DUKASCOPY
Swiss Forex Bank & Marketplace

QUARTERLY REPORT

FX

Q2, 2014

AGGREGATE TECHNICAL INDICATOR

FUNDAMENTAL ANALYSIS

TECHNICAL ANALYSIS

ECONOMIC RESEARCH

TRADE PATTERN IDEAS

COMMUNITY FORECASTS

EXPERT COMMENTARY

"In the short term we should expect to see increased levels of volatility as informational shocks from the Japanese tax hike, following actions from the central bank and ECB's rate decision might create some uncertainty."

Tomas Urniežius, economist at Dukascopy Bank SA

Dear traders,

We entered this year full of optimism and hope, as our worries over the USA economy did not materialise and the overall situation in the world seemed to be improving. However, geopolitical tensions emerged and took us by surprise, revealing that at the very least the near future is not going to be characterised by stability and calmness. Since the latest events are highly unlikely to go unnoticed in the context of global economic recovery, a return to the risk-on environment, which was expected to develop in early 2014, will be postponed.

Unfortunately, this is not the only reason to remain cautious and doubtful this quarter. The 18-nation bloc is currently battling with stagnating price growth. We are all well aware of the possible implication if the right action is not taken in time. And even though Japan looks to be close to achieving success by exiting the vicious circle, as inflation is currently fluctuating around 1.5%, this example forced the Federal Reserve, as it now seems, to do a little in excess of what was required in order to rule out any possibility of facing deflation.

In the meantime, the European Central Bank, led by Mario Draghi, refrains from any bold measures for the moment, even though the Euro is on the rise. This tendency of the currency to appreciate may further aggravate the situation, as it increases the risk of declining prices. As a result, many of the economists expect the monetary authority to turn to unconventional easing measures in order to veer the union’s economy away from the spiral the Japan’s economy found itself back in the 90’s.

And although the aforementioned may create a somewhat gloomy representation of reality, it serves the purpose to remind us to ‘trust, but verify’ and to never forget about hedging. Always being ready for the worst possible course of events in order to take proactive measures and prevent them from taking place or at least limiting the potential negative impact of the unwanted events is one of the keys to success in the long run.

Kind regards,

Alexander Suhobokov, CFA, FRM

Head of Research

Dukascopy Bank SA

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Fundamental Overview

Eurozone

The worst was over. At least, analysts and policymakers claimed so. The single currency moved in a strong uptrend versus the greenback, following the rising wedge pattern on a daily chart that started in October 2013, pointing at the strength of the trend. While strengthening of the Euro is speaking in favour of improving economic conditions, overstrong currency can become a massive drag on the 18-nations bloc's economy. Weak inflationary pressure became a main topic for speculations as Europe was facing the same issue as Japan did 15 years ago.

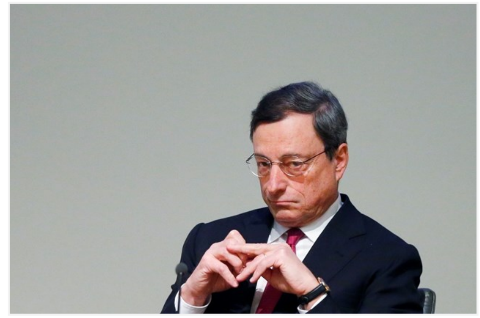
The latest report from Eurostat showed consumer prices stood at 0.5% last month, down from 0.7% in February and hitting the lowest level since November 2009. Moreover, it is 0.1% lower than the value expected by markets. Core inflation, which is considered as a less volatile measure, also eased in March, reaching 0.8% following a 1.0% gain in the preceding month. That puts the inflation well below the official target of 2% and marks the sixth straight month when the rate hovered below 1%. At the same time, there are already three countries with negative inflation, suggesting the ECB is facing a serious need to consider adding fresh stimulus in order to eliminate all the risks of deflation. Earlier in March the IMF said there is a 15-20% risk that long period of inflation below the official level will de-anchor the expected anticipation by the Eurozone's consumers about the longer-term inflation. At the same time, the vast majority of economists believe this risk is equal to 15%. In contrast, Mario Draghi pointed out that deflation risks in the Eurozone are easing for now, and pledged inflation will hit the desired 2% by the end of 2016. "At present there is no reason to expect that overall prices will drop sharply and exert deflationary pressure on the entire economy," according to the European Central Bank.

"At present there is no reason to expect that overall prices will drop sharply and exert deflationary pressure on the entire economy."
- Mario Draghi, ECB President

There are more and more similarities to what we see in Japan now. Shinzo Abe is trying by all efforts to boost growth and inflation, while the ECB was only cutting its benchmark interest rate and pledging to "do whatever it takes" to save the Euro. Back in 1998 BoJ's Governor Yasuo Matsushita signed a report, saying there was no risk of deflation, and within six months Japan's core CPI began falling in a trend that lasted for the next 15 years. Now, in 2014, analysts are expressing their concerns that Mario Draghi risks making the same mistake: publicly calming down investors, diminishing a threat of deflation and not introducing the U.S.-style quantitative easing. Experts are now trying to compare the state of the Eurozone economy and Japan's economy back in 1998. The 18-nation bloc is facing a weak economic expansion following a series of shocks, domestic banks are reluctant to lend money, the shared currency is on the rise, while ECB's monetary policy stance is debatable. All these points were observed in Japan under Matsushita's leadership.

Deflation, however, is not the only concern for the ECB. The situation in the labour market barely improved, as the overall jobless rate stood at 11.9% in February. Although the number of people out of work declined by 35,000 over the period, almost 19 million people are still looking for jobs. What is more important, the latest figures drew attention to the high level of divergence in employment and social outcomes. The unemployment rate in Europe's powerhouse remained unchanged, while situation in Italy's labour market deteriorated further, with the gauge of unemployment soaring to a fresh high of 13.0%. Additionally, producer prices disappointed markets, while fourth quarter's growth was revised down to 0.2% from 0.3% expected earlier, meaning the economy almost stalled. So far, the ECB has done little to boost growth or stop Euro's appreciation, as EUR/USD around 1.40 is a threat to the economy.

'Forward guidance': more and more central bankers stick to this approach now, after Mark Carney implemented it last year during his first policy meeting as the Governor of the Bank of England. The BoE, the Fed and the Bank of Canada, and now Mario Draghi claims that his forward guidance will help to weaken the single currency and decrease real interest rates, diminishing risks of deflation. According to Draghi, the implementation of the forward guidance itself is loosening the monetary policy, as real interest rates move to the south. Moreover, Draghi pointed out that the exchange rate is not a policy target for the European Central Bank; the President warned that constantly rising exchange rate is adding more pressure on the policymakers to maintain price stability. "Our forward guidance ... creates a de facto loosening of policy stance, as real interest rates are set to fall over the projection horizon," claimed Mario Draghi.



Investors were making their bets on the tool Draghi will choose during the March policy meeting. Moreover, dovish comments were required to push the Euro down. Markets were disappointed, once again. The only thing he said is that the ECB is preparing to enter into uncharted territory in the crucial fight against deflation, considering the implementation of the U.S.-style quantitative easing. “There was a discussion about QE, it wasn’t neglected. There are obviously different preferences about which QE would be more effective. We will continue working on that in the coming weeks.” His comments also suggest a negative deposit rate can be the first step. It will be more complicated for the ECB to implement the QE, as American economy absorb cash more easily as more borrowing is done through the capital markets. Moreover, Draghi can face opposition from some countries, like Germany. Nothing is clear yet, especially about central bank’s further actions. The latest meeting only bolstered the case Draghi is ready to “do whatever it takes” to save the Euro. While he is still reluctant to make bold steps, a slew of disappointing data will sooner or later force the ECB to pull the trigger. Therefore, it is highly likely we will see a weaker Euro in the second quarter.

USA

The world's largest economy has lost some of the momentum in the first quarter of 2014. However, it had been predicted by analysts, and markets have been pricing in weak fundamentals since the beginning of the year. The main reason for such a performance was extremely severe weather conditions. March's Beige Book, which is used by the U.S. policymakers to assess the current state of the economy, provided no surprises, as the word 'weather' was mentioned 119 times. The report showed the world's largest economy held its course during the first two months of 2014, even though headwinds from nasty weather impaired growth in some sectors of the economy. "It really looks at weather as the main source of weakness. This latest Beige Book doesn't give us much insight. We are waiting for the clean data. We are very muddled. It seemed fairly upbeat with most regions seeing moderate growth," said Lindsey Piegza, chief economist at Sterne Agee & Leach.

"The general trend is still positive, and that's consistent with a pickup in the overall economy. We look for things to pick up."
- Janet Yellen, Fed Chair

Despite last year's challenges, including the government shutdown and sequester, the economy managed to end the year on a high note. The nation's GDP expanded 2.6% in the three months through December, more than the 2.4% reported earlier, but weaker than the 2.7% growth predicted by analysts. A report also unveiled that Americans were still willing to spend on services, especially health care; boosting the growth further, another sign that earlier slowdown was mostly provoked by a heavy snowfall and low temperatures. It means that the government has overestimated the contribution from non-residential and inventory investments, as companies contributed only 41 basis points towards the fourth quarter's growth. Additionally, a report once again showed a high level of dependence on the household spending, as fourth quarter's final GDP figures were revised up mostly due to the fact consumer spending soared the most in three years.

After low approval rating in 2013, Barack Obama tried to regain the lost positions by drawing brighter pictures regarding future economic outlook. The White House expects more robust growth this year rather than the one recorded in 2013, while growth is likely to pick up in 2015. The current projection stands for 3.1% in 2014. Additionally, unemployment will most likely ease to an average of 6.9% this year. In January the jobless rate turned lower to 6.6%, the lowest in more than five years. Despite these bright forecasts, the recent drop in unemployment was mostly led by the fact many people have stopped looking for job, with the participation rate having fallen to 63% from 66% seen before the start of the recession. At the same time, first quarter's growth can be even weaker than during the previous three months. Charles Evans, president and CEO of the Federal Reserve Bank of Chicago said that first quarter's growth can come below 2% on weather. The first advance GDP will be available on April 30.

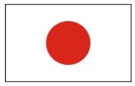
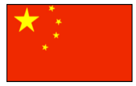
The performance of the U.S. economy looks similar to a recovery from a serious illness. At first, doctors believe the patient starts to return to normal, but later the patient can suffer from permanent damage that can have a devastating effect on health. While economy is still expanding at a stable pace, further slowdown can be an alarming sign. Stronger growth makes both public and private goals more achievable for the government, while slower growth can become a drag on living standards. It will make harder to reduce the budget without any tax hikes, while also posing a threat to the inflation. All this makes it more complicated for the Fed to continue tightening its monetary policy.

Even keeping in mind all these challenges and raising concerns about the sustainability of economic growth, Janet Yellen's first FOMC will remain in investors' memory for a long time. She announced a third $10 billion cut to QE, reducing Fed's monthly bond purchases to $55 billion, which was widely expected by analysts. The Fed's monthly mortgage bond purchases will amount to $25 billion, down from $30 billion, while U.S. Treasury purchases will fall to $30 billion a month from $35 billion. What is more important is the comment the U.S. central bank is preparing for a first rate hike. "The general trend is still positive, and that's consistent with a pickup in the overall economy. We look for things to pick up," said Janet Yellen, Fed Chair. The Fed now projects interest rates to rise to 1% by the end of the next year, up from 0.75% expected in December. Regarding the short-term rates, they are projected to stand at 2.25% by the end of 2015, significantly above the previous forecast of 1.75%. Some of the analysts even believe the Fed will make the first move in the spring, before the middle of 2015. Yellen, however, agrees there is a "slack" in the labour market, suggesting the Fed will still be intervening financial markets for some time.

These comments can be interpreted the same as Mario Draghi's pledge to do whatever it takes which provided a boost to the single currency that lasts until now. The EUR/USD has been appreciating since July and the single currency around 1.40 is a serious threat to European exporters. With hawkish Fed, weak inflation in the Eurozone and overstrong single currency, the bullish rally in EUR/USD can be running out of steam soon. Moreover, Dukascopy traders have been selling the pair almost in 60% during the whole first quarter. The consensus forecast for the most traded currency pair for the second quarter stands for 1.33, with the maximum at 1.36, while the lowest level is seen around 1.31. At the same time, USD/JPY is forecasted to hit 106 by the end of the second quarter.

Despite a recent weakness, the economy will continue gaining momentum, as consumer spending remains strong, housing market is on the mend, while other leading indicators also speaking in favour of the rate hike. The labour market is still a major concern, as participation rate is low, while productivity is also lagging. Janet Yellen has dropped the reference to the 6.5% unemployment rate, saying the Fed will focus on the qualitative assessment of the domestic economy. Some have already called Yellen's actions as a "qualitative teasing", but with the central bank projected to continue tapering its QE and the first rate hike on the horizon early in 2015 the economy should be strong enough to withstand the tightening of the monetary policy.

Asia & Pacific

Last time we predicted that Asia-Pacific region is facing strong but uneven growth, with intra-regional divergences likely to become the main feature. Moreover, the main driver of growth in 2014 was expected to be external demand, not the domestic one. At the same time, we have stated that it is relatively easy to predict the direction of the Asian currencies next year, as policymakers in Japan, Australia and New Zealand have already pledged to stick to certain moves in their monetary policies. In reality, only the Australian economy surprised markets, as the Reserve Bank of Australia switched to a less dovish or even hawkish view on the back of optimistic data. With extremely positive fundamentals from New Zealand, the end of the easing cycle in Australia, the Bank of Japan readiness to pull the trigger if needed and still strong Chinese economy, Asia & Pacific region can play more important role in the global economy. According to the ANZ, Asian economy will account for around 35% of the global economic output by 2030 and the share will soar to 50% by 2050. Regarding the region's bond markets, they all, with the exception of Japan, are projected to expand to six times their current size during the next 15 years. "The U.S. and Europe will receive less of China's outward investment, with Chinese foreign direct investment increasingly favouring Asia Pacific markets. Sound government policy should be focused on developing strong institutions, strong regulatory and supervisory systems, and cultural changes needed for a modern, open financial system," said ANZ chief economist Warren Hogan.

"The U.S. and Europe will receive less of China's outward investment, with Chinese foreign direct investment increasingly favouring Asia Pacific markets."
- Warren Hogan ANZ chief economist

While these projections can sound too promising, the latest performance of the world's second largest economy is raising concerns about the sustainability of the growth. Weak fundamentals raised concerns that Beijing's financial power will not be sufficient enough to keep economic engine ticking over. Chinese companies reported disappointing profits, while domestic banks took large debt write-offs. In addition to that, the gauge of manufacturing activity slowed to an eight-month low of 48.1 in March, having stood in the contraction zone since January. Both output and the number of new orders surprised markets to the downside, intensifying fears that weak demand from China can not only cool domestic growth, but also become a massive drag on other economies.

China is the top import partner for New Zealand. Therefore, the country is highly depended on demand from Asia's largest economy. In theory, economic slowdown in China should result in weaker shipments from New Zealand. Nevertheless, a slew of positive statistics from Kiwi diminished all the earlier concerns. In February the economy recorded an $818 million trade surplus as shipments of primary-industry goods, especially to China, rose further. In addition to that, the nation's gross domestic product posted a 3.1% growth in the final quarter of 2013 slowing from 3.5% a quarter earlier, but outpacing analysts' predictions for a 3.0% growth.

Accelerating economic output underpins signs domestic economy is on the right track, and adds more pressure on the RBNZ to make a quick monetary policy response, as inflationary pressure will increase. A pickup in milk production, construction sector and stronger shipments mean that Kiwi economy will continue gaining momentum. During March policy meeting it finally happened. After months of uncertainty and not very convincing comments from the RBNZ, a rate hike was finally made. New Zealand policymakers decided to increase the official cash rate by a quarter percentage point to 2.75%, widely meeting analysts' expectations. Additionally, the central bank claimed their intentions to remove stimulus faster than initially was thought in order to contain inflation. A rate hike was inevitable, as the economy was projected to expand 3.3% in the year to March. Kiwi's growth is accelerating amid stronger demand from trading partners. After hitting a low of 0.8051 on February 4 NZD/USD began its appreciation and the rally is not over yet. While Dukascopy traders are selling the Kiwi in 72% of all cases across the board, fundamentals are speaking in favour of another rate hike. Therefore, NZD/USD can advance higher, as it has already breached monthly R2 at 0.8663, with the next key level for long traders being located only the historic high at 0.8844.

The Australian Dollar is moving back into "uncomfortable" level against the U.S. Dollar, with the pair climbing above 0.91. The Aussie strength is boosted by some certainty over the local interest rate outlook and overall economic forecast. Australian policymakers left the key refinancing rate unchanged at 2.5%, pledging a period of stable interest rate. Minutes also showed that record-low interest rates are boosting growth. The central bank now believes that stable interest rates will bring the Aussie lower, providing additional boost to the economy. "The market is becoming more and more convinced that the RBA easing cycle has ended with the rate curve no longer pricing in any further cuts," said Boris Schlossberg, BK Asset Management managing director.

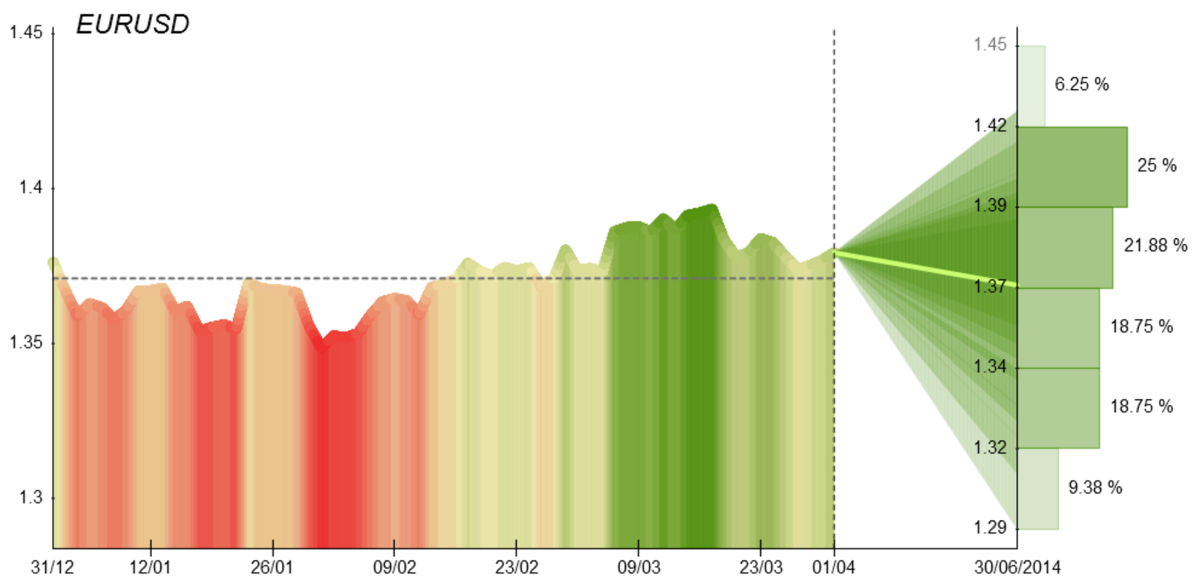
The easing cycle is over, the RBA made it clear. But will they follow RBNZ's example soon? In case markets start speculating on the first rate hike, AUD/USD can easily climb towards a monthly R2 at 0.9265.

While Australian and New Zealand economies are building up steam, the world's third largest economy can find itself on the brink of another recession, after the sales tax hike on April 1. Last year, analysts were claiming the USD/JPY can soar to 112 amid hawkish Federal Reserve and more stimulus from the Bank of Japan. After hitting a low around 100 level on February 4, the pair bounced back. However, for now it looks more like a sideways movement, rather than a beginning of another rally. According to an aide of Shinzo Abe, the central bank should double its annual pace of bond purchases to 100 trillion yen, providing a fresh impetus to the world's third largest economy. Abe's advisor, Koichi Hamada considers May will be the appropriate time for introduction of the additional stimulus, as the 3% tax rise will damage the economy. Moreover, fourth quarter's growth of just 0.7% showed Abenomics did not manage to provide a significant support to the economy.

Despite certain challenges, Asia/Pacific economies are still growing rapidly, with China, Japan and South Korea representing around 25% of the overall world output. Moreover, such countries like New Zealand and Australia are gaining momentum and becoming more and more attractive for investors. However, these countries can face a problem of "uncomfortably" high domestic currency. Hence, policymakers should react quickly to any alarming signals.

Community Forecasts

EUR/USD



For the second consecutive quarter, the EUR/USD currency pair has been trading in the boundaries of a rising wedge pattern. During the first three months of 2014, the pair touched once each of the trend lines, and, despite fluctuation in a 486-pip range, the pair is still trading in the boundaries of a pattern. The pair ended the quarter almost unchanged, even despite the fact it continued its rally that started in July. Throughout the quarter Dukascopy traders were selling the pair almost 60% of the time, and according to Community members, the pair will head South during the second quarter. The consensus forecast stands for **1.3688**, a level just slightly below monthly and weekly S1. The outlook is bearish, as indicators on a daily chart are sending 'sell' signals, and the key level for short traders is located at 1.36- pattern's support, weekly S2 and a 200-day SMA. Strength of the single currency has been a major concern for the policymakers, as it has made products less competitive globally and cooled growth. Moreover, inflation stood at a four-year low, hence Euro's rally can be running out of steam soon. "Euro will rally for some time, but from deflation pressure and fragile Spain, Portugal and Greece I am bearish on EUR/USD in a long-term perspective," said trader NikolaFX.

Mimuspolyglottos

"The second quarter of 2014 will show how USA economy performs when "third party" If USA recovery is a bogus, USD will suffer market's wrath. I expect EUR/USD could reach the right shoulder's price of 2011 Head & Shoulders formation which is at approximately 1.425."

Geula4x

"EUR/USD seems to be under bearish pressure in the daily chart. Market seems to react to recent dovish comments by ECB members by weakening the Euro against the US Dollar. Resistance lies around 1.3950, while support lies around 1.3500, which prevented price from moving lower."

Technical Overview

EUR/USD

Daily Chart

100-day SMA 200-day SMA

2014 Q1 Summary

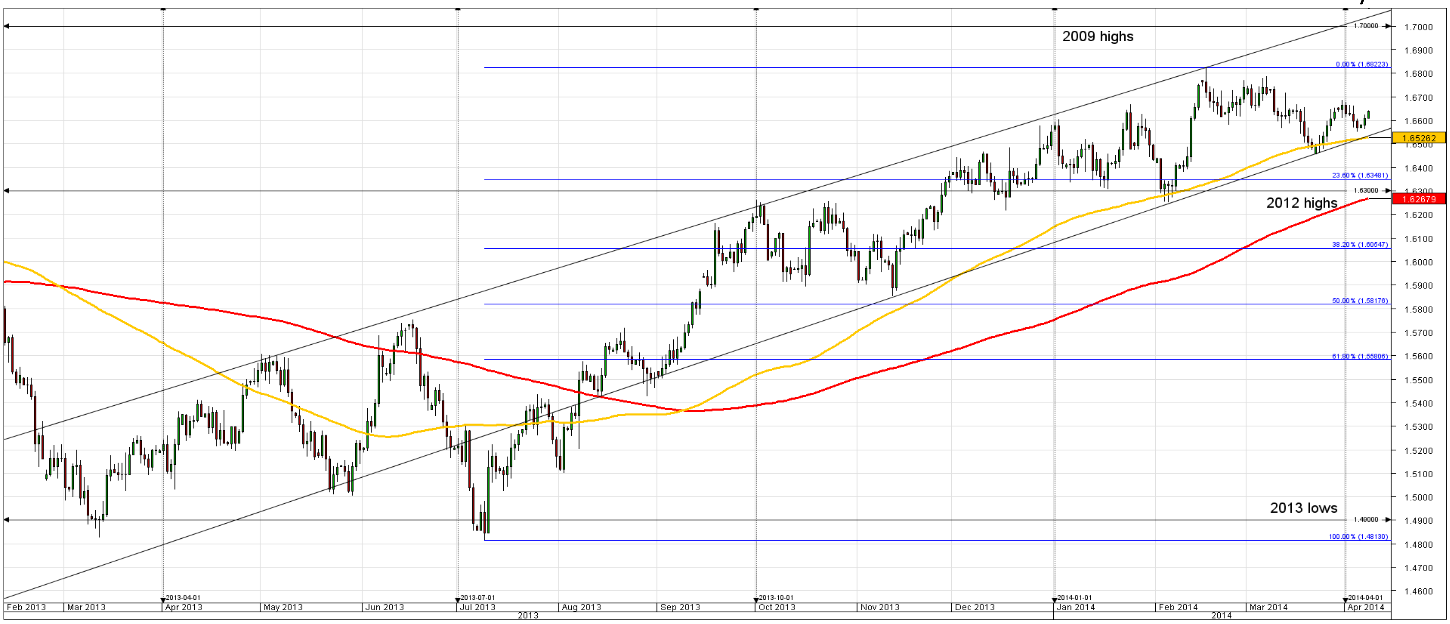
Last quarter we shared our view of further development in the EUR/USD's chart mainly on the assumption that the resistance at 1.38 had a high chance of preventing additional appreciation of the single European currency and that it may potentially trigger a strong sell-off. This hypothesis was based upon a supposition that it would be the most likely point of contact with the major down-trend resistance line connecting some of the most distinct peaks, such as the ones staged in July of 2008 (1.60) and in May of 2011 (1.49). However, the falling line that was supposed to curb demand for the bloc's currency turned out to be somewhat less sloped than initially estimated. Therefore we have redrawn it and now this line creates a ceiling 100-150 pips to the north from the initial point. There it also crosses a two -year up-trend, hardening the case of a formidable supply zone located just above 1.39.

2014 Q2 Outlook

Accordingly, despite the resistance at 1.38 failing to cap the currency pair, there are still enough arguments to claim that the long-term outlook on the Euro is bearish and the common currency will not succeed in reaching the 2011 October highs, namely the 1.42 mark. One of the main reasons to hold bearish bias towards the Euro is the fact that the exchange rate is closing in on the apex of the rising wedge, which traces its origins back to the first half of 2012. And even though the pair could stay near 1.39-1.395 for some time, eventually the bears are likely to take the upper hand and force the pair to descend. In this case, the first notable support is going to be the 100-day SMA standing at 1.37. Meanwhile, an even more important demand area is 100 pips lower, where the 21-month up-trend merges with the 200-day SMA. If the latter support does not manage to hold the price afloat, the rising wedge will have a good opportunity to realise its full bearish potential. The 2013 lows at 1.28 and 2012 lows at 1.20 will then be considered to be viable targets to pursue in the long run.

GBP/USD

Daily Chart



100-day SMA 200-day SMA

2014 Q1 Summary

At the start of this year, we echoed forecasts voiced by many large international banks that implied overvaluation of the Sterling. We were also expecting GBP/USD to halt its seemingly protracted advancement, which was started nine months ago, and then to be pushed down, back to its earlier trading levels. However, the first three months of 2014 were not characterised by elevated volatility and, despite the Cable trading within the boundaries of the rising wedge pattern, a situation which usually portends a reversal of the up-trend, the Sterling carried on with the recovery commenced in early July 2013. The currency pair was well supported by 2012 highs at 1.63 and eventually it eroded all nearby resistance levels, only to stop short of reaching the 2009 highs at 1.70. The Cable peaked at 1.6822 on Feb 17, and since then it has been in a constant decline, giving up more than three figures already.

2014 Q2 Outlook

Right now the currency pair is testing the support at 1.65, created by the 100-day SMA and a seven-month up-trend. If the demand area proves to be tough enough to rejuvenate bullish activity, there will be a strong case for an upward-sloping channel to be fully formed. Then the British Pound will be in a good position to surpass its recent high (1.6822) and re-test the level last seen back in 2009. Conversely, in case 1.65 is breached, the pair will be inclined to slide down to 1.63. A sell-off beyond that point, however, is going to be a difficult task for the bears to accomplish, considering that the 2012 highs stationed there are reinforced by the 23.6% Fibonacci retracement of the July-February up-move and, perhaps even more importantly, by the 200-day SMA. In a scenario where the support at 1.63 does not provide sufficient demand, the currency pair will confirm its long-term bearish intentions and may set the goal at the level of the 2013 lows, that is, 1.49.

USD/JPY

Daily Chart

100-day SMA 200-day SMA

2014 Q1 Summary

The explicitly bullish tendency of USD/JPY observed throughout the last quarter of 2013 was not carried into the next year. Instead, the currency pair topped out at 105.44 and subsequently began to slide lower. However, after the exchange rate had plunged nearly five figures within a single month, the support at 101.91, represented by the 50% Fibonacci retracement level of the November-December rally in 2013, did not let the overall positive outlook to deteriorate further and preserved optimistic towards the U.S. Dollar bias. On the other hand, we must note that it also failed to rekindle interest in the buck for the market participants, thereby postponing the recovery, as USD/JPY remained capped by the three-month line with a negative slope.

2014 Q2 Outlook

The present context in the market is somewhat reminiscent of the pattern that developed in the second and third quarters of 2013, when the currency pair shaped a symmetrical triangle. And while USD/JPY may have just formed a descending triangle instead of a symmetrical one, it is highly unlikely to change the essence of the situation, namely, the fact of a break-out to the upside, since both of these figures usually imply continuation of the major trend, which in our case is bullish. Accordingly, we would expect the support at 101 (15-month up-trend and 200-day SMA) to limit potential losses in the near-term and help the currency pair to regain upward momentum. Consequently, during the next three months the U.S. Dollar will be in a good position to appreciate to its recent peak of 105.50 yen, on the condition that neither of the resistances, such as the 100-day SMA at 103, will be capable of holding the surge for long.

USD/CHF

Daily Chart

100-day SMA 200-day SMA

2014 Q1 Summary

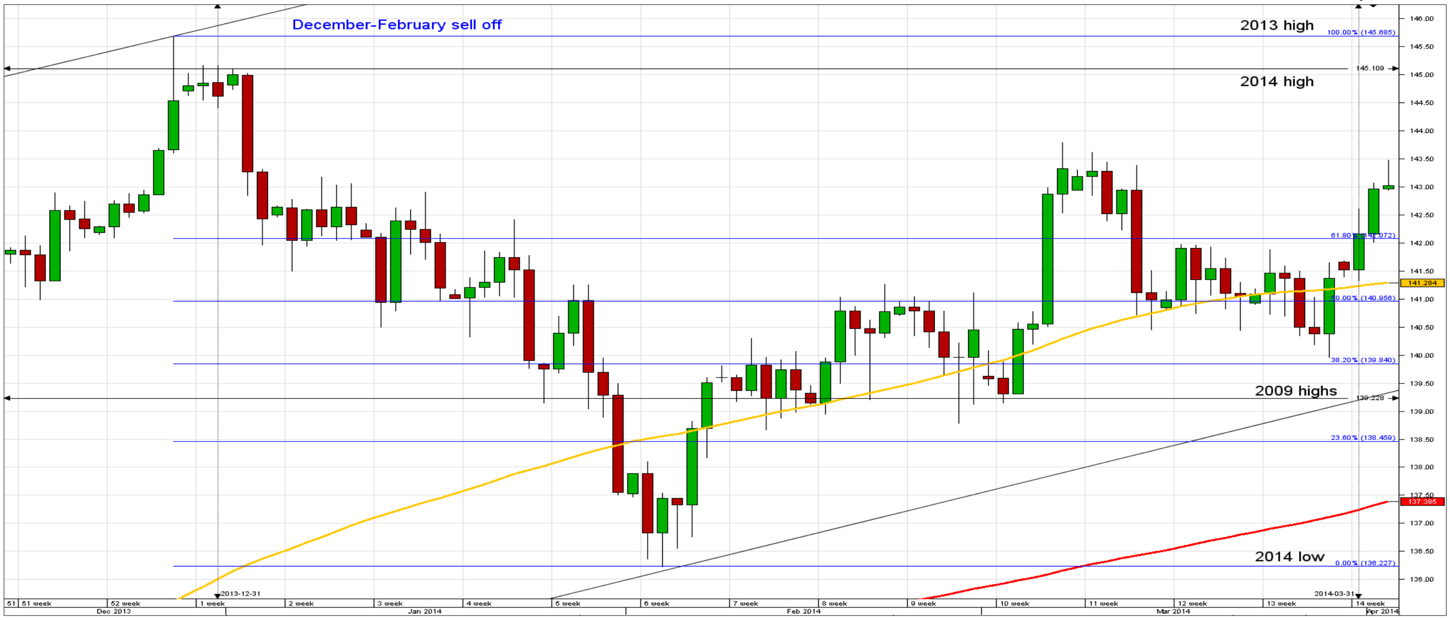
USD/CHF, following the formation of a falling wedge for three quarters (Q2-Q4 of 2013), broke out to the upside from the pattern. And, as suspected, the surge did not last for long, being that first it met the 100-day SMA and then the pair completely lost upward impetus due to an encounter with the 200-day SMA that proved to be impenetrable. Since then the Greenback has been constantly weakening relative to the Swiss Franc, and it nearly reached the 2011 May lows at 0.86 last month, even though the SWFX market sentiment towards the pair was always heavily bullish (70%+ of open positions were long). The descent was stopped by the long-term down-trend support line, which has been in force from the beginning of 2013 and is therefore highly unlikely to be violated in the foreseeable future.

2014 Q2 Outlook

Given the position of the latest peak staged by USD/CHF, we may draw a new, less-sloped (compared to the one discussed last quarter) upper trend-line. By doing so, we may come to the conclusion that there is still a falling wedge being formed on the daily chart. If this turns out to be true, the supply zone near 0.89 should be reckoned to be in danger, even though it is currently reinforced by the simple moving average for the last 100 days. Should this resistance be breached, regardless of its hypothetical toughness, there will be yet another challenge for the currency pair's recovery represented by the 200-day SMA at 0.905, which may turn out to be even more challenging to breach, considering the most recent fluctuations near it. But in case of success USD/CHF may potentially open up a path towards the 2013 highs at 0.98, which were last seen in the first half of 2013, but this is already a perspective for the end of the year that we mention now; for the second quarter of 2014, reaching 0.905 will be more than enough.

EUR/JPY

Daily Chart



100-day SMA 200-day SMA

2014 Q1 Summary

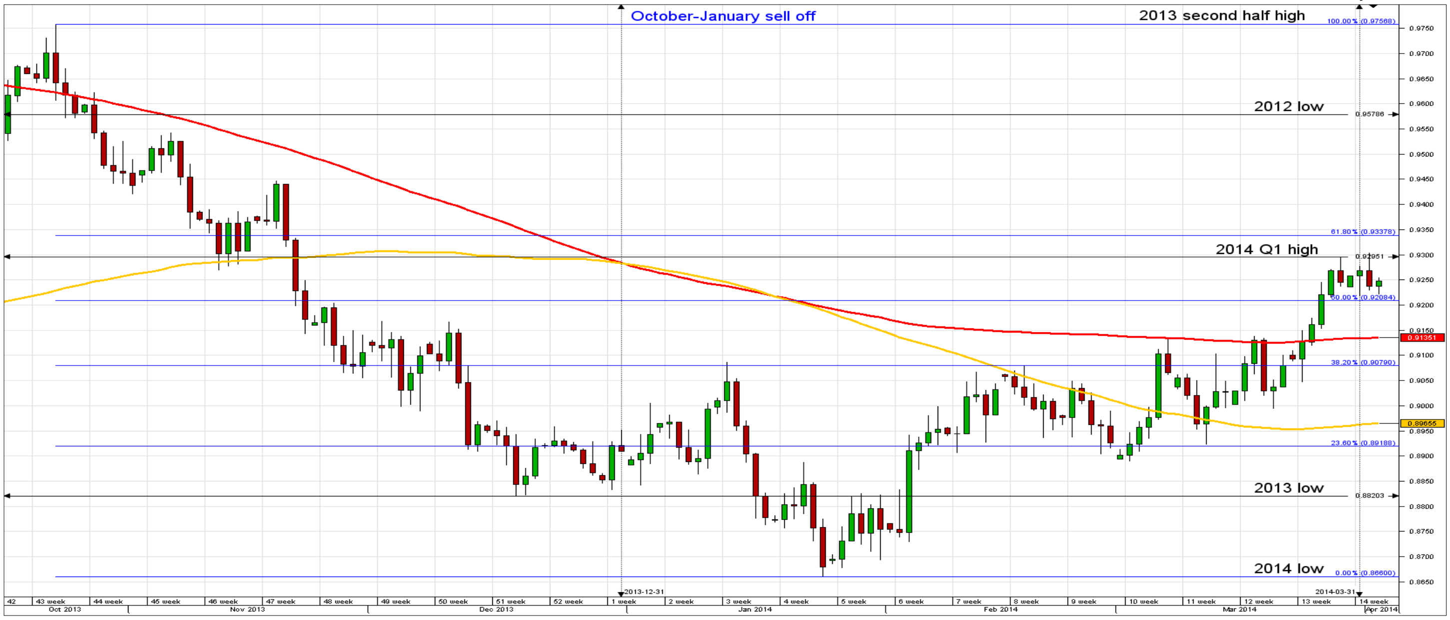
In the first quarter of 2014, the pair remained in the boundaries of a long-lived Channel Up (resistance goes through the February and March 2012, February and May 2013 highs; support goes through April and November 2014 lows) and was heavily influenced by the Fibonacci retracements of the sell off from channels resistance to the support (December to January) as 23.6%, 38.2% and 50% retracements kept the pair bound in February and March. The highest level in 2014 was reached in 1st of January already, but we expect the 7th of March peak to have stronger psychological effects in the future.

2014 Q2 Outlook

In the short term we should expect to see increased levels of volatility as informational shocks from the Japanese Tax Hike, following actions from the central bank and ECB's rate decision might create some uncertainty. In the medium term the pair is expected to slowly climb higher, mainly due to the support coming from the mentioned long term channel and mild momentum gained from it. However, March peak till 143.79 might cause the pair to take a step back. If it manages to push the pair below the 142 JPY the Fibonacci retracements of December to February sell off should come back into play. The importance of 100-day SMA, as it seemingly also helped to push the pair higher in February and March, should not be underestimated either. If the pair is to retreat till 142 JPY, the 100-day SMA should be absolutely capable of providing strong enough impetus to ignite rally. In case of such, or any other, bullish scenario 2014 and 2013 highs will become the main key points. As these are the highest levels since October 2008, peak above it would put 150 JPY on the map.

AUD/USD

Daily Chart



100-day SMA 200-day SMA

2014 Q1 Summary

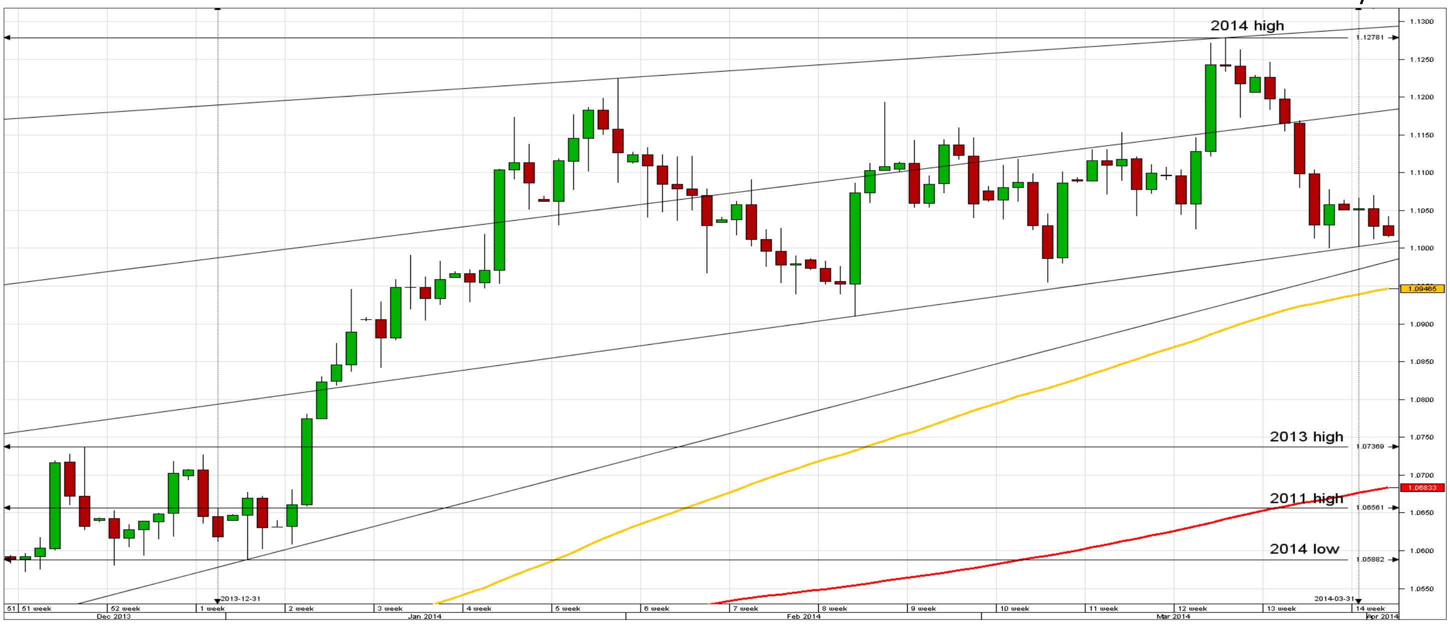
There was a fair share of uncertainty regarding the further moves of the Aussie-Greenback cross at the beginning of the period. It spent quite some time trading sideways and seemed like about to resume the sell off which started in October. However, at the end of January, it started to recover the losses that occurred since October. 23.6% and 38.2% retracements of this sell off, together with 100 and 200-day SMAs, kept the pair bounded through January and March. After breaking through the mentioned levels the pair now seems to be consolidating around 93 cent mark.

2014 Q2 Outlook

As mentioned, consolidation is taking place slightly ahead of 61.8% retracement. It is likely to have at least a remote effect on the pair as pair's bulls might be hesitating to try to push the pair higher for the time being. 100 If, or more likely when, the pair advances above the mentioned Fibonacci retracement, we should see a substantial bullish momentum as ahead of major level at 95 we have only a monthly R1 pivot at 0.9412. After that some bearishness could be expected around the 2012 low as psychological effects coming from it should be strengthened by the monthly R2 at 0.9556. However, despite these strongly bullish expectations, we do not see the pair advancing above the 0.9757, the highest level since June, 2013. We see the pair as being rather resilient for bearish impetus the upcoming quarter. Besides, 200-day SMA already proved that it is capable of holding the pair. Not much far behind we can find the 100-day SMA. In case, unexpectedly, both of these levels fail the 38.2% and 23.6% retracement of the October to January sell off should most certainly stop if the pair's decline if not to kick it back up again.

USD/CAD

Daily Chart



100-day SMA 200-day SMA

2014 Q1 Summary

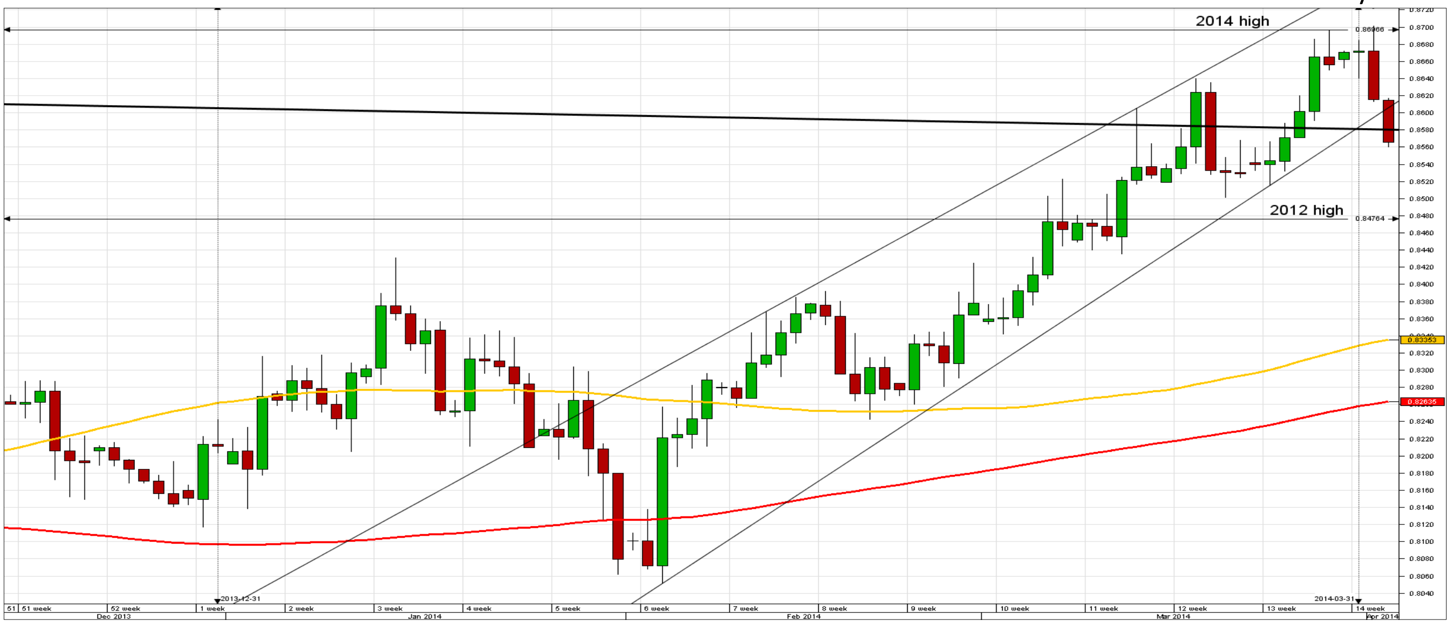
Right from the very beginning of the quarter the pair disrespected the uptrend resistance connecting the March and July 2013 highs. However, it kept the pair somewhat bound from mid-February until mid-March. During this quarter, the pair seemingly formed new uptrend resistance. It connects the January and March highs. However, its importance is questionable since both of these levels are the highest since July 2009 and their nominal values should have more effect in the future than the uptrend.

2014 Q2 Outlook

At the moment pair is trading at a very interesting point. On 11th of April, two uptrend supports are set to intersect (short term (second lowest uptrend line) connects February 19th and March 31st dips; long term (lowest uptrend line) connects October 23rd 2013, and January 2nd 2014). We should see at least some increased volatility then. Outcome could determine the general trend of the pair till the beginning of July and could cause it to test the 2014 high as soon as in the second half of the April. That is assuming that monthly PP and R1 at 1.1095 and 1.1235, respectively, would not cause much trouble for the pair on the way up. In an alternate scenario, in case of a failure at any of the monthly pivots or if neither of the uptrend supports, the short term or the long term, holds, the 100-day SMA, estimated around 1.10 at that time, would be the first support level to start eying. If it does not hold, the cluster of support levels around 1.075 (monthly R2, 2013 high and 200-day SMA (estimated at that time)) should stop the pair's decline, if not to ignite a recovery back at least until 1.10. In case of a highly unexpected dip below the 1.075 are we should start looking at the 2014 low around 1.0580.

NZD/USD

Daily Chart



100-day SMA 200-day SMA

2014 Q1 Summary

At the beginning of the quarter, the pair remained in the 380 pip range, between 0.8431 and 0.8051, in which it was for the most of the time since mid-September, 2013. The only episode outside it was a brief moment when the 2012 high was tested on the second half of October. The 100 and 200-day SMAs were around the pair, but seemingly had close to no effect on the pair's performance. However it might be that the 200-day SMA gave the initial impetus for the pair's appreciation at the beginning of February and the 100-day SMA send it head first upwards on second half of February.

2014 Q2 Outlook

We can see that, despite the initial failure, the downtrend resistance, connecting the 2013 (April) and 2011 (August) highs, was not respected in the end of the quarter. However, the pair seems to be returning below this line and we think that the monthly PP at 0.8470 should not have any impact on this. We expect to see the pair trailing below the 2012 high/monthly S1 at 0.8476/44. At that point we should start eying the 100 and 200-day SMAs which should be somewhere in the 0.8300/350 area. As the two should be converging at that point, they should act as a strong support and provide strong enough bullish impetus for the pair to test the resistance of the mentioned downtrend once more. In case the 100 and 200-day SMA fail to keep the pair afloat we should start looking at the monthly pivots at 0.8216 (S2) and 0.8090 (S3), 2014 low at 0.8051 and 80 cent mark. Monthly pivots might cause some bullishness, but at the moment seem unlikely to cause any major bullish action on their own. The 2014 low and the 80 cent mark, that's were we expect to see substantial action if the pair goes that low in the upcoming quarter.

Expert Commentary

Euro

Ulrich Leuchtmann
Head of FX Research
Commerzbank
Germany

What performance do you expect from the Euro versus its major counterparts during the second quarter?

I expect EUR/USD to trade mainly sideways or in a slight downward trend, but we do not see any spectacular movements. Basically, this is due to the fact that currently the exchange rates are mainly driven by the outlook for central banks. We do not expect any bold actions from the ECB in the near future, and the path of the Fed is pretty clear at the moment. However, this is something that might change later this year, but for now I do not see any big drivers.

As I said, I expect a little bit of a downward trend for EUR/USD, simply because the discussions inside the ECB about further expansionary measures are something that might prevail, and therefore might put some pressure on the Euro. Since we do not anticipate the central bank to take any measures, I suppose the Euro movement will be quite limited.

Since we do not anticipate the central bank to take any measures, I suppose the Euro movement will be quite limited.

- Ulrich Leuchtmann

What will be the main drivers, which will impact Euro's performance during the second quarter?

In my point of view, the shared currency will mainly depend on the ECB's behavior. Recently we have heard some pronounced comments from the different central bankers including Mario Draghi, Jens Wiedmann and others regarding the Euro's strength. This is putting something like a ceiling into the EUR/USD movements. Therefore, I believe that the upside potential will be mainly determined by strength of this verbal intervention that ECB is conducting.

If the ECB really considers further expansionary actions more openly and more meaningfully, I suppose that downside trend would be even more possible. Hence, it is mainly a question of how the ECB is thinking at that moment. Additionally, the Euro is partly driven by economic factors, especially by the Eurozone inflation rate. It is also something to watch closely, because it might determine the ECB's behavior.

What are your forecasts for EUR/USD and EUR/JPY for the end of Q2?

To my mind, EUR/USD should trade in a small downward trend, in the range of 1.37-1.38 by the end of the second quarter. EUR/JPY is a different story, because there is still a need for the Yen's weakness, and we can see it in the Japanese trade balance. Japan simply requires a weaker currency, and therefore we might see more pronounced movement in the exchange rates. I assume that by the end of the Q2 EUR/JPY could easily reach levels around 148.

Pound Sterling

Adam Cole
Global Head of FX Strategy
RBC Capital Markets UK

What performance do you expect from the British Pound versus its major counterparts during the second quarter?

We think it will be patchier. The story for 2013 and for the early part of this year was market expectations still catching up with a very strong U.K. economy. The U.K. economy still is resilient; however, I believe that expectations now have caught up and the news need to be that much better to make of a positive impact on the currency. We think going forward the Sterling is much more a range trade and investors should treat it opportunistically, rather than looking for the sustained uptrend that we saw through most of 2013. Nevertheless, we are not bearish but we no longer are looking for sustained bullish trend this year. It is a bit more opportunistic trade where you can sell rallies and buy dips.

What will be the main drivers, which will impact Pounds performance during the second quarter?

I see that the main driver will be the decisions made by BoE officials on its policy. At the moment, market thinks that the U.K. interest rates most likely will be raised around the early part of the next year. The Pound will advance and decline if that prospect comes near or slips further into the future. Taking that all into account, I think we now find ourselves in actually a quite unconventional world, where we are focusing on the central bank and the timing of the turn in the U.K. interest rates hike.

I see that the main driver will be the decisions made by BoE officials on its policy.

- Adam Cole

What are our forecasts for GBP/USD and EUR/GBP for the end of Q2?

Concerning the cable, we expect that it will stay in relatively tight range between 1.65 and 1.67. However, for the EUR/GBP we have a bias low, largely because of the fact that we see the Euro declining in general. The pair could head towards the low 0.8, that could be a patchy performance with big corrections rather than the straight line trend.

U.S. Dollar

Richard Franulovich
Senior Currency Strategist
Westpac
US

What performance do you expect from the U.S. Dollar versus its major counterparts during the second quarter?

Let me begin with the U.S. Dollar performance against the Yen. The greenback started on the back foot versus the Yen in January of this year. Whereas, since February into March and where we are now the USD/JPY has been range bound and trading roughly between 101 and 104. The pair is not showing much momentum either way, which is in a very clear cut consolidation pattern. The U.S. currency has been on a back foot against the Euro for several weeks, with the Euro rising from 1.35 to 1.40, but in the last week or two, the Dollar managed to call back some of these losses back towards 1.38.

What will be the main drivers, which will impact U.S. Dollar's performance during the second quarter?

In the case of the Euro it is pretty clear, that the ECB officials are becoming a little bit more concerned about the disinflationary effect of a strong Euro. There has been unfold of a commentary from the ECB officials talking about the fact that they are not explicitly talking down the Euro, but they are certainly flagging the fact, that any further strength in the Euro would alter the ECB inflation profile. Thus, it may warrant a policy response from the bank that does not mean the Euro is going to fall, but that any further strength in the currency would be self-defeating, and I expect any strength in the Euro towards 1.40 would be met with more rhetoric from the ECB.

> ***On the US side it is pretty clear to us, that Fed tapering is on an almost automatic pilot and it looks like the next several meetings at least, the Fed will be continuing to cut asset purchases.***
>
> ***- Richard Franulovich***

Hence, there is one reason why I expect the Euro to trade on a heavy footing going forward. Secondly, on the US side it is pretty clear to us, that Fed tapering is on an almost automatic pilot and it looks like the next several meetings at least, the Fed will be continuing to cut asset purchases. Expectations for the U.S. economy are also pretty moderate, we anticipate some better-than-expected numbers to hit the screens in the next several months, and if you put that all together – it spells a weaker Euro. As for the USD/JPY - an ongoing tapering should underpin the Dollar versus the Yen, and, potentially in May of this year it looks like the BOJ is luckily come back with more monetary easing. On April 1 of this year planned sales tax increase will be heating the Japanese economy.

There is a lot of concern about what sort of negative effect that will have on growth and it appears that the BOJ will be taking a good look on what that means for the economy in April and May. Thus, we believe there is a very good chance for the BOJ to slightly increase its' asset purchase programme as well, and that will be negative for the Yen. Thereby, in both cases there are good reasons to think that policy in the US compared to policy in Japan and the Euro would support a higher Dollar.

What is your forecast for EUR/USD and USD/JPY for the end of the Q2?

As far as the outlook is concerned, I expect the Dollar to trade on a firmer footing going forward, I look for the greenback to rally versus the Euro and I expect the EUR/USD exchange rate pushing back towards 1.35-1.36 zone. I believe the greenback should break out of the top of its range and the USD/JPY as well, which is currently hovering around 102.45 and I think the USD/JPY could travel back towards 105 in the Q2.

As far as the outlook is concerned, I expect the Dollar to trade on a firmer footing going forward...

- Richard Franulovich

Australian Dollar

David Forrester
Senior Vice President for G10 FX Strategy
Macquaire bank
Singapore

What performance do you expect from the Australian Dollar versus its major counterparts during the second quarter of this year?

We expect that it could squeeze a bit higher. The bottom line is that the local economy is improving and on top of that there is an increasing real money or long term investor interest in Australian dollar assets. The main reason for that is the fact that their currency has fallen about 10-15% from levels seen in April last year; therefore, long term investors feel more comfortable buying Australian Dollar assets. Current trading levels might be much closer to currency's fair value than ones last year, when the Aussie was clearly overvalued. In our opinion, ultimately AUD/USD will fall, perhaps towards the middle of the year or a little bit later once the U.S. Dollar starts to strengthen again and as soon as U.S. economy shakes off its winter doldrums.

What will be the main drivers for the Aussie during the second quarter of this year?

We will continue to look towards China. At the beginning of this year, our economists had a growth outlook for China to bottom out around 6.8% by the middle of the year. In my opinion, after the recent PMI data the markets have come around to our economists' way of thinking. That has already weighted a bit on the Aussie; therefore, going forward the market will be carefully on the lookout for more stimulus out of China. We do not think that there will be a big stimulus, nevertheless, we do look towards two RRR cuts, which will help support AUD/USD and its hard commodity export prices.

"Current trading levels might be much closer to currency's fair value than ones last year, when the Aussie was clearly overvalued.

- David Forrester

The other factor is the local economy, which we expect to further improve. The RBA's rate cutting cycle is taking hold in country's economy, thus I would not be surprised to see at some stage during the second quarter that the market begins to price in rate hike by year end. On top of that, the other driving factor will be the U.S. Dollar's and the US economy's performance.

What are our forecasts for AUD/USD and AUD/JPY for the second quarter of this year?

For the AUD/USD we expect it to finish the quarter at around 0.92. However, assuming that there will be a lot of positive fundamentals for the Aussie - real money investor demand for Aussie assets, also a stronger local economy. But, stabilization and improvement in U.S. data will bring AUD/USD lower.

AUD/JPY will be driven by the Bank of Japan and how much time it will take for them to engage more QQE (quantitative and qualitative monetary easing). We have a forecast of 98 Yen per Aussie for the end of the second quarter. Moreover, we do think there is a good chance that the BoJ will engage more QQE by the end of Q2 or early Q3.

> ***AUD/JPY will be driven by the Bank of Japan and how much time it will take for them to engage more QQE***
>
> ***- David Forrester***

Japanese Yen

Yujiro Goto
Senior FX Strategist
Nomura
UK

What performance do you expect from the Yen versus its major counterparts during the second quarter?

We expect the Japanese Yen to weaken against the U.S. Dollar and the shared currency, with USD/JPY touching 107 and EUR/JPY 150 at the end of the second quarter.

What will be the main drivers which will impact Yen's performance during the second quarter?

I think positive U.S. economic figures after harsh winter weather would be a positive driver for USD/JPY. Thus, rate differential between the U.S. and Japan should keep supporting the greenback versus the Yen. From Japan's side, we do not expect the Bank of Japan to ease in April or any time soon amid recent sales tax hike. However, still very good job market will encourage Japanese retail investors to take more risks so that they can invest more in foreign assets or Japanese equities, but not in bank deposits. In addition to that, even without any additional monetary easing by the central bank, Japan's real interest rate is much lower compared to its counterparts. Inflation has been gradually rising, while the BoJ's investments in JGB put downside pressure on nominal JGB yields. The JGB is becoming much less attractive for the Japanese institutional investors to accumulate. Therefore, Japanese investors will shift from JGB into foreign assets, which is also will be positive for USD/JPY.

Potential catalyst for Yen weakness would be Prime Minister Abe's announcement of growth strategy sometime in June.

- Yujiro Goto

Potential catalyst for Yen weakness would be Prime Minister Abe's announcement of growth strategy sometime in June. Japan's government is likely to announce its plan to reduce corporate tax rate in Japan, which will be very positive for the Japanese equity market and USD/JPY. In addition to that, Mr. Abe may also include in the growth strategy his plan to reform Japanese biggest pension fund called GPIF. That plan should reduce pension funds in exposing JGBs, while increasing the risky asset investment such as Japanese equities, foreign equities or bonds. This growth strategy announcement in June can be a positive event for USD/JPY and other Yen crosses.

What are your forecasts for USD/JPY and EUR/JPY for the end of Q2?

Our June target for USD/JPY is 107, while EUR/JPY we see at 150, as we see some upside risk for the pair from the current level.

Trade Pattern Ideas

EUR/USD

Daily Chart

200-day SMA

EUR/USD

Rising Wedge

The pair has been narrowing its trading range (60 pips per 50 days) since the October 2013, when it peaked at 1.3833, the second highest level in 2013.

The pair has been narrowing its trading range (60 pips per 50 days) since the October 2013, when it peaked at 1.3833, the second highest level in 2013. At the moment the pair is trading slightly above the weekly PP and 38.2% Fibo (January to March, 2014, appreciation) and trailing towards the pattern's support after hitting 1.3967, the highest level since October 2011, on 13th of March 2014. Medium and long term technicals point at appreciation of the pair suggesting we should see a continuation of the trend. Long traders could focus on the monthly PP/20-day SMA at 1.3815/25, weekly R1/23.6% Fibo at 1.3851/52, major level at 1.3900, monthly R1 at 1.3926, weekly R2/2014 high at 1.3949/67, major level/estimated pattern's resistance at 1.4000, weekly R3 at 1.4022 and monthly R2 at 1.4077.

Short term technicals point at further depreciation of the pair. Besides that, 64% of the traders are short on the pair; Euro is being sold in 58% and USD is bought in 65% of the cases across the board which indicates the pair is bound to trail lower and hit pattern's support and, presumably, 200-day SMA at the end of the march, 2014. Short traders could focus on the 38.2% Fibo/weekly PP at 1.3780/78, 55 and 100-day SMAs/50% Fibo at 1.3737/09, weekly and monthly S1/61.8% Fibo at 1.3680/64, pattern's support/200-day SMA (estimated) at 1.3630, weekly S2 at 1.3607 and monthly S2 at 1.3553.

USD/CAD

Daily Chart

200-day SMA

USD/CAD

Triangle

Recent pullback and the fact that the pair is approaching the last decimal of the pattern's length (apex at 1.1103 on 25th of April 2014) indicates a heightened probability of a breakout.

The pair has been consolidating around 1.1000 since the end of January 2014, but the pattern started in the mid-September 2013, when the pair briefly dipped below the 200-day SMA to 1.0182 and started advancing till in hit 1.1225, then the highest level since July 2009, on 31st of January 2014. After a peak till, now the highest level since July 2009, 1.1278 and a following pullback last week the pair has been hovering lightly above the pattern's support around 1.1065. Recent pullback and the fact that the pair is approaching the last decimal of the pattern's length (apex at 1.1103 on 25th of April 2014) indicates a heightened probability of a breakout. Short term Stochastic indicator and medium term technicals on aggregate point at a possibly bullish breakout. Market sentiment (73% of traders long on the pair, USD bought in 65% and CAD sold 65% of the cases across the board) suggest the same thing as well. Long traders could focus on the 55-day SMA/weekly and monthly PP/major level at 1.1088/1.1100, 20-day SMA/pattern's resistance at 1.1124/40, weekly R1/major level at 1.1198/1.1200, January high/monthly R1 at 1.1225/36 and the 2014 high at 1.1278.

Long term Stochastic suggests that the pair still might trail lower. Short term traders could focus on the major level at 1.1000, weekly S1/100-day SMA at 1.0953/45, monthly S1/major level at 1.0913/1.0900, weekly S2 at 1.0854, major level at 1.0800, monthly S2 at 1.0773 and weekly S3/major level/200-day SMA at 1.0707/1.0680.

USD/SEK

Weekly Chart

200-week SMA

USD/SEK

Triangle

Short term technicals give a mild bullish outlook suggesting the pair has the propensity to at least test the pattern's resistance and 200-week SMA.

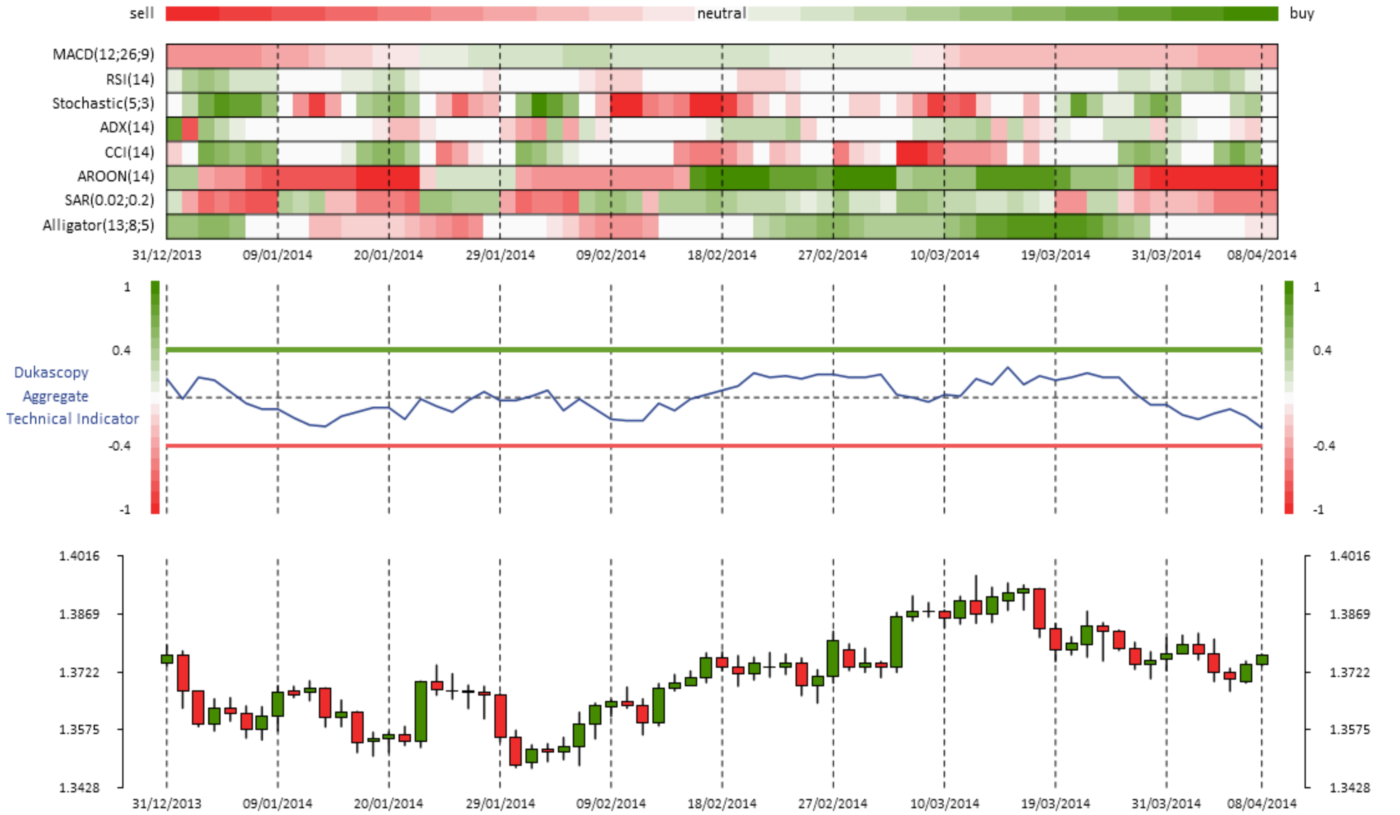
The pair has been narrowing its trading range (4500 pips in 50 days) since the first week of May, 2011. That's when the triangle pattern at hand started forming. It's worth pointing pout that a sell off from 8.1390, June 2010, till 5.9796, May 2011, led to it. We can see a few attempts to recover in the length of the pattern, but 200-week SMA kept the pair at bay. At the moment it is trading around 6.4890 and is about to enter the last quintile of the pattern's length as pattern's apex is located at 6.3740 on the mid-September 2014. Short term technicals give a mild bullish outlook suggesting the pair has the propensity to at least test the pattern's resistance and 200-week SMA. Market participants have similar expectations as 72% of them are long on the pair. Long traders could focus on the 20-week SMA at 6.4950, 55-week SMA/monthly R1 at 6.5229/65, pattern's resistance around 6.5614, major level at 6.6000, monthly R2 at 6.6375, 200-week SMA at 6.6617 and monthly R3 at 6.6997 and 38.2% Fibo (June, 2010, to May, 201, sell off)/2013 high at 6.8045/659.

Medium and long term technicals point at depreciation of the pair suggesting the 200-week SMA should push the pair lower. Short traders could focus on the monthly PP at 6.4637, monthly S1/pattern's support at 6.3522/381, major level/monthly R2 at 6.3000/6.2899, major levels at 6.2500 and 6.2000, monthly S3 at 6.1784, major levels at 6.1500,6.1000 and 6.0500 and 2011 low/major level at 6.0000/5.9796.

Aggregate Technical Indicator

EUR/USD

Daily chart



GBP/USD

Daily chart

USD/JPY

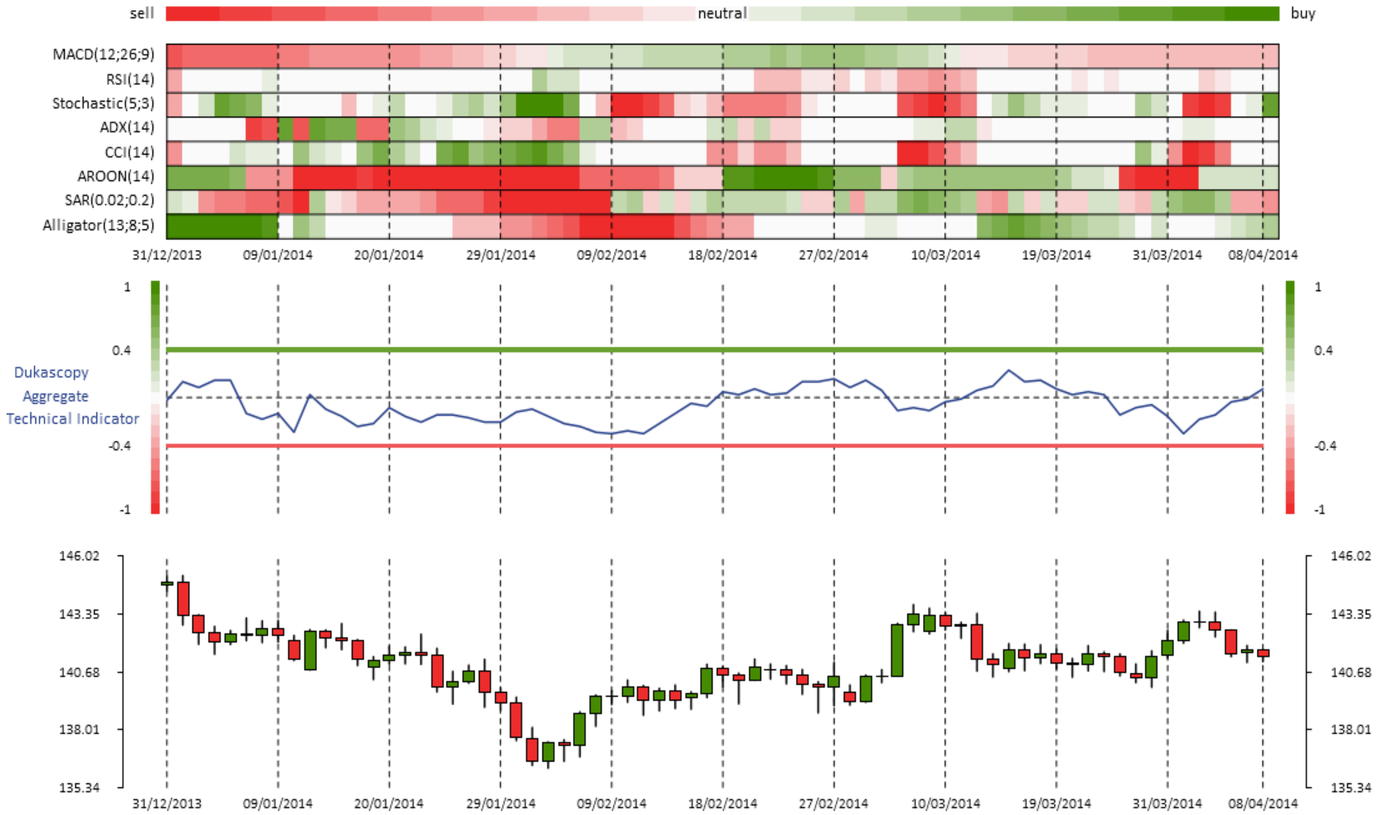
Daily chart

USD/CHF

Daily chart

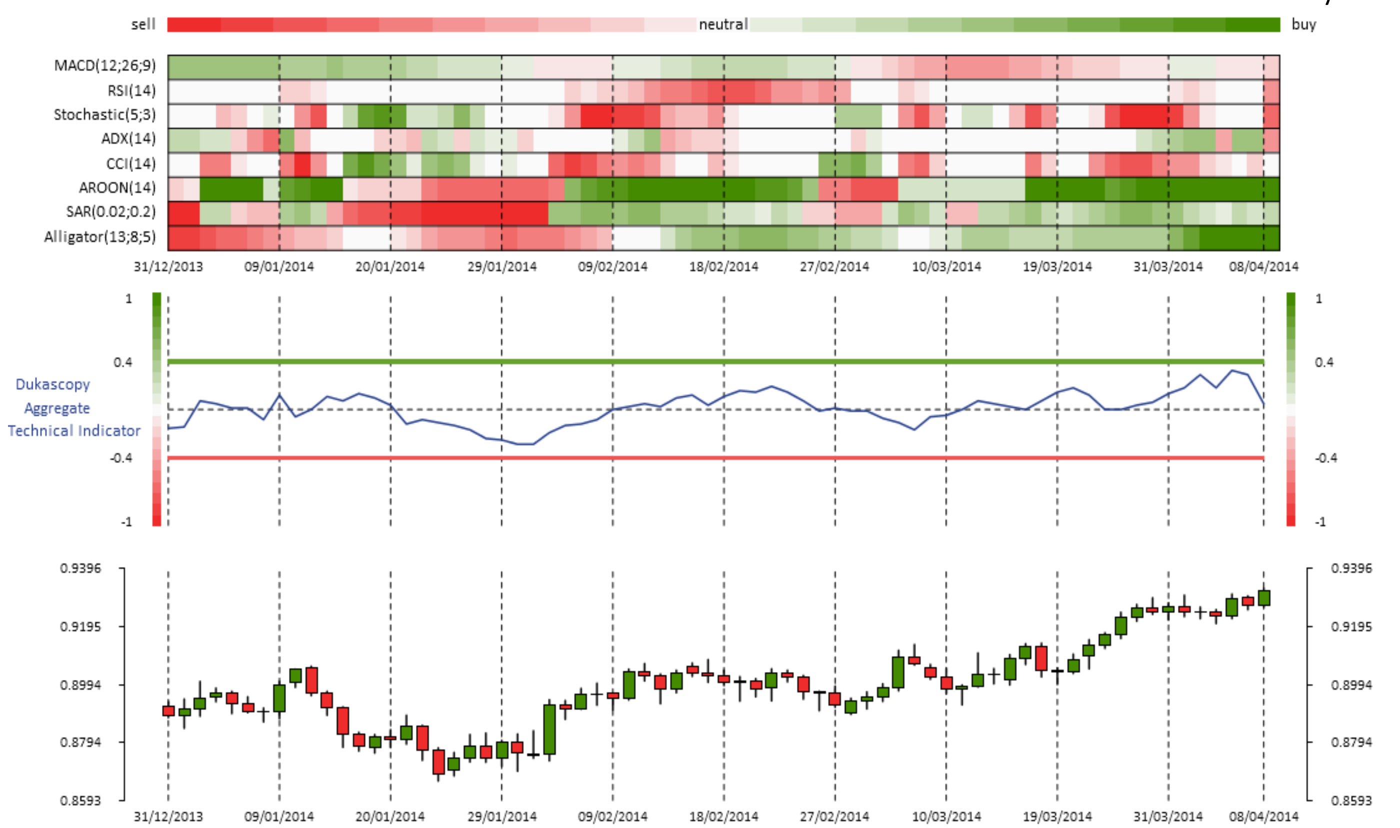
EUR/JPY

Daily chart



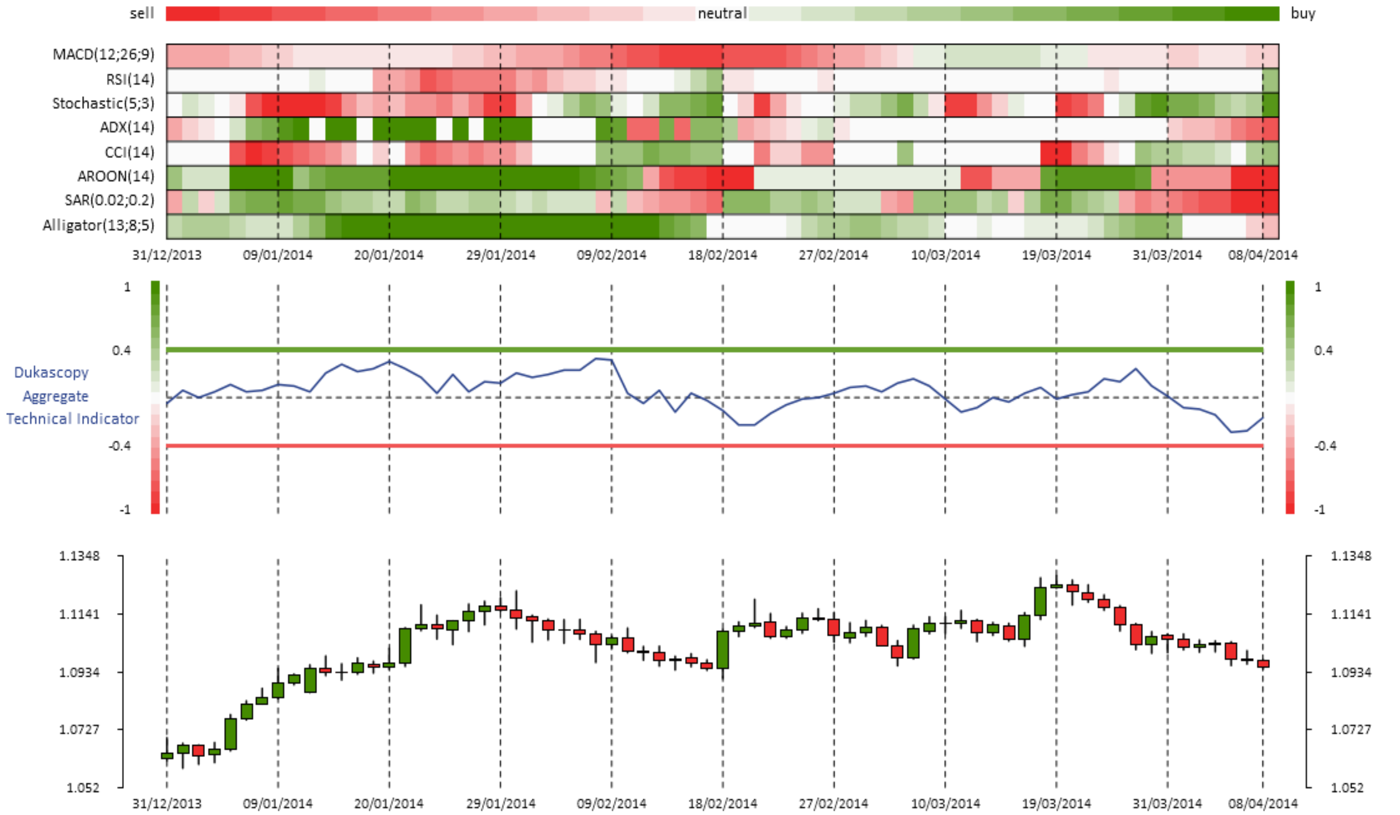
AUD/USD

Daily chart



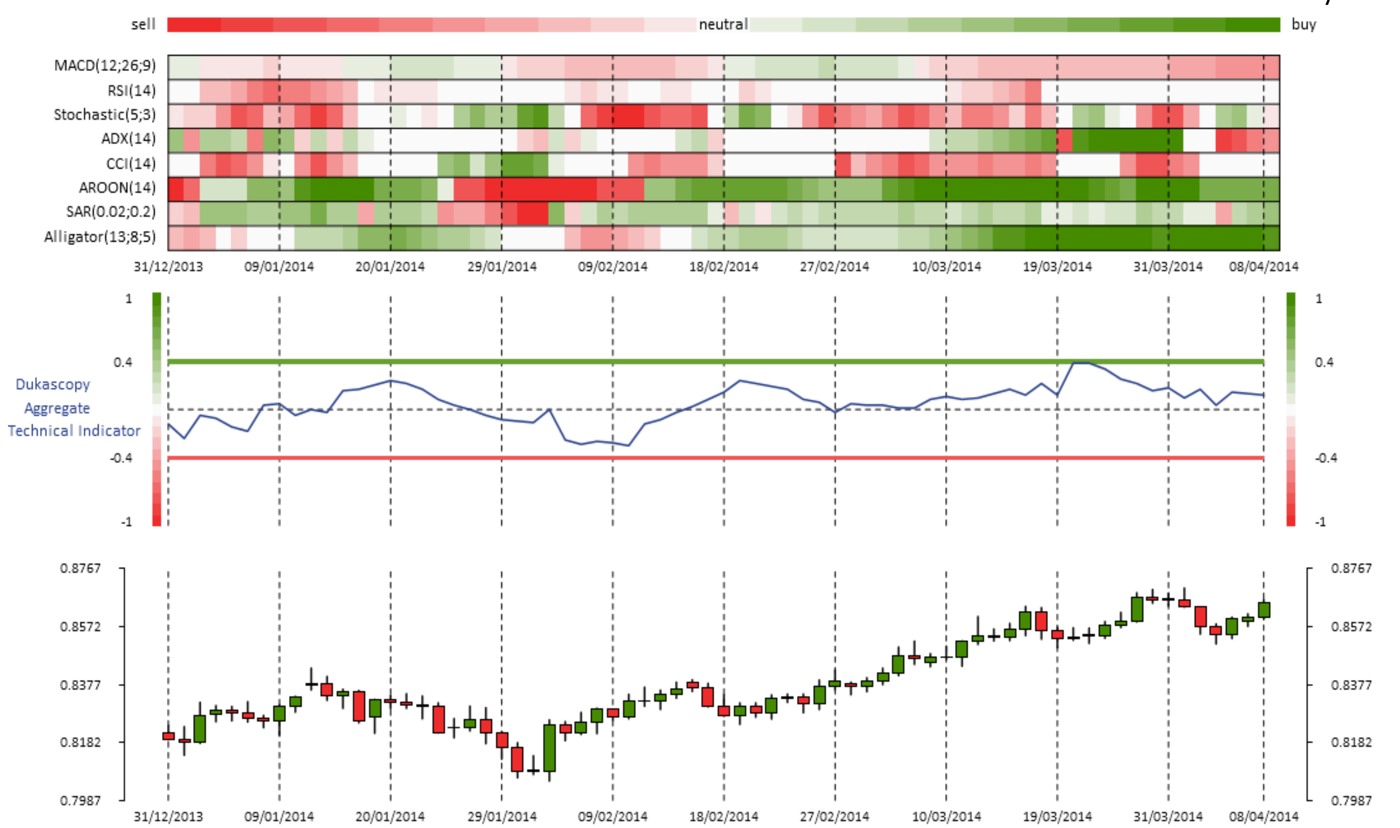
USD/CAD

Daily chart



NZD/USD

Daily chart



Economic Research

Forecasting Models for Exchange Rate

The science of prognostics has been going through a rapid and fruitful development in the past decades, with various forecasting methods, procedures and approaches flooding the economic world. It is estimated that there are more than 100 prediction methods, and sometimes the diversity makes it difficult to choose the one that would do the trick. In our new research we try and compare a few of the most popular techniques, and see if they are in fact suitable for forecasting currency exchange rates.

We look at five models, starting with the most naïve methods and moving up to relatively complex systems, with their own paradigms and special way of thinking. We test the models on EUR/USD currency pair in the time frame from 1/1/2014 to 3/24/2014.

Methodology

Moving Average

Simple moving average (*SMA*) is a naive forecasting method. It uses the most recent observations to forecast future values. The basic *SMA* model assumption is that the time series is stationary, and the model used for forecasting is $y_t = \mu + \varepsilon_t$, where μ is a constant and ε_t is a random variable with mean 0 and variation σ^2.

The only parameter in the model, μ, is estimated as the average value of the last k observations at every time moment t:

$$\hat{\mu}_t = \frac{(y_t + y_{t-1} + \cdots y_{t-k})}{k}$$

The forecasted value of y is then the same as the estimate of the parameter: $\hat{y}_{t+1} = \hat{\mu}_t$

Advantages and disadvantages:

The main advantage of this model is its simplicity and the speed of implementation. But the primality of the model affects the quality of its results – it is not able to foresee the peaks and troughs of the series. It can also prove to be moderately useless if the time series is nonlinear or non-stationary.

Exponential smoothing

Simple exponential smoothing (*EMA—exponential moving average*) is the modification of a weighted moving average. It has the same time series model, $y_t = \mu + \varepsilon_t$, but uses a different approximation. Namely, the single parameter μ is estimated as the weighted average of the last observation and the previous estimate:

$$\hat{\mu}_t = \alpha y_t + (1 - \alpha)\,\hat{\mu}_{t-1}$$

Here α is a smoothing constant in the interval between 0 and 1. The constant α controls the closeness of the interpolated (smoothed) value to the most recent observation, y_t. The forecast value is equal to the parameter estimate: $\hat{y}_{t+1} = \hat{\mu}_t$

Advantages and disadvantages:

The properties of the *SES* are similar to the ones of *SMA* - it also works only with linear and stationary time series and inevitably lags behind a trend.

There are a lot of other exponential smoothing methods and moving average modifications, but all of them share these main drawbacks.

Both methods mentioned above can only be used for stationary time series. For the data we use the *ADF* test (see Appendix) does not reject the null hypothesis of non-stationary, meaning that more sophisticated models are needed to work with real-life exchange rates.

ARIMA

An autoregressive integrated moving average (*ARIMA*) model is the generalization of both *SES* and *SMA*. The most widely known special cases of *ARIMA* models are autoregressive model and random walk and random trend models. *ARIMA(p,d,q)* is a notation used for the general model, with parameters *p*, *d* and *q* describing autoregressive, integrated and moving average components, respectively.

ARIMA(p, d, q):

$$\alpha(L)(1-L)^d y_t = \alpha_0 + \beta(L)\varepsilon_t$$

where $\alpha(L) = 1 - a_1 L - \ldots - a_p L^p$ is an autoregressive polynomial, and $\beta(L) = 1 + b_1 L + \ldots + b_q L^q$ is a moving average polynomial. is a lag operator: $Lx_t = x_{t-1}$

Advantages and disadvantages:

ARIMA model serves a wide spectrum of time series and may be used for both stationary and non-stationary series. Unlike many other complex models, *ARIMA* gives the prediction directly from model estimations and does not require any additional calculations. It does, however, have its practical disadvantages, too - it is sensitive to outliers and requires a large number of observations.

Dynamic Linear Model

Dynamic Linear Models (*DLM*), also called Linear-Gaussian state space models, are a particular group of state space models - a wide class of models for time series analysis. The main idea of *DLM* is to express a time series through a Markov process (represented by a so called state vector) and additive white noise.

The modeling starts with the assumption that at the initial time moment the state vector is normally distributed $\theta_0 \sim N(m_0, C_0)$ and all consequent time moments are described by the set of equations:

$$y_t = F_t\theta_t + v_t, \quad v_t \sim N(0, V_t)$$

$$\theta_t = G_t\theta_{t-1} + w_t, \quad w_t \sim N(0, W_t)$$

where θ_t is the unobservable value of the state vector at time t, and y_t is the observable time series vector.

It is therefore assumed that the evolution of the unobservable states of the system is described by operator G_t, but the F_t operator transforms the model states into observations. The whole analysis is thus aimed at estimating the F_t and G_t operators and covariance matrices V_t and W_t.

Advantages and disadvantages:

The key advantage of the *DLM* is its flexibility. As all system parameters are recalculated at every step, the model adjust quickly to any changes in system. Thus it allows to capture the main features of a wide variety of different time series. The advantages, however, come at the cost of relative complexity of the algorithm. Moreover, the method forces quiet heavy restrictions on the underlying processes, such as the normal distribution of parameters and independence of model errors.

Artificial neural networks

The artificial neural network (*ANN*) method is very different from other techniques of data processing. *ANN* paradigms are inspired by the biological neural system, and its main goal is to simulate the way a human brain works. The reason of the popularity of *ANN*s is its ability to approximate almost any nonlinear function. *ANN*s are used not only in time series analysis, but also in data comparison, clustering analysis, classification problems, and control theory.

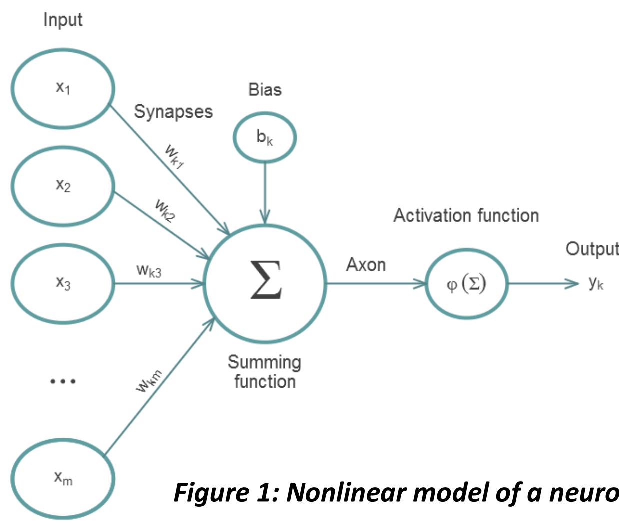


Figure 1: Nonlinear model of a neuron

In mathematical terms, neuron k can be described by the following equations:

$$u_k = \sum_{j=1}^{m} x_j w_{kj}$$

and

$$y_k = \varphi(u_k + b_k)$$

Where $x_1, x_2, \ldots, x_m$ are the input signals; $w_{k1}, w_{k2}, \ldots, w_{km}$ are the synaptic weights of neuron k; b_k is the bias; u_k — summing function, and y_k is the output of the neuron. The activation function φ controls the *ANN* learning process, i.e., the adjustment of the synaptic weights.

The smallest unit of *ANN*, just like in a biological neural network, is a neuron (Figure 1).

The *ANN* algorithm is divided into two parts: training and testing. The first stage is training, when neuron weights are calculated and adjusted to desired precision. Then, at the testing stage, the goodness of weights is tested on real data.

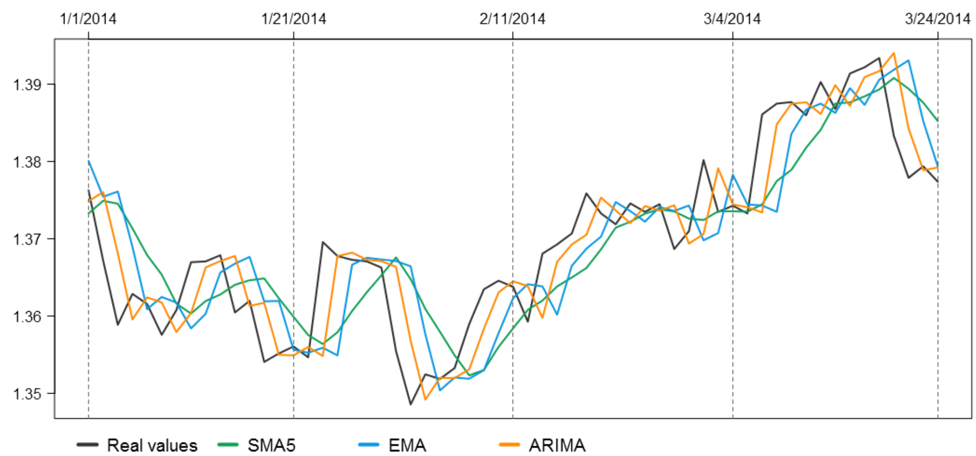
We chose to test a two-layer *ANN* with construction 3-2-1, meaning that there are three neurons on the first layer, two on the second (hidden) layer, and one at the output.

Advantages and disadvantages:

The *ANN* has a more complex structure than any of the methods mentioned above. This quality makes the method harder to implement, but it is also accountable for the main benefit of the *ANN*. The networks structure is parallel, so if one element of the *ANN* fails to produce an adequate outcome, it has little effect on the work of other neurons, and the process can continue without any problems. It also enables us to use the *ANN* while working with time series of any structure. The biggest weakness of the model, similarly to the case of *ARIMA*, is that it requires a large number of observations to properly train the network.

Results

Figure 2: The one-step-ahead forecast results by the SMA5, EMA and ARIMA(1, 1, 1).



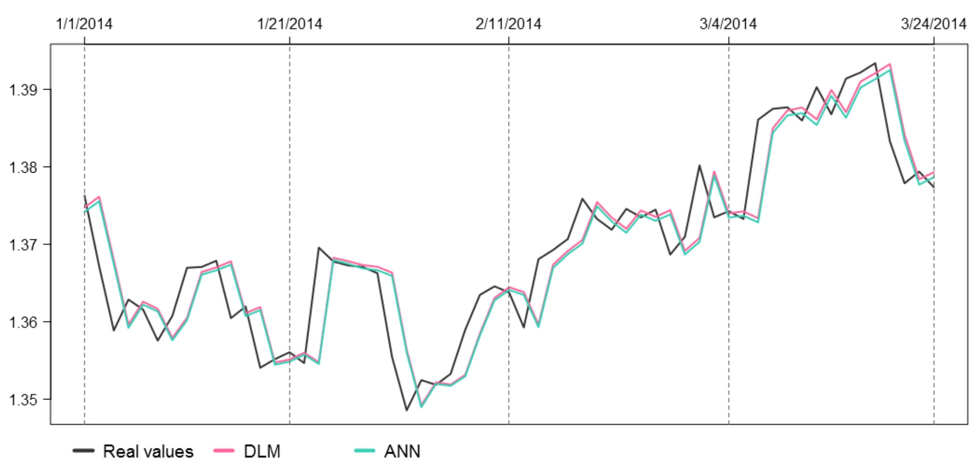


Figure 3: The one-step-ahead forecast results by the DLM and ANN (3-2-1).

The *5*-day window *SMA* model gives the worst results in our analysis. The model captures the general direction of the series and the main peaks and troughs, but is not sensitive to small changes. We can thus say that the result is too smoothed. Which is hardly surprising since the forecast is just the average of the previous values. The exponential smoothing, on the other hand, gives much better results. The *EMA* curve not only moves in the right direction, but also shows even the small motions of the price. In this case a lot depends on the choice of the constant α. We use $\alpha=0.8$, therefore putting the largest weight on the last observation. Visually, however, it is obvious that the best results come from *ARIMA(1,1,1)*, *DLM*, and *ANN(3-2-1)* - their predictions practically coincide (see Figure 4).

All forecasting curves are lagged behind the real values. On of the reasons for this is the strong autocorrelation in the series, but the main cause of the forecast delay is the huge weight of the previous observation in the models. All mentioned techniques increasingly depend on the last value of the time series, with *SMA* and *ANN* being the only exceptions. *SMA5* puts equal weights on all five last observations, while *ANN* fits weights values for the three previous data points. As this forecasting bias seems to be rather considerable, it is natural to wonder whether it is altogether worth it to take trouble over the models. Thus we compare our results to the ones we would obtain by simply assuming the present value of the prediction to be equal to the observation in the previous time moment.

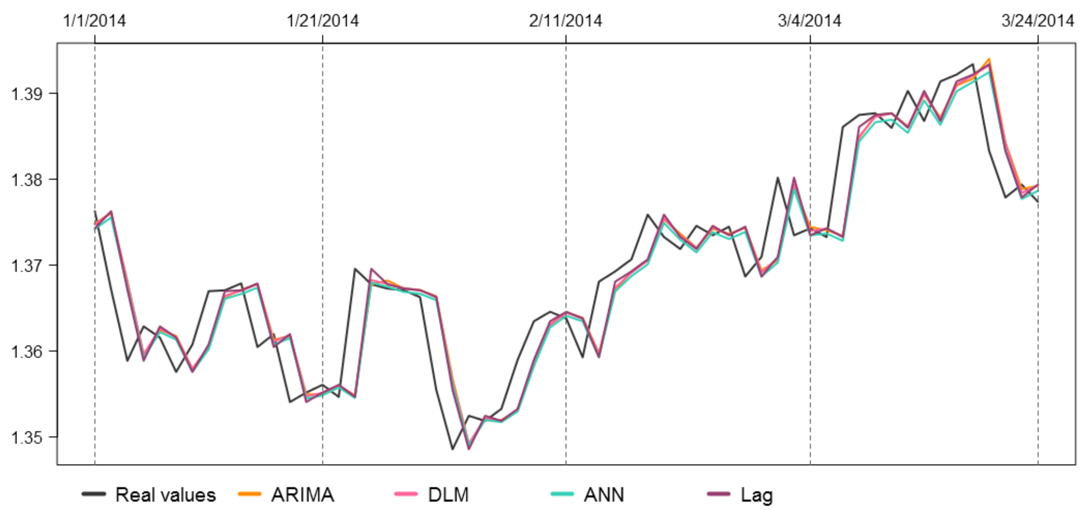


Figure 4: The one-step-ahead forecast of the SMA5, EMA, ARIMA, DLM, ANN, and the lagged series.

We can see that the series of the lagged values is very similar to the best forecasting models - *ARIMA(1,1,1)*, *DLM*, and *ANN(3-2-1)*. To make the comparison numerical and thus more precise we use the error measures - *MSE*, *MAE*, and *MAPE* (see Appendix).

	SMA5	EMA	ARIMA	DLM	ANN	Lag
MSE	4.99×10^{-5}	4.94×10^{-5}	2.58×10^{-5}	2.55×10^{-5}	2.55×10^{-5}	2.54×10^{-5}
MAE	0.0059	0.0054	0.00365	0.00365	0.00372	0.0037
MAPE	0.431	0.394	0.267	0.267	0.271	0.27

Table 1: MSE, MAE and MAPE results

The *ARIMA* model has the smallest error values, with DLM, lagged series and ANN scoring almost insignificantly worse.

SMA5	EMA	ARIMA	DLM	ANN
0.01	0.1	0.51	4.93	0.36

Table 2: SMA5, EMA, ARIMA DLA and ANN algorithms working time (sec.)

Another important characteristic of any algorithm is its working time, and here *SMA5* proves to be the fastest. However, it is *ARIMA(1,1,1)* model that takes the first place in the overall standings.

Conclusion

We have studied five forecasting models with different construction techniques and levels of difficulty. In total, all received results followed the general motion of the real series, some showing slightly more precision than others. Notably, the forecast given by the classical *ARIMA* model was even better than the results of more complex *DLM* and *ANN*. As *ARIMA* is also easier and faster to employ, the superior results make it unquestionably the best forecasting method in our study. However, *SMA* and *EMA* models are also very simple in both understanding and realisation, with *SMA* giving the most smooth curves, but *EMA* being more dynamic. So if the high precision of the forecast is not the main target of analysis, both these methods can also be used.

It is noteworthy, however, that all the models give lagged, or delayed, predictions, and do not offer much superiority over a simple lagged series. Such outcome is dictated by the nature of time series – it is non-stationary and strongly autocorrelated. Therefore, in cases when pointwise and indefinably accurate predictions would suffice, it might be more sensible to save time and effort, and use the lagged series.

Appendix

Mean squared error:

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

Mean absolute error:

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i|$$

Mean absolute percentage error:

$$MAPE = \frac{100\%}{n}\sum_{i=1}^{n}\frac{|y_i - \hat{y}_i|}{y_i}$$

Augmented Dickey-Fuller (*ADF*) test models:

$$1)\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{p}\beta_i \Delta y_{t-i} + \varepsilon_t$$

$$2)\Delta y_t = a_0 + \gamma y_{t-1} + \sum_{i=1}^{p}\beta_i \Delta y_{t-i} + \varepsilon_t$$

$$2)\Delta y_t = a_0 + \gamma y_{t-1} + \sum_{i=1}^{p}\beta_i \Delta y_{t-i} + \varepsilon_t$$

$$H_0 : \gamma = 0 \; (y \text{ is a random walk})$$
$$H_{alt} : -2 < \gamma < 0 \; (y \text{ is stationary})$$

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