saw a sharp drop followed by a quick rebound as volatility and uncertainty receded over the months. By April 2009, the initial losses were recouped. By contrast, it took the US equity market several years (up to January 2011) to recover from the losses that occurred during the height of the financial crisis.

… while momentum returns were surprisingly robust

In contrast to the carry trade, momentum strategies were surprisingly successful over the crisis period (Burnside et al (2011b)). Thus, during this

period of extreme stress, FX strategies clearly provided diversification.[14] The term spread strategy, however, performed poorly over the entire period. This may in part reflect the effect of unconventional monetary policy measures on the correlation between term premia differentials and exchange rate movements.

In line with previous distress episodes, carry trades also suffered some severe losses in August and September 2011. The largest loss for a carry trade portfolio funded by US dollars over these two months amounted to about 3% on a single day. This reflects the fact that carry trade target currencies such as the Australian dollar, Brazilian real and South African rand depreciated strongly whereas the US dollar (the most attractive funding currency) appreciated against the vast majority of currencies. This illustrates that downside risks can be substantial and suggests that carry trades are exposed to systematic volatility risk (Menkhoff et al (2011a)). At the same time, the performance of the other strategies was much less affected by the market stress, while equity markets suffered even larger losses (Graph 4, right-hand panel).

Conclusion

In this feature, we have provided an overview of common FX investment strategies. We have focused on their risk-return properties, especially during periods of market stress.

Our analysis suggests that carry trade and momentum investment strategies have continued to generate attractive returns for extended periods – but that they also involve significant downside risks.[15] Interestingly, we document that the downside risks to momentum strategies are of a similar magnitude to those for carry trades. The strategies, however, have quite different risk-return profiles. The carry trade is a typical "nickel" strategy yielding small gains most of the time but exposing an investor to large losses. In contrast, momentum strategies, in addition to downside risk, also have substantial upside. To put the downside risk of FX investment strategies into perspective, though, standard equity investments expose investors to even greater downside risks.

Our analysis also shows that, historically, the different strategies did not perform uniformly during episodes of market stress. This suggests that it is necessary to have a good understanding of the properties and risks associated with widely practised short-term investment strategies when trying to gauge their implications for price dynamics. From a financial stability perspective, the size of possible losses points to a potential for significant counterparty risks in FX markets. In addition, all the strategies considered have the potential to perpetuate and perhaps to amplify trends as well as short-term misalignments.

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[14] Kroencke et al (2011) show empirically that FX investment strategies provide diversification even for broadly diversified international equity and bond portfolios.

[15] For the carry trade, this is consistent with the findings in Gyntelberg and Remolona (2007) and Brunnermeier et al (2009).

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