Global Foreign Excahnge

Global Markets

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Deutsche Bank Guide To Currency Indices

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Introduction

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To Deutsche Bank's Clients:

Currencies represent the largest financial market in the world. Yet they have not traditionally enjoyed Asset Class status in the same way that Equities and Bonds have.

In large part, this reflects the common view that as a zero sum game, currency has no 'inherent' return, and is simply a source of uncompensated risk.

But this view is changing. Institutional Investors, Plan Sponsors and Consultants have come to recognise over the last two decades what many absolute return investors have always believed: that Currency is a significant source of Alpha that is portable, uncorrelated and sustainable, and as such represents a good use of risk budget. We have explored these themes widely in two previous publications: A Guide to Currency Overlay Management (February 2002) and Currency Alpha: An Investor's Guide (October 2005).

Recent research has gone one step further, making the case for Currency actually having a Beta, and demonstrate that if incorporated into many traditional portfolios it can significantly enhance returns.

In this guide, we seek to highlight some of the investable currency index products available in today's market that allow access to Currency Returns. We hope to make both the theoretical and practical case for making an explicit allocation to Currency in every properly diversified investment portfolio.

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Overview

Investors made their first foray in currency markets following the collapse of Bretton Woods in the 1970s. But currency managers were restricted to a handful of global macro funds and managed CTA programmes, while the majority of market participants typically viewed FX as an unavoidable source of secondary risk. These managers initially traded individual currency pairs, later moving on to trade FX options, as well as indices composed of static currency baskets. These provided a more effective way of expressing tactical views on individual currencies.

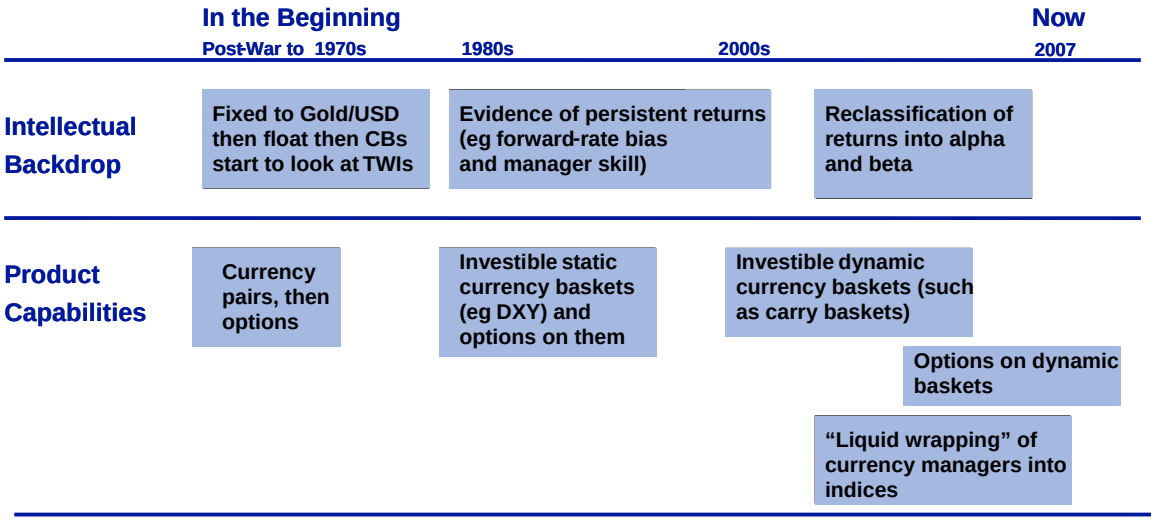
In the ensuing period, the explosive growth in FX turnover has been accompanied by rapid progress in both the perception and management of currency risk. By the late 1990s, it was largely accepted that currencies provide a source of return as well as risk. This led to the development of rules-based indices, whose currency composition changed dynamically over time. These indices aimed to capture returns from widely known investment strategies such as the FX carry trade, which is based on investing in high-yielding currencies through funding in the low-yielders.

Today, it is also possible to wrap the performance of currency managers into investable indices. At the same time, the discussion on currency returns and risk has moved on to the possibility that some indices represent the "beta" of currency markets, while others the "alpha". In this way, currency markets may finally get a returns "benchmark" similar to bond and equity markets.

Clearly, the FX product offering has expanded significantly. The *"Deutsche Bank Guide to Currency Indices"* aims to provide an overview of the full suite of FX index products now available to investors. In the first section, the guide focuses on tactical indices, which typically have fixed weights and can be used to express single-currency or regional views. In the second section, we present strategic indices, where the currency allocation changes over time based on rules-based strategies. In the third section, we present the Deutsche Bank FX Select platform, which provides access to currency manager performance through the creation of custom-based indices. The Deutsche Bank menu of currency indices can therefore be used to access systematic FX returns in the form of both 'beta' and 'alpha'.

The guide opens with an overview of the Deutsche Bank index product suite, where Jason Batt discusses the importance of index design in creating investable currency indices. We then move on to *Currency Markets: Money Left on the Table?,* where Bilal Hafeez argues that theoretically, as long as currency market participants have different motives, understandings of what drives currencies and information sources, currency markets should provide systematic excess returns to those willing to take the risk. Bilal then proceeds with

Evolution of Currency Markets



analyzing the structure of currency markets, and finds that it does conform to one where market participant have different motives. Using a very conservative approach, he argues that at most between 25%-50% of the market is made up of profit-seekers, while the remainder are liquidity-seekers. Employing more realistic assumptions, he argues the range is likely to be 5%-25%. Interestingly, he also finds evidence that the share of profit-seekers is falling, as the rise in cross-border trading in bonds and equities has exceeded the rise in currency turnover. Finally, and perhaps most importantly, he finds that using the actual positioning of liquidity and profit-seekers since 1993, profit-seekers have systematically made profits at the expense of liquidity-seekers. It would therefore appear that liquidity-seekers are paying a premium in the form of profits to profit-seekers in return for the provision of liquidity.

Moving on from theoretical considerations, *DB G10 Trade-Weighted Indices: From Theory to Practice* and *DB EM Asia Policy Baskets* present DB's suite of G10 and EM Asia currency indices. These allow investors to hedge or assume single-currency risk, while avoiding taking a position on any particular currency cross. This is done by using trade-weighted exchange rates (TWI's) for the G10 currencies and nominal effective exchange rate (NEER's) for MYR, CNY and SGD in Asia. The overarching principle for both the G10 and EM currency baskets has been to choose weights that are as close as possible to those used by the respective central banks, which is of particular importance for EM Asia currencies where exchange rate targeting plays a direct role in monetary policy.

Regional currency baskets are a transparent approach to take a view on a whole region rather than a single currency. The Deutsche Bank Asia-4 index takes an equal weighting of the four most liquid currencies in Asia. Alternatively, in *The Emerging Asia Reserves, Liquidity and Yield Index* James Malcolm and Mirza Baig argue that the EARLY index provides a more efficient approach to investing in structurally appreciating EM Asia currencies by accounting for differences in reserve accumulation, liquidity and the cost of carry.

Concluding the section on tactical indices, *The DB Currency Volatility Index (CVIX): A Benchmark for Volatility* presents a benchmark for tracking expected future volatility in currency markets. Aside from using the index to take a directional view on FX volatility, it is argued that the index can be used to hedge exposure to risky assets, as well as to take advantage of relative value opportunities in options markets across asset classes.

The strategic indices section of the guide starts by presenting the Deutsche Bank G10 carry, valuation and momentum indices. In *Carry, Value and Momentum Investing* Bilal Hafeez analyses the academic considerations behind each investment style and presents three investable indices that take advantage of these trading strategies. In *Benchmarking Currencies: The Deutsche Bank Currencies Returns Index* it is argued that these three strategies are evidence of the existence of 'beta' in currency markets, similar to

The Deutsche Bank Menu of Currency Indices

Currency View (one-off/tactical)	**Single Currency Views** G10 TWI's EM NEER's	**Regional Indices** Asia-4, CEFX Convergence and Asia EARLY Indices	**Volatility Indices** DB Currency Volatility Index (CVIX)
Currency Beta (inherent returns)	**Beta Strategies** Deutsche Bank Carry, Valuation, Momentum Indices	**Benchmark Indices** Deutsche Bank Currency Returns Index (dbCR)	
Currency Alpha (idiosyncratic returns)	**Liquid Indices of currency managers** FX Select Platform		

the inherent returns of bonds or equities. The strategies are combined into the dbCR index, which aims to establish itself as a benchmark of currency market returns similar to those used in equity or bond markets.

In *Carry Goes Global: The Global and Balanced Harvest Indices* it is argued that by expanding the universe of currencies used for carry trades to include the more liquid EM crosses, one can improve the prospective returns. For one, the positive carry that can be captured is higher, so even in range-bound markets the returns look more respectable. Second, some high-yielding currencies are less likely to be overvalued than their G10 counterparts, thus providing more scope to capture spot returns.

In the *Currency Manager Indices* section of this guide, Torquil Wheatley argues that currency managers provide an efficient and flexible way to access currency market alpha. He shows how the FXSelect platform allows for the creation of investable indices that track the performance of a completely customisable portfolio of currency managers. He argues that FXSelect provides a cost-effective, transparent and liquid solution to the challenges associated with investing in multiple currency managers.

In the final piece of the guide, Bilal Hafeez looks at currency allocation in an investment portfolio context. He shows that the addition of FX to a portfolio of bonds and equities can significantly enhance the quality of returns by reducing the volatility of returns and duration and magnitude of significant phases of underperformance. The size of the allocation should be comparable to those of bonds and equities (that is 20%+), rather than those of "alternative investments"

Conclusion

The sophistication and range of currency products has expanded rapidly over the last few years. We hope that this guide will provide a useful overview of the Deutsche Bank index product offering, and demonstrate how currency indices can be used to profitably express tactical views or obtain strategic access to long-term currency returns.

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The Deutsche Bank Menu of Currency Indices

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Introduction
Investors use indices to invest in currencies for the same reasons that they use equity, bond or commodity indices to invest in those markets: they provide diverse and cost effective market access, they are a means of outsourcing expertise in a particular market and they are simple to trade. The key feature of any index that we design is that it has to be investable, and in a format that most suits potential users.

Importance of Index Design for Investable Indices
There are some obvious factors that dictate how an investable index is designed: liquidity considerations, availability of reliable market data, fixing sources (particularly relevant for FX which trades on an OTC basis rather than on an exchange where exchange closing levels can reliably be used), and frequency of roll among others. But there are also some more esoteric factors that are a critical part of the intellectual property the non-specialist investor is buying into. Such factors that we pay a great deal of attention to are i.) Roll mechanism – making sure that market front-running of positions that an index has to implement are avoided and that the 'footprint' a large notional index leaves in the market is minimal and ii.) Robustness – making sure that there is a sound economic rationale behind the index rules and that the parameters in the index are not overly optimised to give the best historic performance over a specific back-testing period. This last point is often overlooked but investors should be particularly aware that an over-complicated set of index rules can have parameters optimised in such a way that it is unrealistic to assume historic performance will be repeated (after the index launch date).

Index Type:	Feature:	
Tactical Indices		
	> *Bid/Offer Spread*	Yes, set according to market
	> *Index Fee*	No
	> *Typical Investment Horizon*	1month to 1 year
	> *Pricing Frequency*	Intra-minute, often 24 hours around the clock
	> *Client Types*	Typically hedge funds, prop desks but also corporates and retail
Strategic Indices		
	> *Bid/Offer Spread*	None, executed at mid-market NAV
	> *Index Fee*	Yes, set according to index to cover costs of rolling positions
	> *Typical Investment Horizon*	1year and over
	> *Pricing Frequency*	Daily at index closing level. Daily calculation time typically 4pm London
	> *Client Types*	Typically real money such as insurance companies, pension funds, asset managers and retail but also corporates
All Indices		
	> *Investable via single transaction*	
	> *Single currency pay-off*	
	> *Transparent index calculation*	
	> *Non-discretionary trading rules*	
	> *Liquid underlying*	

Source: DB Global Markets

Investable Products by Index

	Tactical Indices				Strategic Indices	
Wrapper	G 10 TWI's	Asia Policy Baskets	EARLY Index	CVIX	Harvest	DBCR
Delta One	✓	✓	✓	✓	✓	✓
>Format	NDF's traded as contracts that settle each quarterly IMM date				Total Return Swaps (funded or unfunded)	
>Pay Currency	Currency of TWI	Currency of Policy Basket	Can quanto to most Currencies		Can quanto to most Currencies	
>Tick Size	10 units of Pay currency per index 0.01				n/a	
>Notional Invested	Notional is strike dependant and is calculated as No. Contracts X Index Level X 1,000				n/a	
	i.e.: P & L is re-invested					
>Trading Hours	24 hours	00-20 hours GMT			Daily on 4pm GMT Index Closing Level	
Options						
>Vanilla	✓	✓	✓	✖	✓	✓
>Digitals	✓	✓	✓	✖	✓	✓
>Asians	✓	✓	✓	✖	✓	✓
>Barrier	Yes but only with daily discrete observation of barrier against fix			✖	✖	✖
Notes						
>Fixed Maturity	✓	✓	✓	✓	✓	✓
>Path Dependant Maturity	✓	✓	✓	✖	✖	✖
Structured Deposits	✓	✓	✓	✓	✓	✓
Funds	✖	✖	✖	✖	UCITS III EUR Balanced Fund	UCITS III EUR ETF's due Q4 2008
					USD G10 ETF {DBV Index <Go>}	
e-trade capability	✓	✖	✖	✖	✓	✖

Source: DB Global Markets

Currency Markets: Money Left on the Table?

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The Puzzle of Currency Markets.

In previously published research[1], we showed that currency markets delivered consistent excess returns over time, which on some metrics were stronger than equity markets. The systemic returns were evident by the profitability of three widely known and followed strategies: carry, momentum and valuation, and also the actual track records of currency managers. Yet the presence of these returns opens more questions than it answers. As the most liquid market in the world, shouldn't currency markets be efficient, and so not allow consistent profit opportunities? How can a zero-sum game, where for every long position, there is a short position such as in currency markets, offer systematic returns? Who are the systematic losers who supposedly leave "money on the table"? If they exist, what share of the market do they consist of? And is that share declining? In this paper, we attempt to answer all of these questions.

Section A: The Technical Part

What Do We Mean By Efficient Markets, and Does It Work?

The currency markets are the most liquid in the world with a daily turnover of close to $2 trillion, which compares to $500 billion for the US government bond market and $70 billion on the NY Stock Exchange[2]. So of all the financial markets, currency markets should perhaps conform closest to what economists call an "efficient market". That is, a market, where prices reflect all available information and so traders and investors should not be able to earn excess returns over time. Yet, reality has a habit of providing obstacles to many economic theories, and currency markets are one such obstacle.

In order to show why the classical efficient market hypothesis does not hold for currency markets, one simply needs to see what the hypothesis would predict for currency markets, and compare that to the real world. The efficient market hypothesis[3] assumes that market participants are risk neutral and behave rationally. The former means that they care only about the expected return of holding foreign currency and not the risk, and the latter generally means that investors know the true model of the underlying economy and markets, use all publicly available information and stick to the principles of logic[4]. Given these assumptions one of the predictions of the hypothesis would be that uncovered interest parity should hold, or put another way, carry trades should not consistently make money over time[5]. Another would be that momentum or trend-following strategies should not be profitable.

After thirty to forty years of academic work in this area, the overwhelming consensus is that in the real world, uncovered interest parity does not hold, and so currency markets are not efficient using the classical definition[6]. Academic work has also shown that trend-following

[1] Hafeez (Aug 2006), "Currencies: Pension Saviour?", Deutsche Bank.

[2] FX turnover taken from the BIS' "Triennial Central Bank Survey", March 2005 – survey taken in 2004. US bond volumes from Federal Reserve Bank of New York, 22 February, 2007. NYSE volumes taken from NYSE, 22 February, 2007/

[3] Three different forms of efficiency are usually described: i) weak form (current prices incorporate all information contained in past prices), ii) semi-strong form (current prices incorporate all publicly available information, including past prices), iii) strong form (prices reflect all information that can possibly be known).

[4] Or more precisely the Savage axioms, which underlies a theory of expected utility, and includes axioms in addition to those of logic.

[5] A carry trade is where investors borrow in a low interest rate currency and invest in a high interest rate currency. The difference in interest rates is known as "carry" and investors intend to earn the carry, and expect that currency movements should not move to completely offset the carry gain.

[6] For an excellent overview see Sarno and Taylor (2002), "The Economics of Exchange Rate Economics", Cambridge University Press

strategies have been profitable at various points in time[7]. It would appear that for the efficient market hypothesis to work market participants would need to be extremely risk averse[8] or that they are irrational, which does not sit well with most economists. In fact, the fundamental tenet of how market participants are represented in the efficient markets hypothesis appears to be completely ill-suited to apply to currency markets.

New Theories Fight Back

Of course, some avenues of academic research have proven to be more satisfying. Behavioural economics delves into the irrationality of investors, and provides some explanations for observed market dynamics. Other approaches which broadly retain the assumption of rationality and have interesting-sounding names such as rational beliefs and endogenous uncertainty, adaptive market hypothesis and order flow-based models[9] have all proven to conform to market reality. In essence, they are based on a world where market participants have different beliefs[10] of what drives currency markets, different objectives that they may be maximising and often have different information at various times. In such a world, investors can earn systematic returns over time, but not without taking risks, and there is room for "smart" investors to outperform the "average" investor. Therefore, these theories of currency markets suggest that market participants need not be irrational for currency markets to deliver consistent excess returns over time, but instead they need to be shown to have different beliefs of what drives markets and different objectives. If that can be shown, then in theory at least, currency markets may offer systematic returns to those willing to take risk.

Section B: The Tribes of Currency Markets

The Three Tribes of FX Markets: Profit-Seekers, Liquidity-Seekers and Dealers

A useful segmentation of currency markets that is in the spirit of the more successful strands of academic work is to split market participants into two tribes: profit-seekers and liquidity-seekers. The former has the sole objective of entering into currency transactions in order to make a profit from movements in currencies, while the latter has the objective of ensuring they can access the currency markets whenever they need to engage in a cross-border transaction. Examples of profit-seekers would be a hedge fund or currency overlay manager. Examples of liquidity-seekers would be a corporate, which needs to enter into a currency transaction to set up a factory abroad, an international equity investor, who needs to buy a foreign currency in order to invest in a foreign equity market, a bond manager, who always currency hedges their foreign bond exposures or a central bank that needs to buy or sell currencies in order to maintain an exchange rate policy.

In such a world, the liquidity-seekers are willing to pay a premium to induce profit-seekers into currency markets[11]. As a result, this segmentation would lead to profit-seekers generally making profit over time, while liquidity-seekers would not (but would not mind as they are fulfilling other objectives). One obvious question is what the relative sizes of these groups in the currency markets is, and another would be whether we can prove that this profit transfer is occurring between the two segments. But before we go on to answer those questions, a word on a third tribe of FX markets "dealers". Indeed, the most recent BIS survey on FX market turnover, show dealers to be responsible for over 50% of FX turnover.

[7] Neely, Weller, Ulrich (2006). "The Adaptive Markets Hypothesis: Evidence from the Foreign Exchange Market".

[8] So that for a given level of risk premium, a large excess return in the currency would be expected. This is analogous to the "equity premium puzzle". Aside from this, if consumption (in the economy) is highly correlated with the exchange rate then risk premium could be a plausible explanation of the violation of uncovered interest parity. In reality, exchange rates are much more volatile than consumption, so the correlation is low.

[9] See Kurz (1997), "Endogenous Uncertainty: A Unified View of Market volatility", Lo (2004), "The Adaptive Markets Hypothesis: Market Efficiency From an Evolutionary Perspective" and Carlson and Osler (2005), "Short-Run Exchange Rate Dynamics: Theory and Evidence".

[10] In this context, market participants have no structural knowledge of the market, but have a common empirical knowledge. A rational belief is then a theory of the market that cannot be contradicted by the data. At any given time, several theories could meet this criteria (see Kurtz (1997))

[11] For an overview of this dynamic in markets, see Kolb (1992) "Is normal backwardation normal?", Journal of Futures Market

Dealing With Dealers

In reality, dealers are the intermediaries between the two other tribes, and so are in many ways the reactive segment of the market. That is, were the profit- or liquidity-seekers not to place any orders, the dealer or interbank volumes would dry up. Put another way, dealers are the providers of liquidity in the very short-run, where profit-seekers also become liquidity-seekers in addition to the typical liquidity-seeker, such as a corporate. Dealers therefore have to be induced to provide the liquidity, which in essence is the bid-offer spread.

Indeed, dealers constantly showing bid-offers prices is a form of constantly writing very short-dated put and call options, since the clients of the dealer can hit the bid or lift the offer at any time. Thus, writing options earns premium (in this case the spread between the bid-offer prices). However, dealers would also want to manage the risk by transferring their positions to other banks (at a lower spread), thus generating interbank volume. Ideally by the end of each day, the positions should be closed by the dealers by passing the positions back out to end-users. In this way, the volumes generated by dealers should not fall into either tribe of liquidity-seeker or profit-seeker as described earlier, and thus should be left out as the intermediary flows. Of course, some dealer flow could really be proprietary trading, in which case it should be categorised as profit-seeking, but for the purposes of this paper we will assume proprietary flows are relatively small[12].

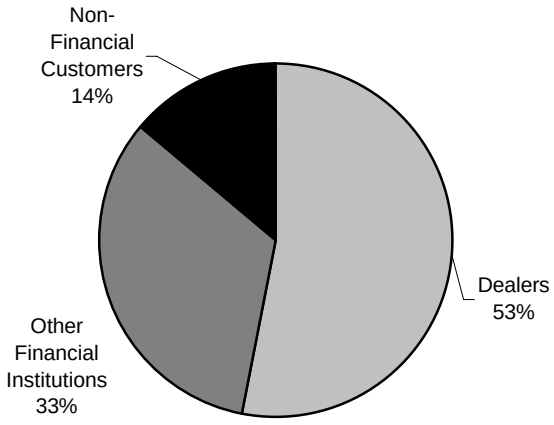
Section C: Quantifying the Sizes Of the Tribes

How Much of the Market Are Profit-Seekers?

There is no definitive way of answering this question since the currency markets are an over-the-counter market, and so there is no centralised source of data on turnover and segmentation of the market. Instead, one needs to make reasonable assumptions using multiple data sources. We will also attempt to estimate the highest proportion of the market that could be profit-seekers – in that way, we will be conservative in our approach.

The starting point would be the tri-annual BIS survey[13], which is the most comprehensive survey of currency market turnover. The latest, which was taken in 2004, shows that total currency market turnover is $1.9 trillion. "Dealers" make up just over 50% of the market, "other financial institutions" make up around 35% and "non-financial customers" make up around 15% (see first chart below). "Other financial institutions" include smaller banks not covered by the dealer category, mutual funds, pension funds, hedge funds, currency funds, money market funds, building societies, leasing companies, insurance companies, financial

BIS Survey of FX Markets: Breakdown by Counterparty of Reporting Dealers



Source: BIS. Survey taken on April 2004.

[12] See Sager and Taylor (2005), "Under the Microscope: The Structure of the Foreign Exchange Market"
[13] See www.bis.org/triennial.htm , or BIS (2005) "Triennial Central Bank Survey"

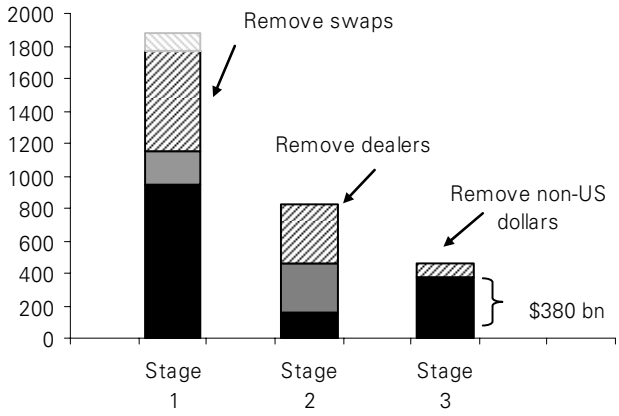
subsidiaries of corporate firms and central banks. "Non-financial customers" would cover all others, and are mainly corporates and governments. Given how broad the "other financial institutions" category is, translating the BIS categories to liquidity-seekers and profit-seekers is meaningless, so the overall BIS data needs to be combined with other data sources. We will do this using two different approaches.

Approach #1: Calculating the Size of Liquidity-Seekers First, and Then Using the Residual as Profit-Seekers

The BIS data can be supplemented by the US balance of payments and capital flow data. This is because between 85% and 90% of currency turnover involves the US dollar. So cross-border volumes in US securities, goods and services (and also US activity in foreign markets) would provide much more colour on the purpose behind certain portions of currency turnover.

So first, the headline BIS turnover of $1.9 trillion needs to be reduced to the US dollar amount that would consist of liquidity and profit-seekers (ie the originators of net FX demand). The headline turnover data includes spot, forwards and swaps. The latter should be excluded as it does not result in net currency demand[14] . Then, dealers should be excluded as they are the "intermediary". And finally only volumes which include the US dollar should be included. Using BIS data for each step, this leaves around $380 billion of currency turnover involving US dollars (see second chart below).

Filtering the BIS Data to the Relevant Volumes ($ billions)



Source: BIS. Survey taken on April 2004.

Second, the total cross-border volumes in non-US resident activity in US assets, goods and services and US resident activity in non-US asset, goods and services need to be calculated. Official US data sources provide gross data that allows one to calculate the breakdowns for long-term securities, direct investment[15], goods and services. The upshot is that these volumes come to around $155bn. That is, 40% of FX turnover can be attributed to buying/selling some asset, good or service (see first chart for full breakdown). So this 40% could safely be categorised as liquidity-seeking. Interestingly, the bulk of this category is made up of investors who are active in a market other than currencies, rather than corporates.

That leaves the remaining 60% of FX turnover which needs to be categorised. These are likely to be attributed to cross-border flows in short-term securities/loans[16], the currency

[14] In a foreign exchange swap, two currencies are exchanged at an agreed rate on completion of the transaction, and a reverse exchange of the same two currencies at date further in the future at an agreed rate.

[15] For FDI volumes, we use the absolute sum of quarterly changes in direct investment. This approaches broadly matches separate data DB holds in cross-border M&A volumes.

[16] More specifically, this category would likely be dominated by changes in claims in and liabilities of banks

hedging of an underlying exposure or currency trading for speculative purposes (see first chart below). The flows in short-term securities/loans, and hedging could be categorised as liquidity-seeking, while the speculative flows would clearly be profit-seeking. So the uncertainty would be how much of the 60% is devoted to pure profit-seeking flows, rather than the other flows.

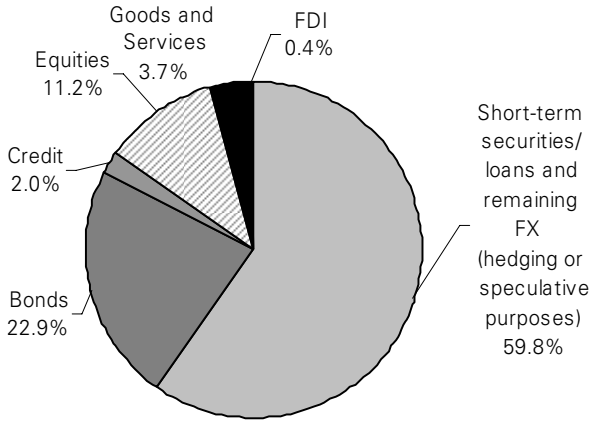
A conservative approach would be to leave the short-term securities/loans out, which would overstate the size of profit-seekers, and only try to estimate the size of currency hedging. We could argue that much of the cross-border activity in bonds (23% of turnover) is likely to be hedged. Assuming conservatively that half of the bond flows are currency hedged, and no other flow is hedged, then that would leave 49% (60% minus 11.5%) as profit-seeking. Hence, using this approach, 49% of the currency markets are made up of profit-seeking flows, while 51% is liquidity-seeking. More realistically, the volumes of cross-border transactions in short-term securities/loans, not related to speculative flows, would likely make up as much of the overall FX volumes as bond flows (23%). So a more reasonable estimate would be to deduct an extra 23% from the 49% we arrived at above. This would leave 26% as the proportion of the market that is "profit-seeking".

Interestingly, if we look at data from 1995, we find that using the conservative approach which overstates the size of profit-seekers, 73% of currency volumes were not related to purchasing an underlying asset, good or service (versus 60% in 2004, see second chart below). Using the same assumptions on hedging as above, it would leave 65% of the market as profit-seeking versus 35% as liquidity-seeking. So it appears that the proportion of profit-seekers has been falling. Another way of looking at this is that cross-border volumes in the trade of goods, services and securities has risen sharply by over 200%, while currency volumes have "only" risen by just over 100%. So the growth in currency investment has not kept pace with the broader growth in cross-border flows in other asset and goods markets.

Approach #2: Calculating the Size of Profit-Seekers First, and Then Using the Residual as Liquidity-Seekers

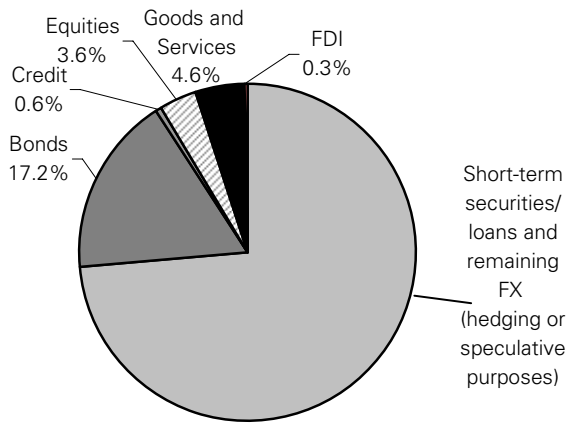
A more direct approach to measure the scale of profit-seekers would be to estimate the size of assets devoted to currency investment, and how much these funds trade. One of the most useful data sources is Deutsche Bank's FX Select platform, which has a broad and detailed array of data on currency managers. It contains funds from over 70 of the leading currency investment managers. Based on data disclosed by these managers, they account for just over $30bn in assets that focus specifically on investing in currencies. We estimate that these assets represent a significant proportion of funds dedicated to currency investments.

Estimated Breakdown of US Dollar FX Turnover By Purpose in 2004



Source: BIS. US Bureau of Economic Analysis, US Treasury Bulletin

Estimated Breakdown of US Dollar FX Turnover By Purpose in 1995



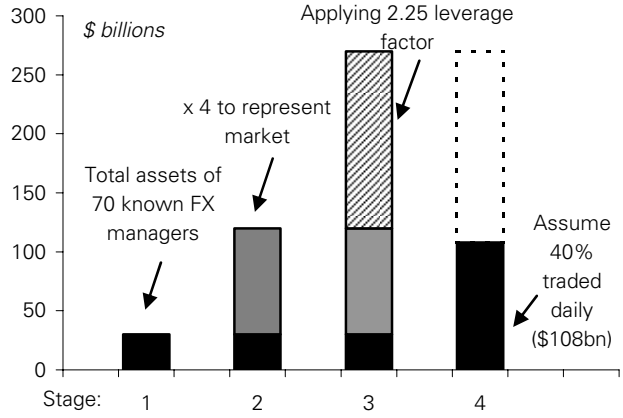
Source: BIS, US Bureau of Economic Analysis, US Treasury Bulletin

However, accounting for other currency managers whose funds are not included on FXSelect, currency overlay managers and the currency component of global macro funds, it would be reasonable to multiply the $30bn by some factor. To stay on the conservative side, we will quadruple the $30bn to $120bn and assume that this should cover any missing assets from our initial estimate.

In order to calculate the currency volumes that these profit-seekers account for, we need to answer several more questions. These include what leverage is used, and what proportion of the funds is traded each day. Fortunately, the FXSelect platform can provide some guidance here. According to data collected by the platform, the average leverage of these funds over the past six months has been 2.25. The leverage factor allows us to estimate the actual "size" of all currency funds to be $270bn (2.25 multiplied by $120bn).

The difficulty is to estimate what proportion of this is traded each day. One data point that may help in estimating this aspect of turnover is the median number of trades done each day on the FXSelect platform. As an absolute upper bound of the likely turnover number, we could assume that if an average portfolio holds the G10 currencies, then the average number of daily trades, which is 4, turns 40% of the portfolio each day (ie 4 divided by 10). This is a very high estimate, and the more likely number is closer to 5%-10%, but it does provide any absolute upper bound. Therefore using the 40%, the daily volume traded by profit-seekers comes to $108bn (ie 40% multiplied by $270bn). The first chart below shows each stage of our calculation in graphical form. Using the more reasonable 5%-10%, the volume would be between $14bn and $27bn.

From DB FXSelect Data to Profit-Seeking Volumes



Source: Deutsche Bank

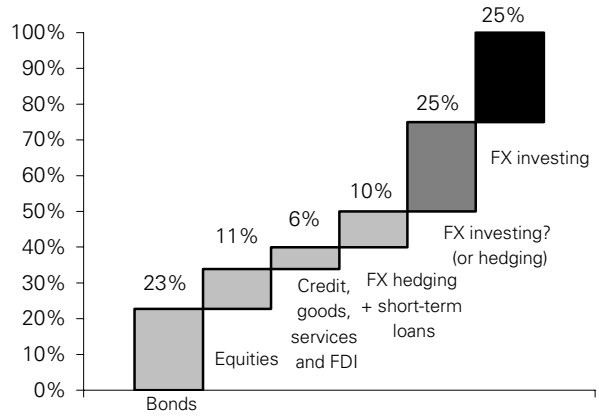
Total BIS daily turnover excluding dealers and swaps, but including all currencies comes to $455biilion. That would imply that 24% of currency market turnover is profit-seeking ($108bn divided by $455bn) using our upper bound estimate, while the rest is liquidity-seeking. The more likely proportion may well be closer to 3%-6%.

And So The Answer Is…

Using the two approaches described above with the conservative assumptions, we arrive at an upper bound range of 24%-49% of the market as profit-seeking (see second chart below). Using more reasonable assumptions, the range would come to 5%-25%. Obviously, very wide ranges, but that is inevitable given the absence of a central source of data for all currency transactions. But whichever way one arrives at these estimates, profit-seekers appear to make up at most 50% of the market, which leaves the rest as non-profit seekers.

Additionally, this share appears to be falling over time. Therefore, there appears to be strong grounds for profit-seekers to have consistent profit opportunities over time at the expense of liquidity-seekers. The question, though, is whether the profit-seekers do actually make these profits. We address this in the next section.

Summary of Currency Market Segmentation (Using "Conservative" Approach)



Source: Deutsche Bank

Section D: The Profitability Of the Tribes

Proving Non-Profit Seekers May Systematically Lose Money

Armed with a sense of how the currency markets are segmented, the question is whether profit-seekers do indeed make profits at the expense of liquidity-seekers. Ironically, this may end up being easier to test, than estimating their relative sizes. The CFTC publishes weekly data on the futures positions of two self-defined groups on the Chicago Mercantile Exchange (CME): non-commercial traders and commercial traders. The former trade for speculative purposes (ie profit-seekers), while the latter for hedging purposes (ie liquidity-seekers). Moreover, the positions of these types are reported on a weekly basis, and by their nature it is a zero-sum game. Therefore, we can use the weekly positioning data to determine the profit (or loss) of both commercial and non-commercial participants. Of course, commercial participants may not view their trades in terms of profit-and-loss as a non-commercial participant would, as they are focusing more on achieving hedging objectives, but nevertheless their positions can be used to calculate a profit-and-loss stream.

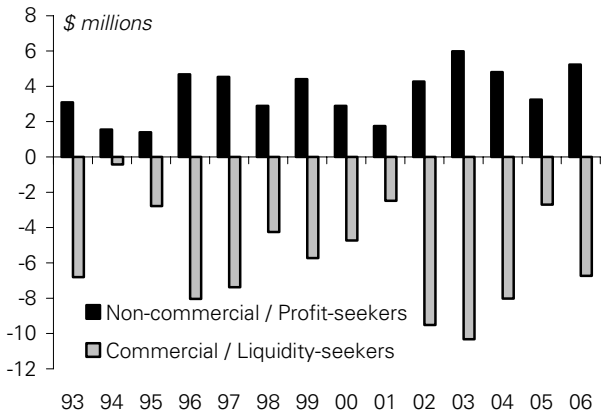
Some assumptions need to be made about what the likely exchange rate was on when the position was taken (we use the previous week's FX average). The upshot is that over the 1993-2006 period across all the currencies we studied, on average, non-commercials traders or profit-seeker made profits, while commercial traders or liquidity-seekers lost money (see first chart). Moreover, across time, it appears that for every year since 1993, non-commercial traders or profit-seekers have made profits in the major currencies at the expense of commercials or liquidity—seekers (see second chart). It should be noted that the charts show absolute profits and losses, so a high number may not necessarily be due to a greater percentage return on capital, but larger volumes being traded. Also, the sum of the two categories is not zero, as there is a third category of positions ("non-reportable"), which was not included in our calculations as they are not explicitly defined as either "commercial" or "non-commercial".

More robust studies[17], which use more precise entry and exit price levels and incorporate transaction costs, also confirm these results (see table). So they are not sensitive to our un-

[17] See Kearns and Manners (2004), "The profitability of Speculators in Currency Futures Markets", Reserve Bank of Australia.

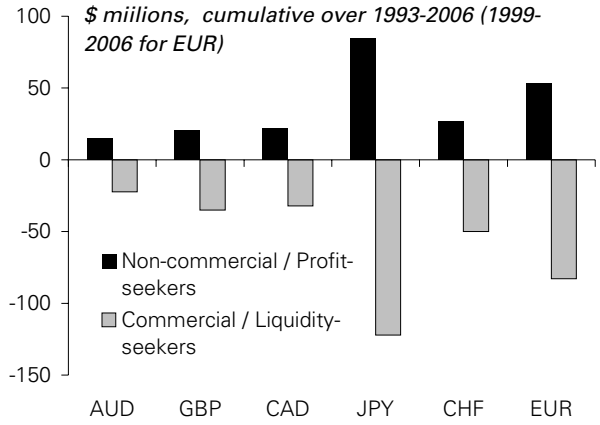
derlying assumptions. Thus, using this approach it does appear that there are segments of the markets such as liquidity-seekers who systematically lose money to profit-seekers.

Absolute P&L Across Time Trading the G5 FX (1993-2006)



Source: DB Global Markets Research, CFTC

Absolute P&L of Profit-Seekers and Liquidity-Seekers Using IMM Data (1993-2006)



Source: DB Global Markets Research, CFTC

Reserve Bank of Australia Study on Profitability of Speculators (1993-2003)

Currency	Non-commercial / Profit-seekers		Commercial / Liquidity-seekers
	Gross profit	Net profit*	Gross profit
	Annualised, US$ millions		
Australian Dollar	23	21	-37
British Pound	3	-11	-30
Canadian dollar	32	24	-33
Euro (99-)	258	235	-401
German mark (pre-99)	189	152	-297
Japanese yen	282	242	-448
Swiss franc	96	74	-183
Total	**661**	**543**	**-1084**

Source: Adapted from Kearns and Manners (2004), "The Profitability of Speculators in Currency Futures Markets", Reserve Bank of Australis

** Net profit calculated using a different methodology to gross profits. Transaction costs of 0.03% used.*

Bottom Line

It appears that theoretically as long as currency market participants have different motives, understandings of what drives currencies and information sources, currency markets can provide systematic excess returns to those willing to take the risk. The structure of currency markets does appear to conform to this. It appears that using a very conservative approach at most between 25%-50% of the market is made up of profit-seekers the remainder are liquidity-seekers. More realistically, the range is likely to be 5%-25%. Interestingly, we also find evidence that the share of profit-seekers is falling, as the rise in cross-border trading in bonds and equities has exceeded the rise in currency turnover. Finally, and perhaps most importantly, we find that using the actual positioning of liquidity and profit-seekers since 1993, we do find that profit-seekers systematically make profits at the expense of liquidity-seekers. It appears that the liquidity-seekers are paying a premium in the form of profits to profit-seekers in return for the provision of liquidity.

Tactical Indices

DB G10 Trade Weighted Indices: From Theory To Practice

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What are trade-weighted exchange rates?

Trade-weighted exchange rates (more broadly known as effective exchange rates) have been used by policy makers and academics for a long time, but were put into broader use by the IMF in the late 1980s as part of its exchange rate surveillance responsibilities.[18] Since then, the move away from fixed pegs or managed floats towards freely-floating currencies in the developed world has seen the majority of central banks adopt effective exchange rates as a crucial indicator of "the" exchange rate value of their currencies.

In its simplest form, a trade-weighted exchange rate can be defined as a weighted average of bilateral exchange rates[19], which distils information on the value of a currency into a single index. The bilateral exchange rates of choice and the relevant weights would typically depend on what the index is intended to analyse, with the emphasis usually placed on the influence of the exchange rate on the real economy and the balance of payments through changes in the relative price of tradable vs non-tradable goods.

How much significance do central banks place on currencies? The overall importance varies significantly between them, but the degree of a country's openness to the world economy is typically a key determinant. The first chart below measures this by looking at the sum of exports and imports as a proportion of GDP, with Switzerland standing out as the most open economy in the G10, and the US the least.

Exhibit 1: Openness of G10 Economies

Source: DB Global Markets Research

The Nuts and Bolts of TWI's

How are exchange rate indices constructed? The first step involves picking the number of currencies to include in the basket. One extreme would be to pick as many currencies as possible, though this is likely to be of marginal added value beyond a certain number of cur-

[18] The earliest IMF indices were based on the multilateral exchange rate model (MERM) first presented in "Measuring Price Competitiveness for Industrial Country Trade in Manufactures", IMF Working Paper, (1987). These were then replaced by indices based on total compositeness weights (TCW), see "New Rates from New Weights", IMF working Paper (2005) for the most recent update

[19] A bilateral exchange rate expresses the value of one currency against another (eg. USD/JPY, EUR/USD)

rencies given that exchange rate movements are often correlated. At the other extreme, only picking a few currencies may not provide a complete picture of how a country's competitiveness is affected by bilateral exchange rate movements. In the G10 world, the number of currencies used by central banks ranges from 6 in the case of Canada to 25 in Norway, with each decision ultimately subject to a trade-off between ease of calculation and completeness.

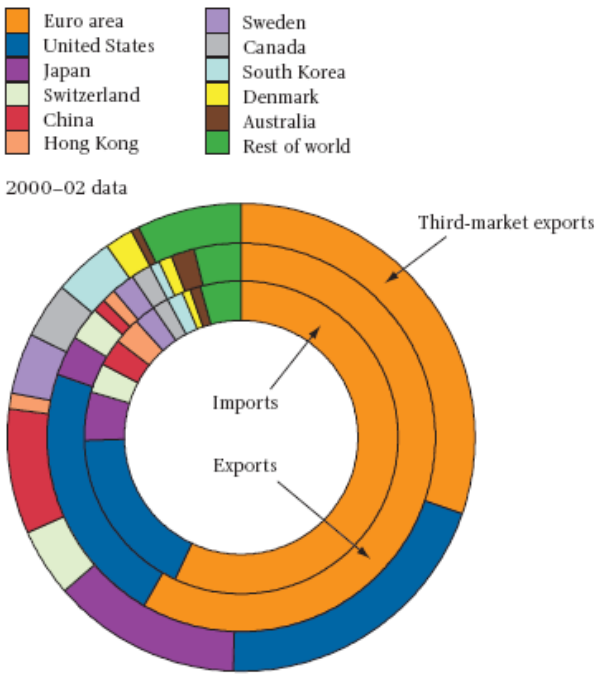
The second step involves choosing weights that are representative of each bilateral exchange rate's importance to a country's global competitiveness. In its simplest form, the weight w attached to a bilateral exchange rate i can be defined as:

$$w_j = \lambda_i^M + \lambda_i^{DX} + \lambda_i^{TX}$$

There are three types of competitiveness which this methodology would cover:

- Import competition (λ_i^M): this reflects the importance of each trading partner i as an importer of foreign products into the domestic market. A higher import share would mean that any given weakening of a country's exchange rate vis-avis importer i would generate a larger effective exchange rate depreciation
- Direct export competition (λ_i^{DX}): this measures the importance of trading partner i as an export destination of a country's exports
- Third-market competition (λ_i^{TX}): this incorporates the degree of export competition faced between the home country and country i in third-country export destinations. Chart 2 below shows the weights for each competition category attached to the sterling effective exchange rate index as an example. Though the direct share of UK exports to the Japanese market is small, UK and Japanese products compete between them in third markets, so that an appreciation of GBP against the JPY would (which makes UK exports more expensive compared to Japanese exports), would have a larger competitiveness effect on the UK economy than what the bilateral UK-Japan trade flows would imply.

Exhibit 2: Import, Export and Third-Market Competition Weights for the UK Effective Exchange Rate Index



Source: Bank of England

How similar are central banks' approaches to calculating exchange rates? Table 1 below summarises the calculation methodology used by central banks across the G10. While the majority use competitiveness-weighted exchange rates based on the approach outlined above, New Zealand and Australia stand out as following a simpler approach based on the bilateral trade flows that does not incorporate third-country competitiveness effects. The appendix at the end of this piece looks at the construction methodology of trade-weighted indices in more detail.

The Deutsche Bank Trade-Weighted Indices

The Deutsche Bank TWI's are a 'narrow' version of the effective exchange rates presented in exhibit 3. Each basket is constructed by taking the five G10 currencies with the largest weights in each central bank's officially published index, to ensure high levels of liquidity and minimise transaction costs. The weights are changed annually based on any modifications made by the central bank.[20] Exhibit 4 looks at the correlation between the DB TWI's and the central bank 'originals', with the majority of currency baskets tracking the central bank indices with a correlation of more than 90%. The currencies that stand out are the JPY and USD, where the tracking error is larger due to the relatively large allocation of EM Asia currencies in each index.

Exhibit 3: G10 Effective Exchange Rates

Central Bank	Name	Type of Weighting	No. of Currencies	Calculation of Weights
US Federal Reserve	Major Currencies Index	Weighted for competition, time varying	7	Internal
Bank of England	ERI	Weighted for competition, time varying	15	Internal
Norges Bank	TWI	Trade-weighted, time-varying	25	OECD
Bank of Canada	CERI	Weighted for competition, time varying	6	IMF
Reserve Bank of Australia	TWI	Trade-weighted, time-varying	23	Internal
Reserve Bank of New Zealand	TWI	Trade-weighted, time-varying	5	Internal
ECB	EER-23	Weighted for competition, updated every fifth year	23	Internal
Riksbank	TCW	Weighted for competition, constant weights	10	IMF
Bank of Japan	NEER	Weighted for competition, time varying	15	Internal
Swiss National Bank	Export-Weighted ERI	Trade-weighted, time-varying	14	Internal

*Two other indices (broad and other important trading partner are also calculated

Source: DB Global Markets Research,

[20] As of December 2006, the indices have been sponsored by the International Index Company (IIC), under the iBoxxFX TWI brand, providing an independent and transparent source of valuation.

Exhibit 4: Correlation Between Central Bank and DB TWI's			
AUD	93%	**JPY**	30%
CAD	94%	**NOK**	99%
CHF	99%	**NZD**	93%
EUR	94%	**SEK**	98%
GBP	94%	**USD**	70%

weekly correlations, 2001-2006

Source: DB Global Markets Research

An alternative approach to the one outlined above would have been to use an identical calculation methodology for all G10 currencies. Though this would have benefited from greater consistency, we felt that it would suffer the drawback of not being representative of the particular monetary policy considerations as reflected in each central bank's choice of weights. In addition, though the IMF does publish a consistent source of TWI indices across the G10, the weights are updated infrequently and with a large time lag, making this approach less effective in incorporating changes in trade patterns over time.

Why trade TWI's?

The main benefit of exchange rate indices over single-currency crosses is that they allow investors to express or hedge a single 'country' view on a particular currency while avoiding taking direct exposure against another. This avoids common pitfalls of single currency trades, which may be vulnerable to overextended positioning on a particular currency cross, or be influenced by exchange rate moves specific to that cross. In addition, TWI's can be a more effective tool to express a macroeconomic view within the context of a multi-asset portfolio, given that they are constructed so as to reflect the true impact of exchange rate moves on the real economy. As a final benefit, currency indices also lead to diversification benefits, as they are typically less volatile than the underlying cross-rates.

Appendix

The Deutsche Bank TWI's are based on geometric (as opposed to arithmetic) averaging based on the formula below:

$$IndexSpot_t^i = \kappa_s^i \times \prod_j^m \left(Spot_t^j\right)^{w(j)_s}$$

where

$i \in \{EU, US\}$ fixings

κ_s^i .....constant factor set for index i at the last re-balancing s

$w(j)_s$ .....weight of currency j at the last re-balancing s

$IndexSpot_t^i$ .....level of index i at time t

Geometric baskets are used as this is the methodology adopted by central banks. The advantage of geometric averaging is that a given percentage change in the spot rate generates an equivalent change of the basket value independently of the base. An arithmetic base, in contrast, would generate a different percent change depending on its starting value.

DB EM Asia Policy Baskets

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The Broad and Narrow SGD NEER Baskets

We launched an index contract based on our full SGD Nominal Effective Exchange Rate (NEER) model nearly three years ago. Recently, we added a narrower proxy, which reduces transaction costs and circumvents the problem of THB (where onshore and offshore rates have diverged by as much as 10% since capital controls were imposed last December).

These indices enable investors to take a view on the Singapore dollar relative to its policy basket. By offering a greater degree of insulation from broad USD moves, one can express a long-term macro view on the Singapore economy – buying SGD against the basket when it is low in the band and the outlook is rosy, and vice versa. It also makes it easier to position and hold out for reversion when the SGD NEER appears to be in overshoot territory and intervention may be imminent.

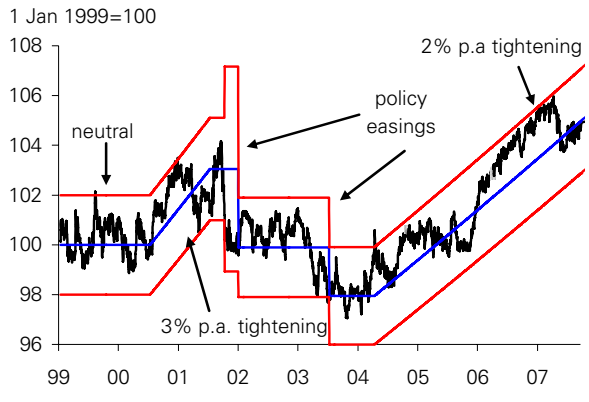
The baskets

Our SGD NEER baskets seek to minimize tracking errors to MAS' official published series (see box). Inputs are the currencies of Singapore's main trading partners. We constrain weights to within a few percentage points of recent trade shares, and solve against the latest two-year rolling window. We also re-run backtests periodically to check whether the incorporation of new currencies significantly improves fit.

Accordingly, we offer two tradable, geometric indices:

- *The full broad basket*, which uses THB onshore and is re-weighted dynamically, approximately four weeks after each policy review to take advantage of all available information.
- *A fixed narrow proxy*, which excludes THB, HKD and peripheral components like AUD. It has eight components; weights rounded to 5% increments; and has tracked stably in- and out-of-sample, albeit with somewhat larger tracking errors and a slightly higher beta to broad USD moves. Naturally, spreads are narrower, the forward curve flatter, and policy risks to the likes of THB smaller. Theoretically, it also reduces unwind risks by allowing for simple entry of an offsetting trade with a different counterparty.

SGD NEER and DB-implied bands



Source: DB Global Markets Research

SGD NEER and DB-implied bands

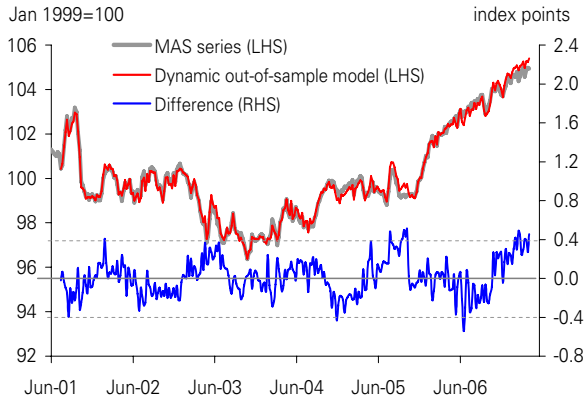
	Latest broad	Narrow
USD	21.4%	15.0%
EUR	8.6%	15.0%
JPY	8.9%	15.0%
GBP	2.0%	
AUD	4.0%	
KRW	3.8%	5.0%
TWD	6.6%	10.0%
CNY	14.9%	15.0%
HKD	2.0%	
THB	7.0%	
IDR	5.5%	5.0%
MYR	15.3%	20.0%

Source: DB Global Markets Research

DB SGD NEERs: broad versus narrow*

*Source: DB Global Markets Research, * Broad shown here uses THB onshore spot but offshore forward*

DB versus MAS model, tracking error



Source: DB Global Markets Research

Monitoring versus execution

The onshore-offshore spot THB basis has complicated SGD NEER monitoring and trade execution. Since the official basket seemingly uses onshore THB (as this is what matters for real economic competitiveness) trade signals need to come from a model which uses onshore THB. But actual trade execution must, if THB is incorporated, use THB offshore – incurring a significant spot basis risk. This is a strong reason for preferring the narrow proxy basket until this basis stabilizes or narrows.

We flag up SGDNEER developments and show charts of our full basket (using THB onshore spot) overlayed against estimated official bands in our regular research publications. Investors who wish to track the basket closely are recommended to set up a custom Bloomberg CIX page and chart or equivalent.

Information on the official SGD NEER

MAS uses the exchange rate as its main tool of monetary policy, announcing a bias for the SGD NEER and intervening (in USD/SGD spot) to keep the currency within bands around a central tendency. With open capital markets, interest rates are thus determined endogenously. .

Monetary policy is reviewed semi-annually, currently in early April and October, as well as in extreme circumstances (e.g., post-9/11).

We know from official publications that policy formulation relies on a formal econometric model which looks at the sensitivity of local growth, inflation and unemployment under various exchange rate scenarios. Critical input variables include foreign growth, inflation and commodity prices.

We also know that MAS' NEER is a geometric series, calculated on the basis of bilateral export weights adjusted for third country effects, and revised periodically to take account of changing trade patterns.

The Authority publishes a weekly chart of the NEER at each policy review, absent bands but with commentary that indicates, roughly, how the currency has traded relative to the band over the past six months. In April 2006, MAS began releasing the underlying data, about three weeks in arrears of each policy review. The data goes back to 1999.

The slope of the band, the NEER constituent currencies and their weights are not officially divulged, though over time can usually be gauged fairly reliably.

Source: DB Global Markets Research, MAS

CNY and MYR: Asia's New Policy Baskets

China and Malaysia staged small revaluations and shifted from hard USD pegs to managed basket floats in July 2005. Two years later, we have a reasonable idea about the operating parameters of their new regimes. And per official commentary, particularly out of China, there are good reasons to believe that the basket framework will play a larger role in guiding day-to-day FX policy over time. That means that NEER analysis could eventually become as important in taking an FX view as it is in SGD.

Second-guessing policy

The methodology for the China basket has been set out pretty clearly by policymakers. PBoC governor Zhou divulged weights are based on the composition of China's trade, inward direct investment and foreign debt. He listed four major partners – the US, Europe, Japan and Korea -- and seven smaller ones – Singapore, the UK, Russia, Malaysia, Thailand, Australia and Canada. He also confirmed that the total USD weight was significantly less than 50%.

Malaysian authorities are more reticent. But Bank Negara's initial depeg statement did spell out their aim of "maintaining the value of the ringgit against a trade-weighted index of major trading partners."

Accordingly, we developed full NEER baskets for both, China per the logic above, Malaysia simply using recent trade weights. We have been tracking these closely for the past 18 months.

For China, we believe authorities are targeting a 3% positive slope and defend +/-3% bands.

For Malaysia, a 2% slope and +/-2% bands initially seemed to explain moves and intervention well, though in recent months BNM seems to have become more comfortable with greater FX strength. This is also evident in broader policymaker comments. Over time, we may be able to confirm suspicions of a one-off 2% upward shift in the band, starting in 2007.

Making it tradable

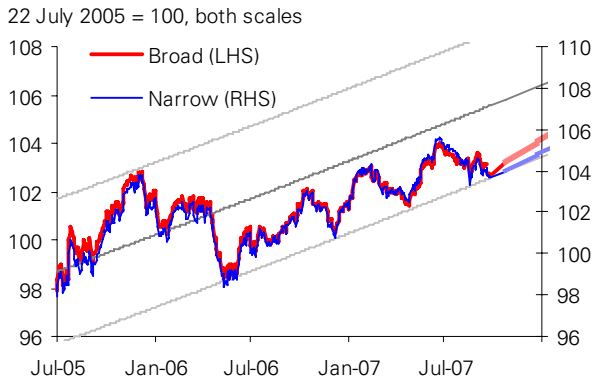
Using only the four "major" trading partners for China yields a remarkably close fit with the broader NEER. For Malaysia, we make our narrower cut by incorporating only those currencies with weights exceeding 10% in the broad basket. That leaves a basket of 5 currencies and, happily, excludes THB (getting around the onshore-offshore basis problem). In both cases, we round the weights for convenience.

DB narrow proxy policy baskets

	China	Malaysia
USD	35%	25%
JPY	27%	20%
EUR	25%	20%
KRW	13%	--
SGD	--	20%
CNY	--	15%

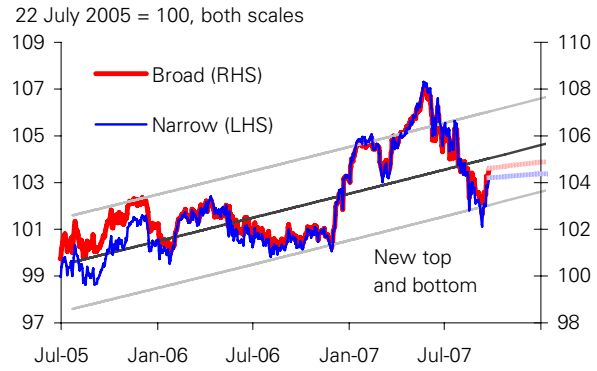
Source: DB Global Markets Research

CNY NEERs and implied policy band



Source: DB Global Markets Research

MYR NEERs and implied policy band



Source: DB Global Markets Research

The Emerging Asia Reserves, Liquidity and Yield (EARLY) Index

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Get in EARLY for Asia

Last year we launched the Emerging Asia Reserves, Liquidity and Yield (EARLY) index to provide a vehicle for simple, transparent and efficient EM Asian FX exposure. While the performance has been impressive, its broader appeal was dented by Thailand's imposition of capital controls. We have now rebalanced, removing THB. The remaining eight currencies are amalgamated into a geometric index with shares based on ordinal rankings across three equally-weighted criteria:

- *Reserve accumulation*: Calculations of currency deviations from "fair value" are numerous, disparate and usually controversial. We prefer a standardized proxy for market pressure that is being offset by central banks: Reserve accumulation as a share of nominal GDP. To avoid distortion from the business cycle and short-term environmental considerations, we average the last three full years' data.

- *Liquidity:* We use estimates of liquidity in the parts of the region's FX markets that are accessible to offshore investors, as published in our annual *Asian Currency Handbook*.

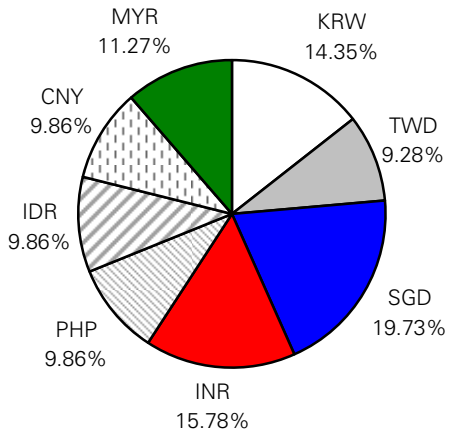
- *Yield:* We take the last one year's average 6-month FX-implied yield (offshore where appropriate) as an indication of the cost of carrying FX exposure in each currency.

THB is excluded on liquidity grounds, with our latest estimates of offshore FX market liquidity having dropped below USD50 million per day on average. HKD is also excluded, as we do not envisage the peg being broken or discarded in the next year or two (top officials have only recently reiterated their commitment to the institution).

DB EARLY index, trend and forward curve

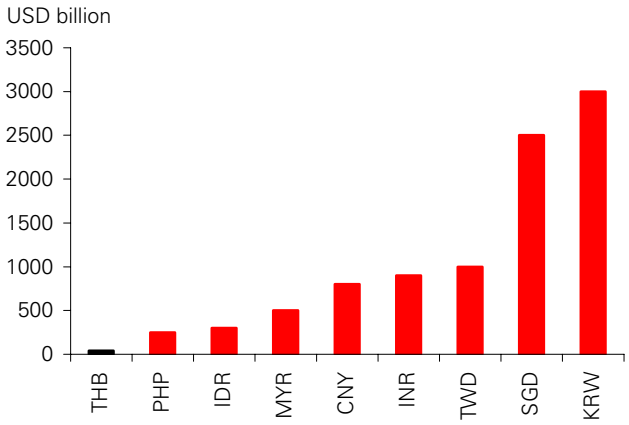
Source: DB Global Markets Research

DB EARLY weights



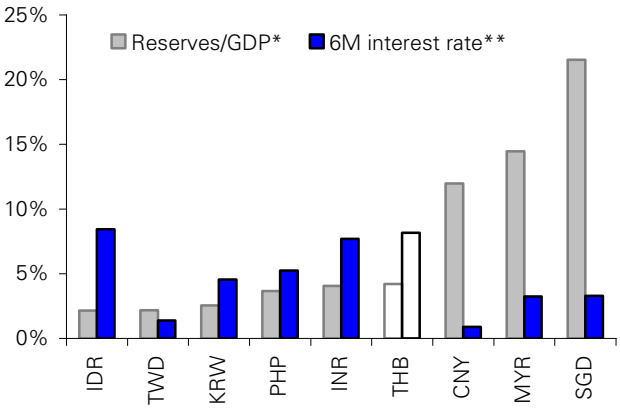
Source: DB Global Markets Research

Liquidity*



*Source: DB Global Markets estimates, * parts of market accessible to off-shore investors*

Reserves and carry



*Source: DB Global Markets Research, * 2004-6 average, includes forward book; ** offshore-implied where applicable, July'06-June '07 average*

The DB Currency Volatility Index (CVIX): A Benchmark For Volatility

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Origins of Currency Option Markets

Currency options first started trading actively in the 1970s and 1980s on listed futures and options markets, but were constrained to a handful of major exchange rates. Following the development of a more liquid OTC interbank market in the 1990s, options trading expanded to the full range of exchange rates. Today, the FX options market is a global, 24-hour market. It is one of the largest option markets by trading volume, with an average daily turnover of more than $200bn based on the most recent BIS survey.[21] Though it remains small relative to the overall size of FX markets, these figures likely underestimate its overall significance, as options traders are particularly active in the spot market as part of their ongoing hedging activity. In addition, the FX options market has been the fastest growing segment of FX markets over the last ten years, and has been the birthplace of some of the most innovative and exotic options structures across the space of financial derivatives.

The Deutsche Bank Currency Volatility Index (CVIX)

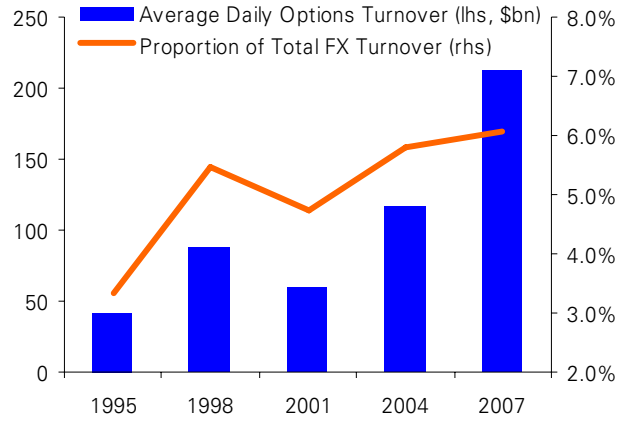
The Chicago Board of Exchange volatility index (VIX) is a well established equity market indicator that measures the implied volatility of a basket of S&P 500 options. The index is a measure of the market's expectation of future equity market volatility, and is widely used as a benchmark of investor sentiment and risk appetite. Though FX dwarfs equities in both size and liquidity, there has so far not been a widely recognizable benchmark of currency market volatility.

The aim of the DB CVIX is to provide such a benchmark for currency market participants. The index is designed to represent investors' expectation of future volatility, and is calculated as the arithmetic average of the 3-month level of implied volatility for all the major currency pairs. The index is defined as:

$$\text{CVIX} = \sum_{i=1}^{9} w_i vol_i$$

where the weights *w* are shown in the table at right below, and *vol* is the implied volatility

Options Market Turnover



Source: DB Global Markets Research, BIS 2004 Survey

Currency Crosses and Weights In CVIX

EURUSD	35.90%
USDJPY	21.79%
GBPUSD	17.95%
USDCHF	5.13%
USDCAD	5.13%
AUDUSD	6.41%
EURJPY	3.85%
EURGBP	2.56%
EURCHF	1.28%

Source: DB Global Markets Research, BIS 2004 Survey

[21] See BIS "Triennial Central Bank Survey", September 2007 and DeRosa "Options on Foreign Exchange", January 2000

of each cross based on a 4pm London BBA fixing. The currency pairs chosen are the ten most liquid crosses as measured by the triannual BIS survey of 2004, with the weights corresponding to the average daily turnover in each cross. Deutsche Bank makes markets in the index, with the trade settling as a contract for difference on the expiration date. Clients can keep track of their positions on Bloomberg on CVIX Index <Go>.

Why Trade the CVIX?

The main advantage of trading a currency volatility index as opposed to individual currency crosses is that an investor can avoid taking single currency risk, with the implied volatility on a particular cross typically dependent on the upcoming event horizon of a particular exchange rate and the economic cycle of a particular economy. Aside from this, one can use the CVIX to express a view based on the following considerations:

(1) Taking a directional view on volatility

Implied volatility is typically a function of realised volatility, so one would also likely be expressing a view on the realised path of volatility. This in turn depends on multiple drivers, ranging from global liquidity to monetary policy, and the microstructure of currency markets. For instance, both the increased transparency of G10 monetary policy combined with the growing number and size of e-platforms in global currency markets are credited by some as reducing the overall level of volatility in currency markets over recent years.

(2) Expressing a view on risk-aversion, event risks or hedging exposure to risky assets

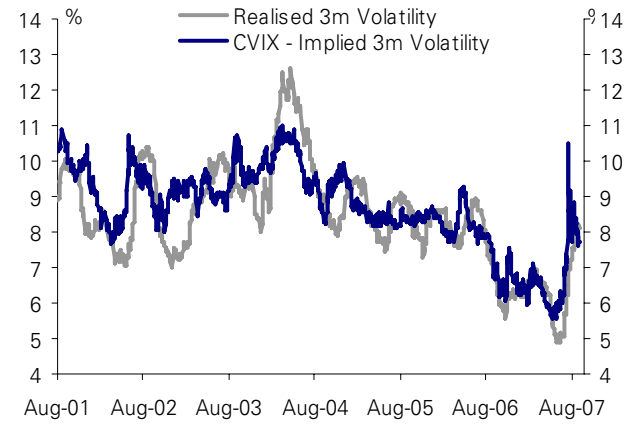
Aside from reflecting the market's view on the outcome of particular event risks (for instance, the CVIX rose significantly over the credit crisis in Augut), implied currency volatility is a broader indicator of investor risk appetite in currency markets. As such, it tends to be negatively correlated to the performance of carry trades and can be used as a hedge that avoids taking a directional and potentially more expensive exposure on a basket of carry crosses.

(3) Tactical asset allocation/Relative Value

The CVIX can be used to express a view on the relative value between options implied volatilities across asset classes. To take one example, equity market and FX market volatility have tended to track each other fairly closely over the last two years, but in some instances have exhibited signs of decoupling (chart at right). This would suggest the opportunity of a spread trade should one believe that FX volatility will 'catch-up' to a heightened perception of risk in equity markets, or vice versa.

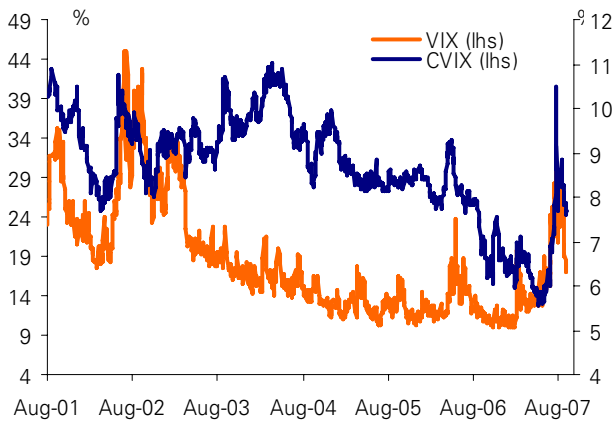
In all, the CVIX offers significant opportunities for investors seeking to express a view on volatility, currency market risk sentiment and the relative value of volatility across asset classes. As such, it has the potential to be an attractive and cheap diversifier in any currency portfolio.

CVIX vs Realised Volatility



Source: DB Global Markets Research, BIS 2004 Survey

FX Market vs Equity Market Volatility



Source: DB Global Markets Research, BIS 2004 Survey

Strategic Indices

Carry, Value and Momentum Currency Indices

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Carry Investing: the DB G10 Carry Index

Just Like Equities, Currencies Have a Puzzle

Equities have tended to significantly outperform relatively risk-free assets over the long-run. This would be expected as equities are riskier. However, theory would suggest that US equities should outperform T-bills by 1%, yet in reality they have outperformed by closer to 7%[22]. This divergence between theory and reality has come to be known as the "equity premium puzzle". The currency markets possibly provide an even bigger puzzle; the "forward premium puzzle" or "forward-rate bias". In this case not only does theory underestimate the magnitude of a currency's performance, it also gets the direction wrong. Consequently, investors have had a consistently profitable, though at times volatile, investment strategy in the form of buying carry trades.

What Does Theory Say? And How Does Reality Compare?
According to the risk-neutral efficient markets hypothesis, the expected gain from holding one currency rather than another should be offset by the loss of interest in holding this currency rather than the other. This is generally referred to as the uncovered interest parity (UIP) condition. From an investor's perspective, this would imply that investing in currencies with high interest rates by borrowing in currencies with low interest rates (ie carry trades) should not deliver consistent profits over time. That is, the high interest currency should depreciate. The reality could not be more different.

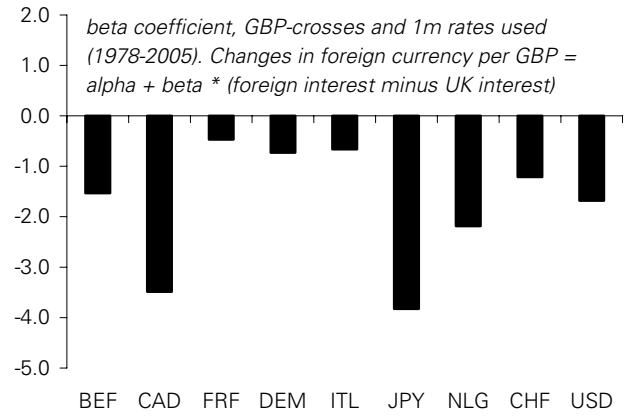
A broad consensus has emerged that the theory does not conform to reality at least over short- to medium-term horizons. Studies that look at the sensitivity of currencies to interest rate differentials (the beta) have found values closer to -1, than the +1 that theory would predict (see first and second charts). The only time horizons over which UIP appears to hold is over the very short period that spans the time interest is paid on currency positions each day[23], and the long-run (5 years onwards, see second chart). Therefore, explanations are needed on the failure of UIP and the efficient markets hypothesis.

Adjusting the Assumptions Seems to Help
Underlying the efficient markets hypothesis is that market participants are risk-neutral and are endowed with rational expectations. The former implies investors care only about expected returns and not risk, while the latter generally implies investors know the true model of the underlying economy and markets, use all publicly available information and stick to the principles of logic.[24]

Much work has been done to test both assumptions. Relaxing the assumption that investors are risk-neutral, and instead assuming they are risk averse, allows for the possibility of earning excess returns (ie the forward-rate bias) to compensate for a risk premium. However, most studies show that investors must be extremely risk averse or that consumption should be highly correlated with currencies for the forward rate bias to be as large as it is[25]. Neither of which are realistic.

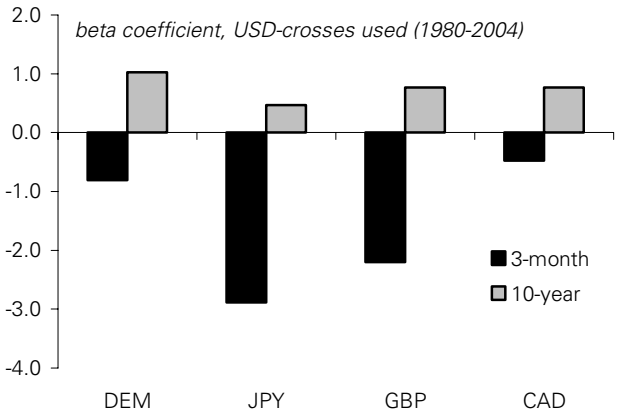
[22] Mehra (2003), "The Equity Premium: Why Is It a Puzzle?"
[23] Chaboud and Wright (2002), "Uncovered Interest Parity: It Works, But Not For Long"
[24] Or more precisely the Savage axioms, which underlies a theory of expected utility, and includes axioms in addition to logic.
[25] Engel (1995), "The Forward Discount Anomaly and the Risk Premium: A Survey of Recent Evidence"

The Sensitivity of Currencies To Interest Rate Differentials Should Be +1, But is Closer to -1



Source: Burnside, Eichenbaum, Kleschelski and Rebelo (2006), "The Returns to Currency Speculation"

Forward Bias Remains With Other Crosses, But Not Over Longer Time Horizons



Source: Chinn (2005), "The Rehabilitation of Interest rate Parity in the Floating rate Era"

Several explanations have been posited on whether investors do not form expectations in the way that the efficient markets hypothesis would suggest[26]. Investors may be irrational, or if they are rational, they are unsure of the true model of the market. In the latter case, investors may come up with different models of what drives currencies even using the same data – that is, they have "rational beliefs" [27]. Investors in carry trades are therefore being rewarded for the "uncertainty" of currency markets. Finally, if market participants are different in other ways, for example by being non-profit maximisers[28] or by having different risk limits, then it may not always be possible for sufficient capital to be allocated to carry trades for the forward-rate bias to disappear. Only when expectations of positive returns are very high would that likely be the case[29].

A Carry Strategy Exploiting the "Puzzle"

Given the extent of the "forward premium puzzle", most strategies that are based on carry are likely to be profitable. However, the real challenge is to avoid the sudden large losses that occur. Discrete rules that use different tenors of interest rates, volatility or correlation are unlikely to be flexible enough to capture them. If anything they may obscure, rather than enhance, the carry strategy by giving a false sense of security. Instead, our approach would be to use the carry strategy in conjunction with other currency strategies in order to minimise downside risks[30]. This also allows us to define the core carry strategy in a simple and transparent fashion.

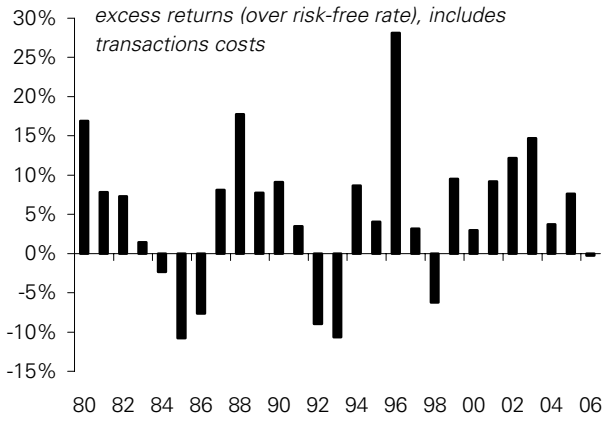
Therefore, our approach for a carry strategy is to use the 3-month interest rate to rank G10 currencies each quarter. We then buy the top-3 yielding currencies and sell the bottom-3 currencies. In this way, we are regularly invested in the 3 largest carry trades in the G10 world.

[26] This may be due the existence of rational bubbles, rational learning, peso problems or inefficiencies in information processing. See Sarno and Taylor (2002), The Economics of Exchange Rates. Chapter 2.
[27] Kurz (97),"Endogenous Uncertainty: A Unified View of Market Volatility".
[28] Hafeez (2007), "Currency Markets: Is Money Left On the Table?"
[29] Sarno, Valente, Leon (2006),"Nonlinearity in Deviations from UIP: An Explanation of the Forward Bias Puzzle", Baillie and Bollersley (2000), "The Forward Premium Anomaly Is Not As Bad As You Think"
[30] Sarno (2007), "An Economic Evaluation of Empirical Exchange Rate Models: Robust Evidence of Predictability and Volatility Timing.", see also Hafeez (2006): "Currencies: Pension Saviour?"

How Does It Perform?

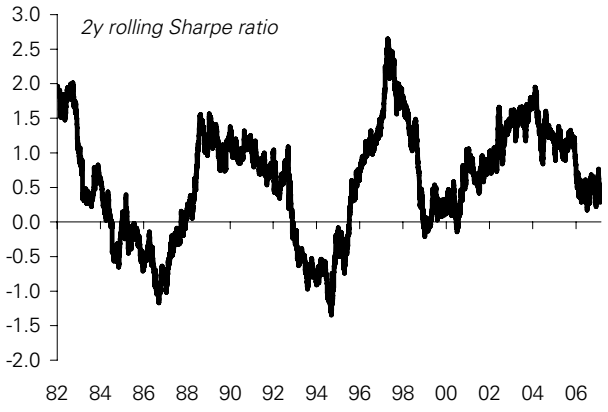
The strategy delivers an annual excess return of 5% from 1980-2006 with a Sharpe ratio of 0.6 and a maximum peak-to-trough drawdown of 31%. More detailed returns are shown in the charts on the right. As touched on above, the pattern of returns for carry trade strategies is a number of positive years of returns followed by several negative years. Interestingly, the worse losses were seen in the early 1990s, rather than 1998.

Annual Returns Carry Strategy



Source: DB Global Markets Research

Rolling 2-Year Risk-Adjusted Returns



Source: DB Global Markets Research

Summary Statistics of Carry Strategy

	1980-2006	1990-2006	2000-2006
Excess Returns*	4.9%	5.1%	7.0%
Volatility	8.4%	7.9%	7.2%
Sharpe ratio	0.59	0.65	0.98
Max. Drawdown	-31%		

** Includes transaction costs and carry, and excludes legacy Euro currencies, save DEM. Including them, would have reduce 1980-2006 returns by 0.8%*

Source: DB Global Markets Research

Value Investing: the DB G10 Valuation Index

Do Fundamentals Matter?

In a seminal paper[31], written almost 25 years ago, it was shown that using fundamentals-based models to forecast currencies could not outperform tossing a coin. Matters were made worse by the fact that even if one knew the fundamental data in advance, the result still held. Put another way, if one was told next year's values for inflation, growth, money supply and interest rates, then one could still not forecast currencies better than tossing a coin!

Every few years or so, the work has been updated to include more models and currencies. The most recent comprehensive update[32] showed that depending on what criteria one used to assess the success of a model, some fundamentals-based models do show some promise. Though, it appears that what works for one currency may not work for another. The chart on the right shows the accuracy of a range of models featured in the recent update. The models cover factors including purchasing power parity (PPP), money supply (sticky prices), debt and net foreign asset positions (composite). The upshot is that on the criteria of accuracy of "direction-of-change", PPP tends to out-perform the random walk (over long time horizons). Interestingly, it also appears to out-perform more recently popularised models such as ones that include productivity and net foreign asset positions. It would therefore appear that the best fundamental model to use, would be the simplest, PPP.

The Resurrection of PPP

The earliest versions of PPP theory have been traced to the Salamanca School of 16th-centrury Spain. Its continued use to this day, attests to its allure (to economists, at least). The idea behind PPP is that a unit of currency should buy the same basket of goods in one country as the equivalent amount of foreign currency, at the going exchange rate, can buy in a foreign country. If that was not the case, then there would be the possibility of arbitrage. The Economist newspaper's "Big Mac Index" is an example of the theory in popular form, where the price of Big Macs from around the world are compared in a common currency to see which currencies are over- or under-valued.

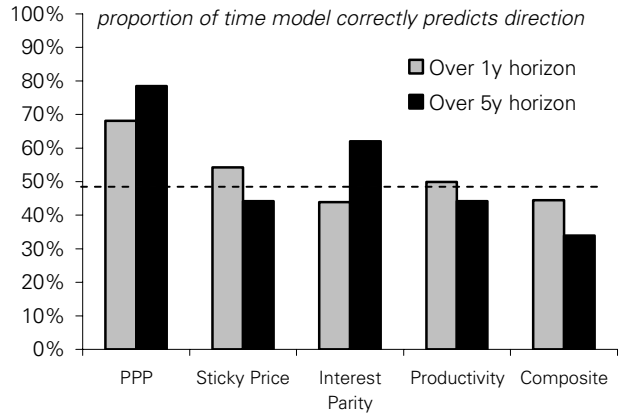
When testing PPP, economists have tended to stick to goods that are tradeable, as that should be where PPP is most likely to hold. Of course, transportation and information costs may make arbitrage difficult, and so it may not be expected that PPP holds at all times. Moreover, productivity difference between countries may also lead to departures from PPP. Notwithstanding these issues, empirical studies show some evidence that PPP holds in the long-run. That is, it takes between 3-5 years for half of the deviation from PPP to be corrected[33]. The length of the deviations has proven to be a puzzle to economists.

Part of it may be explained by a more technical point of how individual goods prices are aggregated up to price indices – that is, when PPP is tested the price indices between countries may contain different goods or different weights between goods. A bigger picture explanation is that currencies may adjust in a non-linear fashion. That is, when currencies are not too far from PPP levels, the scope for arbitrage may be limited as the transport and other costs may offset any potential arbitrage gains. However, if currencies were to deviate significantly from PPP, then arbitrage forces come into play, and may induce a more rapid reversion to PPP. Studies appear to support this dynamic[34] and suggest that when currencies are close to their PPP level, their behaviour is close to a random walk, while when they

[31] Meese and Rogoff (1983), "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?"
[32] Cheung, Chinn, Pascual (2003), "Empirical Exchange Rate Models of the Nineties: Are Any Fit to Survive?"
[33] Rogoff (1996), "The Purchasing Power Parity Puzzle"
[34] New Palgrave Dictionary of Economics, "Purchasing Power Pairty), See also Taylor, Peel, Sarno (2001), "Non-Linear Mean-Reversion in Real Effective Exchange Rates: Towards a Solution to the Purchasing Power Parity Puzzles"

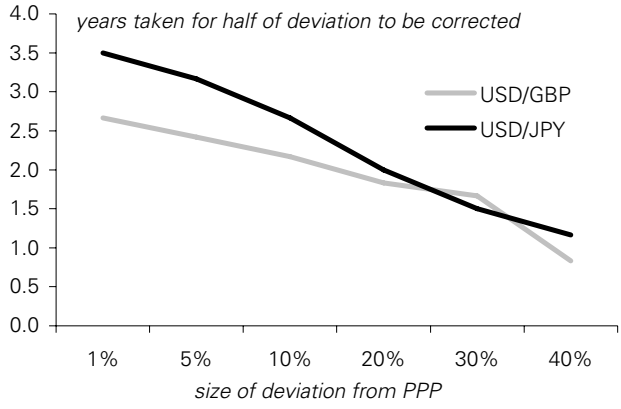
deviate significantly from PPP, they tend to mean-revert (see second chart on previous page).

Which Fundamental Model Works Best?



Results for 1983Q1-200Q4 using GBP, CAD, DEM, CHF, JPY – vs USD.
Source: Chheung, Chinn and Pascual (2003)

Faster Reversion To PPP at Extremes



Source: New Palgrave Dictionary, "Purchasing Power Parity

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Turning PPP Into an Investment Strategy

One of the dilemmas of using PPP in any investment strategy is which PPP measure to use. A direct approach would use the actual price levels of some combination of goods and services and compare these across countries to arrive at an actual level of PPP (such as the Big Mac Index). Alternatively, price indices, such as the consumer price index, could be used, but then PPP levels would have to be derived by assuming some earlier base period represents equilibrium[35]. While this approach allows one to pick a price index that contains more tradeable goods, there is scope for data-mining by choosing the base period that results in PPP working best. For this reason, we prefer to use the direct approach, and opt to use the OECD's PPP values[36]. The OECD calculates direct PPP values in order to make international GDP comparisons, rather than as a tool to forecast currencies. Therefore, it is more robust and comprehensive than other direct PPP measures.

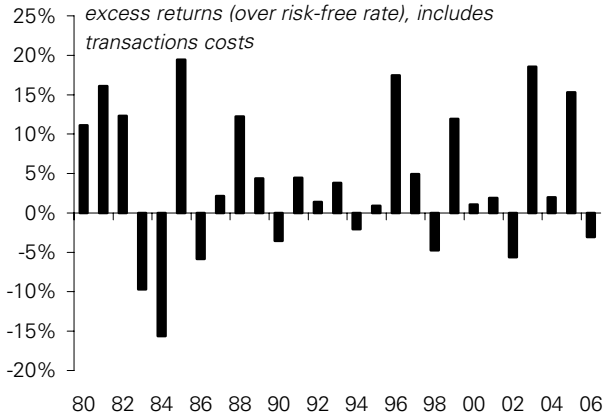
As we showed earlier, PPP tends to work best when currencies are at valuation extremes. However, looking back for each currency to see which extremes tend to see the quickest mean-reversion may not fare so well out-of-sample. Therefore, we take a ranking approach of G10 currencies[37] to avoid having to pick discrete thresholds. We do this by calculating each currencies deviation from PPP, and then rank the currencies by how under- or over-valued they are. We then buy the 3 most undervalued currencies and sell the 3 most overvalued currencies. This is assessed every 3 months.

How Does It Perform?

The strategy delivers an annual excess return of 4.1% from 1980-2006 with a Sharpe ratio of 0.46 and a maximum peak-to-trough drawdown of 26% (see table). There also appears to be a higher sensitivity to whether legacy euro currencies are included or not. If we had included ITL, FRF and ESP, then the Sharpe ratio would have increased to close to 0.65, and importantly, the drawdown would have been reduced sharply to around 15%. The overall strategy appears to be characterised by generally low returns interrupted by occasional large positive gains (see first two charts on next page).

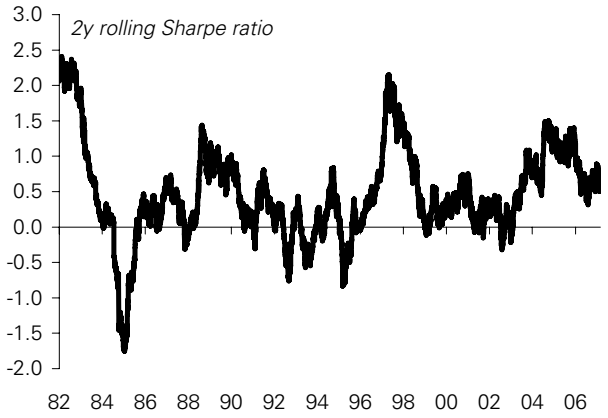
[35] Research on comparisons between the "Big Mac Index" and CPI-based PPP show a high correlation between the two series. See Parsley and Wei (2003), "A Prism Into the PPP Puzzles: The Micro-foundations of Big Mac Real Exchange Rates"
[36] See www.oecd.org
[37] USD, EUR (DEM pre-99), JPY, CHF, GBP, NOK, SEK, AUD, NZD, CAD. For the pre-1999 period, we exclude legacy euro currencies, except the DEM. If we include them, returns are higher.

Excess Returns of Valuation Strategy



Source: DB Global Markets Research

Rolling 2-Year Risk-Adjusted Returns



Source: DB Global Markets Research, Valuation Strategy

Summary Statistics of Valuation Strategy

	1980-2006	1990-2006	2000-2006
Excess Returns*	4.1%	3.8%	4.3%
Volatility	9.0%	9.2%	7.9%
Sharpe ratio	0.46	0.41	0.54
Max. Drawdown	-26%		

** Includes transaction costs and carry, and excludes legacy Euro currencies, save DEM. Including them, would have increased 1980-2006 returns by 0.9%*

Source: DB Global Markets Research

Momentum Investing: the DB G10 Momentum Index

Academics Jump On To the Trend

Currency investors have been using some form of trend-following strategies for decades. The most recent surveys indicate that technical analysis is used as much as fundamental analysis by currency market professionals[38]. Yet, academics have been reluctant to analyse the phenomena. Indeed, from 1960 to 1994, only 11 academic papers had been written on the subject for currency markets. Since then, 33 papers have been written[39]. Part of this was likely due to the scepticism many academics felt towards technical analysis, as it was in clear violation of the standard efficient market hypothesis, which states that the current price contains all available information, so using past prices should prove to be futile for investors. Of course, most studies have now shown that trend-following strategies have been profitable in violation of the standard efficient markets hypothesis. They show that the most statistically significant profits occurred before the 1990s, and then returns appear to have experienced a sharp drop in the early 1990s[40] (see second chart).

Several explanations have been put forward to explain why trend-following strategies have been profitable (and why profits have fallen since 1990). These include the existence of irrational traders ("noise traders"), the possibility that prices adjust slowly to new information, the possibility that prices provide information about non-fundamental currency determinants and finally the existence of temporary market inefficiency. There is some evidence for each one of these[41], though the last one is perhaps the most concerning for currency investors.

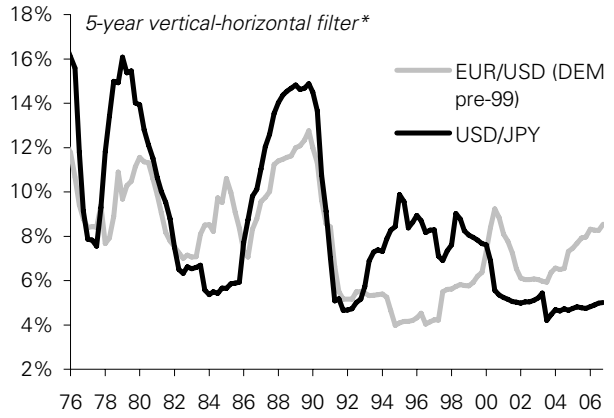
The Extinction of Trend-Following Returns?

Several factors may alleviate concerns of the possibility that trend-following returns will no longer occur. First, the duration of very high returns in the 1970s and 1980s may perhaps be too long for an inefficiency to have existed. Plus, it would be unclear why other widely-known strategies, which violate the standard efficient markets hypothesis, such as carry trades, have not shown a decline in returns. Moreover, the decline in trend-following returns did not occur gradually, but instead very rapidly in the early 1990s. Second and perhaps more importantly, the strength of currency trends in the majors showed sharp declines from the early 1990s onwards (particularly USD/JPY, see second chart). That is, the major exchange rates exhibited large and durable trends in the 1970s and 1980s, but the 1990s saw more range-bound markets. It would be unlikely that a greater number of trend-followers in currency markets in the early 1990s resulted in the disappearance of multi-year trends in currency markets. Instead, larger macro-economic developments were the likely cause. These would include the efforts of policymakers to stabilise currencies through the Louvre Accord[42] finally bearing fruit in the early 1990s, and importantly the marked decline in the volatility of growth and inflation across the G10 world seen since the early 1990s. Looking ahead, the macro environment could well change, and so generate larger trends.

Therefore, it would appear that there are grounds to believe that trend-following strategies may well work in the future, particularly if prices continue to show evidence of adjusting slowly to information and of containing non-fundamental currency determinants. The question, then, is what strategy best captures this.

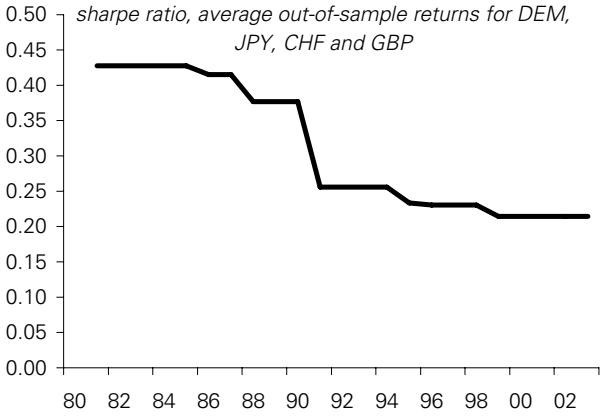
[38] Gehrig and Menkhoff (2003), "Technical Analysis in Foreign Exchange – The Workhorse Gains Further Ground."
[39] Park and Irwin (2006), "What Do We Know About the Profitability of Technical Analysis?"
[40] We take an average of out-of-sample Sharpe ratios for different models tested in academia. As we do not have the year-by-year Sharpe ratios for a given model, we assume a constant Shape ratio over the sub-period each model was tested over. Models are taken from Neely, Weller, Ulrich (2006): "The Adaptive Markets Hypothesis: Evidence from the Foreign Exchange Market", Qi and Wu (2006), "Technical Trading-Rule Profitability, Data Snooping and Reality Check: Evidence from the Foreign Exchange Market", Park and Irwin (2005), "A Reality Check on Technical Trading Rule Profits in US Futures Markets"
[41] Menkhoff and Taylor (2006), "The Obstinate Passion of foreign Exchange Professionals: Technical Analysis",
[42] A coordinated attempt to stabilize currencies initiated in 1987

Strength of FX Trends Have Declined From the 1990s



*Source: DB Global Markets Research. * The vertical-horizontal filter is a measure of the steepness and smoothness of a trend. The higher the number, the stronger the trend.*

Average Risk-Adjusted Returns of Momentum Trading Rules Tested in Academia



Source: Neely, Weller, Ulirich (2006), Qi & Wu (2006), Park & Irwin (2005)

Keeping the Momentum Going

In the literature on trend-following or momentum strategies, approaches have varied from using simple currency returns to moving average cross-over rules to more complex Markov switching models. The essence of all these approaches is that they profit when currencies trend, and that they cover the time horizon over which fundamental models having little forecasting power (that is, over the short- to medium-run). These need to be retained in any strategy. Additionally, switches in signals should be kept to a minimum to reduce transaction costs. Bearing all of these factors in mind, two questions need to be answered: what type of momentum rule should we use (eg a moving average) and which currency pairs should we use?

For the rule, we opt for using 12-month changes in spot exchange rates – an even simpler approach than using a moving average cross-over[43]. It has the advantage of minimising the frequency of signal changes, while remaining within the time horizon where trend-following rules are effective. Picking which currency pairs to apply this rule to is more problematic as there would be scope to data mine, and pick crosses that have worked well in the past. However, a ranking of the changes in spot across all G10 currencies would sidestep this issue. Our approach therefore ranks all G10 currencies[44] by their change over the past 12 months, and then we buy the top-3 performing currencies and we sell the bottom-3 performing currencies. We assess the ranking each month. In this way, the choice of currency pairs is left to the strategy itself.

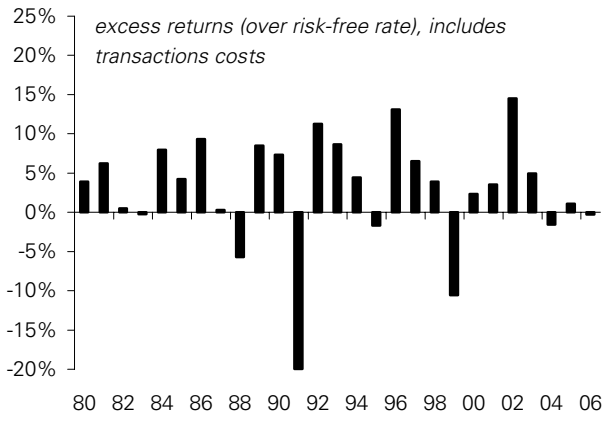
How Does It Perform?

The strategy delivers an annual excess return of 3% from 1980-2006 with a Sharpe ratio of 0.35 and a maximum peak-to-trough drawdown of 24%. More detailed returns are shown in the charts on the right. Notable aspects of the strategy are the overall stability of returns and the large loss in 1991. The former appears to be due to the longer horizon over which the trend is measured (ie 12-months) and the neutral approach to picking currencies, while the latter was due to a sharp mid-year trend reversal in the US dollar (partly due to recession concerns). On balance, our approach appears to be able to capture profits from any trends that do emerge.

[43] A longer moving cross-over rule such as a 20-day/200-day one would broadly deliver the same returns as using 12-month changes, but one would need to pick the currency pairs upfront.

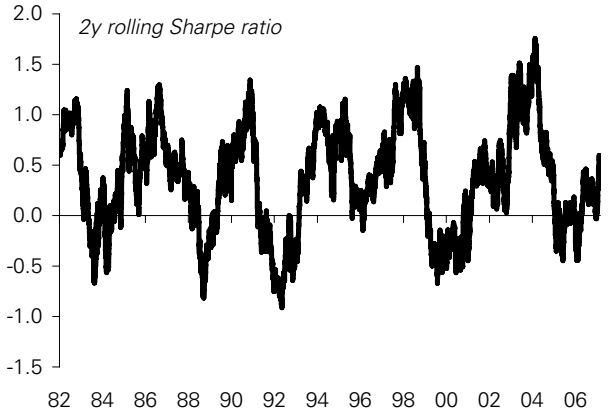
[44] USD, EUR , JPY, CHF, GBP, NOK, SEK, AUD, NZD, CAD. For the pre-1999 period, we exclude legacy euro currencies, except DEM

Excess Returns of Momentum Strategy



Source: DB Global Markets Research

Rolling 2-Year Risk-Adjusted Returns



Source: DB Global Markets Research

Summary Statistics of Momentum Strategy

	1980-2006	1990-2006	2000-2006
Excess Returns*	3.0%	2.8%	3.5%
Volatility	8.7%	8.8%	7.6%
Sharpe ratio	0.35	0.32	0.46
Max. Drawdown	-24%		

** Includes transaction costs and carry, and excludes legacy Euro currencies, save DEM. Including them, would have raised 1990-2006 returns by 0.3%, but kept other time periods unchanged*

Source: DB Global Markets Research

Benchmarking Currencies: The Deutsche Bank Currency Returns (dbCR) Index

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Remember Benchmarks Are Trading Rules

In earlier research[45], we showed that currency markets do deliver inherent positive returns over time, despite being a long-short market or zero-sum game. The fact that market participants have different objectives and beliefs, the actual existence of a sizeable proportion of market participants who do not maximise profits, and the positive returns of following three approaches (carry, momentum and valuation) all provide evidence for this.

The real paradigm shift, though, is to view the inherent returns as "beta", rather than "alpha" alone. In other words, to establish that there is a market return to currency markets. Importantly, we can show that benchmarks in other asset classes that are viewed as representing the market return, or beta, are in fact trading rules that capture the bulk of returns of the given market[46]. The following three examples are instructive:

Bond beta - "Lehmans Global Aggregate Index"

1) Minimum liquidity requirement. For example, US sovereign bonds must have USD 300mn minimum par amount outstanding
2) Must be rated investment grade
3) Fixed-rate coupons

Translation:

1) Pick bonds based on issuance data
2) Pick bonds using fundamentals, such as size and composition of savings and investment, government surplus/deficit trends and government deficit as share of GDP. These criteria are used to define the credit rating.
3) Pick bonds with a yield

Commodity beta "Goldman Sachs Commodity Index" (GSCI)

1) Only actively traded contracts
2) Production-weighted
3) Arithmetic average of commodity prices

Translation:

1) Use activity data to pick contracts, and have mechanism to expand number of commodities in index to increase diversification gains[47]
2) Have a larger bias towards non-storable commodities (such as energy), rather than storable commodities which would be the case if liquidity-weighted.
3) Increase weight towards trending commodities up until rebalancing dates, then "take partial" profits on rebalancing dates as weights moved back to target weights.

Equity Beta "Standard and Poor's 500" (S&P500)

1) Market-capitalisation weighted
2) Four consecutive quarters of positive as-reported earnings
3) Ratio of annual dollar value traded to market capitalisation should be 0.3 or greater

[45] Hafeez (Mar, 2007), "Currency Markets: Is Money Left On the Table?
[46] Hafeez (Aug, 2006), "Currencies: Pensions Saviour?".
[47] Erb and Harvey (2006), "The Tactical and Strategic Value of Commodity Futures"

Translation:
1) Implicit momentum or trend strategy as top-performing shares take increasing share of index
2) Use fundamentals to pick stocks
3) Use trading activity data to signal which stocks to buy

Currencies: Last One to Join the Benchmark Club?

When viewed as a set of trading rules, the accepted benchmarks of other asset classes indicate a level of subjectivity that would not otherwise be apparent. In fact, they really reflect a set of transparent rules that capture a substantial portion of the returns of a given market. By being widely followed, they become benchmarks. In this vein, there is no reason to believe that currencies should not have a benchmark.

The absence of one is all the more conspicuous when markets such as commodities have one. The commodity indices are based on futures, so like currencies can be viewed as a zero-sum gain. This provides sources of returns not apparent in looking at spot prices, for example the roll yield, which compares to the often over-looked carry earned in currency markets. Indeed, the carry, which is the difference between interest rates across countries, is a permanent feature of currency markets, unlike roll yields.

Easy To Pick the Rules, But Needs to be Investable

The basic criteria for establishing a currency benchmark would to be use widely known and followed approaches to capture currency returns. In previously published research[48], we highlighted three such strategies: carry, momentum and valuation. However, they were not intended to be investable. So issues such as transparency, transaction costs and stability were not fully dealt with. We have now constructed a set of rules that allow for the resultant benchmark index to be investable, yet capture the essence of the strategies, More detailed accounts of each are featured in accompanying research notes[49]. Our construction for the benchmark for currency beta, which we will name the Deutsche Bank Currency Returns (DBCR) index, would be as follows:

Currency beta "Deutsche Bank Currency Returns (DBCR) index"

1) Developed world currencies, and buy if:
2) Carry - positive net yield
or 3) Momentum – positive trend
or 4) Valuation – undervalued
and 5) Equally weight the three strategies

Translation:
1) Stick to the liquid currencies with low devaluation/default risk
2) Buy top-3 yielding currencies and sell bottom-3 yielding currencies based on 3-month yields. Re-assess every 3 months
3) Buy top-3 performing currencies and sell bottom-3 performing currencies. Performance defined as past 12-month change in spot returns. Re-assess every month.
4) Buy top-3 undervalued currencies and sell bottom-3 undervalued currencies (ie the three most overvalued currencies). Valuation is defined as spot deviation from OECD PPP value. Re-assess every 3 months.

The above sets of rules capture in a generic fashion the three most widely accepted approaches of capturing returns in currency markets.

[48] Hafeez (Aug 2006), "Currencies: Pension Saviour?"
[49] See Appendix and Hafeez (Mar 2007), "Currencies: Carry Investing", "Currencies: Momentum Investing", and "Currencies: Value Investing". See also Appendix

Brief Summary of the Rationale for These Rules

Carry: Exploits the widely observed "forward premium puzzle" or "forward rate bias", which suggests that systematically buying high interest rate currencies and selling low interest currencies may be profitable. This is because the existence of a risk premia, the use of different models to forecast currencies by rational market participants, or the differing constraints and objectives faced by market participants.

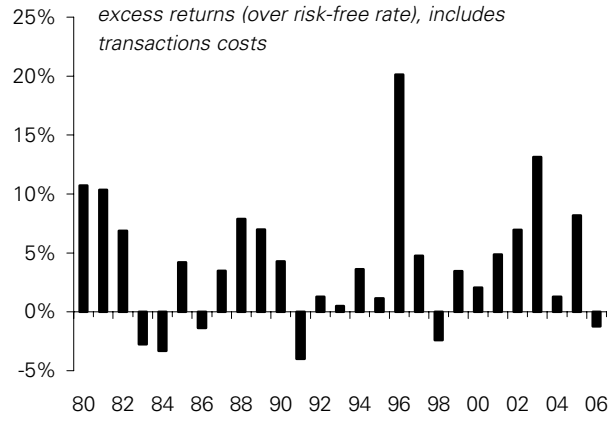
Momentum: Currencies appear to trend over time, which suggests that using past prices may be informative to investing in currencies. This is due to the existence of irrational traders, the possibility that prices provide information about non-fundamental currency determinants or that prices may adjust slowly to new information.

Valuation: In the long-run, currencies tend to move back to their fair value based on Purchasing Power Parity (PPP). However, in the short- to medium-run, currencies can deviate from their PPP values due to trade, information and other costs. This allows the possibility of profiting from currencies as they revert back to their fair values over the long-run.

How Does the Deutsche Bank Currency Returns (DBCR) Index Perform?
Since 1980, the DBCR has delivered excess returns of close to 4% with a Sharpe ratio of 0.80 and a maximum peak-to-trough drawdown[50] of 11%. Since 1990, the excess returns have between 4%-5% with a Sharpe ratio of around 0.80 (see table overleaf). It appears that returns broadly follow a cycle, so like in equities, currencies appear to have bull and bear markets, with bull markets tending to last much longer than bear markets (see charts below)

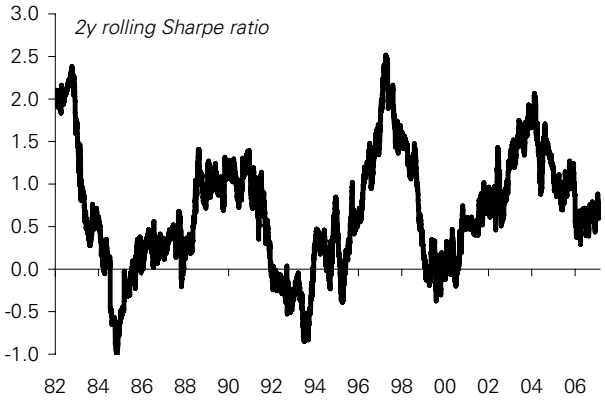
There are two notable aspects of the history of returns. The first is the exceptionally strong returns in 1996, when the stars aligned and all three component strategies were very profitable and resulted in a 20% return for the DBCR. The second is the low frequency of negative years.

Excess Returns of DBCR



Source: DB Global Markets Research

Rolling 2-Year Risk-Adjusted Returns for DBCR



Source: DB Global Markets Research

[50] The largest decline seen from a previous peak. Put another way, the biggest loss one may have faced, had one entered and exited at the worst times; that is, entered at the highs and sold at the lows. For other stats, we use geometric returns rather arithmetic returns

Summary Statistics of DBCR and Components

	1980-2006	1990-2006	2000-2006
DBCR			
Excess Returns*	4.0%	3.9%	4.9%
Volatility	5.2%	5.1%	5.3%
Sharpe ratio	0.77	0.76	0.94
Max. Drawdown	-11%		
Carry	4.9%	5.1%	7.0%
	0.59	0.65	0.98
Momentum	3.0%	2.8%	3.5%
	0.35	0.32	0.46
Valuation	4.1%	3.8%	4.3%
	0.46	0.41	0.54

** Includes transaction costs and carry, and excludes legacy Euro currencies, save DEM. Including them, would have kept returns close-to-unchanged for DBCR*

Source: DB Global Markets Research

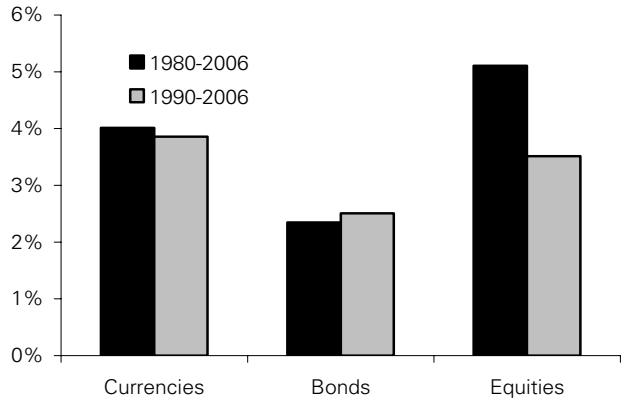
In comparison to the DBCR, the investment return statistics for the component strategies are lower for momentum and valuation, but in some cases are higher for carry (see table above). However, the drawdowns are unambiguously lower with the DBCR than any of the individual strategies and the Sharpe ratio is higher over the long-run. This is due the fact that strategies tend to perform well at different times, and so the correlations are low and often negative between the strategies (see final table). It appears that valuation and carry have positive correlations, while momentum has a negative correlation with both .

Comparing to Bonds and Equities

In earlier research[51], we had made comparisons between a possible currency benchmark and both equities and bonds. Having constructed a more practical currency benchmark that can be invested in and includes transactions costs, we can re-visit the comparison with other markets. The comparison shows that returns when adjusted for risk (ie the Sharpe ratio) have tended to be higher in currencies than in either bonds or equities. Moreover, the correlations are low between currencies and bonds or equities. So currencies score on both counts of positive expected returns and diversification. The conclusions of our earlier research pointing to 20%-30% allocations to currencies in a global asset allocation context, therefore, remain intact.

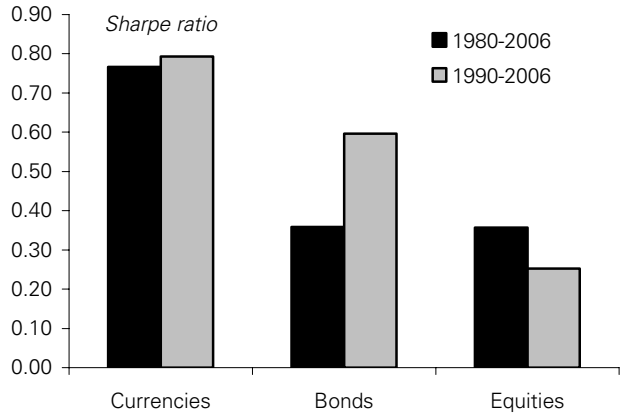
[51] Hafeez (Aug 2006), "Currencies, Pensions Saviour?"

Excess Returns Across Asset Classes



Source: DB Global Markets Research, Lehmans Global Aggregate Index for bonds, and MSCI World for equities

Risk-Adjusted Returns Across Asset Classes



Source: DB Global Markets Research, Lehmans Global Aggregate Index for bonds, and MSCI World for equities

Correlation Between Asset Classes

	Bond	Equity	DBCR	FX Carry	FX Mom.	FX Val.
Bond	100%					
Equity	26%	100%				
DBCR	-21%	5%	100%			
FX Carry	-16%	4%	74%	100%		
FX Mom.	3%	-2%	38%	-6%	100%	
FX Val.	-25%	7%	66%	40%	-25%	100%

Source: DB Global Markets Research

Carry Goes Global: The Global and Balanced Harvest Indices

This is an edited version of "FX Forward-Rate Bias Goes Global", Global Markets Research, Deutsche Bank, September 2005 by Bilal Hafeez, Caio Natividade and Jens Nystedt

Introduction

The popularity of investment strategies based on exploiting the "forward-rate bias", or "carry trade" in the FX markets continues to grow. While traditional economic theory suggests the forward-rate bias should not exist[52] – both empirical studies and the practice of market participants show that it is alive and well. Time-varying risk premia, loss aversion and spot exchange rates following a random walk are some of the explanations forwarded to explain the existence of the bias. However, market participants are currently less interested in finding explanations of the existence of the forward-rate bias, and instead are more interested in first arresting the decline in returns of strategies based on the forward-rate bias, and second ascertaining the odds of a large drawdown event. The latter has been addressed in past research[53] and so we address the former in this paper.

The main upshot is that a global basket may be able to enjoy higher returns than one purely focused on G10 currencies. The global basket is made up of being long the five highest yielding currencies and short the five lowest yielding currencies in an expanded universe of currencies that includes the ten most liquid EM currencies, as well as G10 currencies.

Putting Forward-Rate Bias Strategies into Context

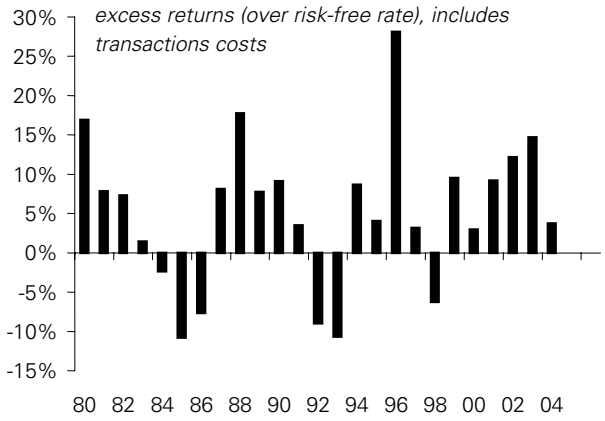
In order to better understand the context of forward-rate bias strategies, we can use the annual returns of Deutsche Bank's preferred approach to trading the forward-rate bias - buying the top-three yielding currencies and selling the bottom-three yielding currencies in the G10 world. The returns of such a strategy are shown in the chart below. Since the mid-1970s, the strategy has delivered annual returns of 5% with a Sharpe ratio of 0.6, because of these types of returns over the long-term, forward-rate bias strategies have formed the bedrock of FX investors' portfolios.

The profile of the returns illuminate the dilemma many investors now face. Typically, forward-rate bias strategies start to build positive returns, which reach a peak, and then subside often flipping to negative returns. In the latest cycle, the peak in returns was seen in 2003, and since then returns appear to be on a downward trend. Aside from a large drawdown event, possibly caused by risk aversion, there are good reasons to expect returns to fall further. These would include clear mean reversion in returns seen in such strategies, and the fact that many of the highest yielding currencies in the G10 world are now overvalued on many valuation metrics, such as Purchasing Power Parity (PPP). Therefore, the prospects of more conventional forms of forward-rate bias strategies are less rosy than a few years ago.

[52] For covered and uncovered interest rate parity conditions to hold, then the forward discount will equal the expected change in the spot exchange rate. That is, the forward rate should be a reliable unbiased predictor of future exchange rates. In reality, most empirical studies show that the parity conditions do not hold.
The hypothesis can be formulated as follows $\Delta e_{t+k} = \alpha + \beta\,(fd_{t,k}) + u$, where e is the spot exchange rate and fd is the forward discount. If the forward rate is an unbiased predictor of future spot changes, then the coefficient β should be close to 1.0. Most empirical studies show that the coefficient is in fact closer to -1.0. This finding implies that currencies that have a forward discount, tend to appreciate, not depreciate, over time. So not only can one earn the interest rate differential, or carry, but additional returns are made from the spot appreciation.

[53] See "Introducing the DB Risk Barometer", Deutsche Bank Global Markets Research, November 2002

DB's Forward-Rate Bias Strategy in Developed Currencies



Source: DB Global Markets Research

We believe that by expanding the universe of currencies used for the forward-rate bias to include the more liquid EM currencies, one can improve on the prospective returns. For one, the positive carry that is captured would be higher, so even in range-bound markets the returns would look respectable. Second, some high-yielding currencies are less likely to be overvalued, thus providing more scope to capture spot returns. The more pressing question though, would be whether the risk premia associated with emerging market currencies are sufficiently low for the yield on those currencies to be worth earning. That is, are the odds of a large depreciation sufficiently low to make consistently owning EM currencies worthwhile. We tackle that question next from an empirical perspective, before showing the fundamental reasons why EM risk premia may have changed.

The Global Forward Rate Bias Strategy In Practice

Defining the strategies

In order to analyse the performance of the global forward rate bias, we have developed two strategies – a global and a balanced strategy. The global strategy is an unconstrained expansion of the original forward rate bias approach, now including a selection of emerging market currencies. The balanced investment strategy incorporates some constraints in order to limit investment concentration in emerging currencies and funding concentration in G10 FX. The global strategy is 100% invested in the 5 highest yielding currencies within the universe analysed, while funding 100% in the five lowest yielding currencies in the universe analysed. The balanced strategy is 60% invested in the overall top 3 yielding currencies and 40% in the 2 highest yielding G-10 currencies in the universe analysed, while funding 40% via the 2 lowest yielding G-10 currencies and 60% in the remaining 3 lowest yielding currencies in the universe analysed. No currency crosses appear twice in any of the strategies. The strategies are rebalanced every three months.

Construction methodology

We have looked to create a strategy that gives exposure to global carry, while at the same time optimizes the risk adjusted excess returns and reduces liquidity implications.

The first step was determining the universe of currencies eligible for inclusion in the strategy. We began by taking the liquidity scorecard from the latest BIS FX turnover survey[54]. We took all individually named currencies in this list (see table below), but then eliminated currencies based on two criteria: first, those which are pegged or in a tight basket (given that they provide sell marginal diversification), and second, those for which there is limited off-

[54] Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity 2004, Bank for International Settlements

shore liquidity. Finally, although the Turkish lira was not included in the BIS liquidity scorecard, we judged that it had sufficient liquidity to justify its inclusion. Naturally, if a strategy such as the one we propose here is followed going forward, this list would need to be re vised for changing liquidity conditions.[55]

Liquidity scorecard – daily turnover according to the BIS survey, April 2004 (currencies in bold are not eligible for inclusion in the strategy)

Currency	$ bn equivalent	Reason For Exclusion
USD	833.8	
EUR	349.7	
JPY	190.8	
GBP	158.9	
CHF	57.3	
AUD	51.7	
CAD	39.5	
SEK	21.6	
HKD	**17.9**	**Currency board.**
NOK	13.2	
KRW	11.3	
MXN	10.3	
NZD	9.4	
SGD	9.4	
DKK	**8.5**	**ERM 2 band.**
ZAR	7.5	
RUB	**6.6**	**Limited offshore liquidity.**
PLN	3.8	
TWD	3.8	
INR	**2.8**	**Limited offshore liquidity.**
BRL	1.9	
CZK	1.9	
THB	**1.9**	**Limited offshore liquidity.[55]**
HUF	1.9	
CLP	**0.9**	**Limited offshore liquidity.**
MYR	**0.9**	**Limited offshore liquidity.**
Other	**57.3**	

Note: Turnover assumes exchange rates as of Apr-04, and includes spot, forward outrights and FX swaps. The Turkish lira is eligible for our investment strategy in spite of not being part of the table, given the fair liquidity in the spot and outright markets.
Source: DB Global Markets Research.

Performance comparison to other criteria

Criteria	5Y Ex-post Sharpe Ratio	5Y Excess Returns	12M Excess Returns
Balanced Strategy	**3.14**	**130%**	**24%**
Global Strategy	**1.80**	**85%**	**19%**
Top 3 G10 yields, bottom 3 G10 yields	1.94	61%	10%
Top 5 yields, funded in USD	1.74	84%	16%
Top vs bottom yields per region	1.73	75%	18%
Top vs bottom yields ÷ historical volatility	1.64	71%	21%
Top 5 EM yields, bottom 5 EM yields	1.37	64%	14%
Top vs bottom yields ÷ implied volatility	1.07	37%	17%
Top 5 yields, funded in EUR	0.50	27%	18%

Note: the same transaction costs were assumed for all criteria, performance over September 2000-September 2005.
Source: DB Global Markets Research.

After identifying the universe of eligible currencies, we decided that the strategy would be based on investing in five currencies and funded in five currencies. While admittedly the total of ten currencies was chosen arbitrarily, we felt that the use of fewer currencies would detract from the desired diversification while the inclusion of more currencies would increase maintenance costs.

The choice of the five currencies in which to invest and the five in which to fund is based solely on yield. From the universe, the five currencies with the lowest yield will be used to fund an investment in the five with the highest yield. This may appear a simplistic rule, and indeed we explored more sophisticated methods for selecting the currencies, for instance, adjusting the yields for volatility (historical and implied). However, none of these alternatives performed better than the simple rule, particularly in the situations in which they were designed to outperform, namely currency crises. Interestingly we found that, in these situations, the rise in yields experienced by the stressed currencies reasonably compensated for the loss and the volatility due to depreciation. The yield defined as the implied yield in each currency forward contract versus the US dollar; in most currencies it is equivalent to the domestic interbank deposit rate in a particular country, but it may also refer to the offshore deposit equivalent in the case of non-deliverable crosses.

[55] Editor's note: Thailand imposed capital controls on December 18, 2006, forcing new investments in the country to be held for more than a year or face stiff penalties for early withdrawal. The THB has since been excluded from the eligible pool of currencies in all the Harvest indices.

Selecting ten currencies purely on yields is the basis of our global strategy. However, given the historical yield gap between EM and G-10 FX, there is a risk that this strategy may in the future invest fully in emerging markets and fully fund in G-10. This is arguably an undesirable construction. In order to provide an alternative which mitigates this risk, we have created a regionally constrained strategy, which we call the balanced strategy. We investigated a number of different criteria for constraining the regional composition of the balanced strategy. The constraint which we felt made the most conceptual sense and coincidently gave the strongest result was one in which the investment strategy contained a minimum of four G-10 currencies, two in the funding side and two in the investment side.

The weights applied to each currency in each strategy are equal. Therefore, the nominal amount in each currency is 20% of the nominal amount invested. We favour equal weights based on three arguments: first, it's the least discretionary and conceptually works as the one that enhances diversification; second, it avoids potential liquidity issues from over-allocating funds in any one particular currency cross; and third, it eliminates the potential risk of data mining implied in using an optimisation technique to identify the optimised weights. In fact, as we show later, the strategy based on equal weighting has historically provided risk return characteristics that are very close to those of the efficient frontier.

Furthermore, the rebalancing of both strategies is done quarterly and investment/funding is done via three month forward outrights. Our choice is based on the argument that it provides more diversification when compared to semi-annual or annual rebalancing. The ability to rebalance the strategies more frequently allows for flexibility to capture currencies that have only recently qualified as higher yielders while at the same time not constraining the holder to a particular cross for a longer time period. Monthly rebalancing, on the other hand, was not viewed as an option due to the higher transaction costs involved.

Finally, the notional allocated to the global and balanced strategies is denominated in the currency against which the FX rates are calculated. We assume in our analysis that the notionals are denominated in US dollars.

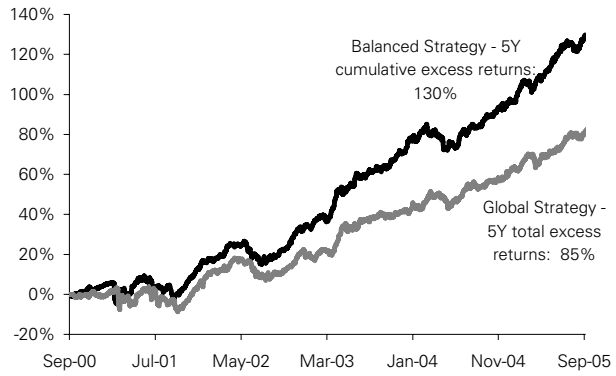
Analysis and results

The five-year performance of the enhanced forward rate bias strategies has been excellent in both absolute and risk adjusted terms. Excess returns on the global strategy, calculated from an initial rebalancing in September 2000 and up until September 22nd 2005 amounted to 85%. The balanced strategy, on the other hand, displayed a cumulative excess return of 130% during the same period[56]. The more recent performance of both of these indices is shown in the appendix to this Guide. Since both strategies are self-financing, these returns can be achieved without expending any cash; therefore, a notional amount of cash can be put on deposit while simultaneously investing in either of the strategies. Therefore, the returns in both strategies can be considered to be an excess over the deposit rate.

Given the diversification of the investment strategies, the five year ex-post Sharpe ratios (September 2000- September 2005) have been impressively high at 1.80 and 3.14, respectively. Even though the rules were not designed so as to provide the strongest historical performance, it is worth noting that many alternative rules failed to perform as strongly, as shown in the table below.

[56] This performance includes a conservative allowance for assumed costs if undertaking the strategy in practice.

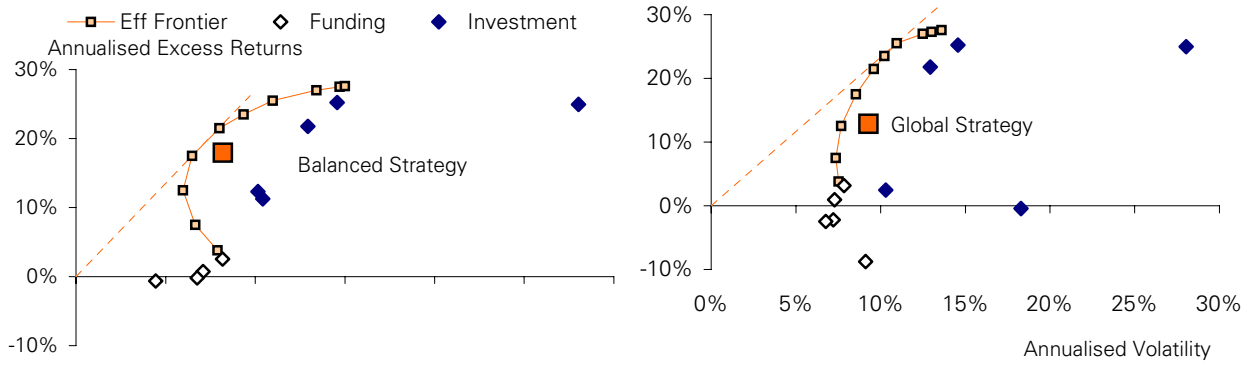
Global carry strategies – excellent returns



Source: DB Global Markets Research.

Equal weighting allocation also proved highly efficient, as evidenced by the proximity of the excess results achieved in both strategies to the efficient frontier of returns using the universe of currencies available. In fact, for the same level of volatility the most efficient annual returns in the balanced strategy would be only 200bp above those implied by an equally weighted basket. Increasing the returns by the extra 200bp would have implied over investing in the second and fourth highest yielding currencies and over funding in the lowest yielding currency – returns that would most likely be outweighed by the additional costs implied by asymmetric allocation.

Returns are highly efficient in both the balanced and global strategies…

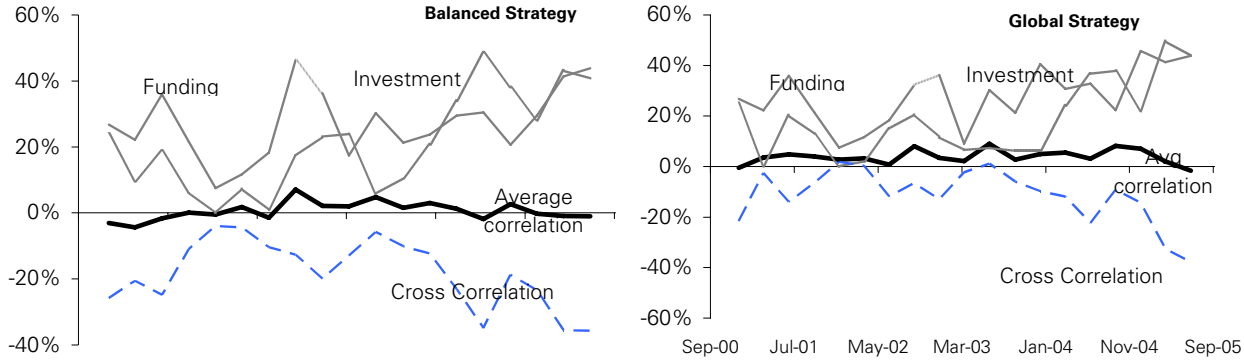


Source: DB Global Markets Research.

The strong risk-adjusted performance is driven, in our view, by the high degree of diversification within the basket. Indeed, the average correlation of daily returns between the currency positions in the basket using a 3 month rolling sample has always been kept within +/- 0.1. While the correlation of returns within the investment currencies (and funding currencies) experiences temporary jumps when analysed as separate categories, that feature is

offset by the negative cross correlation between the two categories[57] which also results in a low overall correlation in both the global and balanced investment strategies. As the charts illustrate, the large correlation pickup in both investment and funding categories, as global dollar weakness picked up pace, largely offset each other thus providing a low average correlation within the baskets.

... while the average correlation is remarkably low.



Source: DB Global Markets Research.

Performance during augmented tail risk events

One of the risks to a strategy based solely on yield criteria, be it either unconstrained or regionally constrained, is that it can be exposed to the tail risk embedded into some of the high yielding currencies. Nevertheless, and as explained later, tail risk in emerging market currencies is typically associated with high current account deficit countries and fixed exchange rate regimes.

From the universe of currencies currently eligible for our investment strategy, only the Hungarian forint and the Singaporean dollar are not fully floating currencies; as subsequently mentioned, the forint, coupled with the Turkish lira, currently strike us as most vulnerable to a significant currency adjustment. And while this vulnerability may increase going into 2006, the compensating rise in implied yields brought by the HUF-only and TRY-only investor in the event of HUF or TRY turbulence will over-compensate the investor in either global or balanced strategy for partial exposure to either of these currencies, since the latter's exposure to this particular tail risk is comparatively smaller (it doesn't exceed 20%).

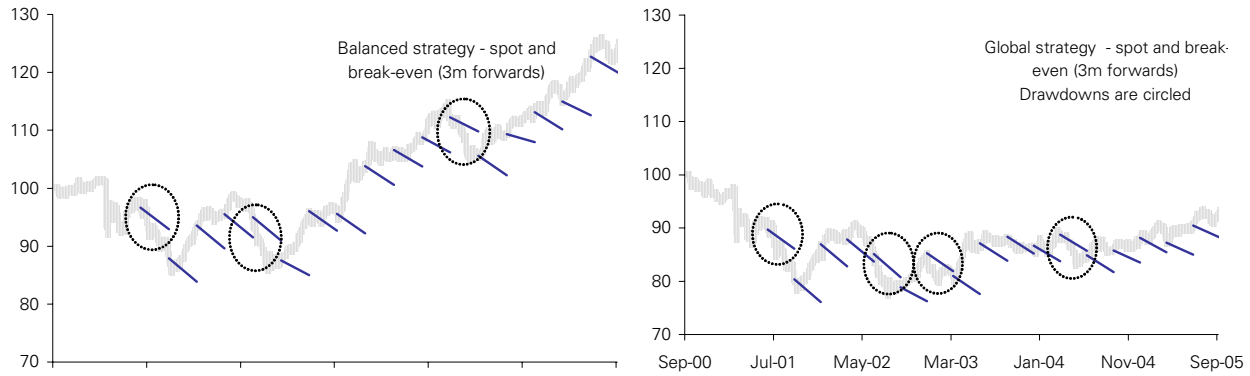
To analyse the impact of negative tail risk and contagion, we analyse two periods where EMFX witnessed turbulence, namely the summer of 2001 and the Turkish devaluation.

The former instance saw the maximum drawdown period of the global strategy and the balanced strategy: they experienced a loss of 12% and 10.5%, respectively, between June and September of 2001. The negative performance is attributed, in our view, to contagion witnessed in EMFX ahead of the Argentine crisis[58]; the Brazilian real lost 13.5%, the Polish zloty lost 6% and the Mexican peso weakened 4%, in addition to the 12.5% weakening of the Turkish lira (all inclusive of carry). At the same time, the funding currencies displayed remarkable resilience to risk aversion, especially the Swiss franc which gained 13.5% during the same time period (which extends to 10 days after the events of September 11). We note, however, that in spite of the contagion within EMFX during that period, the correlation of returns between currency pairs remained subdued in both strategies during the summer of 2001.

[57] Given the positive correlation of returns between the higher and lower yielding currencies, funding in the lower yielders and investing in the higher yielders resulted in negative cross correlation.

[58] The EMBI+ spread widened from 760bp to 1000bp from early June to late September 2001.

Drawdowns are also very limited in time and magnitude for both strategies



Source: DB Global Markets Research.

More relevant to our analysis is the performance of both strategies during the Turkish devaluation of February 2001. At that time, TRY 3 month implied yields rose by 70pp to 105% between Dec-00 and Mar-01[59] in order to allow for USD/TRY to stabilise as the February devaluation took its toll. A short USD/TRY position (via 3 month forwards) in the 6 month period between the two rebalancing dates returned -25%. At the same time, the global strategy incurred a positive return of 2.9% during the same period, with an average correlation of 0.03 between all the currencies involved, thus proving that the rise in yields in USD/TRY over-compensated the investor for his 10% exposure to this currency pair. Even though the Turkish lira (and the Brazilian real and South African rand, currencies highly sensitive to the TRY at the time) performed poorly during the first half of 2001, the global strategy was mostly compensated by a strong performance in the Mexican peso, Polish zloty and Taiwanese dollar, and the poor performance of the funding currencies (JPY, SGD, CHF, SEK and EUR).

At the same time, the balanced strategy showed a gain of 3.7% over the same time period, which results from the South African rand and the Brazilian real's failure to qualify as investment currencies at the rebalancings of Dec-00 and Mar-01[60]. The New Zealand dollar and the Norwegian krone, both G-10 investment currencies that took part in the investment strategy, performed sideways during that period.

In order to analyse all the drawdown periods, we also expressed each strategy in the form of a spot index and equivalent forward outrights, so as to better assess the returns attributed to nominal currency performance and the returns attributed to carry. Given that the index format is computed in inverted form to a normal FX forward vs the US dollar, forward outright rates on the index will naturally be below (and declining) spot rates given the positive carry. The slope of the forward (or break-even) curve relative to spot represents the level of the carry; as a result, carry is higher in the global rather than the balanced strategy. The results show the limited quarterly drawdown periods of this strategy – a total of four in the global strategy versus three in the balanced yield strategy.

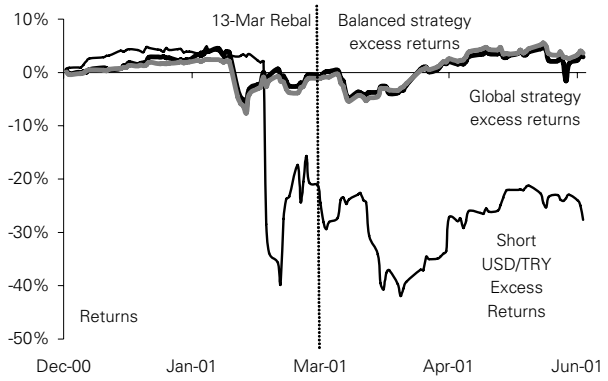
Another argument in favour of exposure to a global forward rate bias investment is the reduced negative tail risk (compared to history) embedded into emerging market currencies at current times, as explained in the next article. Given that we view the Hungarian forint and the Turkish lira as the currencies with the highest negative tail risk going forward, the cost

[59] Returns are calculated between 13-Dec-00 and 13-Jun-01, both being strategy rebalancing dates.

[60] The non-G10 investment currencies that qualified for the balanced strategy at the time were the TRY (105%), PLN (17.5% yield) and MXN (16.7% yield). 3 month implied yields on the BRL (LHS) at the time were between 12.5% and 14%, while ZAR 3 month implied yields were around 10.5%.

of hedging that particular risk in the context of a portfolio of five investment currencies[61] is comparatively low.

DB Yield indices – stress-test performance during the Turkish devaluation of H1 2001



Source: DB Global Markets Research.

Investor exposure to emerging market tail risk is further diminished in the balanced strategy, given the smaller universe of EM currencies included. In the case of the Hungarian forint, for example, it will have to be among the three highest yielding currencies in order to be held as investment currency during a particular quarter.

The overall analysis is very encouraging

The higher carry, favourable valuation metrics and strong performance of G-10 constrained carry indices provide a plausible argument for a global carry basket. Given their exposure to a much larger universe of currencies, the strategies identified above allow for exposure to higher yielding currencies while at the same time maintaining diversification within the portfolio. As demonstrated above, results point to excellent historical returns in both absolute and risk adjusted terms, while at the same time the drawdown periods have been limited in size and scope given high carry and low correlation of returns.

Next we take a closer look at how the fundamentals have changed in emerging markets to ascertain whether the above results are spurious or grounded in actual changes in markets.

EM FX Premia – The Macro Perspective

Has the EMFX Boom and Bust Cycle Ended?

Investors in EMFX in the 1990s took significant headline risk, i.e. the number of currency crises meant that at any given time there was a chance of another currency devaluation triggering an economic crises and eventually possibly sovereign default. As a result, volatility in EMFX went between two extremes, i.e. very low in normal times due to the hard-currency fixed or crawling pegs or very high as the pegs were exited under duress and contagion spread across EM. As the table shows, outside of Asia, fewer EMFX currencies are pegged today, which reduces the chance of event risk in the future. Moreover, contrary to the past market pressures currently seem to be more towards revaluation as some emerging markets have re-built FX reserves, retaining competitiveness and large current account surpluses, rather than letting their currencies float freely.

[61] Assuming that HUF and TRY yields will be high enough to qualify for the investment strategy at the time of rebalancing.

EM Exchange rate Regimes Then and Now

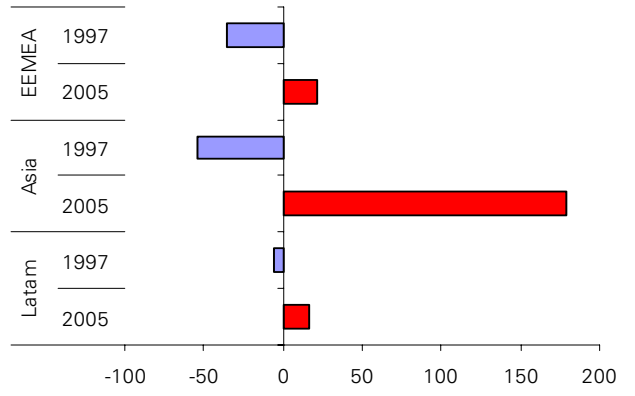
	1995	2000	2005
Fixed Pegs	ARS BRL MXN ZAR KRW SGD THB TWD	ARS	
Crawling or basket	TRY CZK PLN HUF	TRY HUF ZAR SGD	SGD
Floating		BRL MXN THB KRW CZK PLN	ARS BRL MXN CZK HUF 1/ PLN TRY ZAR KRW THB TWD

1/ A wide band is used +/-15%
Source: Reuters, DB Global Markets Research.

EM Macro Fundamentals are different now

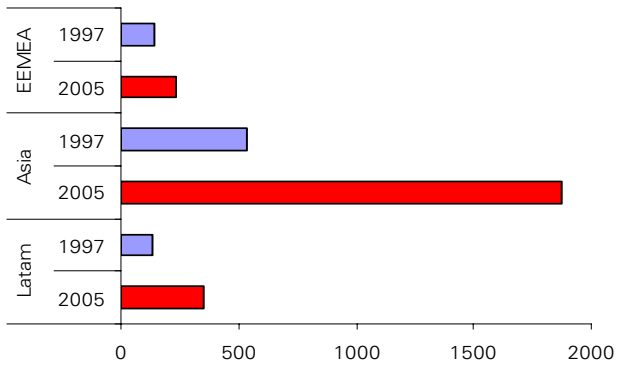
Several factors combined to shift emerging markets external balances across regions from deficits to surplus beginning in 1999 that then steadily rose through 2004. The string of emerging market crises resulted in large real depreciations, which boosted exports while depressed domestic demand reduced imports.

Impressive Change in External Balances… (in USD bn)



Source: DB Global Markets Research.

…has supported surge in EM FX Reserves (in USD bn)



Source: DB Global Markets Research.

The Asian emerging markets were first to shift from deficits through the mid-1990s to surplus by 1998, which then continued to grow. With the recovery in global growth, oil and other commodity prices trended higher, boosting emerging market export revenues. The middle-eastern oil exporters were second to shift into surpluses, in 1999, and these grew with oil prices to reach USD125 bn in 2004. Summing the current accounts of the middle-eastern countries with those of other oil exporters such as Russia, Mexico and Venezuela shows that in 2004 oil exporters' surpluses reached USD175bn or almost half the total current account surplus of the emerging markets.

If the policy induced reserve accumulation alters, revaluation pressures could increase. Reserve accumulation well in excess of current account surpluses, mainly in emerging Asia, suggests that a substantial proportion of the so-called savings glut is policy induced. This, however, implies that of/when the policy of ever higher current account surpluses in EM finishes we could see pressures for both nominal and real appreciation. This is not only a non-Japan Asia phenomenon, but also includes countries such as Argentina, Brazil in Latin America and Russia, Ukraine in EEMEA.

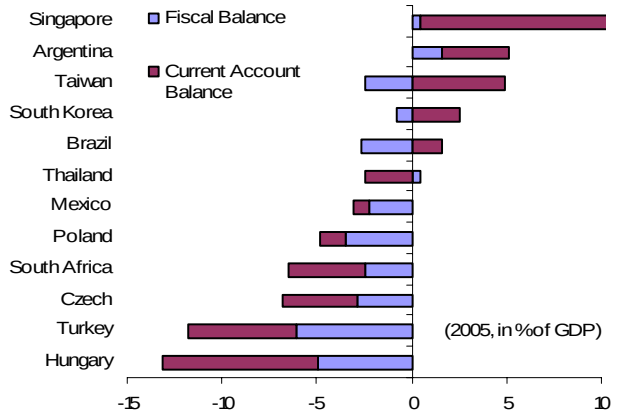
EMFX Volatility in secular decline – Approaching G10 levels

The string of emerging market crises beginning with the Asian crisis in 1997 and followed by that in Russia and subsequently the devaluation in Brazil resulted in large real depreciations and spikes in volatility. These spikes also had a significant spillover effect on other currencies as investors tend to exit EM first and not discriminate between the various macros stories. As the currencies tended to overshoot their new equilibrium level, large real exchange rate depreciations were often followed by a gradual real appreciation as domestic demand recovered and the inflationary impact of the depreciation fed through the economy.

Emerging Asian currencies fell by some 23% in the wake of the Asian crisis in late 1997. They then recovered half their values by early 2000 as nominal exchange rate overshooting was reversed and inflation rates picked up but remained essentially flat after that in real effective terms, remaining some 13% below their pre-crisis levels. China's real effective exchange rate, of course, given the peg to the dollar has closely followed movements in the dollar against the major currencies, appreciating by some 13% between 1999-2001, then following the dollar down beginning in early 2002 to fall by some 16% by end-2004.

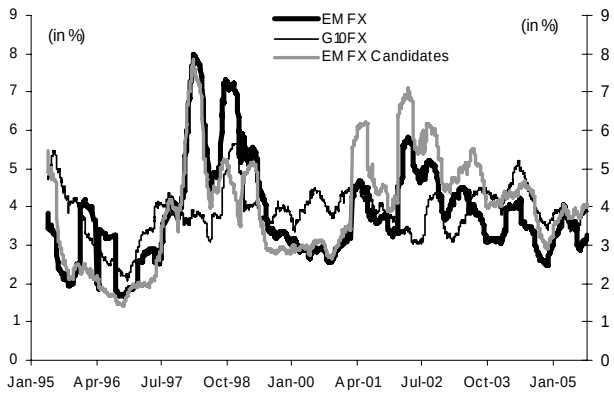
In LatAm, the Mexican peso appreciated steadily in effective terms following the 1994/95 crisis, also following the dollar's trend, peaking along with it in early 2002 and then following the dollar down until mid-2004 (exhibiting a higher sensitivity to the USD than China). In a significant, albeit still modest in real effective terms, break, the peso then decoupled, appreciating in real effective terms even as the dollar depreciated in the second half of last year. The peso has held relatively steady since. The other Latin American currencies were signify

Deficits in Hungary and Turkey Stand out



Source: DB Global Markets Research.

Average Historical Volatility - Looking more and more like G10 currencies?



80-day Historical Volatilities
Source: Bloomberg, DB Global Markets Research.

cantly more volatile, buffeted by a larger number of crises and spillovers from them but have also appreciated significantly.

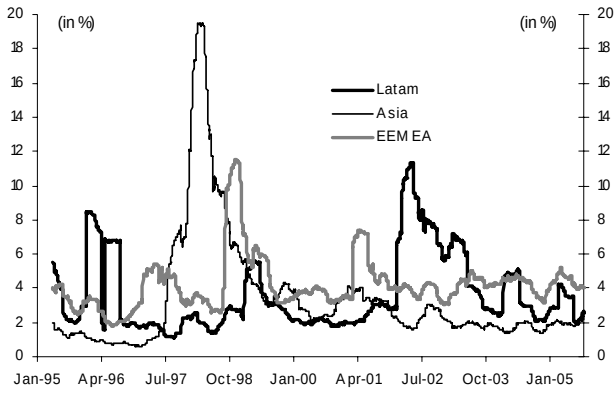
In emerging Europe, outside Russia currencies appreciated steadily in real effective terms reflecting relatively steady convergence, as has the ruble since the 1998 crisis.

Past peaks in EMFX volatility may not be repeated in the future, but may be too low at the moment. With many of the non-Japan Asia EMFX currencies largely freely floating the scope for more volatility spikes seems far more contained today. Non-Japan Asia's historical volatility remains fairly low compared to the other EM regions, but this reflects the either explicit or implicit membership of the USD bloc. As previously mentioned, if anything, the pressure tends to be for appreciation, which can be far more easily controlled than for depreciation.

In Latin America, having last seen spikes in volatility in the context of Argentina devaluation/default and Brazil's politically-induced turmoil in 2002, the region seems to have shifted solidly in a new lower volatility regime. Again this fairly low volatility regime may not be sustained, but it is unlikely to peak as in the past.

Turning finally to EEMEA, EU/EMU convergence has provided an important anchor to many of the central and eastern European currencies and despite significant real appreciation over the last few years, there is little scope for abrupt FX volatility with the exception of the USD/HUF. Regarding Hungary's external and fiscal accounts we have on a number of occasions warned that the country faces an adjustment need regarding both its twin deficits in the years ahead and we cannot exclude that if the government fails to adopt prudent reforms in time an abrupt change in FX rate is indeed possible. Moreover, ERM2/EMU entry is unlikely until Hungary's imbalances have been sufficiently addressed.

Average Historical Volatility - Regional Differences Are Clear in EM



80-day Historical Volatilities Annualized

Source: Reuters, DB Global Markets Research.

Meanwhile, USD/ZAR has continued to trade as a 'turbo-charged' EUR/USD and seems broadly fairly valued from a fundamental point of view. The USD/TRY, on the other hand, has seen a rapid expansion of its current account deficit, partly due to high oil prices, and from a REER perspective the USD/TRY is now at historically rich levels. That said, the capital account in the form of FDI on the back of privatizations and asset sales to foreigners, plus high unexplained errors and omissions, have provided ample support against a backdrop of ongoing discussions of the start of EU accession negotiations. From an EM wide perspective, Turkey has the highest gross external financing requirement (50% higher than Brazil, even though it is less than half its size in GDP terms). Looking ahead, the current favourable dynamic could rapidly reverse if EU progress disappoints, privatizations get held up in court, and/or the IMF anchor is allowed to wane. Hence, the TRY would remain vulnerable to do-

mestic shocks as well as a change in the external environment given its still significant gross external financing requirements.

Outlook and What about Carry – Is past performance indicative for the future?
A separate development, which we have not touched upon has been the rapid improvement of liquidity in EMFX (and local markets). This development has increased the number of currencies we can include in a global carry investment strategy. Over time we would expect the choices of EM currencies to continue to increase, which should help with overall diversification.

With fairly low volatility, the huge opportunities that were observed in the past in the aftermath of currency crises, are for better or for worse, less likely to present themselves in the future. With the exception of the ARS our fundamental EMFX valuation models show fairly limited under/over valuations, which means future performance will be increasingly driven by carry rather than spot.

EM F2X Model Valuation Conclusions (as of Sept' 05)

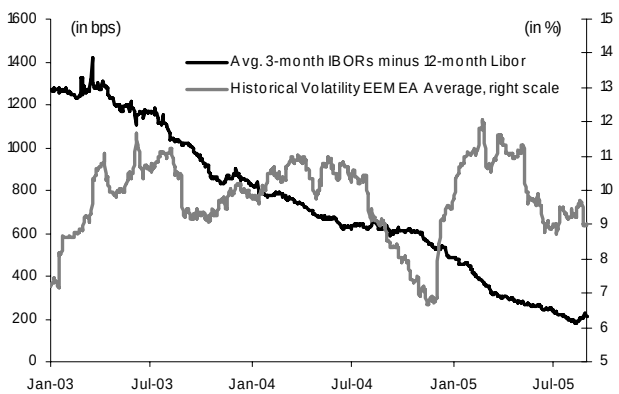
Currency	Spot	Short-Term Misalignment	Long-Term Misalignment
Argentine peso	2.90	-2.3%	-17.0%
Brazilian real	2.25	4.6%	-5.8%
Chilean peso	539	-0.2%	3.3%
Colombian peso	2292	4.7%	2.9%
Mexican peso	10.88	3.2%	2.3%
Peruvian new sol	3.32	-1.0%	-6.8%
South African rand	6.42	0.0%	0.1%
Turkish lira	1.34	13.0%	15.3%

80-day Historical Volatilities Annualized

Source: Reuters, DB Global Markets Research.

As the below chart shows, carry in EEMEA FX has substantially eroded, although historical volatility is bounded below by G10FX volatility. Hence, local market developments, and onshore interest rates, are likely to be more and more critical in return performance than outright FX exposure (i.e. forward positions rather than spot). With overall inflation performance under control we also believe that carry, although from a higher base, will be eroding in LatAm FX. Hence, past performance of high EMFX carry trade may not necessarily be indicative of future performance, but lower volatility and diversification still make EMFX attractive additions to any global FX portfolio.

EEMEA FX: Eroding Carry, eroding safety cushion?



Source: DB Global Markets Research.

The above line of reasoning provides three main conclusions:

- With most tradable EM currencies now freely floating (albeit being it of a dirty form in some cases) the scope for further event risk has been much reduced. There are no obvious general signs of overvaluation, if anything the risks in some (non-Japan Asia) currencies are skewed towards revaluation. Of course some specific currencies do still bear careful watching.

- Historical volatility has fallen down to, and sometimes below, G10 FX volatility. This is partly a reflection of a policy decision of some emerging markets to continue to intervene in FX markets rather than letting their currencies appreciate. Clearly, macro fundamentals in EM, while better, are clearly not at G10 levels, and hence would there be a change in FX policy, volatilities across EM is set to increase, but not to the levels we have seen in the past.

- External and domestic fundamentals are much better today in EM than in the 90s. In general, tighter fiscal policies, combined with a favourable external environment and commodity price picture, have allowed for a rapid improvement in the capability of emerging markets to withstand temporary domestic or external shocks. Of course, those EM that are facing large gross external financing requirements or are excessively reliant on commodity prices, i.e. oil, may still be vulnerable if either of the supportive factors change. Nevertheless, EMFX has matured as an asset class, but this does not take away from the fact that careful individual country analysis may still be required. In particular it is worth highlighting the risks for countries facing vulnerable external fundamentals such as Hungary and Turkey.

Currency Manager Indices

The FXSelect Platform: Accessing Currency Alpha Through Managers

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- Currency managers provide an efficient and flexible way to access currency market alpha
- The FXSelect platform allows the creation of investable indices that track the performance of a completely customisable portfolio of currency managers
- FXSelect provides a cost-effective, transparent and liquid solution to the challenges associated with investing in multiple currency managers.

Enviable diversification and returns

Earlier on in this guide Deutsche Bank Global Markets Research suggests that currency can be viewed as an asset class with returns superior or comparable to the fixed income and equity markets. Furthermore, given the low correlation that currency returns show with these asset classes, currencies should represent a similar proportion of a balanced portfolio. Given that, until recently, there has been no widely accepted investable benchmark for the currency markets such as the MSCI for the equity markets, investments in the currency markets have tended to be overlooked by the investor community.

Investing in multiple, multi-style currency managers (such as hedge funds) is a convenient solution to the problem of integrating currency into the portfolio mix. The only view an investor has to have is that currency managers can offer consistent and positive excess returns over a medium-term timeframe.

At Deutsche Bank we endorse the idea of diversification through investing in multiple managers, as we have seen its success in our own investment programmes when allocating capital to internal proprietary traders and external currency managers (such as hedge funds, asset managers and CTAs).

The low correlation among currency managers suggests that in order to more fully exploit the diversification and return potential of a currency manager investment, choosing a number of managers smoothes the path of the profits that accrue from active risk taking.

Applying the multi-manager concept

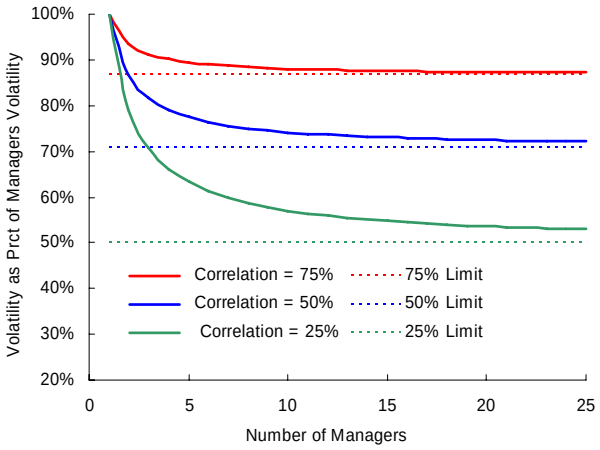
Deutsche Bank has conducted considerable research into using multiple managers and how best to capture the returns from allocating to uncorrelated and successful currency management specialists. The challenge is to find a set of uncorrelated managers (rather than just finding the most successful) in any one period. Naturally if one knew with perfect foresight the best performing manager – then it would always be optimal to allocate to just one manager. This is, of course, an unreasonable expectation and thus we need to assess how many managers can be added to a programme before their incremental value diminishes to nil.

Making some conservative and practical assumptions we have concluded that between 8 and 16 managers is the optimal number to include in a multi-manager programme.

In quantifying the correlation benefit of incrementally adding managers we make the following assumptions:

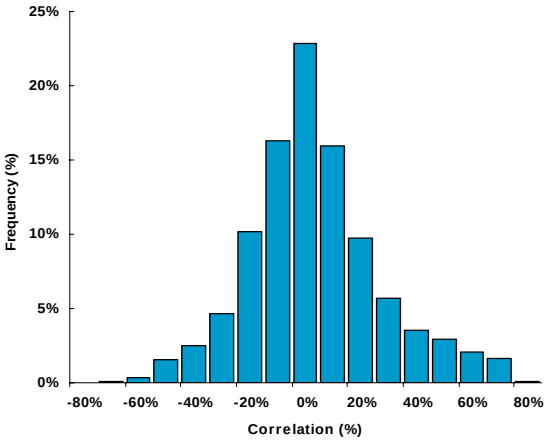
- All managers have the same volatility
- Correlation between the managers are the same
- It is costless to add new managers
- Each manager receives the same allocation.

Theoretical Benefits From Diversification



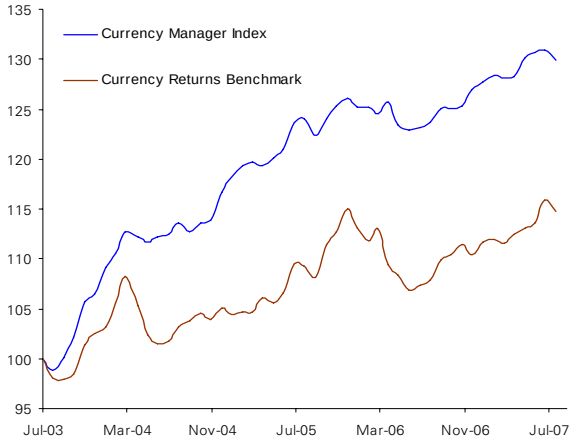
Source: Deutsche Bank

Manager Correlations



Source: Deutsche Bank. Correlations of managers are generated from 22-months of daily data sampled weekly ending July 2007

Manager Performance



Source: Deutsche Bank. Manager performance ending July 2007

In brief, the findings are:

- As more managers are added, the volatility of a portfolio of multiple managers is reduced
- The marginal benefit diminishes with the number of managers
- With 8-10 managers, we can achieve 85% of the potential diversification benefit, while 25 managers results in approximately 95%.

FXSelect – Overcoming the challenges of implementation

However compelling these arguments are, the practical challenges of establishing a roster of active currency managers have, in many instances, deterred investors from more aggressively pursuing opportunities in this asset class. The identification of a currency manager universe, the negotiation of legal agreements, and the eventual modifications to internal risk monitoring systems all consume significant resources. Given the resource requirements to establish a currency manager programme, many investors have simply decided the exercise would be uneconomical or, in other instances, have lowered the priority of the project and have yet to fully implement such a programme.

In March 2005, drawing on seven years of experience investing in the currency manager space, Deutsche Bank launched FXSelect: an open platform that hugely simplifies the investment process in currency managers. Simply put, clients invest in a bespoke index which reflects the returns of a customisable group of managers selected from an expanding universe of over 60 managers. This allows the currency managers to focus on their area of skill (generation of excess returns) while leveraging Deutsche Bank's infrastructure and product structuring capabilities to create the desired delivery vehicle for the end investor to gain exposure.

Any currency manager can submit themselves for registration, but they must satisfy strict, pre-defined requirements and objective criteria before being considered. An independent, external "registrar", manages the self-registration process and verifies that each manager meets the following criteria:

- Managers must be able to provide a daily track record for at least the last 18 months verified by a third party
- They cannot have had more than a 20% draw-down (from peak-to-trough) over the last 12 months
- Their respective assets under management must be at least 15 million USD
- Satisfactory criminal and regulatory searches on key individuals.

The FXSelect universe is continuously evolving. Not only may new funds be admitted, but existing universe members may also be de-selected should they ever fall short of the defined requirements. Adherence to the minimum criteria is verified by the registrar on an ongoing basis via a continuing schedule of monitoring and reporting.

This fund registration process leads to the creation of a unique, investable pool of experienced and "up-and-coming" currency managers with diverse trading styles. It is from this universe that the customised FXSelect indices are constructed and calculated using as many or as few funds as the investor requires.

Delivering currency returns in a traditional way

Whilst the last few years have seen a dramatic growth in investments in hedge funds, these investments have often been the subject of some criticism. Investments made through the FXSelect platform allow investors to counter the majority of these objections as it provides:

- Daily liquidity: investors can withdraw funds daily, avoiding the monthly or quarterly redemption windows typically offered by hedge funds.

- Guaranteed loss limits: Investors can specify the maximum they would be willing to lose on their investment. Deutsche Bank will ensure the investor does not lose more than this amount.
- Total transparency and extensive, live reporting: investors can monitor aggregate exposures on demand.
- Minimal credit risk: multiple manager investment is achieved through a single contract with Deutsche Bank. There is no credit exposure to the underlying currency managers.
-

Whilst there are some aspects of the programme that could be emulated through a "home-grown" solution (obviously at considerable cost), the daily liquidity, credit/embezzlement risk mitigation and ability to guarantee a maximum loss on the investment to the nearest dollar provided by FXSelect demonstrate a unique value proposition unavailable to most investors through conventional means.

Getting started

Once you have decided to invest, you can begin choosing which managers to use. With over 70 available on the platform, you have a wide universe of investment strategies from which to build your manager roster. You can choose as many or as few of the available managers as you want.

Then, once you have decided on your managers, FXSelect will create a customised index to which your investment will be linked. There are a number of approaches that you and/or your consultant can apply when going through this process:

Discretionary Management Selection – provides complete customisation.
Not only can you select any number of managers (from more than 70 currently available) and choose individual weightings, the selection can be altered on a daily basis if desired. Furthermore, these managers can be entered or exited anonymously.

Actively managed, third-party manager selection - use one of a number of pre-existing indices available through the platform, with managers hand-picked by a consultant or fund-of-fund. Manager exposure is constantly monitored and modified according to instructions from the index manager.

Once the managers and their weightings have been selected, an index is created which reflects their returns and by extension, your performance on a daily basis. This index will look similar to any bond or equity index with which you may be familiar and can thus be wrapped into a standard structured product format.

Popular investment structures

FXSelect offers a number of different ways for an investor to take exposure to its chosen index. We understand that permitted investments can vary from fund to fund, and as a result, we offer a range of investment options from which a particular investor can choose the structure best suited to its objectives and legal requirements. FXSelect is available in both funded and unfunded formats (meaning that Deutsche Bank can provide full currency manager exposure with minimal capital from the investor), and two structures, in particular, have proven the most popular: Principal Protected Notes and Total Return Swaps.

Principal Protected Notes – these notes guarantee the return of principal at maturity. Provided you do not reach a pre-defined maximum loss limit, you receive the full nominal amount, interest and the returns of the index. This structure is an elegant and straightforward way to take your exposure.

Total Return Swaps – through a swap, we are able to tailor your exposure to meet your particular liquidity and funding requirements. Our most popular swap structure gives you exposure to FXSelect without requiring that you re-allocate a part of your existing portfolio. This

means that your investment can operate as an overlay and you do not miss out on the returns generated in other asset classes. In this structure, the investor buys a swap which observes the index level on a regular, predefined basis (i.e. quarterly) and is then bound to settle the difference based on an FXSelect Index's movements and the size of the nominal amount. If the index has risen over the period, the swap pays the investor and, vice versa, if the index is down, the investor pays into the swap. To manage risk, you can agree a maximum loss level at the outset of the investment, which, if touched, will trigger the automatic unwind of the swap, at a guaranteed price.

Furthermore, Deutsche Bank can offer other structures in multiple currencies, including fund vehicles, certificates, and warrants.

Currency Indices in a Portfolio Context

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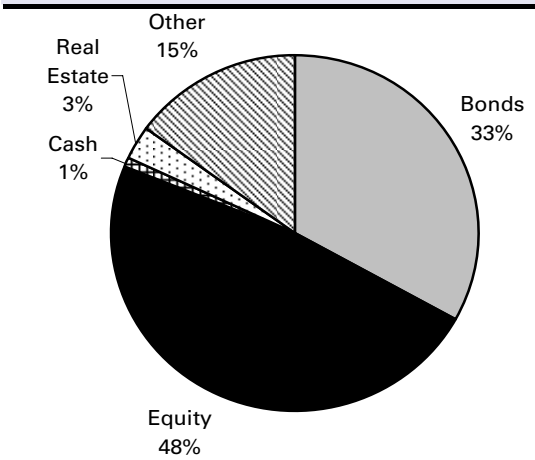
One of the most potentially rewarding routes to achieve higher returns with lower volatility in any portfolio is to include more assets that can offer higher returns and diversification[62]. It therefore comes as no surprise that investments, other than bonds and equities, have proven to be an area of great focus by investors on recent years. To take pension funds as an example, their asset distribution suggest an allocation of 33% to bonds, 48% to equities and 15% to "Other", which may include commodities, private equity and hedge funds (see Figure 1).

However, the biggest pitfall of many investments outside of bonds and equities is their lack of liquidity, which makes larger allocations prohibitive. In that context, foreign exchange stands out. It has the greatest liquidity of all markets (including bonds and equities), a track record of positive excess returns and offers true diversification to bonds and equities (see Figure 2, which shows returns based on FX rules defined later in this piece). Indeed, our work suggests that when foreign exchange is viewed as a separate unconstrained source of total returns, rather than as a constrained secondary risk to manage (that is, as a by-product of being long a certain equity or bond benchmark), foreign exchange should take a share in global portfolios possibly comparable to those of bonds and equities.

What's more, the recent low levels of currency returns relative to past performance suggests that now may be a good time to enter FX markets in particular. Our currency benchmark indicates that FX returns have tended to be cyclical in nature, with several years of positive returns, followed by one or two years of negative or flat returns (see figure 2). The last few years' underperformance may therefore mean that returns are more likely to recover going forward.

Figure 1: Asset Allocation of Pension Funds[63]

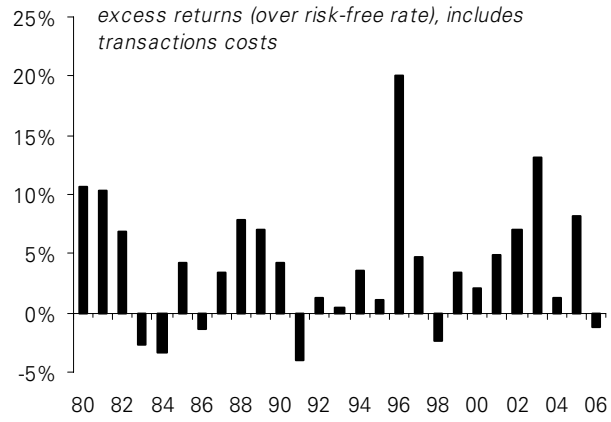


Source: DB Global Markets Research

[62] Intuitively, the more asset classes we have in the mix, the larger choice set, the better the possible outcomes. What is more interesting is that even very naïve asset allocation strategies may provide much better outcomes when the asset class choice set is bigger as compared to sophisticated asset allocation strategies in a smaller choice set due to diversification benefits alone. If the added asset classes have a higher Sharpe ratio, then the choice set is considerably better

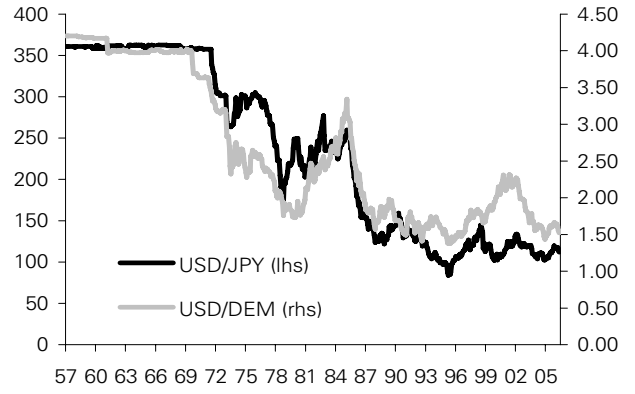
[63] Estimate for 2003, IMF, "Global Financial Stability Report", September 2005. Shares are market-weighted mean shares of Germany, France, Japan, UK and US. Bonds and equities include domestic and foreign. Other includes commercial loans and credits; financial derivatives; short-term investments; investment in hedge funds; private equity and commodities; and miscellaneous assets.

Figure 2: Nominal "Benchmark" Returns for FX Markets Over Past Twenty Years



Source: DB Global Markets Research

Figure 3: FX Markets - Greater Liberalisation Since 1970s



Source: DB Global Markets Research

Time Is Ripe to Ascertain Whether FX is a Long-term Source of Return

The purpose of this paper is to determine whether FX markets can provide systematic positive total returns over the long run, in much the same way as equity and bond markets do, and then to see how it would fit into an investment portfolio of bonds and equities. We look to assess FX returns in an unconstrained form, rather than the possible returns based on managing currency exposures inherited from being long an international bond or equity benchmark (ie currency overlay). Therefore, we are attempting to view currency as an asset class insofar as it is a source of liquid systematic positive returns over time with low correlation with existing asset classes.

Why now? There are two reasons for now viewing FX as a source of long-term systematic returns. First, with the end of the fixed-exchange rate arrangement of Bretton Woods in 1973, and the more widespread adoption of capital-account convertibility for developed world currencies in the late 1970s/early 1980s, we now have at least twenty years of free-floating currencies (see Figure 3). This time period covers major dollar uptrends and downtrends, strong recovery phases and recessions, and numerous idiosyncratic events. Therefore it should be sufficient to determine whether there are sources of consistent FX returns. Second, evidence of the positive FX returns can be supported by the increasingly long and diverse sets of track records of actual returns delivered by FX-only investment managers[64] . In the past, the available track records used to discern whether active FX management could lead to superior performance often had to be gleaned from international bond manager performances, who made active decisions not only in FX, but also on curve, duration and spread.

Alpha, Beta and Benchmarks

Before going on, it is worth clarifying the types of returns we will be focusing on. The investment community tends to focus on the alpha and beta of investment approaches. Alpha is the excess return, adjusted for risk, that an active manager adds relative to the given market return. Beta is the risk and return produced by the market index. Typically, beta is represented by a benchmark index for the given market (for example, the S&P500 for US equities). The total return of an active manager could therefore be split into alpha and beta.

In this paper, we primarily focus on establishing what the beta or benchmark returns are for FX markets. We believe that this approach is best suited to determining the long-run systematic return potential of FX markets. The alternative would be to focus on the various in-

[64] These include the Parker FX Index, Stark Currency Trader Index, Barclays Currency Traders Index, Deustche Bank FXSelect Indices, and Russell/Mellon

dices that aggregate the performance of FX-only managers (see footnote 3). While this does reflect actual performance of FX managers, it is fraught with the problems typically associated with manager composites or peer-group analysis. These would include survivorship bias, selection bias of managers, and lack of representation of strategy types. The latter is particularly pertinent for FX indices, at least for their early history, where the managers have tended to be biased towards futures-based traders, who have tended towards technicals-based investment styles. More fundamentally, investment managers typically base their asset allocation decision on the benchmarks of various markets (such as the MSCI indices or JPMorgan Government Bond Index), rather than manager composite indices. So ideally a comparable approach should be taken for FX.

Unfortunately, there is no widely followed benchmark for FX returns in the same vein as those in equity and bond markets. However, it will likely only be a matter of time before one does get established given the duration of the current free-float period. In this paper, we will construct a plausible FX benchmark, which is comparable to those seen in other markets, and from that, establish how FX could fit into the asset allocation decision.

Benchmarks Not as Passive or Neutral As Many Think

There are many objectives of a market benchmark, which include being a fair representation of the market and its returns, being investable and being transparent. There is also a common perception that the construction of a benchmark is neutral and just reflects market returns. In reality, benchmarks are a set of investment or trading strategies and rules that are believed to best capture the inherent returns of the market in a transparent and liquid form. Taking the example of the S&P500, a benchmark for the performance of US stocks, the current rules for including or excluding US companies are broadly as follows[65]:

1) Market capitalisation-weighted
2) Market cap in excess of US$4 billion
3) Four consecutive quarters of positive as-reported earnings
4) Ratio of annual dollar value traded to market capitalisation should be 0.3 or greater
5) Public float of 50% or more
6) Maintain a balance for the S&P500 in line with sector balance of eligible companies

Most of these could be viewed as a trading rule. Market capitalisation-weighting assumes a momentum strategy, as top-performing stocks take an ever increasing share of the index. An equal-weighting on the other hand would have been a contrarian strategy as the top-performers would have to be sold in order to maintain an equal weighting. The "minimum market capitalisation" rule and "ratio of traded dollar to cap" rule could be both viewed as liquidity rules, but could also be viewed as trading rules. For example, it may be the case that the most actively traded stocks are the best performers, and adjusting the ratio could therefore lead to different returns for the markets. Finally, earnings criteria could clearly be viewed as using "fundamentals" to pick companies to include in the index (and hence go long). Interestingly, using additional rules or criteria such as earnings per share growth, dividend yields or book value to price ratios appear not to systematically outperform the benchmark index. This is evidenced by the broadly similar returns that "growth", "value" and "benchmark" indices deliver, even though the first two use those criteria. It seems that the very basic set of rules used to define a benchmark are difficult to improve on over the long run.

The "basic" rules still do result in fairly regular changes in the composition of the S&P500. For example, in 2005, the rules resulted in 20 additions of companies to the index and 20 deletions. Other equity indices such as the MSCI, which we use in this paper (as our global benchmark) share similar traits in terms of its construction (though the MSCI does not use an earnings criteria as a primary filter). The main point of delving deeper into the construction of benchmark indices is to indicate how they are investment or trading rules, and they

[65] www.indices.standardandpoors.com

do result in changes in the composition of the index over the course of a given time period. However, once broadly followed or agreed upon, they are then used as the benchmark to which performance in that market can be compared against.

Creating a "Neutral" FX Benchmark

By the very nature of exchange rates, it is not possible to perfectly mimic the rules used to create an equity index. The fundamental issue is that unlike equities and bonds, where one can be outright long an equity or bond, in FX markets by definition by being long one currency one has be to short another currency. Otherwise there would be no exchange rate risk. This poses many problems when constructing an index or benchmark, not least of how one would know whether to simply buy and hold EUR/USD (ie long euro/short dollar) over time or USD/EUR (ie long dollar/short euro). Also, what would the market-capitalisation of EUR/USD be at any point in time? Would it be the value of all current EUR/USD open positions (if that could be measured)? Or would it be the net EUR/USD position? And so on. Therefore, like with equity (and bond) indices, a set of broadly agreed upon (and replicable) rules need to be used to determine the market return. The four that we believe could do the job would be to position in currencies such that the first following characteristic is met in addition to either of the second to fourth ones:

1) Developed world currencies[66] - to meet *liquidity requirements*
2) Positive net yield (or carry) – *similar to bond indices*
3) Positive momentum – *similar to market cap-weighting and minimum capitalisation rules*
4) Undervalued – *similar to incorporating a "fundamental" metric such as earnings or revenue often used in equity indices.*

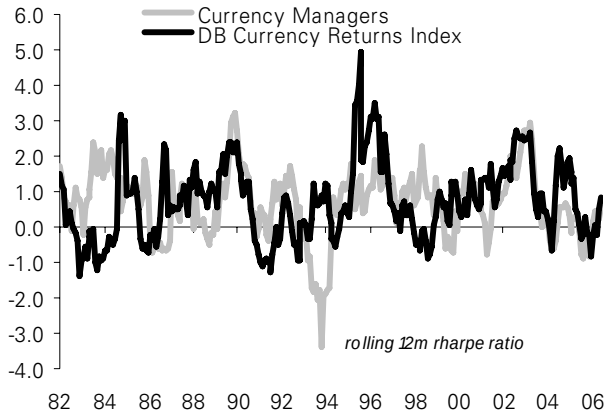
These are the three most widely used FX investment styles (carry, momentum and valuation). All three form the core of any FX-only fund's investment approach, and are supported by decades of academic work.

For the positive net yield or carry style, we simply buy the three highest yielding currencies and sell the three lowest yielding currencies based on short-term yields. This strategy exploits the widely documented forward-rate bias that exists in FX markets[67].

For momentum, we use a ranking rule based on annual spot returns, where one buys the three currencies with the highest return against the USD over the last twelve months, and sells the three currencies with the lowest returns[68]. Finally, for valuation we use Purchasing Power Parity[69], the most basic valuation metric for currencies, which, as a concept, has been around for over one hundred years. The trading rule we employ is to systematically buy the three most under-valued currencies and sell the three most over-valued currencies. In this way, though one may arrive at lower returns, one gets around the issue of picking over- and under-valuation extremes such as +/-20%, which could run the risk of ex-post optimisation[70].

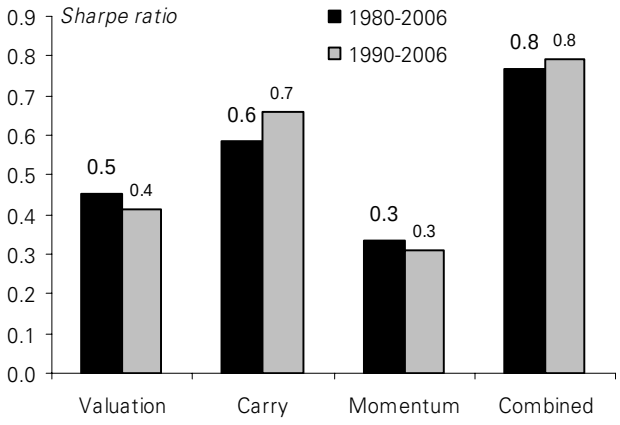
[66] US dollar (USD), euro (EUR), Japanese yen (JPY), British pound (GBP), Swiss franc (CHF), Norwegian krone (NOK), Swedish krona (SEK), Australian dollar (AUD), New Zealand dollar (NZD) and Canadian dollar (CAD). Ten in total.
[67] See Bansal, R "An Exploration of the forward-premium puzzle in currency markets" (1997)
[68] See Okunev, and White "Do momentum-based strategies still work in foreign exchange rate markets" (2003)
[69] See Taylor and Taylor "The Purchasing Power Parity Debate" (2004)
[70] We use the OECD values for GDP PPP

Figure 4: Our Synthetic FX Benchmark Moves Broadly in Line With Actual Performance of Funds



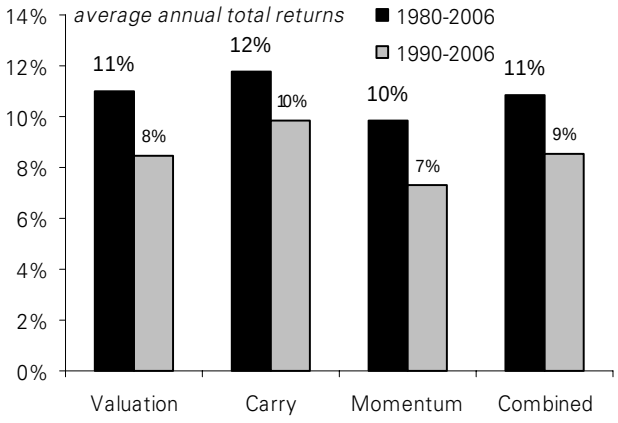
Source: DB Global Markets Research, Parker Global Strategies, LLC

Figure 6: Risk-Adjusted Returns of Generic FX Strategies



Source: DB Global Markets Research

Figure 5: Annual Returns of Generic FX Strategies



Source: DB Global Markets Research

Of course, the choice of top three/bottom three could also be liable to over-fitting, though results are broadly the same whichever number of rankings is used. We create our benchmark by simply taking the average of the three strategies/rules. Importantly, the returns of our synthetic FX returns index are broadly similar to the actual performance of FX funds using currency manager indices (see Figure 4).

In terms of specific numbers, Figures 5-6 show the average annual returns of each strategy and the Sharp ratios. They show that FX carry tends to be the best FX strategy delivering annual returns of 12% since 1980

(including interest) and a Sharpe ratio of 0.60. Moreover, while the absolute returns are lower since the 1990s, the Sharpe ratio remains close-to-unchanged for all the strategies. Combining the strategies together by equally weighting them delivers annualised returns of 11% since 1980 (including transaction fees) with an impressive Sharpe of 0.8. The com

bined strategies provide our best benchmark for FX returns over that time period, which we name the Deutsche Bank Currency Returns Index (DBCR)[71].

Comparing to Equities and Bonds

Comparing these returns to bonds and equities, we use global benchmarks for both[72] and find that our FX benchmark turns out to be the top performing asset class in terms of risk-adjusted returns, and absolute returns over the entire sample (see Figures 7-8). Moreover, even if we use the worst FX strategy or rule (momentum), we still find that FX returns are comparable to those of bonds, and the risk-adjusted returns are comparable to those of equities. Another notable feature of either the FX combined or worst FX strategies are the relative stability of risk-adjusted returns. Both equities and bonds saw sharp gyrations in their risk-adjusted returns when comparing returns from 1980 onwards and 1990 onwards.

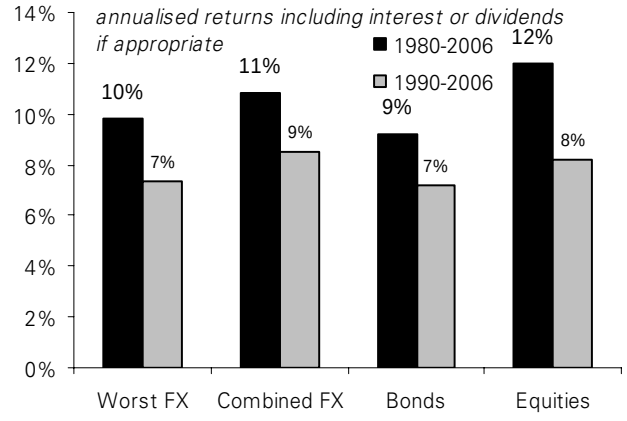
In the asset allocation process, returns are not the only criteria; correlation between asset classes is also an important consideration. On that front, we find that since 1980, equities and bonds have had a 26% correlation in monthly returns. In contrast to this, the correlations of any of the individual FX strategies or the combined one to bonds and equities range from -25% to +7% (see Figure 9). In all cases, they are smaller than those between equities and bonds. FX has a tendency to be negatively correlated with bonds and marginally positively correlated to equities.

Another way of appreciating whether FX is a separate asset class apart from correlation (which could be spurious), would be to test whether it delivers "alpha" relative to either the "betas" of bond or equity markets. We can run a regression on the monthly performance of FX on either bonds or equities to determine this. We find that FX has a clearly significant "alpha" when compared to bonds and equities, a significant "beta" to bonds and an insignificant "beta" to equities (see Figure 10 on next page). The upshot of this analysis is that FX is clearly a separate distinct source of returns. Using these findings, FX appears to offer most value to global portfolio managers in terms of both returns and diversification, and on this basis alone should likely have a fairly large weight in any portfolio.

How Much to Add to a Global Portfolio

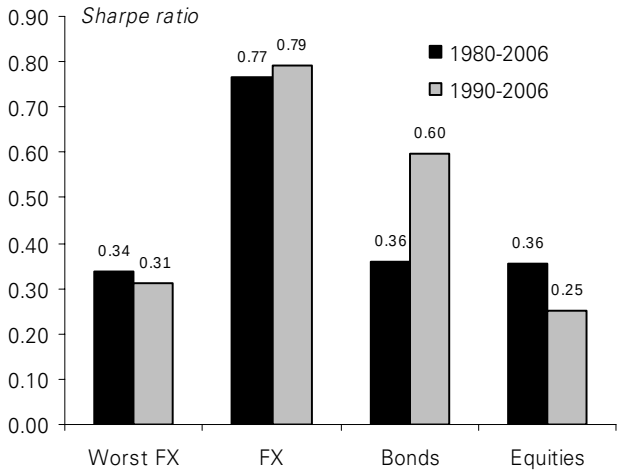
Deciding what proportion of risk should be allocated to a given asset class is not a precise science. The choice of sample period for back-testing, optimisation method, and investor

Figure 7: FX Compares Well on a Total Return Basis…



Source: DB Global Markets Research, worst FX is momentum

Figure 8: …and on a Risk-Adjusted Basis



Source: DB Global Markets Research

[71] For more details, see "Benchmarking Currencies: The Deutsche Bank Currency Returns Index", March 2007

[72] For bonds, we use the Lehmans World Composite Bond Index back to 1980. For Equities, we use the MSCI World Index. All indices are FX hedged and assume a USD base.

risk appetite can all impact the eventual proportions. As a generalisation, it appears that while adding FX to a portfolio of bonds and equities can increase the average annual returns, the biggest benefit appears to be in reducing volatility of returns and periods of drawdowns. In Figure 11, we show various possible allocations of FX to a portfolio of equally weighted bonds and equities. We find that an allocation of say 30% to an equally weighted portfolio of bonds and equities would result in the Sharpe ratio moving up from 0.43 to 0.62, the worst peak-to-trough loss (or drawdown) falling from -18% to -9%, and the longest time needed to return to a previous peak (in returns) would fall to just over 2 years from 3.7 years. Even using the worst strategy or criteria would see significant improvements in the stability and confidence in achieving long-term returns. Therefore, the low correlation of FX is clearly adding diversification.

This is further confirmed by using a Markowitz approach[73] backtested over 1980-2005. The efficient frontiers represent the combination of weights of each asset that would lead to an optimal risk-return ratio for a given level of volatility. Graphically, the frontiers indicate that adding FX to a core portfolio of bonds, equities and cash clearly improves the returns for any given level of volatility (see Figure 12). Even using the worst FX strategy (momentum) pushes the frontier out. Using this strategy and delving deeper into specific weights to allocate to each asset class, it appears that at least using the 1980-2005 period, FX appears to eat into the weight allocated to equities. In general, it appears that the weight allocated to FX should be greater than that of equities (see Figure 13). The results would no doubt be starker if the better performing combined FX strategies were used. On balance it would appear that FX should feature fairly prominently in any global portfolio with allocations in the order of 20% or above, rather than say 5%. Thus, FX should be viewed more like a "traditional" asset class, rather than an "alternative" asset class.

Figure 9: Correlation of FX Strategies Low Compared to Equities and Bonds

	Bond	Equity	DBCR	Carry	Mom.	Valuat.
Bond	100%	26%	**-21%**	**-16%**	**3%**	**-25%**
Equity		100%	**5%**	**4%**	**-2%**	**7%**
DBCR			100%	74%	38%	66%
Carry				100%	-6%	40%
Momentum					100%	-25%
Valuation						100%

Source: DB Global Markets Research

Figure 10: Does FX Deliver True Independent Returns from Bond and Equities?

If $y = \alpha + \beta x$ + error, is α significant? (1980- 2006)

Dependent	Alpha *t-stat*	Beta *t-stat*	Independent (x)
FX	**0.37%** 4.46	**-0.17** -3.89	Bonds
FX	**0.33%** 3.88	0.02 0.94	Equities
Equities	0.32% 1.43	**0.56** 4.75	Bonds

bold = signficant at 5% level

Source: DB Global Markets Research, Combined FX returns used

[73] Other methods include the Black-Litterman, statistical shrinkage bootstrap and factor loading approaches.

Figure 11: Adding FX to a Portfolio of Bonds and Equities Helps Manage Risk

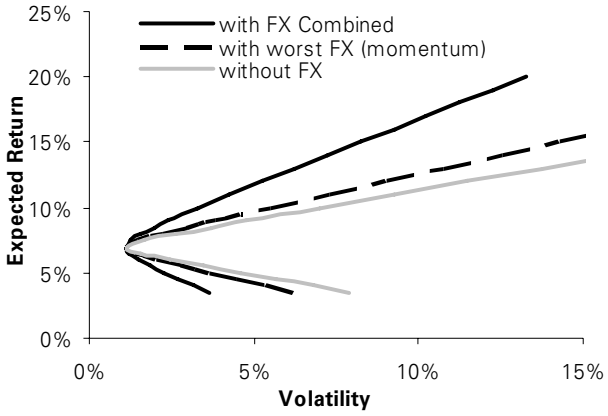
Allocation to FX*	0%	5%	10%	20%	30%	40%
Using FX Combined						
			Annualised Returns			
Entire sample	10.6%	10.6%	10.6%	10.7%	10.7%	10.7%
Best 5-year period	23%	23%	22%	21%	19%	18%
Worst 5-year period	1%	2%	2%	2%	3%	4%
Sharpe ratio	0.43	0.46	0.49	0.55	0.62	0.70
Max drawdown	-18%	-17%	-15%	-12%	-9%	-6%
Duration of max underperformance**	3.7	3.5	3.5	2.7	2.6	1.3
Using FX Momentum						
			Annualised Returns			
Entire sample	10.6%	10.6%	10.5%	10.5%	10.4%	10.3%
Best 5-year period	23%	23%	22%	21%	20%	19%
Worst 5-year period	1%	1%	2%	2%	3%	4%
Sharpe ratio	0.43	0.45	0.47	0.51	0.54	0.56
Max drawdown	-18%	-16%	-15%	-12%	-9%	-6%
Duration of max underperformance**	3.7	3.5	3.1	3.0	2.7	2.3

** Assuming equal split in bonds and equities*

*** Number of years before previous peak is reached*

Source: DB Global Markets Research

Figure 12: Efficient Frontiers (1980-2006)



Source: DB Global Markets Research

Figure 13: Asset Allocation for Given Return Using Worst FX Strategy (1980-2006)

Portfolio		Momentu	Bonds	Equities	Cash
Return	Stdev				
7.0%	1.1%	0%	1%	1%	98%
7.5%	1.5%	7%	7%	4%	82%
8.0%	2.2%	13%	14%	7%	66%
8.5%	3.0%	19%	21%	10%	51%
9.0%	3.8%	25%	28%	12%	35%
10.0%	5.5%	37%	41%	18%	3%
15.0%	14.3%	99%	109%	47%	-154%
20.0%	23.2%	160%	177%	75%	-312%

Source: DB Global Markets Research

Bottom Line

There do appear to be long-term systematic returns in the FX markets. Moreover, the correlation of these returns is very low when compared to those of equity and bond markets. Consequently, the addition of FX to a portfolio of bonds and equities could significantly enhance the quality of returns by reducing the volatility of returns and duration and magnitude of significant phases of underperformance. The size of the allocation should be comparable to those of bonds and equities (that is 20%+), rather than those of "alternative investments".

Appendix – Index Statistics & Construction Details

G10 Trade Weighted Indices

Weights

	USD	EUR	JPY	GBP	CHF	SEK	NOK	AUD	NZD	CAD	Constant Factor
USD TWI	-----	35.52%	19.18%	9.12%	2.79%	0.0%	0.0%	0.0%	0.0%	33.39%	32.92
Bloomberg : TWI USSP Index											
EUR TWI	38.74%	-----	16.94%	28.37%	9.33%	6.62%	0.0%	0.0%	0.0%	0.0%	44.65
Bloomberg: TWI EUSP Index											
JPY TWI	60.91%	25.89%	-----	6.33%	0.0%	0.0%	0.0%	3.67%	0.0%	3.20%	12518.6
Bloomberg: TWI JPSP Index											
GBP TWI	21.47%	66.59%	5.91%	-----	3.14%	2.89%	0.0%	0.0%	0.0%	0.0%	43.8
Bloomberg: TWI BPSP Index											
CHF TWI	15.04%	70.43%	5.15%	7.40%	-----	0.0%	0.0%	1.98%	0.0%	0.0%	120.8
Bloomberg: TWI SFSP Index											
SEK TWI	12.84%	62.06%	0.0%	12.76%	0.0%	-----	6.16%	0.0%	0.0%	6.18%	784.6
Bloomberg: TWI SESP											
NOK TWI	7.35%	47.34%	0.0%	13.67%	0.0%	22.49%	-----	0.0%	0.0%	9.15%	433.8
Bloomberg: TWI NKSP Index											
AUD TWI	22.43%	24.92%	33.36%	9.49%	0.0%	0.0%	0.0%	-----	9.80%	0.0%	35.4
Bloomberg: TWI ADSP Index											
NZD TWI	31.24%	26.37%	16.67%	6.96%	0.0%	0.0%	0.0%	18.76%	-----	0.0%	93.6
Bloomberg : TWI NDSP Index											
CAD TWI	81.50%	9.96%	5.64%	2.90%	0.0%	0.0%	0.0%	0.0%	0.0%	-----	123.2
Bloomberg: TWI CDSP Index											

Pricing and Fixing Source	Pricing: Bloomberg FXIN; Reuters FXINDEX. **Fixings:** www.iboxxfx.com
Calculation Time	4pm and 9pm London
Caluclation Agent	International Index Company (iboxx)
Rebalancing Period	Annually, based on central banks' trade weights with the five largest curencies by weight included
Rebalancing Date	By 24th December, becoming effective from 9am Sydney on the first trading day of the new year.
Tradeable Currencies	G10
Index Base Date	31 December 2001
Index Go-Live Date	4 December 2006
Products Available	delta-one, options, structured products

Geometric index construction:

$$IndexSpot_t^i = \kappa_s^i \times \prod_j^m \left(Spot_t^j\right)^{w(j)_s}$$

The current constant factors κ were set so that the indices started at 100 at inception date.

The new constant factors will be determined at the annual rebalancing so that the indices calculated with the new weights are equal to the last index values calculated in the current year.

κ_s^i .....constant factor set for index i at the last re-balancing s

$w(j)_s$ .....weight of currency j at the last re-balancing s

$IndexSpot_t^i$ .....level of index i at time t

EM Asia Policy Baskets (Nominal Effective Exchange Rate Indices - NEER's)

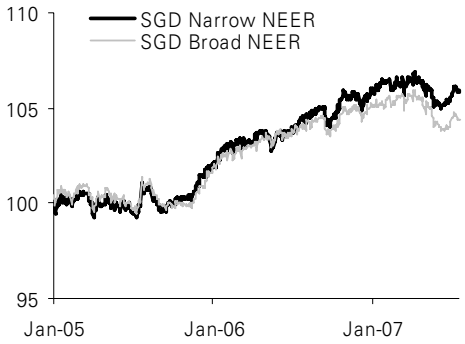
SGD Narrow Policy Basket

Weighted Constituents

USD	EUR	JPY	KRW	TWD	CNY	IDR	MYR
15.0%	15.0%	15.0%	5.0%	10.0%	15.0%	5.0%	20.0%

Broad SGD NEER also available

Pricing	Bloomberg FXIN; Reuters
Fixings	DBIQ website -
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Static
Rebalancing Date	-
Tradeable Currencies	SGD
Index Base Date	1 January 1999
Index Go-Live Date	Q4 2004
Bloomberg Ticker	TWI SDSP Index
Products Available	Delta-one, options, structured products

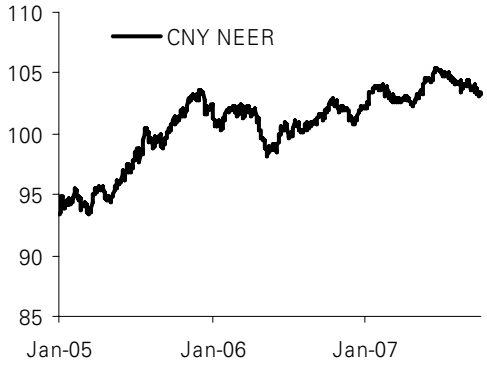


CNY Policy Basket

Weighted Constituents

USD	JPY	EUR	KRW
35.0%	27.0%	25.0%	13.0%

to be launched

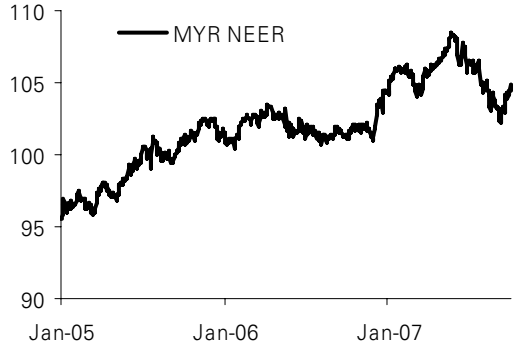


MYR Policy Basket

Weighted Constituents

USD	JPY	EUR	SGD	CNY
25.0%	20.0%	20.0%	20.0%	15.0%

to be launched



Regional Currency Baskets

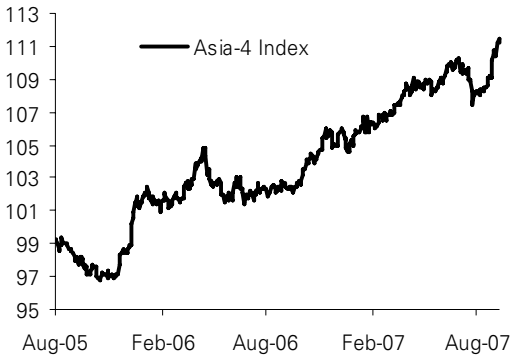
Asia-4 Index

Weighted Constituents

INR	KRW	TWD	SGD
25.0%	25.0%	25.0%	25.0%

Description: A basket of the four most liquid Asian currencies created for investors who want to take a macro view on the region

Pricing	Bloomberg FXIN; Reuters
Fixings	DBIQ website -
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Static
Rebalancing Date	-
Tradeable Currencies	USD or EUR
Index Base Date	-
Index Go-Live Date	-
Tickers	ABFX: ASU/FXI, Bloomberg: ASIUSDSP Index, Reuters:
Products Available	Delta-one, options, structured products



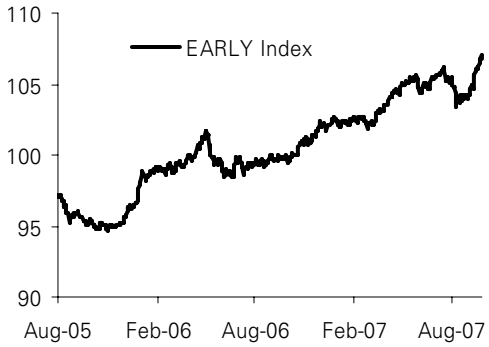
Emerging Asia Reserves, Liquidity and Yield (EARLY) Index

Weighted Constituents

MYR	CNY	IDR	PHP	INR	SGD	TWD	KRW
11.27%	9.86%	9.86%	9.86%	15.78%	19.73%	9.28%	14.35%

Description: A basket of emerging Asian currencies, chosen on the basis of reserve accumulation, liquidity and yield criteria

Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Static
Rebalancing Date	-
Tradeable Currencies	USD
Index Base Date	1 January 1999
Index Go-Live Date	Q1 2006
Tickers	Bloomberg: DBFXEARL Index
Products Available	Delta-one, options, structured products



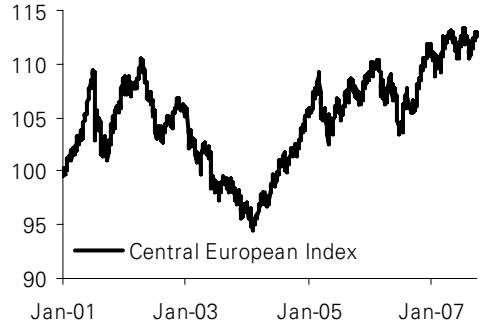
Central European Regional Index

Weighted Constituents

PLN	HUF	CZK	SKK
35.6%	26.3%	24.1%	14.0%

Description: An optimised basket index of four structurally appreciating Eastern European currencies

Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Static
Rebalancing Date	-
Tradeable Currencies	EUR
Index Base Date	2002
Index Go-Live Date	2002
Tickers	CENEURSP Index
Products Available	Delta-one, options, structured products



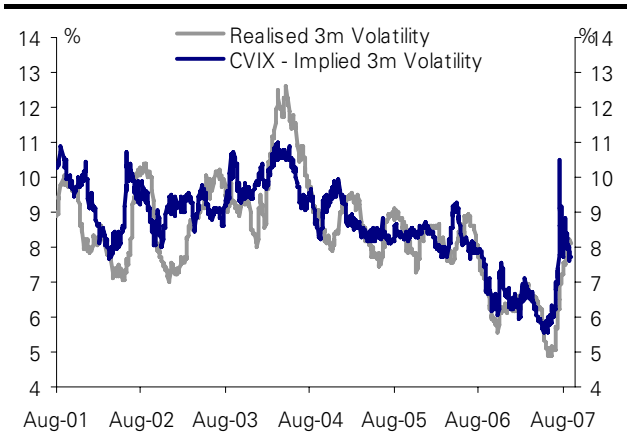
The Deutsche Bank Currency Volatility Index (CVIX)

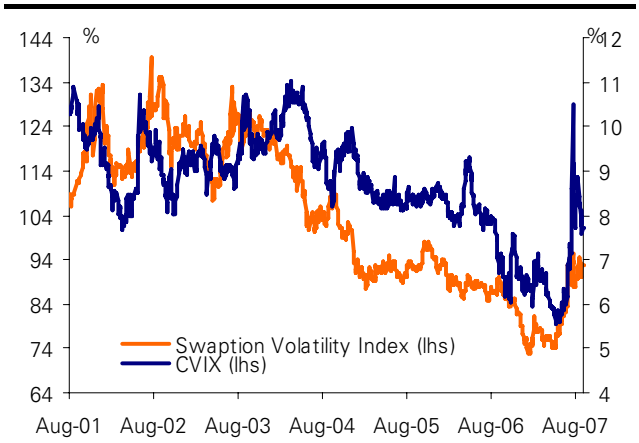
The Deutsche Bank Currency Volatility Index is a weighted index of 3m currency options market implied volatilities based on Bank of International Settlement liquidity weights

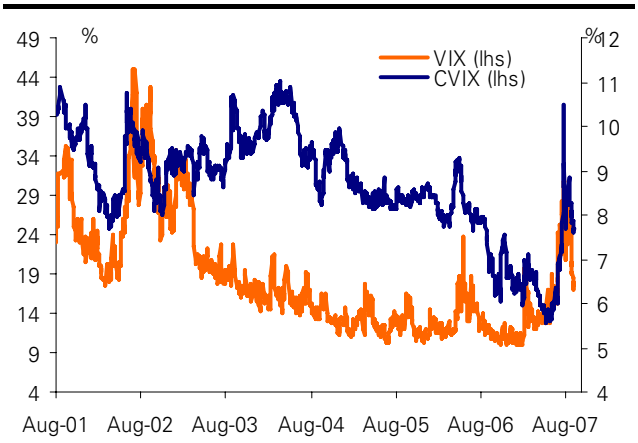
Volatility pool: 3m volatilities in EUR, USD, JPY, GBP, CHF, CAD and AUD crosses

Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Triennially weighted by BIS traded option volumes
Rebalancing Date	-
Tradeable Currencies	Any G10 and most major EM currencies
Index Base Date	-
Index Go-Live Date	1 February 2007
Bloomberg Tickers	CVIX Index
Products Available	**D**elta-one

Currency Crosses and CVIX Weights	
EURUSD	35.90%
USDJPY	21.79%
GBPUSD	17.95%
USDCHF	5.13%
USDCAD	5.13%
AUDUSD	6.41%
EURJPY	3.85%
EURGBP	2.56%
EURCHF	1.28%







The Deutsche Bank G10 Carry, Valuation and Momentum Indices

The Deutsche Bank Carry Index systematically invests in the three highest yielding G10 currencies through funding in the three lowest-yielding currencies, and re-balances quarterly

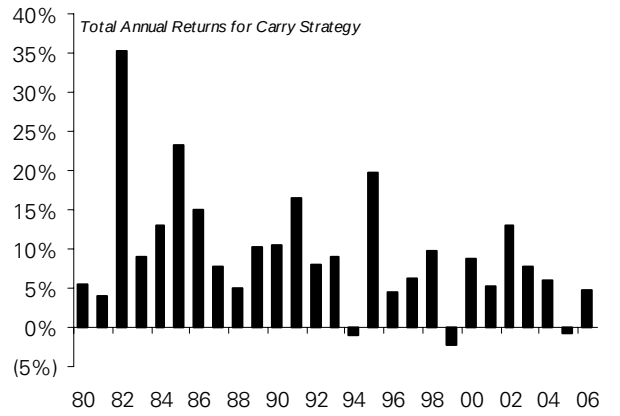
The Deutsche Bank Valuation Index goes long the three most undervalued G10 currencies relative to OECD PPP values and goes short the three most overvalued currencies. Rebalancing is quarterly

The Deutsche Bank Momentum Index invests in the three top-performing G10 currencies over the previous twelve months (spot returns against USD), and borrows in the three worst-performing currencies. Rebalancing is monthly

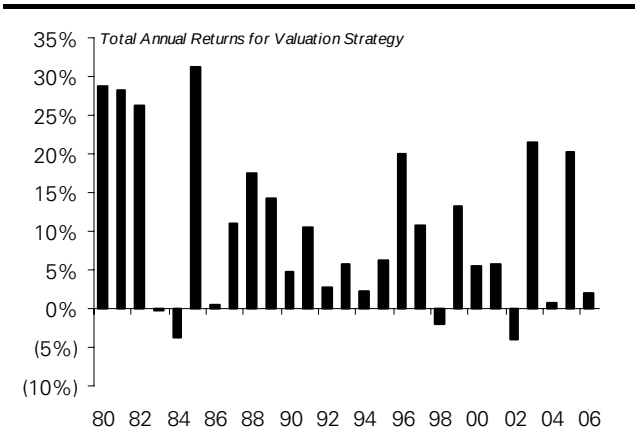
Currency Pool: USD, EUR, JPY, GBP, CHF, AUD, NZD, CAD, NOK, SEK

Products Available: Delta-one, options, structured products

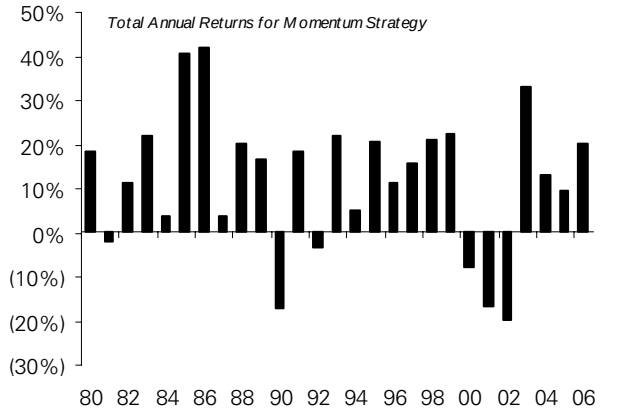
	DB Carry Index
Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Quarterly
Rebalancing Date	Two 50% tranches during Mar Jun Sep Dec IMM weeks
Tradeable Currencies	USD, EUR or quanto into any G10 and most major EM currencies
Index Base Date	19 June 1989
Index Go-Live Date	27 March 2007
Bloomberg Ticker	DBHTG10E Index (excess, EUR) DBHTG10U Index (excess, USD)



	DB Valuation Index
Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Quarterly
Rebalancing Date	Two 50% tranches during Mar Jun
Tradeable Currencies	USD, EUR or quanto into any G10 and most major EM currencies
Index Base Date	19 June 1989
Index Go-Live Date	27 March 2007
Bloomberg Ticker	DBPPPEUF Index (excess, EUR) DBPPPUSF Index (excess, USD)



	DB Momentum Index
Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Monthly
Rebalancing Date	Two 50% tranches during IMM
Tradeable Currencies	USD, EUR or quanto into any G10 and most major EM currencies
Index Base Date	19 June 1989
Index Go-Live Date	27 March 2007
Bloomberg Ticker	DBMOMEUF Index (excess, EUR) DBMOMUSF Index (excess, USD)



The Deutsche Bank Currency Returns (dbCR) Index

The DBCR Index captures the long term systematic returns available by investing in the world's currency markets. It replicates the three most widely employed strategies; Carry, Valuation and Momentum, by investing equally in all three and wraps them into a single non-discretionary index

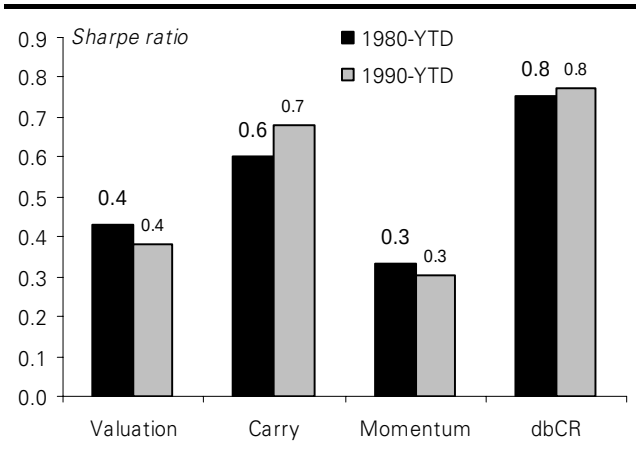
Currency Pool: USD, EUR, JPY, GBP, CHF, AUD, NZD, CAD, NOK, SEK

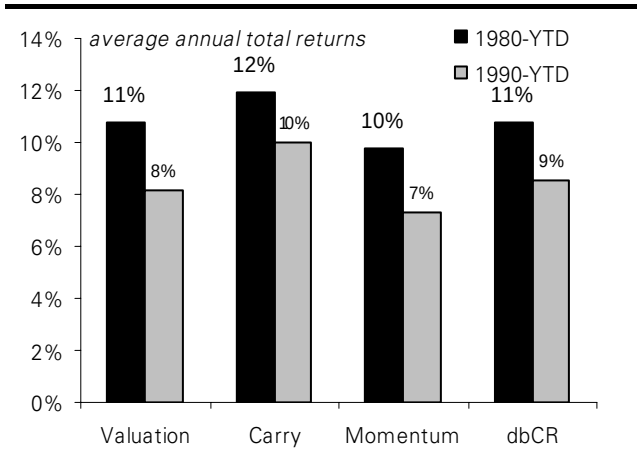
Products Available: Delta-one, options, structured products

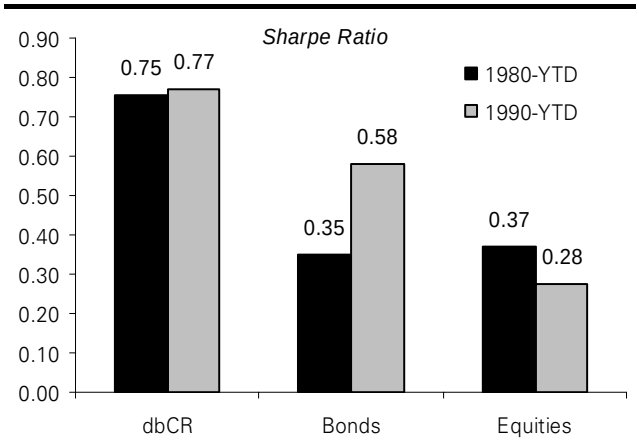
	DB Currency Returns
Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Monthly
Rebalancing Date	Two 50% tranches during IMM weeks
Tradeable Currencies	USD, EUR or quanto into any G10 and most major EM currencies
Index Base Date	19 June 1989
Index Go-Live Date	27 March 2007
Bloomberg Ticker	DBCREUI Index (EUR, excess) DBCRUSI Index (USD, excess) DBCREUF Index (EUR, total) DBCRUSF Index (USD, total)

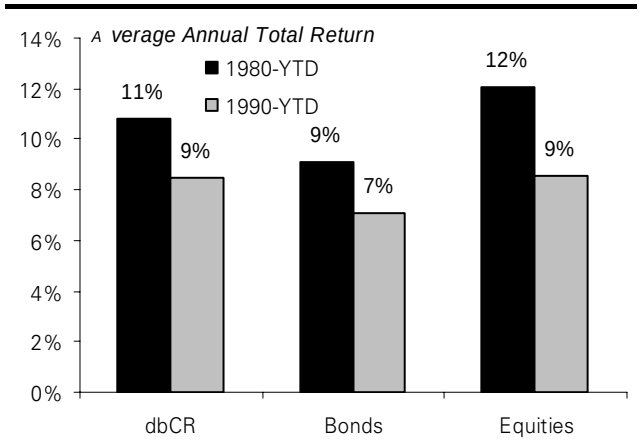
Correlation of monthly changes, 1980-2006

	Bond	Equity	DBCR	FX Carry	FX Mom.	FX Val.
Bond	100%					
Equity	26%	100%				
DBCR	-21%	5%	100%			
FX Carry	-16%	4%	74%	100%		
FX Mom.	3%	-2%	38%	-6%	100%	
FX Val.	-25%	7%	66%	40%	-25%	100%









Equities: MSCI world inc. dividends, Bonds: Lehmans Global Aggregate Bond Index

Balanced and Global Currency Harvest Indices

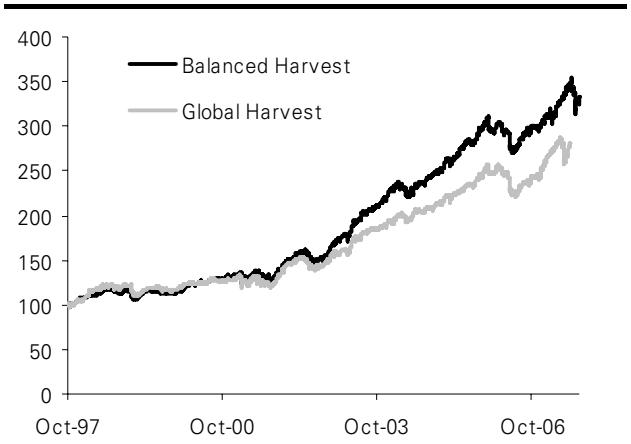
The Deutsche Bank Currency Harvest Indices systematically invest in a diversified basket of high yielding currencies, by going short a diversified basket of low yielding currencies

The **Global** Harvest Index invests in the five highest yielding currencies while shorting the five lowest yielding currencies, regardless of geographic region

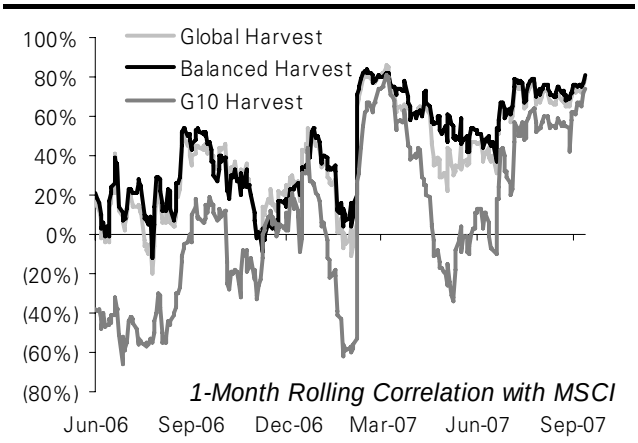
The **Balanced** Harvest Index invests in the two highest yielding G10 currencies while the remaining three come from the whole currency pool, and shorts the two lowest yielding G10 currencies are shorted as are the three lowest yielding currencies from the entire pool. This index strikes a balance between the developed and emerging market currencies

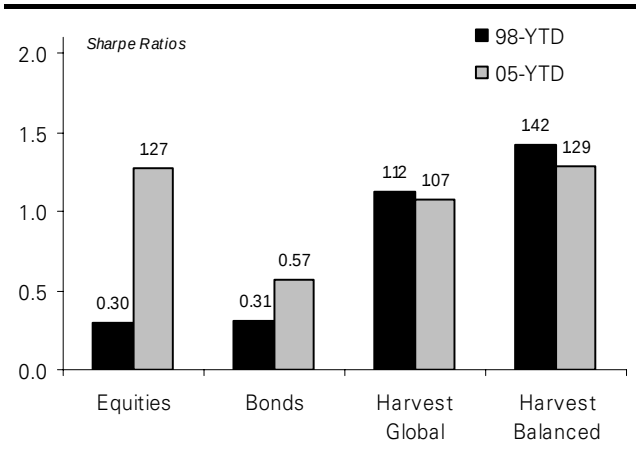
Currency Pool: **G10** USD,EUR,JPY,GBP,CHF,AUD,NZD,CAD,NOK,SEK **Asia** KRW, SGD, TWD; **LATAM** MXN, BRL **EMEA** TRY, PLN, HUF, CZK, ZAR

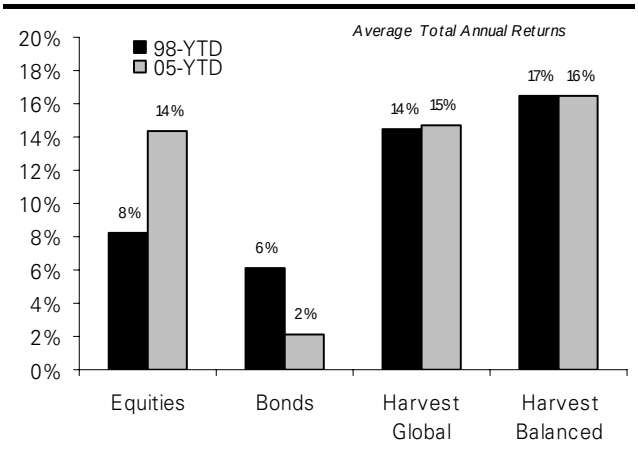
Pricing and Fixing Source	Bloomberg Ticker **or** DBIQ website: http://index.db.com
Calculation Time	4pm London
Caluclation Agent	Deutsche Bank Index Quant
Rebalancing Period	Quarterly
Rebalancing Date	Two 50% tranches during Mar Jun Sep Dec IMM weeks
Tradeable Currencies	USD, EUR or quanto into any G10 and most major EM currencies
Index Base Date	19 September 2000
Index Go-Live Date	19 December 2005
Bloomberg Tickers	DBHVBUSI Index (Balanced, USD, excess) DBHVGUSI Index (Global, USD, excess) DBHVBEUI Index (Balanced, EUR, excess) DBHVBEUF Index (Balanced, EUR, total) DBHVGEUI Index (Global, EUR, excess)



Correlations (2000-YTD)	Global Harvest	Balanced Harvest	MSCI	JPM World Bond	US 10yr Yield
Global Harvest	-----				
Balanced Harvest	83.5%	-----			
MSCI	19.8%	18.9%	-----		
JPM World Bond	(15.6%)	(11.0%)	(4.1%)	-----	
US 10yr Yield	4.9%	1.1%	26.8%	(44.3%)	-----







Equities: MSCI world inc. dividends, Bonds: JP Morgan Global Govt Bond Index, USD unhedged

Glossary

Alpha
The premium (typically expressed in percentage terms) an investment portfolio earns above its performance benchmark.

Arbitrage
A strategy taking advantage of misaligned market prices which gives the potential to earn riskless profits. In theory such opportunities should never arise; in practice any that do are quickly closed.

BIS
The Bank for International Settlements. An international organization fostering co-operation among central banks and other agencies in pursuit of monetary and financial stability

Calmar Ratio
A return/risk ratio, based on the compound annualized rate of return and maximum drawdown over the last 3 years (all available data is used in the event less than three years of data is available)
Calmar Ratio = Compound Annualized ROR / ABS(Max Drawdown)

Correlation
A measure of the degree to which changes in two variables are related. Two assets are said to be perfectly correlated if their daily changes are in the same direction each day, and have the same relative sizes each day.

CTA
Commodity Trading Advisors have been in existence since the 1970s, originally with trading programs focused on physical commodities such as Gold and Corn. As futures markets developed, CTAs increased their product scope to include interest rates, equities and foreign exchange. Nowadays, they typically trade any exchange-traded asset, with a growing number also trading (and more recently solely focusing on) over-the-counter (OTC) foreign exchange as a more liquid alternative to futures. They differ from Hedge Funds in that they are typically onshore and regulated. However, CTA's often do manage offshore hedge funds as well. CTA has become a slightly ambiguous term with context-dependent meaning. Often CTA is used generically to describe Hedge Funds that specialize in trading Managed Futures, and in many minds strongly associated with trend-following strategies, although neither of these is necessarily a feature of CTA business models.

Custodian Institutions
A financial institution that holds in custody (for safekeeping and record keeping purposes) the securities and other assets on behalf of a mutual fund, corporation or individual.

Derivatives
A financial instrument whose value is derived from some underlying cash market, commodity market, futures contract or other financial instrument – for example swaps or options. Derivatives can be traded on regulated exchanges or in over-the-counter markets.

Downside Deviation
This considers the returns that fall below a defined Minimum Acceptable Return (MAR) rather than the arithmetic mean. There are three types of method that can be used to substitute the MAR: the correct figure, the Sharpe risk-free rate, and zero. where L_i and N are the loss and losing periods respectively.

$$\text{Downside Deviation} = \left(\left(\sum_{I=1}^{N} (L_I)^2 \right) \div N \right)^{1/2}$$

EMH
There are three theories falling under the Efficient Markets Hypothesis (EMH) umbrella, differing in the degree to which information is assumed to be impounded in asset prices. The "Weak" form asserts that all past market prices and data are fully reflected in securities prices (hence technical analysis is of no value). The "Semi-strong" form asserts that all publicly available information is fully reflected in securities prices (as such fundamental analysis is of no value). The "Strong" form asserts that all information is fully reflected in securities prices (and so even insider information is of no use)

FDI
Foreign Direct Investment, which includes investment in tangible assets (capital, land etc.) involving cross border capital flows.

Forward Contract
An agreement whereby some underlying instrument is bought or sold with settlement made on a specified date in the future, at a price or exchange rate which is agreed at the time of trade.

Hedge Ratio
In the case of options, the amount of the underlying instrument (expressed as a percentage of the option notional) which when added to a short option position results in a portfolio with no sensitivity to small movements in the underlying instrument. More generally, the amount of hedging instrument which must be added to a position in order to minimize the volatility of the portfolio.

HNW
High Net Worth. Typically used in the context of High Net Worth individuals (investors having a level of liquid assets in excess of a given threshold)

Information Ratio
Typically a measure of the (superior) performance of a fund manager over a predetermined benchmark divided by the tracking error of the performance. In other words, a measure of incremental return scaled by incremental volatility of the excess return.
I nformation Ratio = Active Premium / Tracking Error where the Active Premium is the difference in the annualized returns of the investment and benchmark, and the tracking error is the standard deviation of excess returns over a benchmark.

Kurtosis
A measure of how relatively fat-tailed (or equivalently how peaked) a probability distribution is when compared to a normal distribution with the same mean and standard deviation. A high kurtosis indicates a relatively higher probability of outcomes several standard deviations from the mean. Many financial markets are said to have very high degrees of kurtosis.

Mandates
A legal contract between the manager and client stipulating the objectives and guidelines of the partnership.

Maximum Drawdown
The largest cumulative loss that has occurred in an investment period.

Mean Reversion
The tendency of the value of some instrument to return to some (possibly varying) central level over time. Commodity prices and interest rates are said to be "mean reverting"; in the case of Commodities high prices tend to cause an increase in production, whilst low prices have the opposite effect.

Model- Driven Investment Process
The use of statistical models (which may or may not be based on economic grounds) to systematically generate trading signals.

Monte Carlo Simulation
A technique using a large number of Random Walks (see below) in order to estimate the relative likelihoods of the outcomes of trials. The method is computationally intensive, but allows for higher complexity in the outcomes which are being tested, it is therefore often used in derivatives valuation and risk management.

Overlay Managers
A type of portable alpha strategy that is often unfunded and yet constrained in its positioning taking. Tactical Asset Allocation and Currency Overlay Managers are a relatively recent development, dating back to 1985. Similar to a CTA, they are not given funds to manage per se, but are given a specific mandate within which to trade. The overlay manager is essentially given permission to use the underlying assets of the investor (such as pension funds) to back the OTC FX and exchange traded futures positions taken. Often objective of overlay is to hedge the underlying portfolio against all risk or deviation from strategic benchmark (gains as well as losses), However nowadays these mandates extend to include an element of profit generation, by over eighting or underweighting currencies, fixed income and equity markets in line with the assets of the underlying portfolio.

Percentage Up Ratio
A measure of the number of periods that an investment outperforms the benchmark when the benchmark made gains (L_I), divided by the number of periods that the benchmark made gains (LD_I):
where T is the number of periods where an investment exceeds a benchmark and TD is the number of periods where the benchmark produced positive returns.

$$T = \left(\sum_{I=1}^{N} L_I\right)$$

$$TD = \left(\sum_{I=1}^{N} LD_I\right)$$

$$\textbf{Up Percentage Ratio} = T \div TD$$

Percentage Down Ratio
A measure of the number of periods that the investment outperformed the benchmark when the benchmark contracted (L_I), divided by the number of periods that the benchmark produced negative returns (LD_I):

$$T = \left(\sum_{I=1}^{N} L_I\right)$$

$$TD = \left(\sum_{I=1}^{N} LD_I\right)$$

$$\textbf{Down Percentage Ratio} = T \div TD$$

where T is the number of periods in which the investment exceeded the benchmark and TD is the number of losing periods in the benchmark.

Prime Brokerage
Clients wishing to transact in currency markets can use a prime broker's existing infrastructure and counterparty credit arrangements to efficiently begin currency dealing.

Purchasing Power Parity (PPP)
Postulates that relative developments in domestic and foreign price levels determine equilibrium exchange rates. Specifically, a country experiencing relatively higher inflation should, on average, see its currency depreciate by the amount of the inflation differential, in effect implying the real exchange rate should be constant. The basis for PPP is the notion of the law of one price, which contends that in the absence of transportation and other transaction costs, arbitrage in competitive markets will equalize the price of an identical good in two countries when the prices are expressed in the same currency.

Random Walk
A simulated time series which is created by using the assumption that the change in the variable from one period to the next is generated by drawing a random sample from some probability distribution. The Random Walk hypothesis states that financial asset prices may be modelled in this way because the past behaviour of the asset holds no information about its future direction. Random walks are extensively used in risk management and derivative pricing (see "Monte Carlo Simulation" and "VaR")

Rational Expectations Hypothesis (REH)
States that any information made publicly available will be immediately impounded in asset prices.

Replication Strategies
Strategies where a desired payoff is 'replicated' by constructing an equivalent portfolio using other assets. For instance, a basket of equities could be used to replicate an equity index, or a call option could be replicated using a dynamically rebalanced position in the underlying security.

Sharpe Ratio
A return/risk measure developed by William Sharpe, where the returns are defined as the incremental average return of an investment over the risk-free rate, and risk is defined as the standard deviation of investment returns. The Sharpe Ration is the ratio of the two.

Semi Deviation
Similar to downside deviation, it looks to isolate downside deviation by measuring the deviation below the average return.

Sortino Ratio
A return/risk ratio developed by Frank Sortino:

$$\text{Sortino Ratio} = \left(\text{Compound Period Return} - R_{MAR} \right) \div DD_{MAR}$$

where R_{MAR} is the period minimum acceptable return, while DD_{MAR} is the downside deviation. The return is the incremental compound average period return over the Minimum Acceptable Return (MAR) and the risk is the downside deviation below a MAR. In line with downside deviation, MAR can be interpreted in 3 ways: the MAR value, Sharpe ratio risk-free rate, and zero.

Total-Return Swaps
A mechanism which allows exposure to the profit or loss resulting from the possession of some underlying instrument which is owned and held by a third party. The third party receives compensation for funding and operational costs from the investor in return for passing through the profit or loss on the position.

Total- Return
Measures the change in value of an investment (both capital appreciation and income) over a specific period of time, typically expressed as a percentage of the initial investment.

Tracking Error
The standard deviation of excess returns over a benchmark. It measures the portion of an investment performance that can't be explained by the benchmark:

$$\text{Tracking Error} = \left(\left(\sum_{I=1}^{N} \left(R_I - RD_I \right)^2 \div (N-1) \right)^{1/2} \right) \times 12^{1/2}$$

where R_I and RD_I are the investment and benchmark returns respectively, while N is the number of time periods concerned.

VaR Value at Risk.
It is a measure of the aggregate market risk of an asset portfolio. Typically expressed has a loss that will not be exceeded within some period, with a certain confidence level.
The most common method is a 99% 1-day measure.

Uncovered Interest Parity (UIP)
Like PPP, a fundamental theory of exchange rate determination. It postulates that forward rates are unbiased predictors of future spot rates. Essentially argues relatively high yielding investments should depreciate by the amount of the interest differential. There is evidence to suggest that this theory does not in fact apply to currency markets; in general the forward FX rate calculated from the interest rate differential is a poor predictor of the future spot rate.

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