European Rates Research
J.P. Morgan Securities Ltd.
London, May 17, 2007

JPMorgan

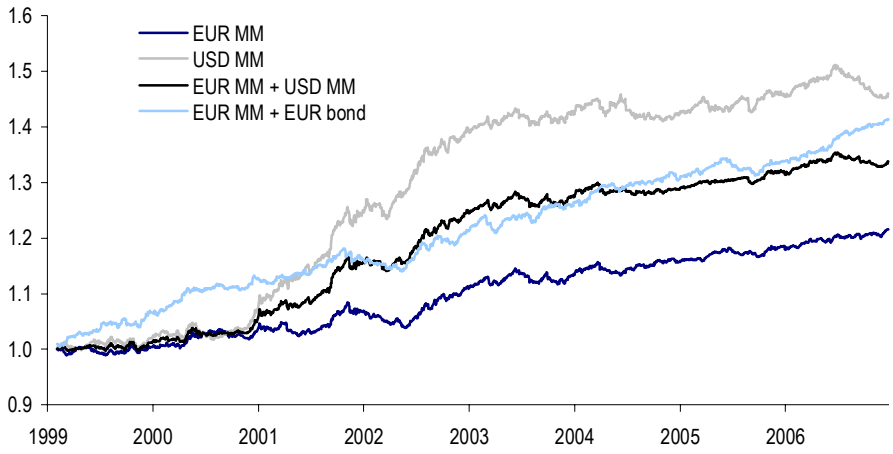
Momentum in Money Markets

- **Momentum-based trading strategies offer attractive risk-adjusted returns on Euro area and US money markets.**
- **Adopting the methodology employed for the Bund momentum strategy (Investment Strategies: No 27), we obtain information ratios higher than 1 for both the Euro and US money market curve.**
- **We find that momentum at the short end of the curve manifests itself on a multi-month horizon rather than multi-week as for the Bund strategy. The results are robust to the choice of the parameter.**
- **We explain the presence of momentum at the short end of the curve with serial correlation in economic surprises and in forecast revisions to data and central bank moves expectations.**
- **There are good diversification gains on momentum strategies in EUR money markets and in the 10-year Bund, with an information ratio of the combined strategy of 1.76. The diversification gains between Euro area and US money markets strategies are more limited.**
- **The inclusion of overbought/oversold signals does not improve the results of the short end momentum strategies. Combining the momentum strategy with value and position indicators provides at best marginal improvements.**

INVESTMENT STRATEGIES: NO. 32

Excess return of money market momentum strategies

MM: first four money market contracts; performance of strategies that allocate the same notional in each contract; excess return over cash



Source: JPMorgan

Gianluca Salford[AC]
(44-20) 7325-4334
gianluca.salford@jpmorgan.com

Contents

The certifying analyst is indicated by an [AC]. See pages 14-15 for analyst certification and important legal and regulatory disclosures.

J.P. Morgan Securities Ltd.
Gianluca Salford (44-20) 7325-4334
gianluca.salford@jpmorgan.com

JPMorgan

What explains momentum at the short end of the curve?

One of the most common explanations for trending behaviour is that financial markets do not respond instantaneously to new information – rather it takes time for information to permeate markets, leading only to gradual adjustments. We believe it is not the speed at which the information travels but rather that investors wait for market price action to confirm their interpretation of the data before acting – herding behaviour in other words.

It is often said that trending markets (and successful momentum strategies) are more likely to occur when the anchor of fair value is loose, e.g. in equities, commodities, etc... It is much easier to get a measure of fair value for the short end of the yield curves (using growth and inflation forecasts and a policy reaction function) than for equities or long dated bonds, for which different fair value models can provide very different results. If the lack of clear valuations is a prerequisite for market momentum it should be difficult to exploit trends at the short end of the curve.

In our view momentum can exist also in presence of a strong fair value anchor as is the case for money markets. The process by which an idea of fair value is formed typically shows signs of serial correlation. We provide two examples here: revisions to expectations and changes in economic activity indicators.

In a previous Investment Strategies piece (No:9, *Which Trade?,* Normand J., February 2004) we showed the strong positive serial correlation of forecast changes in growth, inflation and Fed funds (see Table 1).

Table 1: Conditional probabilities on consensus forecast revisions
Probability of forecast revision in period t+1 given change in period t, 1990-2002, United States

	Growth forecast Period t+1		Inflation forecast Period t+1		Fed funds forecast Period t+1	
	Up	Down	Up	Down	Up	Down
Period t						
Up	0.66	0.34	0.53	0.47	0.65	0.35
Down	0.24	0.76	0.15	0.85	0.19	0.81

Source: JPMorgan

We believe that investors, in addition to waiting for market price action to confirm their views, also fail to extrapolate trends in economic data. For instance, in the Euro area, the PMI surveys are the most important piece of data on the state of the economy. Data since July 1998 shows that monthly changes in the PMIs exhibit strong serial correlation (see Table 2). For instance, a positive change in the manufacturing PMI is followed by another rise the next month 75% of the time; negative changes follow one another 68% of the time.

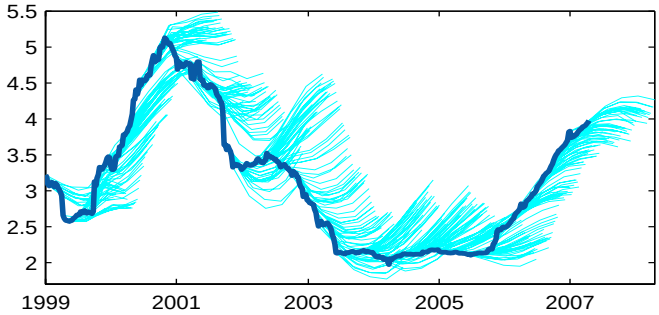
Table 2: Conditional probabilities on changes in Eurozone manufacturing PMI
Probability of change in Eurozone manufacturing PMI in period t+1 given change in period t, 1998-2007

	manufacturing PMI Period t+1		services PMI Period t+1		composite PMI Period t+1	
	Up	Down	Up	Down	Up	Down
Period t						
Up	0.75	0.25	0.61	0.39	0.71	0.29
Down	0.32	0.68	0.44	0.56	0.31	0.69

Source: JPMorgan

Despite the strong serial correlation in the PMI changes, market participants have failed on average to gauge the amount of tightening or easing that the ECB would deliver (see Chart 1).

Chart 1: Evolution of 3m EUR rate vs forward pricing
In %



Source: JPMorgan

To summarise, in our view, the serial correlation in growth, inflation and policy rate forecasts can explain the success of momentum strategies at the short end of the yield curve despite the strong value anchor.

Description of the momentum strategy

The core principle of our momentum strategy is to identify, as early as possible, a pattern of market returns inconsistent with randomly moving prices. This is done by comparing a weighted average of recent market returns with a measure of recent return volatility. Measuring the market movements against market volatility helps ensure the momentum we are observing is not merely the result of unusually volatile markets. A momentum signal is derived from the ratio of directional and volatility measures.

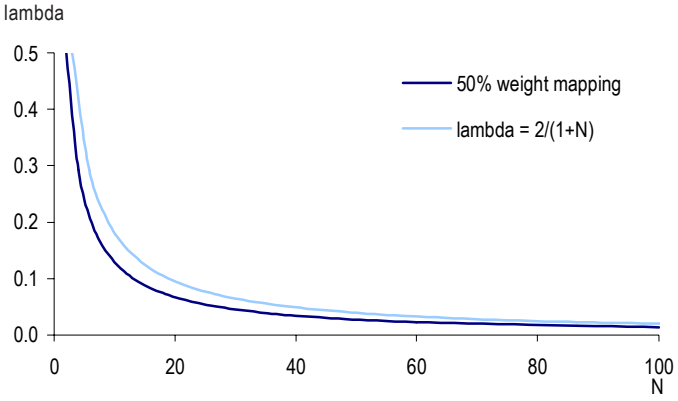
With most momentum-based strategies, a fixed time window is specified over which momentum is measured – monthly or quarterly price changes or monthly moving average changes are typical momentum signals. These fixed window measures suffer the drawback of base effects: even in stagnant markets spurious signals can be generated as the passage of time causes old data to leave the sample window. In our strategy this problem is mitigated by employing an exponentially weighted moving average (also known as exponential moving average, EMA) of returns. This gives increasing weights to the most recent, and we believe most relevant, data. Using the exponential average, the parameter of the time window width is replaced with the decay rate of the moving average, lambda, this being the key parameter of the strategy. The higher the lambda, the higher the weight attached to the most recent observation.

The lambda in an EMA is not as intuitive as the number of days in a simple moving average (SMA). To create a mapping between the two, we can associate each lambda with the number of the most recent observations that sum up to a total weight of 50%. For instance if the lambda is 0.067, the most recent 10 trading days have a total weight of 50%. For an SMA 20 days will give 50% of the weight in the most recent 10 trading days. Therefore according to this mapping an EMA lambda of 0.067 can be associated to a 20-day SMA, and the process can be repeated for any lambda. Another mapping between the lambda and the number of days (N) used in the literature is the following:

$$\text{lambda} = 2 / (N + 1)$$

In Chart 2 we present the mapping between the lambda (the decay factor) in the EMA and N (the number of days in an SMA) according to the two methodologies highlighted.

Chart 2: How to translate EMA lambda into SMA number of days



Source: JPMorgan

Momentum strategy

Sample, trading signal and timing

We use daily data spanning January 1990 to December 2006 for the Euro area market (Germany before EMU): between 1990 and 1998 we use Euromark contracts and from 1999 onwards we use Euribor contracts. In the US, we use data on Eurodollar contracts from January 1990 to December 2006. We restrict the analysis to the first four contracts on each curve. In our charts we define the four contracts as F (front), B1 (first back contract), B2, and B3.

The strategy generates a momentum signal at the close of each business day. If the signal generates a new trade recommendation, we enter the trade at the close of business level of the following working day.

The strategy returns are excess returns over cash, i.e. the strategies can be leveraged.

Sensitivity analysis

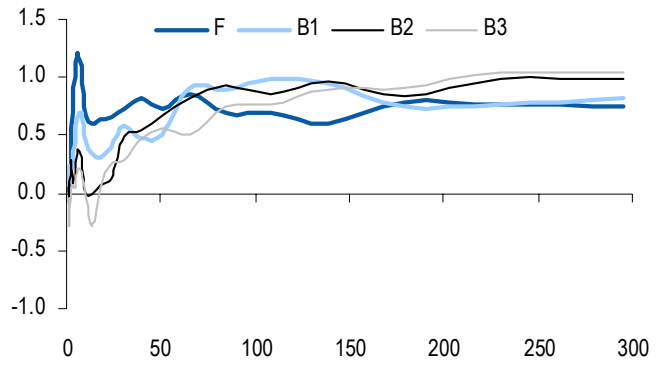
In its simplest form the momentum strategy is defined by a single parameter: the lambda in the exponential moving average. If the momentum signal generated by the moving average is >0, we buy the future contracts, otherwise we sell. In Charts 3-8 we show the information ratios of the strategy plotted against the number of days in an SMA equivalent to the lambda in the EMA for the EUR and USD markets. We also split the sample periods in two: 1999-2006 (EMU period) and 1990-98.

J.P. Morgan Securities Ltd.
Gianluca Salford (44-20) 7325-4334
gianluca.salford@jpmorgan.com

JPMorgan

Chart 3: Information ratio of momentum strategy on Euromark/ Euribor contracts: Jan90-Dec06

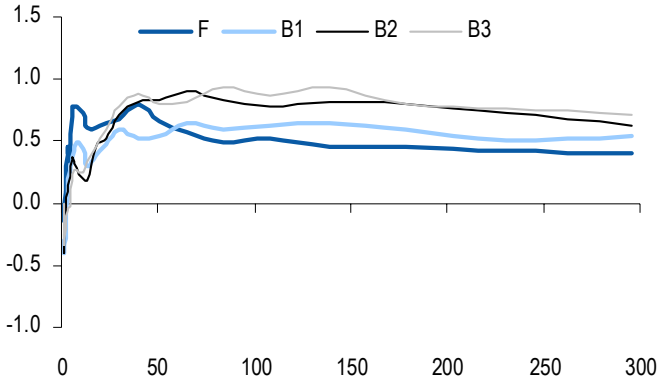
X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

Chart 4: Information ratio of momentum strategy on Euribor contracts: Jan99-Dec06

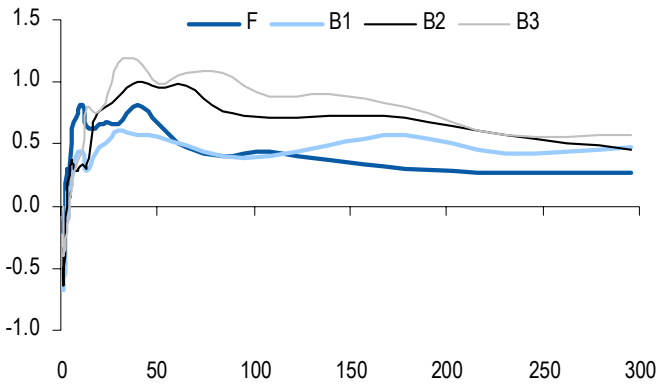
X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

Chart 5: Information ratio of momentum strategy on Euromark contracts: Jan90-Dec98

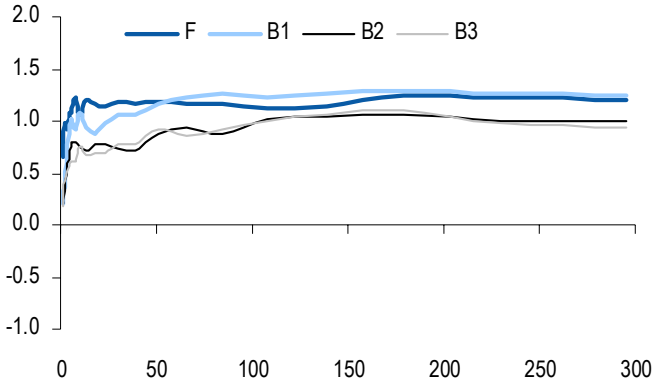
X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

Chart 6: Information ratio of momentum strategy on Eurodollar contracts: Jan90-Dec06

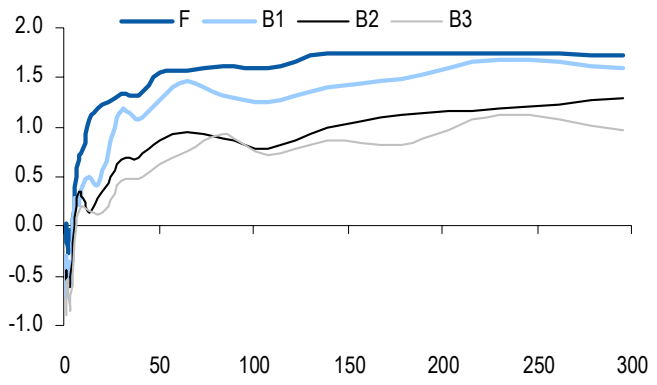
X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

Chart 7: Information ratio of momentum strategy on Eurodollar contracts: Jan99-Dec06

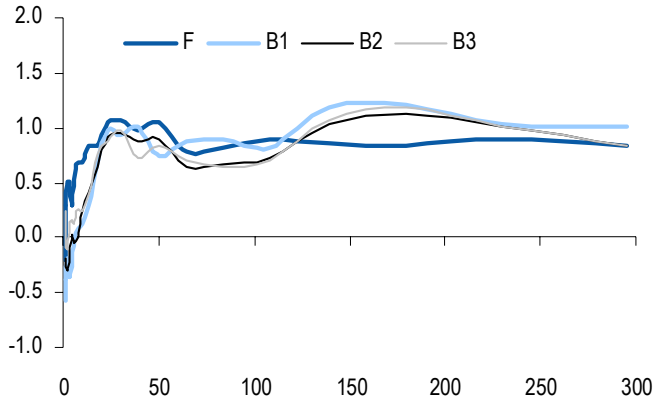
X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

Chart 8: Information ratio of momentum strategy on Eurodollar contracts: Jan90-Dec98

X-axis: No. of equivalent days in equivalent simple moving average



Source: JPMorgan

We highlight a few interesting points:

- There is good evidence of low frequency momentum (very low lambdas equivalent to a high number of days in a simple moving average) in all the samples examined. Information ratios on the individual contracts range from 0.4 to 1.5 for periods longer than 50 business days. The information ratio curves are fairly stable, suggesting that the good performance of momentum strategies does not depend on an arbitrary choice of the parameter. We typically find weak evidence of higher frequency mean reversion (high lambda).

- These results are broadly consistent with the analysis on the Bund future, which showed lack of high frequency momentum and good evidence of low frequency momentum, although for the Bund strategy we find evidence of momentum was strongest on a multi-week period rather than multi-month.

- Momentum strategies work similarly well across contracts: in some cases front contracts give the highest information ratios whereas in others the best information ratio is achieved with back contracts. There is some (limited) value in diversification: the information ratio for a strategy on the first four contracts combined (each trade has the same weight) is higher than the average information ratio of the individual contracts.

- Momentum strategies work well for the full sample period (1990-2006). Splitting the sample in two (1990-1998 and 1999-2006), the latter gives slightly better results both in the Euro area and in the US.

Momentum signals, value signals and position signals

Once confirmed the existence of momentum in money market futures, we can focus on the interaction between momentum signals and other signals that can improve our results.

Momentum and value

In this section we focus on the interaction between momentum and value strategies. At the short end of the curve a measure of value can be represented by the term premium, i.e. the difference between expectation on interest rates and where the market settles. A few studies have highlighted the efficacy of structural longs in the back money market contracts as a way of earning a term premium which historically overcompensated for the risk taken (see *Have 8000 Hedge Funds Eroded Market Opportunities?*, October 2004). However, term premia have not been stable over time, and have been trending down in recent years. Our database contains a monthly history of estimated term premia 1 year forward since March 1991 (see the monthly Short-end Term Premia Report for an explanation of the methodology adopted). We would expect high (low) estimated term premia to be associated with positive returns for long (short) trades. However, since term premia have been trending lower over time, defining high and low term premia is not an easy task.

We test a simple trading rule: if the estimated term premium 1-year out is positive, we are long money market contracts, if the estimated term premium is negative we are short.

We then test the interaction between the momentum signal and a value signal derived from the term premia analysis. We test the following specification:

- If the momentum signal is positive (negative), but the estimated term premium is negative (positive), trade 50% of the usual size.

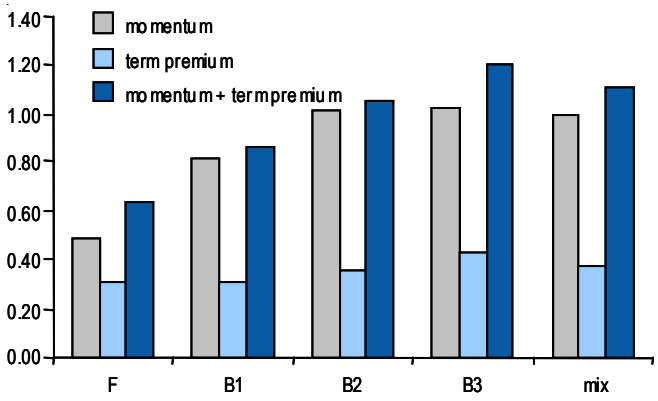
	estimated term premium >0	estimated term premium <0
momentum signal >0	long 1 unit	long 0.5 unit
momentum signal <0	short 1 unit	short 0.5 unit

In the **Euro area** market, the momentum strategy applied to the combination of trades generated by the individual contracts with equal weights gives an information ratio slightly above 1 (the lambda in the EMA selected through an optimisation process).

The value strategy based on the sign of the estimated term premium generates a positive information ratio, but below 0.5 for all the contracts.

The inclusion of a value signal as a cross check for the momentum signal is beneficial to the risk profile of the strategy for all the contracts. The information ratio of the strategy on the four contracts combined rises to 1.12 from 1.00 (see Chart 9).

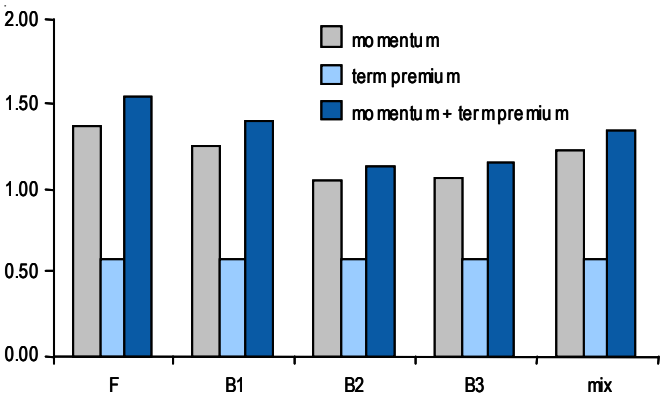
Chart 9: Information ratio of momentum strategy on Euromark/ Euribor Apr91-Dec06
mix = average of 4 contracts



Source: JPMorgan

In the **US** market, contrary to the Euro area, the best evidence of momentum is found for the front contract, and the information ratio for all contracts exceeds 1. Also the value strategy based on estimated term premia works better than the Euro area, with information ratios above 0.5. As was the case for the Euro area, the inclusion of a value signal to temper the momentum signal helps somewhat the risk profile of the strategy for all the contracts. The information ratio of the strategy on the four contracts combined rises to 1.33 from 1.22 (see Chart 10).

Chart 10: Information ratio of momentum strategy on Eurodollar Apr91-Dec06
mix = average of 4 contracts



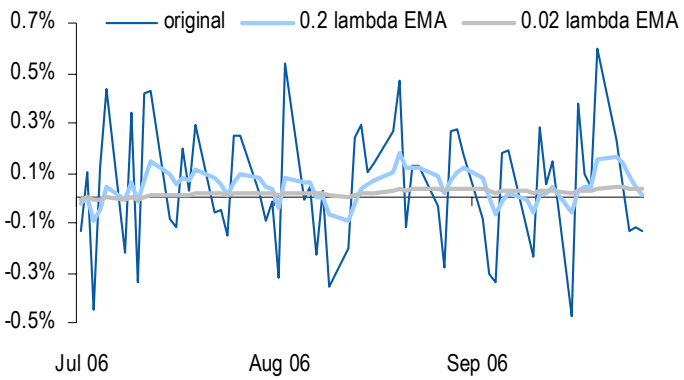
Source: JPMorgan

Momentum and overbought/oversold technical signals

In our analysis of a momentum strategy for the Bund future we found that a simple momentum strategy could be improved by avoiding an active trading position when either positive or negative momentum signals were too strong.

We tested whether the same results applied to the momentum strategy on money market contracts, but the introduction of an exit threshold does not improve our strategy. In our view this is due to the fact that momentum in money markets is evident over a longer horizon than for the Bund (months rather than weeks). Applying a low lambda smoothing to the daily returns time series dampens the fluctuations in the trading signal time-series. Compared to the Bund strategy, the peaks are lower and the troughs are shallower, making the definition of overbought/oversold conditions less meaningful.

Chart 11: Low frequency lambda makes momentum signal series smoother, masking overbought/oversold conditions
Daily returns on Bund, July-September 2006



Source: JPMorgan

We also tested exit strategies based on commonly used technical indicators, such as RSIs (Relative Strength Indicators). Using exit strategies set at 30 and 70 RSI for the Bund future delivered Information Ratios comparable to the original Bund strategy. RSIs highlighting overbought/ oversold market conditions do not improve our momentum strategies for neither Euribors nor Eurodollars. We conclude that overbought/oversold signals fail to provide effective exit points for the momentum strategy.

Momentum and positions

From a theoretical point of view the expected impact of positions on the market can be ambiguous. On the one hand, if we assume herding behaviour, changes in positions should show serial correlation and be positively correlated with future changes in prices. On the other hand, overextended positions among speculative investors might be positively correlated with a reversals in the market and could provide useful exit signals.

To test for the **impact of positions on Euribor contract prices** we used 10 years of data of our Germany/Euro area client survey. The survey captures client positioning across the curve. We are not aware of any survey of positions at the short end of the curve, which would be more precise.

We analyse the following trading rules, alone and in combination with the momentum strategy:

1. If the change in the average position in client survey is positive, be long money market contracts.

2. If the level of the average position in the client survey is >X (<X), be long (short) money market contracts.

We show the results for the BACK2 contract, which shows a very high correlation to the strategy that weights equally the first four contracts.

A rule based on the change in the client survey gives a positive Information Ratio (0.44). We also implemented the rule as a cross check for the momentum strategy (i.e. if the position signal is in disagreement with the momentum signal, halve the size of the momentum-based trade). The Information Ratio improves to 1.14 from 1.03 once we include the position analysis in the strategy.

Being long (short) when the client survey is positive (negative) would generate an Information Ratio of 0.32, but its combination with the momentum strategy does not improve the results of the latter. Adopting different thresholds gives similar results.

This analysis supports the notion that position surveys can provide further evidence of momentum in markets but are not useful to signal market reversals.

For **Eurodollars** we tested whether the data on positions as recorded by the Commitments of Traders would help the momentum strategy. Neither the percentage changes in net speculative positions nor net speculative positions helped improve the momentum strategy.

In conclusion, this analysis does not provide convincing evidence that the inclusion of data on positions helps our momentum strategies in a consistent way as we would have expected the position survey for Eurodollars to give better results than a client survey on the exposure to the bond market.

Table 3 shows a summary of our findings: the momentum strategy was by far the best performer in our analysis and only value signals helped improve the momentum strategy for Euribors and Eurodollars.

Table 3: Evidence for different strategies on money market futures
Period: Apr 1991 - Dec 2006 except for Euribor investors' positions (1997-06)

	Euribors	Eurodollars
Momentum	very good results	very good results
Value (term premium)	positive results	positive results
Overbought/oversold signals	no evidence	no evidence
Investors' positions	positive results	no evidence

Source: JPMorgan

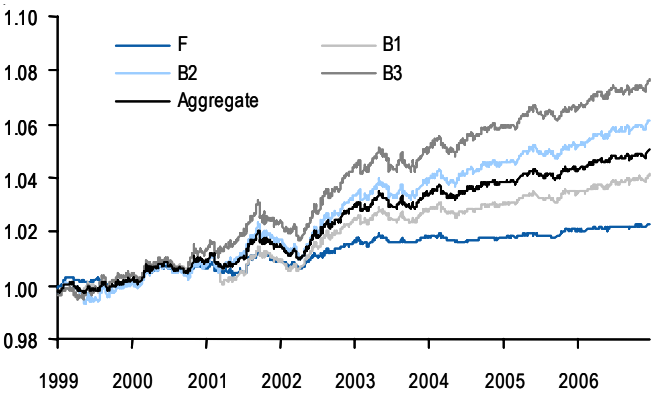
Momentum strategy summary results

Euro area

Our analysis shows evidence of positive low-frequency momentum across the most liquid money market contracts. The momentum trading rule with optimised lambda on a combination of the first four contracts would have generated an information ratio of 1.06 in the full sample period 1990-2006 (average annual return: 2.3%, average volatility: 2.1%).

In this section we analyse in more detail the properties of the momentum trading rule with optimised lambda in the EMU period from 1999 to the end of 2006. Chart 12 overleaf shows the evolution of the P&L for the individual contracts and for the strategy that invests the same notional in the front contracts. We show the results for the strategy without any rebalancing. The results with daily or monthly rebalancing are very similar.

Chart 12: EUR momentum strategy performance
Period: Jan1999-Dec2006; aggregate index: 25% in each contract



Source: JPMorgan

For the individual contracts, the front contract gives the lowest return in absolute terms and also in risk-adjusted terms. The average number of trades is very low, between 26 and 30, i.e. the average length of the trade is 4-5 months. Although the success ratio is not high (between 37% and 58%), the average profit for successful trades is considerably higher than the average loss for losing trades. The strategy is more successful at picking long recommendations than short recommendations (see Table 4).

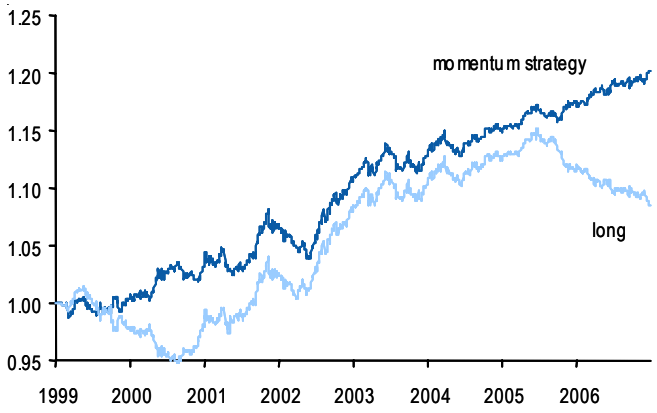
Table 4: EUR momentum strategy statistics by contract
Period: Jan1999-Dec2006

	F	B1	B2	B3
Information Ratio	0.74	0.88	1.13	1.13
Total P&L	2.28%	4.07%	6.02%	7.45%
# trades	30	26	26	26
avg P&L	0.08%	0.16%	0.23%	0.29%
# P&L>0 trades	11	13	14	15
avg P&L	0.26%	0.40%	0.52%	0.57%
# P&L<0 trades	16	12	11	10
avg P&L	-0.04%	-0.09%	-0.12%	-0.11%
# P&L=0 trades	3	1	1	1
success %	37%	50%	54%	58%
long trades	15	13	14	13
avg P&L	0.11%	0.23%	0.39%	0.44%
short trades	15	13	12	13
avg P&L	0.04%	0.09%	0.05%	0.13%

Source: JPMorgan

The combined strategy invests the same notional at inception in the four individual strategies. The information ratio is 1.05, with annualised return of 2.46% and annualised volatility of 2.33% (see table 6 for a comparison of the different strategies). Chart 13 shows the momentum strategy P&L compared to a long only strategy. The momentum strategy has been very good at capturing almost fully the long market rally, and also has posted positive results in the 1999-2000 and 2005-2006 tightening cycles.

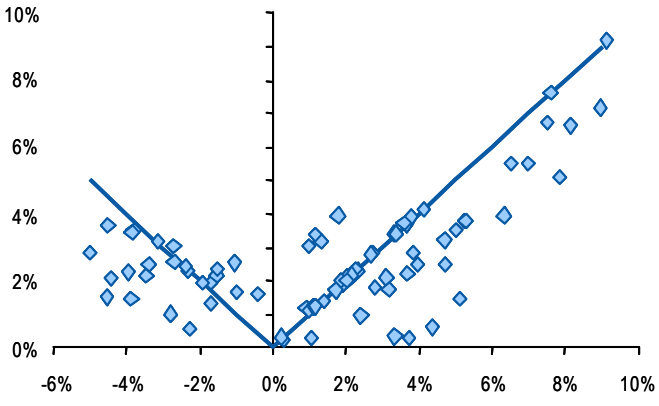
Chart 13: EUR momentum strategy vs long first four EUR contracts
Period: Jan1999-Dec2006; strategy: sum of the four individual strategies



Source: JPMorgan

Chart 14 shows the 12-month rolling return of the combined momentum strategy vs the 12-month return of a long-only strategy. The momentum strategy posts positive returns for all the rolling sample considered and shows good symmetric behaviour in market sell offs and market rallies. The better performance of long recommendations is due to the fact that the market has rallied on average over the sample period.

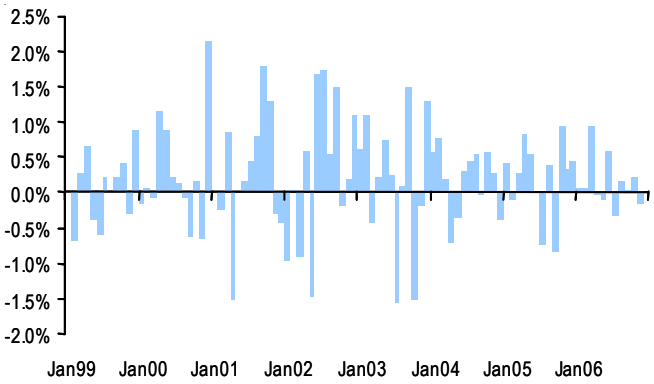
Chart 14: EUR momentum strategy 12m rolling performance
Period: Jan1999-Dec2006; strategy performance vs long-only performance



Source: JPMorgan

The monthly return profile is shown in Chart 15. The strategy would have posted a profit 66% of the months, with a maximum monthly loss of 1.5%. The largest peak to trough loss including intramonth data is 3.5% between November 2001 and April 2002.

Chart 15: EUR momentum strategy monthly P&L profile
Period: Jan1999-Dec2006; strategy: sum of the four individual strategies



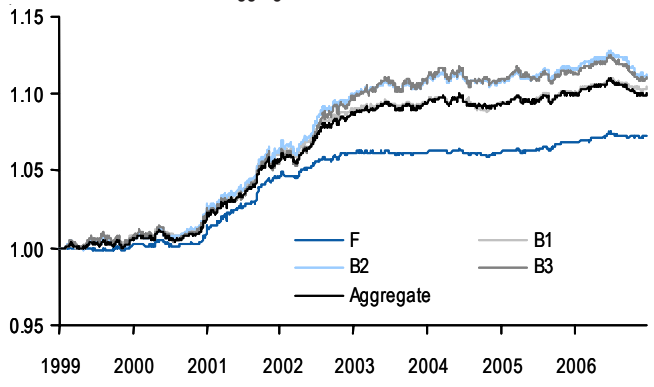
Source: JPMorgan

Summary results: US

The momentum trading rule with optimised lambda on a combination of the first four contracts would have generated an information ratio of 1.23 in the full sample period 1990-2006 (average annual return: 4.5%, average volatility: 3.7%). For the period 1999-2006 the information ratio is 1.49 (average annual return: 4.9%, average volatility: 3.3%).

Chart 16 shows the evolution of the P&L for the momentum strategy individual contracts and for the strategy that invests the same notional in the front contracts for the period 1999-2006.

Chart 16: USD momentum strategy performance
Period: Jan1999-Dec2006; aggregate index: 25% in each contract



Source: JPMorgan

Looking the individual contracts, the strategy on the front contract gives the lowest absolute return but the highest risk adjusted return. In line with the Euro area results, the average number of trades is very low, the success ratio on individual trades is low but it is more than compensated by the difference between the average profit for successful trades and the average loss for losing trades. The strategy is more successful at picking long recommendations than short recommendations (see Table 5).

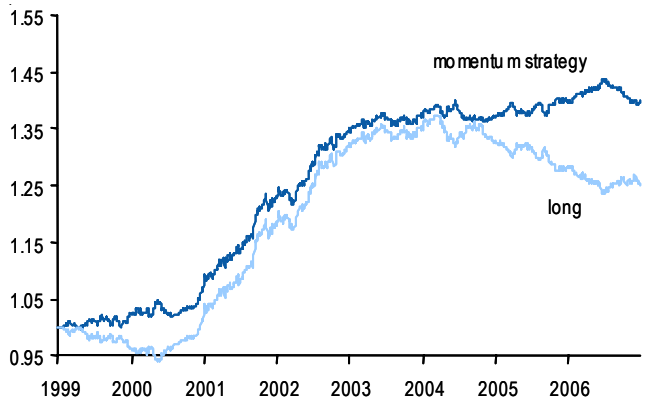
Table 5: USD momentum strategy statistics by contract
Period: Jan1999-Dec2006

	F	B1	B2	B3
Information Ratio	1.79	1.62	1.32	1.13
Total P&L	7.20%	10.28%	11.18%	11.06%
# trades	23	31	31	37
avg P&L	0.31%	0.33%	0.36%	0.30%
# P&L>0 trades	4	10	11	12
avg P&L	1.96%	1.16%	1.17%	1.13%
# P&L<0 trades	17	19	19	24
avg P&L	-0.04%	-0.07%	-0.09%	-0.10%
# P&L=0 trades	2	2	1	1
success %	17%	32%	35%	32%
short trades	11	15	15	18
avg P&L	0.53%	0.53%	0.60%	0.51%
neutral trades	12	16	16	19
avg P&L	0.12%	0.15%	0.14%	0.09%

Source: JPMorgan

The strategy that combines positions in the first four Eurodollar contracts gives an information ratio of 1.49, with annualised return of 4.9% and annualised volatility of 3.3%. Chart 17 show the momentum strategy P&L compared to a long only strategy. As was the case for the Euro area, the strategy has been very good at capturing the long market rally, while also providing positive results in the 1999-2000 and 2004-2006 tightening cycles.

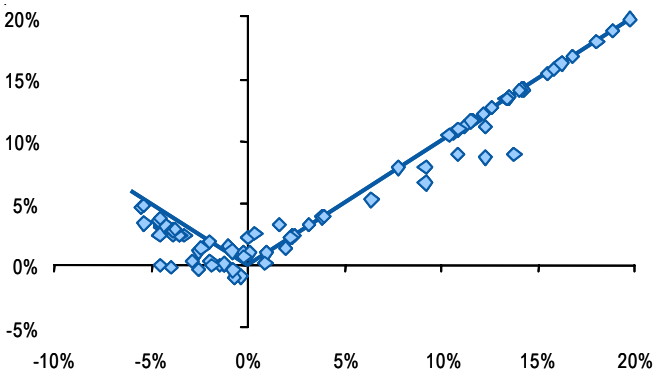
Chart 17: USD momentum strategy vs long first four USD contracts
Period: Jan1999-Dec2006; strategy: sum of the four individual strategies



Source: JPMorgan

Chart 18 shows the 12-month rolling return of the combined momentum strategy vs the 12-month return of a long-only strategy. As was the case with the Euro strategy the profile resembles an option. The US strategy is slightly less successful than the Euro area one in sell offs. However, the worst 12-month performance is just -1%.

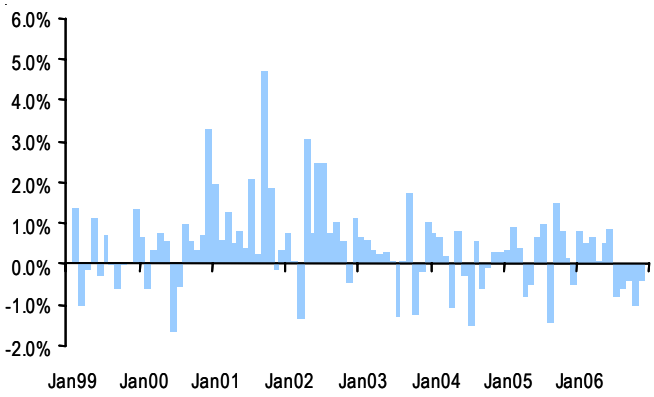
Chart 18: USD momentum strategy 12m rolling performance
Period: Jan1999-Dec2006; strategy performance vs long-only performance



Source: JPMorgan

The monthly return profile is shown in Chart 19. The strategy would have posted a profit 68% of the months, with a maximum monthly loss of 1.6%. The largest peak to trough loss including intramonth data is 3.1% between June and December 2006.

Chart 19: USD momentum strategy monthly P&L profile
Period: Jan1999-Dec2006; strategy: sum of the four individual strategies



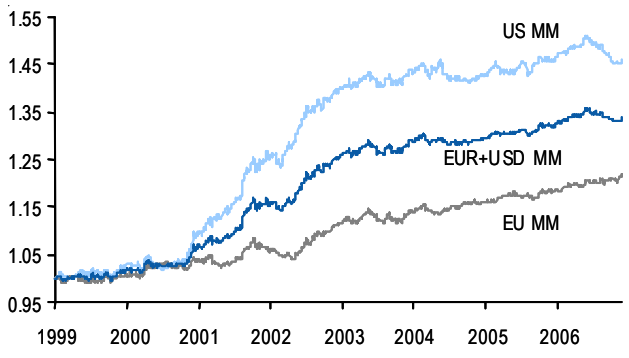
Source: JPMorgan

EUR and the USD strategies combined

A combination of the EUR and USD money market strategies provides some diversification. The information ratio of a strategy that puts 50% of the weight in terms of notional traded on the EUR and USD strategies would have generated an information ratio of 1.55, higher than the two separate strategies (1.05 and 1.49). The annualised return is 3.7% with annualised volatility of 2.4%.

The correlation of the daily returns of the two strategies is not negligible, 0.35. This highlights that momentum strategies on different money market curves are to a certain extent driven by common factors even though the monetary policy cycle has not been perfectly synchronised. Indeed, over the period analysed the ECB has been lagging moves by the Fed by around six months to as much as 18 months.

Chart 20: EUR, USD momentum strategy performance
Period: Jan1999-Dec2006; EUR+USD: 50% in EUR strategy, 50% in USD strategy



Source: JPMorgan

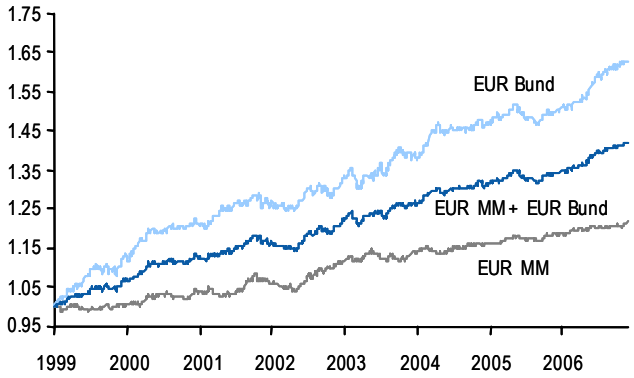
EUR money market and EUR Bund strategies combined

A combination of the EUR money market strategy and the EUR bond strategy described in "Investment Strategies: No 27" provides more diversification gains. The information ratio of a strategy that puts equal weight in terms of notional traded in each of the four money market strategies and the Bund strategy would have generated an information ratio of 1.76, much higher than the two separate strategies (1.05 and 1.51). The annualised return is 4.4% with annualised volatility of 2.5%.

The correlation of the daily returns is very low, 0.04. In our view, this result confirms our hypothesis that the nature of momentum at the short end of the curve is different from momentum at the long end of the curve, as highlighted by the different frequency between short end momentum and 10yr bond momentum, and by the different success of overbought/oversold signals.

Chart 19: EUR money market and bond momentum strategy performance

Period: Jan1999-Dec2006; 50% in EUR MM strategy, 50% in Bund strategy



Source: JPMorgan

Conclusions

Following the approach firstly developed for the 10yr Bund future, we found that momentum-based strategies give Information Ratios in excess of 1 for the first four Euribor contracts and for the first Eurodollar contracts (1.05 and 1.49 respectively) since EMU.

Compared to the Bund momentum strategy, the data shows evidence of positive momentum on a multi-month horizon rather than multi-week. The results are very stable to the choice of the lambda in the exponential moving average.

The inclusion of an overbought/oversold signal did not improve our results. These findings suggest that the dynamics that generate momentum at the short end and long end of the curve are different and employing the two strategies together provide diversification gains.

A strategy that combines the Euro area money market and Bund momentum strategies would have generated significant diversification, with an information ratio of 1.76.

The diversification gain is weaker for a combination of the Euro area and US money market strategies. Despite the mismatch in the timing of ECB and Fed action (with the ECB typically lagging the Fed by months), the profile of the EUR and USD strategy are similar.

We looked at other factors affecting money market moves that could be systematically exploited, with mixed results:

- We analysed whether the level of estimated term premia can provide a measure of value. The inclusion of a value-based strategy in conjunction with the momentum-based strategy improved only slightly the results for the pure momentum-based strategy, both in the Euro area and in the US.

- Information on positions gave mixed results. Positive changes in the average position in our European client survey are positively correlated with subsequent money market rallies. However, we failed to find any impact of speculative positions recorded by the Commitments of Traders on the evolution of US short end interest rates.

Table 6: Momentum strategies summary

	period	IR	ann. return	ann. vol.
EUR money market	1990-2006	1.06	2.3%	2.1%
EUR money market	1999-2006	1.05	2.5%	2.3%
USD money market	1990-2006	1.23	4.5%	3.7%
USD money market	1999-2006	1.49	4.9%	3.3%
EUR+ USD money market	1999-2006	1.55	3.7%	2.4%
EUR Bund	1999-2006	1.51	3.7%	2.4%
EUR MM + EUR Bund	1999-2006	1.76	4.4%	2.5%

Source: JPMorgan

This page is intentionally left blank

This page is intentionally left blank

Analyst certification: The research analyst(s) denoted by an "AC" on the cover of this report (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect his or her personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report. **Risks to Strategies: Put or Payer Sale.** Investors who sell put or payer options are exposed to the level of the underlying falling below the strike of the option. Therefore, at maturity of the option, if the level of the underlying is below the strike, an investor will have to purchase the underlying position from the buyer of the option in return for the strike of the option, or provide equivalent financial compensation if it is a "cash settled" option. **Call or Receiver Sale**. Investors who sell call or receiver options are exposed to level of the underlying rising above the strike of the option. Therefore, at maturity of the option, if the spread on the underlying is above the strike, an investor will have to source a long position which he/she must hand over to the buyer of the option in return for the strike of the option, or provide equivalent financial compensation if it is a "cash settled" option. **Call Overwrite.** Investors who sell call options against a long position in the underlying give up any appreciation in the level of the underlying above the strike price of the call option. Additionally, they remain exposed to a decline in the underlying in return for the receipt of the option premium. **Put Overwrite**. Investors who sell put options against a short position in the underlying give up any decline in the level of the underlying below the strike price of the call option. Additionally, they remain exposed to a rise in the underlying in return for the receipt of the option premium. **Call Purchase.** Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying level is below the strike of the call option at maturity. **Put Purchase**. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying level is above the strike of the put option at maturity. **Straddle or Strangle.** The seller of a straddle or strangle is exposed to underlying level ending up above the call strike or below the put strike at maturity of the option. If an investor has a short in the underlying and overlays this with selling a straddle or strangle, they will define their lower exit point where underlying falls below the put strike. Additionally, they will lose twice as much as an outright short risk position if the underlying is above the call strike. Conversely if an investor is long the underlying and overlays this with selling a strangle, they will define their higher exit point by the call strike and lose twice as much below the put strike. **Risks to strategies**: Not all option strategies are suitable for investors; certain strategies may expose investors to significant potential losses. We have summarized the risks of selected derivative strategies. We advise investors to consult their tax advisors and legal counsel about the tax implications of these strategies. **Pricing Is Illustrative Only**: Prices quoted in the above trade ideas are our estimate of current market levels, and are not indicative trading levels. **Explanation of Ratings: Ratings System:** JPMorgan uses the following sector/issuer portfolio weightings: Overweight (over the next three months, the recommended risk position is expected to outperform the relevant index, sector, or benchmark), Neutral (over the next three months, the recommended risk position is expected to perform in line with the relevant index, sector, or benchmark), and Underweight (over the next three months, the recommended risk position is expected to underperform the relevant index, sector, or benchmark). JPMorgan's Emerging Market research uses a rating of Marketweight, which is equivalent to a Neutral rating. **Valuation & Methodology:** In JPMorgan's credit research, we assign a rating to each issuer (Overweight, Underweight or Neutral) based on our credit view of the issuer and the relative value of its securities, taking into account the ratings assigned to the issuer by credit rating agencies and the market prices for the issuer's securities. Our credit view of an issuer is based upon our opinion as to whether the issuer will be able service its debt obligations when they become due and payable. We assess this by analyzing, among other things, the issuer's credit position using standard credit ratios such as cash flow to debt and fixed charge coverage (including and excluding capital investment). We also analyze the issuer's ability to generate cash flow by reviewing standard operational measures for comparable companies in the sector, such as revenue and earnings growth rates, margins, and the composition of the issuer's balance sheet relative to the operational leverage in its business. **Analysts' Compensation:** The research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors and overall firm revenues. The firm's overall revenues include revenues from its investment banking and fixed income business units.

Other Disclosures: **Options related research:** If the information contained herein regards options related research, such information is available only to persons who have received the proper option risk disclosure documents. For a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options, please contact your JPMorgan Representative or visit the OCC's website at http://www.optionsclearing.com/publications/risks/riskstoc.pdf. **Legal Entities Disclosures: U.S.:** JPMSI is a member of NYSE, NASD and SIPC. J.P. Morgan Futures Inc. is a member of the NFA. JPMorgan Chase Bank, N.A. is a member of FDIC and is authorized and regulated in the UK by the Financial Services Authority. **U.K.:** J.P. Morgan Securities Ltd. (JPMSL) is a member of the London Stock Exchange and is authorised and regulated by the Financial Services Authority. **South Africa:** J.P. Morgan Equities Limited is a member of the Johannesburg Securities Exchange and is regulated by the FSB. **Hong Kong:** J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong. **Korea:** J.P. Morgan Securities (Far East) Ltd, Seoul branch, is regulated by the Korea Financial Supervisory Service. **Australia:** J.P. Morgan Australia Limited (ABN 52 002 888 011/AFS Licence No: 238188) is regulated by ASIC and J.P. Morgan Securities Australia Limited (ABN 61 003 245 234/AFS Licence No: 238066) is a Market Participant with the ASX

and regulated by ASIC. **Taiwan:** J.P.Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and regulated by the Taiwan Securities and Futures Commission. **India:** J.P. Morgan India Private Limited is a member of the National Stock Exchange of India Limited and The Stock Exchange, Mumbai and is regulated by the Securities and Exchange Board of India. **Thailand:** JPMorgan Securities (Thailand) Limited is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission. **Indonesia:** PT J.P. Morgan Securities Indonesia is a member of the Jakarta Stock Exchange and Surabaya Stock Exchange and is regulated by the BAPEPAM. **Philippines:** J.P. Morgan Securities Philippines Inc. is a member of the Philippine Stock Exchange and is regulated by the Securities and Exchange Commission. **Brazil:** Banco J.P. Morgan S.A. is regulated by the Comissao de Valores Mobiliarios (CVM) and by the Central Bank of Brazil. **Japan:** This material is distributed in Japan by JPMorgan Securities Japan Co., Ltd., which is regulated by the Japan Financial Services Agency (FSA). **Singapore:** This material is issued and distributed in Singapore by J.P. Morgan Securities Singapore Private Limited (JPMSS) [mica (p) 069/09/2006 and Co. Reg. No.: 199405335R] which is a member of the Singapore Exchange Securities Trading Limited and is regulated by the Monetary Authority of Singapore (MAS) and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) which is regulated by the MAS. **Malaysia:** This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-x) which is a Participating Organization of Bursa Malaysia Securities Bhd and is licensed as a dealer by the Securities Commission in Malaysia. **Pakistan:** J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Country and Region Specific Disclosures: U.K. and European Economic Area (EEA):** Issued and approved for distribution in the U.K. and the EEA by JPMSL. Investment research issued by JPMSL has been prepared in accordance with JPMSL's Policies for Managing Conflicts of Interest in Connection with Investment Research which can be found at http://www.jpmorgan.com/pdfdoc/research/ConflictManagementPolicy.pdf. This report has been issued in the U.K. only to persons of a kind described in Article 19 (5), 38, 47 and 49 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2001 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this document relates is only available to relevant persons and will be engaged in only with relevant persons. In other EEA countries, the report has been issued to persons regarded as professional investors (or equivalent) in their home jurisdiction **Germany:** This material is distributed in Germany by J.P. Morgan Securities Ltd. Frankfurt Branch and JPMorgan Chase Bank, N.A., Frankfurt Branch who are regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht. **Australia:** This material is issued and distributed by JPMSAL in Australia to "wholesale clients" only. JPMSAL does not issue or distribute this material to "retail clients." The recipient of this material must not distribute it to any third party or outside Australia without the prior written consent of JPMSAL. For the purposes of this paragraph the terms "wholesale client" and "retail client" have the meanings given to them in section 761G of the Corporations Act 2001. **Hong Kong:** The 1% ownership disclosure as of the previous month end satisfies the requirements under Paragraph 16.5(a) of the Hong Kong Code of Conduct for persons licensed by or registered with the Securities and Futures Commission. (For research published within the first ten days of the month, the disclosure may be based on the month end data from two months' prior.) J.P. Morgan Broking (Hong Kong) Limited is the liquidity provider for derivative warrants issued by J.P. Morgan International Derivatives Ltd and listed on The Stock Exchange of Hong Kong Limited. An updated list can be found on HKEx website: http://www.hkex.com.hk/prod/dw/Lp.htm. **Korea:** This report may have been edited or contributed to from time to time by affiliates of J.P. Morgan Securities (Far East) Ltd, Seoul branch. **Singapore:** JPMSI and/or its affiliates may have a holding in any of the securities discussed in this report; for securities where the holding is 1% or greater, the specific holding is disclosed in the Legal Disclosures section above. **India:** For private circulation only not for sale. **Pakistan:** For private circulation only not for sale. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money. JPMSAL does not issue or distribute this material to members of "the public" as determined in accordance with section 3 of the Securities Act 1978. The recipient of this material must not distribute it to any third party or outside New Zealand without the prior written consent of JPMSAL. **General:** Additional information is available upon request. Information has been obtained from sources believed to be reliable but JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively JPMorgan) do not warrant its completeness or accuracy except with respect to any disclosures relative to JPMSI and/or its affiliates and the analyst's involvement with the issuer that is the subject of the research. All pricing is as of the close of market for the securities discussed, unless otherwise stated. Opinions and estimates constitute our judgment as of the date of this material and are subject to change without notice. Past performance is not indicative of future results. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipient of this report must make its own independent decisions regarding any securities or financial instruments mentioned herein. JPMSI distributes in the U.S. research published by non-U.S. affiliates and accepts responsibility for its contents. Periodic updates may be provided on companies/industries based on company specific developments or announcements, market conditions or any other publicly available information. Clients should contact analysts and execute transactions through a JPMorgan subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise. Revised March 30, 2007.

Investment Strategies Series

This series aims to offer new approaches and methods on investing and trading profitably in financial markets.

1. *Rock-Bottom Spreads*, Peter Rappoport, Oct 2001
2. *Understanding and Trading Swap Spreads*, Laurent Fransolet, Marius Langeland, Pavan Wadhwa, Gagan Singh, Dec 2001
3. *New LCPI trading rules: Introducing FX CACI*, Larry Kantor, Mustafa Caglayan, Dec 2001
4. *FX Positioning with JPMorgan's Exchange Rate Model*, Drausio Giacomelli, Canlin Li, Jan 2002
5. *Profiting from Market Signals*, John Normand, Mar 2002
6. *A Framework for Long-term Currency Valuation,* Larry Kantor and Drausio Giacomelli, Apr 2002
7. *Using Equities to Trade FX: Introducing LCVI,* Larry Kantor and Mustafa Caglayan, Oct 2002
8. *Alternative LCVI Trading Strategies,* Mustafa Caglayan, Jan 2003
9. *Which Trade,* John Normand, Jan 2004
10. *JPMorgan's FX & Commodity Barometer*, John Normand, Mustafa Caglayan, Daniel Ko, Nikolaos Panigirtzoglou and Lei Shen, Sep 2004.
11. *A Fair Value Model for US Bonds, Credit and Equities*, Nikolaos Panigirtzoglou and Jan Loeys, Jan 2005.
12. *JPMorgan Emerging Market Carry-to-RiskModel*, Osman Wahid, February 2005
13. *Valuing cross-market yield spreads*, Nikolaos Panigirtzoglou, January 2006
14. *Exploiting cross-market momentum*, Ruy Ribeiro and Jan Loeys, February 2006
15. *A cross-market bond carry strategy*, Nikolaos Panigirtzoglou, March 2006
16. *Bonds, Bubbles and Black Holes*, George Cooper, March 2006
17. *JPMorgan FX Hedging Framework*, Rebecca Patterson and Nandita Singh, March 2006
18. *Index Linked Gilts Uncovered*, Jorge Garayo and Francis Diamond, March 2006
19. *Trading Credit Curves I*, Jonny Goulden, March 2006
20. *Trading Credit Curves II*, Jonny Goulden, March 2006
21. *Yield Rotator*, Nikolaos Panigirtzoglou, May 2006
22. *Relative Value on Curve vs Butterly Trades*, Stefano Di Domizio, June 2006
23. *Hedging Inflation with Real Assets,* John Normand, July 2006
24. *Trading Credit Volatility*, Saul Doctor and Alex Sbityokov, August 2006
25. *Momentum in Commodities*, Ruy Ribeiro, Jan Loeys and John Normand, September 2006
26. *Equity Style Rotation*, Ruy Ribeiro, November 2006
27. *Euro Fixed Income Momentum Strategy,* Gianluca Salford, November 2006
28. *Variance Swaps,* Peter Allen, November 2006
29. *Relative Value in Tranches I*, Dirch Muench, November 2007
30. *Relative Value in Tranches II*, Dirch Muench, November 2007
31. *Exploiting carry with cross-market and curve bond trades,* Nikolaos Panigirtzoglou, January 2007