

**PREDICTING CURRENCY MARKETS BEHAVIOR AFTER
SCHEDULED MACROECONOMIC NEWS RELEASES
THROUGH A TRADING SYSTEM APPROACH**

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Abstract

This paper analyses the effectiveness of the “Trading the News” phenomena, practiced by many speculators. We examine, through a trading system approach, in the very short time (3 hours), how several macroeconomic news announcements, from 5 different regions (U.S., Euro Zone, U.K., Japan and Australia) are impounded into forex prices. Our goal is to find out whether an exploitable trading pattern exists around these announcements. Profitable results are obtained for the US NFP, the Australian GDP and the UK GDP. Miscellaneous results are obtained for the US Trade Balance, US GDP, Australian CPI and UK Jobless Claim. For the US ISM-Manufacturing, US Retail Sales, Euro GDP, Euro CPI, Japanese GDP, Japanese Tankan, Australian Employment and UK CPI, no exploitable trading pattern is found.

Keywords

Forex market, trading system, scheduled news, macroeconomic indicators.

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Resumo

Este trabalho analisa o grau de validade do fenómeno “Trading the News”, ou seja, obter ganhos sobre a reacção imediata dos preços do mercado forex às notícias macroeconómicas, também chamadas de indicadores. Esta estratégia é aplicada por vários especuladores, com resultados positivos, e que por isso argumentam ser possível prever o comportamento dos preços.

Abordando esta questão da previsibilidade, através da utilização de simples sistemas automáticos de transacção, examinamos de que forma várias notícias macroeconómicas, de 5 regiões diferentes do globo (E.U.A., Zona Euro, Reino Unido, Japão e Austrália), são assimiladas pelos preços do mercado forex, nos respectivos pares cambiais (EUR/USD, GBP/USD, AUD/USD e USD/JPY). E como focamos somente no impacto imediato destas notícias, o período de transacções estende-se apenas por três horas, começando sempre dez minutos antes da publicação da respectiva notícia.

O objectivo é descobrir se realmente existem padrões de comportamento dos preços, à volta destas notícias, que possam ser sistematicamente explorados. Para tal, maximizamos várias estratégias de transacções automáticas que visam o lucro, num período de quatro anos (Jan 2004 - Dez 2007). Depois de seleccionadas as melhores estratégias, aplicamo-las, sem alterações, num período posterior de três anos (Jan 2008 – Dez 2010), para observar as suas capacidades de previsão/lucro.

Foram obtidos resultados positivos para o US Non-farm payrolls, o PIB Australiano e o PIB do Reino Unido.

Resultados inconclusivos ou insuficientemente significantes foram obtidos para o PIB dos EUA, o Jobless Claims do Reino Unido, a Balança Comercial dos EUA e o Índice de Preços dos Consumidores Australiano.

Para os indicadores: US ISM-Manufacturing, US Retail Sales, PIB da Zona Euro, Índice de Preços dos Consumidores da Zona Euro, PIB Japonês, Tankan Japonês, Emprego Australiano e Índice de Preços dos Consumidores do Reino Unido, não foi encontrado nenhum padrão lucrativo.

Executive Summary

This paper analyses the effectiveness of the “Trading the News” phenomena, practiced by many speculators. This is done with the development and use of simple trading systems that seek abnormal risk adjusted returns. This way of analyzing price behavior is a more realistic one, as it deals with real world constraints and traders behavior. This method performs a simulated ruled based trading activity over real prices and values the final results. Our goal is to understand whether it is possible or not to capture reaction of prices after scheduled news releases, as an attempt of better understanding its behavior. Other papers attempted to forecast price behavior after such releases with the use of econometric models, but they generally failed in the short term.

This work focuses on the forex market, the biggest and still fastest growing market of the last years. The currency pairs used are the USD/JPY, EUR/USD, GBP/USD and AUD/USD and the releases followed are: US Non-farm payrollsFP, US GDP, US Trade Balance, US ISM-Manufacturing, US Retail Sales, Australian CPI, Australian GDP, Australian Unemployment, UK GDP, UK CPI, UK Jobless Claims, Euro Zone GDP, Euro Zone CPI, Japanese Tankan and Japanese GDP. The data set covers the period from January 2004 until December 2010.

In order to create the simple automated trading systems, rules of entering and exiting positions are designed based on possible price behavior assumptions. Different strategies are then created to be performed over the sample period. Risk Management orders are also introduced, and their optimal position for each strategy and each different release is obtained through an optimization process. The whole data set is then divided in two: the in-sample period, from January 2004 until December 2007, and the out-of-sample period, from January 2008 to December 2010. Optimizations are made, and strategies are tested in the in-sample period. Once the best result is obtained, that best performing strategy is applied in the out-of-sample period, and final results are valued. This prevents for a future artificial advantage, which is to be avoided for robustness of results. The final results include also real world constraints like commissions or slippage in the execution of orders.

Final results show that exploitable trading patterns are found for the US NFP, the Australian GDP and the UK GDP, as their final results in the forecasting period (out-of-sample) are still profitable. Mixed results are obtained for the US Trade Balance, US

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GDP, Australian CPI and UK Jobless Claim. For these indicators price behavior were positively forecasted, but profits are cancelled out or turn out to be insignificant when real world costs are subtracted. For all other indicators no exploitable trading pattern is found.

This paper adds to the existing literature by offering, through a trading system approach, a different perspective for understanding very short term price behavior after scheduled macroeconomic news releases. It is suggested that price predictability under these circumstances is possible, and this justifies the large speculative activity around these releases.

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1 Introduction

The foreign exchange market is by far the largest financial market in the world, accounting with more than \$3 trillion of value traded daily, and with a large number of different market participants. It has been, at the same time, the fastest growing market of the last years (BIS¹ 2007²), especially concerning speculative activity.

Short term speculators focus primarily on Technical Analysis and macroeconomic indicators, having these, therefore, also grown in importance, and their impact tend to be very quick and immediate after a release. This situation gave birth to a phenomenon, well known and accepted among traders, named by “Trading the News”³. This fact arises an hypothesis among academics: If this strategy is applied by traders, many of them being successful, than, a predictive pattern of short term macroeconomic announcements effect over prices must exist. The focus of this paper is to cover this issue.

Forecasting price behavior was always one of the most explored fields in finance, driven by the enticement of future prediction’s possibility. But according to the market efficiency assumption, no predictive tradable strategy should attain unusual risk adjusted profits. Speculators obviously bet against this theory, and if they weren’t right, their activity wouldn’t last long. But explaining it in a scientific manner is a more complex task. The academic literature is full of papers arguing in favor and against the Market efficiency theory. Nevertheless, the question of explaining and predicting exchange rate movements in the short term is largely unanswered.

The general approach for these explanations has been through traditional econometric models, but they generally fail, as they are not able to capture trading behaviors or market and political conditions (Ehrmann and Fratzsher, 2004). Lately, microeconomic theory did remarkable improvements, as they consider the importance of trading activity in the price discovery process (Evans and Lyons, 2005; Love and Payne, 2006). An

¹Bank of International Settlements.

²The most recent year, for which global data is available.

³ Entering position, usually covered with stop and take profit orders, just before the release, in order to profit from the usual “jump” in prices after it.

alternative approach has also emerged, which uses the optimization and application of a trading strategy in order to capture and explain exchange rate price behavior (Schneller and Vanstone, 2010). This last approach is very interesting because captures all possible features of psychology finance such as: traders irrational behavior, market and political conditions, and real world constraints like slippage on execution of orders, commissions of trades and risk and money management. Besides that, it allows us to study market behavior through a different point of view, which is closer to reality. Therefore we adapt this approach to predict and study exchange rate price behavior.

In this paper is examined, through a trading system approach, how several macroeconomic news announcements, from 5 different regions (U.S., Euro Zone, U.K., Japan and Australia) are impounded into 4 different currency pairs (EUR/USD, GBP/USD, AUD/USD and USD/JPY). Our focus is restricted only on intraday patterns, from the moment of a news release up to 3 hours after it, studying therefore only the immediate effect. The null hypothesis in this study is that mechanical rules of generating trading orders should not result in unusual profits. This research has implications in better understanding the exchange rate behavior immediately after news announcements and on the development of future behavioral-based models.

The remainder of this paper is organized as follows. In section 2 we review and discuss the existing literature. Section 3 describes the foreign exchange markets, the characteristics of the different currencies, the implications of each macroeconomic indicator, and the data set. Section 4 presents the methodology we use in this paper to attain our objectives. In section 5 we expose all the result and discuss the findings. Section 6 concludes and gives some insight for future work.

2 Literature Review

Meese and Rogof (1987) is a big reference in the literature of short to middle term macroeconomic models for exchange rate forecast, as it was one of the first to explore this subject. The authors empirically proved that a random walk beats any attempt to predict exchange rates with macroeconomic models, especially in the short term, and out-of-sample periods. With these results they questioned the credibility of some long accepted models, like the PPP (Purchasing Power Parity) or the UIP (Uncovered Interest-rate Parity), among others. Although the Meese-Rogof findings are remarkably robust, after it, a number of authors argued against them, developing models whose out-of-sample forecasting performances improves upon a random walk.

Among these authors we find Faust and Rogers (2001), whose work focuses on the impact of data revision. They found out that macroeconomic models predict better using non revised data, and in some cases the Federal Reserve Staff future forecast is a better predictor than future actual values. This happens because market participants react to the information available at the time of release. As the time lag over such macroeconomic news is very important (the sooner they come out, the better), usually, by the time a revision is made, its impact becomes weaker. These findings also go against the Meese and Rogof attempt of forecasting. Meese and Rogof used actual future values to predict out-of-sample behavior, creating what is called as an artificial advantage. An artificial advantage is created when we use some values of a certain period, to predict the price behavior of that same period. In this manner, we would theoretically admit that people, by that time, would have known the future, what is also called by look-ahead bias⁴. Meese and Rogof argued that by doing so their findings were even stronger, because even with this advantage, any model could beat the random walk, but Faust and Rogers showed that the use of future actual value not always represents an advantage. In any case, and after analyzing several models of other authors, Faust and Rogers admit that most of them have low predictability value and fail when tested out-of-sample.

⁴Look-ahead bias is the use of information that was not contemporaneously available at the time of decision making.

Changing from predicting to analyzing exchange rate behavior we find the work of Olser (1995), which suggests that speculative activity could be a source of random walk behavior. He states that risk adverse speculators will smooth the impact of shocks to exchange rate fundamental (indicators). This could be one of the reasons why macroeconomic models fail in short time forecasting.

Edison (1996) examines the response of foreign exchange rates, namely JBP/USD and DTM/USD, and interest rates, to 6 US economic indicators releases. He analyses only the surprise component of the releases, as it is stated that market participants react only to what is unknown or unexpected. His findings suggest that all of the indicators present statistically significant results but quantitatively insignificant. By other words, a predicting behavior could be found, but trying to profit from it would be harder, although not impossible. The reason for it is also because he found daily reaction to surprises not to be 100% linear, which means that positive surprises could lead to negative reaction and vice versa.

Another work that deserves attention is the one by Almeida, Goodhart and Payne (1997). Their findings suggest that exchange rates react to macroeconomic news announcements in the very short term, and in the long run their effect is rather insignificant. Besides that, markets react more quickly to US data than German one. They also argue that every reaction to news is lastly caused by the expectations on possible behavior of interest rate decision authorities. For example, an increase of Consumer Price Index, should inform inflation is rising, what would depreciate the value of a currency. But markets usually react positively because they expect authorities to control inflation with an increase of interest rates, what would turn the currency more attractive.

An interesting article from Harris and Zabka (1995) shows the increase of importance of Non-farm Payrolls from 1986 to 1995, turning out to be the most important US release, instead of the famous Money Supply figure. From here we get the first hint that the impact of variables change over time. This same idea is also stated in the book of Kathy Lien, “Day Trading the Currency Market”, and in many other articles or papers, like the one from Thawornwong and Enke (2003) in which they focus on stock market price variables; or the one from Andersen, Bollerslev, Diebold and Vega (2004) where they prove that the effect of macroeconomic news on stock, bond and foreign exchange, have

different reactions during expansion and regression periods. Once more, these findings represent another reason why macroeconomic models fail in the short term.

Up to this point, all studies were based considering the effects of exchange rate on the level of price and volatility. A very important finding was then brought by Chaboud *et al.* (2004) analyzing the effects of volume in this market. Studying volume was always a very difficult task due to the absence of a centralized market⁵, which makes the collection of volume data very challenging. Chaboud *et al.* collaborated with the EBS, the biggest existing electronic broking system, in order to get this type of data. We should note however that, although being the biggest, it does not represent the entire market. In any case, due to confidential policies, in their work, they refer the amounts of value always indexed to an average volume value represented by 100, and not the actual total value itself. Even with these constraints their results are remarkable. Focusing on two currencies, the Euro and the Japanese Yen, both against the US Dollar, and constructing a minute by minute returns time series, they found that the conditional mean respond very quickly to news, usually inside the first 20 minutes after the release. From the 6 US releases they studied, the Non-farm Payroll and Gross Domestic Product were the two with higher impact on returns and volume. Another very important discovery is that volume levels spike after news releases even when they perfectly match the market expectations. This fact highlights the importance of these scheduled macroeconomic releases, which are closely followed by market participants, especially speculators, and by the time they come out, huge amounts of currency change hands having this, usually, an immediate impact on prices. Regarding volatility, it stays elevated for a bit longer and the effect of the release is usually dissipated after up to two hours.

At last, a more recent work conducted by Rezania, Rachev, Sun and Fabozzi (2010) did an impressive description about the effect of a pool of US economic indicators over the three major currency pairs (EUR/USD, JPY/USD and GBP/USD). They used second by second executed data, from 2004 to 2007. Executed data has a better accuracy than quoted data because the latter is just indicative. Banks usually quote the prices they offer to their customers, even at every second, but it not always exactly matches the execution price. This also happens because quoted prices also depend and can change

⁵In the next section, there is a complete description of the foreign exchange market characteristics.

upon the amount of the trade. The findings from Rezania *et al.* reveal that the volatility cluster before and after macroeconomic releases is not random. It also tends to increase as we approach the time of the release, and then decays fast after it. It decays faster, the more a release is important. This last behavior was explained to be due to market participants urge to adapt their positions to the new information. If the release doesn't have a big impact, they take more time to think about their action, whereas if it has a big impact, they tend to rush. They further demonstrate that the volatility cluster occurs more frequently for the Japanese Yen, followed by the Pound Sterling and then the Euro⁶. They also conducted 2 interesting pools, with the opinion of several well established economists and traders, to find out which were the most important and market mover US indicators in their opinion. The authors then compare three different results: the opinion of economists, the one of traders, and their own empirical effective average impact of each indicator on prices. The results show, among different rankings, that the US Non-farm Payrolls release is overall the most important one.

Going back again to predicting forex⁷ behavior, we find the remarkable paper of Ehrmann and Fratzscher (2004) in understanding, once more, the failure of macroeconomic models in a short to middle term basis. There are several findings in here that support previous literature. They confirm that models using real-time data outperform the ones using vintage data⁸. US releases have a stronger impact than news from the E.U. due to more detailed information, earlier release period and bigger market. Negative news have, in general, a stronger impact, than positive ones. The model developed by Ehrmann and Fratzscher (2004) made it to forecast 75% of monthly direction, but failed in forecasting magnitude. The authors believe this happens because fundamentals impact changes over time and depend on market and political conditions. Besides that, prices are also affected by traders irrational behaviors, like overreaction, herd behavior, anchoring, etc. None of these factors are captured by macroeconomic models, what makes them inefficient.

This frustration has led to an academic search for alternatives that better explain forex behavior in the short term, and three different approaches have emerged that made some

⁶ This is partially related with the characteristics of each of these currencies, which we describe in section 3.

⁷ This is the short-cut for foreign exchange rate, which we will use from now on.

⁸ Revised data.

progress in understanding this. One of these approaches is the Psychology Finance. This field goes against a major assumption in the academic world, which states that investors are rational. Besides that, it is very hard to quantify psychology, what makes it difficult to present numerical results or develop models. For these reasons, this field is less approached by academics. Still though, there have been some attempts of prices explanations through it. Hirschleifer (2001) explains that security expected returns should be determined by risk and misvaluation factors, instead of risk alone as stated by the CAPM model. In his work, he reviews some recent psychological models that attempt to introduce psychological variables to explain asset pricing. Once again, the results of such models are hard to compare and therefore they can't claim strong findings. Even with all these constraints, several irrational behaviors like overreaction, under reaction, herd behavior, overconfidence, contrarian strategies, cascading, among others, are more and more documented and accepted, mostly by practitioners, but also among the academics.

The second approach is a more successful and the most recent one, and is based on microeconomics, in particular order flow⁹. In the base of this subject lies the seminal work of Evans and Lyon (2005 and before). They argue against the traditional asset market models assumptions that, under rational expectations and efficient markets, the announcements of public information are directly impounded in prices with no role for trades in this process of information assimilation. Instead, they empirically prove that induced order flow account for two thirds of news total price effect. In their work named “Order Flow and Exchange Rate Dynamics (2002) the authors estimate that 1 billion of net dollar purchases increases the DM/\$ spot price by about 0.5 percent. These findings conclude that trading process, indeed, affect prices, and therefore order flow contains predictive information, especially in the short term. Developing several models, it is shown that microeconomic models outperform macroeconomic ones, and integrating microeconomic variables on previous models, the forecasting ability of those models were, in average, improved by 30%. An explanation for this improvement is that macroeconomic models are solely based on public information, whereas order flow is non public (in the forex market). Due to the absence of a centralized market, normal traders don't have access to market depth information. Only interdealer banks can see

⁹i.e. excess buying initiated or seller initiated trading, which reflects the market information processing mechanism.

the order flow of their customers. This represents an unfair advantage because of order flow ability to forecast future flow. Besides that it also reflects market participants' expectation, for instance, before important releases. Anyway, this issue is no longer of concern of the authors, who solely focused on the forecasting ability of order flow. These finding are further supported also by the work of Love and Payne (2006), in which they analyzed the effects of order flow, just before important macroeconomic announcements and found out that about one third of price changes after the release is due to it.

At last, there is also a chartist approach to predict forex behavior. Technical Analysis¹⁰ has grown in fame in the last years, especially in the forex market, where many practitioners state it fits the best. Although not yet well accepted in the academic world, as it goes against some basic theories, like the efficient market hypothesis, it has a solid acceptance among practitioners and specially speculators. An infinite number of published books, papers and articles can be found about it as many market participants consider it a source of valuable information. Many papers attempted to prove its effectiveness through models that have technical analysis indicators as variables. One of them is, for instance, the work of Lo, Mamaysky and Wang (2000), where it was found that Technical Analysis indeed provides additional information in price predictions and has some practical value. Besides that, it has been shown that Technical Analysis reflects also human psychology information like over and under reaction or resistance and support levels.

Instead of using any type of econometric model for short term forecasting, Schneller and Vanstone (2010) suggest that a trading system method provides an alternative way to measure currency behavior to macroeconomic news. The authors also defend that this method considers some real world constraints such as: liquidity constraints, slippage on execution of orders, commissions of trades, and risk and money management, which allows for a more practical interpretation of the final results. Besides that, all human psychological factors, as well as political or market conditions, are impounded on the trading activity.

¹⁰Technical Analysis theory argues that the whole information about a security is impounded in its historical price behavior, and that's enough to predict the future price.

The use of automated trading systems has been intensely researched by practitioners and academics, but for different purposes. Practitioners were motivated by a profit maximization motive. The Bank of International Settlements recognized an increase in the application of automated trading systems in currency markets. Instead, academics have used them more to test market inefficiency. But using this time a trading system to forecast and describe forex behavior after news releases, Schneller and Vanstone analyzed the monthly impact of the US Non-farm Payrolls releases over the GBP/USD pair, for a period of 15 years. Unfortunately no exploitable pattern was found, as the out-of-sample result turned out to be non profitable.

2.1 Review Summary

Meese and Rogoff (1987) is one of the first important references in the literature of forex behavior forecasting. But in order to forecast in a fair way, we shouldn't use future actual value, because that creates an artificial advantage. The correct way is by dividing the data set in in-sample and out-of-sample periods (Faust and Rogers, 2001). In any case, at a short term horizon, it remains not well accepted macroeconomic models to describe and predict forex behavior (Ehrmann and Fratzscher, 2004). This can be due to several characteristics of the market, which are more difficult to be captured:

- Speculators activity could be a source of random walk (Olser, 1995);
- Reactions to macroeconomic indicators are not always linear: positive surprises can lead to negative impacts and vice-versa (Edison, 1996);
- Exchange rates react to macroeconomic news announcements in the very short term and in the long run their effects are rather insignificant (Almeida, Goodhart, Payne, 1997). To be more precise, the price usually suffers the biggest changes within the first 20 minutes and the volatility unusual activity is dissipated up to two hours after the release (Chaboud, *et al.*, 2004). This is due to market participants urge to adapt their positions as fast as possible to the new information (Rezania, Rachev, Sun and Fabozzi, 2010);
- Macroeconomic indicators or variables importance change over time (Harris and Zabka, 1995; Thawornwong and Enke, 2003) and have different impacts during regressions or expansion periods (Andersen, Bollerslev, Diebold, Vega, 2004);
- Many models are built using quoted data, which is less precise than actual executed one (Rezania, Rachev, Sun and Fabozzi, 2010).

This frustration has led to the search for different approaches to explain forex behavior. One that has not yet attained convincing results but is a field with many open possibilities is the use of Psychology Finance models (Hirschleifer, 2001). A second and more successful approach is the use of microeconomic variables. Between these, order flow plays a principal role and has demonstrated to increase predictability compared to traditional macroeconomic models, what demonstrate that trading plays indeed an important role in price discovery (Evans and Lyon, 2005; Love and Payne, 2006). A third approach, also with some practical value, is the use of Technical Analysis in model construction, what was found to bring some additional information (Lo, Mamaysky and Wang, 2000). But instead of using any type of econometric models, Schneller and Vanstone (2010) suggest that a trading system method also provides an alternative and more realistic way to measure currency behavior reaction to macroeconomic news.

3 Currency Market and Data

The foreign exchange market is by far the largest financial market in the world accounting with more than \$3 trillion of value traded daily (BIS¹¹ 2007¹²). This is an over the counter market, where brokers/dealers negotiate globally directly with one another, without a central exchange or clearing house. The absence of a centralized market creates a unique microstructure environment where trading occurs at 3 different levels: direct dealer to dealer (interbank) transactions, broker dealt transactions (between banks and retail traders), and non-interbank customer dealt trades (between bank and, for instance, companies) (Shneller and Vanstone, 2010). This particular structure allows also this market to be 24 hours open, although it stays mostly inactive during weekends and national holidays. The trading week starts Sunday at 22:30 GMT¹³, which correspond to the opening of the Asian market, and ends Friday at approximately 22:30 GMT, corresponding to the closure of New York trading hours.

Going back in time, it all started around 1973 with the complete collapse of the Bretton Woods Agreement. This agreement fixed most of the currencies to the US Dollar, which by itself was fixed to gold value. Under these conditions, there was no room for currency trading or speculation, but with the end of it, currency value started to be more and more determined by market forces of supply and demand, and market participants could start taking also their speculative position upon it. Although most individual traders could not participate in this market, this was the birth of modern day forex trading, as we know it today.

In the early nineties, the spot forex market has undergone a radical change, when electronic broking systems were introduced (Chaboud *et al.*, 2004). The speed of transactions was increased and costs reduced due to the elimination of traditional “Voice brokers”, as previously everything had to be done by telephone. Furthermore, around 1997, as computers and internet started to make online financial transactions, forex brokers/market-makers started to emerge and opened the possibility for forex

¹¹Bank of International Settlements.

¹²The most recent year for which global data is available.

¹³Greenwich Mean Time.

retail trading. Now, individual traders started to enter in a market previously reserved only for banks and large institutions

Since then, and with technology improvements, costs have been reduced, transactions numbers have increased, the number of individual traders also increased and there is a vast variety of market makers. Besides that, forex perspective as an asset class has grown in importance and therefore more pension funds, hedge funds and investment banks increased their positions in this market. The amount of speculative activity is now-a-days so big that is the main responsible for the larger intraday price movements. All these reasons explain why this was the fastest growing market in the latest years having more than doubled its daily volume, from 2001 to 2007

Today, two electronic broking systems are mainly used globally for interdealer spot trading: one offered by EBS¹⁴ and one offered by Reuters. Most of all interbank transactions occur through these two platforms and therefore, at each moment, the process of price discovery occurs within the computers of these electronic brokers, which receive and process all orders from around the globe. As a result, the reference spot price at any moment, for a particular currency, is the price observable on the screens of EBS and Reuters (Chaboud *et al.*, 2004).

The number of participants in this market is huge and they are divided in different categories:

- Commercial companies don't have a speculative approach to this market. They usually need foreign currency to conclude their international transactions (buying or selling products in other countries), or, for example, to hedge investments they are doing in other countries;
- Central banks also don't have a speculative approach, what would be unfair, but they can do some big interventions in order to defend national economic interests. However, speculators are used to these interventions and they usually don't represent a constraint for them;
- Banks, financial institutions, management funds, pension funds, hedge funds, all belong to the interbank category. Their activity is primarily speculative and they are

¹⁴Electronic Broking System

responsible for the biggest part of daily volume. Therefore their actions also have the biggest influence on price change;

- At last we have the retail individual trader, who represent a very small fraction of daily activity and have almost no influence on price changes.

Another characteristic of this market is the possibility for high levels of leverage, which is especially used by hedge funds. This fact increases even more the trading volume and, in particular, gives more weight to speculative activity. With so many market participants all over the world and such huge amounts of volume, the liquidity of this market is by far unbeatable by any other, what makes it very tradable at any time, and with very near bid ask spreads¹⁵.

The major forex trading center worldwide is London, followed by New York, Tokyo, Singapore and Hong Kong. Volume usually is more elevated during the overlap hours of the 3 different trading sessions: Asia, Europe and US, being the overlap between the ending of European session and opening of New York where higher activity is registered.

Figure 1: Most actively traded currency pairs

TABLE 1 — THE FX MAJORS

The most actively traded currency pairs involve the U.S. dollar. These six currency pairs, commonly known as "the majors," account for 72 percent of average daily forex volume. Non-U.S. dollar pairs account for only about six percent of volume.

Currency pair	Symbol	Percent of daily volume
Euro/U.S. dollar	EUR/USD	28%
U.S. dollar/Japanese yen	USD/JPY	17%
British pound/U.S. dollar	GBP/USD	14%
Australian dollar/U.S. dollar	AUD/USD	5%
U.S. dollar/Swiss franc	USD/CHF	4%
U.S. dollar/Canadian dollar	USD/CAD	4%

Source: Bank for International Settlements (BIS) triennial survey (www.bis.org)

3.1 Different currencies

As seen above, these are the most actively traded currencies in the world, also known as “the majors”, and each one of them present particular own characteristics,

¹⁵Usually around 1 pip for the major currencies.

which should be taken into account when trading them, and which will be shortly described. (

EUR/USD

Also considered just as the “Euro”, this is the most traded and important pair. The US and Euro Zone are the world’s two largest economies and the Euro is the second most significant reserve currency after the dollar. In this sense the Euro often acts as the primary currency in which overall dollar sentiment is expressed. This pair’s liquidity is unmatched by any other major currency pair, and this is reflected in its tighter spreads and tendency to trade tick by tick. Besides that, EUR/USD receives extra liquidity through crosses like EUR/GBP and EUR/CHF as the less liquid dollar pairs (USD/CHF and GBP/USD) are turned into more liquid cross positions: long USD/CHF (less liquid, and therefore, higher slippage risk) = long EUR/CHF (more liquid) + short EUR/USD. This extra liquidity also contributes to smooth price reaction to macroeconomic releases, what tends to lower a bit the “Euro” volatility, when compared to other crosses. This happens because: let’s suppose a good release comes out for the US. Traders will short EUR/USD, but others will short the Swiss franc (long USD/CHF), and if the last ones want to improve liquidity, they will do it using the formula we saw previously, which means we will have long EUR/CHF trades on the way and this will slow down the “Euro” fall. Therefore, some short term traders observe less liquid currencies behavior to anticipate the “Euro”. This pair reacts much less to scheduled macroeconomic news from the Euro Zone because these are more difficult to interpret as they come from different countries.

USD/JPY

This pair is the second more traded and liquid one. Japan was, until recently, the second biggest economy in the world, now surpassed by China. Besides that, the Japanese Yen tends to reflect the general sentiment of Asian currencies, because some are too illiquid to trade efficiently and others are fixed (China). The Japanese economy also has particular features that affect the behavior of the Yen: The country’s trade balance presents a large surplus, what causes a continuous strengthening pressure of the currency¹⁶. But due to the Japanese long period of recession and as measures for

¹⁶ In the next pages is explained what moves the currency markets.

preventing the economy to slow even more, the Bank of Japan (BOJ) has an active participation on the market in order to prevent valuation of the Yen, what would reduce exportations. This means that when the USD/JPY is falling under certain values a participation of the BOJ is expected. Besides this, Japan has the highest domestic saving and investment rate in the world, and so being, massive amount of capital are invested by Japanese financial institutions, which, due to their particular culture, are very cooperative and communicative with each other. This fact makes so that technical levels, like supports and resistances, among others, have a higher validity compared to other currencies, and that market participants react more unanimously to news releases. Therefore, jumps and breakouts tend to be higher, and this makes the Japanese Yen to be theoretically an easier currency for speculators to trade on.

GPB/USD

This pair is also known as the “Cable”. The British currency is traditionally among the most volatile and erratic currencies, because of its lower liquidity and larger point value. It usually trades through key support/resistance levels just to pull back after, because their moves tend to be more pronounced and stay longer in one direction, whereas, for instance, the “Euro” tends to move with more corrections on the way. Some speculators observe the “Cable” also as a leading reaction to US news releases, as it tends to be “faster” than the “Euro” on adapting to the new fair price, but once more, this is due to smaller liquidity and can often lead to erratic movements. It reacts also consistently to news from the United Kingdom.

USD/CHF

Also called the “Swissy” it is mostly known for its role of safe heaven on period of global uncertainty, which causes the currency to strengthen in those periods. The Swiss economy is strongly linked to the European one, and is quite stable. Therefore, scheduled news from Switzerland has little impact on this pair. In terms of liquidity and volatility it mostly shares the same characteristics of the “Cable”.

AUD/USD

Known as the “Aussie”, this currency pair also reacts consistently to news from the Australian economy. A peculiarity is that this currency is strongly correlated with gold, as Australia is an important global producer of this metal. So being, the currency tends to strengthen when gold price rises. In term of liquidity, it is a bit lower, as this currency

is globally less traded. In any case is higher than most of other world currencies as it belongs to “the majors”.

USD/CAD

Canadian economy is strongly linked to the US. Good economic releases for the US also benefit the Canadian dollar, for which it makes challenging to trade this pair. However, this pair has a strong correlation with oil prices. When they rise, this is usually beneficial for the Canadian Dollar. In terms of liquidity is pretty much the same as the “Aussie” or the “Swissy”.

This paper will examine the impact of macroeconomic news announcements using 4 of these currencies. The selected ones are the 3 first ones, obviously due to their degree of importance, and also the AUD/USD. The “Aussie” was the preferred choice instead of the “Swissy” or the CAD due to the higher degree of independence of the Australian economy, as Switzerland has a strong connection to the Euro Zone and Canada is very linked with the US economy.

3.2 What moves the markets

Exchange rates are affected in the long run by many different factors, but like any other market, the basis of currency price variations are always demand and supply forces. The factors that drive these forces are divided into political conditions, market psychology, and economic factors.

Political conditions have a direct impact in a country’s economy and subsequently the currency. Instability usually causes investors to run away and the currency to depreciate.

Market psychology is important because speculative traders react upon it. For example:

- In global uncertainty conditions, they seek currencies that represent a safe haven;
- Traders remember long term trends, although the trend alone doesn’t represent any fundamental information;
- Support and resistance levels are followed by market participants, so even if there is a bad release, a psychological resistance level will fight against the fall. Technical Analysis indicators also influence the opinion of traders;
- Short term speculators are also very influenced by macroeconomic indicators numbers, and tend to react very quickly to them without a better analysis of its real

meaning for the economy. Sometimes the number itself turns out to be more important than the actual possible effect of the release.

At last we have the Economic factors, which, in theory, should be the most important ones, also known as “Fundamentals”. These are mostly related with: economic growth and health, interest rates, inflation and the Balance of Payments, being all connected among them. Several theories exist for currency changes in the long run, but as stated previously, forces of supply and demand are driven by many different factors, and therefore, these theories, all present their drawbacks. The most important ones will be shortly described¹⁷:

- The Balance of Payments theory is directly related to supply/demand forces. It is divided into Trade Balance and Capital Flows. Trade Balance is the relation between imports and exports. If it is negative (more imports than exports), more capital is flowing outside than coming in, what should cause a currency to depreciate, and vice versa. This occurs because when a country imports, it must pay with the foreign country currency, therefore must sell its own to buy the foreign one. Capital Flow works in the same way but regarding investments, like bonds, equity market, real state, bank accounts, acquisition of companies, etc... So, it measures the amount of capital being invested by foreign countries investors compared to the amount of capital flowing out to other countries. Just like before, negative Capital Flow makes a currency to depreciate and vice versa. The US Trade Balance monthly figure is one of the most closely watched by speculators. However, a common mistake is made here, because even if the figure is, let's say, negative (decreased), could happen that in the same period the Capital Flow increased and the total Balance of Payments also increased. But as stated before, many speculator react solely to the numbers;
- The Purchasing Power Parity (PPP) theory is based on the belief that foreign exchange rates should be determined by the relative prices of a similar basket of goods between two countries. So being, same products should theoretically have the

¹⁷ Based in the Forex Book, Day Trading the Currency Market, by Kathy Lien, chief Strategist by FXCM.

same value all around the globe¹⁸. For example, say that \$1 = £2, and a burger in the US costs \$2.50 and in the UK £1.8 (= \$3.60), then the pound sterling is overvalued and should depreciate. This theory fails because it doesn't take into consideration different taxes among countries and assumes that all goods are easily traded all over the globe and without limitations. Besides that, it only has some effect on the very long run, say over 10 years;

- Interest Rate Parity theory states that if two different countries have different interest rates then that difference will be discounted into the forward exchange rate between the two currencies, in order to prevent riskless arbitrage¹⁹. Let's say, US interest rate is 3% and Japanese is 1%, then US Dollar should depreciate against the Yen by 2%. This theory has shown very little proof of working. Usually currencies with higher interest rates rise because central bankers are trying to slow down a booming economy, which means the country is attractive for investors;
- The Real Interest rate differential model also explains why the previous theory has little effect. This model says exactly the opposite. Countries with higher interest rates should see their currencies appreciate in value, and vice-versa, because international investors will always seek the higher yielding currencies. Although being more successful than the previous theory, this model fails in taking into consideration other factors, like political stability of a country, trade balance, and, most important, inflation;
- The Monetary model defends that countries with a more stable Money Supply policy will have their currencies appreciated, whereas expansionist measures will tend the currency to depreciate. This happens because when there is an increase in Money Supply more currency is printed, which naturally increases inflation, and inflation usually provokes currency depreciation. Like all other models, this one cannot be considered alone, as it fails to include the effect of interest rates rise due to higher inflation, which by its way will increase the capital flow of investors

¹⁸ The Bic Mac Index is one of the most famous examples of PPP indicators, as it compares the price of a MacDonald's burger among different countries.

¹⁹ Arbitrage is the possibility of having a higher return than the riskless rate of return, without incurring into any risk. In the Market Efficiency theory arbitrage cannot exist.

seeking higher yields. It also doesn't take into consideration a possible equity market that may be booming and attracting foreign capital;

- The Asset Market Model's basis premise is that the flow of funds into financial assets of a country, such as equity, real state, bonds, bank accounts, mergers and acquisitions, etc, will increase the demand for that country's currency (and vice versa). It actually represents the Capital Flow. The biggest limitation of this model is that it doesn't take into account a country's Trade Balance.

Summarizing, we conclude that exchange rates are affected by many different factors. However, at a very short term, speculators will focus on macroeconomic indicators releases, which by their way are numbers that reveal one of these factors at a time. So, in general we can state that usually markets react to news about:

- Economy health and grow. A growing and healthier economy will attract investors seeking business opportunities, and that will increase the Capital in-Flow and therefore currency value;
- Increases in Inflation causes a positive effect on exchange rate prices because of the expected reaction of interest rates authorities in also increasing interest rates (Almeida, Goodhart, Payne, 1997). This attracts the yield seeker investors;
- Balance of payments, in particular the Trade Balance. An increase in exportations over importations should lead to a positive price reaction of the currency.

3.3 Macroeconomic indicators

This paper will cover some of the most important macroeconomic indicators released in 5 different regions: United States, United Kingdom, Euro Zone, Japan, and Australia. Each one of them and their effect will be shortly described. Their selection was thrilled because, as already stated, their effect can change over time and can be different under different market/political conditions (Andersen, Bollerslev, Diebold, Vega, 2004). Besides that, very little has been researched about indicators other than the US ones, as these are logically considered to be the most important because the US Dollar is on the other side of about 90% of traded currency pairs²⁰.

²⁰ Source: www.investopedia.com/articles/forex/05/TradingOnNews.asp.

Under these conditions, the selection was made giving more attention to recent years impact of the indicators, and was based on the degree of importance attributed by DailyFX²¹, supported also by the work of Rezania, Rachev, Sun and Fabozzi (2010) (for US releases). In their paper, they conducted two pools of opinions to determine the US market mover's indicators: one from economists and one from traders; then they compared their own results with the results of the pools.

After these considerations we selected the following indicators to analyze their impact on prices:

US Indicators:

- Non-Farm Payrolls (NFP) – Monthly change in employment, excluding the farming sector. This is considered to be the most important market mover indicator. Besides employment reflecting overall economic health, it has also a political direct relationship with the Federal Reserve (Fed) as the Fed is responsible for employment equilibrium. So being, a surge in NFP suggests rising employment and potential inflation pressure, which the Fed often counters with rate increases. On the other hand, a consistent decline on NFP suggests a slowing economy, which makes a decline in interest rates more likely to happen. The figure comes out as the actual total change (in thousands of people);
- Gross Domestic Product (GDP) – Is the most comprehensive overall measure of economic output and provides key insights as to the driving forces of the economy. If the figure increases, economy is improving, and thus the dollar tends to strengthen. But a negative change (for example, from 3% to 2%) is more difficult to trade, because even if the pace of growth has slowed it doesn't mean it has deteriorated. The figure comes out as the annualized change compared to the previous Quarter;
- Advanced Retail Sales –Monthly measures the sales increase (annualized) from previous month, of goods to consumers at retail outlets (excludes the service sector). It is an important market mover due to the importance of consumer spending in the US economy. At the same time it represents a measure of consumer

²¹www.dailyfx.com is a professional forex market news and analysis platform, where releases of all macroeconomic indicators from several countries are daily followed and analyzed.

demand and confidence. As it is not adapted to inflation this is reflected on it as well. Although quite volatile (revision values can be very different from the previous released ones) it significantly moves the markets on release, being a rise in the figure usually followed by dollar appreciation and vice versa.

- ISM-Manufacturing –This is a survey valued for its timeliness, and especially during waning boom cycles, analysts tend to point it as one of the biggest market movers. It tends to anticipate sentiment towards inflation and labor conditions, two of the most significant economic health indicators. The figure is expressed as an average diffusion index based on survey responses from several categories like: production, new orders, etc. An increase in the figure should be followed by dollar appreciation and vice versa;
- Trade Balance –The figure comes out as total net difference between exports and imports (in \$billions). A decrease of the figure should usually be followed by dollar depreciation and vice versa.

Although also being very important, in this paper the US CPI figure wasn't considered to be as important as the other indicators selected. Besides that, inflation is assimilated by the Retail Sales figure.

UK indicators:

- GDP – Reflects the overall UK economic growth and health. The effects are the same as for the US GDP figure but affecting the pound sterling. The figure is the annualized percentage change from previous Quarter;
- Consumer Price Index (CPI) – Is the key measure of inflation in the United Kingdom, and is used by the BOE when making interest rate decisions. Therefore a rise in the figure usually should lead to pound sterling appreciation;
- Jobless Claims change – Monthly absolute change in the number of people (in thousands) that claims to be jobless. A negative figure is positive for the UK economy and also for the pound sterling.

For the UK we selected the 3 indicators generally considered to be the most important ones.

Euro Zone indicators:

- Euro Zone GDP – Reflects the overall economy growth for the whole Euro Zone area. The figure is the annualized change from previous Quarter and has the same effect as described for the US GDP but affecting the Euro;
- Euro Zone CPI – Is the key measure of inflation in the Euro Zone area. Inflation in this region is specially followed by interest rates authorities, as the ECB has a strict inflation objective of 2% maximum per annum, being their policy decisions usually made in this direction. Therefore, an increase in the figure should lead to interest rates rise expectations and consequently Euro appreciation, and vice versa.

The Euro Zone has the particular characteristic that indicators reflect the average of all countries what makes their interpretation more challenging. We can have simultaneously some countries running well and growing whereas others are not doing so well. Besides that, Euro Zone releases usually come out later than US ones (Ehrmann and Fratzscher, 2004). For all these reasons, market participants react less to scheduled news coming from the Euro Zone. We also consider the Euro Zone Unemployment figure to be too general (being an average of such different countries) and therefore we left it outside of our analysis.

Japanese indicators:

- GDP – Same meaning, as for the US GDP figure, but their effects concern the Japanese Yen;
- JPY Tankan Large All Industry Capex – measures the quarterly capital expenditures²² (capex) change of all the Japanese industries except the financial sector. This is considered an important early indicator of productivity growth. A high reading is seen as positive/bullish for the JPY, while a low reading is seen as negative/bearish. This figure is usually released at the same time with some other also quite relevant indicators, and markets react to the overall sentiment of all of them, being this, the one with the most influence. The figure represents the relative annualized quarterly change in expenditures compared to the previous quarter.

The Japanese economy has some particular features that should be taken into account when reading the indicators. Japan has a very high surplus in its Trade Balance and has

²² Investments done by companies in fixed assets, usually for production purposes

faced a long recession in the past for more than 10 years. This factor kept inflation always at very low levels making it already almost a characteristic of Japan. For this reason, the Japanese CPI figure is not as important as for other countries. Consequently interest rates were always low as well. Because of the big productivity (lots of exportations) employment in Japan was also most of the time stable (even during this long recession period), which makes the Unemployment figure not that followed by market participants, compared to the same figure of the other countries.

Australian indicators:

- GDP – Reflects the overall Australian economic health and growth. The figure comes out as the annualized percentage change from previous quarter;
- Employment change – Monthly absolute change of employed people (in thousands). A positive figure reflects increasing economy and increasing risks of inflation, which will tend to provoke a rise in interest rates, and therefore AUD appreciation. A negative figure has the opposite effect;
- CPI –Reflects general inflation and is likely to provoke reactions on the interest rate to control it. A rise suggests AUD appreciation, and vice versa. Unlike most other countries (where the release is monthly) the release is quarterly and indicates the annualized percentage change from previous quarter. Being quarterly, its impact is usually stronger, compared to other countries CPI releases.

Just like for the UK, it was considered for Australia the 3 general more important figures.

Five important releases, related with interest rates decision in the different regions, where left outside this work: the Federal Open Market Committee (FOMC) rate decision, for the US; the Bank of England (BOE) rate decision; the European Central Bank (ECB) rate decision; the Bank of Japan (BOJ) rate decision; and the Reserve Bank of Australia (RBA) rate decision. Interest rates are the reference for the return of a currency (yield), thus a direct implication on it causes an immediate reaction of prices. If the figure rises, it follows an appreciation of the related currency, and vice versa. Even when the figures remain unchanged (most of the times) large moves can be seen due to usual comments and statements that come along with the release, emanated from the responsible authorities, in which they give future insight about the economic situation. These insights can sometimes be more important than the release itself.

Although usually having a big impact, we don't cover these indicators because their time of release is not precise, like the others previously described. They can come out some minutes before or later than the expected time. Besides that, the numerical figure is always well anticipated and what usually make the biggest impact are the comments around it, which are more difficult to capture in an automated trading system.

The previous scheduled macroeconomic indicators were described based on the information of www.dailyfx.com as the result of many studies and analysis done by their team of forex analysts.

3.4 The Data Set

From all the above selected indicators we retrieved the historical data concerning: exact time of release; date of release; actual value at release date (instead of revised one); and Money Market Services (MMS) median survey expectation²³. All this information was obtained for the period of January 2004 to December 2010 (7 years). This data was retrieved in the Bloomberg platform.

Concerning the currency prices, due to financial constraints, quoted data is used in this paper instead of the more precise actual executed one. The data was obtained through the free "Historical Data Feed"²⁴ facility, made available by the Swiss Forex Bank "Dukascopy" in its website²⁵.

Data was collected for all the days in which all the selected macroeconomic announcements of each country are released. Depending on the announcement, the corresponding currency is used. Then, for each selected day, we used the 1 minute closing ask prices, from a period of 3 hours, starting 10 minutes before the corresponding release. The 3 hours limitation was imposed because this paper focuses on the immediate effect of releases over currency prices, being the period after the first 3 hours not further objective of our analysis.

²³ The most used source of market expectation data.

²⁴ This facility is made available for personal research uses, but Dukascopy doesn't guarantee its 100% accuracy, as there is no assurance that data didn't suffer any distortion.

²⁵ www.dukascopy.com/swiss/english/data_feed/historical/.

For simplicity purposes, and because the forex market offers very narrow spreads, only the ask prices were retrieved and handled as mid prices. Then, for trading simulations, an average spread is subtracted to obtain the bid price.

4 Methodology

As stated previously, our main objective is attempting to forecast exchange rate behavior after scheduled macroeconomic releases, through a trading system approach, for a better understanding of their effects. We therefore focus on the search for trading systems that could systematically capture the formation of behavioral predictive patterns.

4.1 Hypothesis development

The null hypothesis in our study, for each macroeconomic indicator, is that mechanical rules for generating trading orders should not result in unusual risk adjusted returns, considering retail traders trading conditions. Otherwise we will be arguing against the Market Efficiency theory, stating that predictive patterns of exchange rate behavior after scheduled macroeconomic news releases indeed exist.

4.2 Trading System design

A general criticism of using trading systems is the absence of a formal methodology describing the procedure for the development as well as the benchmarking of results (Vanstone and Finnie, 2009). In this paper we just develop, by our own, some very simple trading strategies, based on logical possible forex reactions that speculators usually expect. As the main goal of this paper is not profit maximization but rather patterns discovery, these simple trading strategies fit our needs. So, we follow the rules suggested by Vanstone and Finnie (2009) from their empirical methodology for trading systems development.

Any time we address to prices in our strategies description, we refer to the 1 minute closing prices of our data set.

Strategy 1 – React to the unexpected value of the release. As explained by Edison (1996), the market should only react to the surprise component of a release, because the expected one should be already reflected into prices. As we've seen previously, a rise in

interest rates provokes a direct appreciation of the currency, however, if the market is expecting and pricing a rise of 1%, a figure coming out with a rise of only 0.5% would cause a negative surprise of -0.5%, what would tend to be followed by an immediate fall in the currency value. Nevertheless, Edison (1996) also prevents for the fact that the expected component is usually a media forecast, but this methodology fails to take account of the general diversity of opinions and expectations. In any case, as the MMS forecast expectation is the most widely used by speculators, our first strategy will be based on it. So being, strategy 1 compares de expected figure before the release with the actual one after it. If a positive surprise appears, a long position is opened at the closing price of the minute when the news was released. If the surprise turns out to be negative or it exactly matches expectations²⁶, a short position is opened in the same place. The position is then closed 2 hours and 50 minutes later, as by this time the immediate effect of a release should have dissipated (Chabou *et al.*, 2004).

Example: the CPI figure is released at 9:30. The expected value is 1.5%. The figure comes out to be 2.3%. A long position is opened at 9:30 minute closing price.

Strategy 2 – React to the first move of the market. As the effect of surprises is not always 100% linear, since positive surprises can lead to negative price changes and vice versa (Edison, 1996), Strategy 2 reacts to the first minute price variation. If the variation between the closing price of the previous minute and the closing price of the minute, when the news was released, is positive, that a long position is opened. If the variation between the two 1 minute closing prices is negative, than a short position is opened. The position is then closed 2 hours and 50 minutes later.

Example: The NFP release comes out at 12:30. At 12:29 closing price the Euro was 1.3460. At 12:30 closing price is 1.3420. A short position is opened at 1.3420.

Strategy 3 – Considers that certain market participants could have access to private information, like for instance: bank dealers can see their costumer order flow, which forecasts the release figure (Evans and Lyon, 2005). Also, the inside trading reality is tested in here, as some traders could have access to the information before public

²⁶As the impact of negative news tends to be bigger than positive ones (Ehrmann and Fratzscher, 2004), the impact of surprises is slightly skewed to the left, and generally a perfect match of expectation tends to develop a little negative impact.

release. Also, before such releases, a decrease in volume and volatility is to be observed, as market participants are all watching the screens waiting for the release to come out, therefore, not much market activity should be seen the minutes just before the release. This is also known as “the calm before the storm” (Chaboud *et al.*, 2004). So being, strategy 3 will open a position any time a one minute variation is larger than, say 5²⁷ pips²⁸, during the 10 minutes period preceding the release. If such a variation happens, when positive, a long position is opened (at the closing price of the minute when the variation happened), same thing happens with a negative variation, but entering a short position. If no such one minute variation happens, at the moment of release this strategy adopts the behavior of strategy 2. If the one minute variation happens and a position is opened before the release, when the release comes out, if the one minute market reaction is on the opposite direction by a move higher than, say 10²⁹ pips, than the position is closed and a position in the opposite direction is opened. The final position is then closed 2 hours and 50 minutes later.

Example: The GDP figure is released at 00:30. At 00:26 the AUD/USD is quoted 0.8570, at 00:27 is 0.8562 (8 pips decrease in one minute); a short position is opened at 0.8562. At 00:29 the price is 0.8560, than: scenario 1- at 00:30 the price is 0.8510, the position keeps short until the end; scenario 2- at 00:30 the price is 0.8568 (8 pips one minute variation at release, which is less than our 10 pip limit), the position keeps short until the end; scenario 3 – at 00:30 the price is 0.8590, the short position is closed and a long one is opened, which will then last until the end.

Strategy 4—As it was graphically noted that before a jump in the exchange rate, caused immediately by the news release, prices often tended to slightly move in the opposite direction, this strategy was developed to test this assumption. So being, it will consider the absolute variation in the 9 minutes previous to the release. If the variation is positive

²⁷ This is an indicative number, the optimal number is then found through the optimization of the strategies, as described further in this section.

²⁸A pip is the smallest price change of a currency pair. For most of the pairs it represents a variation of 0.0001, for the USD/JPY is a variation of 0.01.

²⁹This is an indicative number, the optimal number is then found through the optimization of the strategies.

a short position is opened, and vice versa. The position is then closed 2 hours and 50 minutes later.

Example: The Advanced Retail Sales figure comes out at 13:30. At 13:20 the EUR/USD price is 1.4350 and at 13:29 is 1.4362. A short position is opened at 1.4362.

Strategy 5 – A very common strategy among speculators profiting from “Trading the News” is one based on the assumption that these releases are always going to significantly move the markets in one of the directions. Therefore a strategy is followed simulating entering both a long and a short position with two very narrow stop orders. When the release comes and prices move to one direction, one of the orders is immediately canceled out and the other occurs into a winning position³⁰.

This is the same as inserting a stop and a limit order (for an imaginary long position) with no open position at all. Then, by the time the release comes out, one of the orders will be executed opening a position in the direction of the jump. This strategy is usually used by large financial institutions as they have capital to invest in stronger computing software to speed up the automated reaction. The order execution must be as fast as possible because at the exact moment of release the whole market is being invaded with orders, which cause a larger slippage³¹ risk. The faster the order can be executed, the less slippage it will suffer. A retail trader will possibly suffer more slippage as his order must pass through the dealer bank computers before reaching the electronic broking system. In any case, this is a possibility, and strategy 5 will be examined as follows:

Supposing the limit and stop orders are just 5 pips away, and placed 1 minute before the release. At the end of the minute, when the news are released, if this minute variation is positive, a long position is opened at the previous minute closing price plus 5 pips. If the variation is negative, a short position is opened at the previous minute closing price less 5 pips. If the minute variation is lower or equal to 5 pips, no position is opened.

³⁰ An example of this strategy can be seen at: <http://forexjungle.blogspot.com/2008/11/use-ea-to-trade-non-farm-payroll-nfp.html>.

³¹ The difference between the price we see when we insert an order, “at market price” and we click to confirm, and the actual executed price. Example: on the screen we see EUR/USD at 1.4550, we click to buy, and our order was executed at 1.4552. We had 2 pips negative slippage.

Example: The Trade Balance figure comes out at 13:30. At 13:29 the GBP/USD price is 1.9350 and at 13:30 is 1.9410. A long position is opened at 1.9355.

Special care must be given to this strategy as it is considered to act immediately during the minute when the release is launched (contrary to the other strategies that consider only the closing price of that same minute, losing some immediate momentum). But in order to gain from this immediate momentum, or jump of prices, some greater risks are associated with it, namely: immediately after the release volatility spikes and bank dealers tend to widen the bid ask spread³² to their customers, sometimes up to 10 pips (this problem is only addressed to retail traders); another fact is the increase on slippage due to markets moving very fast. All this usually happens in the first 20/30 seconds after the release, then tends to calm down to normal values, but this period coincides with the one strategy 5 is acting on. For this reason we assume and deduct 25% of the first minute absolute variation's Standard Deviation³³ as an attempt to include these factors³⁴. This deduction is subtracted to each trading result of this strategy.

4.3 Risk and Money management

Because it is being analyzed a very short term reaction of forex behavior (up to 3 hours after the release) and each macroeconomic indicator is being examined alone, in every trading strategy we would be making one trade per month that would last a maximum of a couple of hours. For this reason we found to be confusing trying to replicate a continuous portfolio. Instead, we will only sum up the results from every single trade instead of constructing a time series of returns. Then, for comparison purposes, each trade result will be considered to represent the daily return.

As constructing a continuous portfolio is not our main goal, each trade will be considered independent. This means that for each trade, the initial invested amount is

³²This is a fact to be considered in this paper, as we are only dealing with Ask prices, if we were using also Bid prices we would directly compute the actual difference.

³³ Usually, the first minute after the release has the larger variation on prices, also known as the "jump" after the release. The absolute Standard Deviation of this variation is a proxy for the average dimension of the variation (considering both sides, positive or negative).

³⁴ These factors effects are only possible to be measured with the use of actual traded Data. In this paper we can only make an estimate.

always 1 unity of currency (for the GBP/USD is one pound; for the USD/JPY is one dollar, and so on). In the real world it would make no sense to trade 1 dollar, but for computational reasons, the amount makes no difference and results can be then multiplied. Is not the purpose of this work to determine which amount of capital is better to trade, nor to deal with liquidity constraints issues. Therefore we will never refer amounts of capital and the money management dimension is left out of focus.

The risk component is much more important to evaluate trading performances and understanding price patterns. Therefore we will conduct a determined risk management policy with the use the following instruments:

Stop order – an order usually placed at a level where market price is against our position. That level means the maximum amount we are ready to lose. If markets move against us and reach that level, the order is triggered and a “market” order is sent to the market, immediately closing our position.

Trailing Stop order – same use as a stop order but this time the level of the order moves, as the market moves in our favor and stays unchanged if the market goes against us. For example, if we open a long position and put a trailing stop order 20 pips bellow our entry price, if prices goes up 100 pips and then back again 200, we would win 80 pips. The order would follow the rise of the price, being always 20 pips bellow it and when it would fall the order would stay unchanged until being triggered and closing the position 80 pips above (a normal stop order in this example would incur a loss of 20 pips). Although it seems to be more advantageous because it better protects possible small gains, it increases the possibility of being wiped out from a bigger gain. For example, if prices go up 100 pips, than fall 30 pips and then move 200 pips higher again, the trailing stop order would make a gain of 80 pips, but a normal stop order would not have closed the position and the gain would have been 270 pips. Like every order, it has its pros and cons.

Limit order – this order is usually placed at a level where markets would be in our favor. From an execution perspective works like the stop order: if markets reach that level, our position is then closed. It is used when we fear that markets will start moving in our favor, but will later change course.

For each one of the 5 Strategies described previously, 5 more combinations are tested using these risk management features: stop order alone; trailing stop order alone; limit order alone; stop and limit orders; trailing stop and limit orders.

In strategies 1, 2 and 4 these orders are introduced at the same time as the position is opened. In strategies 3 and 5 these orders are introduced only at the end of the minute when the release comes out.

The distance to the entering price, to which the orders will be placed, will be a function of the optimization process described further in section 4.5. Whenever an order is to be placed “as narrow as possible”, we will consider the minimum distance to be 5 pips away (4 pips for the AUD/USD), as less than this is sometimes not practicable or irrational due to market noise³⁵. Specially for strategy 4, the minimum distance will be 10 pips away (8 pips for the AUD/USD), as an attempt of including more slippage risk, because if markets move against this strategy, the closure of the position will be during the “jump”, when the risk for slippage and spreads are higher, as we’ve seen with strategy 5.

A general constraint of using closing prices is that we can’t say what happened in between one minute. This fact can lead to a little bias on risk management orders results, but their impact would be very low on the general trading system performance.

4.4 Division of data

Our period of analysis of seven years (January 2004 to December 2010) is divided in two: the in-sample period (January 2004 to December 2007) and the out-of-sample period (January 2008 to December 2010). The in-sample data is used to test all the system strategies and optimize them in order to get the best Trading System that captures price change behavior. Once the whole optimization is concluded, parameters are frozen and tested out-of-sample as they are and without changes. In this way we are simulating being in 2007, working only with information preceding this period, and then trying to forecast the unknown future from 2008 on. There is a general criticism of researches examining trading patterns in which the results are the product of data

³⁵ Noise – little movement of prices due to transactions between traders, even when prices are flat without any particular direction.

mining caused by a future artificial advantage (Faust and Rogers, 2001). This may lead to higher quality predictions, but doesn't have a valid basis because a system is then created, which works with information that couldn't be known in chronological time (Schneller and Vanstone, 2010). Besides that, the relationship between prices and variables that determine prices change over time (Thawornwong and Enke, 2003). This represents a real world constraint that is wiped out when using future actual data. For these reasons, and for better results, this paper avoids what is also called as "look ahead bias".

The selection of both periods was made based on a 60% training and 40% testing rule (Vanstone and Finnie, 2009). Furthermore, the length and number of observations determine how solid a system is. The more observations the greater robustness, and the longer the period the greater number of different market conditions like political events, financial crises, wars, etc, are considered. Our period of 4 years training and 3 years testing seems to cover many different market situations, although the testing period will go through the 2008 big financial crises and the training period doesn't face such conditions. But this will be a good ground to examine if the systems are consistent over time. Our number of training observations is usually 48 releases (over the 4 years) which respect the general rule of minimum 30 observations (Vanstone and Finnie, 2009). The only drawback is when analyzing quarterly indicators, in which observations occur less often (only 16 in a 4 years period). Although probably less consistent, we are limited to the selected period and will examine them in this way.

We decide to further divide data once more. The in-sample data is divided in two sub periods: Jan 2004 to Dec 2005 and Jan 2006 to Dec 2007. This allows us, when selecting the trading system that best fits, to observe consistency over time, as we analyze different periods. Because we want to predict future price behavior, a system must be able to fit several market conditions over time.

The out-of-sample data is also divided in two sub periods: Jan 2008 to Jun 2009 and Jul 2009 to Dec 2010. This serves to give robustness to final results and check, even if a strategy turns out to be profitable, if it was along different phases of the period, or if it could have been just due to a luck factor. In this way more solid results about the forex price behavior can be obtained.

4.5 In-sample testing and optimization

The 5 trading strategies are tested, each one with all the risk management orders variations. This generates a series of metrics, for each strategy variation, based on a set of inputs (like f.e. the distance of risk management orders). The optimization process will change thesees inputs in order to find the best profitable solution through an interaction of parameters, values and performances.

In strategy 3 it will also be found the optimal amount of one minute variation to open a position before the release, and the optimal one minute variation, at release, to which market has to go against us in order for our position to be inverted.

In strategy 5 we logically see that, as more narrow the “break out rage speculation” orders are placed, the more profit we will have after the jump caused by the release. But a distance of 1 pip would be practically nonsense as the order could be triggered even before the release. We considered a 5 pip distance to be fair enough for the purpose.

The optimal solution for each strategy variation can be different among different macroeconomic indicators, although they tend to be similar. For each macroeconomic indicator, when the optimal parameters are set, all strategies are frozen and their results are compared among them. As we are in a speculative environment and in a market that allows high levels of leverage, likewise increasing risk, absolute return is not the only thing we consider when selecting the best strategy. We look rather at risk adjusted return and consistency over the 2 in-sample sub periods. Consistency is measured by the difference of results of the 2 sub periods, in which bigger differences represent less consistent systems. For comparing risk adjusted returns we create an absolute variation of the Sharpe ratio³⁶: the components are: average profit per trade (appt); average value of the currency in the period (avc); absolute standard deviation of single trade results (astd); a risk free annual rate of 5%.

$$\text{Sharpe Ratio} = \frac{\text{appt} * 252 \text{ days} - \text{avc} * 0.05}{\text{astd} * \sqrt{252}}$$

³⁶ Sharpe Ration is a measure of performance in which total return is divided by the Standard Deviation (measure of risk) to obtain a relative performance to the risk incurred.

The higher the ratio the better the risk adjusted performance. A value higher than 3 is considered to be very good³⁷.

At last, we select the best automated trading strategy for each indicator and apply it to the out-of-sample period, adding the real world constraints in order to analyze the final trading results.

In the in-sample testing we are still not considering real world constraints, as the purpose of in-sample testing is not yet to obtain a profitable result but rather just to compare the different trading strategies among them. Additionally we have to remember that our data set is composed only by ask prices. This causes a spread advantage because all our selling orders will be at ask price (should be bid). This advantage will provoke a slightly increase of performance in all strategies but, for comparison purposes between them, it won't change a thing. Later, for real trading profit results, this advantage will be eliminated by subtracting the average difference between an ask and a bid quotation³⁸.

4.6 Out-of-sample testing

For each macroeconomic indicator, the best in-sample trading performance strategy is selected and applied “as it is” to the out-of-sample period. Then, in each trade result the following is subtracted:

- 3 pips for eliminating de ask prices only advantage – For each single trade we incur in two transactions: one for opening the position, and another to close it (a buy and a sell, or a sell and a buy). The buy operation is correct because we use ask prices, only the sell one is not. For this reason we subtract 3 pips, once per trade.
- 2 x 3 pips for commissions – Nowadays, for active traders, who trade significant amounts of currency, the fixed commissions are insignificant, compared to the spread commission, and tend to disappear. Dealers price the commissions directly on the spread they show to their customers widening the bid ask spread to their advantage. There are brokers that offer lower spread commissions but in general,

³⁷ Source: www.investopedia.com/articles/07/sharpe_ratio.asp

³⁸This difference is in average lower than 2 pips, due to the huge liquidity of the forex market, but we will subtract 3 pips as to increase robustness of final results.

worldwide and for the major currencies, the spread is around 3 pips³⁹. We have to deduct it twice as every trade is made by two operations.

- 2 x 3 pips of slippage – There are many retail dealers worldwide and some argue to be more serious than others, or with better infrastructures. The fact is that a good dealer, under normal market activity, should prevent slippage of orders from his customers, or allow just a minimal amount of it. It is to be noted that slippage, usually seen as an added cost to be considered when evaluating trading performances, can also be positive. Once again, in order to improve robustness of final results, and because in this paper we also include in slippage calculations any other possible constraint that could arise from the real world, we consider an average negative slippage per operation of 3 pips, which is far above average.

After deducting all these cost constraints for each single trade, the final performance is evaluated and found out whereas it exist indeed a profitable pattern behavior or not. Independently of numerical result, further conclusions are also described.

The AUD/USD average bid-ask spread is significantly lower than the other pairs we are considering. This is due to the fact that an absolute dollar variation has a lower pip variation in this pair, due to the unit size. For example: 1 unit GBP is on average 1.6 dollars, but 1 unit AUD is only 0.85. Therefore, particularly for this pair's calculation, we are considering a bid-ask spread of 2 pips as well as a slippage of 2x2 pips.

³⁹ www.investopedia.com/articles/forex

5 Empirical Findings and Results

In order to compare the four currency pairs among them, two of the most important US indicators were selected, as the USD is presented in all of the four pairs. The selected indicators were the US NFP and US GDP. In these two cases, all strategies were applied using the four currency pairs.

US NFP

For all currency pairs, strategy 5 was the best performer in the in-sample period⁴⁰, using a trailing-stop order as narrow as possible. For the EUR/USD, GBP/USD and USD/JPY we consider the “as narrow as possible” to be 5 pips away; and for the AUD/USD to be 4 pips away⁴¹. Results can be seen in the table below:

Table 1: US NFP results for all 4 currency pairs

NFP	In Sample						Out of Sample						Real					
	1st Block		2nd Block		Total		1st Block		2nd Block		Total							
Euro	12.35	70%	0.0038	11.27	30%	0.0022	10.71	50%	11.26	42%	0.0025	9.15	23%	0.0023	10.10	33%	1.26	8.42%
Libra	12.04	58%	0.0026	14.66	43%	0.0025	12.61	50%	10.11	24%	0.0018	9.66	20%	0.0017	9.98	22%	0.25	5.38%
Yen	9.11	43%	0.0039	11.96	76%	0.0050	10.52	60%	14.13	70%	0.0044	17.54	61%	0.0046	15.46	66%	6.54	29.53%
Aussie	9.93	47%	0.0035	8.67	25%	0.0022	9.04	36%	19.86	53%	0.0023	13.61	55%	0.0039	16.10	54%	4.83	19.44%

Absolute Sharp Ratio
Annualized Average Daily Profitability
1st minute Standard Deviation (Average "Jump")

The first minute standard deviation (average “jump”) observed in this table was recalculated to be proportional to the relative one unit invested amount of each currency pair. It is obtained dividing the normal absolute standard deviation of the first minute variation in pips by the average quotation of the underlying currency pair. So being, we can also compare in which currency pair a greater first minute impact, of the same new release, is observed.

The USD/JPY was the most profitable currency to trade with 29,53% annualized daily profitability and 6.54 risk-adjusted Sharpe ratio, which is considered to be a very good performance (over 3). We can also observe that the USD/JPY has always the higher first

⁴⁰ We remind that for comparison reasons we do not consider only overall profitability, but also risk-adjusted absolute Sharpe Ratio.

⁴¹ We consider a bit less for this pair, due to the reasons explained in the section: Out-of-Sample testing.

minute average jump, confirming that investors react more unanimously in this pair, which makes an easier currency for speculators to trade on, as stated in section 2.1.

The strategy performance is quite robust as results were consistent over the 4 sub periods. Besides that, the next graphs show how profitability and Sharpe ratio would stay positive even changing the trailing stop order distance:

Figure 2: US NFP profitability in function of order distance (USD/JPY)

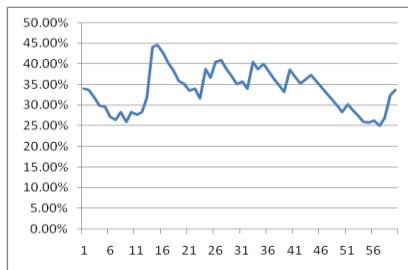
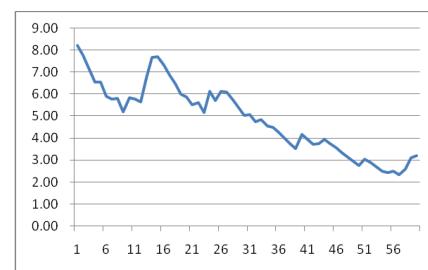


Figure 3: US NFP Sharpe ratio in function of order distance (USD/JPY)



Below we can see the details of the USD/JPY out-of-sample trading results⁴²:

Table 2: US NFP trading summary (USD/JPY)

Average Initial Amount USD/JPY	95.65
Top Loss	-0.24
Top Profit	0.66
Avg Loss	-0.12
Avg Profit	0.23
Avg Trade	0.11
Absolute Std Deviation	0.23
Number Trade Losses	10
Number Trade Profits	22
Profits over Losses Ratio	69%
Number No Trades	3
Total Profit	3.92
Avrg annualized Daily Profitability	29.53%
Sharp Ratio	6.54

A positive return was achieved in the out-of-sample data following the US NFP monthly release. This indicates that, based on the parameters used in this paper, a predictable behavior or exploitable trading pattern was found. Our null hypothesis is in this case therefore rejected.

Furthermore, we would like to highlight that very short term trading costs are proportionally very high. For opening and closing a position we pay 6 pips (in this case

⁴² Before every trade, the initial amount considered is always 1 US Dollar

0.06 USD/JPY), which is equivalent to an annualized daily cost of 15,8%. In our calculations we include also more 6 pips for slippage and other costs. So being, in the case of the US NFP, a retail trader would be having an average trading profit of 11 pips per trade, but 12 pips have already been discounted, which is half of the profitability. From here we can also conclude that big speculators, who mostly move de markets, like hedge funds, investment banks and other with direct access to the main electronic broking systems, they have a big advantage over the retail traders, as they don't pay commissions and the execution of their orders are much faster. For them, the same trading strategies have an even better performance. In any case, for the remainder of this section, we will be mostly showing the results from the retail trader point of view.

US GDP

This is the second indicator in which all 4 currency pairs were applied. For all of them, once more, strategy 5 was the best performer, with a trailing stop order as narrow as possible (5 pips, and 4 pips for AUD/USD). Result can be seen bellow:

Table 3: US GDP results for all 4 currency pairs

GBP	In Sample						Out of Sample						Real						
	1st Block			2nd Block			Total			1st Block									
Euro	11.46	32%	0.0010	10.19	26%	0.0013	11.18	29%		6.84	16%	0.0012	7.99	12%	0.0010	7.26	14%	-11.2	-8.42%
Libra	13.65	40%	0.0012	10.42	26%	0.0012	12.28	33%		4.53	15%	0.0011	2.69	8%	0.0009	3.85	12%	-7.0	-7.11%
Yen	14.72	20%	0.0009	9.12	37%	0.0023	9.29	29%		6.05	23%	0.0022	20.11	43%	0.0024	11.34	33%	-2.2	0.07%
Aussie	4.60	14%	0.0014	1.87	7%	0.0011	3.54	11%		6.46	14%	0.0011	5.25	15%	0.0018	5.96	15%	-7.7	-6.08%

Absolute Sharp Ratio
Annualized Average Daily Profitability
1st minute Standard Deviation (Average "Jump")



Results for this indicator were fairly robust and positive, but from a retail trader perspective, when we add all real world constraint costs, that profitability is wiped out, as we can see in the table.

Once more, the USD/JPY, aside from the first sub period (block), presented always, and on average, the larger first minute “jump” after the release, confirming again the characteristics of the Japanese Yen. This led also to the best performance among the four currency pairs, which was almost neutral, compared to the others that were negative. The graphs bellow show how profitability would change, changing the distance parameter of the trailing stop order. On the left we consider the real results (retail trader perspective), and on the right results without deducting commissions and slippage (possible for direct market participants):

Figure 5: US GDP profitability in function of order distance (USD/JPY)

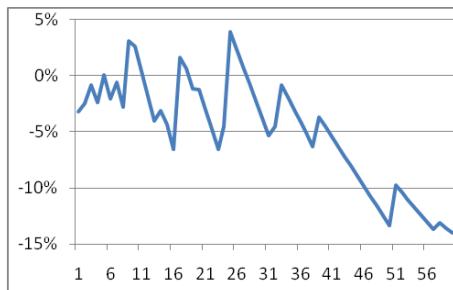
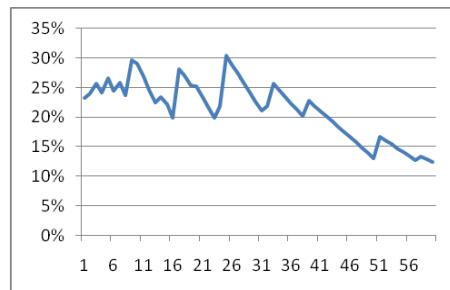


Figure 4: US GDP profitability in function of order distance (USD/JPY)



It is to be referred that for quarterly indicators, like this one, the out-of-sample results are based only on 12 trades (3 years period). This low number lowers also the final robustness of results. Nevertheless, we can observe that the results don't drastically change with the change of the trailing stop order distance parameter and they were consistent over the four sub periods, what lead us to conclude that they are fairly significant.

The final conclusion is that, for this indicator, our strategy was able to get a significant positive performance, therefore exploiting a predictable behavior of price reactions. However, the profitability obtained is almost totally cancelled out by the trading costs faced by the retail trader, what makes the final result insignificant. As we are analyzing the existence of exploitable trading patterns from a retail trader perspective, for this indicator the null hypothesis can't be rejected.

Below we can see the details of the USD/JPY out-of-sample trading results, with normal trading costs and without them:

Table 4: US GDP trading summary (USD/JPY): normal (left); and without trading costs (right)

US GDP	US GDP without trading costs
Average Initial Amount USD/JPY	95.31
Top Loss	-0.20
Top Profit	0.27
Avg Loss	-0.15
Avg Profit	0.10
Avg Trade	0.00
Absolute Std Deviation	0.14
Number Trade Losses	4
Number Trade Profits	6
Profits over Losses Ratio	60%
Number No Trades	2
Total Profit	0.00
Avrg annualized Daily Profitability	0.07%
Sharp Ratio	-2.16
Average Initial Amount USD/JPY	95.31
Top Loss	-0.08
Top Profit	0.39
Avg Loss	-0.08
Avg Profit	0.17
Avg Trade	0.10
Absolute Std Deviation	0.15
Number Trade Losses	2
Number Trade Profits	8
Profits over Losses Ratio	80%
Number No Trades	2
Total Profit	3.92
Avrg annualized Daily Profitability	26.51%
Sharp Ratio	8.67

As we can see, the profit over losses ratio stay positive in both situations, but when trading costs are subtracted, the average profit turns to be lower than the average loss, cancelling the obtained profitability.

After analyzing these two US indicators using the four currency pairs, we conclude that the USD/JPY is the best pair for this type of speculation, as in both cases it had the best trading performance. We therefore agree with the Japanese Yen currency description of section 2.1. In the work of Chaboud *et al.* (2004) is stated that, immediately after the announcements of US GDP and US NFP, the EUR/USD has a higher average return than the USD/JPY. However, their data set goes from 1999 to 2004. If we compare it to our study, indeed, in our first sub period (2004-2005), the USD/JPY is not already the best performer. This fact leads us to agree with Chaboud *et al.* (2004), but a hint is left, that currencies performance and characteristics can change over time.

Just in order to improve our confidence in considering the USD/JPY the best currency to speculate on, we further compared the performances between the EUR/USD and USD/JPY over the US ISM-Manufacturing and US Retail Sales releases, only for the period of 2005-2006⁴³. Results were in line with our assumption. Based on our results so far, we will be working exclusively with the USD/JPY currency pair when analyzing the 3 remaining US indicators.

US ISM-Manufacturing

The analysis is made using the USD/JPY. The best in-sample performing strategy was strategy 1, with a stop order 20 pips away from the entry price. Results were as follows:

Table 5: US ISM-Manufacturing results

ISM	In Sample						Out of Sample						Real
	1st Block		2nd Block		Total		1st Block		2nd Block		Total		
	3.39	18%	0.0004	4.21	24%	0.0012	3.86	21%	2.76	26%	0.0018	-11.77	-23%
												-0.57	2%
												-6.34	-33.1%
Absolute Sharp Ratio													
Anualized Average Daily Profitability													
1st minute Standard Deviation (Average "Jump")													

As we can see, results were quite consistent during most of the time, but suddenly, in the second sub period of the out-of-sample data, they turn out to be very negative. This result gives some support to the theory that the importance and characteristics of variables affecting price behavior change over time (Harris and Zabka, 1995;

⁴³ Result can be seen in the Appendix section.

Thawornwong and Enke, 2003), or that they can have different impacts during regressions or expansion periods (Andersen, Bollerslev, Diebold, Vega, 2004).

Our findings here are that, even without accounting for trading costs, the best in-sample system performance wasn't able to generate additional profits when tested out-of sample. Subtracting the trading costs, the real results are significantly negative. So being, for the US ISM-Manufacturing we strongly reject the alternative hypothesis that considers the existence of a profitable trading pattern.

Details of the trading results can be seen bellow:

Table 6: US ISM-Manufacturing trading summary

US ISM	
Average Initial Amount USD/JPY	95.65
Top Loss	-0.35
Top Profit	1.31
Avg Loss	-0.30
Avg Profit	0.37
Avg Trade	-0.13
Absolute Std Deviation	0.36
Number Trade Losses	26
Number Trade Profits	9
Profits over Losses Ratio	26%
Number No Trades	0
Total Profit	-4.40
Avrg annualized Daily Profitability	-33.11%
Sharp Ratio	-6.34

US Retail Sales

The currency used was the USD/JPY. The best in-sample performer was strategy 2 with a trailing stop order as near as possible, therefore 5 pips away from the entry price. Results were as follows:

Table 7: US Retail Sales results

Ret Sales	In Sample					Out of Sample					Real
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	
	3.70	10% 0.0007	5.40 15% 0.0014	4.65	13%		-3.77	-1% 0.0023	-12.94 -6% 0.0023	-6.66	-3% -38.2 -43.2%
Absolute Sharp Ratio											
Annualized Average Daily Profitability											
1st minute Standard Deviation (Average "Jump")											

For the US Retail Sales, our trading system wasn't able to capture the variations of market conditions and reactions over time and therefore the results couldn't be replicated when applied out-of-sample. In this case, even the results without considering trading cost are negative, and so being no predictable trading pattern is found. Details of the out-of-sample trading period are showed in the next table:

Table 8: US Retail Sales trading summary

US Retail Sales

Average Initial Amount USD/JPY	95.05
Top Loss	-0.20
Top Profit	0.16
Avrg Loss	-0.17
Avrg Profit	0.16
Avrg Trade	-0.16
Absolute Std Deviation	0.08
Number Trade Losses	34
Number Trade Profits	1
Profits over Losses Ratio	3%
Number No Trades	0
Total Profit	-5.70
Avrg annualized Daily Profitability	-43.16%
Sharp Ratio	-38.21

US Trade Balance

The currency used was the USD/JPY. The best in-sample performer was strategy 4, with a trailing stop order “as narrow as possible” (in this situation, is 10 pips away). Results were as follows:

Table 9: US Trade Balance results

Trade Bal	In Sample					Out of Sample					Real
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	
	9.24	39% 0.0019	4.35 17% 0.0019	6.97	28%		4.02	18% 0.0014	13.36 35% 0.0010	7.60 26%	-6.5 -13.3%
Absolute Sharp Ratio											
Anualized Average Daily Profitability											
1st minute Standard Deviation (Average "Jump")											

Already in the in-sample period, there is a significant difference between the results of the first sub period and the second one. This makes the trading system less linear and therefore more volatile. The out-of-sample results turn out to be similar to the in-sample forecasts, but also with significant differences between the 2 sub periods. This can lower a bit the consistency of the system, but the most important factor is that it performed over time always a positive return. Unfortunately, the profitability obtained is not enough to cover normal trading costs⁴⁴ and therefore the real results turn out to be negative.

⁴⁴We will always address to „normal trading cost” to the cost supported by normal retail traders.

The following graphs show how profitability changes with the change of the trailing stop order distance parameter:

Figure 7: US Trade Balance profitability in function of order distance

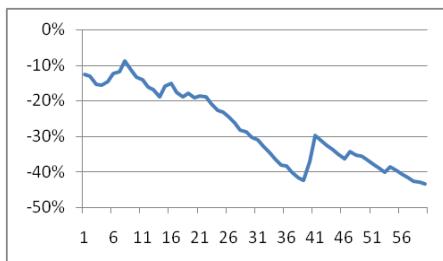
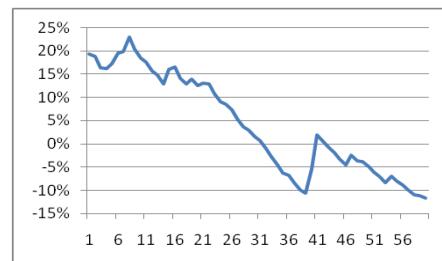


Figure 6: US Trade Balance profitability in function of order distance, without trading costs



We can see how results are stable up to a distance of 23 pips and after that it decreases significantly. This gives a fair margin to state that results are slightly robust.

The following table shows the details of the trading simulation:

Table 10: US Trade balance trading summary: normal (left); and without trading costs (right)

Trade Balance		Trade Balance without trading costs	
Average Initial Amount USD/JPY	95.05	Average Initial Amount USD/JPY	95.05
Top Loss	-0.25	Top Loss	-0.13
Top Profit	0.55	Top Profit	0.67
Avg Loss	-0.14	Avg Loss	-0.10
Avg Profit	0.15	Avg Profit	0.13
Avg Trade	-0.05	Avg Trade	0.07
Absolute Std Deviation	0.17	Absolute Std Deviation	0.17
Number Trade Losses	24	Number Trade Losses	9
Number Trade Profits	11	Number Trade Profits	26
Profits over Losses Ratio	31%	Profits over Losses Ratio	74%
Number No Trades	0	Number No Trades	0
Total Profit	-1.76	Total Profit	2.44
Avrg annualized Daily Profitability	-13.33%	Avrg annualized Daily Profitability	18.48%
Sharp Ratio	-6.50	Sharp Ratio	4.78

Like in the case of US GDP our system obtained a positive performance (slightly less consistent though), but it is cancelled out by normal trading costs, incurring in a final loss. The biggest impact of costs is to be noted in the profits over losses ratio that changes from 74% to 31%.

Euro GDP

The currency used was the EUR/USD. The best in-sample performer was strategy 4, with a trailing stop order 10 pips away. Results can be seen below:

Table 11: Euro Zone GDP results

Eur GDP	In Sample					Out of Sample					Real							
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	Real								
	4.73	16%	0.0002	-3.13	3%	0.0003	2.43	9%	-2.57	2%	0.0007	-2.82	2%	0.0005	-2.81	2%	-27.3	-25.4%

Absolute Sharp Ratio
Annualized Average Daily Profitability
1st minute Standard Deviation (Average "Jump")

No exploitable trading pattern is found here. Even the best system presents poor in-sample results and low consistency between the two sub periods. The out-of-sample trading results are similar over the two sub periods, but profits are insignificant and negative when risk adjusted. The high failure rate among the different strategies can be due to the low impact of this indicator over prices. This can be seen in the low average first minute “jump” over time, indicating that market participants don’t react very strongly and quickly to this announcement. The real results incurred in a significant loss and details can be seen in the table below:

Table 12: Euro Zone GDP trading summary

Euro GDP	
Average Initial Amount USD/JPY	1.3850
Top Loss	-0.0025
Top Profit	0.0001
Avrg Loss	-0.0015
Avrg Profit	0.0001
Avrg Trade	-0.0014
Absolute Std Deviation	0.0010
Number Trade Losses	11
Number Trade Profits	1
Profits over Losses Ratio	8%
Number No Trades	0
Total Profit	-0.0168
Avrg annualized Daily Profitability	-25.43%
Sharp Ratio	-27.29

Euro CPI

The currency used was the EUR/USD. The best In-sample performer was strategy 3, with a trailing stop order 20 pips away. Results can be seen below:

Table 13: Euro Zone CPI results

Eur CPI	In Sample					Out of Sample					Real							
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	Real								
	4.83	16%	0.0002	2.84	11%	0.0001	3.92	14%	-0.86	2%	0.0008	-11.65	-13%	0.0005	-3.88	-5%	-14.2	-32.1%

Absolute Sharp Ratio
Annualized Average Daily Profitability
1st minute Standard Deviation (Average "Jump")

No exploitable trading pattern was found here either. As we can see from the first minute average “jump”, reaction of market participants is again low for indicators coming from the Euro Zone. This indicates that US news have a stronger impact than EU ones (Ehrmann and Fratzscher, 2004). Besides that, as stated in section 2.1, Euro Zone data is a result of different countries averages, which makes its interpretation more challenging and less immediate.

We also notice a significant difference between the in-sample results and the out-of-sample ones, indicating once more that market conditions change over time, and this system wasn't able to capture that change. Final results are significantly negative (even without trading costs) and details can be seen in the table below:

Table 14: Euro Zone CPI trading summary

Euro CPI	
Average Initial Amount USD/JPY	1.4027
Top Loss	-0.0046
Top Profit	0.0070
Avrg Loss	-0.0027
Avrg Profit	0.0019
Avrg Trade	-0.0018
Absolute Std Deviation	0.0023
Number Trade Losses	28
Number Trade Profits	7
Profits over Losses Ratio	20%
Number No Trades	0
Total Profit	-0.0625
Avrg annualized Daily Profitability	-32.09%
Sharp Ratio	-14.17

Japanese Tankan

The currency used was the USD/JPY. The best in-sample performer was strategy 5, with a trailing stop order 5 pips away. This is a curious situation because this strategy allows for not starting a trade if the first minute jump is not higher than 5 pips. When this happens, the trade still accounts for averages with a value of 0. In this particular case there were 7 “no trades” out of 14 possible ones. This means that strategy 5 comes on top of all others although only opening half of trades. Nevertheless, this can also have its advantage, as on the out-of-sample trading simulation a “no trade” spares trading cost. Results can be seen below:

Table 15: Japanese Tankan results

Jap Tankan	In Sample					Out of Sample					Real
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	
	7.54	17%	0.0016	-0.30	5%	0.0012	4.75	11%		4.30	12%
										0.0009	0.0001
Absolute Sharp Ratio							0.00	0%	0.95	6%	-6.8
Anualized Average Daily Profitability											-0.6%
1st minute Standard Deviation (Average "Jump")											

Absolute Sharp Ratio
Anualized Average Daily Profitability
1st minute Standard Deviation (Average "Jump")

From the first minute average “jump” values, we observe that market reaction to this indicator lost strength over time. In the out-of-sample trading simulation there were 10 “no trades” out of 12 possible ones. From here we get a clear insight that this indicator is better not to trade at all. Results are based only over 2 trades and its validity is therefore doubtful. In any case, the final results are insignificant and neutral, therefore we clearly reject the alternative hypothesis.

Japanese GDP

The currency used was the USD/JPY. The best in-sample performer was strategy 5, with a trailing stop order 5 pips away. Results can be seen below:

Table 16: Japanese GDP results

Jap GDP	In Sample						Out of Sample						Real
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	
	3.95	11% 0.0012	7.92 33% 0.0017	6.30	19%		-0.30	5% 0.0006	0.00	0% 0.0001	-3.31	3%	-11.8 -8.4%
Absolute Sharp Ratio													
Anualized Average Daily Profitability													
1st minute Standard Deviation (Average "Jump")													

Similar conclusions, like the previous Japanese Tankan indicator, are to be taken here as well. Market reaction to the Japanese GDP has also decreased over time. In the out-of-sample trading simulation there were 8 “no trades” out of 11 possible ones. Results are therefore based only over 3 trades. In any case these results are negative and therefore no satisfactory conclusions can be made. It is to be noted that, just like the Euro Zone indicators, the Japanese ones also prove to have little impact on immediate price behavior, and mainly for this reason no exploitable trading patterns is found in these two regions.

Australian CPI

The currency used was the AUD/USD. The best in-sample performer was strategy 5, with a trailing stop order “as narrow as possible”, in this case 4 pips away. Results can be seen below:

Table 17: Australian CPI results

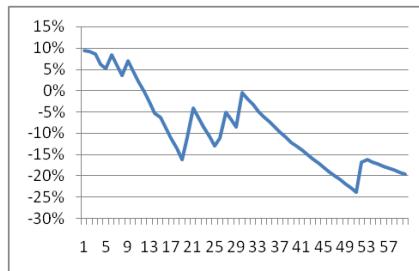
Au CPI	In Sample						Out of Sample						Real
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	
	1.63	6% 0.0012	12.63 54% 0.0026	8.06	30%		-0.40	4% 0.0008	13.05 67% 0.0038	7.53	36%		0.3 6.1%
Absolute Sharp Ratio													
Anualized Average Daily Profitability													
1st minute Standard Deviation (Average "Jump")													

In this case our strategy performance is not very linear. Results significantly change, between sub periods, from neutral to very positive. Another disadvantage is this

indicator being quarterly, which means the number of observations is much smaller and the out-of-sample trading results are based only on 12 trades. Nevertheless, the profitability results are overall positive, which gives some robustness to our final results. Our trading system was applied on the out-of-sample data, considering also all trading costs, and obtained a final positive result, although little significant and with a very low Sharpe ratio. In any case we've already seen the huge impact of trading cost in reducing profitability, and results without considering them turn out to be much more significant and profitable.

The following graph shows profitability robustness in function of the trailing stop order distance:

Figure 8: Australian CPI profitability in function of order distance



As we can see, the little profitability decays fast to unprofitable results. Facing all the above constraints we don't have consistency enough to reject the null hypothesis. However, if we don't consider trading costs, an exploitable trading pattern is found for this indicator.

Details about the trading performance can in the next table:

Table 18: Australian CPI trading summary

Australian CPI	
Average Initial Amount USD/JPY	0.8566
Top Loss	-0.0018
Top Profit	0.0046
Avrg Loss	-0.0013
Avrg Profit	0.0026
Avrg Trade	0.0002
Absolute Std Deviation	0.0021
Number Trade Losses	6
Number Trade Profits	4
Profits over Losses Ratio	40%
Number No Trades	2
Total Profit	0.0025
Avrg annualized Daily Profitability	6.10%
Sharp Ratio	0.28

Australian GDP

The currency used was the AUD/USD. The best in-sample performer was strategy 5 with a combination of a stop order, 10 pips away, and a take profit order, 30 pips away. Results can be seen below:

Table 19: Australian GDP results

Au GDP	In Sample			Out of Sample			Real											
	1st Block	2nd Block	Total	1st Block	2nd Block	Total												
	1.87	11%	0.0011	8.24	34%	0.0021	5.21	23%	9.12	70%	0.0038	16.49	69%	0.0030	11.76	70%	6.6	39.7%
Absolute Sharp Ratio																		
Anualized Average Daily Profitability																		
1st minute Standard Deviation (Average "Jump")																		

It can be stated that the importance of this indicator has grown over time, as the average “jump” increases, as well as profitability. The 2 in-sample sub periods are fairly consistent between them and the 2 out-of-sample sub periods as well, which makes the strategy sufficiently consistent. Details about the trading results can be seen in the next table:

Table 20: Australian GDP trading summary

Australian GDP	
Average Initial Amount USD/JPY	0.8448
Top Loss	-0.0025
Top Profit	0.0062
Avrg Loss	-0.0022
Avrg Profit	0.0032
Avrg Trade	0.0013
Absolute Std Deviation	0.0028
Number Trade Losses	3
Number Trade Profits	7
Profits over Losses Ratio	70%
Number No Trades	2
Total Profit	0.0160
Avrg annualized Daily Profitability	39.70%
Sharp Ratio	6.64

The graphs bellow show as well how profitability and Sharpe ratio would change changing the orders distance parameters of the stop order and eliminating completely the take profit order:

Figure 10: Australian GDP profitability in function of order distance

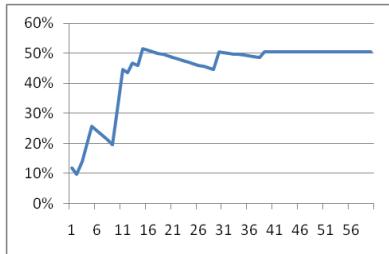
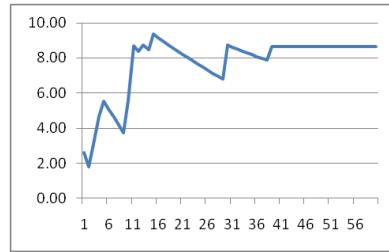


Figure 9: Australian GDP Sharpe ratio in function of order distance



Incredibly enough, even eliminating both risk management orders, the final results would be even better. But as we didn't create a future artificial advantage, we work in the out-of-sample data with the best results obtained in the in-sample one. Nevertheless, this shows that final results are quite robust and in this case the null hypothesis can be rejected.

Australian Employment Change

The currency used was the AUD/USD. The best in-sample performer was strategy 5, with a trailing stop order 15 pips away. Results can be seen below:

Table 21: Australian Employment Change results

Au Employment	In Sample			Out of Sample			Real											
	1st Block	2nd Block	Total	1st Block	2nd Block	Total												
	6.67	23%	0.0017	8.00	30%	0.0016	7.42	27%	-3.65	-1%	0.0008	0.55	6%	0.0007	-1.35	3%	-7.5	-9.6%
Absolute Sharp Ratio																		
Anualized Average Daily Profitability																		
1st minute Standard Deviation (Average "Jump")																		

In this case, once more, we have a hint that market conditions can significantly change over time, more specifically from the in-sample period to the out-of-sample one. This can be observed in the average “jump” and also in the profitability results. Even without considering trading costs, out-of-sample results turn out to be negative when risk adjusted. A predictable behavior is therefore not found for this indicator.

Next table shows the out-of-sample trading details:

Table 22: Australian Employment Change trading summary

Australian Employment Change	
Average Initial Amount USD/JPY	0.8516
Top Loss	-0.0028
Top Profit	0.0025
Avrg Loss	-0.0019
Avrg Profit	0.0010
Avrg Trade	-0.0003
Absolute Std Deviation	0.0010
Number Trade Losses	8
Number Trade Profits	4
Profits over Losses Ratio	33%
Number No Trades	23
Total Profit	-0.0113
Avrg annualized Daily Profitability	-9.55%
Sharp Ratio	-7.51

We also highlight the large number of “no trades”, which increased very much compared to the in-sample period. This is once more due to market conditions change over time, which the selected trading strategy wasn’t able to capture.

Concluding, Australian indicators proved to have a higher impact on its currency, after macroeconomic releases, than the Euro Zone and Japanese counterparts.

UK CPI

The currency used was the GBP/USD. The best in-sample performer was strategy 5, with a stop order 12 pips away. Results are as follow:

Table 23: UK CPI results

UK CPI	In Sample			Out of Sample			Real	
	1st Block	2nd Block	Total	1st Block	2nd Block	Total		
	3.72	15%	0.0009	12.73	51%	0.0019	8.33	33%
Absolute Sharp Ratio	6.36	27%	0.0016	-10.58	-2%	0.0013	2.99	13%
Anualized Average Daily Profitability							-4.3	-6.5%
1st minute Standard Deviation (Average "Jump")								

As we can observe, results are not very linear between the several sub periods, being it in the in-sample period or in the out-of-sample one. This fact lowers the consistency of the applied trading strategy in this indicator. Although results without considering trading costs are slightly positive, the lack in consistency doesn't allow for solid conclusions about its efficiency. In any case, looking to the real results, these turn out to be negative. Details of the trading performance can be seen in the next table:

Table 24: UK CPI trading summary

UK CPI	
Average Initial Amount USD/JPY	1.6573
Top Loss	-0.0031
Top Profit	0.0106
Avg Loss	-0.0018
Avg Profit	0.0036
Avg Trade	-0.0004
Absolute Std Deviation	0.0028
Number Trade Losses	23
Number Trade Profits	7
Profits over Losses Ratio	23%
Number No Trades	5
Total Profit	-0.0150
Avg annualized Daily Profitability	0.30%
Sharp Ratio	-0.07

UK GDP

The currency used was the GBP/USD. The best in-sample performer was strategy 5, with a trailing stop order 10 pips away. Results are as follow:

Table 25: UK GDP results

UK GDP	In Sample			Out of Sample			Real	
	1st Block	2nd Block	Total	1st Block	2nd Block	Total		
	11.17	32%	0.0010	5.68	13%	0.0014	8.69	18%
Absolute Sharp Ratio	11.80	35%	0.0013	29.85	81%	0.0033	18.51	58%
Anualized Average Daily Profitability							10.5	35.0%
1st minute Standard Deviation (Average "Jump")								

Here is to be specially noted that market behavior changes significantly in the second sub period of the out-of-sample period. This is confirmed by the notable rise in the first

minute average “jump” and profitability. This points again for the possible change in market characteristics over time. But in this specific case our trading system was able to capture these changes for its benefit. These higher imbalances could also be due to the lower number of observations as this is a quarterly indicator. This lower number of observations is a disadvantage towards consistency. However, results were always significantly positive over the 4 sub periods. The real final performance is positive, and trading results can be seen in the next table:

Table 26: UK GDP trading summary

UK GDP	
Average Initial Amount USD/JPY	1.6587
Top Loss	-0.0029
Top Profit	0.0083
Avrg Loss	-0.0012
Avrg Profit	0.0035
Avrg Trade	0.0023
Absolute Std Deviation	0.0030
Number Trade Losses	3
Number Trade Profits	9
Profits over Losses Ratio	75%
Number No Trades	0
Total Profit	0.0276
Avrg annualized Daily Profitability	34.98%
Sharp Ratio	10.52

Furthermore, we can observe from the graphs bellow that increasing the trailing stop order distance would have no impact on the Sharpe ratio performance (right), and would even increase profitability (left). Therefore we consider our final results to be significantly robust.

Figure 12: UK GDP profitability in function of order distance

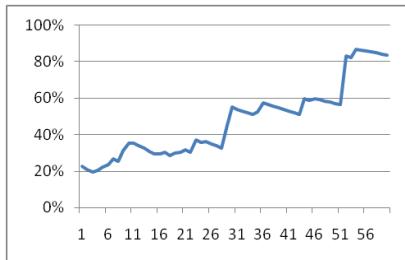
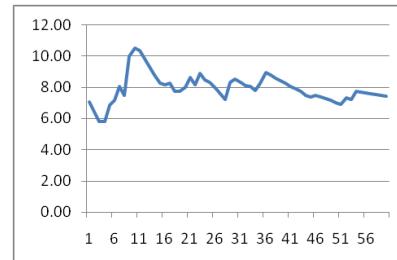


Figure 11: UK GDP Sharpe ratio in function of order distance



For the UK GDP an exploitable trading pattern with robust trading result is found and confirmed in the out-of-sample forecasting period. We therefore, once more, reject the null hypothesis.

UK Jobless Claims

The currency used was the GBP/USD. The best in-sample performer was strategy 5, with a trailing stop order, 5 pips away. Results are as follow:

Table 27: UK Jobless Claims results

UK Jobless C.	In Sample						Out of Sample						Real						
	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	Total	1st Block	2nd Block	1st Block							
	-0.37	5%	0.0006	7.46	12%	0.0009	3.41	8%		9.09	24%	0.0016	5.14	15%	0.0010	7.29	19%	-2.5	0.3%
Absolute Sharp Ratio																			
Anualized Average Daily Profitability																			
1st minute Standard Deviation (Average "Jump")																			

In the in-sample period, results were not very famous: in the first sub period we even have a slightly negative risk-adjusted performance. However, no other strategy could get better results, and profitability was linear in the two blocks. The winning trading strategy then improved its performance in the out-of-sample period, which shows its great adaptability to market conditions change. Results are also quite linear along the forecasting period. The graphs below show as well the profitability impact when changing the trailing stop order distance, which varies but stays consistent up to high values, like 60 pips away:

PREDICTING CURRENCY MARKETS BEHAVIOR AFTER SCHEDULED MACROECONOMIC NEWS RELEASES
THROUGH A TRADING SYSTEM APPROACH

Figure 13: UK Jobless Claims profitability in function of order distance

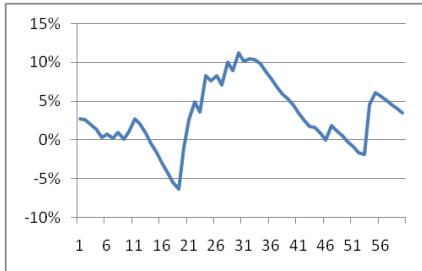
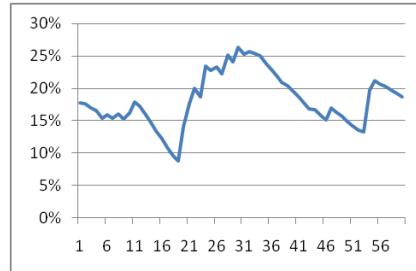


Figure 14: UK Jobless Claims profitability in function of order distance, without trading costs



All the above factors make the strategy a consistent one, and results are robust. However, as we can see in the tables below, profitability is then totally cancelled by normal trading costs, which makes real results to be insignificant, and the null hypothesis can't be rejected.

Table 28: UK Jobless Claims trading summary: normal (left); and without trading costs (right)

UK Jobless Claim	UK Jobless Claim without trading costs
Average Initial Amount USD/JPY	1.6589
Top Loss	-0.0023
Top Profit	0.0052
Avrg Loss	-0.0014
Avrg Profit	0.0020
Avrg Trade	0.0000
Absolute Std Deviation	0.0019
Number Trade Losses	17
Number Trade Profits	12
Profits over Losses Ratio	41%
Number No Trades	6
Total Profit	0.0007
Avrg annualized Daily Profitability	0.30%
Sharp Ratio	-2.52
Average Initial Amount USD/JPY	1.6589
Top Loss	-0.0011
Top Profit	0.0064
Avrg Loss	-0.0009
Avrg Profit	0.0022
Avrg Trade	0.0010
Absolute Std Deviation	0.0020
Number Trade Losses	9
Number Trade Profits	20
Profits over Losses Ratio	69%
Number No Trades	6
Total Profit	0.0355
Avrg annualized Daily Profitability	15.41%
Sharp Ratio	5.35

Just like the Australian indicators, also the UK ones show to have a greater impact on their currency than the Euro Zone and the Japanese counterparts.

PREDICTING CURRENCY MARKETS BEHAVIOR AFTER SCHEDULED MACROECONOMIC NEWS RELEASES
THROUGH A TRADING SYSTEM APPROACH

Table 29: All indicators final trading results summary

Indicator	Currency Pair	Best Strategy	Risk Management	Final Trading Results	
				Sharp Ratio	Annualized daily Profitability
US NFP	USD/JPY	5	Trailing Stop order 5 pips away	6.54	29.53%
US GDP	USD/JPY	5	Trailing Stop order 5 pips away	-2.16	0.07%
US Trade Balance	USD/JPY	4	Trailing Stop order 10 pips away	-6.50	-13.33%
US Retail Sales	USD/JPY	2	Trailing Stop order 5 pips away	-38.21	-43.16%
US ISM	USD/JPY	1	Stop order 20 pips away	-6.34	-33.11%
AU CPI	AUD/USD	5	Trailing Stop order 4 pips away	0.28	6.10%
AU GDP	AUD/USD	5	Combination: Stop order 10 pips away & Take profit order 30 pips away	6.64	39.70%
AU Employment	AUD/USD	5	Trailing Stop order 15 pips away	-7.51	-9.55%
UK GDP	GBP/USD	5	Trailing Stop order 10 pips away	10.52	34.98%
UK CPI	GBP/USD	5	Stop order 12 pips away	-4.30	-6.50%
UK Jobles Claims	GBP/USD	5	Trailing Stop order 5 pips away	-2.52	0.30%
EU GDP	EUR/USD	4	Trailing Stop order 10 pips away	-27.29	-25.43%
EU CPI	EUR/USD	3	Trailing Stop order 20 pips away	-14.17	-32.09%
JP Tankan	USD/JPY	5	Trailing Stop order 5 pips away	-6.82	-0.56%
JP GDP	USD/JPY	5	Trailing Stop order 5 pips away	-11.80	-8.42%

5.1 Final Comments

Our objective was to investigate if there were exploitable trading patterns, following macroeconomic scheduled news releases, in a very short term (3 hours total trading period). In general, the immediate reaction can be very mixed, and it is common to see prices moving significantly in one direction to just turn around and cancel the previous movements. Therefore, price movements in such a small period of time are rarely of a big scale. Predictive behaviors were identified, but as we can see from the results, the average trade result is not large when compared to the average costs implied for each trade. Indeed, assuming one trade per day, a total trading cost (commissions + slippage + other possible) of 12 pips⁴⁵ represents an annualized daily loss higher than 30%⁴⁶, which is already a high value. Retail traders willing to pay such costs also expect immediate returns to be even higher. But even if the average trade result is just double so high (as seen in the US NFP), the daily profitability is already an impressive one. From here we observe that this type of very short term trading is also very speculative and for risk taking participants, as costs alone represent already a big margin of risk. Furthermore, not accidentally, this market offers easy conditions to apply high levels of leverage, sometimes up to 1:400, which increases even more the riskiness of this speculative activity. In summary, real world costs tend to cancel much of the trading performances of retail traders.

Another fact to be considered is that main market participants, like investment banks, hedge funds, main dealers and other financial institutions have big advantage over retail traders. This is mainly because of: they don't have to account for the same commissions, because they act directly in the market; their orders are executed quicker (less slippage); they usually have more access to paid information (like the Bloomberg platform). Besides that, financial institutions offering dealing service to retail traders can also observe their customers order flow and therefore have access to market direction expectations (Evans and Lyons, 2005; Love and Payne, 2006). Finally, offering dealing service to retail traders is a quite profitable activity for dealers, and this

⁴⁵ This is a high value, obtained with a quite large margin of slippage, which we consider in our paper in order to improve consistency and robustness in our results.

⁴⁶ Initial amount considered is 1 US Dollar.

significant profitability is equivalent to significant costs for traders. A retail trader doing just one trade (opening and closing) per day is already paying 6 pips of commissions, which is equivalent to an annualized daily cost greater than 15%⁴⁷

Regarding the different currencies, it was also observed that commissions have a greater impact on the AUD/USD followed by the USD/JPY, EUR/USD, and less impact on the GBP/USD. The difference between the GBP/USD and AUD/USD is twice as much. Most of the dealers⁴⁸ offer the same commission spread for all major currencies (usually 3 pips), but as explained previously, the one unit amount of each one of them is relatively different. Therefore, 1 pip represents a higher variation on the AUD/USD than on the GBP/USD.

Regarding the trading performances, overall was noted that the “take profit” order mostly just cuts out further profits. Only in one situation (Australian GDP) it was proved to be of advantage, but usually, when applied, profitability tended to be reduced. The Sharpe ratio instead tended to increase, but it was due to a decrease of the standard deviation of trade’s results, almost exclusively by a reduction of positive trades, which doesn’t mean that the risk was lower.

The best performer strategy was, in most of the cases, strategy 5. As described in section 4.2, this strategy is used by many traders trying to profit from the “Trading the News” phenomena, and indeed it proved to be the one with higher predictive abilities in such a market of mixed reactions.

Among the risk management orders, the trailing stop showed to be the one that best fits for this purpose. Even if the normal stop order, in general, achieved slightly better profitability results in the in-sample period, the trailing stop achieved almost always better risk-adjusted performances (Sharpe ratio). Indeed, trailing stop orders in general adapted better to market conditions changes over time.

In order to somehow check if prices react linearly to releases surprises, as argued by Edison (1996), for all indicators we also applied strategy 1 in the out-of-sample data, without any risk management orders. In this way we only test the profitability

⁴⁷Initial amount considered is 1 US Dollar.

⁴⁸We confirmed it with the trading commissions of the Portuguese dealer GoBulling.

expectancy of investing in the direction of the surprise component⁴⁹, for a period of 2 hours and 50 minutes. For most of the cases, the final trading result was negative or neutral⁵⁰. This points and agrees with Edison (1996), that prices don't react linearly to news surprises, otherwise strategy 1 would have been the most successful one. Only the Australian CPI, Australian GDP and UK GDP presented strong positive trading results, which means that traders react more uniformly to news surprises over these indicators.

5.2 Findings Summary

- Exploitable trading patterns, with solid profitable out-of-sample trading results including normal trading costs, were found for the US NFP, the Australian GDP and UK GDP. For these indicators the null hypothesis was rejected;
- For the US GDP, US Trade Balance, Australian CPI and UK Jobless Claims, an exploitable trading pattern was found for the out-of-sample period, but results turn out to be non robust enough, insignificant, or even negative, when trading costs are subtracted. In these situations, the null hypothesis is doubtful, but respecting our parameters, can't be rejected;
- For the US ISM-Manufacturing, US Retail Sales, Euro GDP, Euro CPI, Japanese GDP, Japanese Tankan, Australian Employment and UK CPI, no exploitable trading pattern was found and therefore the alternative hypothesis is rejected;
- Considering the US releases, the USD/JPY is the currency pair that obtained the best results for speculative activity;
- Trading cost for retail traders are proportionally very high and often cancel out most of the profitable results;
- Financial institutions have a big advantage over retail traders and therefore, from their perspective, trading results would be much better;
- Commissions, although amounting to the same value (3 pips), have different impact over the several currencies, being GBP/USD the one losing the less and the AUD/USD the one losing the most with them;

⁴⁹Difference between the expected result by MMS Survey Median Expectations and the actual value of the release.

⁵⁰Complete results can be found in the Appendix section.

- The take profit order is, in most of the cases, of no advantage for the purpose of profitability under these circumstances;
- Strategy 5 was generally the best performer, almost all of the time combined with a trailing stop order, which showed to be the risk management order that best fits our purpose, and best adapted to market changing situations;
- Reactions to the news surprise component were always non linear, with the exception for the Australian CPI, Australian GDP and UK GDP.

6 Conclusions

We analyzed the immediate reaction of price behavior to macroeconomic indicators releases, through the application of automated trading systems, attempting to discover possible exploitable trading patterns. As an overall result, we reject the null hypothesis that mechanical rules for generating trading orders should not result in unusual risk adjusted returns. This happens because the US NFP, the Australian GDP and UK GDP obtained significant robust positive trading results. The following implication is that a trading pattern was found and successfully applied in the out-of-sample data, meaning that the behavior of prices was successfully forecasted. We are therefore arguing that the Market Efficiency Theory doesn't fit reality and the activity of speculators is justified.

Other macroeconomic indicators also performed well, but their profits were wiped out by the relatively large costs implied for retail traders on the trading activity. Large financial institutions have an advantage over retail traders, and for them speculative activity offers even greater results.

The US NFP is the best monthly release performer, confirming again its strongest importance (Harris and Zabka, 1995) and preference among traders (Rezania, Rachev, Sun and Fabozzi, 2010). It followed the several GDPs, excepting the ones from the Euro Zone and Japan. In general, US, Australian and UK indicators had a greater impact on the respective currencies. Euro Zone and Japanese indicators had a lesser and almost insignificant impact.

This paper adds to the existing literature in offering, through a trading system approach, a different perspective for understanding very short term price behavior after scheduled macroeconomic news releases. Many papers analyze this same behavior through

econometric models (Rezania, Rachev, Sun and Fabozzi, 2010; Almeida, Goodhard, Payne, 1997; Chaboud et. al, 2004; among others). Other papers try to forecast the same prices behavior with the use of macroeconomic models, but fail in a very short term window due to their incapacity in including real world constraints and investors' irrational behaviors (Ehrmann and Fratscher, 2004). Here, through the obtained results we can conclude that predictability is possible also for a very short term frame.

The work developed by Schneller and Vanstone (2010), also through a trading system approach and over the NFP release, acts only on a longer term reaction of prices.

Contrary to most of the papers, we focus also on releases from other countries, other than US ones, some of them being very little researched up until now. With this we offer also a comparison view among different regions of the globe and different currency pairs.

We give significant insights that price predictability under these circumstances is possible, which justifies the large speculative activity around these releases. These findings can also be the basis for future behavioral-based models, for a better comprehension of the “Trading the News” phenomena.

6.1 Drawbacks and Limitations

Some well conceived papers working with econometric models deal with second by second executed data, which for this type of high frequency very short term analysis obviously have a much better consistency. This type of data is however confidential and not available publicly. We therefore had to work with one minute quoted data, which for some of our strategies, like number 5 that act directly on the first “jump” (very short reactions) is harder to capture the whole real effect.

Due to calculation system constraints we decided to work only with one minute ask closing prices and apply a spread, a little higher than average, in order to get the bid quotations. Further information, like the actual bid quotation, one minute opening prices, max prices and min prices, could be added, but that would have an insignificant impact on final results, which we consider not to be worth of the added calculations efforts needed. Instead we apply a higher than normal slippage cost policy in order to overcome any possible positive bias.

Due to the nature of our analysis, it was not possible to replicate a portfolio, for a better understanding of final results. We are trading for a maximum period of 3 hours, once in a month, which is by far not a continuous activity. Instead, we consider every trade to be the profitability of one day and we annualize the results, in order for them to be comparable.

Some important indicators are only quarterly released. In a period of 7 years we couldn't have a satisfactory high number of observations, which lowers the consistency of those results.

Trading costs, other than commissions, and mainly slippage, are very difficult to be estimated. Only with executed data and real orders information of customers of a financial institution would be possible to compute average slippage values in different volatility periods.

6.2 Future work

A very interesting possibility for future research is to perform these same calculations using actual executed second by second data.

The trading performances of this paper can also be improved with the use of added different information. Trading systems designs can be further optimized with the use of order flow information (Evan and Lyons, 2005; Love and Payne, 2006), Technical Analysis information (Lo, Mamaysky and Wang, 2000), or even market psychology variables (Hirschleifer, 2001).

Other strategy systems, more complex than our basic ones, can also be developed, maximized and tested, in order to better understand price behavior through this real trading approach.

To conclude, a wider range of economic indicators can be investigated. Up to this point US indicators are the most analyzed ones and little research has been conducted studying the effect of releases from other countries.

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Appendices

Table 30: Out-of-sample trading profitability results of all indicators, using strategy 1 without any risk management orders.

Indicator	Currency Pair	Annualized daily Profitability
US NFP	USD/JPY	-48%
US GDP	USD/JPY	-48%
US Trade Balance	USD/JPY	-28%
US Retail Sales	USD/JPY	-9%
US ISM	USD/JPY	-5%
AU CPI	AUD/USD	19%
AU GDP	AUD/USD	21%
AU Employment	AUD/USD	-10%
UK GDP	GBP/USD	33%
UK CPI	GBP/USD	-47%
UK Jobles Claims	GBP/USD	-14%
EU GDP	EUR/USD	-24%
EU CPI	EUR/USD	2%
JP Tankan	USD/JPY	-29%
JP GDP	USD/JPY	-5%

Table 31: US NFP (USD/JPY) comparison between the best performers of each strategy

US NFP Y	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Stop order 5 pips away	3.14	0.3171	-0.0500	1.3000	-0.0500	0.6528	0.0818	39	9	19%	3.9250	21.5%	2.47	18%	3.71	26%
Strategy 2	Stop order 5 pips away	4.32	0.3421	-0.0500	1.3000	-0.0500	0.6568	0.1120	37	11	23%	5.3750	29.5%	2.47	18%	5.85	41%
Strategy 3	Trailling stop order 40 pips away	2.79	0.6361	-1.0250	1.9400	-0.3319	0.5935	0.1308	24	24	50%	6.2800	34.5%	1.64	23%	3.91	46%
Strategy 4	Stop order 10 pips away	7.43	0.6316	-0.1000	1.9900	-0.1000	0.8947	0.3145	28	20	42%	15.0950	82.9%	4.22	40%	10.19	126%
Strategy 5	Trailling stop order 5 pips away	10.52	0.3132	-0.1500	1.0550	-0.0627	0.3855	0.2266	11	30	73%	10.8750	59.7%	9.11	43%	11.96	76%

Table 32: US NFP (GBP/USD) comparison between the best performers of each strategy

US NFP £	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Stop order 5 pips away	3.66	0.0041	-0.0005	0.0203	-0.0005	0.0072	0.0013	37	11	23%	0.0612	19.3%	3.29	20%	4.13	19%
Strategy 2	Trailing stop order 5 pips away	5.22	0.0030	-0.0005	0.0183	-0.0004	0.0027	0.0013	21	27	56%	0.0640	20.1%	6.70	31%	3.63	10%
Strategy 3	Stop order 20 pips away	5.36	0.0072	-0.0149	0.0238	-0.0042	0.0066	0.0027	17	31	65%	0.1318	41.5%	7.56	60%	2.88	23%
Strategy 4	Stop order 10 pips away	10.08	0.0033	-0.0010	0.0107	-0.0010	0.0045	0.0025	18	30	63%	0.1180	37.2%	10.00	39%	9.97	36%
Strategy 5	Trailling stop order 5 pips away	12.61	0.0038	-0.0012	0.0206	-0.0007	0.0042	0.0033	5	39	89%	0.1593	50.2%	12.04	58%	14.66	43%

Table 33: US NFP (AUD/USD) comparison between the best performers of each strategy

US NFP A	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Stop order 4 pips away	4.02	0.0011	-0.0004	0.0044	-0.0004	0.0011	0.0005	21	27	56%	0.0218	13.5%	6.04	20%	1.13	7%
Strategy 2	Stop order 4 pips away	3.66	0.0023	-0.0004	0.0101	-0.0004	0.0044	0.0007	37	11	23%	0.0339	20.9%	4.90	32%	1.84	10%
Strategy 3	Stop order 20 pips away	-2.01	0.0036	-0.0102	0.0101	-0.0029	0.0028	-0.0003	26	22	46%	-0.0139	-8.5%	-1.85	-10%	-2.29	-7%
Strategy 4	Stop order 8 pips away	7.31	0.0019	-0.0008	0.0065	-0.0007	0.0022	0.0010	19	29	60%	0.0490	30.3%	5.66	26%	9.22	34%
Strategy 5	Trailling stop order 4 pips away	9.04	0.0018	-0.0008	0.0088	-0.0004	0.0021	0.0012	10	30	75%	0.0584	36.0%	9.93	47%	8.67	25%

Table 34: US NFP (EUR/USD) comparison between the best performers of each strategy

US NFP €	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Stop order 5 pips away	4.15	0.0031	-0.0005	0.0106	-0.0005	0.0059	0.0011	36	12	25%	0.0529	19.8%	6.60	35%	-0.43	4%
Strategy 2	Stop order 5 pips away	3.53	0.0031	-0.0005	0.0106	-0.0005	0.0059	0.0010	37	11	23%	0.0465	17.4%	4.58	25%	2.03	10%
Strategy 3	Stop order 20 pips away	5.81	0.0063	-0.0109	0.0202	-0.0032	0.0061	0.0026	18	30	63%	0.1234	46.2%	7.58	71%	3.52	21%
Strategy 4	Trailling stop order 10 pips away	8.62	0.0044	-0.0010	0.0170	-0.0009	0.0052	0.0027	20	28	58%	0.1280	47.9%	9.53	62%	7.98	34%
Strategy 5	Trailling stop order 5 pips away	10.71	0.0037	-0.0013	0.0160	-0.0006	0.0037	0.0028	7	37	84%	0.1340	50.2%	12.35	70%	11.27	30%

Table 35: US GDP (USD/JPY) comparison between the best performers of each strategy

US GDP Y	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Combination: trailing stop 10 pips away and Take profit 20 pips away	7.66	0.1882	-0.0400	0.7300	-0.0333	0.1427	0.1097	3	13	81%	1.7550	29.0%	10.59	25%	6.70	33%
Strategy 2	Trailing stop order 5 pips away	5.69	0.0650	-0.0500	0.1500	-0.0400	0.0696	0.0422	4	12	75%	0.6750	11.2%	10.84	16%	1.01	6%
Strategy 3	Trailling stop order 40 pips away	-1.07	0.2434	-0.3000	0.6700	-0.1483	0.1964	0.0025	9	7	44%	0.0400	0.7%	-6.99	-10%	1.15	11%
Strategy 4	Stop order 20 pips away	6.56	0.4420	-0.4300	1.2200	-0.1600	0.4828	0.2016	7	9	56%	3.2250	53.3%	0.87	9%	10.68	97%
Strategy 5	Trailling stop order 5 pips away	9.29	0.1530	-0.0600	0.6150	-0.0600	0.1632	0.1084	1	11	92%	1.7350	28.7%	14.72	20%	9.12	37%

Table 36: US GDP (GBP/USD) comparison between the best performers of each strategy

US GDP £	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 10 pips away	9.20	0.0022	-0.0010	0.0062	-0.0008	0.0027	0.0016	5	11	69%	0.0257	24.2%	10.58	31%	7.27	18%
Strategy 2	Trailling stop order 10 pips away	6.87	0.0021	-0.0010	0.0062	-0.0008	0.0025	0.0013	6	10	63%	0.0201	18.9%	6.32	20%	7.27	18%
Strategy 3	Trailling stop order 20 pips away	0.89	0.0055	-0.0082	0.0157	-0.0043	0.0036	0.0006	6	10	63%	0.0103	9.7%	-5.80	-18%	5.50	38%
Strategy 4	Trailing stop order 10 pips away	1.87	0.0024	-0.0010	0.0053	-0.0010	0.0033	0.0006	10	6	38%	0.0098	9.2%	4.88	17%	-1.94	1%
Strategy 5	Trailling stop order 5 pips away	12.28	0.0024	-0.0001	0.0081	-0.0001	0.0029	0.0022	3	12	80%	0.0351	33.0%	13.65	40%	10.42	26%

Table 37: US GDP (AUD/USD) comparison between the best performers of each strategy

US GDP A	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 10 pips away	3.38	0.0014	-0.0010	0.0031	-0.0007	0.0014	0.0005	7	9	56%	0.0074	13.8%	0.41	6%	6.35	21%
Strategy 2	None	2.88	0.0026	-0.0031	0.0054	-0.0016	0.0028	0.0006	8	8	50%	0.0103	18.9%	3.67	20%	2.17	17%
Strategy 3	None	6.65	0.0029	-0.0024	0.0064	-0.0013	0.0035	0.0014	7	9	56%	0.0223	41.1%	5.34	36%	7.58	47%
Strategy 4	Trailing stop order 8 pips away	-0.41	0.0011	-0.0008	0.0025	-0.0007	0.0010	0.0001	8	8	50%	0.0022	4.2%	5.27	18%	-9.94	-9%
Strategy 5	Trailling stop order 4 pips away	3.54	0.0009	-0.0006	0.0022	-0.0004	0.0011	0.0004	5	7	58%	0.0059	10.8%	4.60	14%	1.87	7%

Table 38: US GDP (EUR/USD) comparison between the best performers of each strategy

US GDP €	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 30 pips away	6.09	0.0032	-0.0027	0.0085	-0.0018	0.0030	0.0015	5	11	69%	0.0244	27.4%	8.87	38%	3.16	17%
Strategy 2	Trailling stop order 5 pips away	4.54	0.0016	-0.0005	0.0053	-0.0005	0.0017	0.0007	7	9	56%	0.0118	13.2%	6.09	19%	2.06	8%
Strategy 3	Trailling stop order 30 pips away	4.52	0.0038	-0.0048	0.0100	-0.0018	0.0038	0.0014	7	9	56%	0.0219	24.6%	7.14	41%	0.88	8%
Strategy 4	Trailling stop order 10 pips away	-1.69	0.0015	-0.0010	0.0036	-0.0010	0.0016	0.0001	9	7	44%	0.0020	2.2%	0.33	6%	-4.14	-1%
Strategy 5	Trailling stop order 5 pips away	11.18	0.0019	-0.0004	0.0058	-0.0002	0.0020	0.0016	2	13	87%	0.0257	28.9%	11.46	32%	10.19	26%

Table 39: US Trade Balance comparison between the best performers of each strategy

US Trade Balance	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailing stop order 5 pips away	-0.09	0.1074	-0.0500	0.3800	-0.0414	0.1092	0.0182	29	19	40%	0.8750	4.8%	1.12	7%	-1.95	2%
Strategy 2	Stop order 5 pips away	-0.35	0.1824	-0.0500	0.8500	-0.0500	0.3394	0.0149	40	8	17%	0.7150	3.9%	2.01	13%	-5.56	-5%
Strategy 3	Stop order 30 pips away	2.81	0.4626	-0.7000	1.0000	-0.2875	0.4294	0.1008	22	26	54%	4.8400	26.7%	3.73	38%	1.60	15%
Strategy 4	Trailing stop order 10 pips away	6.97	0.1982	-0.1000	0.6700	-0.0717	0.2125	0.1059	18	30	63%	5.0850	28.1%	9.24	39%	4.35	17%
Strategy 5	Trailling stop order 20 pips away	5.86	0.2791	-0.2100	0.9200	-0.1136	0.3916	0.1219	14	19	58%	5.8500	32.3%	7.21	43%	4.20	22%

Table 40: US Retail Sales comparison between the best performers of each strategy

US Retail Sales	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailing stop order 5 pips away	2.18	0.0924	-0.0500	0.4000	-0.0371	0.1002	0.0316	24	24	50%	1.5150	8.4%	0.25	5%	3.55	11%
Strategy 2	Trailing stop order 5 pips away	4.65	0.0967	-0.0500	0.4000	-0.0338	0.1102	0.0472	21	27	56%	2.2650	12.5%	3.70	10%	5.40	15%
Strategy 3	Trailing stop order 10 pips away	3.45	0.1589	-0.1700	0.4700	-0.0757	0.1627	0.0534	22	26	54%	2.5650	14.2%	-0.61	3%	7.60	25%
Strategy 4	Trailing stop order 10 pips away	0.67	0.1333	-0.1000	0.3800	-0.0804	0.1294	0.0245	24	24	50%	1.1750	6.5%	2.70	11%	-1.63	2%
Strategy 5	Trailing stop order 5 pips away	3.18	0.0993	-0.0900	0.4150	-0.0444	0.1256	0.0388	9	18	67%	1.8600	10.3%	-6.07	0%	7.32	20%

Table 41: US ISM-Manufacturing comparison between the best performers of each strategy

US ISM	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Stop order 20 pips away	3.86	0.2464	-0.2000	0.7600	-0.1521	0.2302	0.0789	19	29	60%	3.7850	20.8%	3.39	18%	4.21	24%
Strategy 2	Trailling stop order 20 pips away	2.38	0.2426	-0.2000	0.8500	-0.1208	0.2315	0.0553	24	24	50%	2.6550	14.6%	0.27	6%	4.27	23%
Strategy 3	Trailling stop order 20 pips away	0.01	0.2423	-0.4400	0.6300	-0.1530	0.2405	0.0192	27	21	44%	0.9200	5.0%	-2.48	-2%	1.51	12%
Strategy 4	Trailing stop order 10 pips away	1.03	0.1470	-0.1000	0.5600	-0.0744	0.1404	0.0285	25	23	48%	1.3700	7.5%	-0.16	5%	2.19	10%
Strategy 5	Stop order 20 pips away	3.52	0.1990	-0.2100	0.6350	-0.1394	0.3768	0.0631	8	11	58%	3.0300	16.6%	0.17	5%	5.33	28%

Table 42: Australian CPI comparison between the best performers of each strategy

AU CPI	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	None	6.19	0.0022	-0.0022	0.0068	-0.0010	0.0022	0.0010	6	10	63%	0.0165	30.4%	-2.35	-2%	14.30	63%
Strategy 2	Trailling stop order 5 pips away	6.60	0.0014	-0.0005	0.0044	-0.0005	0.0015	0.0008	6	10	63%	0.0121	22.2%	4.36	13%	8.20	32%
Strategy 3	None	5.82	0.0026	-0.0022	0.0068	-0.0010	0.0028	0.0011	7	9	56%	0.0182	33.5%	-2.83	-4%	12.56	71%
Strategy 4	Trailing stop order 15 pips away	4.93	0.0018	-0.0015	0.0037	-0.0010	0.0018	0.0007	6	10	63%	0.0116	21.3%	-1.50	2%	8.85	41%
Strategy 5	Trailling stop order 4 pips away	8.06	0.0017	-0.0005	0.0056	-0.0003	0.0020	0.0010	4	9	69%	0.0164	30.2%	1.63	6%	12.63	54%

Table 43: Australian GDP comparison between the best performers of each strategy

AU GDP	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 5 pips away	0.08	0.0015	-0.0020	0.0030	-0.0012	0.0012	0.0002	7	9	56%	0.0028	5.2%	-0.92	2%	1.14	8%
Strategy 2	None	0.01	0.0015	-0.0023	0.0030	-0.0010	0.0013	0.0002	8	8	50%	0.0027	5.0%	1.18	9%	-1.22	1%
Strategy 3	Trailling stop order 10 pips away	5.65	0.0012	-0.0010	0.0030	-0.0005	0.0014	0.0006	7	9	56%	0.0095	17.7%	3.87	14%	7.26	21%
Strategy 4	Trailing stop order 8 pips away	-0.60	0.0012	-0.0008	0.0028	-0.0007	0.0014	0.0001	10	6	38%	0.0019	3.6%	3.64	14%	-5.55	-7%
Strategy 5	Combination: Stop 10 pips away and Take profit 30 pips away	5.21	0.0018	-0.0015	0.0042	-0.0010	0.0020	0.0008	4	8	67%	0.0122	22.7%	1.87	11%	8.24	34%

Table 44: Australian Unemployment Change comparison between the best performers of each strategy

AU Unemployment	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	None	0.39	0.0017	-0.0039	0.0033	-0.0014	0.0013	0.0002	19	29	60%	0.0101	6.2%	-1.86	-2%	3.66	14%
Strategy 2	Trailling stop order 4 pips away	-1.25	0.0006	-0.0004	0.0018	-0.0003	0.0007	0.0001	28	20	42%	0.0058	3.5%	-3.76	1%	0.70	6%
Strategy 3	Stop order 20 pips away	0.31	0.0019	-0.0037	0.0044	-0.0015	0.0016	0.0002	22	26	54%	0.0099	6.1%	1.50	11%	-0.99	2%
Strategy 4	Trailing stop order 8 pips away	0.94	0.0013	-0.0008	0.0044	-0.0007	0.0014	0.0002	27	21	44%	0.0118	7.3%	-1.00	3%	2.48	12%
Strategy 5	Trailling stop order 15 pips away	7.42	0.0016	-0.0018	0.0042	-0.0008	0.0020	0.0009	12	26	68%	0.0433	26.7%	6.67	23%	8.00	30%

Table 45: UK CPI comparison between the best performers of each strategy

UK CPI	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	None	3.27	0.0042	-0.0087	0.0110	-0.0029	0.0039	0.0012	19	29	60%	0.0571	18.1%	-1.51	-2%	11.88	38%
Strategy 2	None	4.94	0.0040	-0.0080	0.0110	-0.0026	0.0041	0.0016	18	30	63%	0.0761	24.1%	1.09	10%	11.88	38%
Strategy 3	None	4.04	0.0047	-0.0130	0.0130	-0.0037	0.0041	0.0015	16	32	67%	0.0729	23.1%	2.84	19%	5.58	27%
Strategy 4	Stop order 10 pips away	3.71	0.0036	-0.0010	0.0133	-0.0010	0.0055	0.0012	32	16	33%	0.0559	17.7%	-4.83	-4%	8.65	40%
Strategy 5	Stop order 12 pips away	8.33	0.0035	-0.0018	0.0122	-0.0011	0.0050	0.0022	13	24	65%	0.1052	33.3%	3.72	15%	12.73	51%

Table 46: UK GDP comparison between the best performers of each strategy

UK GDP	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 10 pips away	7.67	0.0015	-0.0010	0.0038	-0.0008	0.0017	0.0010	4	12	75%	0.0167	15.9%	8.90	21%	6.12	11%
Strategy 2	Trailling stop order 10 pips away	3.67	0.0020	-0.0010	0.0056	-0.0008	0.0024	0.0008	8	8	50%	0.0127	12.0%	8.57	24%	-4.14	0%
Strategy 3	Trailling stop order 10 pips away	-1.05	0.0030	-0.0056	0.0056	-0.0016	0.0039	0.0001	11	5	31%	0.0021	2.0%	6.63	23%	-10.22	-19%
Strategy 4	Trailing stop order 10 pips away	6.59	0.0022	-0.0010	0.0055	-0.0008	0.0025	0.0012	6	10	63%	0.0199	18.9%	4.41	17%	10.36	21%
Strategy 5	Trailing stop order 10 pips away	8.69	0.0021	-0.0013	0.0065	-0.0009	0.0026	0.0015	3	10	77%	0.0238	22.6%	11.17	32%	5.68	13%

Table 47: UK Jobless C. comparison between the best performers of each strategy

UK Jobless Claims	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 5 pips away	0.24	0.0009	-0.0005	0.0034	-0.0004	0.0010	0.0003	23	25	52%	0.0165	5.2%	0.30	5%	0.19	5%
Strategy 2	None	0.44	0.0040	-0.0080	0.0111	-0.0029	0.0033	0.0004	22	26	54%	0.0212	6.7%	-0.34	4%	1.43	10%
Strategy 3	Stop order 5 pips away	-3.34	0.0025	-0.0046	0.0089	-0.0012	0.0029	-0.0002	36	12	25%	-0.0092	-2.9%	-1.12	2%	-6.07	-8%
Strategy 4	Trailling stop order 40 pips away	1.75	0.0034	-0.0040	0.0084	-0.0024	0.0031	0.0007	21	27	56%	0.0336	10.6%	5.19	24%	-3.56	-3%
Strategy 5	Trailling stop order 5 pips away	3.41	0.0011	-0.0008	0.0032	-0.0005	0.0015	0.0006	11	22	67%	0.0268	8.5%	-0.37	5%	7.46	12%

Table 48: Euro Zone GDP comparison between the best performers of each strategy

EU GDP	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 5 pips away	-3.81	0.0006	-0.0005	0.0012	-0.0004	0.0005	0.0001	7	9	56%	0.0022	2.5%	-5.04	2%	-2.53	3%
Strategy 2	Trailling stop order 5pips away	-2.46	0.0010	-0.0005	0.0035	-0.0004	0.0008	0.0001	9	7	44%	0.0019	2.2%	-0.67	4%	-6.56	0%
Strategy 3	None	-0.96	0.0017	-0.0022	0.0052	-0.0008	0.0014	0.0002	9	7	44%	0.0028	3.1%	5.05	17%	-16.15	-11%
Strategy 4	Trailing stop order 10 pips away	2.43	0.0015	-0.0008	0.0058	-0.0005	0.0010	0.0005	5	11	69%	0.0081	9.2%	4.73	16%	-3.13	3%
Strategy 5	Not Possible	First minute "jump" always lower than 5 pips															

Table 49: Euro Zone CPI comparison between the best performers of each strategy

EU CPI	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 30 pips away	2.45	0.0020	-0.0029	0.0053	-0.0015	0.0017	0.0006	17	31	65%	0.0279	10.4%	3.01	13%	1.67	8%
Strategy 2	Trailling stop order 30 pips away	3.80	0.0019	-0.0029	0.0053	-0.0014	0.0017	0.0007	15	33	69%	0.0347	13.0%	4.62	16%	2.78	10%
Strategy 3	Trailling stop order 20 pips away	3.92	0.0019	-0.0023	0.0053	-0.0011	0.0020	0.0008	19	29	60%	0.0363	13.6%	4.83	16%	2.84	11%
Strategy 4	Stop order 10 pips away	2.62	0.0018	-0.0010	0.0055	-0.0009	0.0018	0.0006	22	26	54%	0.0273	10.2%	5.13	17%	-1.22	3%
Strategy 5	Not Possible	First minute "jump" always lower than 5 pips															

Table 50: Japanese Tankan comparison between the best performers of each strategy

JP Tankan	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avg -	Avg +	Avg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	None	3.21	0.4106	-0.4150	1.2300	-0.1356	0.5290	0.1018	9	5	36%	1.4250	27.3%	8.60	76%	-6.56	-21%
Strategy 2	Trailling stop order 5 pips away	-5.70	0.0569	-0.0500	0.1050	-0.0462	0.0575	-0.0018	8	6	43%	-0.0250	-0.5%	-1.68	3%	-9.38	-4%
Strategy 3	Trailling stop order 5 pips away	-5.70	0.0569	-0.0500	0.1050	-0.0462	0.0575	-0.0018	8	6	43%	-0.0250	-0.5%	-1.68	3%	-9.38	-4%
Strategy 4	Trailling stop order 10 pips away	-0.27	0.1102	-0.1000	0.2500	-0.0743	0.1079	0.0168	7	7	50%	0.2350	4.5%	1.29	8%	-2.06	1%
Strategy 5	Trailling stop order 5 pips away	4.75	0.0750	-0.0300	0.2300	-0.0300	0.1008	0.0411	1	6	86%	0.5750	11.0%	7.54	17%	-0.30	5%

Table 51: Japanese GDP comparison between the best performers of each strategy

JP GDP	TOTAL IN SAMPLE												First period		Second period		
	Risk Mng.	Sharp Rat.	Standard Dev.	Top -	Top +	Avrg -	Avrg +	Avrg +/-	No. losses	No. wins	Win/Loss Ratio	Total profit	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability	Sharp Rat.	Annualized Daily Profitability
Strategy 1	Trailling stop order 5 pips away	4.10	0.1158	-0.0500	0.3100	-0.0383	0.1138	0.0486	6	8	57%	0.6800	13.0%	3.99	14%	4.03	12%
Strategy 2	Trailling stop order 5 pips away	0.74	0.0905	-0.0500	0.2300	-0.0400	0.0857	0.0229	7	7	50%	0.3200	6.1%	-3.10	1%	4.03	12%
Strategy 3	Trailling stop order 5 pips away	0.74	0.0905	-0.0500	0.2300	-0.0400	0.0857	0.0229	7	7	50%	0.3200	6.1%	-3.10	1%	4.03	12%
Strategy 4	Trailing stop order 10 pips away	0.42	0.1584	-0.1000	0.4550	-0.0762	0.1550	0.0229	8	6	43%	0.3200	6.1%	1.61	8%	-0.29	4%
Strategy 5	Trailling stop order 5 pips away	6.30	0.1358	-0.0500	0.3600	-0.0400	0.1679	0.0725	4	7	64%	1.0150	19.5%	3.95	11%	7.92	28%