



VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

VERSLO VADYBOS FAKULTETAS

FINANSŲ INŽINERIJOS KATEDRA

Domas Klimavičius

**PREKYBOS STRATEGIJOS FORMAVIMAS FOREX RINKOJE
NAUDOJANT TECHNINĘ ANALIZĘ**

**FOREX TRADING STRATEGY FORMATION USING TECHNICAL
ANALYSIS**

Baigiamasis magistro darbas

Verslo vadybos studijų programa, valstybinis kodas 62403S121

Investicijų valdymo specializacija

Vadybos ir administravimo mokslo kryptis

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sukurti prekybos FOREX valiutų rinkoje strategiją naudojant techninės analizės indikatorius; nustatyti, ar techninės analizės indikatoriai gali nustatyti valiutų kainų kitimo pasikartojančius modelius ir valiutų kainų kitimą ateityje.

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Pavadinimas **Prekybos strategijos formavimas FOREX rinkoje naudojant techninę analizę**

Autorius **Domas Klimavičius** Vadovas prof. habil. dr. **Aleksandras Vytautas Rutkauskas**

Kalba

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☒

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Anotacija

Šiame baigiamajame magistro darbe nagrinėjami FOREX rinkos analizei naudojami techniniai indikatoriai, jų savybės bei galimybės. Pagrindinis baigiamojo darbo tikslas yra nustatyti, ar techninės analizės indikatoriai gali nustatyti valiutų kainų kitimo pasikartojančius modelius ir ar jie gali numatyti kainų judėjimą ateityje. Pirmojoje baigiamojo darbo dalyje pristatomi teoriniai FOREX rinkos aspektai, jos dalyviai bei charakteristika. Antrojoje baigiamojo darbo dalyje apžvelgiami FOREX analizės įrankiai, išskiriant techninę analizę. Aprašomi populiariausi techninės analizės indikatoriai. Trečiojoje baigiamojo darbo dalyje nagrinėjami pagrindiniai prekybos FOREX rinkoje strategijos kūrimo naudojant techninę analizę elementai. Ketvirtojoje baigiamojo darbo dalyje kuriama ir testuojama prekybos FOREX rinkoje strategija naudojant techninę analizę. Pateikiami prekybos strategijos rezultatai bei jų analizė. Paskutinėje baigiamojo darbo dalyje, remiantis gautais rezultatais, pateikiamos išvados ir pasiūlymai.

Darbą sudaro 6 dalys: įvadas, teorinė, praktinė dalys, išvados ir siūlymai, literatūros sąrašas.

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Annotation

FOREX technical analysis indicators, their characteristics and capabilities are researched in this final master thesis. The main goal of this thesis is to determine if technical analysis indicators can recognise patterns in price movements and if they can predict future price movement. The first part of the thesis presents with FOREX theoretical aspects, its characteristics and participants. In the second part of the thesis FOREX analysis tools are overviewed, focusing on technical analysis. Most popular technical analysis indicators are analyzed. The third part of the thesis provides with the essentials of FOREX trading strategy creation using technical analysis. In the fourth part the FOREX trading strategy using technical analysis is created and tested. The results of the trading strategy are presented and analyzed. Last part of the thesis contains the summary of the thesis, conclusions and suggestions. Thesis has 6 parts: introduction, theoretical and practical sections, conclusions and suggestions, references.

Structure: introduction, theoretical and practical sections, conclusions and suggestions, references.

Thesis consist of: 66 p. text without appendixes, 23 pictures, 5 tables, 62 bibliographical entries.

Appendixes included.

Keywords: FOREX, currencies, technical analysis, indicators, trends, price fluctuation.

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ABBREVIATIONS

AUD – the Australian dollar;

CHF – the Swiss franc;

CPI – Consumer Price Index;

EMA – Exponential Moving Average;

EUR – euro;

FOREX, FX – Foreign Currency Exchange;

GBP – the British pound sterling;

GDP – Gross Domestic Product;

GNI – Gross National Income;

GNP – Gross National Product;

HKD – the Hong Kong dollar;

IMF – International Monetary Fund;

JPY – the Japanese yen;

MA – Moving Average;

MACD – Moving Average Convergence Divergence;

NNI – Net National Income;

NNP – Net National Product;

NOK – the Norwegian krona;

NZD – the New Zealand dollar;

PIP – percentage in point;

PMI – Purchasing Manager Index;

PPI – Producer Price Index;

RSI – Relative Strength Index;

SEK – the Swedish krona;

SMA – Simple Moving Average;

USD – United States dollar;

VIX – Volatility Index;

WMA – Weighted Moving Average;

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INTRODUCTION

FOREX is the world's largest and most liquid trading market. Every day more and more investors are turning to the all-electronic world of FOREX trading for income and profit because of its numerous benefits and advantages over traditional trading vehicles, like stocks, bonds and commodities.

To settle transactions between businesses located in different countries, governments, speculative transactions and so forth, banks around the world execute currency trades on FOREX market. Depending on various trade, economical and other parameters, interest rates, central bank policies, time of the day, preferences and anticipations of the market players, and many other causes, the rates of currencies stay in ceaseless motion.

Various methods are used to predict future currency price movements, including technical analysis method. This method assumes that all market fundamentals are reflected in price data; history repeats itself in regular, fairly predictable patterns; prices move in trends.

Problem. Can FOREX technical analysis identify certain patterns in price movements and predict future currency price changes?

Objective. The objective of this thesis is to determine whether FOREX technical analysis can predict future currency price movements by creating a FOREX trading strategy using technical analysis indicators.

Tasks. The following tasks are set for this final master thesis:

1. Analyze FOREX theory;
2. Research the properties of commonly used FOREX technical analysis indicators;
3. Determine the key features of FOREX trading strategy using technical analysis;
4. Create FOREX trading strategy using technical analysis;
5. Test FOREX trading strategy in real FOREX environment using historical data;
6. Conclude if technical analysis helped predict future currency price movements.

Methods of research and analysis. The theory of FOREX will be analyzed by studying FOREX-related articles, literature and video material. The FOREX trading system using technical

analysis will be creating using FOREX trading platform MetaTrader™ and charting data package FX AccuCharts™, to determine the performance of the strategy.

Structure of the final master thesis. This thesis consists of 66 pages without appendixes, 5 tables, 23 pictures, 62 bibliographic entries. Appendixes included.

Significance of the final master thesis. This final master thesis provides the practical FOREX trading strategy using technical analysis which is tested in the real FOREX market conditions. It provides the practical data of how the currency trading using technical analysis is done in FOREX market, by providing examples of FOREX trading using real data. The parameters of technical indicators used in FOREX trading strategy provided in this final master thesis can be modified for further research of technical analysis capabilities.

1.1. Conception of FOREX

Growing international cooperation increases the volume of economic and financial operations between the countries. Every such operation, performed outside the country border, usually requires a currency conversion. This is how international business operations create the base on which the currency market can exist. Currency markets (foreign exchange markets, FX markets, FOREX) are a system which helps the currency sellers to meet currency buyers and *vice versa*. [1]

Foreign Exchange, according to The American Heritage® Dictionary of the English Language, is:

1. Transaction of international monetary business, as between governments or businesses of different countries.
2. Negotiable bills drawn in one country to be paid in another country. [3]

A transaction in this market means buying one currency and selling, at the same time, another one. The participants are represented, for about 95% of the transactions, by the small or the big speculators. They are only buying or selling currencies for generating profit from the difference between prices. The rest of the daily volume of transactions, for about 5%, is generated by the companies and the governments which buy or sell products and services abroad or which have to repatriate the profits made abroad and, in order to accomplish that action they have to exchange the foreign currency into the national currency. [13]

What make foreign exchange trading existing are the underlying themes that drive the market. On the fundamental side, there are geopolitics, governments, societies, macroeconomics, and the behavior of the numerous market participants who vary greatly in objectives and approach. On the technical side, there is a market that seems to move in patterns and with endless liquidity. [2]

1.2. FOREX history

In July 1944, representatives of 44 nations met in Bretton Woods, New Hampshire, to create a new institutional arrangement for governing the international economy in the years after World War

II. After various negotiations, the final form of the Bretton Woods Agreement consisted of several key points:

1. The formation of key international authorities designed to promote fair trade and international economic harmony.
2. The fixing of exchange rates among currencies.
3. The convertibility between gold and the U.S. dollar, thus empowering the U.S. dollar as the reserve currency of choice for the world. [4]

The Bretton Woods system rested on one simple assumption - that economic policy in the United States would be stabilizing. The absence of an effective external discipline on U.S. policy could not threaten the regime so long as that assumption held, as it generally did prior to 1965. During the first half of the 1960s, America's foreign deficit actually shrank as a result of a variety of corrective measures adopted at home. After 1965, however, U.S. behavior became increasingly destabilizing, mostly as a result of increased government spending on social programs at home and an escalating war in Vietnam. America's economy began to overheat and inflation began to gain momentum, causing deficits to widen once again. Yet Washington pointedly declined to undertake any new ameliorative actions under a calculated policy of 'benign neglect.' With governments elsewhere committed to defending their pegged rates by buying the growing surfeit of dollars, a huge reserve base was created for global monetary expansion. Inflation everywhere began to accelerate, exposing all the latent problems of Bretton Woods. The pegged rate system was incapable of coping with widening payments imbalances, and the confidence problem was worsening as speculators were encouraged to bet on devaluation of the dollar or revaluations of the currencies of Europe or Japan. [18]

On August 15, 1971, it became official: the Bretton Woods system, a system used to fix the value of a currency to the value of the gold, was abandoned once and for all. While it has been exorcised before, only to subsequently emerge in a new form, this final eradication of the Bretton Woods system was truly its last stand: no longer would currencies be fixed in value to gold, allowed to fluctuate only in a 1 percent range, but instead their fair valuation could be determined by free market behavior such as trade flows and foreign direct investment. [4]

The foreign exchange markets officially switched to a free-floating market after the double demise of the Smithsonian Agreement and the European Joint Float. This switch occurred more due to lack of any other available options, but it is important to understand that the free floating of currency was not by any means imposed. [17]

Both agreements collapsed in 1973, signaling the official switch to the free-floating system by default, as no further agreements were signed. In 1978 the free-floating system was officially

mandated by the IMF. Europe, however, created the European Monetary System, in a final effort to gain independence from the dollar, but in 1993 it too failed, like all of the previous agreements. [5]

The major currencies today move independently from each other. Central banks occasionally intervene to move or attempt to move their currencies to desired levels. The free-floating system is ideal for today's foreign exchange markets – the underlying factor is mostly supply and demand. [5]

1.3. FOREX market participants

Major FOREX participants include commercial and investment banks and central banks (see Table 1). Other participants include corporations, hedge funds, and millions of traders worldwide. [17]

Table 1. Major FOREX market participants. Source: www.moneyscience.com

Rank	Name	% of volume
1	Deutsche Bank	19.26
2	UBS AG	11.86
3	Citigroup	10.39
4	Barclays Capital	6.61
5	Royal Bank of Scotland	6.43
6	Goldman Sachs	5.25
7	HSBC	5.04
8	Bank of America	3.97
9	JPMorgan Chase	3.89
10	Merrill Lynch	3.68

There are typically two levels or tiers in the FOREX market. The first tier is the inter-bank market which is characterized by large volumes of transactions. Within the inter-bank market, the spread (the difference between the bid and ask prices) is very thin on account of large volumes. The second tier involves the banks and the customers who either need foreign currencies or have foreign currencies for sale. [14]

1.3.1. Banks and the interbank

Many interbank members act as market makers for the currency pairs traded on the spot currency market and offer the quotes that ultimately drive the pricing you see in your trading software. Participants on the interbank are big-dollar players, since the lowest accepted trade size is set at an even \$1 million. It isn't uncommon for orders larger than \$100 million to be executed on the spot FOREX market due to the global size and liquidity of the interbank market. Many banking participants on the interbank fill orders for customers who actually intend to take delivery of the currency being traded; however, most interbank members also trade the bank's money as speculators attempting to make a profit just like any other currency trader. The advantage interbank market makers have over regular retail trader is access to order flow information. [9]

Commercial banks take the majority of currency deals. Accumulating the markets exchange conversion cumulative needs due to clients' operations as well as means accommodation or attraction and their movement to other banks are the main bank activities. Banks can carry out their independent deals for their own purpose aside from customers. [8]

1.3.2. Commercial companies

Business enterprises engaged in import, export or provision of cross-border services would either receive foreign currencies as payment for their goods or services, or would require foreign currencies to pay for goods or services, received from abroad. Such business enterprises are participants in the FOREX market as buyers and sellers of foreign currencies. [14]

Investment management firms are engaged in managing the funds of customers. These customers may be individuals or institutions such as pension funds, trusts, endowments, and so on. Investment management firms which maintain international portfolios of financial securities need to buy and sell foreign currencies in the FOREX market to transact the dealings in foreign securities. Although the FOREX transactions of investment management firms depend on their actual investment decisions, they may also engage in FOREX transactions for hedging their risk as well as for speculative gains. [14]

Companies with foreign investments use FOREX market for their foreign trading operations. The companies being the participants of international FOREX market such as regarding importers have a stable foreign currency demand whether the exporters have large amounts of the currency on offer. Both these kinds of the companies have short-term deposits to hold their currency. That's why

these companies don't use the FOREX market directly due to using commercial banks for conversion and depositary operations. [8]

The companies carrying out foreign investments of assets, such as investment funds, international corporations, money market funds contain a number of international investment funds that are following the policy of their investments diversification by placing the assets in various governmental and company securities. Georges Soros's "Quantum" and "Dean Witter" funds are well-known funds of this kind. *Xerox*, *Nestle*, *General Motors*, *British Petroleum* and others are the kind of companies that deal with the international industrial investments for purposes of joint ventures, creating branches and others. [8]

1.3.3. Hedge funds

Hedge funds are professional investment firms that usually manage funds on behalf of high net worth investors. They may invest in a variety of financial instruments, including foreign currencies. Their motivation is speculative profit for their investors, as they earn their money from a percentage of profits earned. [7]

These funds, known due to George Soros's Quantum fund, have raised their importance during the 1990s currency speculation in an aggressive form. Billions of dollars at the disposal of these funds along with the billions that can be borrowed make Hedge Funds the possible better support for the currencies of the countries welcoming Hedge Funds than central banks are. [8]

The reputation of the Hedge Funds has raised due to their recent aggressive currency speculations. As far as the amounts of money in such funds are increasing they are very attractive for foreign exchange markets. These markets can speculate with tens billions of dollars due to their leverage so consolidation of the players known as the "herd instinct" of these funds can be very unpleasant. Though, these funds are not thought to be successful without the strategy that sounds. It is also thought that the actual functioning of these funds is instable financial weakness using and uncovering for the purpose of returning the normal values to realignment. [8]

1.3.4. Speculators, investors, individual traders

Retail speculators may be trading their own account or clients funds through a managed account program. Some speculators at the retail level may be trading for clients looking to hedge risks; however, most are looking to generate profit. [9]

Individual traders are increasingly active in the FX markets. This is driven by the ready access to the market through the Internet and the opportunities available to earn significant profits with a relatively low capital investment. Individual traders face higher transaction costs than professional traders as they don't have direct access to the market and have to use a broker. Also, individual traders can't watch the market all the time as they usually have other commitments such as work or family life. These factors are a disadvantage, but the advantage is that the individual trader can choose whether to participate in the market at any given point in time. Professional traders are pretty much obliged to trade all the time by the nature of their jobs which means that they may not be able to be as selective about the trades that they enter. [7]

Currency speculators and the influence they cause to the currencies depreciations are widely and regularly disputed. Though the speculators are considered to carry out such important functions as supporting hedgers for the market and entrusting the risks with suitable people from the point of view of some economists like Milton Friedman. Others (for instance Joseph Stiglitz) consider this not an economical approach, but mostly a political or dedicated to the free market one. [8]

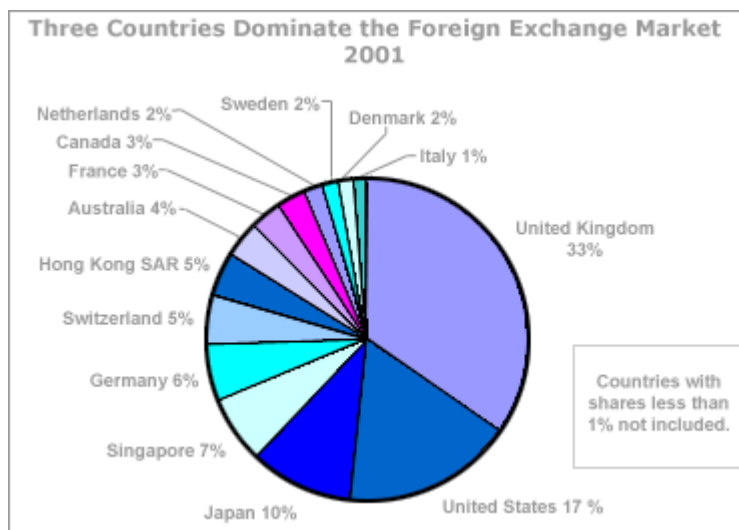
Many countries are quite suspicious to such operations as currency speculations. From this point of view, the traditional forms of investment including stocks and bonds bring more effective economic rise by supplying the capital unlike currency speculations. This is considered just as gambling that often doesn't go along with the economic policy. The currency speculations obliged the Central Bank of Sweden make a short-term rise of the interest rates up to the value of 150% a year that has been followed by krona devaluation. One of the most determined advocates of this point of view, Mahathir Mohamad who used to be the Prime Minister of Malaysia, called George Soros and other speculators the main culprits of the Malaysian ringgit devaluation in 1997. [8]

1.4. Trading characteristics

There is no unified or centrally cleared market for the majority of FX trades, and there is very little cross-border regulation. Due to the over-the-counter nature of currency markets, there are

rather a number of interconnected marketplaces, where different currency instruments are traded. This implies that there is not a single dollar rate but rather a number of different rates (prices), depending on what bank or market maker is trading. In practice the rates are often very close, otherwise they could be exploited by arbitrageurs instantaneously. A joint venture of the *Chicago Mercantile Exchange* and *Reuters*, called “FXMarketSpace” opened in 2007 and aspires to the role of a central market clearing mechanism. [10]

There are three main centers of trading, which handle the majority of all FX transactions – United Kingdom, United States, and Japan (see Picture 1). Transactions in Singapore, Switzerland, Hong Kong, Germany, France and Australia account for most of the remaining transactions in the market. Trading goes on 24 hours a day: at 8 a.m. the exchange market is first opening in London, while the trading day is ending in Singapore and Hong Kong. At 1 p.m. in London, the New York market opens for business and later in the afternoon the traders in San Francisco can also conduct business. As the market closes in San Francisco, the Singapore and Hong Kong markets are starting their day. [11]



Picture 1. Three countries dominate the FOREX market. Source: www.ny.frb.org

It is difficult to get useful inside information on currencies. Even if you did know in advance a key government statistic, the markets are so unpredictable that it is not often easy to foretell which way the market will go after a news release. [12]

1.4.1. Traded currencies

The most common currencies traded in the market are called ‘majors’ (see Table 2). Most currencies are traded against the United States dollar (USD). USD is traded more than any other currency. The five currencies most traded next are: the euro (EUR); the Japanese yen (JPY); the British pound sterling (GBP); the Swiss franc (CHF), and the Australian dollar (AUD). Trades of the six major currencies total 90% of the market. [15]

Table 2. Most traded currency pairs. Source: <http://www.investopedia.com>

USD/CAD	EUR/JPY
EUR/USD	EUR/CHF
USD/CHF	EUR/GBP
GBP/USD	AUD/CAD
NZD/USD	GBP/CHF
AUD/USD	GBP/JPY
USD/JPY	CHF/JPY
EUR/CAD	AUD/JPY
EUR/AUD	AUD/NZD

The most highly traded currency pair in the world is the euro and the US dollar, which is always quoted as EUR/USD. Because trillions of dollars worth of transactions occur with the EUR/USD every week, this currency pair is highly liquid and is the least expensive pair to trade. [16]

Although trading in the euro has grown considerably since the currency's creation in January 1999, the foreign exchange market is thus far still largely dollar-centered (see Table 3). [10]

Table 3. Most traded currencies. Source: <http://www.moneyscience.com>

Rank	Currency	ISO 4217 code	Symbol	% daily share
1	United States dollar	USD	\$	88.7%
2	Eurozone euro	EUR	€	32.2%
3	Japanese yen	JPY	¥	20.3%
4	British pound sterling	GBP	£	16.9%
5	Swiss franc	CHF	Fr	6.1%
6	Australian dollar	AUD	\$	5.5%
7	Canadian dollar	CAD	\$	4.2%
8	Swedish krona	SEK	kr	2.3%
9	Hong Kong dollar	HKD	\$	1.9%
10	Norwegian krona	NOK	kr	1.4%
Other				15.5%

1.5. Factors affecting currency trading

Currency prices are affected by a variety of economic and political conditions, most importantly interest rates, GDP, unemployment rate, inflation and political stability. Before any major economic data release, there will be an expectation figure expected by economists, FOREX market will only respond accordingly if the figure release is far away from the expected figure. [19]

Governments sometimes participate in the FOREX market to influence the value of their currencies, either by flooding the market with their domestic currency in an attempt to lower the price, or conversely buying in order to raise the price. This is known as Central Bank intervention. However, the size and volume of the FOREX market makes it impossible for any one entity to "drive" the market for any length of time. [19]

Although exchange rates are affected by many factors, in the end, currency prices are a result of supply and demand forces. The world's currency markets can be viewed as a huge melting pot: in a large and ever-changing mix of current events, supply and demand factors are constantly shifting, and the price of one currency in relation to another shifts accordingly. No other market

encompasses (and distills) as much of what is going on in the world at any given time as foreign exchange. [10]

Supply and demand for any given currency, and thus its value, are not influenced by any single element, but rather by several. These elements generally fall into three categories: economic factors, political conditions and market psychology. [10]

1.5.1. Economic factors

Where economic theory will affect the FOREX market on a long-term basis, the effect of changes in economic data is much more immediate. Oftentimes, the biggest companies in the exchange market are the various countries that participate in market activities and there currency is likened to shares in that country. It follows then that the country's economic data is analogous to the earnings data of a company or business entity. [20]

News and information regarding a country's economy can have a direct impact on the direction that the country's currency is heading in much the same way that current events and financial news affect stock prices, hence the importance of economic factors. [20]

Economic conditions include the following:

- Deficits and surpluses: The wider a nation's deficit, the lower its currency and trade value will be.
- Trade levels and trends: The higher a nation's trade levels, the higher the demand will be for its currency to perform these trades, thus increasing the currency's value.
- Inflation: Characteristically, the higher a nation's rate of inflation, the lower the value of its currency.
- Economic figures and reports: Reports such as GDP, unemployment (and employment) levels, sales of goods, offer insight into a nation's economic growth and health. Commonly, the more healthy country's economy, the better its currency will perform, resulting in a higher demand for it. [21]

1.5.2. Political conditions

Another very important factor that influence trends in FOREX, are the conditions of a country's political sector. This is because political instability or turmoil can generally create

negative fluctuations to an economy. But if such instances occur wherein a country may rise above political obstacles, the opposite may occur and the economy may improve. [22]

Events in a region can surely create negative or positive interest among investors for a nation's currency. And so, such conditions surely influence the trends for demands and prices of a certain currency. [22]

1.5.3. Market psychology

Market psychology influences the FOREX market in a variety of ways:

- Economic figures and reports: Economic figures that FOREX investors pay constant attention to include, inflation, money supply, (un-)employment, and trade figures. Also of importance are a country's economic reports outlining GDP, GNP, GNI, NNI, NNP. [21]
- Flights to quality: Unsettling international events can lead to a "flight to quality", with investors seeking a "safe haven". There will be a greater demand, thus a higher price, for currencies perceived as stronger over their relatively weaker counterparts. [10]
- Long-term trends: Although currencies do not have clear growth trends like stocks and commodities, they do often move in visible long-term trends. Cyclical trend analysis looks at longer-term price trends that may rise from economic or political trends. [21]
- 'Buy the rumor, sell the fact': this market truism can apply to many currency situations. It is the tendency for the price of a currency to reflect the impact of a particular action before it occurs and, when the anticipated event comes to pass, react in exactly the opposite direction. This may also be referred to as a market being "oversold" or "overbought". To buy the rumor or sell the fact can also be an example of the cognitive bias known as anchoring, when investors focus too much on the relevance of outside events to currency prices. [10]

1.6. FOREX financial instruments

There are many different types of financial instruments in the FOREX market. Financial instruments are cash or evidence of an ownership interest or contractual right to deliver or receive

cash or some other financial equivalent. Some of the noteworthy financial instruments would be: [23]

- Spot;
- Forward transaction;
- Futures;
- Swap;
- Options.

Spot: A spot transaction is a two-day delivery transaction (with the exception of transactions involving the Canadian dollar as one of the currencies of a pair [24]), as opposed to the futures contracts, which are usually three months. This trade represents a “direct exchange” between two currencies, has the shortest time frame, involves cash rather than a contract; and interest is not included in the agreed-upon transaction. The data for this study come from the spot market. Spot has the largest share by volume in FX transactions among all instruments. [10]

Forward - the agreement established between two parties wherein they purchase, sell, or trade an asset at a pre-agreed upon price is called a forward or a forward contract. Normally, there is no exchange of money until a pre-established future date has been arrived at. Forwards are normally performed as a hedging instrument used to either deter or alleviate risk in the investment activity. [25]

Currency future - FOREX futures are standardized forward transactions with fixed contract sizes and maturity dates. Futures trade on an exchange and their contract duration is around three months and includes amounts of interest. [24]

Due to the reason that futures contracts generally entail high levels of leverage, they have been at the heart of many market blowups. Nick Leeson and Barings Bank, Enron and Metallgesellschaft are just a few of the infamous names that are associated with futures-driven financial disasters. [26]

Swap - currency swaps are the most common type of forward transactions. A swap is a trade between two parties wherein they exchange currencies for a pre-determined length of time. The transaction then is reversed at a pre-agreed upon future date. Currency swaps can be negotiated to mature up to 30 years in the future, and involve the swapping of the principle amount. Interest rates are not "netted" since they are denominated in different currencies. [25]

A foreign exchange option is a derivative where the owner of the option has the right but not an obligation to exchange money in one currency to a different currency at a pre-arranged exchange rate and on a set date. Foreign exchange options will be the largest option market in the world. [23]

2. FOREX ANALYSIS

There are two main schools of thought when it comes to FOREX analysis. Fundamental analysis studies the overall picture of a nation's economy. This so called big picture view has practitioners who insist that the overall state of the economy as indicated by the different economic indicators is the key to forecasting price movements. [32]

FOREX technical analysis states that it is all about patterns and using historical data. The idea is that charting patterns can be inferred which will then be used as indicators of price direction. [32]

2.1 Fundamental analysis

Fundamental analysis is a method of forecasting the future price movements of a financial instrument (e.g. currencies) based on economic, political, environmental and other relevant factors and statistics. In practice, many market players use technical analysis in conjunction with fundamental analysis to determine their trading strategy. One major advantage of technical analysis is that experienced analysts can follow many markets and market instruments, whereas the fundamental analyst needs to know a particular market intimately. Fundamental analysis focuses on what should happen in a market and the technical analyst looks at what has actually happened. Factors involved in price analysis include supply and demand, seasonal cycles and weather, and government policy. [27]

The fundamentalist studies the cause of market movement, while the technician studies the effect. Fundamental analysis is a macro or strategic assessment of where a currency should be trading based on any criteria but the movement of the currency price itself. These criteria often include the economic condition of the country that the currency represents, monetary policy, and other "fundamental" elements. [27]

It is possible to predict the conditions of the economy but unlikely the market prices by using the fundamental analysis. FOREX fundamental analysis is a fundamental strategy of trading widely used by online trader of FOREX. This strategy contains some estimation where the different basic criteria, except for the price movement, are taken into consideration during currency trading. The economic conditions in the currency native country along with a number of other factors are the obligatory elements of these criteria. Any fundamental part of the economy is included into the

fundamental analysis. A decent FOREX fundamental analysis includes a number of macroeconomic factors like economic growth rates, interest rates, inflation, unemployment level and others. The market supply and demand coming from political and social powers is the aim of fundamental analysis. The market supply and demand balance forms the currencies prices. The interest rates and the overall economy strength are the two key factors that influence the supply-demand balance. The overall health of the economy can be understood through a number of economic indicators like GDP. The frequent inability of online FOREX fundamental analyses to find the entry and exit points is FOREX fundamental analysis key problem. Due to this factor the risk control, especially provided with the leverage, gets quite complicated. Only a piece of an enormous amount of information coming every day is considerable. The interest rates and international trade are the factors analyzed the most carefully. In order to create the FOREX trading strategy fundamentalists traders create models. The empirical data is gathered in these models for further forecasting the possible price trends and market behavior basing on the key economic indicators. [28]

The basis of fundamental analysis is mainly on the political and economic changes as these can frequently affect currency prices. Thus, traders are most likely to gather information from news sources to determine unemployment forecasts, political ideologies, economic policies, inflation, and growth rates. Traders keep an eye on the figures and statements given in speeches by important politicians and economists, as well as announcements related to United States economy and politics. Speeches from prominent people like the Chairman of the Federal Reserve Bank of USA, Secretary of Treasury, President of the Federal Reserve Bank of San Francisco and so on. [29]

There are many economic indicators released by government and academic sources. These indicators are usually released on a monthly basis but will sometimes be released weekly. These are pretty reliable measures of economic health and are closely followed by all traders. [30]

There are many indicators that are released but some of the most important and commonly followed are: interest rates, international trade, CPI, durable goods orders, PPI, PMI and retail orders. [30]

Interest Rates - can have either a strengthening or weakening effect on a particular currency. On the one hand, high interest rates attract foreign investment which will strengthen the local currency. On the other hand, stock market investors often react to interest rate increases by selling off their holdings in the belief that higher borrowing costs will adversely affect many companies. Stock investors may sell off their holdings causing a downturn in the stock market and the national economy. [33]

Determining which of these two effects will predominate depends on many complex factors, but there is usually a consensus amongst economic observers of how particular interest rate changes will affect the economy and the price of a currency. [33]

International Trade - trade balance which shows a deficit (more imports than exports) is usually an unfavorable indicator. Deficit trade balances means that money is flowing out of the country to purchase foreign-made goods and this may have a devaluing effect on the currency. Usually, however, market expectations dictate whether a deficit trade balance is unfavorable or not. If a country habitually operates with a deficit trade balance this has already been factored into the price of its currency. Trade deficits will only affect currency prices when they are more than market expectations. [33]

Other indicators include the CPI - a measurement of the cost of living, and the PPI - a measurement of the cost of producing goods. The GDP measures the value of all goods and services within a country, while the M2 Money Supply measures the total amount of all currency. [33]

Fundamental analysis planning example:

- 1st step: study the macroeconomic area:
 - Decide on the phase of the cycle
 - Examine technological innovations, political environment, emerging market fundamentals
- 2nd step: study global monetary environment:
 - Study the interest rate policies of major global powers
 - Compare money supply expansion and credit standards with the previous period
 - Analyze the VIX, developed market loan default rates of corporate and private sectors
- 3rd step: choosing currency pairs:
 - Examine the interest rate differentials of nations;
 - Compare the balance of payments of the currencies. [31]

2.2. Technical analysis

Technical analysis can be opposed to fundamental analysis. It could be a short term position as the different styles of analysis look from diverging view points and do not answer the same questions. Technical analysis is concerned with signals and timing based on the action of the market, while fundamental analysis is concerned with evaluations. [57]

Technical analysis has connections with other disciplines. Notably, cycle analysis, intermarket and quantitative analyses which share a common point through the approach to price behavior, they are all concerned with market action, and they all attempt to project into the future. [57]

The beginning of technical analysis is usually dated to the Dow theory, and to the early part of the 20th century. Over the years, many contributors have created indicators, oscillators and moving averages of all sorts to increase the arsenal which the trader can utilize to understand the FOREX market. But the basic principles of technical analysis have remained the same:

- Prices discount all available information.
- Prices trend.
- Historical data is useful for predicting future developments. [53]

Technical analysts claim that they can predict financial price movements using an information set limited to a few variables, such as past prices. Many of the major technical indicators were described as early as 1930 by Shabacker, who based his conclusions on observations of U.S. stock prices. By now, technical indicators are widely used in major financial markets around the world, including foreign exchange and futures markets. [53]

Technical analysis is useful for analyzing price patterns that emerge as a result of global economic activity. Thus, it's different from fundamental analysis: its effectiveness is greatest when market participants are the most emotive; the total turnaround in the market is constant with little new money entering or exiting; and economic fundamentals are of short-term value only. [35]

Technical analysts are confident that historical performance of stocks and markets denote future performance. They use charts and other tools to identify patterns that can suggest future activity. They do not attempt to measure a security's intrinsic value. They study the price and volume movements, and they create charts from that data. They use different patterns in order to create the price chart that will suit the future market and the price would follow the pattern. [36]

Technical analysts make a few key assumptions:

- All market fundamentals are reflected in price data. Moods, differing opinions, and other market fundamentals need not be studied.
- History repeats itself in regular, fairly predictable patterns. These patterns, generated by price movements, are called signals. A technical analyst's goal is to uncover a current market's signals by examining past market signals.

- Prices move in trends. Technical analysts believe price fluctuations are not random and unpredictable. Once an up, down or sideways trend has been established, it usually will continue for a period. [34]

Benefits of technical analysis:

- Identify a trend. This allows investors to make predictions on future trends.
- Judge the direction of the current trend. This helps investors gauge the best time to enter a trade or exit from a position in the FOREX market.
- Minimize risk exposure. A trader can manage risks with technical analysis. This method should be used in tandem with fundamental analysis, while staying abreast of news related to a country's economic and political environment. [37]

Drawbacks of technical analysis:

- The analysis is heavily skewed to individual opinion or interpretation.
- It is more a study of probabilities than of actual values.
- It is useful only for short-term investors. [37]

Technical traders don't base their strategies on fundamentals, which they believe are already reflected in a currency's price. Instead, technical traders study historical price movements. Utilizing those historical prices, they develop mathematical models or pattern recognition to predict future prices, and they use this information to take positions. [2]

2.2.1 Technical analysis indicators

There is no single technical indicator that can be exclusively relied on to produce winning outcomes, because the markets are too complex. No one, to date, has produced a consistently reliable technical trading system for a market, let alone FOREX. This is because technical indicators can never capture all of the variables that influence price movements. [55]

Yet technical analysis is not without its value. Technical analysis of chart movements, when used correctly, can improve trading, not by predicting but by providing a 'map' revealing important aspects of what the price has been doing and how it got there. Technical analysis can help sort out the 'noise' of price movements and reveal patterns that can be traded with a high probability of

success. The FOREX trader's main challenge is to use technical analysis of charts to achieve actionable 'knowledge' of market conditions. [55]

Technical analysis indicators can be assigned to the following types:

- Trend – trend indicators smooth price data out, so that a persistent up, down or sideways trend can be easily seen.
- Strength - strength indicators describe the intensity of market opinion on a certain price by examining the market positions taken by various market participants. Volume or open interest are the basic ingredients of strength indicators.
- Volatility – 'Volatility' refers to the magnitude of day-to-day price fluctuations, whatever their directional trend. Changes in volatility tend to anticipate changes in prices.
- Cycle - cycle indicators indicate repeating market patterns from recurrent events such as seasons or elections. Cycle indicators determine the timing of a particular market pattern.
- Support/resistance - support and resistance describes the price levels where markets repeatedly rise or fall and then reverse. This phenomenon is attributed to basic supply and demand.
- Momentum - Momentum indicators determine the strength or weakness of a trend as it progresses over time. Momentum is highest when a trend starts and lowest when the trend changes. When price and momentum diverge, it suggests weakness. If price extremes occur with weak momentum, it signals an end of movement in that direction. If momentum is trending strongly and prices are flat, it signals a potential change in price direction. [34]

The main FOREX technical analysis indicators include:

- Moving Averages
- Stochastics
- Relative Strength Index
- Bollinger Bands
- Moving Average Convergence Divergence
- Fibonacci Retracements

2.2.1.1 Moving averages

The MA indicator (Moving Average indicator) (see picture 2) is one of the oldest technical modern indicators and the most often used indicator in technical analysis. A moving average is an average of a shifting body of data, as seen from its name. For example, a 10-day moving average is got by adding closing prices for the last 10 periods being measured and dividing by 10. The term "moving" is used as only the last 10 days are used in the measurement. That's why the data body is averaged shifted forward with every next trading day. [38]

The moving average line will be placed directly in the price shifting chart. The moving average is measured with a definite predefined period. The sensibility of the moving average is weaker if the period is longer. The probability of false signals is higher if the period is shorter. [38]

Moving average indicators are trend type indicators.



Picture 2. Moving average indicator. Source: <http://www.forexrealm.com>

Three main types of moving averages are:

- Simple moving average;
- Weighted moving average;
- Exponential moving average.

The simple moving average (SMA) is formed by computing the average price of a security over a specified number of periods. When a variable is put for a simple moving average calculation, it is always the close price of the security that will be included in the calculation. [39]

The volatility of the FOREX market is much more smoothed at the long periods of time due to the equal weight given for the daily price by SMA. Only the long-term trends may be seen out of the long-term averages as far as any insignificant fluctuations get smoothed. For finding put short-term trends the short-term averages are taken, however they still give the long term expense. [38]

A weighted average gives different weights to different data points, so some points are given a larger emphasis than others. In technical analysis, the weights placed on different data point decrease in value, so the latest day gets the largest weight, and the weight decreases as the data is earlier. If we are looking at a timeframe of n days, the latest day will get a weight of n, the second latest will get n-1, and so on, until the earliest day gets the lowest weight. [40]

The equation for the WMA is:

$$WMA = \frac{nP_1 + (n-1)P_2 + \dots + 2P_{n-1} + P_n}{n + (n-1) + \dots + 2 + 1}; [40]$$

An exponential moving average is a different way of weighing more current data. An exponential moving average multiplies a percentage of the most current price by the previous period's average price. Basically the oldest pieces of data are never removed, the way they are with other types of moving averages. Instead of replacing the oldest pieces of data with newer, the oldest pieces are given less and less value, creating an average that appears more like an exponential curve. [41]

2.2.1.2 Stochastics

The stochastic FOREX oscillator tool (see Picture 3) is a popular indicator applied by all kinds of traders in their FOREX trading analysis. Momentum is the principal apply of this indicator. [42]

There a three main kinds of stochastics utilized by most traders. The full stochastic, slow stochastic in addition to the fast stochastic. They operate very alike. Ordinarily however, the sort of stochastic referred to in discussions is the slow stochastic. Stochastic indicators are based on the theory that prices ordinarily close in the higher trading ranges when in an uptrend. Conversely, prices have a tendency to close in the lower trading range when the instrument is in a down trend. Momentum is strong when this happens. The stochastic indicator has two main lines. They are the %D along with %K line. This indicator is a banded oscillator which makes it rather similar to the Relative Strength Index FOREX indicator. The %D as well as %K lines fluctuate within a range between values of zero to a hundred. [42]



Picture 3. Example of stochastics. Source: <http://www.babypips.com/school/stochastics.html>

Interpretation:

- Buy when %K falls below the oversold level (below 20) and rises back above the same level.
- Sell when %K rises above the overbought level (above 80) and falls back below the same level. [43]

The interpretation above is how most traders and investors use them; however, it only works when the market is trendless or ranging. When the market is trending, a reading above the overbought territory isn't necessarily a bearish¹ signal, while a reading below the oversold territory isn't necessary bullish² signal. [43]

Stochastics indicator is a momentum indicator type.

¹ Believing that a particular security, a sector, or the overall market is about to fall. Source: <http://www.investorwords.com/442/bearish.html>

² Believing that a particular security, a sector, or the overall market is about to rise. Source: <http://www.investorwords.com/615/bullish.html>

2.2.1.3 Relative strength index

The Relative Strength Index (RSI) is one of the most widely used technical indicators by traders. The RSI is an oscillator because it is an index whose value tends to swing between an upper limit value and a lower limit value (see Picture 4). It is used primarily to help identify overbought or oversold conditions in a particular currency, as it is formulated to fluctuate between 0 and 100, enabling fixed overbought and oversold levels. It does this by confirming changes in momentum which signals an imminent change in price direction or trend for the particular currency. [47]

The RSI indicator is an indicator of speed of changing of price. It is calculated in the following way:

$$RSI = 100 / (1 + D(P,n)/U(P,n)),$$

where $U(P,n)$ - is a moving average of growing of the P price within n periods,

$D(P,n)$ - is a moving average of falling of the P price within n periods. [38]

There are all possible merits of the indicators situated in an area from 0 to 100. The two control levels (the higher bottom control level is above 70, the lower bottom control level is below 30) are put on the chart with the help of horizontal markers. [38]

While the RSI increases and overcomes the top control level (above 70), the indicator displays the oversaturation of the market with buy trades, and then begins the zone of sales. Conversely, when the RSI crosses the low bottom control level (below 30), the indicator displays the oversaturation of the market with sell trades, and then starts the buying area. [38]



Picture 4. Example of Relative Strength Index. Source: www.forexmakingmoney.com

RSI indicator is a momentum indicator type.

2.2.1.4 Bollinger bands

Bollinger bands (see Picture 5) are a technical trading tool created by John Bollinger in the early 1980s. They arose from the need for adaptive trading bands and the observation that volatility was dynamic, not static as was widely believed at the time. [38]

The purpose of Bollinger bands is to provide a relative definition of high and low. By definition prices are high at the upper band and low at the lower band. This definition can aid in rigorous pattern recognition and is useful in comparing price action to the action of indicators to arrive at systematic trading decisions. [38]

Bollinger bands consist of a set of three curves drawn in relation to securities prices. The middle band is a measure of the intermediate-term trend, usually a simple moving average that serves as the base for the upper band and lower band. The interval between the upper and lower bands and the middle band is determined by volatility, typically the standard deviation of the same data that were used for the average. [38]



Picture 5. Bollinger bands. Source: www.bollingeronbollingerbands.com

Bollinger bands can help to define if ongoing data field values are behaving normally or breaking out in a new direction. For instance, when the closing price of a FOREX market moves over its upper Bollinger band, it usually increases in that direction. Bollinger bands also help to find out when trend reversals may happen. A reversal is usually characterized by new peaks or falls outside of the bands followed by another peak or fall inside the bands. [47]

Bollinger Bands indicator is a volatility indicator type.

2.2.1.5 Moving average convergence divergence

The idea of the difference between two averages that are smoothed exponentially (EMA) was founded and put into practice by Jerald H. Appller. [38]

$$\text{MACD} = \text{MA}(\text{P}, \text{nlong}) - \text{MA}(\text{P}, \text{nshort}),$$

$$\text{MACD Signal} = \text{MA}(\text{MACD}, \text{n}),$$

where $\text{MA}(\text{P}, \text{nlong})$ - moving average of the price P within nlong periods (usually 26);

$\text{MA}(\text{P}, \text{nshort})$ - moving average of the price P within nshort periods (usually 12);

$\text{MA}(\text{MACD}, \text{n})$ - moving average MACD within n periods (usually 9).

Thus, The Moving Average Convergence/Divergence (MACD) (see picture 6) is calculated by subtracting the value of a 26-day exponential moving average from the value of a 12-day exponential moving average. [38]



Picture 6. Example of Moving Average Convergence Divergence. Source:

www.informedtrades.com

Divergence is found by comparing price shifts on the chart and MACD values. MACD Divergence phenomenon occurs as a result of shifting forces on the FOREX market. For example, while sellers may seem to be dominating the market at the moment and price continues to trend down, there already might be signals for an overall weakening of sellers' powers. These key warning moments can be observed with MACD indicator. [48]

MACD indicator is a momentum indicator type.

2.2.1.6 Fibonacci retracements

This technique is very similar to using speed resistance lines. Fibonacci numbers are frequently used to hypothesize which rates particular assets will gravitate towards. Use of these numbers is widely accepted in the currency market. There are four popular types of Fibonacci studies, arcs, fans, retracements and time zones. [38]

In 1170 A.D., Leonardo Fibonacci a mathematician, discovered the relationship that is now referred to as the Fibonacci numbers while he was studying the Great Pyramid of Giza, in Egypt. The Fibonacci ratio exists between any two successive numbers in the Fibonacci sequence. The numbers are a sequence of numbers for which each successive number is the sum of the two previous numbers. For example: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233 etc. [38]

When the market is moving rapidly in any given direction, it sometimes experiences breaks where investors simply hold on to their profits. This phenomenon is known as retracements and generally creates good opportunities for investors to re-enter the market at some attractive levels before the move resumes. Retracements are usually similar in size. Technical traders in particular, pay considerable attention to retracements that are at the Fibonacci ratios of 38.1% and 50%. [38]

Fibonacci retracements use horizontal lines to indicate areas of support or resistance. They are calculated by first locating the high and low of the chart. Then five lines are drawn: the first at 100% (the high on the chart), the second at 61.8%, the third at 50%, the fourth at 38.2%, and the last one at 0% (the low on the chart) (see Picture 7). After a significant price movement up or down, the new support and resistance levels are often at or near these lines. [49]



Picture 7. Example of Fibonacci retracements. Source: www.it-finance.com

Fibonacci retracements indicator is support/resistance indicator type.

3. MAIN ELEMENTS OF FOREX TRADING STRATEGY USING TECHNICAL ANALYSIS

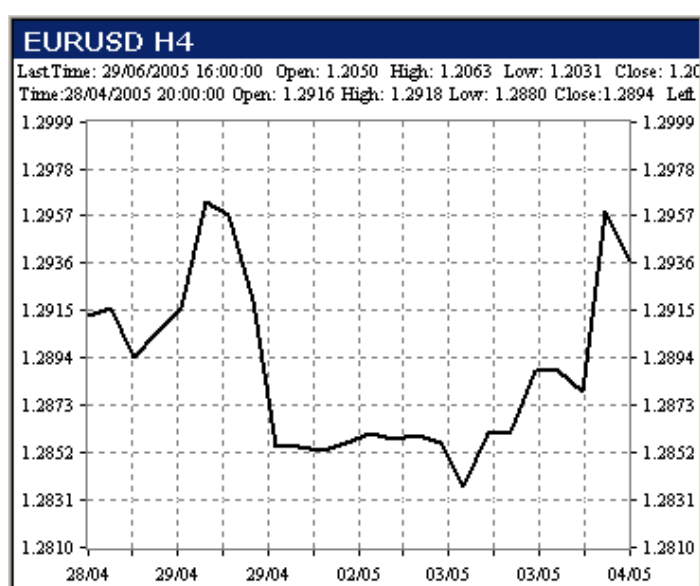
3.1. Main technical analysis elements

Charts are used in conducting the technical analysis of FOREX prices. They display the price movement and help find and identify trends, by using various indicators to determine the trade entry and exit levels.

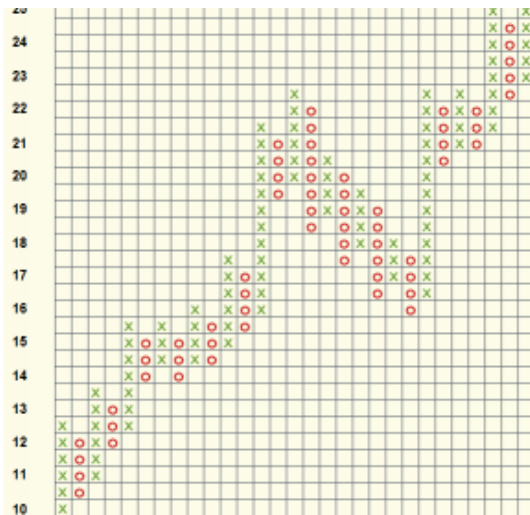
3.1.1. Charts

The movement of price change over time is shown in the price charts. The price chart of an instrument can be linear, bar, point-and-figure and candlesticks, depending on how they reflect the prices. Also, charts can reflect the prices of different time intervals. [1]

A line chart (see Picture 8) is a graph that displays the value of a particular currency at specific time intervals based upon the current prices. The strength of a line chart comes from the simple design. It's uncluttered and easy to understand and displays the closing price of the currency. [51]



Picture 8. Line chart. Source: www.forexrealm.com



Picture 10. Point-and-figure chart. Source: www.forex-daytrading.info

Candlebars or Japanese candlesticks (see Picture 11) show opening, closing, highest and lowest prices. The body color depends on whether the opening or closing price is higher. Higher closing price makes the body white while the higher opening price makes the body black. The shadow length displays the minimum and maximum of the price. [1]



Picture 11. Japanese candlesticks in FOREX technical analysis. Source: www.forexrealm.com

Traders using the candlestick chart usually focus on the ratio of opening and closing prices and the interpretation of several candlesticks formation, rather than focusing on highest and lowest prices. [1]

3.1.2. Trends

Prices will either trend or range. The FX market is uniquely suited to accommodate both styles, providing either trend or range traders with opportunities for profit. Trend seems to be the more popular subject. [62]

Market trends (see picture 12) seem to follow geometric patterns as they go through both low and high trends. An uptrend creates a series of trends that have higher lows and highs. A trend line drawn between the rising lows can often be fairly accurate in determining where the market can find greater support during the next low trend and indicate fairly good buying levels. [50]

The term ‘trend’ is used to describe the price movement, when perpetually new higher price levels or new lower price levels are reached. In technical analysis, trends are shown as rising or falling price graphs in regard to time frame. Trend is not necessary straight. It can evolve in waves. Wave is one price movement until the trend/price reversal. There are two reasons why trend develops in waves. Firstly, the nature of markets is based on the principle of waves – slump is followed by climb. Secondly, price exists in several timeframes at the same time, thus the formation which in the weekly chart looks like one wave, can have a whole different trend in the daily chart. [1]



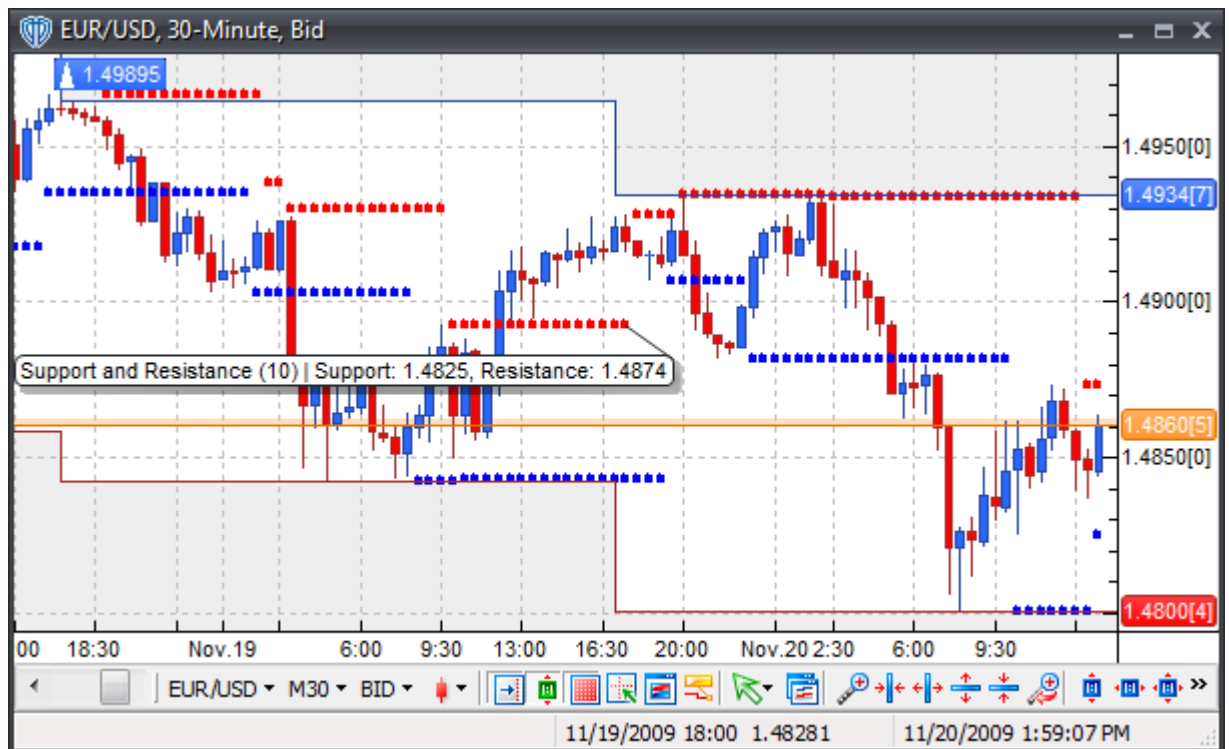
Picture 12. Market trend. Source: ROSENSTREICH, Peter. *FOREX Revolution*, p. 210

3.1.3. Support and resistance levels

According to technical analysts, support and resistance levels are points at which an exchange rate trend is likely to stop and may be reversed (see Picture 13). For example, a firm publishing a support level of \$1.50/£ would claim that the dollar-pound exchange rate is likely to stop falling if it reaches \$1.50/£. If the firm also provided another support level of \$1.45/£, the firm would claim that if the exchange rate passes through \$1.50/£, it is likely to stop falling at \$1.45/£. [53]

Support levels indicate the price where the majority of investors believe that prices will move higher, while resistance levels indicate the price at which a majority of investors feel prices will move lower. Prices often tend to ‘bounce’ off of these levels rather than break through them. However, once price has broken through a support or resistance level it is likely to continue moving in that direction until it encounters the next support or resistance level. An interesting phenomenon of support and resistance levels is that once a support level has been broken it often becomes a new resistance level and, alternatively, when a resistance level is broken it often becomes a new support level. Another point of interest is that the more often a support or resistance level is “tested” (that is touched and bounced off of by price), the more significance that particular support or resistance level gains. [54]

To identify the support and resistance levels relevant for the coming day, practicing technical analysts consult a variety of information inputs. These include visual assessments of recent price performance, simple numerical rules based on recent price performance, inference based on knowledge about order flow, and market psychology. The simplest approach to visual assessment is to look at recent minima and maxima: ‘Usually, a support level is identified beforehand by a previous reaction low,’ and ‘a resistance level is identified by a previous peak’ (Murphy 1986, p. 59). According to Pring (1991), one could also identify support and resistance levels by drawing a trend-line, or “channel,” in which recent peaks are connected by one line and recent troughs are connected by another: ‘A good trend-line represents an important support and resistance zone’ (p. 105). One numerical rule used to infer support and resistance levels is the ‘50 percent rule,’ which asserts that a major market move will often be reversed by about 50 percent in the first major correction (Pring, p. 187). Fibonacci series, which are widely used, suggest that 38.2 percent and 61.8 percent retracements of recent rises or declines are common. Simple market psychology is also used to help identify support and resistance levels. According to Murphy (1986): ‘Traders tend to think in terms of important round numbers . . . as price objectives and act accordingly. These round numbers, therefore, will often act as psychological support or resistance levels.’ [53]



Picture 13. Support and resistance. Source: www.vtsystems.com

3.2 Main features of the FOREX trading strategies using technical analysis

- Selecting time frame;
- Selecting indicators to help identify trends early, avoid whipsaws and confirm trend;
- Defining risk;
- Defining entry and exit. [45]

3.2.1 Selecting time frame

Most charting software allows traders to choose from a wide variety of timeframes for bar and candlestick charts. This choice is critical for numerous reasons. Most importantly, it dictates how much time is contained in each bar or candlestick. For example, in a daily chart, each bar has a duration of exactly one day, or 24 hours. A five-minute candlestick, on the other hand, has a duration of exactly 5 minutes. It is crucial for traders to know exactly what timeframe is being

viewed at all times, as there are different strategies for long-term, medium-term, and short-term trading. [56]

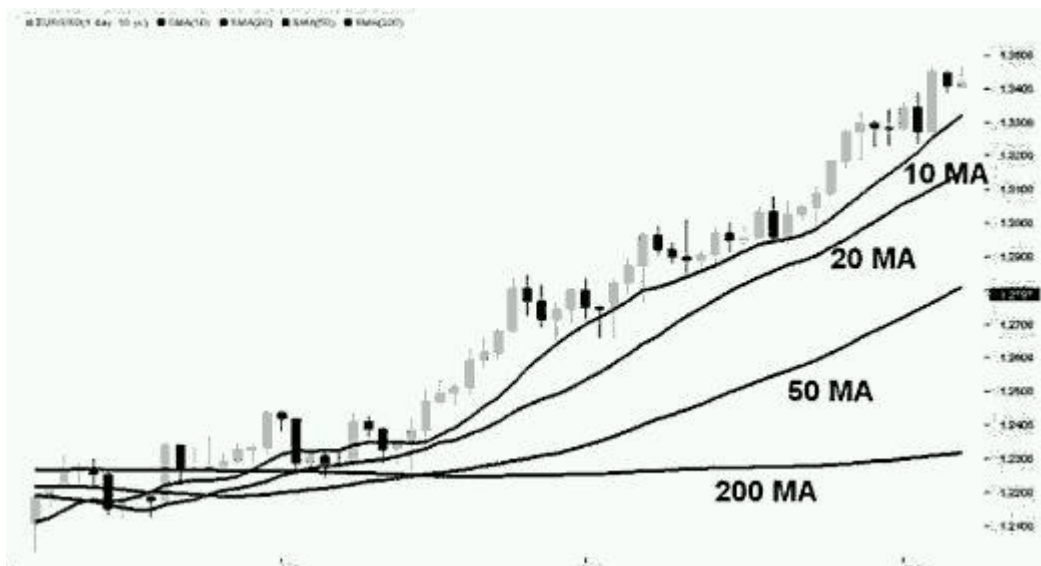
Selecting a time frame to trade is a combination of several factors such as:

- Market cycle;
- Volatility;
- Liquidity;
- Trading or investment account value;
- Market price;
- Market you trade in;
- Trader's skill level;
- How much time trader has to monitor the markets. [58]

Yet another reason timeframes are so critical lies in the very nature of technical analysis itself. It is certainly true that chart patterns are generally fractal, which means that these patterns can be found on all chart timeframes. But from a practical trading perspective, trends and patterns are usually much more reliable on longer-term charts like daily and higher, rather than short-term charts like the intraday hourly and minute charts. This is partly due to the fact that directionless volatility, or noise, that usually defies all technical analysis efforts, is much more prevalent on shorter-term charts. [56]

3.2.2. Selecting indicators

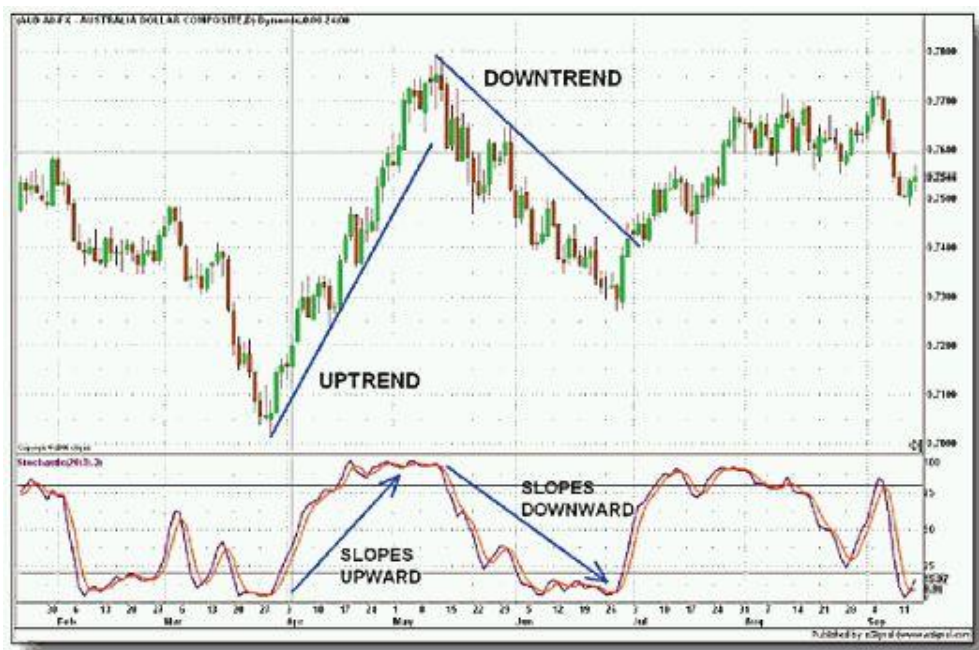
One way to determine if a pair is trending is through the use of moving averages, and what is referred to as the 'proper order' of moving averages. The proper order for an uptrend is (see Picture 14): the 10-period simple moving average (SMA) is located above the 20-period SMA, which is above the 50-period SMA, which is above the 200-period SMA. The order would be reversed in the case of downtrend. More SMA indicators can help to confirm the trend better, but using too many of them can miss out on a lot of trades. [59]



Picture 14. EUR/USD moving averages assemble into proper order for an uptrend. Source: FXtrek IntelliChart™, www.FXtrek.com

Grace Cheng suggests using Slow Stochastic to confirm the momentum of a trend: ‘once you have determined the direction of the trend using trendlines or moving averages, you should confirm it with the slope of the Slow Stochastic which indicates the momentum. In an uptrend, you should be looking for the Stochastic to slope strongly upward, whereas in a downtrend, the Stochastic should be sloping strongly downward, in accordance to the direction of the trend (see Picture 15)’.

An alternative to using the Stochastics is the moving average convergence/divergence histogram.



Picture 15. Stochastic. Source: CHENG, Grace. *7 Winning Strategies For Trading FOREX*, p. 117

3.2.3 Defining risk

If a trader is to maintain a degree of profitability over time, managing risk and using a system that helps evaluate price changes are essential. The process in selecting stop placement as a risk management tool starts with the price of where the trade was initiated. Here are some finer points on the rationale for using a risk method, or having a stop-loss system in place:

- Predetermined stops help conquer emotional interference.
- Stops should be part of a system or included in a set of trading rules.
- The risk/reward ratio should be weighed before entering trades, and a stop objective should be set.
- When volatility is low, stops can be placed closer to an entry level.
- When volatility is high, stops should be placed further away from entry level. [61]

3.2.4 Defining trade entry and exit levels

Trade entry point is determined by indicators detecting and confirming the trend, as stated in previous sections.

Marcel Link in his book about stock trading ‘High probability trading’ emphasizes the importance of correct trade exit strategy. Same rules apply to FOREX trading. He states that ‘once the reasons you got into a trade have changed, you should get out of the trade. If you get into a trade because of a support level or some indicator and it fails to do what it should do, <...> get out [of the trade]’. [60]

4. CREATING AND TESTING FOREX TRADING STRATEGY USING TECHNICAL ANALYSIS

In this part of the thesis FOREX trading strategy will be created and tested. The real data of currency prices during the period of 01/12/2009 – 01/05/2010 will be used to determine the performance of the strategy.

A trading strategy which helps identify trends will be created because more information sources about trend trading are available than about range trading. This FOREX trading strategy using technical analysis must be formed from indicators that help identify and confirm trend, or predict the direction of price movement in the future, as stated in Chapter 3. From the indicators that were described in Chapter 2, the following were selected to form a FOREX trading strategy: Relative Strength Index (RSI), Exponential Moving Average (EMA), Simple Moving Averages (SMA).

Relative Strength Index is a momentum type indicator. It was chosen over MACD and Stochastic indicators because it is one of the most widely used indicators. RSI is an indicator of speed of price change. While the RSI increases and overcomes the top control level (above 70), the indicator displays the oversaturation of the market with the buy trades. Conversely, when the RSI crosses the low bottom control level (below 30), the indicator displays the oversaturation of the market with the sell trades. This momentum type indicator will help to determine if there is enough interest in buying or selling in the market when entering the trade.

Exponential Moving Averages will help reveal the price trending by smoothing raw, noisy data because EMA, unlike Simple Moving Averages, do not calculate simple averages of price movement which may be misleading for short-term trend confirmation, but use another average calculation method which reduces the influence of rapid price changes over short periods of time (usually caused by FOREX related news). The EMA with the parameter of 10 will show the exponential average of last ten hourly price levels while EMA (20) will show the exponential average of last twenty hourly price levels. The intervals of 10 and 20 hours should be sufficient to illustrate the recent currencies price movement.

A group of Simple Moving Averages with different parameters will help confirm the long-term trend. Simple Moving Averages with parameters of 10, 20 and 50 will be used to illustrate and confirm the trend. SMA with higher parameter than 50 will not be used because, according to

theory, only very long trends are confirmed with 4 SMA indicators which may not occur during trading period. SMA indicators should illustrate the current price trend.

Bollinger Bands and Fibonacci Retracement indicators will not be used because they are suitable for range trading.

Candlebar charts will be used because they best illustrate the opening and closing prices which are most important for this trading strategy.

Hourly time frame will be used for trading. It should present a handful of trading opportunities with big price fluctuation instances which will illustrate if the strategy works when price rapidly changes in the opposite direction. Shorter time frames will not be used because, according to theory, they are less reliable. Longer time frames would mean less trade opportunities because the price graphic would be shorter.

Risk will not be defined in this FOREX trading strategy to test the full volatility of the trading strategy. Risk management is needed to control the account of the trader to avoid big losses. It is not relevant to this trading strategy because its purpose will be to test if technical analysis indicators can identify patterns in price movements and predict future movements.

EUR/USD currency pair will be traded because it is the most popular – the most traded currency pair with highest turnover.

MetaTrader™ and FX AccuCharts™ computer software will be used for the testing of the trading strategy.

4.1. Trading strategy using FOREX technical analysis indicators

Trading strategy outline:

- Trading on an hourly candlebar chart;
- Trading EUR/USD currency pair;
- Identifying and confirming trend with Simple Moving Averages indicators;
- Two Exponential Moving Averages with different parameters will trigger the trade entry point. If EMA with a parameter of 10 (shows the average of last ten price movements excluding rapid price movements) will cross above the EMA with a

parameter of 20 and the Relative Strength Index will not display the oversaturation of the market with buy trades (70 or more), this will trigger a buying signal (buying Euros by selling United States Dollars). If EMA (10) will cross below EMA (20) and RSI will not display the oversaturation of the market with sell trades (30 or less), this will trigger a selling signal (selling Euros by buying United States Dollars). The crossing of EMA indicators should mean that price is changing its direction because the exponential average price values are crossing each other. RSI indicator should remain in the neutral zone (no oversaturation of buy or sell trades) to ensure that the trend has enough potential to continue trending.

- Relative Strength Index indicator must confirm the speed of price change by being above 50 when the buying signal is triggered by EMA indicators, and being below 50 when the selling signal is triggered. If RSI has crossed top or bottom control levels (70 or 30) – the trade cannot start. These parameters should illustrate that there is enough potential for price movement in the same pattern.
- Entering trade when all conditions are met and new candlebar appears (at the start of new hour on a hourly chart). This will enable to easily identify trade entry signal.
- If EMA indicators cross but SMA indicators do not confirm the trend – wait for SMA indicators to confirm the trend, and if EMA and RSI remain in favorable positions – enter trade. This measure is needed to avoid entering the trade against the trend.
- Exiting trade if EMA indicators cross back. This should illustrate that the price is changing its direction and beginning to trend in the opposite direction.
- Exiting trade if RSI returns to 50. This should illustrate that price is reversing its direction.
- Exiting trade when the above exiting conditions are met and new candlebar appears (at the start of new hour on a hourly chart).
- Assumption is made that trader is tracking the market movement once every hour. This will enable to easily identify trade exit signal.

4.1.1. Selling signals

In picture 16, a EUR/USD currency pair price fluctuation is displayed between 13:00 PM, Jan 5, and 03:00 AM, Jan 6. Candlebars filled with black represent the growth of the price at a given hour, bottom of the candle showing the opening price and top of the candle – closing price of the

hour; lines (or shadows) represent the minimum and maximum price of the given hour. Candlebars filled with white represent the shrink of the price at a given hour, top of the candle showing the opening price and bottom of the candle – closing price. The blue and red lines in the upper part of the chart are the Exponential Moving Averages, red one being EMA (10) and blue one – EMA (20). In the lower part of the chart the Relative Strength Index is displayed. It is an oscillator that shows the speed of price changing.



Picture 16. EMA and RSI indexes signal to sell EUR and buy USD.

In picture 16, at 17:00 PM, Jan 5, EMA (10) line clearly crosses the EMA (20) line. RSI is lower than 50 but is not in the oversold area (>30). According to the trading strategy, this combination triggers the sell signal. But before doing it, one more condition – the Simple Moving Averages – must be met. They must confirm the trend so the trade could be made according to the trading strategy rules.

The Simple Moving Average indicators are displayed in Picture 17. Blue indicator is SMA (10), red – SMA (20) and white – SMA (50). The number in the brackets shows how many of the last hourly currency pair prices are used to calculate the price average. For example, SMA (10) means that the price average is calculated by adding last ten hourly price values and then dividing them by 10. If SMA (10) appears above SMA (20) which appears above SMA (50) – this suggests

an uptrend in the price movement. SMA (50) being above SMA (20) which appears above SMA (10) shows a downtrend in the price movement.



Picture 17. SMA indicators confirm a downtrend at 00:00 AM, Jan 6.

According to Picture 17, the conditions of beginning a trade are not met at 17:00 PM, Jan 5 because MA indicators do not show a downtrend. However, a downtrend is confirmed at 00:00 AM, Jan 6, because SMA indicators appear in the right order. According to the trading strategy, EMA and RSI indexes must be checked again, and if they meet the required conditions – a trade entry point can be placed. Looking back at Picture 16, at 00:00 AM, Jan 6, EMA (10) line is still below EMA (20) line and RSI is still in the limits of 30 to 50. This means that a trade entry ‘sell EUR, buy USD’ is made. EUR is sold and USD is bought at the given price of 1.4363.

According to the trading strategy, a selling trade is in progress until EMA indexes cross back or RSI index reaches a value of 50. In Picture 18, the RSI value crosses back to 50 at 08:00 AM, Jan 6, signaling to exit the trade – buy EUR by selling USD. The price at the start of the hour, which has RSI index parameter greater than 50, is 1.4350. This means that EUR was bought back by selling USD 0.0013 PIPs cheaper than it was sold. In conclusion, this trade brought a profit of 0.0013 PIPs.



Picture 18. RSI signals to exit the trade.

4.1.2. Buying signals

In Picture 19, at 4:00 AM, Dec 3, EMA (10) index crosses above EMA (20) index, RSI parameter is greater than 50 but is not in the overbought territory. If MA indicators can confirm the trend, the trade can be made.



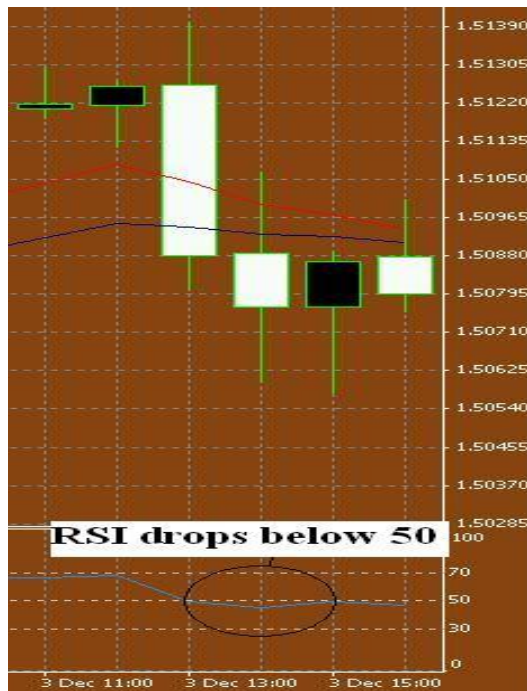
Picture 19. EMA and RSI indexes signal to buy EUR and sell USD.

Picture 20 shows that SMA indicators are in the right order to confirm an uptrend – SMA (10) is above SMA (20) which is above SMA (50). A trade can be made.



Picture 20. SMA indicators confirm the uptrend.

According to the trading strategy, the trade must be exited when EMA indicators cross back or RSI index value drops below 50. At 13:00 PM, Dec 3, RSI index drops below 50 and the trade must be finished by selling EUR and buying USD (see Picture 21). The difference between buying EUR at the start of the trade and selling them later is minus 0.0016 PIPs. It means that this trade brought a loss of 0.0016 PIPs.



Picture 21. RSI signals to end the trade.

4.2 Trading results

49 trades were made using this trading strategy in the period of 6 months. The results are shown in Table 4.

Table 4. Results of the trading strategy.

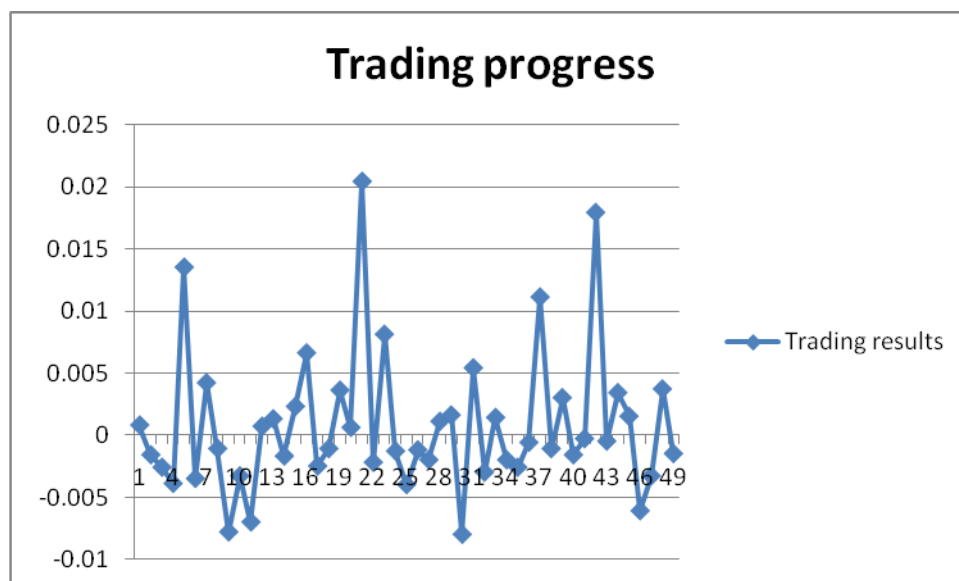
No.	Date	Trade type	Entry price	Exit price	Duration (h)	Exit trigger	Profit/loss
1	Dec/01/09 09:00	Buy	1.5066	1.5074	28	RSI	0.0008
2	Dec/03/09 04:00	Buy	1.5091	1.5075	9	RSI	-0.0016
3	Dec/04/09 04:00	Sell	1.5058	1.5084	3	RSI	-0.0026
4	Dec/10/09 06:00	Sell	1.4701	1.4740	4	RSI	-0.0039
5	Dec/16/09 22:00	Sell	1.4527	1.4392	30	RSI	0.0135
6	Dec/18/09 14:00	Sell	1.4317	1.4352	61	RSI	-0.0035

No.	Date	Trade type	Entry price	Exit price	Duration (h)	Exit trigger	Profit/loss
7	Dec/23/09 20:00	Buy	1.4333	1.4375	120	RSI	0.0042
8	Dec/21/09 18:00	Sell	1.4310	1.4321	14	RSI	-0.0011
9	Dec/29/09 09:00	Buy	1.4432	1.4354	7	RSI	-0.0078
10	Dec/30/09 01:00	Sell	1.4323	1.4356	9	RSI	-0.0033
11	Dec/31/09 07:00	Buy	1.4438	1.4368	7	RSI	-0.0070
12	Jan/04/10 13:00	Buy	1.4395	1.4402	25	RSI	0.0007
13	Jan/06/10 00:00	Sell	1.4363	1.4350	8	RSI	0.0013
14	Jan/06/10 20:00	Buy	1.4407	1.4390	9	RSI	-0.0017
15	Jan/07/10 10:00	Sell	1.4352	1.4329	22	RSI	0.0023
16	Jan/08/10 19:00	Buy	1.4422	1.4488	75	RSI	0.0066
17	Jan/13/10 11:00	Buy	1.4515	1.4490	4	RSI	-0.0025
18	Jan/25/10 02:00	Buy	1.4154	1.4143	9	RSI	-0.0011
19	Jan/26/10 04:00	Sell	1.4114	1.4078	32	RSI	0.0036
20	Feb/02/10 14:00	Buy	1.3935	1.3941	23	RSI	0.0006
21	Feb/03/10 19:00	Sell	1.3904	1.3700	109	RSI	0.0204
22	Feb/09/10 13:00	Buy	1.3766	1.3744	16	RSI	-0.0022
23	Feb/16/10 11:00	Buy	1.3644	1.3725	23	RSI	0.0081
24	Feb/18/10 22:00	Sell	1.3523	1.3536	18	RSI	-0.0013
25	Feb/22/10 00:00	Buy	1.3628	1.3588	15	RSI	-0.0040
26	Feb/23/10 03:00	Buy	1.3611	1.3599	7	RSI	-0.0012
27	Feb/23/10 17:00	Sell	1.3535	1.3555	17	RSI	-0.0020
28	Feb/24/10 21:00	Sell	1.3533	1.3522	18	RSI	0.0011
29	Feb/26/10 03:00	Buy	1.3576	1.3592	79	RSI	0.0016
30	Mar/01/10 16:00	Sell	1.3476	1.3556	3	RSI	-0.0080
31	Mar/02/10 20:00	Buy	1.3598	1.3652	10	RSI	0.0054
32	Mar/04/10 20:00	Sell	1.3576	1.3606	19	RSI	-0.0030
33	Mar/09/10 06:00	Sell	1.3617	1.3603	11	RSI	0.0014
34	Mar/10/10 17:00	Buy	1.3656	1.3636	21	RSI	-0.0020
35	Mar/15/10 18:00	Sell	1.3670	1.3696	10	RSI	-0.0026
36	Mar/16/10 15:00	Buy	1.3758	1.3752	22	RSI	-0.0006
37	Mar/18/10 06:00	Sell	1.3672	1.3561	106	RSI	0.0111
38	Mar/23/10 09:00	Sell	1.3522	1.3533	6	RSI	-0.0011
39	Mar/26/10 20:00	Buy	1.3413	1.3443	89	RSI	0.0030
40	Mar/31/10 00:00	Sell	1.3433	1.3449	8	RSI	-0.0016
41	Mar/31/10 12:00	Buy	1.3481	1.3478	18	RSI	-0.0003
42	Apr/09/10 10:00	Buy	1.3393	1.3572	62	RSI	0.0179
43	Apr/13/10 21:00	Buy	1.3611	1.3606	9	RSI	-0.0005
44	Apr/20/10 16:00	Sell	1.3443	1.3409	38	RSI	0.0034
45	Apr/22/10 11:00	Sell	1.3338	1.3323	21	RSI	0.0015
46	Apr/26/10 01:00	Buy	1.3387	1.3326	7	RSI	-0.0061
47	Apr/26/10 21:00	Buy	1.3380	1.3347	10	RSI	-0.0033
48	Apr/27/10 13:00	Sell	1.3294	1.3257	23	RSI	0.0037
49	Apr/30/10 00:00	Buy	1.3249	1.3234	1	RSI	-0.0015

Table 5. Statistics of the trading strategy.

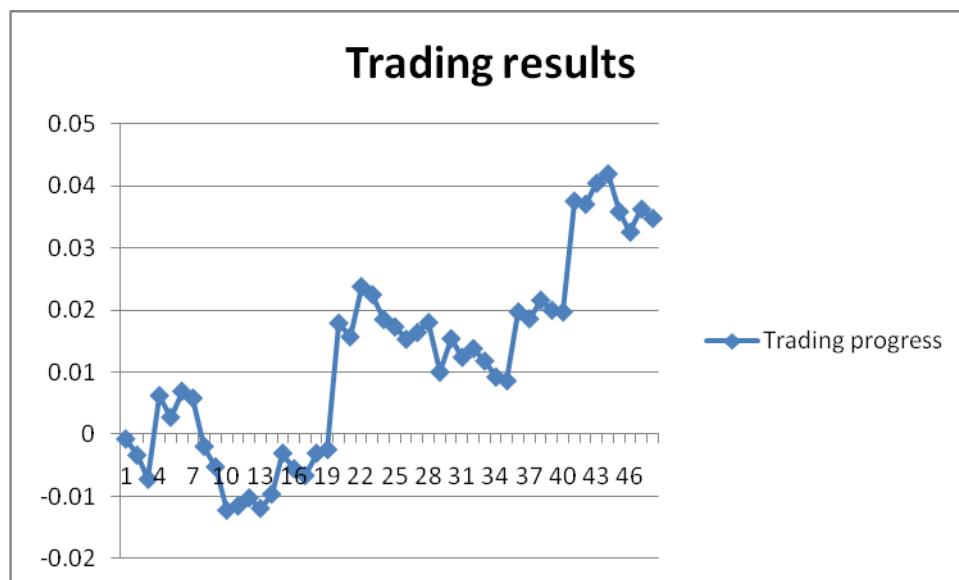
Average duration of trade	26.4 hours
Average duration of profitable trade	45.3 hours
Average duration of unprofitable trade	12.25 hours
Profitable trades	21
Unprofitable trades	28
Average value of profitable trade	53.4 PIPs
Average value of unprofitable trade	26.2 PIPs
Total profit	348 PIPs

The changes in RSI value triggered the trade exit 100% of the times. We can conclude that RSI will always cross back the 50 marker signaling to finish the trade before EMA indicators cross back again, meaning that exit trade condition of EMA indicators crossing back is unnecessary in the trading strategy.



Picture 22. Trading progress.

28 out of 49 trades were unprofitable (see picture 22), but the average value of unprofitable trade was 26.2 PIPs while the average value of profitable trade was 53.4 PIPs (see Table 5). This data means that the indicators were able to stop the unsuccessful trades early enough to reduce the losses, and at the same time let earn profits on a steady trending market.



Picture 23. Trading results.

The strategy brought a profit of 348 PIPs (see Table 5). Picture 23 displays how the profit/loss progress went. The strategy proved that it is suitable for long-trend trades because the indicators needed a strong forming trend to meet the trade entry conditions. The strategy relied on catching a long uptrend or downtrend which would cover the losses of failed trend signals and generate profit. The strategy was not suitable for short-term trades and missed a lot of trading opportunities; it only signaled 49 trade entries in the period of 6 months, averaging one trade signal in about 86 hours.

The most profitable trades lasted the longest time (45.3 hours on average) comparing to other trades proving that technical indicators were able to identify long price trends and give appropriate trade entry and exit signals. The example of currencies price fluctuation graphic (see Appendix A) illustrates how Exponential Moving Average indicators go almost parallel to price fluctuation when the market is in a downtrend, while Relative Strength Index (shown below the currencies price graphic, see Appendix A) illustrates the saturation of buy and sell trades. The EMA indicators fail to react to sudden price changes because of the steady price trending in the previous hourly periods, but RSI indicator signals when the buying trades rise in comparison to sell trades by heading up to the RSI 50 marker. SMA indicators (see Appendix B) recede from each other when price continues to drop and come closer to each other when the price rises.

Most of the unprofitable trades lasted a relatively short time (12.25 hours on average) comparing to the profitable trades illustrating that the given trading strategy was not suitable for periods of rapid price fluctuation. The example of currencies price fluctuation graphic (see Appendix C) illustrates how Exponential Moving Average indicators and RSI indicator provide a trade signal at 9:00 a.m., 15/03/2010 but SMA indicators (see Appendix D) confirm the trend only

at 18:00 p.m., therefore the sell trade is being entered when the market is already changing its direction. This proves that SMA indicators used in the strategy are not suitable for periods of rapid price fluctuation because they need a certain amount of time to confirm the trend while the price is already trending.

In conclusion, technical analysis indicators helped to identify and confirm the trends, but they could not predict future price movements. Currencies price has a major influence on the indicators' movement while indicators themselves do not influence the price movement in any way. It means that technical analysis indicators are helpful in determining whether the price is moving in patterns at a certain period of time but they cannot forecast a future price movement. As shown in the Appendixes A, B, C and D, technical analysis indicators can confirm price trend but they cannot forecast if the price will change rapidly or continue to trend.

CONCLUSIONS AND SUGGESTIONS

Analysis of the FOREX market theory revealed foreign currency exchange market main characteristics. It is a currency trading market with high liquidity and high turnovers, with main participants being interbank, central banks, commercial companies, hedge funds and speculators, investors, individual traders. Conditions of foreign currency trading for speculative needs arose when Bretton Woods Agreement was abandoned and currency valuation could be determined by free market behavior. FOREX market main characteristics include little to none cross-border regulations, ability to trade 24 hours per day (except the weekends), no inside information. Main factors affecting currency trading are economic factors, political conditions and market psychology. Most popular traded currencies are USD and EUR.

The research of FOREX related literature and articles showed that main technical analysis indicators used in currency trading are Moving Averages, Stochastics, Relative Strength Index, Bollinger Bands, Moving Average Convergence Divergence and Fibonacci Retracements. Further research of those indicators revealed their multifunctional use and capabilities of extracting useful data from currencies price fluctuations.

It was determined that key features of FOREX trading include charts, trends, support and resistance levels, while key elements for creating FOREX trading strategy using technical analysis include selecting time frame, selecting trend-identifying indicators, defining risks, defining trade entry and exit levels.

FOREX trading strategy using technical analysis was created based on the results of theory research. Three technical analysis indicators – Simple Moving Average, Exponential Moving Average and Relative Strength Index – were selected to form a trading strategy. The detailed trading plan was created which included using hourly time frame, trading EUR/USD currency pair, defining trade entry and exit requirements.

The trading strategy was tested in the real FOREX trading environment using MetaTraderTM and FX AccuChartsTM computer software. The EUR/USD currencies price fluctuation between the dates of 01/12/2009 and 01/05/2010 were used to determine the performance of the strategy. During this period, 49 trades were made using the trade entry and exit condition parameters specified in the FOREX trading strategy using technical analysis. The strategy showed profit during the trading period. Less than a half - 21 out of 49 (42.8 percent) - trades were profitable, but the profits were bigger than the losses gained with the rest of the trades.

The results of the trading showed that the strategy was suitable for the selected period of time because it showed profit. This strategy could take advantage of steady trending markets, but it was ineffective when price changed rapidly.

Technical analysis indicators helped to identify and confirm the trends, but they could not predict future price movements. Currencies price had a major influence on the indicators' movement while indicators themselves did not influence the price movement in any way. It means that technical analysis indicators are helpful in determining whether the price is moving in patterns at a certain period of time but they cannot forecast a future price movement. As shown in the Appendixes A, B, C and D, technical analysis indicators can confirm price trend but they cannot forecast if the price will change rapidly or continue to trend.

I suggest technical analysis to be treated like historical data which has no influence on price fluctuations in the future, but can identify certain patterns in price movement which tend to repeat. FOREX trading strategy using technical analysis created and tested in this thesis illustrated that technical analysis can bring profit.

I suggest using fundamental analysis together with technical analysis to identify better trading opportunities. Such fundamental data as countries' economic statistics or news reports which could influence price movement should contribute to trading strategy because they can directly (to some extent) influence the currencies price movement while technical indicators cant.

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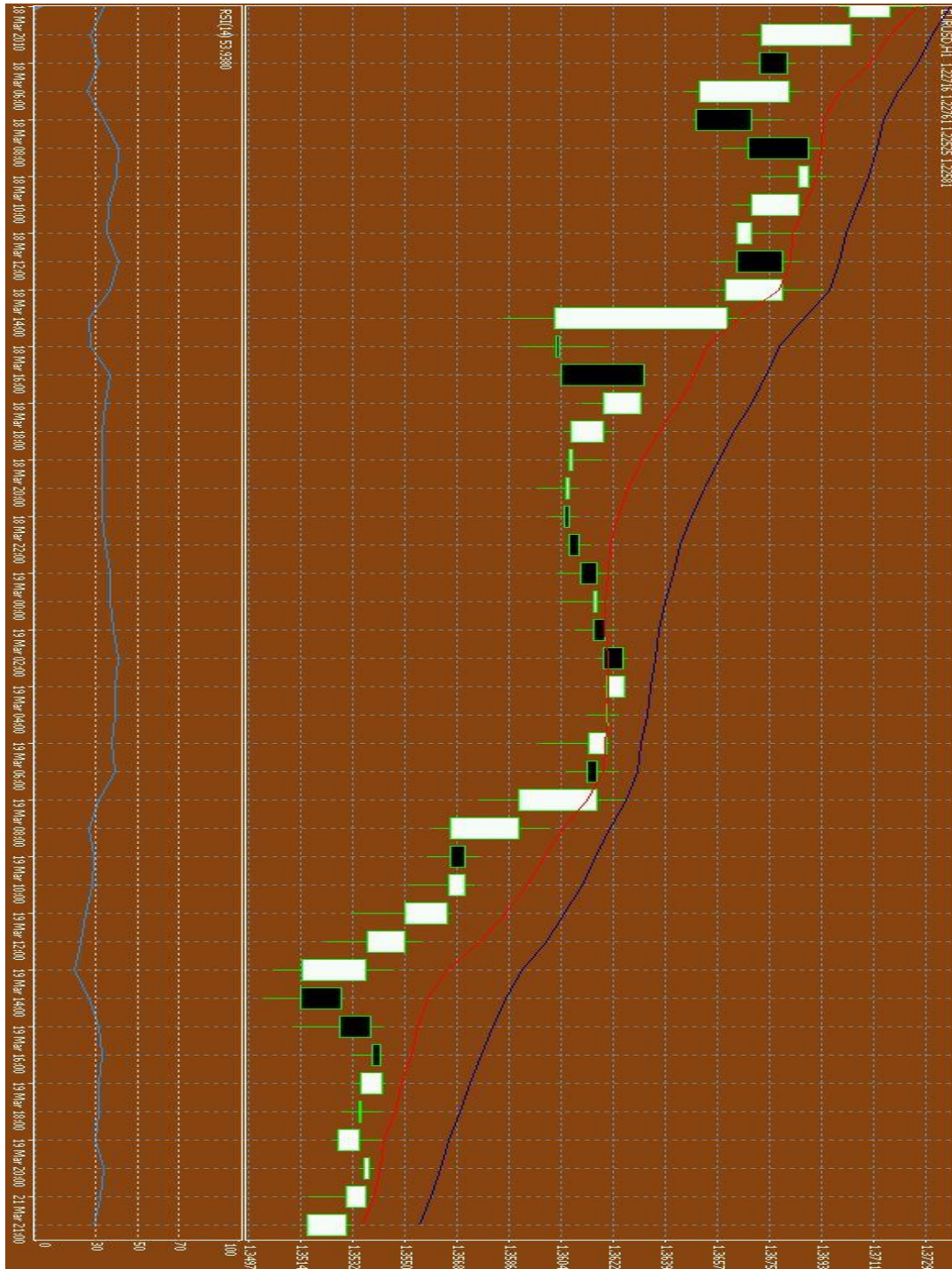
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APPENDIXES

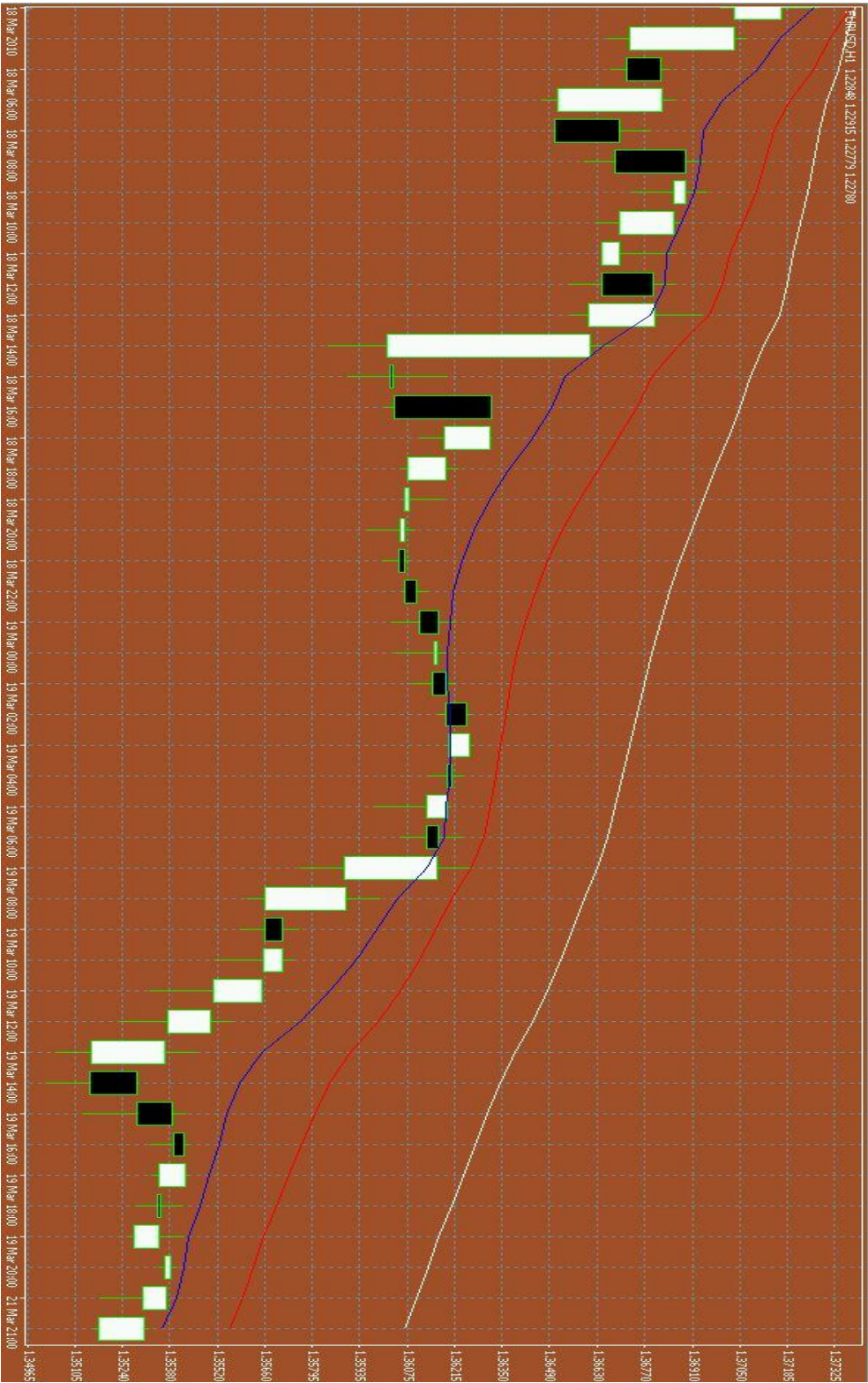
APPENDIX A

EMA INDICATORS CONFIRM A DOWNTREND, RSI INDICATOR ILLUSTRATES STRONG SELL TRADES SATURATION



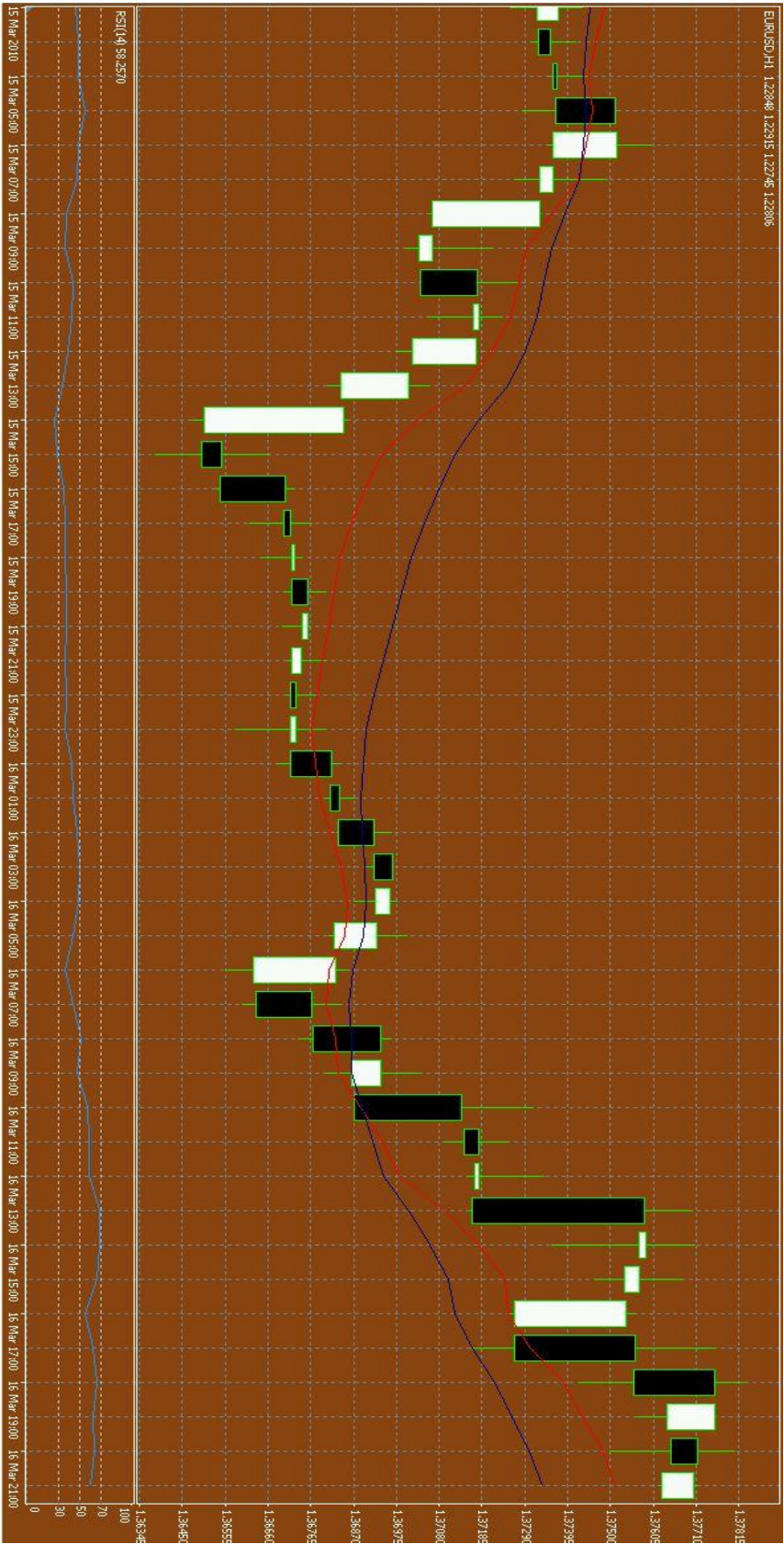
APPENDIX B

SMA INDICATORS ILLUSTRATE A DOWNTREND



APPENDIX C

EMA AND RSI INDICATORS GIVE A TRADE SIGNAL AT 9:00 A.M., 15/03/2010



SMA INDICATORS CONFIRM DOWNTREND AT 18:00 P.M., 15/03/2010

