

Inside

Introduction	2
A Brief Description of the Cross-Over Strategy	3
Evaluating the Cross-Over Strategy	4
Signal Consistency and Stop Loss Mechanism	12
Conclusion	14

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Intraday Forex Trading Based on Sentiment Inflection Points

In this study, we introduce a cross-over strategy in the FX market that trades based on short to long term news sentiment inflection points. These inflection points are captured by consulting a set of sentiment indexes that measure the trailing sentiment on both scheduled and unscheduled economic and geopolitical news events. The sentiment index is proven to predict intraday price moves in the EURUSD for up to several hours after an inflection point.

The RavenPack U.S. Macro Sentiment Index Predicts EURUSD Price Movements following Sentiment Inflection Points

- With a 10 hour holding period, a cross-over strategy between short (1-week) and long-term (3-month) sentiment generates an annualized Information Ratio of 1.61 based on monthly P&L.
- With a 3 hour holding period, a cross-over strategy between medium (1-month) and long-term (3-month) sentiment generates an annualized Information Ratio of 1.29 based on monthly P&L.
- Introducing a stop loss mechanism can improve trading performance for the cross-over strategy between short (1-week) and long-term (3-month) sentiment when considering holding periods of up to 4 hours.

RavenPack Data

The RavenPack U.S. Sentiment Index is based on RavenPack's News Analytics 3.0 dataset which systematically tracks and analyzes information on more than 2,200 government organizations, 138,000 key geographical locations, 150 major currencies, 80 traded commodities and over 30,000 companies.

RavenPack global macro news analytics automatically tracks and analyzes news on over 2,200 government organizations, 138,000 key geographical locations, 150 major currencies and 80 major commodities

RavenPack's news analytics data allows us to use technical and fundamental analysis rather uniquely

1. Introduction

In this study we propose a short-term foreign currency trading strategy that uses the principles of technical analysis to create buy or sell signals based on data derived from fundamental news. Typically, technical analysis is applied to continuous data sets like price and traded volume, while fundamental analysis is based on discrete observations of the state of an economy which are updated at a much lower frequency. Purist technical or fundamental analysts will not mix the two techniques, but many market participants use the two in combination – often with fundamentals determining direction and conviction and technicals confirming the timing of entry and exit.

RavenPack's news analytics data allows us to use technical and fundamental analysis rather uniquely – applying technical analysis to a traditionally fundamental data set (news). RavenPack tracks and analyzes information on over 138,000 key geographical entities, more than 2,200 government organizations, and all major currencies and traded commodities. For any news record that can be matched with an event category, RavenPack generates an Event Sentiment Score (ESS) signaling its potential impact on any given economy or financial market (see Appendix A for details). RavenPack covers over 1,200 events of which 895 relate to unscheduled news such as political events, natural disasters, wars, etc., as well as scheduled news such as the release of important macroeconomic indicators.

In this paper, we present a simple cross-over strategy that tracks the short and long term¹ sentiment trends for a given economy in order to detect cross-over events identified as sentiment inflection points. We take a “bullish” view on a currency when the short term sentiment trend crosses above the long term sentiment trend and a bearish view when the short term sentiment trend crosses below the long term sentiment trend. In the next section, we describe this cross-over strategy applied to the EURUSD. In later sections, we discuss the performance of the strategy over the period of January 2010 to June 2012, examine the signal consistency, and present our findings and conclusions.

¹Faster vs. slower moving sentiment average.

2. A Brief Description of the Cross-Over Strategy

To measure the sentiment trend for a given economy (the United States, for example), we take the moving average of all news events with ESS scores over a certain aggregation window. Specifically, the country sentiment index for time t is measured as:

$$S_{t,m} = \sum_{j=1}^m ESS_{t-j} / (m + 1) \quad (1)$$

where ESS is the Event Sentiment Score for all “non-neutral” global macro news events ($ESS \neq 50$) relevant to the given economy, and m is the length of the aggregation window.

Note that we exclude any news events tagged as “foreign-exchange” as news in this group is generally backward-looking, reporting value fluctuations in the foreign exchange rate².

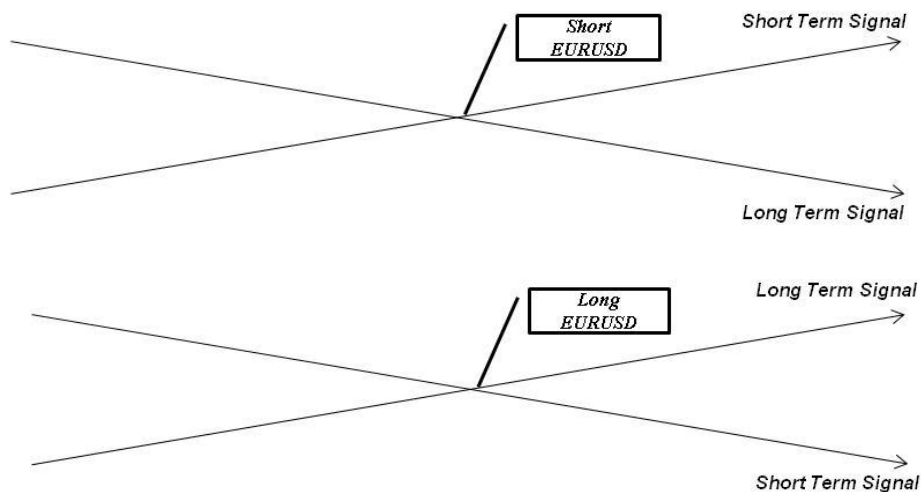
As part of this study, we examine three different aggregation periods including 1-week, 1-month, and 3-month windows. All economy-specific macro sentiment indexes are updated for every minute when non-neutral news events are recorded. To detect sentiment inflection points, we find the cross-over between the short-term and long term indexes. Specifically, we determine the following three crossovers: 1-week vs. 1-month; 1-week vs. 3-month; and 1-month vs. 3-month.

While this strategy can be applied to multiple currencies, here we only focus on U.S. events in a cross-over strategy on the EURUSD exchange rate. More specifically, we take a short position in the EURUSD when the short-term U.S. macro sentiment index crosses above the long-term sentiment index, suggesting a bullish view on the U.S. Dollar. Conversely, we take a long position in the EURUSD when the short-term index crosses below the long-term index. The strategy is illustrated in Fig 1.

A more in-depth presentation on strategy performance is considered in Section 3.

We take a “bullish” view on a currency when the short term sentiment trend crosses above the long term sentiment trend and a bearish view when the short term sentiment trend crosses below the long term sentiment trend.

² The event categories in the “foreign-exchange” news group include “currency-guidance-appreciate”, “currency-guidance-depreciate”, “currency-rate-appreciate”, and “currency-rate-depreciate”

Fig1: Illustration of the Sentiment Cross-Over Strategy

This figure provides a simple illustration of a news based cross-over strategy.

SOURCE: RavenPack, January 2013

3. Evaluating the Cross-Over Strategy

As described above, the cross-over strategy can easily be applied to other currencies, but in this paper we focus on U.S. macro news only, and apply it to the EURUSD. We test the strategy using 1-minute bar prices over the period of January 2010 to June 2012.³ Note that since the time zone for our EURUSD data is Eastern Standard Time (EST) without Day Light Savings adjustment, we convert the time zone of RavenPack news analytics (UTC) to EST accordingly. As part of our study, we consider the following three cross-over strategies: 1-week vs. 1-month; 1-week vs. 3-month; and 1-month vs. 3-month. To examine the persistency of the trading signal, we look at the performance up to 10 hours after the cross-over event.

1 week vs. 3 months cross-over strategy with a holding period of 10 hours is able to generate annualized Information Ratio of 1.61 based on monthly P&L.

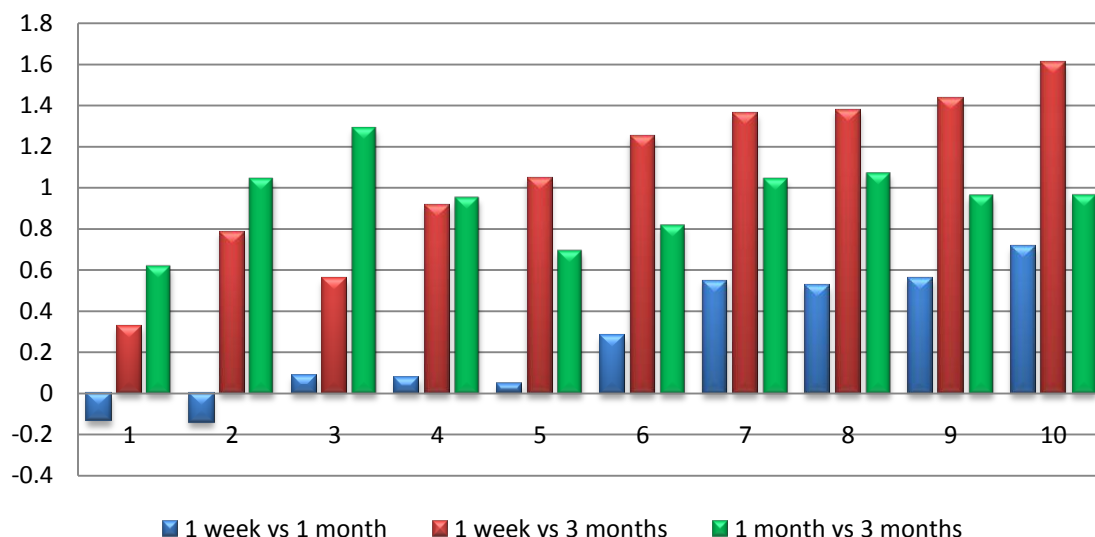
The strategy is evaluated based on the annualized Information Ratio of the monthly P&L assuming fixed daily capital of \$10,000 before transaction and roll-over costs. We also assume no leverage is used. Fig 2 below plots the Information Ratio by holding horizon (1-10 hours) for each strategy based on non-overlapping signals⁴. We find that the cross-over strategy generates strong performance during the back-testing period. The highest annualized Information Ratio achieved is 1.61 and is observed for the 1-week vs. 3-

³ 1-minute bar data on the EURUSD exchange rate is downloaded from <http://www.histdata.com>

⁴ We ignore any new signal that appears during the holding period.

month cross-over strategy with a holding period of 10 hours. The 1-month vs. 3-month cross-over strategy with a 3-hour holding period generates an Information Ratio of 1.29 based on monthly P&L. Overall, better results are found when the macro sentiment index is aggregated using long-term windows (3 months)⁵.

Fig 2: Annualized Information Ratio of Monthly P&L by Holding Period; Jan 2010-Jun 2012; Non-Overlapping



This figure shows the annualized Information Ratio of the monthly P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on all signals from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

The highest Hit Ratio achieved is 0.59 for the 1-month vs. 3-month cross-over strategy with 8-hour holding period

Fig 3 lists the Hit Ratios (the proportion of winning trades) of the non-overlapping signals for each strategy by holding horizon (1-10 hours). Overall, the highest Hit Ratio is 0.59 and is observed for the 1-month vs. 3-month cross-over strategy with an 8-hour holding period. For the 1-week vs. 1-month strategy, the highest Hit Ratio is 0.51 when the holding period is 10 hours. For the 1-week vs. 3-month strategy, the highest Hit Ratio is 0.55 when the holding period is 10 hours. Consistent with the pattern of the Information Ratio, the 1-week vs. 1-month strategy tends to have a lower Hit Ratio across all holding

⁵The strategy generates similar performance if evaluated based on weekly or daily P&L. The 1-week vs. 3-month cross-over strategy with a 10-hour holding period generates an Information Ratio of 1.71 (1.29) based on weekly (daily) P&L. The 1-month vs. 3-month cross-over strategy with 3-hour holding period generates an Information Ratio of 1.11 (0.92) based on weekly (daily) P&L. See Appendix B for details.

periods. Over the back-testing period from January 2010 to June 2012, the 1-week vs. 1-month strategy generates about 5.64 trades on average per month, the 1-week vs. 3-month strategy generates about 5.94 trades per month, while the 1-month vs. 3-month strategy generates about 3.15 trades per month⁶.

Fig3: Hit Ratio of Non-overlapping Trading Signal

Holding Period	1 Week vs. 1 Month	1 Week vs. 3 Months	1 Month vs. 3 Months
1 Hour	0.50	0.47	0.55
2 Hours	0.47	0.49	0.50
3 Hours	0.48	0.46	0.53
4 Hours	0.48	0.49	0.51
5 Hours	0.47	0.50	0.56
6 Hours	0.50	0.51	0.55
7 Hours	0.49	0.53	0.54
8 Hours	0.48	0.53	0.59
9 Hours	0.49	0.53	0.57
10 Hours	0.51	0.55	0.55
Average Number of Trades Per Month	5.64	5.94	3.15

This figure shows the Hit Ratio of the non-overlapping signal for each strategy by holding horizon (1-10 hours). The average number of trade per month for each strategy from January 2010 to June 2012 is shown at the bottom of the table.

SOURCE: RavenPack, Histdata, January 2013

We also examine the trading strategy based on all available trading signals that could overlap with each other. Overall, we find lower Information Ratios, slightly lower Hit Ratios and, as expected, more available trading signals⁷. Detailed results are available in Appendix C.

⁶ For the non-overlapping 1-week vs. 3-month strategy 83.4% of days have no trading, while the equivalent numbers for weekly and monthly are 31.5% and 9.4%, respectively. For the non-overlapping 1-month vs. 3-month strategy, 90.3% of days have no trading, while the equivalent numbers for weekly and monthly are 68.5% and 25% respectively. For the non-overlapping 1-week vs. 1-month strategy, 84.8% of days have no trading, while the equivalent numbers for weekly and monthly are 35.4% and 9.4% respectively.

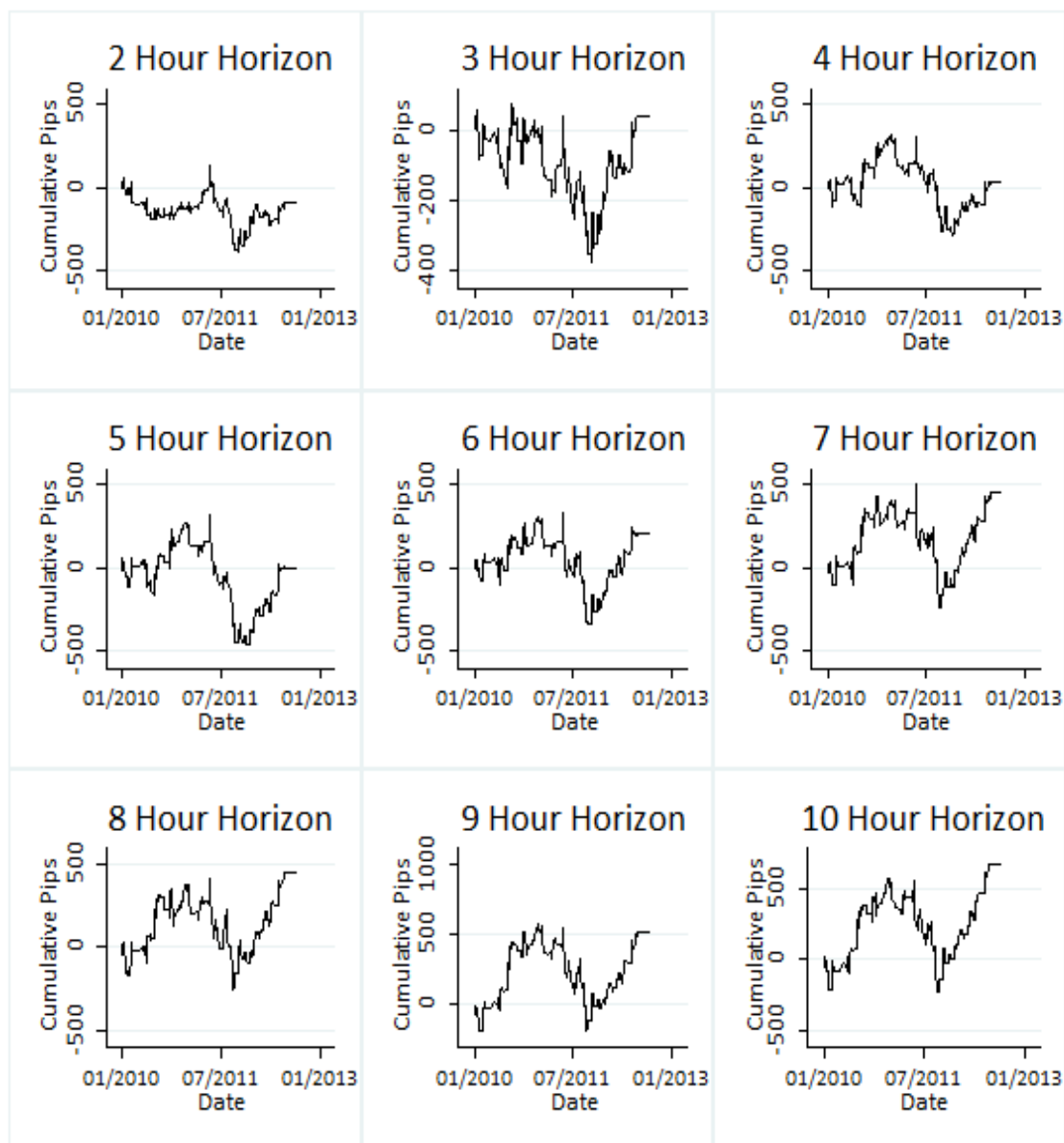
⁷ For the overlapping signal strategy, the number of monthly trades increases to 8.18, 8.06, and 4.06 trades, respectively.

The most desirable trading strategy is the 1-week vs. 3-month cross-over strategy with holding period of 10 hours.

To examine the stability of the trading strategies during the back-testing period, we plot the cumulative pips generated from the cross-over strategy for holding periods from 2 to 10 hours⁸. The cumulative pips from the 1-week vs. 1-month, 1-week vs. 3-month, and 1-month vs. 3-month strategies are plotted in Fig 4, Fig 5, and Fig 6; respectively.

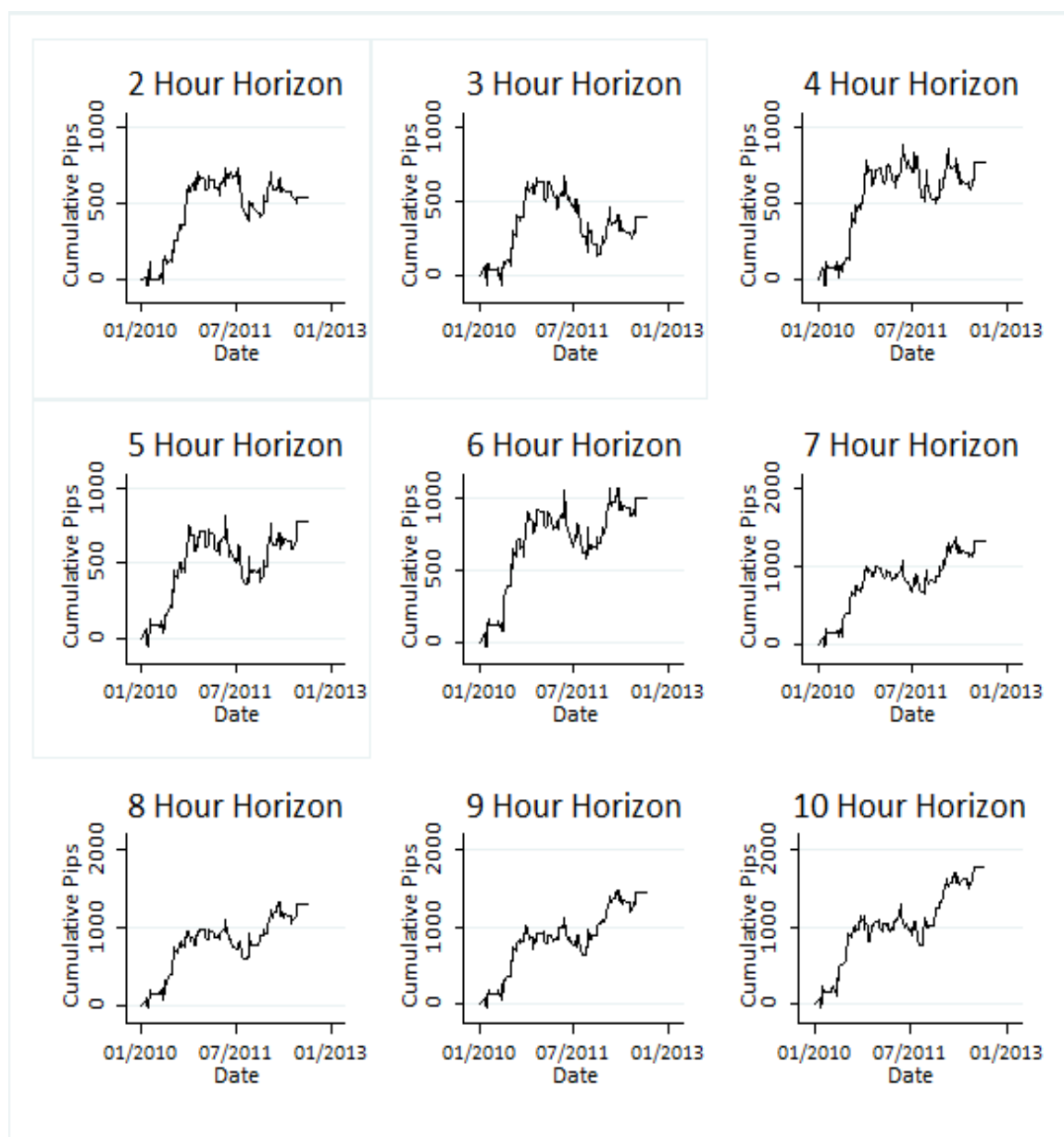
Consistent with the pattern of the Information Ratio, the 1-week vs. 3-month strategy is able to generate stable performance when the holding horizon exceeds 6 hours. The 1-month vs. 3-month strategy, with more sparse signals, is more volatile and only able to generate stable performance for the holding periods within 3 hours. The most volatile strategy is the 1-week vs. 1-month strategy. One possible explanation is that the 1-month aggregation window is insufficient in reflecting the long term macro sentiment trend due to news flow seasonality.

⁸For display purposes, we discard the plot for the 1-hour holding period.

Fig4: Cumulative Pips from 1 Week VS 1 Month Strategy (Non-overlapping)

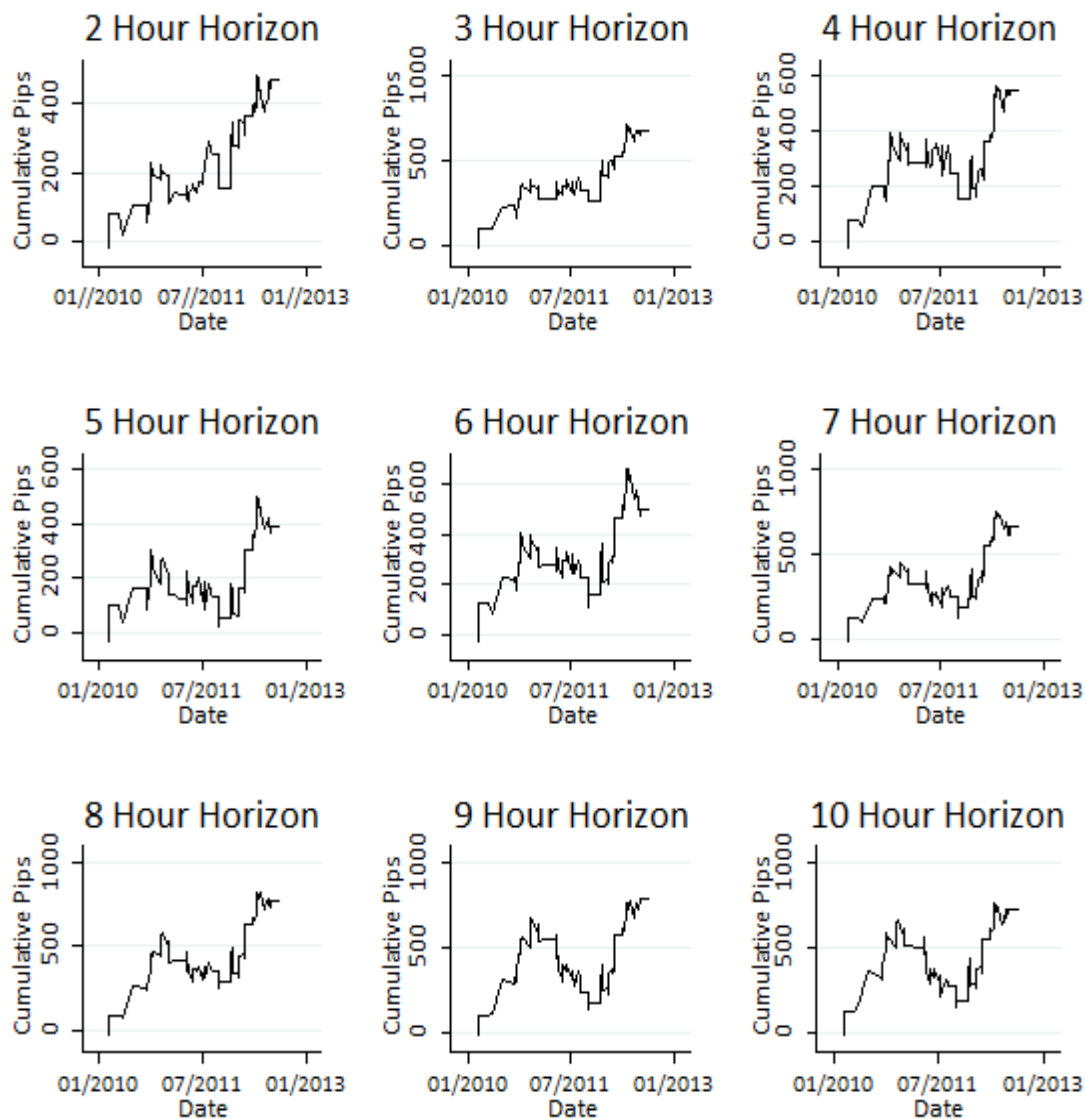
This figure plots the cumulative pips earned from the non-overlapping trading signals of the 1-week vs. 1-month cross-over strategy by holding horizon (2-10 hours) from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

Fig5: Cumulative Pips from 1-Week VS 3-Month Strategy (Non-overlapping)

This figure plots the cumulative pips earned from the non-overlapping trading signals of the 1-week vs. 3-month cross-over strategy by holding horizon (2-10 hours) from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

Fig6: Cumulative Pips from 1-Month VS 3-Month Strategy (Non-overlapping)

This figure plots the cumulative pips earned from the non-overlapping trading signals of the 1-month vs. 3-month cross-over strategy by holding horizon (2-10 hours) from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

The 1-month vs. 3-month cross-over strategy has the highest average pips earned per trade of 5.6 across all holding horizons.

We also summarize the average number of pips earned per trade by holding period for each strategy in Fig 7. Not surprisingly the pips earned per trade tend to increase with the holding horizon. The 1-month vs. 3-month cross-over strategy has the highest average pips earned per trade of 5.6 across all holding horizons.

Fig7: Average Number of Pips Earned per Trade from Non-overlapping Trading Signal

Holding Period	1 Week vs. 1 Month	1 Week vs. 3 Months	1 Month vs. 3 Months
1 Hour	-0.4	0.7	2.5
2 Hours	-0.5	2.8	4.5
3 Hours	0.2	2.0	6.5
4 Hours	0.2	4.0	5.3
5 Hours	0.0	4.0	3.8
6 Hours	1.1	5.2	4.9
7 Hours	2.4	6.8	6.3
8 Hours	2.4	6.7	7.4
9 Hours	2.8	7.4	7.5
10 Hours	3.6	9.0	7.0
Average	1.2	4.9	5.6

This figure shows the average number of pips earned per trade from the non-overlapping signal for each strategy by holding horizon (1-10 hours) from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

RavenPack's news based cross-over strategy is able to predict future exchange rate movements over short term trading horizons

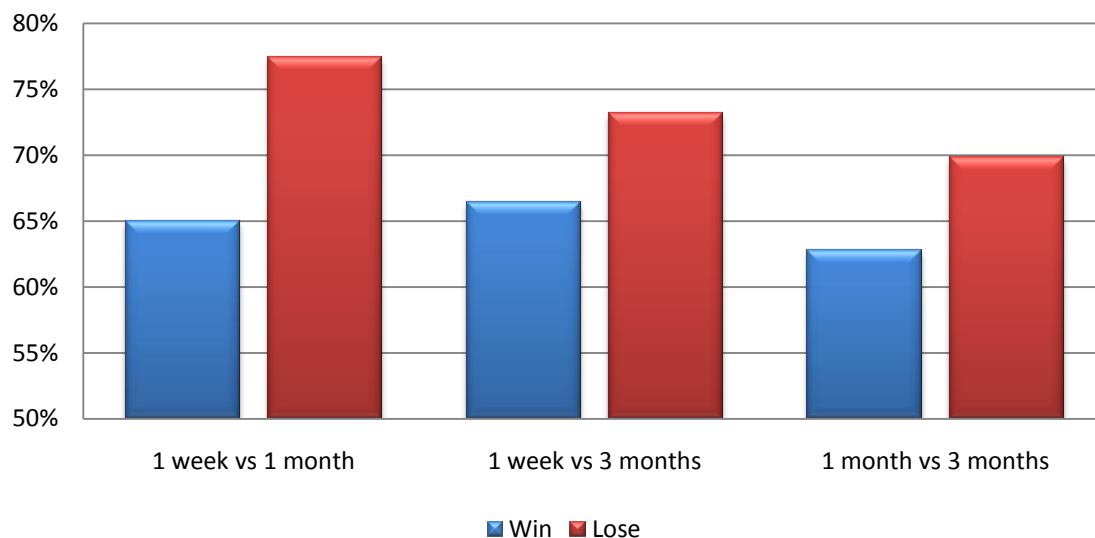
Overall, we find that the news based cross-over strategy is able to predict future exchange rate movements over short-term trading horizons, especially if the faster moving macro sentiment index is aggregated using a window of at least one week and the slower moving macro sentiment index is aggregated using a window of 3 months. The strategy is able to generate positive annualized Information Ratios with stable returns over the back-testing period. Among the three versions of the cross-over strategy, we find the 1-week vs. 3-month strategy to be the most attractive with high Information Ratio, stable performance, and a reasonable number of trading signals.

5. Signal Consistency and Stop Loss Mechanism

We find the losing trade has higher signal consistency than the winning trade across all three strategies.

In this section, we explore the consistency of the trading signals across all holding periods. To this end, we first classify the trading signal into a *winning trade* if it earns positive pips for the 1st hour and a *losing trade* if it earns negative pips for the 1st hour. At the end of each hour for the following 9 hours, we continue monitoring the status of each trade by looking at the cumulative pips. The consistency of the trading signal is then measured as the percentage of time that a winning (losing) trade for the 1st hour remains winning (losing) during the 10 hours horizon. Fig 8 below plots the non-overlapping signal consistency for the winning (losing) trades in the 1st hour by each strategy. Interestingly, we find that the losing trades have higher signal consistency than the winning trades across all three strategies. Specifically, the losing trading signal consistency exceeds 70% for both the 1-week vs. 1-month and the 1-week vs. 3-month strategies.

Fig 8: Signal Consistency by Strategy (Non-overlapping)



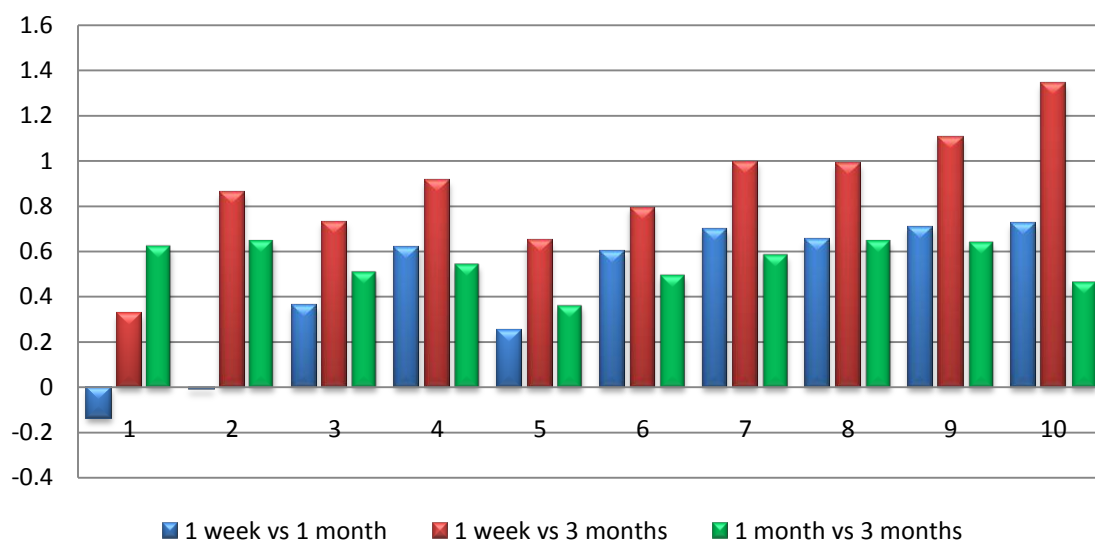
This figure plots the non-overlapping trading signal consistency for each strategy. The consistency is measured as the probability that a winning (losing) trade for the first hour will remain winning (losing) during the 10 hours horizon.

SOURCE: RavenPack, Histdata, January 2013

Given the high probability that a losing trade in the 1st hour will remain losing for the 10-hour window, we introduce a simple stop loss mechanism into the cross-over strategy that can potentially improve performance. Specifically, we dispose of the position at the end of the 1st hour if the trading signal turns out to be a losing trade in the 1st hour. A

more aggressive approach would have been to reverse the position initially taken. In Fig 9 below, we plot the annualized Information Ratio of the monthly P&L on the non-overlapping signals including the stop loss mechanism. The stop loss mechanism is able to improve trading performance for the 1-week vs. 1-month strategy across all holding periods and improve trading performance for the 1-week vs. 3-month strategy with up to 4 hour holdings. The stop loss mechanism, however, is not able to improve the 1-month vs. 3-month strategy⁹.

Fig 9: Annualized Information Ratio of Monthly P&L on Non-Overlapping Signal with Stop Loss Mechanism



This figure shows the annualized Information Ratio of the monthly P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on non-overlapping signals from January 2010 to June 2012. The losing trade during the 1st hour is terminated.

SOURCE: RavenPack, Histdata, January 2013

⁹ See Appendix D for the annualized Information Ratio of the monthly P&L on the overlapping signals including the stop loss mechanism.

6. Conclusion

In this paper, we introduce a hybrid FX trading strategy that applies simple technical analysis to fundamental news. Specifically, we consider a cross-over strategy that tracks the short and long term sentiment trends for a given economy in order to detect cross-over events that can be considered likely sentiment inflection points. The economy-specific sentiment indexes are constructed based on economic and geopolitical news events available as part of the RavenPack News Analytics dataset. We take a “bullish” view on a currency when the short term sentiment trend crosses above the long term sentiment trend and a bearish view when the short term sentiment trend crosses below the long term sentiment trend.

Applying this strategy using one minute bar data of the EURUSD exchange rate from January 2010 to June 2012, we obtain strong performance results with holding periods of up to 10 hours. With a 10-hour holding period, a cross-over strategy between short (1 week) and long-term (3 months) sentiment generates an annualized Information Ratio of 1.61 based on monthly P&L. With a 3-hour holding period, a cross-over strategy between medium (1-month) and long-term (3-month) sentiment generates an annualized Information Ratio of 1.29 based on monthly P&L. These findings suggest that RavenPack's news analytics of both scheduled and unscheduled global macro news can be used as a new source of alpha for market participants in the FX market.

As part of future research, we will expand the strategy into other currencies and asset classes including commodities that are known to move closely with macro news.

Appendix A

ESS – EVENT SENTIMENT SCORE: A granular score between 0 and 100 that represents the news sentiment for a given entity by measuring various proxies sampled from the news. The score is determined by systematically matching stories typically categorized by financial experts as having short-term positive or negative financial or economic impact. The strength of the score is derived from training sets where financial experts classified entity-specific events and agreed these events generally convey positive or negative sentiment and to what degree. Their ratings are encapsulated in an algorithm that generates a score range between 0-100 where higher values indicate more positive sentiment while lower values below 50 show negative sentiment.

ESS probes many different sentiment proxies typically reported in financial news and categorized by RavenPack. The algorithm produces a score for more than 1,200 types of business, economic, and geopolitical events ranging from earnings announcements to terrorist attacks. The algorithms can dynamically assign an ESS score based on fixed scores assigned by experts or by performing analysis and computation when figures or ratings are disclosed in the story.

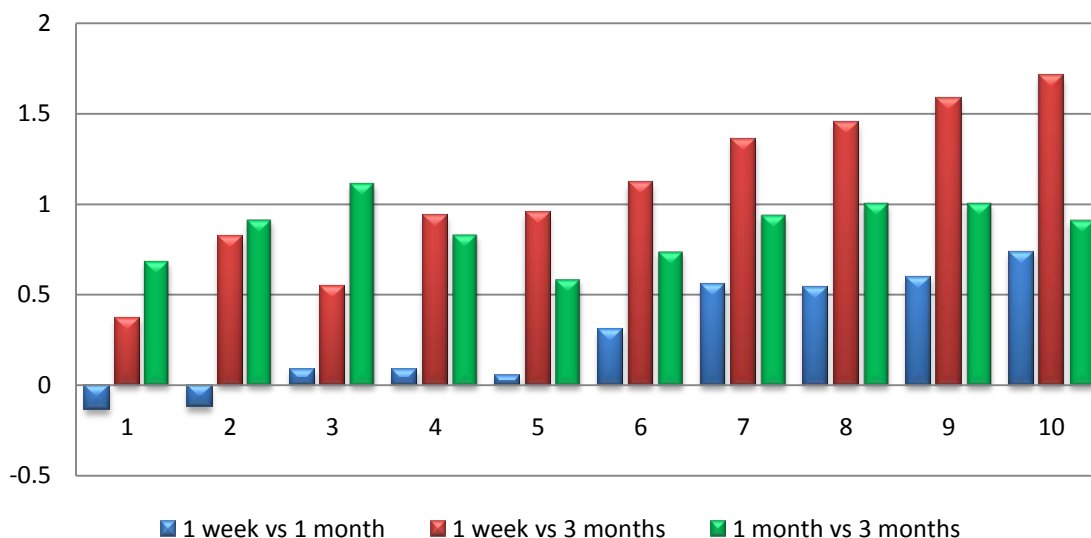
For example, the algorithm is capable of interpreting actual figures, estimates, ratings, revisions, magnitudes and recommendations disclosed in news stories. It can compare actual vs. estimated figures about earnings, revenues, and dividends – and produce an ESS score based on comparisons. It calculates percentage differences between financial figures and reads and interprets stock and credit ratings disclosed by analysts. The ESS algorithms can factor information such as the Richter scale in the case of an earthquake or the number of casualties in a suicide bombing event. The use of emotionally charged language by authors is also factored when shaping the strength component of ESS.

The ESS algorithm has embedded information on ratings scales from all major brokerage firms, investment banks, and credit rating agencies. It uses this information to differentiate and assess the various actions taken by analysts. For example, the algorithm generates a lower (more negative) ESS score for stories about an analyst downgrade from a —Strong Buy to a Strong Sell than from a —Buy to a Neutral . In the case of stories about financial results or economic indicators, it computes the percentage change between the disclosed actual figures vs. the street consensus or any other benchmarks disclosed in the story. For example, a company beating earnings by 70% will receive a higher (more positive) ESS score than a company exceeding a benchmark by 1%.

ESS leverages RavenPack’s event detection technology and produces an entity specific sentiment score every time an event category is matched. ESS is based on RavenPack’s Expert Consensus and Event Score Factors methodologies.

Appendix B

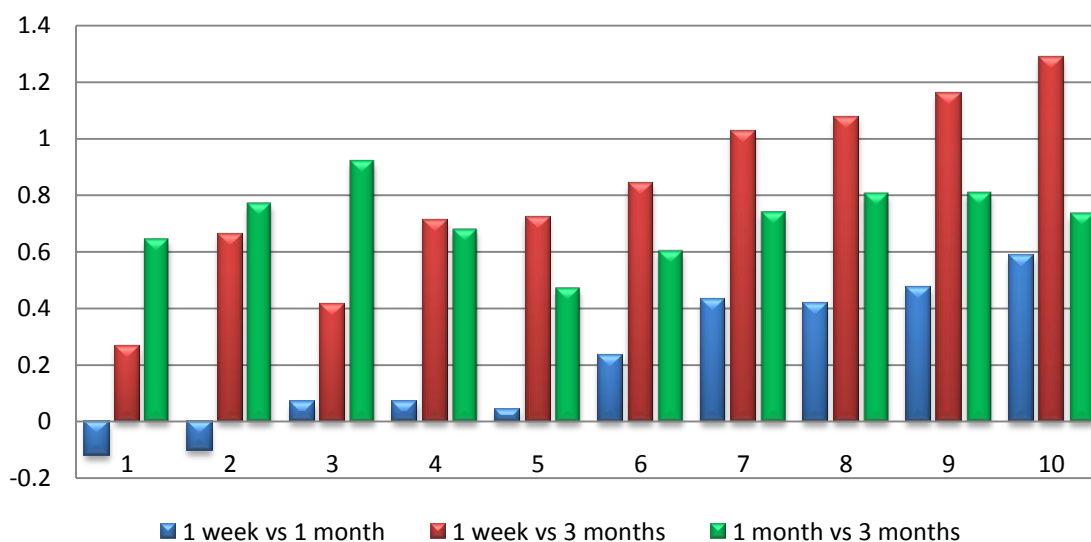
Fig 10: Annualized Information Ratio of Weekly P&L by Holding Period; Jan 2010-Jun 2012; Non-Overlapping



This figure shows the annualized Information Ratio of the weekly P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on all signals from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

Fig 11: Annualized Information Ratio of Daily P&L by Holding Period; Jan 2010-Jun 2012; Non-overlapping

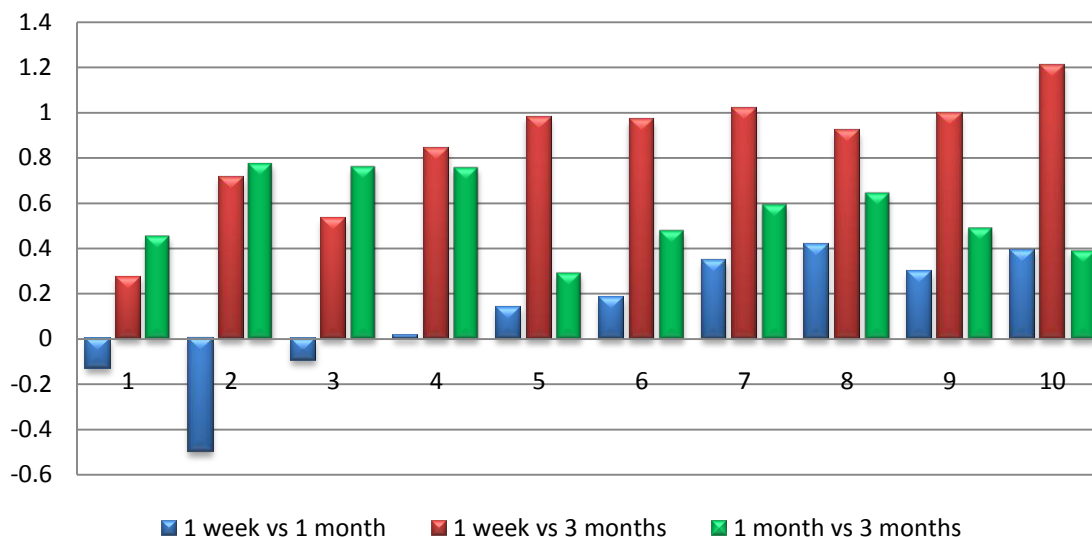


This figure shows the annualized Information Ratio of the daily P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on non-overlapping signals from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

Appendix C

Fig 12: Annualized Information Ratio of Monthly P&L by Holding Period; Jan 2010-Jun 2012; Overlapping



This figure shows the annualized Information Ratio of the monthly P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on all signals from January 2010 to June 2012.

SOURCE: RavenPack, Histdata, January 2013

Fig 13: Hit Ratio of Overlapping Trading Signal

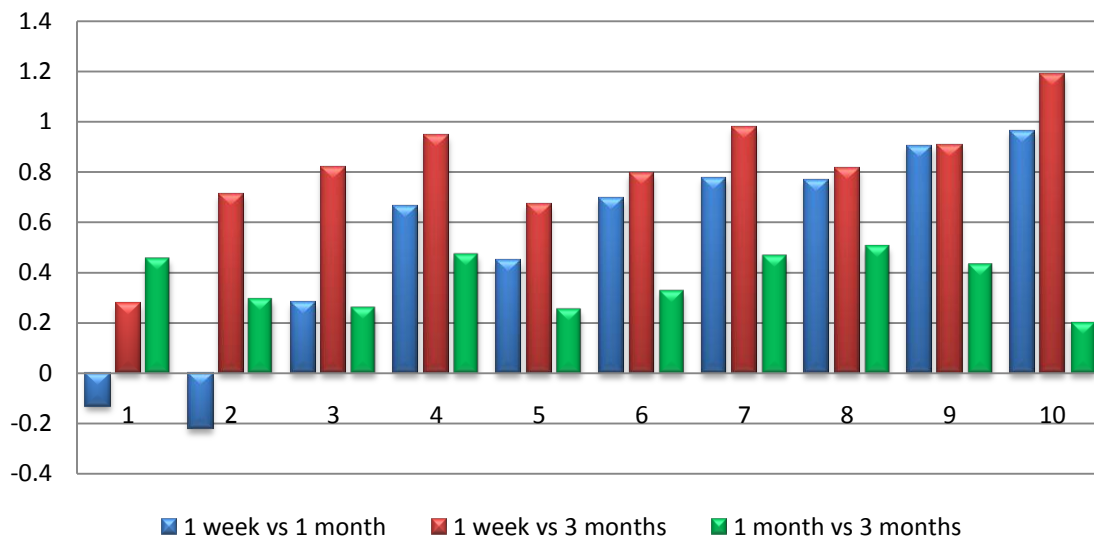
Holding Period	1 Week vs. 1 Month	1 Week vs. 3 Months	1 Month vs. 3 Months
1 Hour	0.48	0.48	0.52
2 Hours	0.44	0.49	0.51
3 Hours	0.47	0.46	0.51
4 Hours	0.47	0.50	0.52
5 Hours	0.48	0.51	0.55
6 Hours	0.49	0.51	0.53
7 Hours	0.49	0.53	0.52
8 Hours	0.48	0.52	0.56
9 Hours	0.49	0.52	0.54
10 Hours	0.50	0.55	0.54
Average Number of Trading Signals Per Month	8.18	8.06	4.06

This figure shows hit ratio of all trading signals for each strategy by holding horizon (1-10 hours). The average number of trade per month for each strategy from January 2010 to June 2012 is shown at the bottom of the table.

SOURCE: RavenPack, Histdata, January 2013

Appendix D

Fig 14: Annualized Information Ratio of Monthly P&L on Overlapping Signal with Stop Loss Mechanism



This figure shows the annualized Information Ratio of the monthly P&L assuming a fixed daily capital of \$10,000 by holding horizon (1-10 hours) based on overlapping signals from January 2010 to June 2012. The losing trade during the 1st hour is terminated.

SOURCE: RavenPack, Histdata, January 2013

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