

Melvin, Michael; Shand, Duncan

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Active Currency Investing and Performance Benchmarks

Michael Melvin
Duncan Shand

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Active Currency Investing and Performance Benchmarks

Abstract

There are no established benchmarks for evaluating currency investment manager performance. Some analysts have suggested that known investing styles like momentum, purchasing power parity, and carry serve as benchmarks. Challenges for this approach include: there is no market portfolio; there are many alternative generic factor constructions; different constructions of the same factor may have low correlations; the 3 factors may not provide diversification; and there is no “buy and hold” in the FX market. An evaluation of professional currency managers’ returns indicates that they are often generated independently from the generic style factors. Skill in timing is what investors should pay for and some managers demonstrate superior skill in timing the factors. Managers are also skilled at minimizing drawdowns relative to the generic factors. The use of generic style factors may be a worst case scenario instead of returns to which an FX investor may aspire.

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Michael Melvin
BlackRock
400 Howard St.
USA - San Francisco, CA 94105
michael.melvin@blackrock.com

Duncan Shand
BlackRock
Murray House
1 Royal Mint Court
UK - London EC3N 4HH
duncan.shand@blackrock.com

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Foreign exchange markets are different from other asset classes in some important respects. From an investor's perspective, one important difference is the lack of a well-defined benchmark to be used in assessing investment manager performance. This leads to questions like the following. How should an active currency manager be evaluated? Do active currency managers add value beyond passive strategies? Can I realize returns from investing in currencies through the use of investable currency indices offered by several firms?

This paper seeks to shed light on the issue of using indexes to invest in currencies and the related question of what is alpha and what is beta. The analysis will provide a new look at the value added by active currency managers. While there has not been much work on this topic in the public domain, we are not the first to study this issue. Pojarliev and Levich (2008) recently published a paper asking the question "Do Professional Currency Managers Beat the Benchmark?" They answered the question with a qualified "yes" in that about a quarter of the managers studied outperformed, generating an average alpha that was "quite high." However, they concluded that the returns of many managers may be explained by exposure to "a small set of factors that proxy the returns from well-known and easily implemented trading styles" (Pojarliev and Levich, p. 30). We want to reconsider such factors and the extent to which these are really easily implemented and a readily available cheap source of exposure to currency risk factors. While everyone in the industry is aware of strategies such as the carry trade or trend following, that does not mean that there will be returns easily available from investing in a particular approach to such exposures. In addition, even if active managers seek exposure to such strategies as part of their investment approach, the best active managers should have superior skill in

timing such factors so that they add value beyond what is realized by a passive investment.

The paper proceeds as follows: Section 1 discusses the issue of whether the concept of a “market portfolio” truly exists for currency investing. We make the point that even though there are recognized generic currency investing strategies, there exist many alternative constructions of such strategies and there is no such thing as “buy and hold” in the currency market. Section 2 examines a decomposition of manager returns into generic factor exposures and non-factor exposures to test if exposures to the different factors are diversifying to a currency portfolio. We show that meaningful incidental correlations across factors exist so that the expected diversification benefits of combining different generic strategies may be illusory. Individual investment manager performance is studied in Section 3. It is shown that managers differ greatly in terms of their skill in generating alpha. Additionally, manager returns often are generated independently of the generic style factors analyzed. In fact, during the financial crisis, managers who could time a reduction in exposure to the generic factors did best. Beyond alpha and timing ability, we also consider the issue of drawdowns, or periods of major loss. The generic factors each experienced deep and lengthy periods of negative performance. Many managers outperformed the generic strategies on this front, minimizing both the magnitude and duration of worse-case loss relative to generic style factors. Finally, Section 4 offers conclusions. This section may be summed up with the following: the simplistic use of generic style factors in currency investing is fraught with dangers and investors must proceed warily before employing such factors as useful performance benchmarks.

1. Currency Indices: Is there a market portfolio?

Unlike the equity market, where popular notions of “the market” exist, there is nothing like that in currencies. One can buy the S&P 500 index and feel reasonably comfortable that you have a broad exposure to the U.S. equity market. In the foreign exchange market, one does not “buy and hold.” Since every trade in the foreign exchange market involves buying one currency while selling another, an investor is naturally long and short across the chosen currencies. So how may one think about a passive strategy in currencies? First, there is no such thing as a purely passive strategy. All the various indices that have been suggested for currency investors involve some degree of active management in that they must be rebalanced over time as market conditions change. One may conclude that there really is no passive strategy for currency investors. As a result, trade execution and strategy are extremely important.

If we rule out the concept of passive investing in the currency market, can we still identify useful benchmarks for performance evaluation? The suggested benchmarks have all been indices representing known investment strategies in the currency market: carry, momentum or trend, and value (often some version of purchasing power parity). Rather than passive strategies, one may think in terms of common risk factors that currency investors are exposed to. In this spirit, there have been suggestions that active managers should beat these common factors in order to add value. However, there are many ways that such strategies are employed by investors and the indices on offer reflect interesting

differences. So the common factors are really not exactly “common.” For an example, we analyze a representative sample of indices.

Figure 1 displays cumulative returns from three different momentum or trend strategies as offered by indices created by the Centre for International Banking Economics and Finance (known as the AFX Currency index), Credit Suisse (CS), and Deutsche Bank (DB). The AFX and DB samples begin in June 1989, while the CS sample begins in June 1999. A cursory look at the figure suggests that there is no such thing as a single concept of “trend.” Each firm has a different approach to modeling exchange rate momentum.

- DB calculates 12-month returns and then once-a-month ranks the G10 currencies, going long the top 3 while shorting the bottom 3.
- AFX uses three moving averages of 32, 61, and 117 days and if the current spot rate exceeds (is less than) a moving average value a long (short) position is established. The benchmark return is the average of the returns from the three rules.
- CS defines “trend” as a 12-month exponentially-weighted moving average of total returns (including carry) and then takes long (short) positions in currencies whose total returns are above (below) the trend. So this trend concept includes an element of carry.

The cumulative performance of the three different strategies in Figure 1 are quite different at times. One can observe periods when one index is rising while others are flat or falling. The lesson is that even a simple concept like “trend” can be employed many different ways which yield differential performance so that it is an oversimplification to

claim that there are clear benchmarks for applying in currency markets. This is reflected in academic studies of technical analysis in currency markets where survey data indicate a wide variety of trading rules are employed in trend-following strategies as reported in the survey by Menkhoff and Taylor (2007).

To further investigate the extent to which alternative reasonable measures of “benchmark factors” may differ, we examine correlations across a set of alternative indices as provided by DB, CS, and Citi. For Trend, we also include the AFX index that was studied by Pojarliev and Levich (2008). Table 1 displays the estimated correlations. Trend factor index correlations range from 0.20 for AFX/DB to 0.76 for CS/DB. Carry factor index correlations range from 0.46 for Citi/CS to 0.81 for Citi/DB. Finally, PPP factor index correlations range from 0.39 for CS/DB to 0.45 for Citi/DB or Citi/CS. Clearly the notion of a “generic” strategy in currency investing does not result in alternative indices of the generic factors looking much alike. This is unlike the case of equity markets where the S&P 500 and the Dow Jones Industrial average have a correlation of 0.99 over the period from March 1980 to March 2010. In the case of equities, it is entirely reasonable to talk about the “market” and then benchmark returns against such a concept. In currency markets, the situation is much different.

2.Measuring Factor Exposures

Active managers employ various strategies aimed at providing returns to investors that compare favorably to other risky investment opportunities yet offer low correlation to other opportunities. While we have just seen that there is no such thing as a unique

generic strategy, it is reasonable to expect active managers to often employ many different strategies that may include combinations of the factors considered above: momentum or trend, carry, and value.

Pojarliev and Levich (2008) examined the degree to which such factors, representing popular currency investment strategies, could explain active manager returns over the G10 universe of currencies or nine currency pairs versus the U.S. dollar. If we had three truly orthogonal factors, we should be able to explain a large proportion of such a low-dimensional space of currency returns. One would expect to explain much less of an active equity manager's returns across 500 stocks using only 3 factors.

What sort of exposures would we observe if we constructed a portfolio based upon the standard factors of interest? Over any given subsample, would the factors yield similar holdings or would they be diversifying? We employ a methodology to analyse a simple 'indexed' portfolio and show that meaningful incidental correlations can occur. We apply this firstly to a simple aggregation of 'factors'.

We could use a moving window regression approach to try to explain manager's returns on a time varying basis. However, this is a limited approach, as we would need to ensure that we have 'enough' data points to make the regressions statistically meaningful. Given that we have relatively short datasets, we propose an alternative method to measure the exposure based on holdings to infer some properties of directional currency portfolios. Our objective is to partition a manager's holdings (h) into a 'factor component' (h_F) and a 'non-factor component' (h_{NF}) such that the expected returns to the components h_F and h_{NF} must be orthogonal. We can denote this decomposition as

$$h \equiv h_F + h_{NF} \quad (1)$$

where

$$h_F \equiv \gamma h_G \quad (2)$$

and h_G denotes the holdings of the factor portfolio, i.e. γ is a unit-less exposure measure for the factor h_G in h .

Our objective is thus to choose γ to satisfy the required orthogonality criterion, that the expected correlation of non factor-return and factor return, (i.e. $r'h_{NF}$ and $r'h_F$ for vector of currency returns r) be zero:

$$E \left[\frac{(h'_F r)(r' h_{NF})}{\sqrt{(h'_F r)(r' h_F)} \sqrt{(h'_{NF} r)(r' h_{NF})}} \right] = 0. \quad (3)$$

Making the approximation¹

$$E \left[\frac{(h'_F r)(r' h_{NF})}{\sqrt{(h'_F r)(r' h_F)} \sqrt{(h'_{NF} r)(r' h_{NF})}} \right] = \left[\frac{h'_F E(rr') h_{NF}}{\sqrt{h'_F E(rr') h_F} \sqrt{h'_{NF} E(rr') h_{NF}}} \right],$$

the criterion function (3) reduces to setting to zero the 'ex ante correlation' between the factor and non-factor component, with $E(rr') = V$:

¹ We can avoid this slight approximation by requiring the expected covariance rather than correlation of returns from factor and non-factor to be zero and moving directly to $E(h'_F r)(r' h_{NF}) = h'_F V h_{NF} = 0$, which also implies equation (6) given (1) and (2).

$$\left[\frac{h'_F V h_{NF}}{\sqrt{h'_F V h_F} \sqrt{h'_{NF} V h_{NF}}} \right] = 0. \quad (4)$$

Using (1) and (2) in (4):

$$\frac{\gamma h'_G V (h - \gamma h_G)}{\sqrt{\gamma h'_G V^{-1} \gamma h_G} \sqrt{(h - \gamma h_G)' V^{-1} (h - \gamma h_G)}} = 0. \quad (5)$$

Equation (5) implies the normal equation:

$$\gamma [h'_G V h - \gamma h'_G V h_G] = 0,$$

which implies a unique expression for γ :

$$\gamma = (h'_G V h_G)^{-1} h'_G V h. \quad (6)$$

The expression for γ given in (6) is in fact akin to the standard generalised least squares estimator in a projection of the signal holdings h onto the factor portfolio holdings h_G . It looks slightly odd at first sight because the weighting matrix is not the usual *inverse* of the covariance matrix but the covariance matrix V itself. However, recall that V is the covariance matrix of *returns*. The intuition is that the estimator (6) will give higher weighting to currency pairs where the absolute correlation of returns is high as well as to currencies with riskier returns.²

² Given $h_i = V^{-1} \alpha_i$, however, (6) may also be written $\gamma = (\alpha'_G V^{-1} V V^{-1} \alpha_G)^{-1} \alpha'_G V^{-1} V V^{-1} \alpha$ i.e. $\gamma = (\alpha'_G V^{-1} \alpha_G)^{-1} \alpha'_G V^{-1} \alpha$. Hence, (6) is equivalent to the usual GLS estimator in a projection of signal alpha onto factor portfolio alpha. Moreover, premultiplying (2) by V , we have

To use this type of analysis we need to have an estimate of the covariance matrix of returns V . In the analysis below, we show the effect of two covariance matrices, in the first we use the simplifying assumption of the identity matrix and the second we use the full period in-sample covariance matrix of spot exchange rate returns. We use this approach to look at properties of portfolios of generic factors. We look in particular at a G10 portfolio of equally weighted carry, momentum and value factors from Deutsche Bank³. Deutsche Bank calls this the DBCR portfolio which invests 1/3 in each of the carry, momentum and value portfolios. We wish to look at the exposure, as defined above, of each of the momentum, carry and value factors to the composite portfolio. If these factor portfolios are uncorrelated at each point in time we would expect to see each factor being 1/3 of the composite exposure. If they are perfectly correlated, we would expect to see each factor with an exposure of 1.

We look first at a real world example for the major currencies from the last rebalance in 2008 (17 December) for the Deutsche Bank indices. Figure 2 displays a bar chart of the holdings. We see that the Carry factor was short yen, Swiss franc, and U.S. dollar and long elsewhere. Overall, the model exposures to each factor are:

$Vh_F = \gamma Vh \Rightarrow \alpha_F = \gamma \alpha_G$, so that we could perform an exactly equivalent decomposition in alpha space, with the weighted refined alphas and using a standard GLS estimator. This, however, obscures the intuition for using the GLS estimator.

³ Thanks to Chris Smith at Deutsche Bank for providing the holdings level dataset.

| | Carry | Momentum | Value |
|-----------------------------|-------|----------|-------|
| In sample covariance matrix | 0.17 | -0.17 | 0.29 |
| Identity Matrix | 0.06 | -0.10 | 0.29 |

At this point in time, the portfolio was long Carry and Value and short Momentum. These are generally low exposures showing that, at least at this point in time, the portfolio was reasonably diversified. Also note that, even though momentum is a component of the composite DBCR portfolio, we actually have a *negative* exposure to the factor in the composite in this period, even though on average it has a *positive* exposure in the composite.

Figure 3a illustrates the time-series of exposures to each factor using the full-sample covariance matrix, while Figure 3b shows exposures using the identity covariance matrix. Generally, the portfolio takes positive exposures to all three factors, with Momentum exposure turning negative for several brief periods through the sample. This general pattern does not depend upon which risk matrix is employed. The sample averages for each factor are:

| | Carry | Momentum | Value |
|-----------------------------|-------|----------|-------|
| In-sample covariance matrix | 0.52 | 0.27 | 0.44 |
| Identity covariance matrix | 0.52 | 0.26 | 0.38 |

Over the period covered in Pojarliev and Levich (2008) the exposures were a little higher, showing there was more commonality in the factors at the time period they studied:

| | Carry | Momentum | Value |
|-----------------------------|-------|----------|-------|
| In-sample covariance matrix | 0.65 | 0.38 | 0.54 |
| Identity covariance matrix | 0.68 | 0.31 | 0.47 |

These results show that the diversification offered by simply combining factors can be illusory. The incidental exposures from the different factors can be high, or can lead to negative exposure to a factor even when it is included in a diversified portfolio. Over any given subsample, managers are likely to have positive exposure (through incidental means or deliberately) to these factors, but managers skill should be measured by showing evidence of ability in timing the factors.

3. Manager Performance Analysis

Pojarliev and Levich (2008) suggested that only returns beyond those explained by the generic factors of carry, momentum, and value should be considered as true alpha. However, the previous section demonstrated how such factors can be very different depending upon construction method—there is no standard accepted definition of the three factors. Given the plethora of constructions utilized by currency investors, identifying true alpha is challenging. To better understand these issues, we analyze the returns of a currency manager dataset employed by Pojarliev and Levich (2009) in an analysis of survivorship among currency managers. The dataset is the Deutsche Bank FXSelect platform. Deutsche Bank (DB) provides daily return data for the currency

managers participating on their platform. Managers' identities are not known to us as they are identified by numbers only. There are 42 managers active at the time of this research with enough data to allow analysis. The data set begins in November 2004 and ends in May 2009. The shortest included manager sample exists for Manager 59, who has 64 weekly observations. Any managers with less than a year of data were excluded from the analysis. For style factors, we employ the Deutsche Bank indexes for carry, purchasing power parity (PPP or value), and momentum (or trend).

3.a. Style Factor Regressions

Table 2 displays results of a regression of manager returns on a constant plus the 3 style factors. While 35 of the 42 managers have positive alpha (constant) coefficients, only 3 managers are identified as having statistically significantly positive alpha when conditioned upon the 3 factors. As for the factors themselves, 12 managers load on the carry factor with a significantly positive beta, 6 load with a significantly positive beta on PPP, and 11 load on momentum with a significantly positive beta. Keeping in mind that there are many alternative constructions of these factors, it is interesting to note the extent to which these managers' returns appear to be generated independently of the 3 style factors. It is also interesting to note that the 3 managers with significant and positive alpha indicate that successful managers may employ other than standard styles of investing. For instance, manager 13 has a negative loading on all 3 factors, significantly so only for carry. Manager 27 does not load on any of the factors and appears to follow different strategies than incorporated here. Manager 116 loads significantly only on momentum. Finally, the frequency of negative style loadings is notable. Carry enters

negatively in 24, or about half, of the cases, 10 of which are significant. A similar finding appears for PPP, about half (25) of the managers load negatively, with 4 being statistically significant. In the case of Momentum, 22 load negatively, 8 of which are significant.

The last row of Table 2 shows the results of estimating a pooled regression across all managers. The alpha is positive and significant. This suggests that if one had combined the performance of all managers, say into a multi-manager currency fund, positive alpha would have been produced. The only style factor with a statistically significant coefficient is Momentum, for which the sign is positive. The variety of manager styles is not revealed by the pooled results, and this points out the importance of looking at disaggregated results.

An examination of a plot of the cumulative returns associated with an investment in each of the style factors over the sample period, reveals that these factors realized very uneven performance. So it is not surprising that the most successful managers may not load heavily on the factors. Figure 4 displays the cumulative returns to each factor over the 2004-2009 period covered by the data set. From 2004 until 2008, performance of momentum was quite flat. Then in late 2008, momentum has a very strong run of positive performance that is seen to reverse in 2009. PPP has a good run of performance early in the sample period; is quite flat until a drawdown begins at the onset of the crisis period in 2007; and then has a period of outperformance beginning late summer 2008. Finally, the carry factor is seen to have positive performance early in the sample period followed by a drawdown from the fall of 2005 until the summer of 2006; a strong run of positive

performance from summer 2006 until the summer of 2007, after which there is a slow decline until the failure of Lehman Bros. in 2008, when there was a sharp and deep fall which ends in early 2009.

Figure 4 suggests that the presence of the financial crisis may contribute to this sample being less than representative of the historical record. We explore the implications of the crisis by reestimating the model over the crisis period of August 2007 to December 2008.⁴ Estimation results are reported in Table 3. Only 31 of the managers now have positive alpha coefficients and only 2 are statistically significant. Carry was a bad bet at times during this period and we see quite a few managers loading negatively on carry, which would have been a wise move at times. However, value or PPP was a profitable factor late in the crisis, and the fact that 5 of the 7 significant PPP coefficients are negative suggests that manager positioning was probably not aligned with the value bet (at least as measured by this particular PPP construction). Finally, Momentum was basically flat until post-Lehman Bros. and then had a positive run of performance, so only if managers had timed the 2008 episode well, would it have been profitable to load positively on Momentum. Table 3 shows that 10 managers had significantly positive Momentum exposures with only 4 negative manager exposures.

The last row of Table 3 contains results for pooling across all managers. As in the full-sample case, there is significant and positive alpha. The inference is that a multi-manager currency fund would have generated alpha, even though only two individual managers delivered significant alpha. The only style coefficient with a significant loading is Momentum, also as before. Again, the pooled results hide the great variety of

⁴ Melvin and Taylor (2009) present an analysis of the financial crisis effects in the FX market and assert that for currency investors, the crisis began in August 2007.

individual manager performance revealed by the manager regressions. The results so far suggest that managers differ considerably in their ability to time factors. Given the time-specific nature of factor performance, the ability of managers to time their exposures should make an important contribution to performance.

3.b. Timing Ability

We explore the issue of timing by decomposing the style factors into positive and negative returns and then exploring whether managers have the ability to time the changing returns. The estimation strategy is given by the following equation:

$$r_{j,t} = \alpha_j + \sum_{i=1}^3 \beta_{i,j} [F_{i,t} | F_{i,t} > 0] + \sum_{i=1}^3 \gamma_{i,j} [F_{i,t} | F_{i,t} < 0], \quad (7)$$

where r is return of manager j at time t ; F is the return associated with style factor i , and the factors are decomposed into positive and negative return observations. Manager timing ability is inferred from whether managers load positively (negatively) onto factors when factor returns are positive (negative). In other words, do managers tend to have long positions when factor returns are positive and short positions when factor returns are negative? Table 4 reports estimation results. There is some evidence of timing ability among the individual managers. Statistically significant results include the following: 4 managers timed positive carry; 9 managers timed negative carry; 3 timed positive PPP; 2 timed negative PPP; 6 timed positive Momentum; and 3 timed negative Momentum. While 4 of the managers had positive alpha coefficients, this may be misleading as an indicator of manager skill, as the ability to time factor returns is surely something that sets successful managers apart from the herd.

The last row of Table 4 reports pooled results for timing ability. While alpha is positive, it is not statistically significant. Estimated coefficients for factor timing, indicate that only negative Momentum has a statistically significant coefficient and that coefficient has the wrong sign—suggestive of managers timing it wrong. Once again, the pooled results hide the great differences that exist for individual managers.

Again, one must keep in mind that we only employ one measure of each style factor and in practice there are a great many approaches that investors use to model such factors. As was shown earlier, given the relatively low correlations that may exist between different measures of the same factor, it is entirely possible that we do not show a manager loading on a particular factor when, in reality, they bet on such a factor via a different approach. In this sense, all such estimations of manager loadings on factors are only suggestive and not conclusive.

A simple example illustrates this last point. We pick Manager 116, the manager with the strongest alpha performance in Table 2 as a test case. That manager's returns are seen in Table 2 to load significantly on momentum. Recall that those regressions employ the Deutsche Bank measure of momentum. However, if we replace the Deutsche Bank momentum measure with the Credit Suisse measure, the significant momentum factor loading disappears. The earlier Section 1 discussion surrounding Figure 1 stated that the DB measure used 12-month returns to create monthly rankings of momentum. DB then goes long the top 3 and short the bottom 3. CS, however, uses a 12-month exponentially-weighted moving average of returns and goes long those currencies whose returns are above trend and short those currencies whose returns are below trend. These results indicate that Manager 116 follows more closely a strategy reflecting the DB concept than

the CS concept. Both the CS and DB concepts are reasonable constructions. Yet, an analyst employing the CS concept of momentum, would conclude that Manager 116 does not employ momentum as a strategy. This serves to reinforce the notion that there is no such thing as a generic strategy in FX. There are many alternative definitions and inferences drawn from empirical work will differ according to which concepts are employed by the researcher.

3.c. Drawdowns

As a final exploration of manager performance, we examine drawdown performance over the period for which a large group of managers have historical data: November 15, 2005 to May 18, 2009. We can calculate the periods of major loss associated with each factor and then check if managers have skill in moderating the loss relative to a mechanical implementation of (and constant exposure to) style factors. Since different managers employ different amounts of risk in their portfolios, we scale all returns to being consistent with 10 percent risk portfolios. Figure 5 reports the maximum drawdowns.

We see that Carry, PPP, and Momentum all have very sizeable drawdowns. The maximum Carry drawdown of -26 percent was realized during the crisis period of July 24, 2007 to February 2, 2009. The maximum PPP or value drawdown of -16 percent was also during the crisis and ran from June 13, 2007 to August 7, 2008. Finally, the maximum Momentum drawdown was realized in 2009 from February 2 to May 8. Only two managers had worse drawdowns than Carry. Nineteen managers had drawdowns that ranged between the Carry and PPP drawdowns. Twenty nine managers had drawdowns

between that of PPP and Momentum. Fifteen managers had drawdowns smaller than Momentum.

Investors in generic currency strategies may be subject to periods of significant loss that can persist for quite some time. Carry had a run of about 1 ½ years of poor performance along with a 26 percent loss. PPP had a bad run of a little over a year, and the worst momentum drawdown ran for 3 months. The individual managers' worst drawdown durations ranged from less than 1 month to 2 years. Clearly, there is considerable difference in skill across managers but many are able to minimize the duration and magnitude of worst-case loss compared to a simple generic strategy.

4. Conclusions

Unlike equity markets, there are no generally accepted benchmarks for active currency managers. This study has documented the challenges facing those who would apply benchmarks. The problems include:

- there are many alternative constructions of the generic style factors of currency investing: carry, purchasing power parity, and momentum
- different constructions of the same style factor may have low correlations, and so can reflect very different portfolios
- the 3 generic factors are not orthogonal and can have high correlations at times
- there are no truly passive strategies where one “buys and holds”, the generic style factors each require rebalancing at intervals.

Our empirical results indicate that returns associated with the currency investors included in our dataset are often generated quite independently from the generic style factors. This seems to be particularly true of the most successful managers. In addition, it appears that the financial crisis was a rather special episode in terms of returns to the generic factors, as this was when their performance was at its worst. Those managers who were able to time their exposures to reduce the use of the generic factors during the crisis did best. An analysis of timing ability reveals that some managers appear to have superior ability to time the factors. Such skill is what investors should willingly pay for. An additional skill involves risk controls and our analysis indicates that many managers have ability in avoiding worst-case drawdowns that are associated with a mechanical implementation of the generic factors. Loss avoidance is appreciated more now, in the aftermath of the crisis, than pre-crisis and this is a skill that is rewarded in the market.

In conclusion, we believe that the simple use of style factors in currency investing is fraught with dangers and is of limited use as a benchmark for currency managers. While it does provide a base case, this can turn out to be a worst case scenario, rather than returns that investors might aspire to achieve.

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Table 1: Correlations Across Currency Performance Benchmarks

The table reports correlations across alternative factor indexes that are frequently employed by active currency managers: trend or momentum, carry, and value. The indexes are provided by Deutsche Bank (DB), Credit Suisse (CS), the Centre for International Banking Economics and Finance (AFX), and Citibank (Citi).

| | | <i>Trend</i> | | | |
|-------------|-----------|--------------|-------------|-------------|--|
| | DB | CS | AFX | Citi | |
| DB | 1 | | | | |
| CS | 0.76 | 1 | | | |
| AFX | 0.20 | 0.59 | 1 | | |
| Citi | 0.43 | 0.26 | 0.74 | 1 | |
| | | | | | |
| | | <i>Carry</i> | | | |
| | Db | CS | Citi | | |
| DB | 1 | | | | |
| CS | 0.57 | 1 | | | |
| Citi | 0.81 | 0.46 | 1 | | |
| | | | | | |
| | | <i>Value</i> | | | |
| | DB | CS | Citi | | |
| DB | 1 | | | | |
| CS | 0.39 | 1 | | | |
| Citi | 0.45 | 0.45 | 1 | | |

Table 2: Regressions of Individual Manager Returns on Currency Style Factors

Weekly data on currency manager returns from the Deutsche Bank FXSelect platform are regressed on Carry, Purchasing Power Parity (PPP), and Momentum or trend. The data set begins in November 2004 and ends in May 2009. Since each manager joins the platform at different points in time, the number of observations for each is reported in the last column. Statistically significant t-statistics are reported in bold italics.

| Mgr | Constant | tstat | Carry | tstat | PPP | tstat | MOM | tstat | Rsquare | Nobs |
|------|----------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|------|
| 3 | 0.0001 | 0.3540 | -0.0170 | -0.6985 | -0.0538 | -1.6131 | -0.0036 | -0.1497 | 0.0151 | 233 |
| 5 | 0.0013 | 0.9896 | -0.3959 | -4.8583 | 0.1218 | 1.0946 | 0.1052 | 1.3239 | 0.1505 | 235 |
| 10 | 0.0001 | 0.1398 | -0.1014 | -2.3292 | 0.0507 | 0.8457 | -0.0881 | -2.0739 | 0.0302 | 225 |
| 11 | 0.0002 | 0.6565 | -0.1216 | -5.6580 | 0.0085 | 0.2887 | 0.0145 | 0.6906 | 0.1722 | 232 |
| 13 | 0.0012 | 2.1374 | -0.1109 | -3.2138 | -0.0287 | -0.6055 | -0.0505 | -1.4988 | 0.0479 | 232 |
| 19 | 0.0019 | 1.4157 | -0.1832 | -2.7399 | -0.1271 | -1.3776 | -0.1603 | -2.5098 | 0.0932 | 91 |
| 25 | 0.0028 | 1.8342 | -0.5013 | -5.5771 | -0.2233 | -1.7755 | -0.3129 | -3.5644 | 0.1537 | 217 |
| 26 | 0.0005 | 1.5192 | -0.0720 | -3.6961 | -0.0844 | -3.1055 | -0.1062 | -5.5813 | 0.1764 | 218 |
| 27 | 0.0016 | 3.2297 | -0.0464 | -1.5647 | -0.0171 | -0.4129 | -0.0246 | -0.8472 | 0.0131 | 218 |
| 31 | 0.0008 | 0.9594 | -0.0853 | -1.7145 | -0.1462 | -2.0721 | 0.0467 | 0.9608 | 0.0590 | 202 |
| 35 | 0.0002 | 0.2672 | 0.3390 | 7.3186 | 0.0326 | 0.4864 | 0.3307 | 7.2719 | 0.2806 | 191 |
| 37 | 0.0011 | 1.2283 | -0.0298 | -0.6296 | -0.1134 | -1.6309 | 0.0314 | 0.6723 | 0.0305 | 158 |
| 38 | 0.0007 | 0.6715 | 0.3528 | 5.4199 | -0.2444 | -2.6910 | 0.3629 | 5.7063 | 0.1764 | 218 |
| 45 | 0.0014 | 1.4138 | -0.4234 | -7.7599 | 0.1700 | 2.2048 | -0.2304 | -4.3188 | 0.2357 | 205 |
| 47 | -0.0021 | -1.4568 | 0.1572 | 2.0410 | -0.0951 | -0.8358 | -0.0646 | -0.8508 | 0.0617 | 157 |
| 53 | 0.0006 | 1.6476 | -0.1848 | -8.7511 | 0.0894 | 2.9195 | -0.0436 | -2.1013 | 0.3219 | 187 |
| 59 | 0.0012 | 1.0919 | -0.1471 | -1.9312 | -0.0833 | -1.1315 | -0.0969 | -1.3650 | 0.0683 | 64 |
| 79 | 0.0012 | 1.2917 | 0.4363 | 8.8704 | 0.1454 | 2.0408 | 0.4825 | 9.9856 | 0.4200 | 179 |
| 85 | 0.0016 | 1.5168 | 0.0986 | 1.5940 | -0.1263 | -1.4586 | -0.0227 | -0.3758 | 0.0268 | 217 |
| 87 | 0.0017 | 1.5221 | -0.2762 | -4.2328 | -0.0756 | -0.8161 | -0.0935 | -1.4656 | 0.0925 | 203 |
| 88 | 0.0003 | 0.2646 | 0.3254 | 4.9806 | 0.3042 | 3.2129 | 0.2070 | 3.2093 | 0.1792 | 175 |
| 93 | -0.0001 | -0.1882 | -0.0173 | -1.0194 | -0.0387 | -1.5750 | -0.0307 | -1.8474 | 0.0329 | 187 |
| 94 | -0.0001 | -0.1780 | 0.0334 | 0.7526 | -0.0418 | -0.6492 | 0.0799 | 1.8322 | 0.0200 | 187 |
| 95 | 0.0010 | 1.1677 | 0.3442 | 6.9565 | -0.0247 | -0.3524 | 0.4738 | 9.7904 | 0.3403 | 203 |
| 98 | 0.0004 | 0.4437 | 0.0264 | 0.5021 | 0.0361 | 0.4863 | 0.0167 | 0.3241 | 0.0029 | 204 |
| 100 | 0.0013 | 0.7933 | -0.0022 | -0.0234 | -0.1993 | -1.8156 | -0.1834 | -2.0429 | 0.1510 | 80 |
| 103 | 0.0011 | 1.4076 | 0.1219 | 3.1724 | -0.0056 | -0.0940 | 0.0394 | 1.0655 | 0.0854 | 121 |
| 108 | 0.0008 | 0.5853 | -0.0042 | -0.0561 | -0.1291 | -1.1938 | -0.0465 | -0.6321 | 0.0111 | 169 |
| 110 | 0.0009 | 1.2742 | -0.0235 | -0.6163 | 0.0598 | 1.0836 | -0.0836 | -2.2309 | 0.0348 | 183 |
| 116 | 0.0029 | 4.1553 | -0.0368 | -1.0898 | -0.0523 | -0.9835 | 0.1020 | 3.1386 | 0.1659 | 118 |
| 117 | 0.0008 | 1.5246 | 0.1570 | 5.2525 | -0.1158 | -2.6732 | 0.1461 | 4.9533 | 0.1922 | 175 |
| 130 | -0.0006 | -0.7322 | 0.2191 | 3.8151 | -0.0086 | -0.1562 | -0.1040 | -1.9357 | 0.6747 | 67 |
| 136 | 0.0002 | 0.1118 | -0.0735 | -0.7007 | 0.2438 | 2.1007 | 0.1480 | 1.4775 | 0.1897 | 78 |
| 144 | -0.0030 | -2.3075 | 0.1397 | 2.1540 | 0.2357 | 2.3311 | -0.0812 | -1.2977 | 0.1345 | 126 |
| 147 | -0.0004 | -0.7212 | -0.0416 | -1.3638 | -0.0159 | -0.3354 | -0.0260 | -0.8830 | 0.0153 | 128 |
| 151 | 0.0012 | 1.2178 | 0.0830 | 1.6858 | -0.0208 | -0.2715 | 0.1938 | 4.0716 | 0.1243 | 127 |
| 152 | -0.0013 | -1.0373 | 0.5927 | 9.6338 | 0.1599 | 1.6713 | 0.5870 | 9.8752 | 0.4973 | 128 |
| 154 | 0.0017 | 1.8803 | -0.0590 | -1.1696 | 0.0901 | 1.4939 | 0.0187 | 0.3905 | 0.1046 | 80 |
| 158 | 0.0001 | 0.5840 | 0.0082 | 0.7065 | -0.0301 | -1.6566 | 0.0261 | 2.3561 | 0.0891 | 104 |
| 167 | 0.0001 | 0.1139 | -0.0632 | -1.2645 | 0.0352 | 0.4590 | -0.0536 | -1.1282 | 0.0250 | 92 |
| 169 | -0.0014 | -0.7186 | -0.0171 | -0.1890 | 0.0259 | 0.1867 | -0.0250 | -0.2916 | 0.0015 | 94 |
| 170 | 0.0004 | 0.6138 | 0.1434 | 4.1924 | 0.0010 | 0.0189 | 0.0906 | 2.7818 | 0.1472 | 109 |
| Pool | 0.0004 | 3.9020 | 0.0090 | 1.3050 | -0.0140 | -1.4760 | 0.0340 | 5.1250 | 0.0030 | |

Table 3: Regressions of Individual Manager Returns on Currency Style Factors During Crisis

Weekly data on currency manager returns from the Deutsche Bank FXSelect platform are regressed on Carry, Purchasing Power Parity (PPP), and Momentum or trend. The crisis period begins in August 2007 and ends in December 2008. Since each manager joins the platform at different points in time, the number of observations for each is reported in the last column. Statistically significant t-statistics are reported in bold italics.

| Mgr | Constant | tstat | Carry | tstat | PPP | tstat | MOM | tstat | Rsquare | Nobs |
|------|----------|---------------|---------|----------------|---------|----------------|---------|----------------|---------|------|
| 3 | 0.0000 | 0.0533 | -0.0195 | -0.6684 | -0.0073 | -0.1387 | -0.0063 | -0.2364 | 0.0067 | 73 |
| 5 | 0.0013 | 0.5341 | -0.3989 | -3.9251 | 0.4643 | 2.5478 | 0.0401 | 0.4297 | 0.3614 | 73 |
| 10 | -0.0005 | -0.3441 | -0.1066 | -1.8452 | 0.0561 | 0.5415 | -0.0767 | -1.4442 | 0.0619 | 73 |
| 11 | 0.0001 | 0.1481 | -0.1497 | -5.1013 | -0.0226 | -0.4291 | 0.0272 | 1.0097 | 0.4037 | 73 |
| 13 | 0.0022 | 1.5725 | -0.1021 | -1.7016 | -0.0430 | -0.3997 | -0.0311 | -0.5650 | 0.0424 | 73 |
| 19 | 0.0023 | 1.4244 | -0.2374 | -3.1695 | -0.2298 | -1.9106 | -0.1539 | -2.2239 | 0.1464 | 71 |
| 25 | 0.0020 | 1.1251 | -0.3432 | -4.6169 | -0.3070 | -2.3032 | -0.0747 | -1.0941 | 0.2674 | 73 |
| 26 | -0.0002 | -0.3802 | -0.0719 | -3.9613 | -0.0770 | -2.3652 | -0.0810 | -4.8563 | 0.3019 | 73 |
| 27 | 0.0016 | 2.2333 | -0.0110 | -0.3731 | 0.0671 | 1.2740 | -0.0109 | -0.4051 | 0.0293 | 73 |
| 31 | 0.0013 | 1.1112 | -0.1707 | -3.4574 | -0.1463 | -1.6529 | -0.0433 | -0.9560 | 0.1653 | 73 |
| 35 | 0.0000 | 0.0292 | 0.2433 | 5.1219 | 0.0365 | 0.4287 | 0.2252 | 5.1612 | 0.3347 | 73 |
| 37 | 0.0020 | 1.1881 | -0.0531 | -0.7512 | -0.3304 | -2.6083 | 0.0610 | 0.9393 | 0.1103 | 73 |
| 38 | 0.0028 | 1.5762 | 0.3047 | 4.1475 | -0.3268 | -2.4802 | 0.2966 | 4.3944 | 0.3319 | 73 |
| 45 | 0.0029 | 1.5956 | -0.5782 | -7.5074 | -0.1844 | -1.3354 | -0.2996 | -4.2344 | 0.4504 | 73 |
| 47 | -0.0045 | -1.7950 | 0.3043 | 2.8755 | 0.0000 | -0.0001 | 0.0856 | 0.8810 | 0.1199 | 73 |
| 53 | 0.0010 | 1.2547 | -0.1840 | -5.3240 | 0.1162 | 1.8744 | -0.0454 | -1.4293 | 0.3793 | 73 |
| 59 | 0.0000 | 0.0164 | -0.2218 | -2.3552 | -0.1881 | -1.7765 | -0.1237 | -1.5126 | 0.1485 | 44 |
| 79 | 0.0010 | 0.7001 | 0.3747 | 6.5476 | 0.1485 | 1.4468 | 0.4263 | 8.1085 | 0.5145 | 73 |
| 85 | 0.0026 | 1.2132 | 0.1584 | 1.7834 | -0.0758 | -0.4759 | 0.0459 | 0.5622 | 0.0585 | 73 |
| 87 | 0.0033 | 1.5590 | -0.2571 | -2.8520 | 0.1120 | 0.6928 | -0.0890 | -1.0751 | 0.1313 | 73 |
| 88 | -0.0002 | -0.1874 | 0.1392 | 2.8748 | 0.0686 | 0.7893 | 0.0750 | 1.6865 | 0.1077 | 73 |
| 93 | 0.0001 | 0.1961 | -0.0280 | -1.2304 | -0.0468 | -1.1456 | -0.0320 | -1.5281 | 0.0497 | 73 |
| 94 | -0.0005 | -0.2760 | -0.0083 | -0.1181 | -0.1778 | -1.4072 | 0.1263 | 1.9513 | 0.0922 | 73 |
| 95 | 0.0003 | 0.2378 | 0.2540 | 4.1697 | -0.1415 | -1.2953 | 0.4482 | 8.0097 | 0.4908 | 73 |
| 98 | 0.0007 | 0.4912 | 0.0179 | 0.2983 | 0.1303 | 1.2095 | 0.0172 | 0.3119 | 0.0221 | 73 |
| 100 | 0.0006 | 0.2719 | 0.0074 | 0.0644 | -0.1781 | -1.1579 | -0.1795 | -1.7240 | 0.1458 | 60 |
| 103 | 0.0007 | 0.6471 | 0.1185 | 2.5215 | 0.0518 | 0.6143 | 0.0215 | 0.4975 | 0.0962 | 73 |
| 108 | 0.0030 | 1.1986 | 0.0055 | 0.0525 | -0.2192 | -1.1674 | -0.0200 | -0.2080 | 0.0232 | 73 |
| 110 | 0.0026 | 1.7023 | -0.0200 | -0.3084 | 0.0202 | 0.1730 | -0.0791 | -1.3248 | 0.0279 | 73 |
| 116 | 0.0029 | 3.5332 | -0.0951 | -2.7885 | -0.0997 | -1.6304 | 0.0790 | 2.5226 | 0.3055 | 73 |
| 117 | 0.0018 | 1.5987 | 0.1451 | 3.0611 | -0.1418 | -1.6685 | 0.1425 | 3.2724 | 0.2071 | 73 |
| 130 | -0.0004 | -0.5202 | 0.1471 | 3.1493 | -0.1316 | -2.5527 | -0.1497 | -3.6480 | 0.8209 | 47 |
| 136 | -0.0004 | -0.2329 | -0.1568 | -1.5003 | 0.0003 | 0.0021 | 0.1353 | 1.4169 | 0.2742 | 58 |
| 144 | -0.0036 | -1.9880 | 0.2896 | 3.8280 | 0.4067 | 2.9976 | -0.0166 | -0.2383 | 0.2700 | 73 |
| 147 | -0.0010 | -1.2106 | -0.0550 | -1.5810 | -0.0188 | -0.3023 | -0.0232 | -0.7276 | 0.0352 | 73 |
| 151 | 0.0013 | 1.0905 | -0.0202 | -0.3903 | -0.0941 | -1.0159 | 0.1247 | 2.6285 | 0.1449 | 73 |
| 152 | -0.0020 | -1.1679 | 0.6205 | 8.8036 | 0.1629 | 1.2890 | 0.5589 | 8.6320 | 0.5902 | 73 |
| 154 | 0.0021 | 1.8451 | -0.0616 | -1.0144 | 0.0949 | 1.1609 | 0.0223 | 0.4037 | 0.1119 | 61 |
| 158 | 0.0003 | 1.0658 | 0.0109 | 1.0185 | -0.0274 | -1.4332 | 0.0208 | 2.1164 | 0.0893 | 73 |
| 167 | 0.0008 | 0.6400 | -0.0504 | -0.9303 | 0.1080 | 1.1175 | -0.0599 | -1.2016 | 0.0447 | 72 |
| 169 | -0.0009 | -0.3807 | -0.0145 | -0.1402 | -0.0594 | -0.3212 | -0.0274 | -0.2897 | 0.0028 | 73 |
| 170 | 0.0000 | 0.0327 | 0.1421 | 3.4131 | 0.0195 | 0.2612 | 0.0929 | 2.4302 | 0.1520 | 73 |
| Pool | 0.0007 | 2.6100 | 0.0061 | 0.5640 | -0.0289 | -1.4806 | 0.0435 | 4.4104 | 0.0078 | |

Figure 1: Cumulative Returns to Trend Following Strategies

The figure displays the cumulative returns to momentum or trend investment strategies offered by indexes created by AFX, Credit Suisse, and Deutsche Bank.

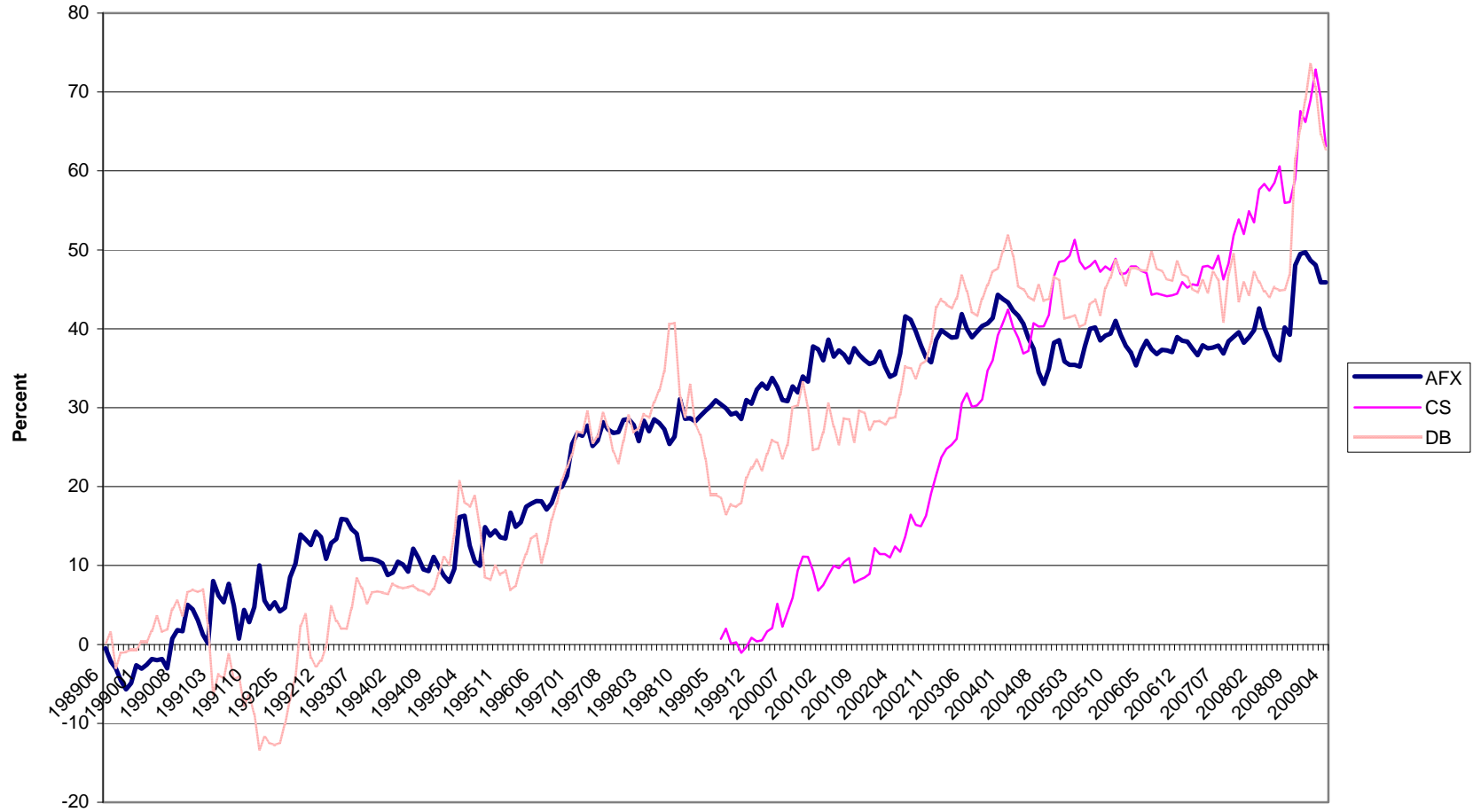


Figure 2: Portfolio Exposures to Deutsche Bank FX Indexes on December 17, 2008

The figure shows the positions in the G10 currencies based upon the factors in the DB index: Carry, Momentum, and Value. In addition, the position in a composite portfolio (DBCR) with a 1/3 weight on each factor is also displayed.

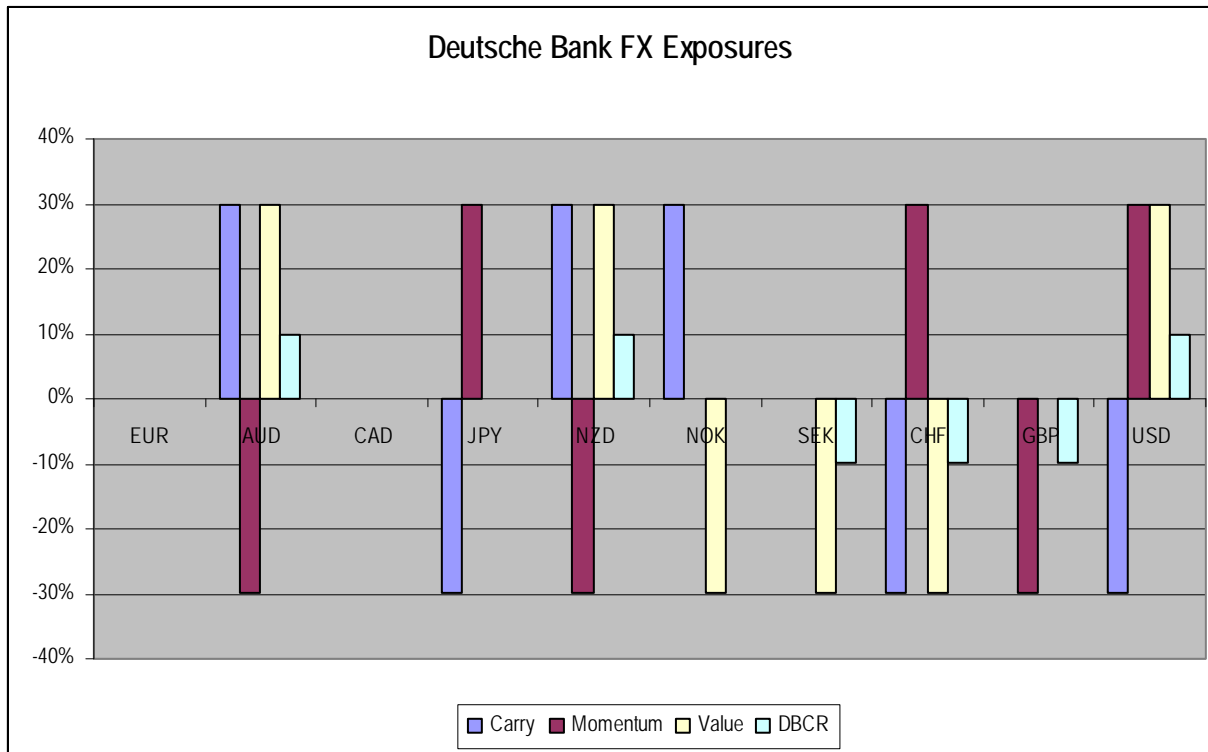


Figure 3: Time-Series of Exposures to Deutsche Bank Carry, Momentum, and Value Factors

Figure 3a displays the exposures to each factor using the full in-sample estimate of the covariance matrix to form portfolios. Figure 3b shows portfolio exposures based upon the identity covariance matrix.

Figure 3a

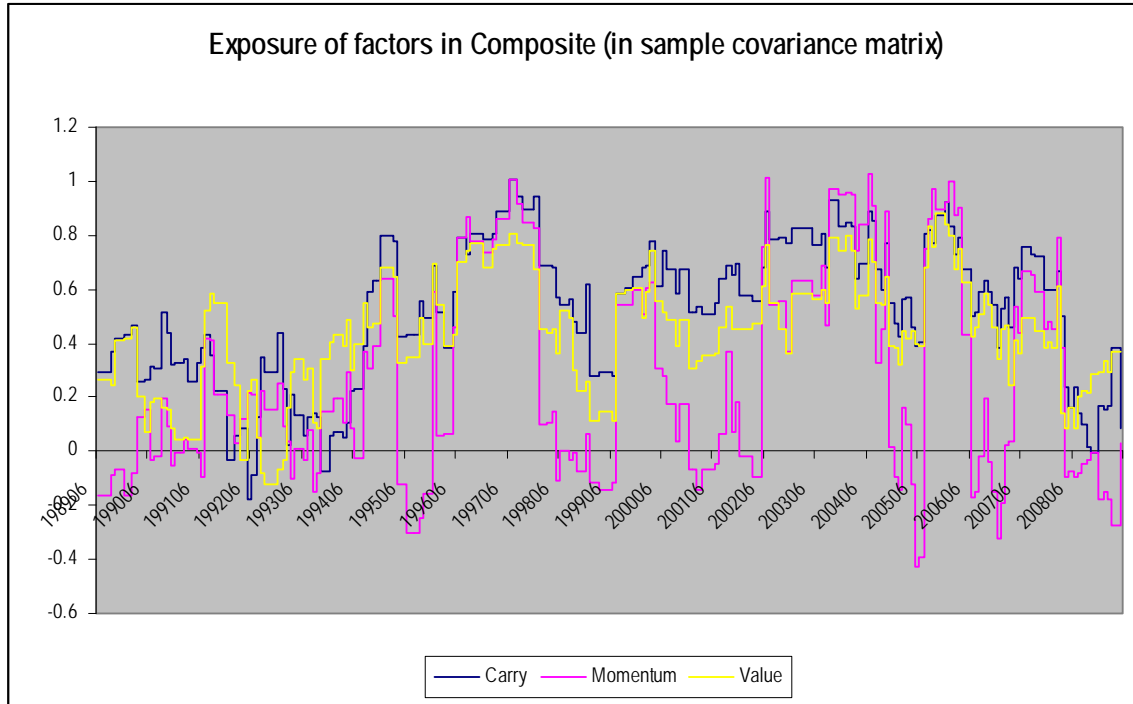


Figure 3b

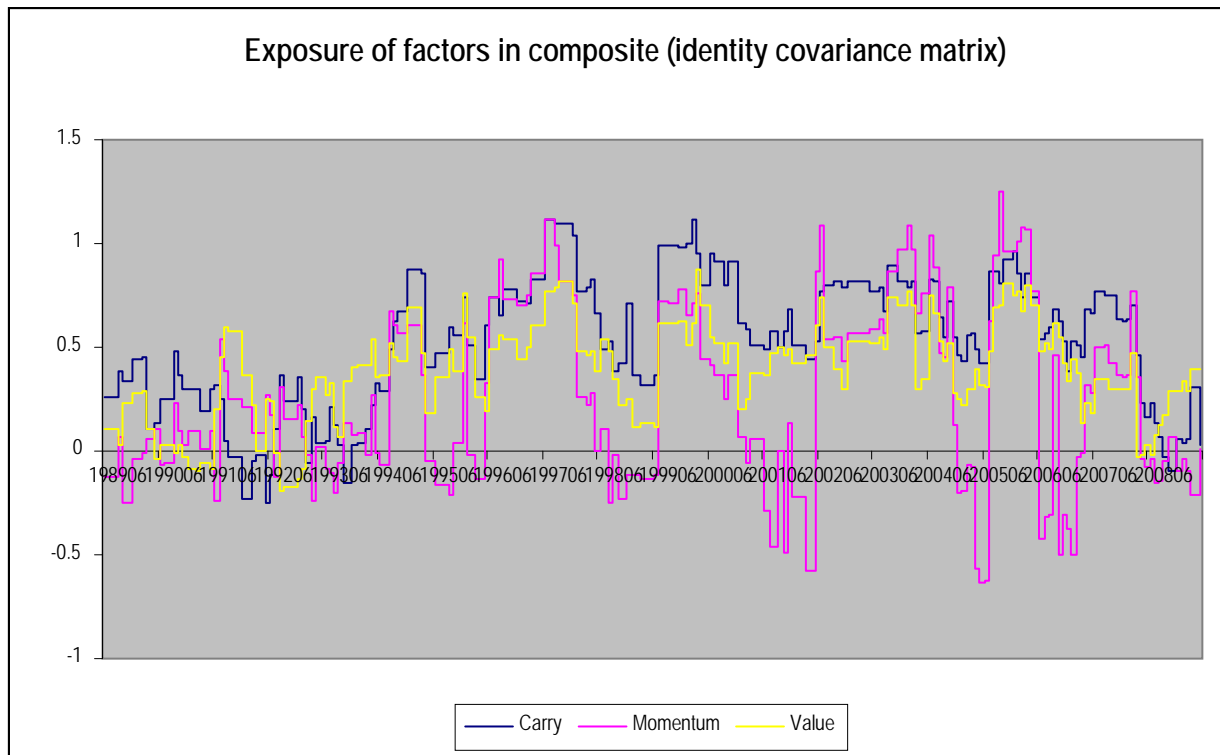


Figure 4: Cumulative Returns from Deutsche Bank Currency Style Factors

Deutsche Bank publishes returns associated with popular currency factors used by currency investors. The figure plots the cumulative returns from investing in Purchasing Power Parity (PPP), Momentum, and Carry as currency factors.

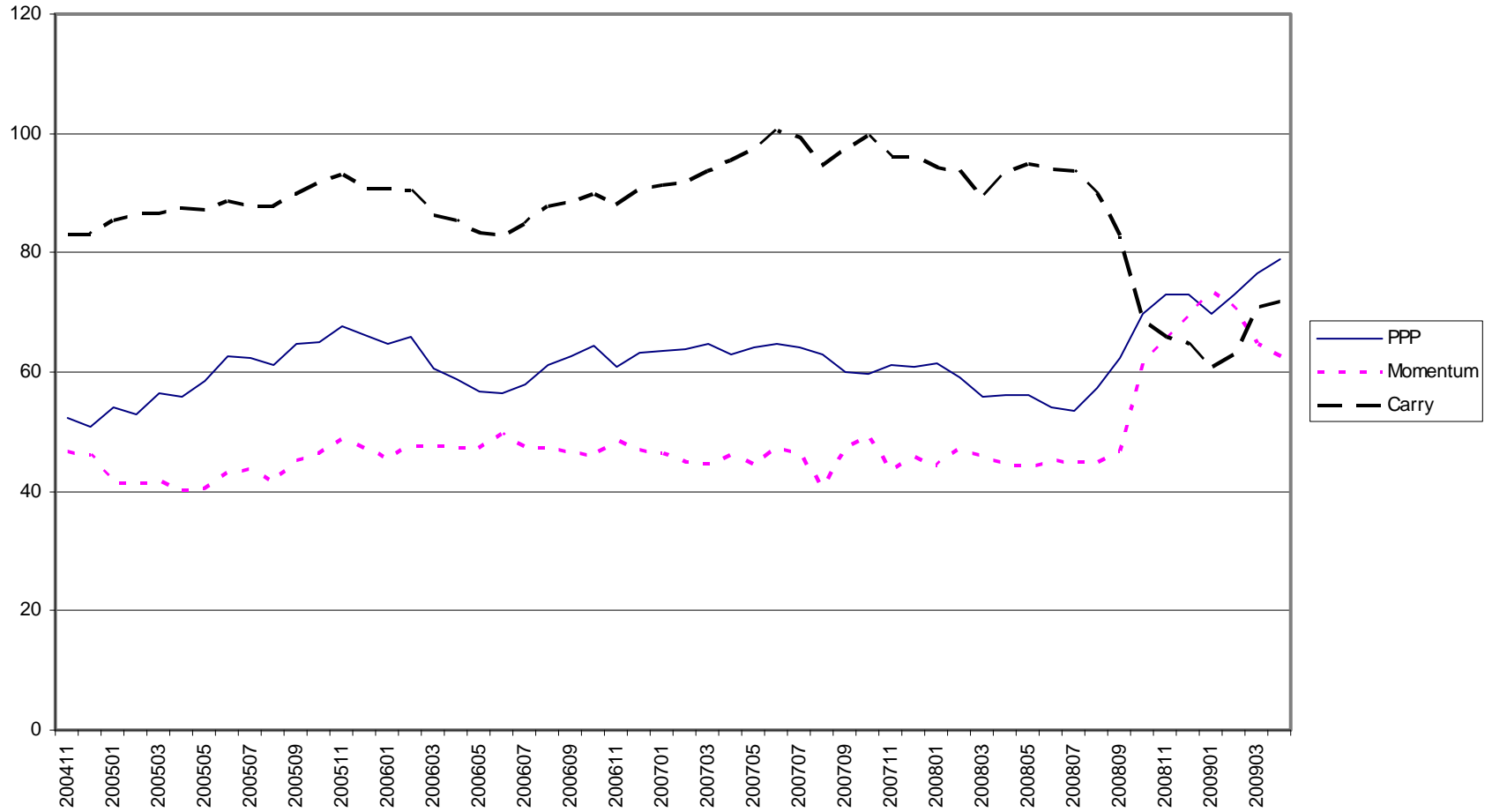
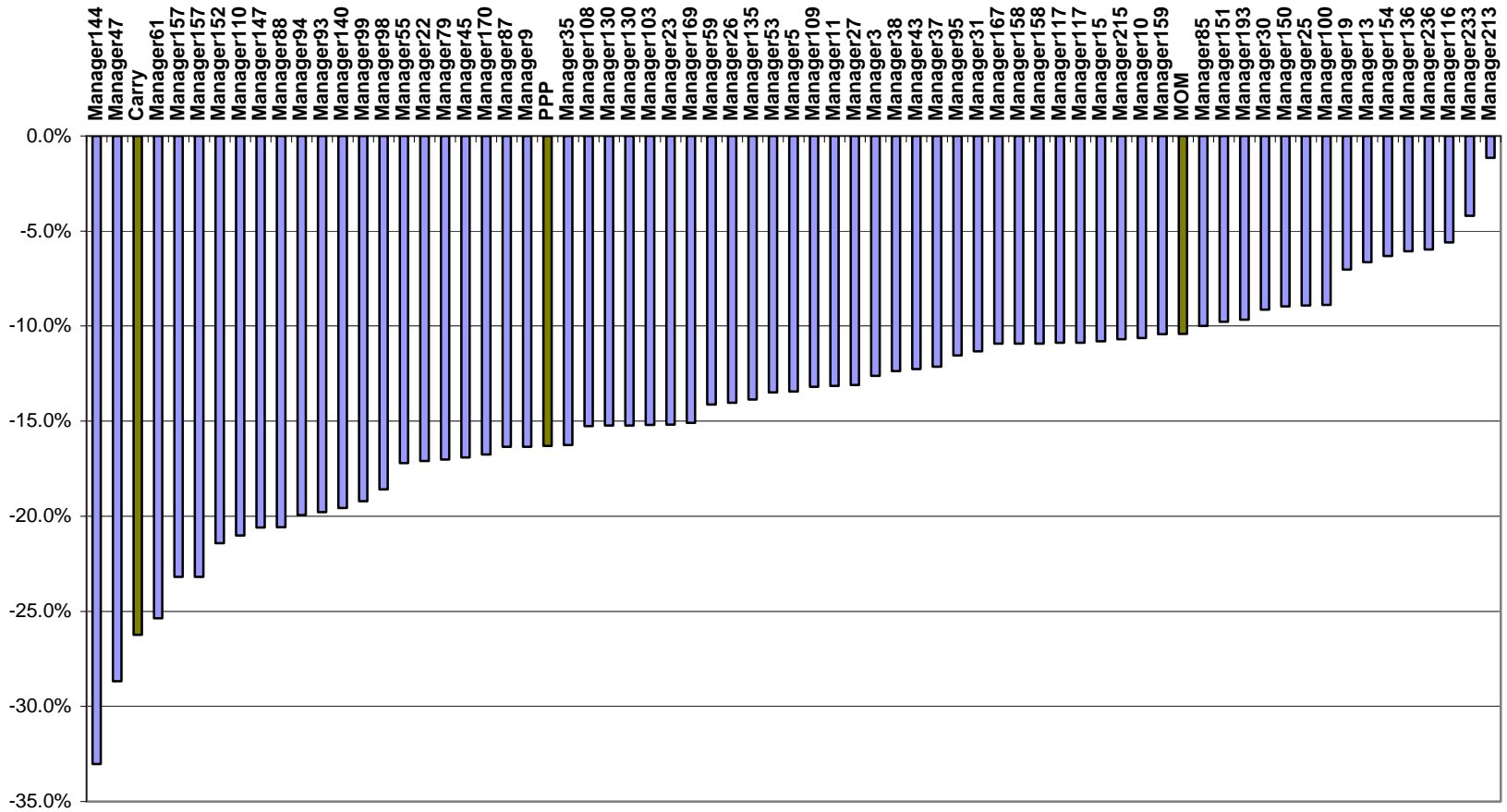


Figure 5: Maximum Drawdowns: Nov 15, 2005 – May 18, 2009

The figure plots the maximum drawdowns experienced by each currency investment manager, along with the worst drawdowns realized by a constant exposure to the currency investment style factors of Carry, PPP, and Momentum (MOM) over the period from November 15, 2005 to May 18, 2009.



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