

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics**



**Diploma Thesis**

**Economic analysis of the Macedonian denar (MKD)**

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## DIPLOMA THESIS ASSIGNMENT

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Economics and Management

Thesis title

**Economic analysis of the Macedonian denar (MKD)**

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### Objectives of thesis

This thesis is focused on the issue of Macedonian currency – the Macedonian denar (MKD). The main objective is to identify and evaluate the key factors that have an influence over the Macedonian denar. In particular, this thesis will aim to provide an insight into the currency and its economic development since its establishment in 1992.

The first partial goal is analyzing the currency as an integral part of the Macedonian economy by following the historical occurrences that shaped the Macedonian denar as it is today.

The second partial goal is comparing the exchange rate similarities (consequently dissimilarities) between the Macedonian denar and the neighboring currencies from the Balkan region in particular: the Croatian kuna, the Serbian dinar and the Bulgarian lev.

The third partial goal is comparing the Macedonian denar with the official currency of the euro zone and the second most traded currency in the world – the euro.

As a final aim, the author will provide a prognosis scenario for the future of the Macedonian denar.

### Methodology

The methodological tools used in this thesis are divided into two parts. The first part of the thesis is predominantly based on theoretical research while the second part of the thesis is based on analytical research.

The theoretical research is conducted based on secondary sources such as academic papers, books, publications and articles. The tools selected for theoretical research are qualitative and quantitative analysis in particular: historical research, deduction, induction, data extraction and data analysis.

The second part of the thesis will be based on analytic research and will provide insight into the thesis topic in a practical way. The tools selected for analytical research are: technical analysis, fundamental analysis, regression analysis and prognosis scenario.

## **The proposed extent of the thesis**

60+ pages

## **Keywords**

Macedonian denar, US dollar, economy, exchange rate, forex, technical analysis, fundamental analysis, regression analysis, evaluation, forecasting.

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## **Recommended information sources**

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## **Expected date of thesis defence**

2015/16 SS – FEM

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### **Declaration**

I declare that I have worked on my diploma thesis titled "Economic analysis of the Macedonian denar (MKD)" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on 23.03.2016

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Sunchitsa Gerasimova

### **Acknowledgement**

I would like to thank Ing. Petr Procházka, MSc, Ph.D. for his advice and support during my work on this thesis. I would also like to thank my parents, Persa Gerasimova and Misho Gerasimov for their endless love and encouragement throughout this study and especially for their confidence in me.

# **Ekonomická analýza makedonského denáru (MKD)**

## **Souhrn**

Cílem této práce bylo identifikovat a vyhodnotit klíčové faktory které ovlivňují pohyb makedonského denáru. Diplomová práce nejdříve poskytla pohled na historické události které formovaly současný denar. Práce zároveň porovnávala makedonský denár se sousedními měnami a navrhla krátkodobé prognózy na dobu šesti měsíců. Výzkum byl proveden za pomoci tří metodických nástrojů: technická, základní a regresní analýza. Technická analýza vedla k účinné identifikaci trendů, vzorů a překážek, které potvrdily že v průběhu času má trh tendenci reagovat konzistentně na podobné podněty. Základní analýza byla účinná při detekci specifických makroekonomických a politických faktorů a objasnila základní důvody trendů směnného kurzu. Regresní analýza byla použita na konstrukci ekonometrického modelu pro sedm ekonomických proměnných na časové období leden 2002 - červenec 2015. Model byl testován pro důležitost a jeho důvěryhodnost byla potvrzena. Prognóza byla určena na časové období srpen 2015 - leden 2016. Predikce byla přesná pro první tři měsíce ale průměrná procentuální chyba 2.8825 byla důvodem odchylky mezi prognózou a skutečnými (reálnými) daty ve zbylých třech měsících.

**Klíčová slova:** makedonský denár, americký dolar, ekonomika, směnný kurz, forex, technická analýza, základní analýza, regresní analýza, hodnocení, prognózy

# **Economic analysis of the Macedonian denar (MKD)**

## **Summary**

The purpose of this thesis was to identify and evaluate the key factors that influence the movement of the Macedonian denar. Additionally, the paper sought to provide an insight into the historical occurrences that shaped the denar as is it today, compare it to its neighboring currencies and provide a short-term forecast for a period of six months. The research was conducted with the assistance of three methodological tools: technical, fundamental and regression analysis. Technical analysis was efficient in identifying trends, patterns, support and resistance levels that confirmed that over time, the market trends to provide a consistent reaction to similar stimuli. Fundamental analysis was effective in detecting specific macroeconomic and political factors and clarified the underlying reasons behind trends in the exchange rate. Regression analysis was used to construct an econometric model for seven economic variables for the time period January 2002 - July 2015. The model was tested for significance and its credibility was confirmed. A forecast scenario was designed for the period August 2015 - January 2016. The forecast was accurate for the first three months but a mean percentage error of 2.8825 was the cause for deviation between the forecasted and the actual (real) data in the remaining three months.

**Keywords:** Macedonian denar, US dollar, economy, exchange rate, forex, technical analysis, fundamental analysis, regression analysis, evaluation, forecasting

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# 1 Introduction

Some of the most closely monitored indicators of a country's economic health are changes in the level of inflation, interest rates, GDP growth rate, GDP per capita and the unemployment rate. However, another very important indicator of a healthy economy is the movement of the exchange rate. The reason behind this statement is the fact that exchange rates play an essential role in the quantity of trade in a country. Trade on the other hand, is a key aspect of every free market economy in the world. In fact, exchange rates are among the most analyzed and in many cases, governmentally controlled economic indicators.

Accordingly, it is the author's opinion that an economic analysis of the Macedonian denar will provide an appropriate reasoning for the health of the Macedonian economy. The analysis will follow the denar's historic development and will also serve to determine the factors that cause the greatest impact on its movements.

The paper begins with presenting the main objectives, goals and hypothesis of the diploma thesis. It is followed by a detailed overview of the selected methodological tools. The next chapter explores the foreign exchange fundamentals by introducing the main definitions and descriptions of the market. It is followed by a brief overview of the history of the foreign exchange market and explanation of exchange rate regimes. A further literature overview provides an in-depth historical research into the early development and history of the Macedonian denar. It also follows the foreign exchange policies of Macedonia and examines their significance in the first years of the existence of the Macedonian denar. The literature overview is build upon official reports and publications of the National Bank of Macedonia as well as selected literature on the topic of foreign exchange.

The practical part of the paper examines the Macedonian denar with the assistance of three methodological tools: technical, fundamental and linear regression analysis. The technical analysis looks at past market statistics, identifies trends and predicts future movements. The fundamental analysis looks deeper into quantitative and qualitative factors and attempts to measure the intrinsic (true) value of the denar. The linear regression analysis assists the construction of an econometric model that quantifies the relationships between the macroeconomic factors that are influencing the denar movement. The model is tested for economic, statistical and econometric significance and then utilized as the basis

of constructing a forecast scenario. New data is retrieved in order to verify the presented forecast. The last chapter discusses the findings of the research and makes final remarks and conclusions.

## **2 Objectives and Methodology**

### **2.1 Objectives**

This thesis is focused on the subject of Macedonian currency - the Macedonian denar (hereinafter also referred by its currency code MKD). The main objective is to identify and evaluate the key factors that have an influence over the Macedonian denar. In particular, this thesis will aim to provide an insight into the currency and its economic development since its establishment in 1992.

The first partial goal is analyzing the currency as an integral part of the Macedonian economy by following the historical occurrences that shaped the Macedonian denar as it today. The second partial goal is comparing the exchange rate similarities (accordingly dissimilarities) between the Macedonian denar and the neighboring currencies from the Balkan region in particular: the Croatian kuna, the Serbian dinar and the Bulgarian lev. The third partial goal is comparing the Macedonian denar with the official currency of the euro zone and the second most traded currency in the world - the euro. As a final aim, the author will provide a short-term forecast scenario for the Macedonian denar in the period of six months.

The main hypothesis of this diploma work is as follows: Based on preliminary research, it is presumed that the exchange rate movement of the Macedonian denar is influenced by the following macroeconomic factors: inflation rate (expressed as purchasing power parity), key interest rates of the Central Bank, import and export volumes and various economic and political events.

### **2.2 Methodology**

The methodological tools used in this thesis are divided into two parts. The first part of the thesis is predominantly based on theoretical research while the second part of the thesis is based on practical research and work.

### **2.2.1 Methodology used for theoretical research**

The theoretical research is conducted based on secondary sources such as academic papers, books, official publications and journal articles. The tools selected for theoretical research are quantitative analysis and qualitative analysis.

Quantitative analysis is a systematic research approach that uses numerical data as a way of quantifying a selected topic. It involves the analysis of a situation or an event by using various techniques that convert data into numerical form that is used for deriving further conclusions. In other words, the researched phenomenon is described by transforming the research observations and giving them a numerical representation. By using measurable data, quantitative analysis formulates facts and reveals patterns in research (Babbie, 2016, pg. 423).

The methods chosen for quantitative analysis are: deduction, induction, data extraction, data transformation and data analysis. Deduction is a reasoning process that begins with a broad theory, hypotheses or concept that is based on scholarly literature. The theory is then tested whether it is applicable for a particular situation. This deductive process enables the researcher to come to a specific logical conclusion for the selected case. Induction is essentially a reverse deduction process. It starts with specific observations and empirical data that are used to formulate a broader conclusion such as theory, hypotheses or concept. In other words, the researcher seeks to detect patterns and formulate meanings from the collected data and arrive to a broader conclusion (Taylor, Sihna, Ghoshal, 2006, pg. 4).

Data extraction refers to retrieving data from typically unstructured data sources. In some cases, the data is not represented in a form that is suitable for the research needs. For this purpose, the data is transformed in a way that it closely expresses the theoretical concepts of the researcher (Treiman, 2009, pg. 72). Finally, in order to go from raw data to practical and usable information, data analysis is performed by applying the previously mentioned quantitative methods.

Qualitative analysis is mainly an investigative research. Same as quantitative analysis, it is used to uncover trends and formulate opinions. However, qualitative analysis tends to go deeper into the issue. It is a form of social enquiry that has a more flexible and data-driven research approach. The data is relatively unstructured and the analysis studies the naturally occurring cases of the researched topic. Qualitative research method is used to

identify the basic reasons and factors behind a certain event and it provides in-depth understanding of the reasons for such behavior (Hammersley, 2013, pg. 12).

The method used for qualitative analysis is historical research. It is a critical inquiry into past events in order to produce an accurate explanation of those events and provide answers to current issues. Historical research is not the mere collection of facts and data, but also analyzing and interpreting these facts in order to get a better understanding of past occurrences (MC Dowell, 2002, pg. 4-5).

### **2.2.2 Methodology used for practical research**

The tools selected for analytical research are: technical analysis, fundamental analysis and linear regression analysis.

Technical analysis is a popular tool that is used in the foreign exchange market. It works by evaluating the statistics generated by past market activity such as price and volume information and uses this material to predict the future movement or trend in a market. Price movements are believed to follow trends and this means that once identified, a price is likely to follow the same direction of the trend than to move against it. Technical analysis is also based on the idea that history tends to repeat itself – over time, the market tends to provide a consistent reaction to similar stimuli (Stevens, 2002, pg. 4-6).

The methods used for technical analysis are: trend line analysis, technical pattern analysis, relative strength index, support and resistance and simple moving average. Trend lines are amongst the most commonly used tools of technical analysis. A trend line is drawn between two significant points and projected into the future. It represents the overall direction in which the market is heading. Based on this a trend can be either an uptrend or a downtrend. Trends are also classified as short-term (less than a month), medium-term (between one and three months) or long-term (longer than a year) based on the time period they refer to (Lim, 2016, pg. 155).

Another popular technical tool is pattern analysis. According to technical analysis, chart patterns are believed to develop as a consequence of human behavior. Trends tend to reoccur over time and form patterns that are largely predictable. Since these patterns are seen many times before, a pattern can be either a reversal or a continuation pattern. A reversal pattern indicates that once the pattern is completed, the trend will most likely reverse its direction. A continuation pattern indicates that once a pattern is complete, the

trend will most likely continue. Each of these patterns is given a name according to its visual form (Lim, 2016, pg. 495-496).

The relative strength index (RSI) is a technical indicator that is used to measure the strength or weakness of an asset and determines if the asset is overbought or oversold. By observing the gains or losses over a certain period of time, the RSI indicator is used as a signal of when to buy or sell an asset. The relative strength index uses a scale measuring from zero to one hundred where the asset price is recorded. When the price approaches the 70 level, it is a sign that the asset is becoming overvalued. When the price comes close to the 30 level, it is considered as a sign that the asset is becoming undervalued (Stevens, 2002, pg. 254).

The trends and technical patterns mentioned earlier are based upon the idea of support and resistance. Support is defined as the price level below which price rarely falls due to the expected demand versus the supply of it. Resistance is essentially the opposite – the price level above which price rarely rises due to the expected supply versus the demand for it. These levels are skillfully used by traders that choose a strategic entry or exit from the market based on whether the price is approaching a support or resistance level (Little, 2011, pg. 128-129).

The moving average is common statistical tool used to analyze the price movements of an asset. Simple moving average is calculated by adding the closing price of an asset in a given time period and then dividing this sum to the number of periods. In other words, it is the mean of the price data points. As new price data is added every day, the simple moving average is shifted forward and uses the next most recent closing price to calculate the average value. Short-term averages are very quick to respond to changes in price while long-term averages are slow to react (Lim, 2016, pg. 440).

Fundamental analysis is thought to be the opposite of technical analysis. It takes into consideration everything that may affect the movement of a security and deals with the fundamental factors. Fundamentals refer to the qualitative and quantitative information that contributes to the well-being of a security, currency or company. While technical analysis is limited to past prices and volume only, fundamental analysis attempts to measure the intrinsic (true) value by considering a broad range of economic, financial, historical, quantitative and qualitative factors. It identifies the underlying forces that affect the movements in the market and builds predictions based on them. Fundamental analysis is

based on the assumption that in the long-run, the market will always reveal the fundamentals (McClure, 2016).

The last methodological tool that is selected for this paper is linear regression analysis. For this analysis the support from the statistical software Gretl is needed. The analysis is done by: parameters' estimation, economic, statistical and econometric verification of the model, model application (scenarios simulation) and forecast scenario.

A linear regression model will assist to determine the specific relationship between the selected macroeconomic factors that are presumed to influence the movement of the Macedonian denar. The movement of the exchange rate cannot be determined simultaneously in time; the given macroeconomic factors are set at some value and each change of their value will in turn affect the movement of the exchange rate.

In such case, the variables whose values are determined first are referred to as *independent* or *input* variables. The variable that experiences a movement as a result of changes in the input variables is called *dependent* or *response* variable. Linear regression model can be consequently described as representing the relationship between the dependent variable  $y$  and the independent variable  $x$ . The quantities of the variables are expressed with the use of parameters  $\gamma$  and  $\beta$ , and the model also includes the variable  $u_t$ , called the error term. This variable includes errors in measurements as well as variations of the dependent variable  $y$  that cannot be explained by the independent variables  $x$  (Ross, 2010, pg. 539-540).

Parameters are estimated in order to make conclusions about the future development of the observed variables and for the mathematical modeling of the events. The expected values of the observations are expressed as linear functions of the unknown parameters. Therefore, estimation of parameters is basically the estimation of the expected values of the observations (Koch, 2010, pg. 149). The statistical method of Ordinary Least Squares (OLS) is selected for the estimation of the unknown parameters. The method works by minimizing the sum of the squares of errors (residuals). Residuals represent the difference between the observed values and the predicted values under the regression model (Koch, 2010, pg. 152).

Economic, statistical and econometric verification of the model is needed to test the credibility of the proposed regression model and serve as the basis for the forecast scenario of the Macedonian denar. Economic verification is a logical verification that checks for the

direction and intensity of the estimated parameters. It verifies if the model is consistent with economic theory. Statistical verification includes tools that test the statistical significance of the estimated parameters and the model as a whole. An important statistical test is for example the *goodness-of-fit* test that checks how close the estimated model is to the real observations. In other words, it measures the percentage of variation in the dependent variable that is explained by the independent variables (Keller, 2014, pg. 135). Econometric verification involves specific statistical tests such as: multicollinearity, autocorrelation, heteroskedasticity and normality of residuals that are described and tested in the practical part of this paper.

Model application is done by applying the model to economic situations. Different scenarios of macroeconomic conditions are simulated to check if the initial economic assumptions are accurate and to determine if the model can be applied in reality. The forecast scenario includes new (future) values of the independent variables or values that were not used to estimate the regression model. The future values of  $x$  are obtained with the help of a trend line and a 95% forecast interval is projected for the predicted values of  $y$  (Hyndman, Athanasopoulos, 2014, pg. 93).

### **3 Literature Review**

#### **3.1 Definitions and description of the foreign exchange market**

Financial markets have grown and matured to a point, that they now have a significant influence over our daily lives. One of these markets is the foreign exchange market that facilitates the trading of currencies. To be more precise, “*The foreign exchange market is that in which currencies are bought and sold against each other*” (Dun & Bradstreet, 2007, pg. 2). Dun and Bradstreet enrich the definition and state that the foreign exchange is “...*a market that enables participants to buy and sell currencies in such a way that they can convert the inflow or outflow into the currency of their choice*”. Others, like leading foreign exchange broker and an expert on trading, James Chen, prefer to use a more straightforward definition of the term such as “*Foreign exchange trading is essentially about trading money*” (Chen, 2009, pg. 2).

The foreign exchange market (also known as forex, currency trading market, FX) is a market unlike any other. It is not a typical marketplace by any standards. It is by far the

largest and most liquid market of all and it is therefore considered to be the most efficient financial market. Unlike other traditional markets, the currency trading market does not have a central or a physical location. Money is traded through a global decentralized network of dealers and brokers. It is said to be the largest market in terms of volume since it enables the trade of trillions of dollars' worth of transactions every day. These characteristics set the forex market apart from other financial markets. They make the market exciting and dynamic as currencies are bought, sold and exchanged rapidly and all through online accounts and a simple click of a mouse.

The forex market offers some unique advantages for investors and it holds great potential for profitable trading. Some of these include:

- ❖ *No commission.* There are no exchange fees, government fees or brokerage fees in the forex market.
- ❖ *No middleman.* Participants can interact directly with the market maker.
- ❖ *High liquidity.* With an average trading volume per day that exceeds \$4 trillion, a trader can easily enter and exit the market.
- ❖ *24 hour market.* With no physical location, the forex market is free to operate any time of the day.
- ❖ *Low margin, high leverage.* There is a potential for higher profits (and respectively losses).
- ❖ *No insider trading.* Due to the decentralized nature and size of forex, the chances of insider trading are very limited (Archer, 2010, pg. 6-7).

The participants of the foreign exchange market vary based on their purpose of currency trading and the influence they can exert. The most influential actors are central banks, governments, banks and other financial institutions. Other participants include: foreign exchange brokers, non-bank authorized dealers, retail clients, corporate sector, hedge funds, hedgers, arbitrageurs and speculators (Faure, 2013, pg. 9).

Central banks are in charge of managing a country's monetary policy and the money supply. They are directly involved in the implementation of specific goals like currency stability, managing the exchange reserves and steering interest rates. In fact, the changes in interest rates made by central banks as response to other economic indicators

have the biggest influence over the foreign exchange market. Banks and other financial institutions are part of the massive interbank market that does most of the currency trading. Banks act as dealers and make money by selling currency at a higher price than they bought it for.

Hedgers are part of the futures market and are essentially investors that want to reduce the risk they take on a deal. It is a strategy most commonly used by multinational companies that are dealing with the problem of instability of fluctuating exchange rates. By signing futures contracts, they are eliminating the risk of exchange losses. As opposed to hedgers, speculators like taking risks and advantage of the fluctuating exchange rates. Hedge funds are also a group of speculators but they are often regarded as controversial due to their investments practices. They tend to work with very risky investments that offer large returns but these can have a major effect on a country's economy and currency (Investopedia, 2016).

As with every industry or market, the foreign exchange market has developed a unique terminology that should be noted before continuing with this paper. A *currency pair* (for example USD/MKD) is a term used to refer to the two currencies that are simultaneously bought and sold (Archer, 2010, pg. 37). A *base currency* is the first currency quoted in a currency pair. In the previous example it would mean USD is the base currency of the pair. It shows how much the first currency is worth in terms of the second currency. For example, if the exchange rate for USD/MKD is equal to 54.8777, this means that one US dollar is worth 54.8777 Macedonian denars. The second currency quoted in a currency pair is called a *quote currency*. It is the amount one has to pay in order to obtain one unit of the base currency. Following the previous example, it would require paying 54.8777 Macedonian denars in order to obtain one US dollar.

Another term to consider is the *pip*. A pip is the smallest change that an exchange rate can make. Almost all currency pairs are rounded down to four or five digits. Therefore, the smallest change a currency can make is that of the last decimal point. For example, if USD/MKD equals 54.8777, then the smallest change the rate can make is 0.0001 or 54.8778. For most currency pairs, the pip is equivalent to 1/100 of one hundred percent (Chen, 2009, pg. 37).

The price at which the market is prepared to buy a currency pair is known as the *bid price*. It is the amount a dealer is prepared to pay in order to buy the base currency. *Ask*

*price* (also known as offer price) is the price at which the market is prepared to sell the base currency in exchange for the quote currency. As a general rule of forex, the bid price is always lower than the ask price. The difference between the bid price and the ask price is called the *spread* (Archer, 2010, pg. 41).

### **3.2 History of the foreign exchange market**

The modern foreign exchange trading began soon after the end of the Bretton Woods Agreements in the early 1970<sup>s</sup> as world currencies were left to float freely. Previous to that, countries have agreed to implement a monetary policy that would fix the exchange rate of their currencies to the US dollar. The dollar in turn was fixed to a gold rate at \$35 per ounce of gold (Chen, 2009, pg. 3). Before World War II, the exchange rates were extremely unstable as a result of the competitive exchange rate policies adopted by many countries. Bretton Woods's officials considered that a growth in international trade can be achieved by a stable system of exchange rates.

Under the Bretton Woods Agreement there was no possibility for foreign exchange trading. In the period between 1950 and 1971 the United States was dealing with a balance of payments deficit on reserve transactions. The deficit was the result of military outflow abroad, governmental loans and outflows of private capital. This deficit was initially financed by the sale of treasury bills and notes, and later by the sale of gold reserves. It soon became apparent that the US dollar convertibility to gold could not be maintained forever. The overvaluation of the US dollar relative to the price of gold kept increasing and then-president Nixon responded to the situation by limiting the dollar's convertibility to gold. As a result, in 1973 the Bretton Woods system was officially terminated. At the same time all currencies that were previously fixed, now became floating (Kritzer, 2012, pg. 2-3).

Immediately after, the market forces of demand and supply began to work and this marked the birth of the foreign exchange market as we know it today. In the beginning, the foreign exchange market was reserved for influential financial players like central banks, hedge funds and other large institutions. However, national economies have experienced an increased interconnection to each other as a result of global trade and foreign investment. This, together with the fluctuating exchange rates of the countries has created exciting investment and profit opportunities for many investors. And so, the *forex* was

born. The spread of the internet has made the market open to all kinds of investors, and it seems that these days everyone wants to get a piece of the action.

### **3.3 Types of foreign exchange markets and exchange rate regimes**

The foreign exchange market can be divided into four different markets that although closely interconnected, tend to function separately. The *spot market* (also called the cash market) enables the trading of currencies for immediate delivery on the spot, as the name suggests. In reality, the transactions are settled within two business days. An example of a spot market transaction is a tourist purchasing a foreign currency. Another example is a firm's decision to convert their exports sales in their domestic currency immediately after the transaction has been completed (Levinson, 2006, pg.15).

The *forward (futures) market* works by allowing the buyer/seller to lock in an exchange rate at a specific future date. This is done through the purchase/sale of a futures contract. The exchange rate is then referred to as the forward exchange rate. This market is mostly used by companies in order to protect themselves from not receiving the agreed payment. This can happen if the foreign currency loses value before the payment is made. The futures contract ensures the conversion of foreign currencies at an agreed rate and it is useful for both parties that are involved in the transaction.

The *options market* involves a smaller volume of currency trading when compared to the others. The holder of currency options is able to buy or sell foreign currency at a specific price and during a specific period of time. The highest volume of foreign exchange trading is done in the *derivatives market*. The market works with instruments that are not traded on organized exchanges and are derived from other forms of assets. Examples include: forward contracts, foreign-exchange swaps, forward rate agreements and barrier options. Although a recent development, the trades of derivatives have now surpassed the spot market (Levinson, 2006, pg.16).

The price of one currency against another can be determined in two ways. The government or the central bank of a country can maintain a determined and official exchange rate usually against a major world currency such as the US dollar. This rate is called a *fixed* or *pegged* exchange rate. The exchange rate is then maintained by the central bank by buying or selling its currency for the currency to which it is fixed.

A *floating* exchange rate is regulated through the forces of the market: supply and demand. It simply means, that if there is less demand for a specific currency, its value will decrease and vice versa. Floating exchange rates are constantly changing and they are influenced by many economic factors such as international trade, political conditions and other macroeconomic factors.

There are advantages and disadvantages to both kinds of exchange rates. For example, a flexible rate means a country can implement an independent monetary policy and fight economic difficulties through monetary expansion or contraction. In an economy with a fixed exchange rate, the country has to rely on automatic mechanisms like price flexibility and wages and these are often slow to respond to changes. Free-floating rates can offer more stability as compared to the fixed rates. In the case of the Bretton Woods system, the lack of an effective adjustment mechanism made the systems more vulnerable to crises and speculative attacks (MacDonald, 2007, pg. 30). Another advantage of the fixed exchange system is that it lets the world economy function freely and without resorting to tariffs or trade barriers. If the exchange rate is free to float, it will eventually bring the country's balance of payments to a desired equilibrium and eliminate the need for trade barriers.

On the other hand, supporters of the pegged exchange system point out that a floating exchange rate is highly uncertain and has a negative influence on trade and investment. The more stable a country is, the more it will encourage international trade and foreign investment. Pegged rates can also prevent competitive devaluations. A currency crisis of one country can easily spread to neighboring currencies, but this cannot occur when the currencies are pegged (MacDonald, 2007, pg. 31).

### **3.4 History of the Macedonian denar**

#### **3.4.1 Introduction of the first denar**

There are different economic and political forces that influenced and shaped the Macedonian denar throughout the years of its existence. In 1918, Macedonia became part of People's Federal Republic of Yugoslavia and from this period on it was led by a strong central government controlled by the Socialist Party and Marshal Josip Broz Tito.

Since the 1980<sup>s</sup> Yugoslavia was experiencing a complex political and economic crisis. The structure of the Yugoslav economy was set up in such a way, that the stability

of the whole economy was dependent on the inflow of foreign funds that were in contrast not backed up by domestic production. The trade deficit was growing along with the foreign debt and they were no longer sustainable. In the summer of 1980, the economic instability culminated with the highest inflation recorded in post-war Yugoslavia of 45%. There was a fall of living standards, increased discontent and national intolerance. In addition, the death of Josip Broz Tito meant a loss of vital authority figure and countries were suddenly unable to lead the federation.

These problems led to the breakup of Yugoslavia as one by one, countries decided to leave the Federal Republic. If Macedonia had decided to stay in the federation, it would have meant taking part into a conflict that was not hers. If it opted to form an alliance with one of the republics, it would have risked losing the sovereignty that has been a dream of the Macedonian people for centuries. For that reason, a referendum was held on 8<sup>th</sup> of September, 1991 where 71% of the population voted for a sovereign and independent Macedonia (Phillips, 2004, pg. 50).

The year 1992 was an important year for Macedonia's monetary and foreign exchange policy goals. Although it declared independence in 1991, in the first four months of 1992 Macedonia was still part of the Yugoslav dinar currency zone and as such it did not have its own macroeconomic policy. The monetary policy goals and targets were carried out as they were set by the Yugoslav National Bank. Macedonia was still using the Yugoslav dinar that was fixed against the German mark and it floated against the other convertible currencies.

Prior analysis indicated that Macedonia will most certainly face difficulties in the balance of payments as soon as it becomes monetary independent from Yugoslavia. It was possible that the country might run out of foreign currency funds for the purchase of basic and necessary products such as food and medicine. Experts advised that Macedonia should first purchase foreign currency from the National Bank of Yugoslavia at the official exchange rate for import and only then consider the declaration of monetary independence. It was also not clear by which means will Macedonia acquire foreign currency reserves in order for the economy to run without obstructions in the first months after the new currency will be introduced. Another concern was the reaction of Yugoslavia. No one could be certain if it will continue to trade with Macedonia or might introduce economic blockade. In such a severe case, alternative solutions were needed (Trpeski, 2002).

Despite these concerns, on April 26<sup>th</sup>, 1992 Macedonia declared economic independence from Yugoslavia and this marked the beginning of a new chapter in Macedonian economy. The economy after the political and monetary independence required continuous work and the transition was not a simple process. At the time, the National Bank of Yugoslavia was financing the ethnically driven Yugoslav wars and its rapid expansion led Macedonia into an ongoing circle of hyperinflation. This situation required the introduction of a stable currency that will save the country from inflation.

In conditions of ongoing military aggression and monetary war, the country had an important decision to make: either borrow a foreign currency or create its own. Macedonia opted for the second option. An independent macroeconomic policy was to be implemented through the newly passed: “National Bank of the Republic of Macedonia Act” and the “Republic of Macedonia’s Currency and Currency Usage Act”. As of April 27<sup>th</sup>, 1992 the Macedonian denar was established as the official currency of the country (Official Gazette of the Republic of Macedonia, 1992, nr. 26, pg. 422-423).

The name of the Macedonian currency was uncertain almost until the day of their release. Few days before the printing, Macedonian academic Petar Hr. Ilievski gave the final proposal that was accepted by everyone - the Macedonian denar. He explained his reasons for suggesting the name when he submitted the proposal to the relevant institutions: *“The names of most currencies are usually borrowed from other languages. At the time when the Slavs settled in the Balkan Peninsula, Macedonia was a Roman province and it used Roman money. The name of these coins was the Latin word “denarius”. Following this tradition, it makes sense to keep one or the other form de/inar. I think it fits well”* (Ilievski, 2012).

The new currency was printed nearly four months before the monetary independence was official, and so it was done in highest secrecy. Even the special paper that was ordered from the small town Radeče in Slovenia was transported by boat secretly. Everyone feared that the public will find out that soon after the political independence, Macedonia was also preparing for a monetary independence although this was expected. Every member of the working group for monetary independence had a clear vision that the introduction of Macedonian currency was the single most correct solution.

The first Macedonian denars were printed in the form of value coupons. Due to the sensitivity of the issue of the design and the short time before printing, it was decided that

all value coupons will have the same design and differ only in color. The design work was assigned to a young boy from the printing house. He had only one week to design them. The first coupons were in denomination of 10, 25, 50, 100, 500 and 1,000 denars, and later two new banknotes of 5,000 and 10,000 units were printed. The value coupons were to be used in a period of six months and pave the ground for the introduction of the actual Macedonian currency (Madzovska, 2011).

On January 15<sup>th</sup>, 1992 the printing of the first Macedonian denars began. Borko Stanoevski, the first governor of the National Bank recalls the day: *“There was a formal and quiet atmosphere in the printing hall. When all the preparations were finished, the machine switchboard set to zero, and ordinary paper replaced with special, around 11 a.m. the printing of the first Macedonian denars began. When I saw the first sheet with the face of 24 banknotes, I felt that my eyes are starting to tear. With the intention to hide my weakness, I turned to the window wiping them so that others will not notice. When I came to my senses, I turned again to the machine which was continuously printing the face of the banknote, 24 samples on each sheet. I saw that the eyes of the people working on the machine were also filled with tears. And not just them, there were tears in the eyes of everyone that witnessed this historic event when the printing of the first Macedonian currency began”* (Stanoevski, 2012, pg. 26).

In the anticipated period of three days, the Yugoslav dinars were successfully changed into Macedonian denars with an exchange rate of 1:1. By April 30<sup>th</sup>, 1992 the Yugoslav dinar was no longer an official medium of payment as recognized under the Macedonian law. From that time on, the Macedonian National Bank had one primary objective: achieve and maintain the stability of the denar. The monetary policy was governed by law and not independently set up by the bank but the Macedonian National Bank had the authority to decide on the instruments by which it will accomplish national currency stability (National Bank of Macedonia, 1993, pg. 2).

In order to achieve the monetary policy goals and targets, the Macedonian Parliament passed the “Anti-inflation program” that was essentially a restrictive monetary policy aimed at reducing the money supply, maintaining a balanced budget, preserving real positive interest rates, wage control, reducing the inflation and stabilizing it at average monthly level of 4.5%. Coming out as a newly sovereign country, it was expected that

there will be higher inflation but the strategy was aimed to decrease it as much as possible (Trpeski, 2002).

In the first year of monetary independence, the Macedonian National Bank did not use the interest rate mechanism as a monetary instrument and a regulator for reserve money supply and demand. This was because Macedonia did not have conditions for market determination of the discount rate. The discount rate was calculated based on the average inflation in previous three months plus taking into consideration the expected rate of inflation in the upcoming three months. During the course of 1992, the discount rate was changed four times starting from 60% per year to 170% per year after the Anti-inflation program was implemented. The third change was done after the Anti-inflation program was revised and it was set to 410% per year. After the inflation dropped to 10% in November, the discount rate was changed for the fourth time and this time to 250% per year (National Bank of Macedonia, 1993, pg. 19-20).

### **3.4.2 Foreign exchange policy 1992**

Macedonia's first foreign exchange policy in 1992 was being carried out under exceptionally unfavorable conditions. Three specific reasons were hindering the foreign trade environment for Macedonia. The first reason was the ongoing Yugoslav wars that started in 1991. Even though Macedonia remained at peace during the wars, the ethnic conflicts had a considerable impact on the situation in Macedonia.

Furthermore, as an attempt to bring the situation under control and concerned that the wars were causing a threat to international peace and security, the United Nations passed several resolutions in 1992 that had a significant impact on the Macedonian market. Resolution 752 was passed urging countries to follow the ceasefire agreement signed in April 1992. The failure to implement this resolution was harshly condemned by the United Nations and this led to the passing of the Resolution 757 that imposed a trade embargo on Yugoslavia. The embargo blocked all imports on Yugoslavian products, all exports to Yugoslavia and funds or financial resources were unavailable for the whole territory (United Nations Security Council, 1992).

The next barrier came from Greece. In the beginning of 1992, after submitting all the necessary documents for the recognition of Macedonia, there was a huge shock and national disappointment after the European Council decided not to recognize Macedonia

by its constitutional name. The Council stated that Greece was displeased with the name of the state and that the recognition will be temporarily delayed until the issue is resolved. In the same year, Greece introduced an unpublished and cruel economic blockade by closing the borders with Macedonia. The already poor road transportation left Macedonia isolated and links with the European countries were obstructed. This had a significantly negative impact on Macedonian foreign trade (Institute of National History, 2008 pg. 332).

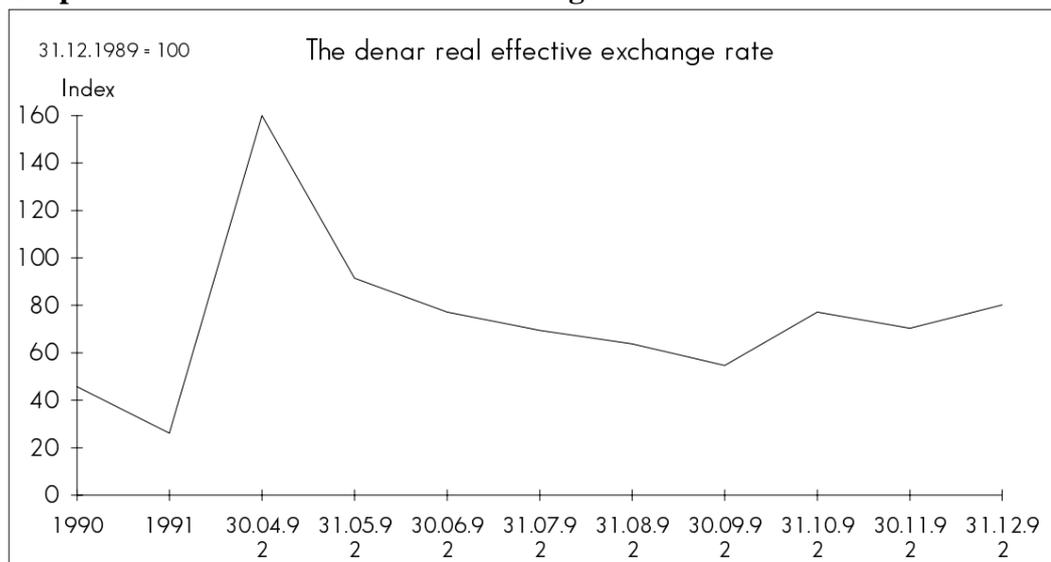
All of these conditions were making the economic activity in Macedonia contract more and more. Until April 1992, Macedonia was still under the former federal laws for foreign economic relations. These laws however, were suitable for an economy with high level of foreign exchange reserves, stable foreign trade relations and an active foreign exchange market. As a newly independent country, Macedonia did not have these things and was in a specific economic condition. Therefore, the Parliament passed on the “Foreign Exchange Policy Charter” and the “Projection for Macedonia’s 1992 Balance of Payments”. These policies laid out the need for creation of foreign exchange reserves and possible sources for its accumulation, denar exchange rate policy and the need for legal regulation of the system (Official Gazette of the Republic of Macedonia, 1992, nr. 26. pg. 430).

The foreign reserves were to be funded through two main sources. A fundamental source was 30% retention on the earnings of foreign exchange export at the official exchange rate. A second source was the purchases from foreign and domestic natural persons in the form of road tolls, checks, entry transportation permits, exit duties, petrol coupons, effective foreign currency etc. Finally, the purchased gold for denars from the domestic producers was also going to be added to the foreign exchange reserves (National Bank of Macedonia, 1993, pg. 26).

As part of the Anti-inflation program, and in extension of the former federal exchange rate policy, Macedonia introduced the Macedonian denar at a fixed exchange rate of 360 denars to the German mark with 60% expected devaluation. The new currency fluctuated against the other currencies on the foreign exchange market as led by the example from the Yugoslav dinar. The initial outcome from the introduction of the new currency was positive. Whereas the fixed exchange rate policy implemented by Yugoslav federal government was leading to a drastic decrease on export price competitiveness of 73% in 1991, the monetary independence and the introduction of the Macedonian denar led

to the increase of export price competitiveness by 60%. These denar movements against a determined basket of other major currencies where most exports were realized can be observed through the real effective exchange rate. The following table shows an index above 100 in the first quarter of 1992 which indicates that the export price competitiveness was increasing.

**Graph 1: The denar real effective exchange rate**



**Source: National Bank of Republic of Macedonia, 1993**

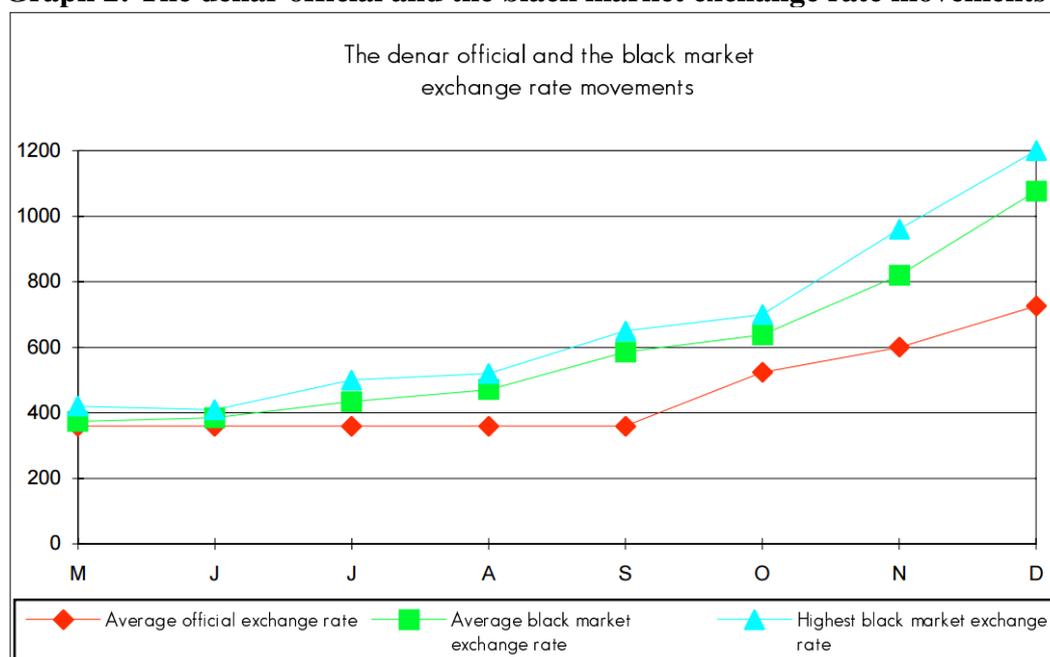
The fixed exchange rate was one of the main targets of the Anti-inflation program. As such, it contributed to the substantial decrease of inflation from 72.4% in May to 6.6% in August the same year. It also created a more positive climate for foreign economic relations as the overall inflow of goods and services exports has been steadily increasing throughout the first six months.

However, the extension of the Yugoslav monetary policy that was implemented in Macedonia was created for a different economic environment and this became visible in the first six months of the existence of the Macedonian denar. The initial positive effects proved to be unsustainable in the long run. The high foreign exchange demand for energy import payments as well as the inconsistency of the Anti-inflation program in the field of wage regulation resulted in high inflation rates return.

The compulsory retention of 30% on the earnings on exports pushed the exporters to find ways around paying their duty to the state. They avoided bringing in the earnings from their exports and this caused a decreased amount of foreign currency earnings as well

as purchases in the country. The fixed exchange rate did not follow the price movements on domestic and foreign markets. The unfavorable official exchange rate led to the creation of at least two unofficial exchange rates. The gap between the official and the unofficial exchange rate started to increase and exporters were trading under much higher exchange rate compared to the official one. A black exchange market was born with natural persons as its main participants (National Bank of Macedonia, 1993, pg. 24-25).

**Graph 2: The denar official and the black market exchange rate movements**



Source: National Bank of Republic of Macedonia, 1993

Another reason for the creation of the black exchange market was that the conversion of Yugoslav dinars to Macedonian denars was substantially higher than expected. The exchange of money occurred twice than what was predicted in the dinar-denar conversion. With the fixed exchange rate to the German mark of 360 denars, there were twice as higher amounts of denars to dinars. This brought a misbalance to the 1:1 proportion and the creation of an unofficial exchange rate at a much higher level than the official one (Trpeski, 2002).

The bank tried to resolve this problem by interfering and devaluating the denar. However, this correction was delayed and by then the exporters had already lost their incentives for export. The discouraging denar fixed exchange rate made them hold onto their foreign currency earnings in their accounts abroad. Needless to say, the monthly

inflow from exports as well as imports from foreign exchange was low. At the same time, the German mark started to increase on the international financial markets which meant the Macedonian denar had also increased against other currencies.

In order to prevent further adverse effects of this situation, the National Bank fixed the denar to a basket of seven convertible currencies instead of only to the German mark. There was a small improvement, but the price increase was still ongoing. In December the bank did a second devaluation of the denar of 30% against the basket of seven currencies. As a result, export price competitiveness finally showed some growth but by the end of 1992 this was significantly lower when compared to the initial results achieved through the Anti-inflation program which was 50% (National Bank of Macedonia, 1993, pg. 25).

Despite the bank's efforts, the two devaluations did not solve the existing problem and the gap between the official and the black market exchange rate still remained. Only the official payments abroad were done at the official exchange rate, while the exporters satisfied their own needs first at the significantly higher rate and only then sold their foreign exchange surpluses.

Although the estimated reserves level was set to \$100 million, the final accumulated foreign exchange reserves amounted to \$63.7 million. Considering the fact that before the monetary independence Macedonia did not have any foreign exchange reserves, the outcome of 1992 was considered as positive. Macedonia now had at least a starting basis for a foreign exchange market establishment. However, from the foreign exchange policy viewpoint, these results proved that the established exchange rate policy was not suitable for the newly independent Macedonian market.

The inappropriate exchange rate policy was the main reason why the foreign exchange reserves accumulation was lower than it was determined in the beginning of the year. Despite the restrictive monetary policy and tight wage control, the Anti-inflation program also failed to produce the expected results. This was also due to the fact that the control over the wages was lost and there was no external resources inflow. Public spending and personal consumption was below the targeted level and this called for a revision of the policy concept. By the end of 1992 the need for a free foreign exchange market became apparent. If implemented, the forces of supply and demand will shape the true exchange rate of the Macedonian denar and will simultaneously put an end to the illegal foreign exchange market.

In the first months of 1992 before Macedonia's monetary independence, the weakened functioning of the foreign exchange market called for obtaining \$7 million from Yugoslavia's foreign exchange reserves in order to repay the Macedonian foreign debt. After the monetary independence, Macedonia faced insufficient foreign exchange reserves and was not able to repay any foreign debt during 1992. The National Bank and the Macedonian Government contacted the World Bank and the International Monetary Fund in hopes of finding a solution for the economic situation. On December 14<sup>th</sup>, 1992 Macedonia became member of the International Monetary Fund (International Monetary Fund, 2016) and on 25<sup>th</sup> February, 1993 a member of the World Bank (The World Bank, 2016). The total external debt of Macedonia at the end of 1992 was \$842.1 million and the total debt to international financial institutions was \$252.5 million or 30% of the total debt for 1992 (National Bank of Macedonia, 1993, pg. 30-31).

### **3.4.3 Foreign exchange policy 1993**

In the second year of economic independence, the monetary policy of the Macedonian National Bank included the introduction of definite paper money, denomination of the denar value and introduction of market-based interest rates. On May 10<sup>th</sup>, 1993 definite banknotes and coins were officially put into circulation. Banknotes were denominated in 10, 20, 50, 100 and 500 denars and coins in 50 deni (where 1 denar equaled 100 deni), 1, 2 and 5 denars. The value coupons of 10 and 25 ceased to be a legal tender, while the rest were used together with the newly issued banknotes and coins. Their withdrawal from circulation was done gradually throughout the year. As an attempt to repair the currency issues from 1992, the denar value was reduced in a ratio 100:1. All claims and liabilities as well as the value coupons expressed in denars were also reduced by 100 times.

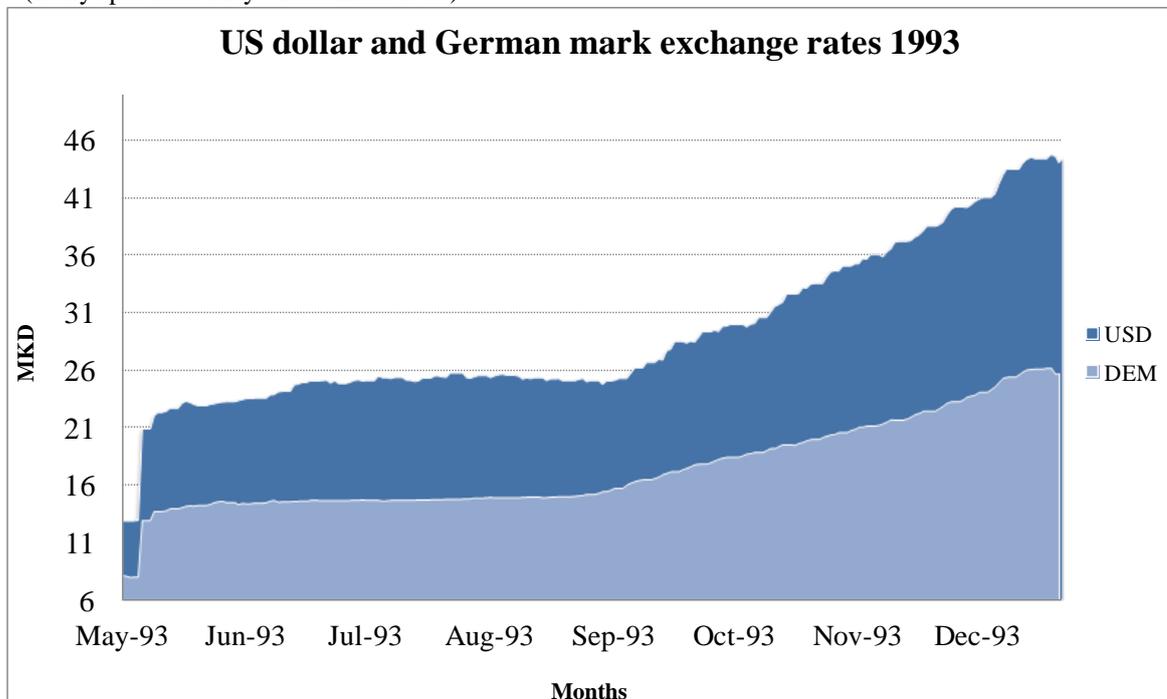
The weaknesses of the first foreign exchange system were taken into consideration before the new policy was set up for 1993. The National Bank decided to abandon the existing fixed denar regime and proposed a new foreign exchange system. The system signified a freely floating exchange rate of the denar that would be determined by the foreign exchange supply and demand as well as the organized foreign exchange market within authorized Macedonian banks. The National Bank was to intervene only within the

limits of the foreign exchange reserves and in order to maintain exchange rate stability in case of volatile exchange rate fluctuations.

On May 13<sup>th</sup>, 1993 the new foreign exchange system was officially implemented after the Council of the National Bank approved the “Decision on the Terms and Conditions for Buying and Selling Foreign Exchange among Legal Persons in the Republic of Macedonia”. The government and the National Bank hoped that the establishment of the real denar exchange rate and the functioning of the foreign market will eliminate the illegal market and bring monetary stability to the country (National Bank of Macedonia, 1994, pg. 29-30).

The new exchange rate was determined at 12.94 Macedonian denars for one German mark and 20.88 denars for one US dollar. For both currencies this was an increase of around 61%. The spread of the official and unofficial rate for the German mark was decreased from 66.91% to 8.18% and from 61.54% to 6.81% for the US dollar. The graph below shows the exchange rates from the period of introduction of new foreign exchange system to the end of the calendar year.

**Graph 3: US dollar and German mark after free-floating denar**  
(Daily spot rates May - December 1993)



Source: National Bank of Republic of Macedonia, author's computation

The new foreign exchange system brought relative stability of the Macedonian denar. In September 1993, the denar became unstable due to increased demand for foreign exchange on the currency exchange market. The National Bank intervened through tight credit and monetary policy and by selling \$14.4 million of foreign exchange reserves. The stability of the denar was restored in the last month of the year (National Bank of Macedonia, 1994, pg. 31).

The floating denar exchange rate created better conditions that enabled the compulsory requirement of 30% of realized foreign exchange inflow to be abandoned. Exporters were able to use their exchange inflow to pay their foreign obligations, sell them to another enterprise or keep them as deposit on a foreign exchange account. As a result, the exporters started bringing the foreign exchange inflow in the country instead of keeping it in accounts abroad. The accumulated inflow from export and import of goods was almost twice as higher than in 1992. The floating exchange rate brought an increase in foreign exchange inflow from \$28.9 million before the new foreign exchange policy, to \$60.5 million from June until the end of the year.

The policy showed a positive result and it increased the foreign exchange potential of Macedonia. The success of the policy was also apparent by the fact that the main resources that built the foreign exchange reserves were the foreign exchange activities. New sources for the accumulation of foreign exchange reserves were introduced. They included: buying foreign exchange on the foreign exchange market, mandatory purchase of 30% of total foreign exchange inflow of companies, inflow from petrol coupons, bond issue in foreign exchange and buying gold according to estimations of National Bank. The reserves formation in 1993 was considered successful since at the end of the year there was an increase of 75.86% of foreign exchange reserves as compared to 1992 (National Bank of Macedonia, 1994, pg. 33-37)

In the absence of a bank association, the foreign exchange market was established as a market within each authorized bank for payment activities abroad. Buying and selling was possible between individual banks and enterprises and also between enterprises and banks. The turnover of the market was growing with each consecutive month and by the end of the year, the total foreign exchange market turnover was \$345.9 million. In this period the National Bank intervened by selling \$46.9 million and repurchasing \$20.8

million and it kept a balanced foreign exchange demand and supply. The end of 1993 marked a satisfactory result in the foreign exchange market.

At the same time, the currency exchange market operations also started. The liberalization of the market operations expanded the group of entities that were legally permitted to participate in the market. After obtaining an appropriate license from the National Bank, the exchange offices could publish their own exchange rate list determined by the exchange rate supply and demand. Thus, the foreign exchange market operated on two levels. The first level was a foreign exchange market where supply and demand for foreign currency of banks and enterprises met. The second level was a market where individuals traded with foreign currency, or the exchange offices market (National Bank of Macedonia, 1994, pg. 34-36).

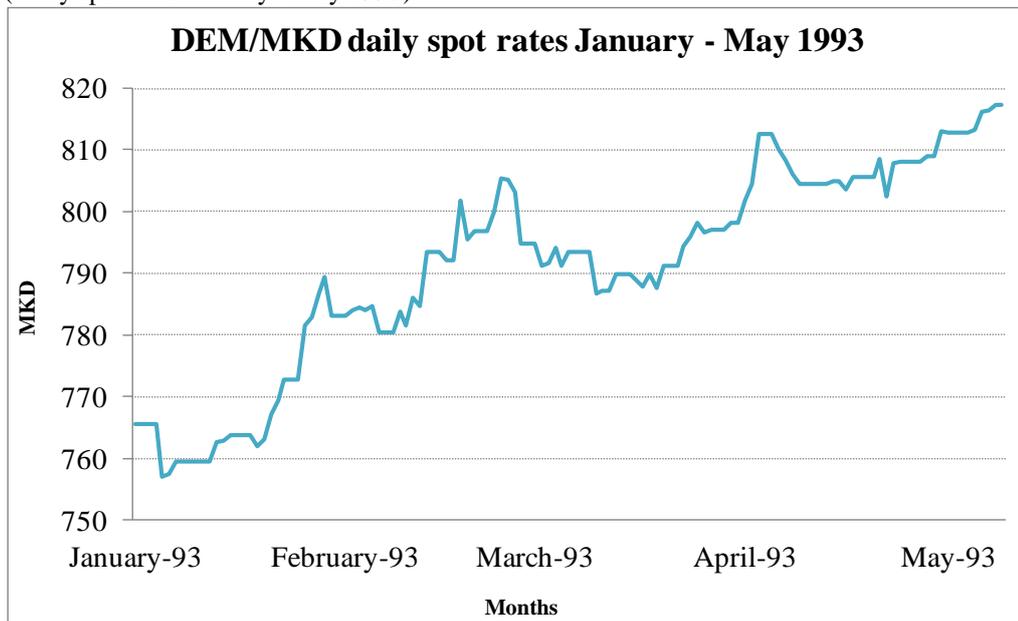
In terms of foreign credits, there was again a delay in the repayment and only the interest on the standing obligations towards International Monetary Fund and the World Bank was paid. The inherited obligations from Yugoslavia amounted to \$140.2 million principal and \$54.5 million in interest. Since the main pre-condition of the World Bank for obtaining a new credit was a timely settlement of the standing one, Macedonia negotiated for credit under the status “Country in transition” and was eligible for an Economic Recovery Loan. Macedonia simultaneously continued to settle its outstanding obligations towards the bank (The World Bank, 1994, nr. P-6204-MK).

In April, 1993 Macedonia became the 181<sup>st</sup> member of the United Nations under the name “Former Yugoslav Republic of Macedonia”. This signified another success in the political recognition and the Macedonian government had since given very high priority to economic reforms (United Nations, 2006). The National Bank started using monetary targeting and the exchange rate of the denar was used as a signal for the equilibrium between supply and demand. If the currency was stable, then money supply was increasing in the same way as money demand. If the currency was depreciating, it meant money supply was increasing faster than the money demand. This approach proved to be very efficient (National Bank of Macedonia, 1994, pg. 14-15).

The graphs below show the movement of the Macedonian denar before the introduction of the free floating system (January - May, 1993) and after.

#### Graph 4: German mark before free floating regime

(Daily spot rates January - May 1993)

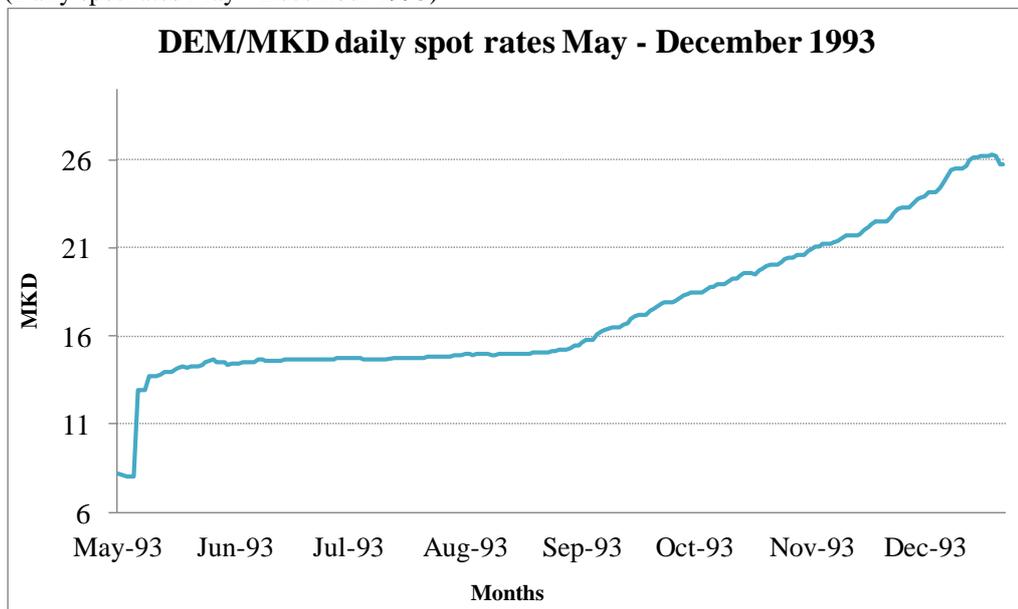


Source: National Bank of Republic of Macedonia, author's computation

The exchange rate of the denar started at 765.5628 denars per mark in January 2013 and increased to 817.3494 by the beginning of May 1993.

#### Graph 5: German mark after free-floating regime

(Daily spot rates May - December 1993)

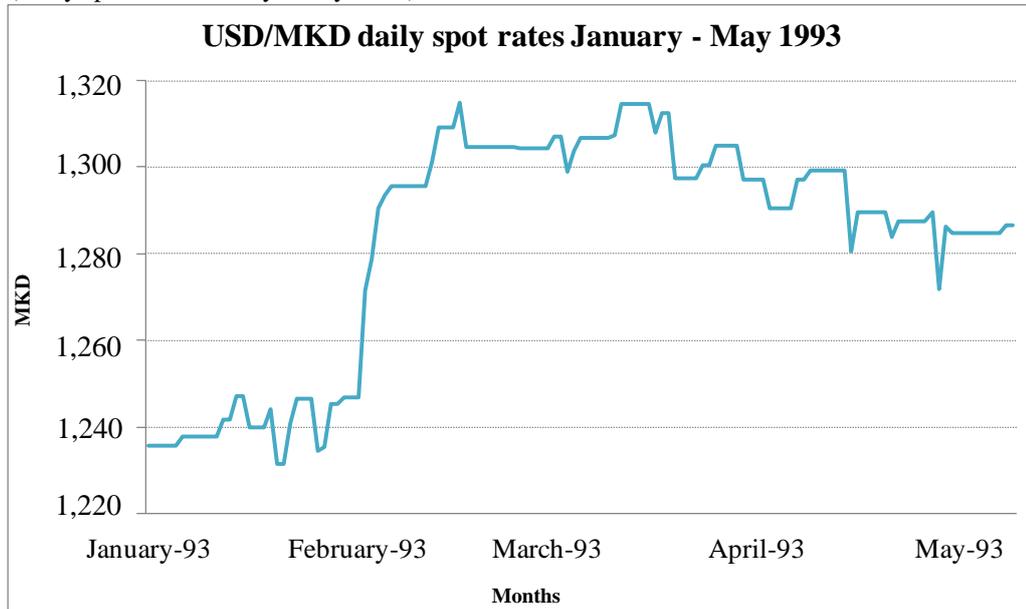


Source: National Bank of Republic of Macedonia, author's computation

The free-floating system and foreign exchange market forces established a new rate of 8.1735 MKD/DEM which by the end of the year tripled to 25.7521 denars per one mark.

### Graph 6: US dollar before free floating regime

(Daily spot rates January - May 1993)

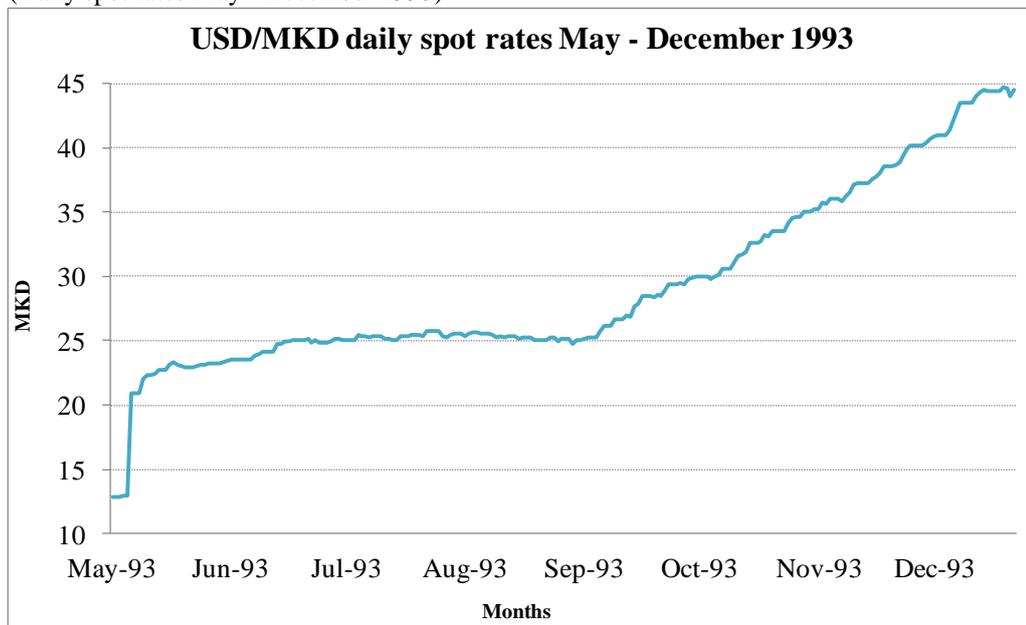


Source: National Bank of Republic of Macedonia, author's computation

The US exchange rate reached its maximum of 1,315.0353 MKD/USD in February. The pattern was reversing and by May the denar was exchanged at 1,286.5078 MKD/USD.

### Graph 7: US dollar after free-floating regime

(Daily spot rates May - December 1993)



Source: National Bank of Republic of Macedonia, author's computation

The free movement of the denar established the new exchange rate at 12.8651 denars per US dollar which by the end of the year 1993 and similar to the German

mark, also more than tripled to a higher exchange rate of 44.4558 denars per US dollar.

## **4 Practical Part**

The analytical part of this paper examines the Macedonian denar in a practical way. The first half evaluates the denar through the use of technical analysis (based on past market data) and fundamental analysis (based on intrinsic value). The second part is consisted of regression analysis to verify/reject the given hypothesis and a short-term currency forecast for a period of six months.

Since 1995, the National Bank of Macedonia followed a monetary strategy aimed at targeting the nominal exchange rate of the denar against the German mark. After the introduction of the euro in 2002, the monetary policy was adjusted against the euro and since then the bank's intermediary objective is the preservation of the denar exchange rate stability. The significance of the exchange rate for a small and open economy such as Macedonia, the high level of euroization and the need of nominal anchor for the maintenancy of credibility were the main factors that influenced this decision (National Bank of Macedonia, 2016). Nevertheless, the firm control over the exchange rate stability against the euro leaves little room for constructive currency analysis. It is therefore the authors' assessment that an analysis of the Macedonian denar against the US dollar would be of greater relevance for the purposes of this paper.

### **4.1 Technical analysis**

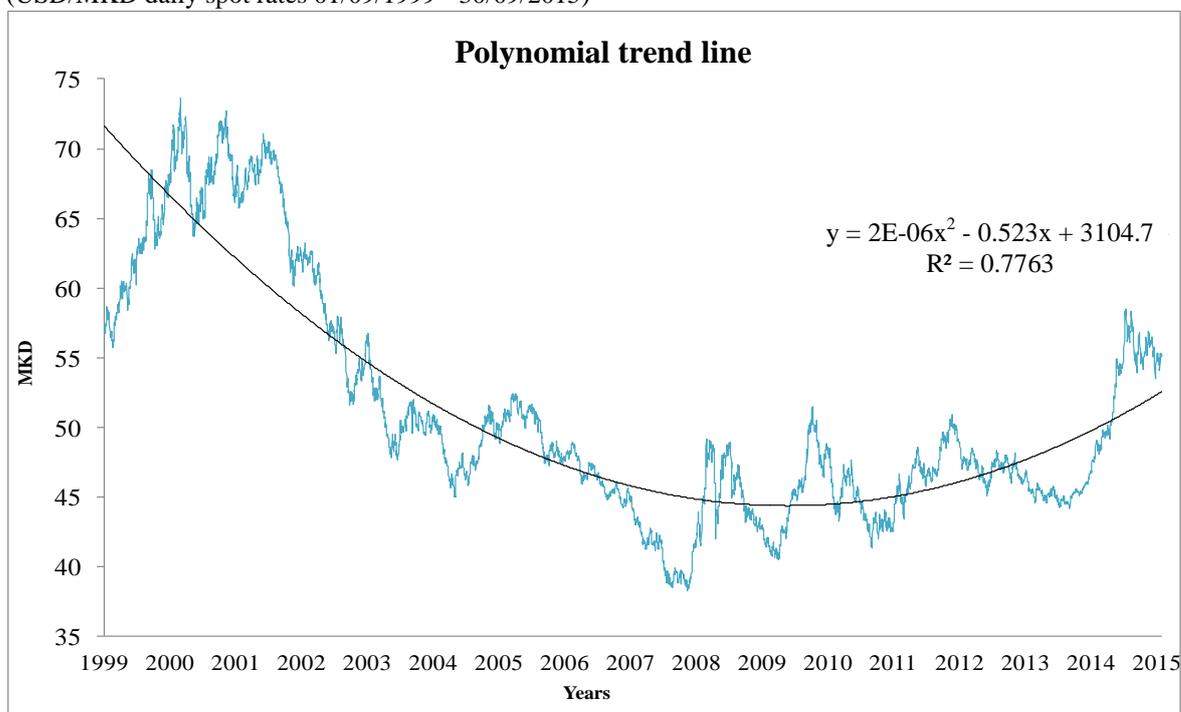
The technical analysis was performed based on market activity statistics such as past prices and volume. Technical analysis suggests that the historical performance of the Macedonian denar could be an indicator for its future performance. Through the use of charts and other technical indicators, several currency patterns were identified and based on them the future activity of the denar is suggested. Various literatures, such as Leign Stevens' "*Essential Technical Analysis Tools and Techniques to Spot Market Trends*" and Thomas N. Bulkowski's "*Encyclopedia of chart patterns*" were used in order to perform the analysis.

#### 4.1.1 Trend line analysis

As described by Mark Andrew Lim in his book “*A Handbook of Technical Analysis: the Practitioner’s Comprehensive Guide to Technical Analysis*” a trend line is a line that is drawn over pivot highs or under pivot lows to indicate the predominant direction of something (Lim, 2016, pg. 155). The graph below illustrates the daily spot rates of the Macedonian denar against the US dollar taken for the period of sixteen years from September 1<sup>st</sup>, 1999 to September 30<sup>th</sup>, 2015. It is a visual representation of the general course and exchange rate tendency of the Macedonian denar in terms of the US dollar.

#### Graph 8: Polynomial trend line

(USD/MKD daily spot rates 01/09/1999 - 30/09/2015)



Source: National Bank of Republic of Macedonia, author’s computation

With a coefficient of determination of 77.7%, a polynomial trend line provides the best fit and it demonstrates an overall downtrend followed by a recent uptrend. The pair starts at 57.3376 MKD per US dollar and follows and uptrend movement in the upcoming months. The rate reached its peak in December 1999 at MKD 60.5084 and the average exchange rate at the end of the year was MKD 59.9574 per US dollar.

The uptrend continued until late 2000 when the exchange rate reached its highest peak of MKD 73.6304 in October the same year. The period between October 2000 and

beginning of 2001 follows a sideways trend as the rate travelled between strong levels of support and resistance. The period of consolidation ended in the beginning of 2001 and it progressed into a downward trend. In the seven years between 2001 and 2008 the rate experienced a continuous decline with temporary depreciations. The trend reached its first low point in December 2004 at MKD 44.9876 and its record low in July 2008 of MKD 38.26 per one US dollar. This downtrend represents a change from an average MKD 68.0421 in 2001 to an average MKD 41.8646 in 2008 or an appreciation of 61.53%.

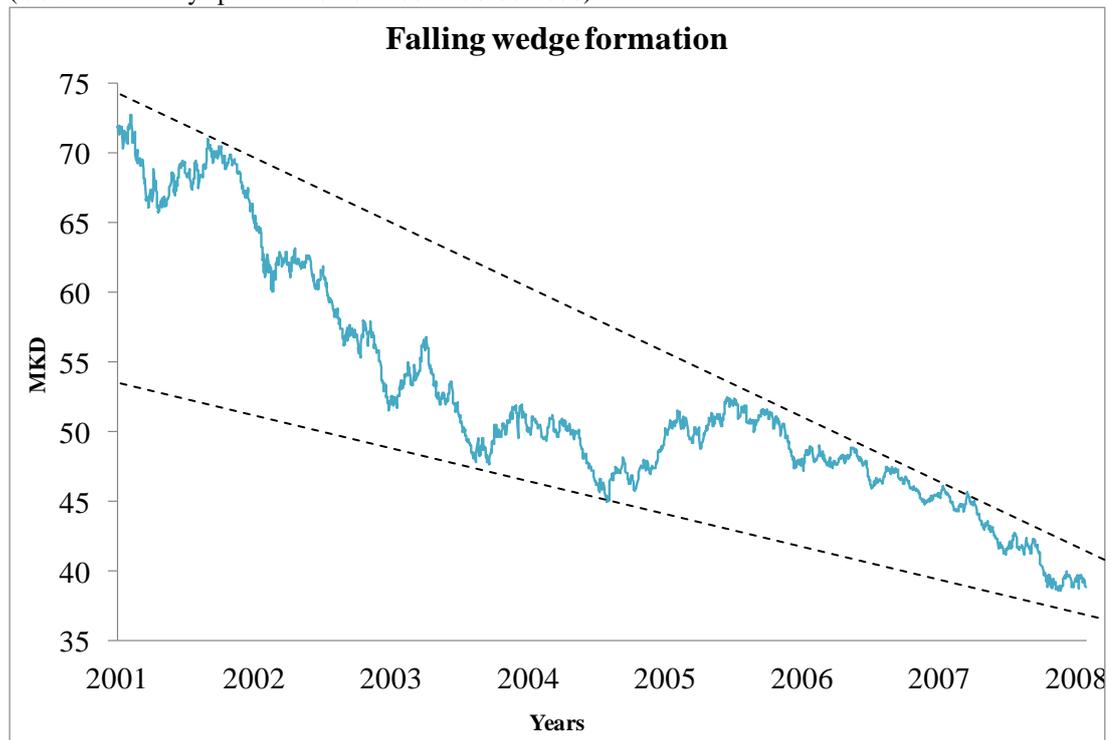
The trend visibly demonstrates the impact of the global financial crisis on the Macedonian denar. As the market regained its confidence, so did the exchange rate. By the end of the same year the Macedonian denar traded at an average of MKD 49.1364 per US dollar and was slowly reversing the previous trend. Another sideways trend followed after that. The exchange rate was fluctuating between MKD 48.9151 in March 2009 and MKD 48.5422 in September 2014. As of 2015, the denar has experienced a steady but persistent depreciation against the US dollar with highest rate of MKD 58.4359 in March 2015.

#### **4.1.2 Falling wedge formation**

Wedge-shaped patterns are generally seen as signs of possible trend reversal. There are two kinds of wedges that differ according to the overall incline of the pattern. Wedges can be falling or rising. As the name suggests, a falling wedge has a downward slope while a rising wedge moves upward. The wedge pattern is a generally a long-term pattern and in some cases it takes several years to be completed. A falling wedge is a bullish pattern that begins wide at the top and slowly contracts as prices decrease. The price eventually forms a cone that slopes down. The pattern was identified with the help of Thomas N. Bulkowski' *"Encyclopedia of chart patterns"*.

A downward pattern was observed for the USD/MKD exchange rate for the period between 2001 and 2008. The falling wedge lasted for seven consecutive years but it also signaled a bullish outlook that the rate will very likely break upwards through the wedge and reverse into an uptrend. Despite the fluctuations, the exchange rate bounced between two trend lines which acted as borders to the price movement. The trend lines illustrated below show a convergence as they both follow a downtrend direction as a result of the falling rate trade. The lines became narrow as the trend grew by 2008 and it suggested that the trend was in the prime for reversal.

**Graph 9: Technical pattern analysis: Falling wedge formation**  
(USD/MKD daily spot rates 01/01/2001 - 30/06/2008)



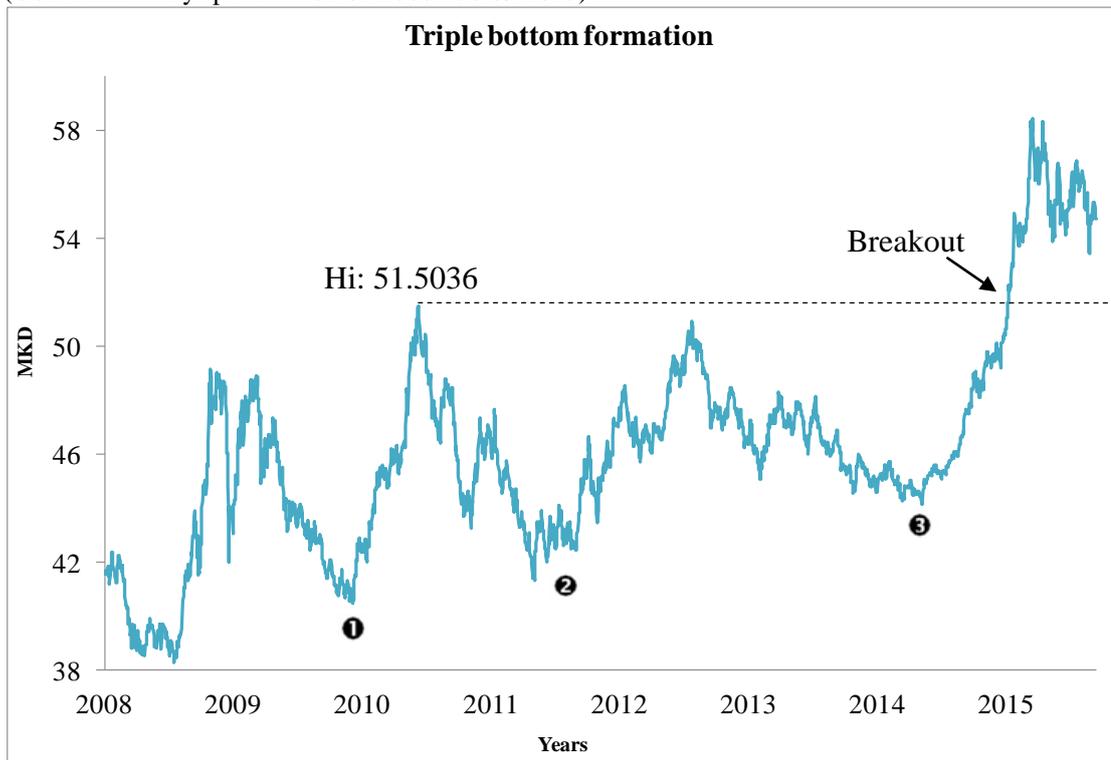
Source: National Bank of Republic of Macedonia, author's computation

#### 4.1.3 Triple bottom formation

Same as the falling wedge, the triple bottom pattern predicts the reversal of a prolonged down trend. The pattern is identified when the price creates three bottoms at nearly the same price level. Once the first bottom is created, the price changes the direction and begins to follow an uptrend. After reaching a peak, it contracts back to a similar level that acts as support. At this point the market buyers enter again and push the price higher through the increased demand for the asset. This creates the second bottom. The process is repeated one more time before the price breaks and the pattern is completed. This pattern is quite rare, but also a very reliable indication that a downward trend has been surely reversed (Bulkowski, 2013, pg. 765-768).

A triple bottom formation is visible for the period following the 2008 crisis recovery. The pattern formation illustrates that the Macedonian denar was being traded in a downtrend and it fell through a level of support three times, each time going back to the previous level of resistance. Following the third attempt to push the price lower, the triple bottom pattern was completed when the rate broke the resistance level of 51.5036 MKD per US dollar and began trading in an upward trend.

**Graph 10: Technical pattern analysis: Triple bottom formation**  
(USD/MKD daily spot rates 01/01/2008 - 30/09/2015)

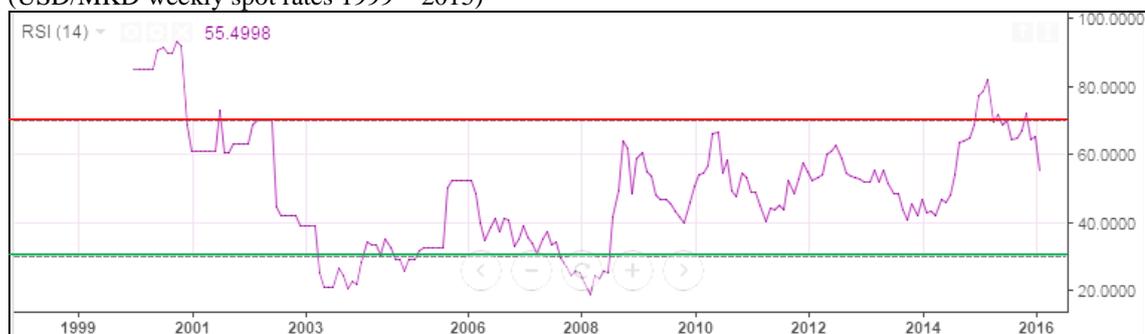


Source: National Bank of Republic of Macedonia, author's computation

#### 4.1.4 Relative strength index (RSI)

This technical indicator was used to demonstrate the positions in time when the dollar was overbought or oversold in terms of the denar. Measuring on a scale from zero to one hundred, the rate of the dollar was recorded over a period of sixteen years. Every time the rate approached the 70 level the dollar was overbought and therefore overvalued. Every time the dollar approached the 30 level it was due to the fact that it was being oversold and becoming undervalued.

**Graph 11: Technical indicator: Relative strength index**  
(USD/MKD weekly spot rates 1999 – 2015)



Source: Investing.com - Stock Market Quotes & Financial News, 2015

As anticipated, the dollar was mostly oversold during the financial crisis of 2007-08 and overbought only as of 2015.

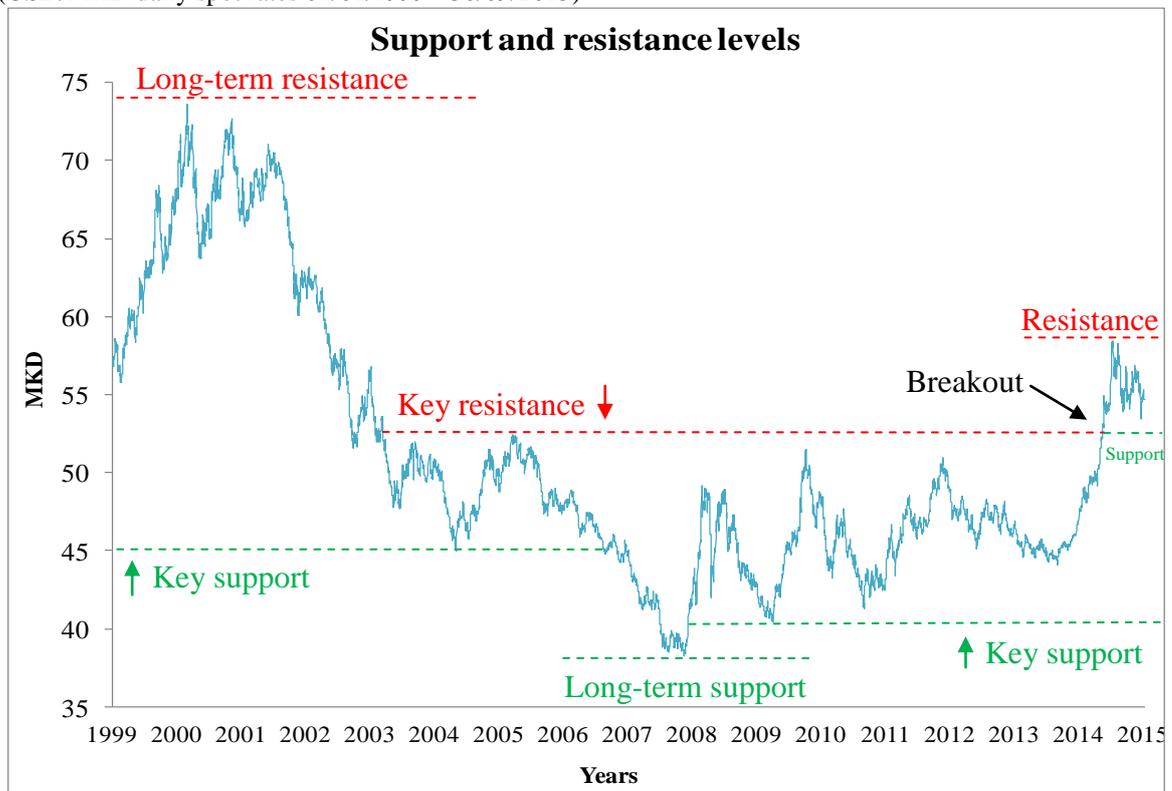
#### 4.1.5 Support and resistance

The support and resistance levels are very important in determining supply and demand as well as market psychology. Support level represents the level below which a price is less likely to continue to fall. In the foreign exchange market it is also referred to as *floor*. Resistance level represents the level above which a price is less likely to surpass and is commonly referred to as *ceiling*. The support and resistance restrict the movement of the price as it touches the given levels multiple times without breaking through. When trend lines are broken the supply and demand that are driving the rates' movements are shifted and new levels are established (Bulkowski, 2014, pg. 34-36).

The table below illustrates the levels of support and resistance in the example of Macedonian denar against the US dollar.

**Graph 12: Technical indicator: Support and resistance levels**

(USD/MKD daily spot rates 01/01/1999 - 30/09/2015)



Source: National Bank of Republic of Macedonia, author's computation

The long-term resistance identifies the level which the Macedonian denar did not surpass in the course of its overall existence. After reaching a peak of 73.6304 Macedonian denars per one US dollar in October of 2000, the overwhelming selling pressure stopped and the exchange rate did not reach this level ever again. The key resistance demonstrates the level where the exchange rate bounced back downwards for the longest period. Starting from early 2003 and up until the end of 2014, the denar appreciated and depreciated against the US dollar in numerous occasions but the strong resistance level of 52.4272 denars per dollar that was established in November 2005 was not broken for eleven continuous years. After the breakout, new levels of support and resistance were established.

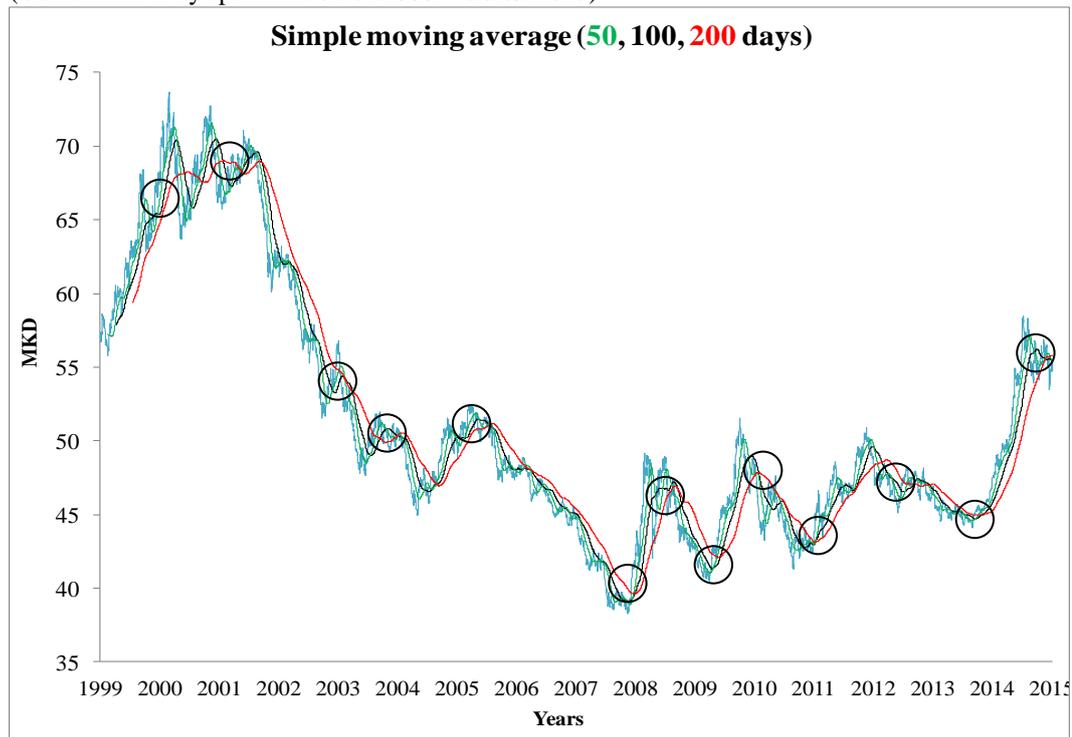
The same can be observed for the long-term support. After reaching an all-time low during the financial crisis in July 2008 at MKD 38.26 per one US dollar, the overwhelming buying demand stopped and the rate never went below this support line. Two levels of key support were identified, each lasting for seven years. The first key support is visible in the period from 1999 to late 2006. The second key support is visible in the period from 2008 to 2015. During these independent time periods, the denar appreciated and depreciated against the US dollar in numerous occasions but the strong support levels of MKD 44.9786 in December 2004 and MKD 40.4591 in December 2009 kept the denar in this range for the longest period of time. A new support line was established after the breakout.

#### **4.1.6 Simple moving average (SMA)**

As a common trend-following technical indicator, the simple moving average was used in order to filter out the noise from random rate fluctuations. Another reason why moving averages are widely used is because they determine the strength and direction of a rates' movement. By placing three moving averages onto a graph and observing how they behave in relation to the other, it is possible to establish levels of support and resistance and predict price movements. Breaks above and below the moving averages represent important trading signals. Additionally, every time the averages cross over, they signal the beginning of a new trend (Lim, 2016, pg. 440).

By adding the closing exchange rate of the Macedonian denar against the US dollar for a period of 50, 100 and 200 days and then dividing the total to the number of periods, three simple moving averages were identified.

**Graph 13: Technical indicator: Simple moving average**  
(USD/MKD daily spot rates 01/01/1999 – 30/09/2015)



Source: National Bank of Republic of Macedonia, author's computation

The points in time where the averages crossed over are identified as the beginning of a new trend.

## 4.2 Fundamental analysis

Unlike the technical analysis that was focused on past price and volume movements of the Macedonian denar, this part of the thesis will focus on fundamental analysis which looks below the surface of the foreign exchange movements. For that reason, macroeconomic factors as well as country-specific factors will be taken into consideration during this evaluation. The analysis will look at quantitative factors that can be measured or expressed in numerical terms in addition to qualitative factors that hold non-numerical characteristics (McClure, 2016).

### 4.2.1 Events and factors that influenced the denar movement

To begin with, it is worth noting that being independent from the Yugoslav dinar, the new Macedonian denar was more vulnerable in the first years of its existence. As a new currency, there was also not a lot of confidence in the denar. During 1994, two years after the establishment of the Macedonian denar, the Greek politics towards Macedonia became

stronger and more aggressive due to the discontent over Macedonia's name. The Greek foreign minister, Mr. Papoulias informed the United Nations that the Greek government will no longer tolerate the Macedonian propaganda and spreading disinformation of a "historically non-existent country" (Shea, 1997, pg. 278). In February 1994 Greece blocked the petrol supply through the port of Thessaloniki. Macedonia lacked alternative transit routes and it was very dependent on this port. Being cut off from the much needed oil supplies caused a political destabilization and an economic disaster in Macedonia (Ackermann, 2000, pg. 74).

The Greek embargo, combined with the ongoing sanctions against Yugoslavia imposed by the United Nations created constant economic losses. These events triggered an extremely large inflow of short-term capital in the country so as a result there was higher supply than demand for foreign exchange. Throughout the year there was a fundamental imbalance of the inflow and outflow movements of foreign exchange and the permanently higher supply had an impact on the Macedonian denar. In 1994, the denar appreciated in real terms by 19.7% compared to the weighted average value of the US dollar and the German mark. The increased foreign supply created large trade deficit and the National Bank had to repurchase the surplus foreign exchange (National Bank of Macedonia, 1995, pg. 84).

In May 1995, Macedonia negotiated a Stand-by Agreement with the IMF (International Monetary Fund, 1995). From then on, all economic performance was monitored and this pushed institutions to be more disciplined in the implementation of the economic restructuring program. The international institutions such as IMF and the World Bank helped Macedonia to achieve a complete macroeconomic stability and solve the problem of the deficit in the balance of payments. It also replaced the inherited external debt from Yugoslavia (that came matured and with high interests) with new credits that bare no interests and were to be repaid in 35 years (Trpeski, 2002).

In the same year Greece agreed to lift the embargo after an agreement was reached that Macedonia will change its national flag since it contained the Greek Vergina sun (United Nations, 1995, nr. 32193). The lift of the embargo was very important for Macedonia's landlocked economy. The improved political relations, combined with appropriately restrained monetary, fiscal, and incomes policies brought significant result in the area of financial stability. For the first time since its monetary independence

Macedonia achieved to reduce the inflation rate to a one-digit number on an average of 0.7% on a monthly level. The appreciation of the denar was stabilized and there was an increase of only 3% compared to the weighted average value of the US dollar and the German mark (National Bank of Macedonia, 1996, pg. 65).

By 1996 Macedonia had finally recovered from the several years of recession. This was visible through the low inflation rate that was decreased down to the level of the developed industrial countries. The Macedonian denar was highly stable against the German mark and this price stability was a positive sign towards economic growth. The denar depreciated against both, the German mark and the US dollar.

The monetary targeting strategy from previous years was replaced with a denar exchange rate targeting. As a main target of the monetary policy, the denar exchange rate stability was directly achieved through a change in the money supply. This in turn led to price stability. The strategy was implemented due to the fact that as a small economy, Macedonia was heavily dependent on the exchange rate as it posed hard budget constraints for formation of other prices in the economy such as wages and domestic products (National Bank of Macedonia, 1997, pg. 14-16).

In 1998 another war escalated on Balkan territory. The Kosovo war was fought between the Albanian group Kosovo Liberation Army (KLA) with the support of the North Atlantic Treaty Organization (NATO) and the forces of the Federal Republic of Yugoslavia at that time consisting of Serbia and Montenegro. As with the ethnic wars in Slovenia, Croatia and Bosnia, this armed conflict was also somewhat anticipated. The problems began after Kosovo's status as an autonomous province of Serbia was revoked and Kosovo held referendum that declared the territory as an independent country. Serbia's ongoing ethnic repression towards the Albanians that started since the 1990<sup>s</sup> could no longer be tolerated in Kosovo. In 1997, the KLA started attacks on Yugoslav authorities in Kosovo and by 1998 it erupted into a full-scale war (Pavković, 2000, pg. 186-191).

Despite the ongoing conflict in a neighboring country, Macedonia marked a third consecutive year of macroeconomic stability. It maintained a low inflation level of 0.8% annually which was the lowest rate achieved since the monetary independence of Macedonia. However, other problems persevered such as high unemployment, trade deficit and slow restructuring of the economy. The unemployment rate in 1998 was 34.5% which was the highest rate recorded in Europe. The GDP growth was slowed down due to the

crisis in Kosovo and Yugoslavia since these economic partners of Macedonia were now in a state of recession. Internally, there was lack of financial discipline which stalled the economic growth.

Furthermore, the inflation rate was now lower than what was projected and Macedonia started to enter into a deflation zone. Main reason for this was the sharp decline in the prices of agricultural products of more than 25% since they could not be sold anymore on Yugoslavian and European markets. The year also recorded increase of imports and decrease of exports due to speculations of denar devaluation, unfavorable prices of raw materials as well as the overall worsened situation in the Balkan region. The trade agreement signed with the former Yugoslav countries started to have a contra-productive effect on the Macedonian foreign trade.

The interest rates of deposit money banks remained high and at an economically unacceptable level. They had significant influence on the economic growth rate and over investment activity in the country. The weighted average of lending rates was 21% which proved the inefficiency of the banking system (Trpeski, 1999 pg. 1-3).

As of June 1998, and under the obligations of Article VIII of the International Monetary Fund, the denar's convertibility for foreign current payments was officially confirmed in Macedonia. Macedonia now had an obligation not to impose any restrictions on the foreign current payments (International Monetary Fund, 2006, pg. 3-13). For the companies doing business in Macedonia it meant they now had the option for free payments and transfers of the current liabilities in foreign currency. The acceptance of these obligations also signified that Macedonia is implementing a consistent economic policy. This improved the conditions for foreign direct investment since part of the foreign profit could be transferred without being taxed.

The fluctuations of the exchange rate were due to government elections during the year and the relaxation of the fiscal policy before the elections took place. The demand for foreign currency increased and it consequently led to a depreciation of the denar of 8% against the German mark (National Bank of Macedonia, 1999 pg. 45-50).

By 1999 the crisis in Kosovo had escalated further and it caused an external shock to the Macedonian economy both in terms of supply and demand. Macedonia could no longer do business with its second most important trading partner and a major market for Macedonian products was lost. Macedonian exports to West European countries were also

hindered since the most convenient transport through Yugoslavia was closed. The end of the conflict led to re-establishment of the transportation corridor through Yugoslavia and consequently increased exports towards the Yugoslav market. The political risk weakened and there was again access to foreign markets. The negative effects had only short-term influence over the Macedonian economy. There was positive economic growth of 2.7% real GDP and considering the circumstances on the region, that was a good outcome for the year (National Bank of Macedonia, 2000 pg. 11-12).

The conflict also brought large numbers of refugees to Macedonia that started to exceed 10% of the total Macedonian population. This put additional stress to the government that had to finance their stay from budget funds. The additional expenditures were financed through borrowing from abroad as well as from donations

Interest rates remained high and did not take into account the fluctuations of economic movements in Macedonia. They were set up based on market principles but also based on other fundamental factors such as low domestic savings. The average lending rate in 1999 was 20.5% per year and it kept acting as a barrier to the expansion of economic activity. Due to the crisis, there was large outflow of funds and banks found it hard to collect their claims. There was increased demand for deposits on auctions which only led to another increase of the interest rate. In May 1999, it reached the highest level of 29.9%.

The crisis led to a contraction of the foreign trade and this was visible through the decrease of supply and increase of demand for foreign exchange. The denar exchange rate against the German mark reached fluctuated between 31.1 and 32.75 denars per mark. At the end of year 1999, the exchange rate was 31.55 denars per one German mark which signified a 0.5% appreciation (National Bank of Macedonia, 2000 pg. 42-53).

On January 1<sup>st</sup> 1999, the new currency of the European Union, the euro was introduced for administrative use. The implementation was done through irrevocable or fixed rates of conversion between the euro and the national currencies of EU countries. The exchange rate for the German mark was set up to 1.95583 marks for one euro (Deutsche Bundesbank, 1999, pg. 20). Since the Macedonian denar was being maintained against the German mark, the exchange rate against the euro during the first year equaled 60.62 denars for one euro. During 1999, the US dollar was getting stronger towards the German mark and as a result, the Macedonian denar depreciated by 16.4% against the US dollar (National Bank of Macedonia, 2000 pg. 54).

In April, 2000 the Turnover Tax was replaced by the Value Added Tax (VAT) which had positive effect on the demand and supply of goods and services (Public Revenue Office, Republic of Macedonia). The GDP growth reached 5.1% which was the highest growth recorded since Macedonia became independent. The inflation rate was slightly higher as compared to previous years due to the introduction of VAT, the world prices of crude oil as well as the appreciation of US dollar that was influencing the prices of imports (National Bank of Macedonia, 2001 pg. 10-14).

Despite the fact that the demand for liquid money was lower and the banking system became more liquid, the decrease of the interest rates was still not significant and once more confirmed the inflexibility of the banks. They were not responding to market movements and kept the weighted lending rate at a high level of 18.9%. The end of the crisis in Kosovo signified a re-open of the Yugoslav market and renewal of the transportation links to EU countries. The export contracts with the European Union and United States were also renewed and Macedonian products increased their competitiveness. As a result, the exports marked an increase of 28.3% (National Bank of Macedonia, 2001 pg. 42-53).

The supply of foreign exchange surpassed the demand and as a result, the National Bank had to re-purchase \$190 million of foreign exchange. Prior to the introduction of VAT, there was an increased import of goods and consequently a higher demand for foreign currency. The bank had to intervene through the sale of \$9 million. The average exchange rate against the German mark increased and reached 32.10 denars to one German mark.

Since the rates of conversion between the euro and the German mark were fixed, the denar also remained unchanged to the euro and was equal to 60.79 per euro. In the period that followed, there was an inflow of foreign exchange coming from increased exports, foreign creditors, loans and funds from the privatization. This led to a higher supply than demand and in order to stop the denar from appreciating the National Bank repurchased foreign exchange worth \$187 million (National Bank of Macedonia, 2001 pg. 57-60).

Despite being the poorest among the ex-Yugoslav countries, it was visible that various interventions taken by the government of Macedonia have helped improve the

economic situation in the country significantly. Until 2001, Macedonia had experienced a steady but valuable growth with a continuous GDP increase.

Even though Macedonia was the only country that claimed independence from Yugoslavia in a peaceful and non-violent way, the beginning of February 2001 marked yet another year of armed conflict, but this time on Macedonian territory. The ethnic Albanian National Liberation Army attacked the security forces of Macedonia with the goal to separate the country and create a "Great Albania". Resulting from the Kosovo crisis in 1999, over 200,000 Albanian refugees found shelter in Macedonia and at one point they accounted for more than 10% of the total population (Phillips, 2004, pg.74). With the increased Albanian population in the country, this largest ethnic minority had rebelled against what they considered to be a repression of the Macedonian government and demanded greater political rights. This conflict persisted throughout the whole year and did not spare the Macedonian economy.

The preceding five years of continuous economic growth have been abruptly broken and 2001 marked a real GDP decline of 4.1% (National Bank of Macedonia, 2002, pg. 10). The average inflation for the year reached 5.5% which was not a drastic change if compared to the previous year (5.8%). The conflict also resulted into the cancellation of many trade contracts with foreign partners and the overall trade decreased by 16.5. Exports decreased by 12.4% and imports by 19% when compared to previous year (Trpeski, 2002, pg. 2-3).

In conditions where the safety of the Macedonian citizens was jeopardized, the National Bank had to maintain the monetary policy in an extremely difficult and tense situation. The psychological factors during the crisis led to a high level of currency in circulation as citizens started to withdraw their deposits from the banks and increased the demand for foreign currency. These factors also put pressure for depreciation of the denar. Together with the increased budget expenditures for security needs, the bank had the difficult task to monitor the day to day movements of the economy and attempt to implement the appropriate monetary instruments.

The National Bank intervened in two ways. Once on the demand side by doubling interest rate to raise the attractiveness of the Central bank bills and hence decreasing the denar liquidity, and once on the supply side by selling foreign currency. At its lowest, the denar exchange rate against the German mark reached 29 denars while the exchange rate

against the euro remained the same and in December 2001 it was 61 denars per euro. On the other hand, the exchange rate against the US dollar equaled 68.2 denars per US dollar which signified 5.9% depreciation against the US dollar (National Bank of Macedonia, 2002, pg. 60-61).

As the tensions decreased, the National Bank began repurchasing foreign currency again. The interest rates were slowly reduced from 20% in June to 13% at the end of February the following year in an attempt to help the economic activity in the country. The Macedonian Telecom was privatized and this brought the highest recorded inflow of foreign investments in the amount of \$442 million. The foreign currency deposits also increased due to the conversion of the currencies of the twelve member states of the European Monetary Union into the euro (Trpeski, 2002, pg. 2-3). It could be concluded that despite the circumstances and the increased budget spending, the National Bank managed to maintain the microeconomic stability in 2001 and to neutralize the destabilizing effects of the insurgency.

The year 2002 marked the 10<sup>th</sup> anniversary of the monetary independence of Macedonia including the existence of the national currency and the National Bank. In January 2002, the “Law of the National Bank of Macedonia” came into force and put emphasis on the independence and sovereignty of the National Bank from the government. The bank’s operations were harmonized with the central banks of the European Union countries and the price stability of the Macedonian denar was now officially defined as a principle goal of the monetary policy (Official Gazette of the Republic of Macedonia, 2002, nr. 3, pg. 1).

As expected, the macroeconomic performance of the Macedonian economy was heavily influenced by the events that occurred in the preceding year. The crisis left consequences and it was evident that the economy would require a longer period of time in order to recover. The increase in GDP compared to the previous year was only 0.7% which was below the upward trend of growth registered in the several years before the events took place (National Bank of Macedonia, 2003, pg. 11-12).

Since the establishment of the Macedonian denar and until the end of 2001, the exchange rate was targeted against the German mark. As of 2002, and the actual introduction of the new European currency, the National Bank officially began maintaining the stability of the Macedonian denar against the euro. In times when the euro conversion

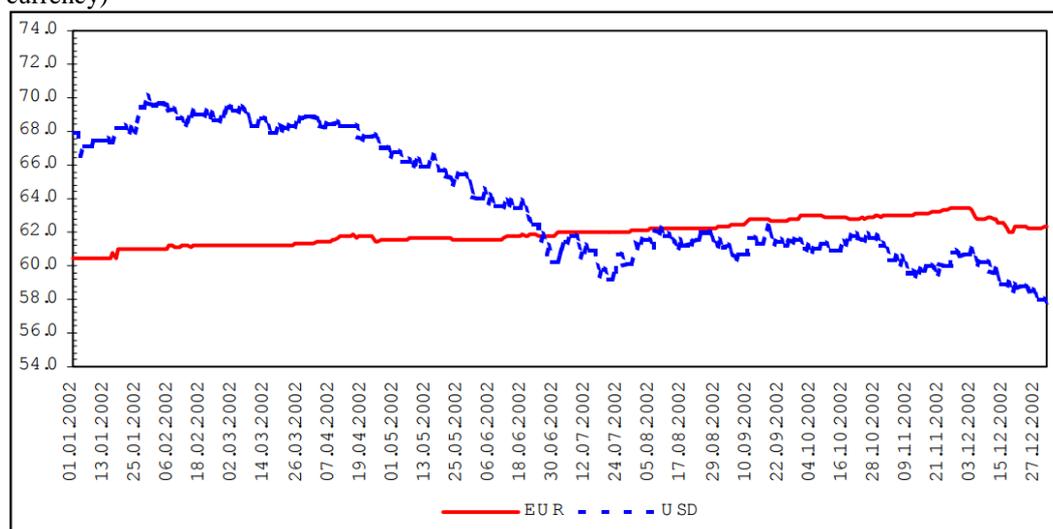
was an ongoing process and the economy was characterized with high liquidity, the National Bank managed to achieve its primary monetary objective - preserve the price stability. The stability was maintained by applying the same principles in the form of interventions on the foreign exchange market and implementation of corresponding monetary instruments

As the official trading in Euros began, the Macedonian denar was continuously depreciating. This movement of the exchange rate was anticipated due to the higher demand of Euros in 2002 and the conversion of the currencies of the EMU member states into euro cash. From the initial exchange rate of 61 denars per euro, the denar depreciated by 4.1% and by November it was traded at 63.5 EUR/MKD.

At the same time, the US dollar was performing poorly and lost its attractiveness on the foreign exchange market. This was evident from the increased conversion of the dollar into the stronger euro. Following the terrorist attack in September 2001, the US economy was struggling to recover and this caused continuous depreciation against the euro and consequently against the Macedonian denar. By the end of the year the exchange rate was 58.5979 MKD per USD and thus the denar experienced an appreciation of 15.3% against the dollar (National Bank of Macedonia, 2003, pg 65-67). The graph below demonstrates the annual movements of the denar against the US dollar and the official euro.

**Graph 14: Nominal denar exchange rate**

(Relative to the euro and the US dollar on the exchange offices market - denars per unit foreign currency)



Source: National Bank of Republic of Macedonia, 2003

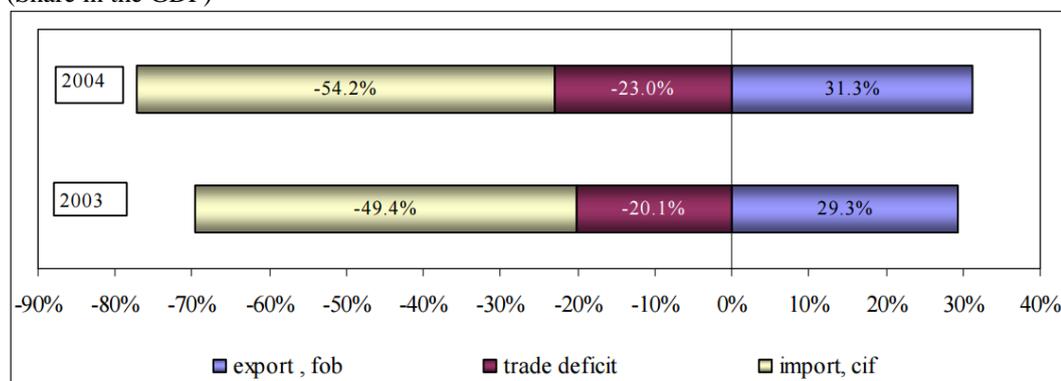
In October 2002, the General Council of the World Trade Organization signed the protocol for accession of Macedonia and with this action it formally completed the negotiation process that started in 1994. Half a year later, in April 2003, Macedonia became the 146<sup>th</sup> member of the World Trade Organization. This was a significant step for Macedonia's foreign trade relations and it further opened the Macedonian market towards international commodity trade (World Trade Organization, 2003).

In 2003 the economy had stabilized and this allowed the National Bank to relax its monetary policy through the lowering of interest rates from 15.2% to 6.2% at the end of the year. This year was also important for the Macedonian economy in terms of domestic production. For the first time since 1996, the industrial output had increased by 4.7% and it was considered to be one of the most successful years for Macedonian economy (National Bank of Macedonia, 2004, pg. 3, 16).

In March 2004 Macedonia applied for EU membership and the following month the "Stabilization and Association Agreement" came into force. The agreement was adapted to the specific situation in Macedonia and it created a free trade area between the European Union and Macedonia (European Commission, 2004). This year recorded a significant increase of the trade deficit as a result of several factors: joining the World Trade Organization and liberalization of foreign trade; signing the Stabilization and Association Agreement and establishing a free trade area with the European Union; rise in world oil prices and the restoration of one of the main metallurgical plants in the country (National Bank of Macedonia, 2005, pg. 70). The graph illustrates the changes in trade shares as part of GDP for years 2003 and 2004 influenced by the stated events.

**Graph 15: Export, import and trade deficit**

(Share in the GDP)



**Source: State Statistical Office of the Republic of Macedonia; the calculations are made in the National Bank of Macedonia**

The increase in oil prices had a specifically strong impact on the import volumes especially since Macedonia is dependent on the import of oil. It accordingly led to a much higher outflow of foreign currency from the economy.

Throughout 2005 and 2006 the Macedonian economy marked a subtle but stable GDP growth rate which generated positive expectations for the future economic performance. Despite the optimistic outlook for the future, Macedonia and the rest of the world could not have been prepared enough for what was coming. By 2006 the United States housing bubble was gradually progressing and increased the price of a typical American property by 124% (The Economist, 2007). Many homeowners were forced to refinance their homes at lower interest rates and in just seven years banks doubled the amount of money and debt in the economy. As these debts became un-payable a financial crisis began to unravel.

The global financial crisis of 2007-08 threatened the collapse of large financial institutions and also brought about significant halt in markets worldwide. Macedonia, although not in the centre of the crisis, experienced the value of the denar strengthen relative to the US dollar. In fact, by mid-July 2008 the USD/MKD exchange rate fell to a record low of 38.26 denars per one US dollar. The exchange rate in 2008 registered a substantial annual appreciation of 6.4 % and the dollar was being traded at an average of 41.8646 Macedonian denars. As expected, the terms of trade worsened and the trade deficit for the year reached 30% share of GDP - the highest ever recorded. This signified a decrease in the role of the export sector as a key growth generator for the Macedonian economy (National Bank of Macedonia, 2009, pg. 47).

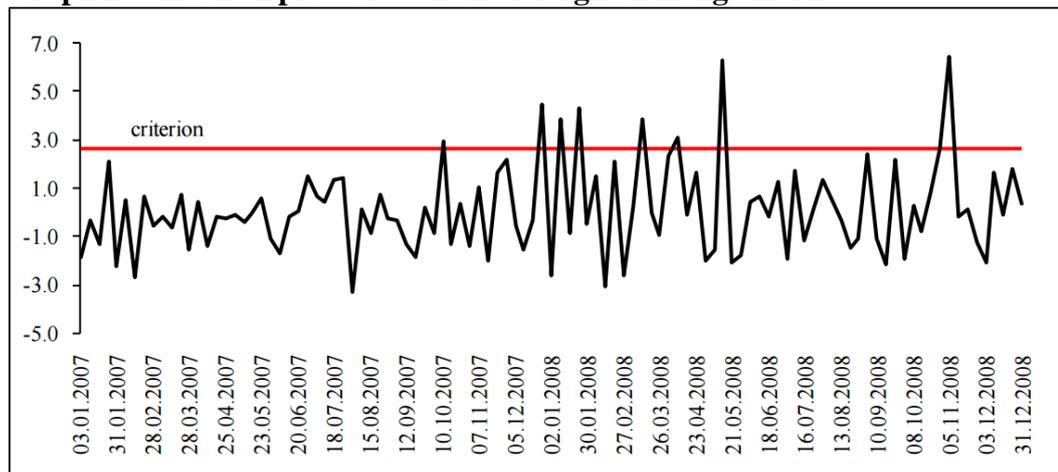
In the three month time period from September to November 2008 a positive change was recorded in terms of purchases on the currency exchange market. By November the same year, the exchange rate has bounced back to 49.0323 MKD per USD. However, the psychological pressure from the crisis was persistent and ultimately stirred the demand for foreign exchange. A further drop occurred in December 2008 and set the rate to 41.9972 MKD per US dollar.

Although it was caught by the crisis in a relatively stable condition, the influence of international events related to the crisis demonstrated very clearly that the Macedonian economy is not immune to internal and external factors. Macedonia was indirectly vulnerable to the crisis due to the economic movements that took place in its main trading

partners such as the European Union as well as the neighboring countries. The strong decline of export demands as well as the increased tendencies of the citizens for accumulation of foreign currency created intense pressure for depreciation of the denar.

To demonstrate this, the index of pressures on the foreign exchange market in 2007-08 is displayed. The index surpassed the critical threshold several times with the majority of signals arising from the pressures for depreciation of the Macedonian denar and two of them arising as a result of the change in the interest rate policy of the National Bank to 7%. The table below illustrates the critical value of 2.66 with the clarification that values above the criterion represent pressure on the foreign exchange market.

**Graph 16: Index of pressures on the foreign exchange market**



Source: National Bank of the Republic of Macedonia, 2009

In the year that followed Macedonia noticed the first signs of overcoming the strong global recession. The pressures of the foreign exchange market were weakened in the beginning of 2009 as the National Bank introduced several monetary measures in order to minimize the risks of the crisis. The bank intervened with significant sales of foreign currency and further increasing of the interest rate from 7% to 9% (Mahmutefendic, 2014, pg. 128). The results of the taken measures were already visible in March 2009 as there was a decreased tendency for accumulation of foreign currency both among banks and among households.

The positive outcome could be also attributed to the Economic Stimulus Plan that the US president Barack Obama signed in January 2009 which was a \$787 billion package for boosting the economic growth in the United States (Teslik, 2009). During 2009, the

National Bank of Macedonia continuously intervened with the net purchase of foreign currency assets.

The turbulent developments on the international financial markets kept changing the fluctuations of almost all currencies. A further trading signal is visible in the second quarter of 2009. The denar started appreciating again against the US dollar and this could be attributed to the measure announced by the Federal Reserve System in March 2009 to purchase state securities. The measure influenced the rate of yield of the US government securities and this in turn started to reduce the foreign currency inflow by foreign investors (Federal Reserve System, 2009). In general, Macedonia experienced a slowing down of its economic growth in 2009 which can be explained by the continuous draining effects from the fiscal and monetary stimuli that were taken in response to the crisis.

As the United States began to recover in 2010, the effects were also felt internationally. The US Federal Reserve implemented aggressive monetary policy measures whereby it reduced the key interest rate from 5.25 % to a historically low 0.25% in an effort to fight off the recession (Federal Reserve System, 2008). As the US dollar began to appreciate, the foreign demand for Macedonian products began to increase and it reached an average growth of 0.4 % in 2010. The exchange rate slowly climbed up and it ultimately reached 51.5036 MKD per USD as of June 2010. This depreciation of the denar was a result of the increased exports on the global trade level. The growth of value added in trade in 2010 was 4.8% and it was one among the main reasons of growth of the total output (National Bank of Macedonia, 2011, pg. 13, 25). As a response to the improved condition of the economy, the National Bank relaxed the monetary policy and gradually reduced the interest rate from 8% in the beginning of the year to a 4.11 % by December the same year.

It is visible from the further appreciation in May 2011 that the exchange rate with the US dollar remained under the influence of various perceptions on the foreign exchange markets. The US dollar depreciation had not been uniform against all currencies though; the different amount of depreciation may be attributed to the countries' willingness to let their currencies float freely against the dollar as was the case with Macedonia. The weakening of the US dollar against the denar could be a result of the slow economic recovery and a rising public debt in the United States. The rising US debt created political disagreements regarding the raising of the ceiling on federal debt and these uncertainties

were reflected on the foreign exchange market. Another explanation for this trend might be the low interest rate that weakened the dollar by reducing its attractiveness. This growing interest rate differential in favor of the Macedonian denar attracted foreign capital inflows from abroad and strengthened the denar against the US dollar.

In 2012, the United States tightened its oil sanctions on Iran which were aimed at reducing the volume of oil and oil products purchased from Iran. The sanctions that were originally imposed with the intention to get Iran to give up its nuclear program, were now essentially forcing countries to choose between doing business with Iran or with the United States (Hargreaves, 2012). Fears regarding international supply disruptions led to the increase in world prices of crude oil that reached a peak in March 2012 at \$125 per barrel for Brent and \$110 per barrel for WTI (U.S. Energy Information Administration, 2012). The US dollar, as the world's main reserve currency is closely linked to oil and any fluctuations in the price of oil are therefore reflected in the exchange rate. As prices of oil went up, a depreciation of the US dollar can be observed in the early 2012.

Not long after, concerns about lower oil demand decreased the prices by almost 30% by the end of June and this led to a much stronger dollar (U.S. Energy Information Administration, 2012). By end of July, the Macedonian denar was trading at 50.9173 which demonstrates a recovery of the exchange rate to the same level as two years earlier.

In 2013, Macedonian economy had recovered significantly and the National Bank was able to reduce the interest rate twice (once in January and once in July) to a 3.25% which is the lowest historical level. Macedonia also registered a real GDP growth of 3.1% that was mainly driven by net exports (National Bank of Macedonia, 2014, pg. 4). The average inflation rate for the year was 2.8% which was in line with the expectations and within an acceptable range.

In the first half of 2014, while Macedonia was occupied with a double national election for president and parliament and increasing its budget expenditures, the US economy made a strong return and created 288,000 new jobs in April - the highest monthly job creation since 2012. The unemployment rate decreased to 6.3% which was the lowest recorded since September 2008 (Sharf, 2014). In Europe the European Central Bank relaxed the monetary policy by decreasing the key interest rate and in United States the Federal Reserve stopped the quantitative easing. With this, the largest financial stimulus program in the history of the United States was brought to an end. The faster recovery of

the US versus the European economy played a significant role on the foreign exchange market. In this economic environment, the US dollar began to regain its strength again. It soon appreciated against the majority of leading world currencies.

With the gradually depreciating denar, Macedonia recorded a GDP growth of 3.8% which can be attributed to new export-oriented facilities that stimulated the production. These structural changes in the economy were the main factor for the increased export in 2014. The government invested in public infrastructure and this had additional positive effect on growth (National Bank of Macedonia, 2015, pg. 19-20). This trend continued also in 2015, as it can be observed by the steadily depreciating exchange rate in terms of the US dollar. At the end of September 2015 the Macedonian denar was being traded at an average of 54.9161 MKD per USD.

#### **4.2.2 The Macedonian denar compared to Balkan currencies**

The second partial goal of this thesis is comparing the exchange rate similarities and consequently dissimilarities between the Macedonian denar and the neighboring currencies from the Balkan region. Coming from the same geographical area and having experienced similar historical and cultural development, it is worth taking a look at the countries that are most closely related to Macedonia. Comparing the currency value of the Macedonian denar with the currencies of its neighboring countries can serve as an indicator of whose economy is doing better and which one is more developed. The question whether a strong currency is good for a country or not is a very common one. Although it can be assumed that a strong currency is always desirable, this assumption is too simple as there are several things to be taken into consideration before reaching the final conclusion.

The first comparison is between the Macedonian denar and the Croatian kuna (HRK). The Macedonian denar has been traded at an almost constant exchange rate ranging between 7.5 and 9 Macedonian denars per one Croatian kuna for a period of ten years. A minimum was documented in March 2006 of 7.7705 MKD/HRK while in September 2008 a record high of 8.9035 MKD/HRK was achieved.

The graph suggests that the Croatian kuna is relatively stronger in terms of the Macedonian denar. Same as Macedonia, Croatia also went through a process of transition to a market-based economy after the collapse of socialism and the fall of Yugoslavia.

**Graph 17: MKD per 1 HRK**  
(Daily spot rates 14/02/2006 - 11/02/2016)



Source: xe.com, The world's Trusted Currency Authority, 2016

However unlike Macedonia, Croatia's economy suffered badly during the Yugoslav wars from 1991-95. Despite this obstacle, in the years before the global financial crisis Croatia has experienced a steady economic growth of 4-5% annually, a rise in economic opportunities and a doubling of incomes (The World Bank, 2016). Trading at a current average of 7 HRK/EUR compared to the average of 60 MKD/EUR is a clear confirmation of the dominance of the Croatian kuna over the Macedonian denar. As of July 2013, Croatia is also part of the European Union which demonstrates that the Croatian economy has met the key criteria for EU accession, including trading at a competitive exchange rate to the European euro - something that is still out of reach for the Macedonian denar and the Macedonian economy.

The second comparison is between the Macedonian denar and the Serbian dinar (RSD). The graph illustrates the exchange rates for the period of ten years from 2006 to 2016.

### Graph 18: RSD per 1 MKD

(Daily spot rates 07/11/2006 - 11/02/2016)



Source: xe.com, The world's Trusted Currency Authority, 2016

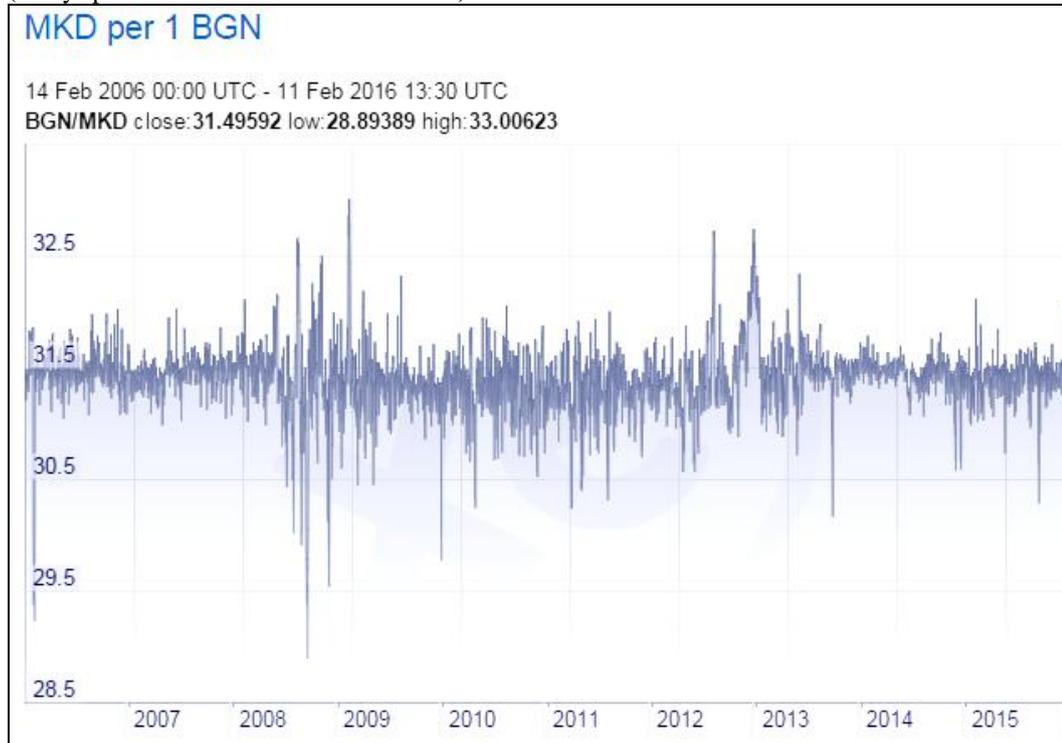
If analyzed historically, the Serbian dinar has been around for much longer than the Macedonian denar. It was first used in the mid 19<sup>th</sup> century whereas the third and final modern dinar was established in 2003 as a replacement to the Yugoslav dinar. Although at the beginning of the economic transition from a planned to a market economy Serbia's economy had an advantage over the rest of the countries, the economic sanctions from 1992-95 had a great impact on the economy and the dinar. As most countries, Serbia also struggled with the financial crisis. In 2012 Serbia entered into a "double dip" recession which even four years later restricts its economic growth (Labus, 2012, pg. 33).

The graph shows that unlike the Croatian kuna, the Serbian dinar is relatively weaker in terms of the Macedonian denar. In September 2008, corresponding to the global financial crisis, the Serbian dinar was traded at 1.19702 RSD/MKD. Since the recovery of the foreign exchange market, the rate has been steadily increasing to the current average of 2 RSD/MKD which indicates that the Macedonian denar is stronger and worth twice as much as the Serbian dinar.

The third comparison is between the Macedonian denar and the Bulgarian lev (BGN). The graph illustrates the exchange rates for the period of ten years from 2006 to 2016.

**Graph 19: MKD per 1 BGN**

(Daily spot rates 14/02/2006 - 11/02/2016)



Source: xe.com, The world's Trusted Currency Authority, 2016

Compared to the Croatian kuna and the Serbian dinar, the Bulgarian lev has a considerably higher superiority towards the Macedonian denar. Similarly to the denar, the Bulgarian lev was also pegged to the German mark at par from the start. Since the mark was replaced by the euro, the peg switched to the euro and it kept the precisely equivalent exchange rate used for the German mark, or 1.95583 leva per one euro. Since Bulgaria is committed to adopting the euro and currently fulfills four out of the five euro convergence criteria it is very likely to be assumed that this exchange rate will stay until the eventual retirement of the lev (Szczepański, Marcin, 2015, pg. 6). This is the main reason why the Bulgarian lev is stable against the euro and at the same time stronger in terms of the denar. With an average exchange rate of 30 Macedonian denars per one Bulgarian lev, it is evident that the lev is headed in a different direction than the denar.

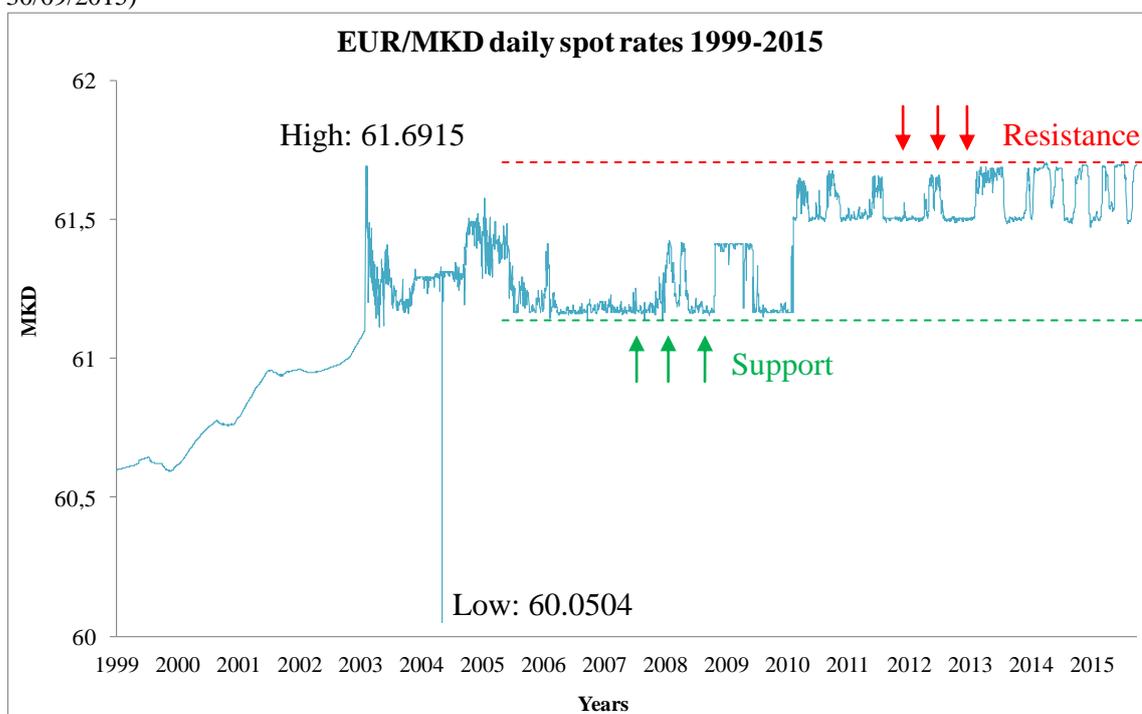
To complete the comparison, the Macedonian denar is assessed in terms of the leading currency in Europe - the euro. As mentioned before, since 1995 the National Bank

of Macedonia followed a monetary policy that targeted the exchange rate of the denar against the German mark. The policy was adjusted against the euro in 2002 and since then the bank's main objective is the preservation of the denar exchange rate stability against the European euro.

The graph demonstrates that the National Bank has maintained the exchange rate against the euro between the levels of minimum 60.0504 and a maximum 61.6915 MKD/EUR so the overall fluctuation of the rate during the years has not been a volatile change. Strong levels of support and resistance controlled by the National Bank serve as indicators of when to buy/sell foreign reserves in euros.

### Graph 20: MKD per 1 EUR

(Technical pattern analysis: Support and resistance levels for EUR/MKD daily spot rates 01/09/1999 - 30/09/2015)



Source: National Bank of Republic of Macedonia, author's computation

A high was reached in February 2003 of 61.6915 Macedonian denars per one euro due to the recent introduction of the official euro banknotes and the anticipated higher demand for euros. One of the most visible fluctuations in the exchange rate is in March 2004 when the rate dropped to 60.0504 MKD per one EUR and this can be contributed to the fact that Macedonia had submitted its official application for EU membership (European Commission, 2012).

The rate soon recovered from this event and as observed in the graph above, it travelled through strong levels of resistance and support for the period of ten years. Everytime the exchange rate would begin to depreciate and approach the level of resistance, the National Bank intervened through the purchase of euros and thus bringing the rate down. The opposite can be observed when the rate would begin to appreciate against the euro and approach the level of support. The National Bank was correcting the rate through the sale of euros and bringing the rate back up within the level of an average 61 MKD per one EUR. During the global financial crisis of 2008 the currencies of many countries appreciated under the volatile economic and market conditions. Macedonia however, maintained a reasonable level of macroeconomic stability even throughout the crisis as a result of the prudent monetary policy and pegging the denar to the euro.

This analysis also reveals that the Macedonian denar is undervalued in terms of the euro much more in comparison to the Croatian kuna and the Bulgarian lev. As expected, the comparison has demonstrated that the countries with stronger currencies (Croatia and Bulgaria) are generally doing better than Macedonia and are more developed in an economic sense. Correspondingly, Macedonia is displaying the same relationship towards Serbia, as the Macedonian denar is stronger than the Serbian dinar. Although larger in territory and population, the Serbian economy has had a historically lower growth rate when compared to Macedonia and a weaker currency compared to euro.

### **4.3 Linear regression analysis**

#### **4.3.1 Assumptions (hypotheses)**

Assumptions establish cause and effect relationships between variables based on the existence of known facts. They are also used in providing the basis for creating a “what if” scenarios that simulate different reality situations. However assumptions should not be accepted as reality without a careful and thorough examination. Critical thinking and objective examination is necessary in order to assess the legitimacy and validate the correctness of the statements.

There are numerous factors that determine the movement of exchange rates. As previously stated in the hypothesis, some of the main factors that have an influence over exchange rate movements are: Central Bank’s monetary policy (changes in key interest rate), inflation rate, international terms of trade (import and export volumes) and various

economic and political events. Like most aspects of economics, the relevance of these factors is a continuous debate. For the purposes of this thesis, the assumptions are as follows:

- ❖ A rise in the key interest rate will attract foreign capital and lead to an appreciation of the currency.
- ❖ The opposite relationship can be observed for decreasing interest rate; lower interest rate will tend to depreciate the currency.
- ❖ A country with a consistently lower inflation rate commonly experiences an appreciation of the currency (the purchasing power increases compared to other currencies).
- ❖ A country with a consistently higher inflation rate experiences an over-supply of its currency which in turn will lead to a depreciation of the currency (the purchasing power decreases compared to other currencies).
- ❖ A current account deficit signals that a country is using more cash on foreign trade than it is earning and this excess demand for foreign currency leads to a depreciation of the domestic currency.
- ❖ The opposite relationship can be observed for a current account surplus. The excess demand for domestic currency leads to an appreciation of the same currency.
- ❖ A country that is politically and economically stable tends to attract more foreign investment and hence appreciate the currency.

#### **4.3.2 Declaration of variables**

Based on the given assumptions, seven independent variables were selected. Considering the fact that a static model shows the system in a stage of equilibrium while a dynamic model accounts for time-dependent changes and better reflects the reality, a lagged dependent variable was included to dynamize the model and will be used as an explanatory variable.

The data set chosen for the regression analysis is a monthly time-series data for the period January 2002 - July 2015. The selected variables for the regression model are listed in Table 1.

**Table 1: Declaration of variables**

<b>Variable</b>	<b>Description</b>	<b>Unit</b>
<b>y<sub>1</sub></b>	USD/MKD average monthly spot rates, dependent	Nominal
<b>y<sub>2</sub></b>	USD/MKD average monthly spot rates, independent	Nominal
<b>x<sub>0</sub></b>	Constant, unit vector	/
<b>x<sub>1</sub></b>	MK Central Bank bills rate	%
<b>x<sub>2</sub></b>	U.S. Federal Funds effective rate	%
<b>x<sub>3</sub></b>	MK Chain Consumer Price Index by COICOP	%
<b>x<sub>4</sub></b>	U.S. Consumer Price Index - All Urban consumers	%
<b>x<sub>5</sub></b>	Macedonia trade balance with U.S.	In million USD
<b>x<sub>6</sub></b>	U.S. trade balance with Macedonia	In million USD
<b>x<sub>7</sub></b>	Financial crisis of 2007-08	1, 0

Source: Various sources, listed in chapter 7.4 Websites for historical data generation

where,

**y<sub>1t</sub>** is an endogenous (dependent variable) which will be explained with the use of exogenous variables.

**y<sub>2t</sub>** is a lagged endogenous variable in time which will be used to explain the values of **y<sub>1t</sub>**. It was used as an explanatory variable in the current period as a means of capturing the dynamic effects of the exchange rate movement in the previous period.

**x<sub>0</sub>** is a constant, unit vector.

**x<sub>1t</sub>, x<sub>2t</sub>, x<sub>3t</sub>, x<sub>4t</sub>, x<sub>5t</sub>, x<sub>6t</sub>** are exogenous variables in time (regressors), which will be used to explain the values of **y<sub>1t</sub>**

**x<sub>7t</sub>** is a dummy variable used to estimate shock. This variable was used as an explanatory variable in the current period in order to capture the shock that occurred in the exchange rate due to the financial crisis of 2007-08.

### **Function 1: Economic model**

$$y_1 = f(y_2; x_0; x_1; x_2; x_3; x_4; x_5; x_6; x_7)$$

### **Function 2: Econometric model**

$$y_{1t} = \beta_{12}y_{2t} + \gamma_0x_{0t} + \gamma_1x_{1t} + \gamma_2x_{2t} + \gamma_3x_{3t} + \gamma_4x_{4t} + \gamma_5x_{5t} + \gamma_6x_{6t} + \gamma_7x_{7t} + u_t$$

where,

$\beta$  is a parameter of the endogenous variable, represents the quantitative relationship between  $y_{1t}$  and  $y_{2t}$

$\gamma$  is a parameter of the exogenous variables, represents the quantitative relationship between  $y_{1t}$  and  $x_{it}$

$u_t$  is a stochastic variable (residual term), that includes all variations of  $y_{1t}$  which cannot be explained by the included exogenous variables such as various economic and political events.

### 4.3.3 Parameters' estimation

The majority of economic time-series such as the variables that were selected for the regression model are non-stationary in nature when they are expressed in their original units of measurement. Even if seasonally adjusted, they still tend to exhibit trends, cycles and other non-stationary behavior. It means that when time-series increases over time, the mean and variance of the data will also grow and therefore underestimate the mean and variance in future periods. Therefore, it is important to obtain a meaningful sample statistics and this is best done by stationarizing the observed data.

For the purposes of parameters' estimation the selected variables were mathematically transformed into a stationary time-series. Stationarity indicates that the statistical properties of the time-series such as correlation, mean and variance are constant over time. When the data is presented in this form, the model predicts that the statistical properties of the variables will be the same in the future as they have been in the past. The technique of differencing was used by computing the differences between consecutive observations (Hyndman, Athanasopoulos, 2014, pg. 213-215).

Changes in interest rates are known to have the biggest influence over the foreign exchange market. Being the worlds' main reserve currency, any changes in the US dollar and U.S. Federal Funds effective rate have a strong impact on market behavior. In order to capture the dynamic effects of the interest rate movement in previous periods, the variable  $x_2$  (U.S. Federal Funds effective rate) was lagged by three periods. Upon entering the selected variables and their monthly values into the Gretl software, the program minimized the sum of squares of residuals and the parameters of each variable were estimated (Koch, 2010, pg. 149-152).

**Table 2: Output from Ordinary Least Squares method (OLS)**

Model 1: OLS, using observations 2002:05-2015:07 (T = 159)				
Dependent variable: USD_MKD				
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>
const	3.84563	1.05959	3.6294	0.0004 ***
MK_interest_rates	-0.220683	0.153792	-1.4349	0.1534
US_interest_rates_3	0.22035	0.682048	0.3231	0.7471
MK_CPI	0.122576	0.119096	1.0292	0.3050
US_CPI	-0.333554	0.103266	-3.2301	0.0015 ***
MK_trade_balance	0.000570559	0.00847677	0.0673	0.9464
US_trade_balance	-0.0392472	0.0159733	-2.4571	0.0151 **
Financial_crisis	-0.148817	0.401814	-0.3704	0.7116
USD_MKD_1	0.918249	0.0208383	44.0654	<0.0001 ***
Mean dependent var	48.13610	S.D. dependent var	5.116427	
Sum squared resid	179.5734	S.E. of regression	1.094146	
R-squared	0.956584	Adjusted R-squared	0.954268	
F(8, 150)	413.1169	P-value(F)	4.45e-98	
Log-likelihood	-235.2848	Akaike criterion	488.5695	
Schwarz criterion	516.1897	Hannan-Quinn	499.7858	
rho	0.239842	Durbin's h	3.134427	

Source: Gretl software, author's computation

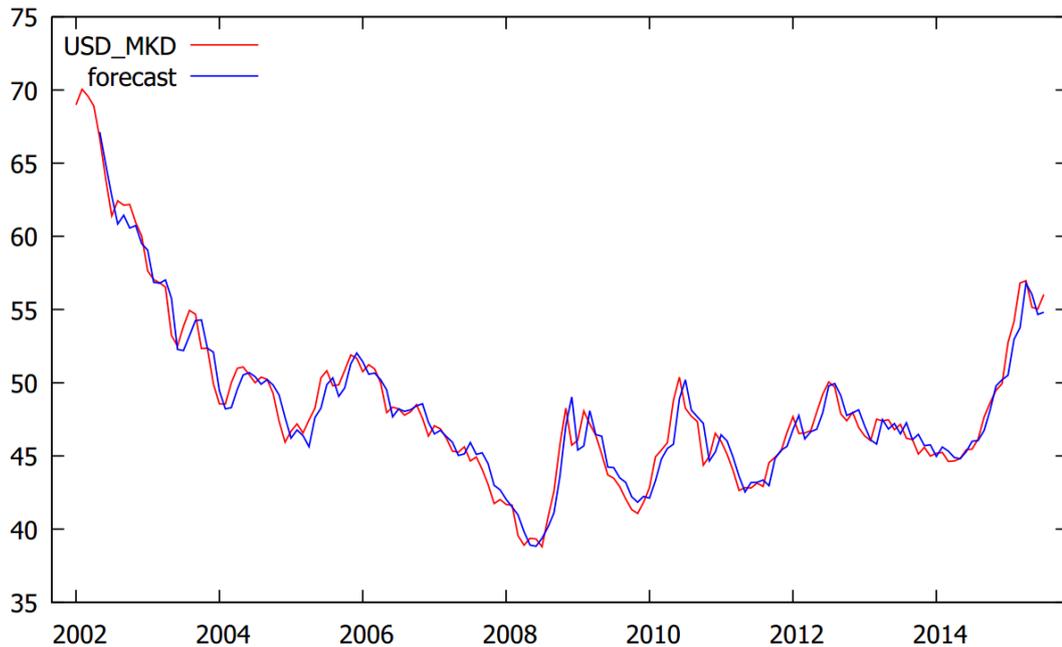
Based on the OLS output, the estimated econometric model for the linear regression model is:

**Function 3: Estimated econometric model**

$$y_{1t} = 3.84563 - 0.220683 x_{1t} + 0.22035 x_{2t} + 0.122576 x_{3t} - 0.333554 x_{4t} + 0.000570559 x_{5t} - 0.0392472 x_{6t} - 0.148817 x_{7t} + 0.918249 y_{2t} + u_{1t}$$

The parameters express the quantitative relationship between the seven explanatory variables and the dependent variable USD/MKD exchange rate. By plotting the estimated model against the actual values of the historical USD/MKD exchange rate, it is possible to verify how well does the predicted model fit the real exchange rate movements. In the graph below, the red line represents the real USD/MKD exchange rate and the blue line (forecast) represents the predicted responses of the linear regression model. The smaller the differences, the better the model fits the real data. Based on this visual assessment, the estimated model provides a satisfactory representation of the real exchange rate.

**Graph 21: Actual and fitted model estimation**



Source: Gretl software, author's computation

#### **4.3.4 Economic verification of the model**

The economic verification of the model is done by comparing the model assumptions with the obtained results. It checks for the direction and intensity of the parameters and it verifies if the model is consistent with economic theory. The estimated parameters confirm most of the assumed relations between the chosen variables for the model and the USD/MKD exchange rate.

- ❖ If all explanatory variables are equal to zero, the Macedonian denar will experience a monthly depreciation of 3.85 pips against the US dollar.
- ❖ If the National Bank of Macedonia increases the interest rate by 1%, the denar will appreciate by 0.22 pips in terms of the dollar.
- ❖ If the Federal Reserve increases the interest rate by 1%, the denar will depreciate by 0.22 pips in terms of the dollar.
- ❖ If the consumer price index (inflation) in Macedonia increases by 1%, the exchange rate will increase by 0.12 pips.
- ❖ If the consumer price index (inflation) in the United States increases by 1%, the exchange rate will decrease by 0.33 pips.

- ❖ If the trade balance of Macedonia increases by one thousand units, the Macedonian denar will depreciate by 0.0006 pips, contrary to the initial assumption.
- ❖ If the trade balance of the United States increases by one thousand units, the Macedonian denar will appreciate by 0.04 pips contrary to the initial assumption.
- ❖ During the financial crisis of 2007-08, the denar appreciated by 0.15 pips against the US dollar.
- ❖ The USD/MKD exchange rate movement in the current period, is influenced by 0.92 pips from its behavior in the past (previous) period.

#### 4.3.5 Statistical verification of the model

The statistical verification of the model is done by checking for statistical significance of parameters, testing for coefficient of determination  $R^2$  and declaring the statistical significance of the estimated parameters and the model as a whole.

##### *Test of parameter significance*

<b>parameter</b>	3.84563	-0.220683	0.220350	0.122576	-0.333554
<b>H0/A hypotheses</b>	A	A	A	A	A

where, H0 = parameter is equal to 0 and A = parameter is not equal to 0

<b>parameter</b>	0.000570559	-0.392472	-0.148817	0.918249
<b>H0/A hypotheses</b>	A	A	A	A

where, H0 = parameter is equal to 0 and A = parameter is not equal to 0

Based on the test for parameter significance, all estimated parameters are statistically significant (not equal to zero).

##### *Test statistic (p-value)*

The estimated p-value for the whole model is:

P-value(F)	4.45e-98
------------	----------

##### *Conditions of the test*

if  $p\text{-value} < \alpha$  Statistically significant model

$p\text{-value} = 4.45e^{-98}$  and  $\alpha = 0.10$

$4.45e^{-98} < 0.10$  Conclusion: The model is statistically significant

### ***Coefficient of determination $R^2$***

The coefficient of determination is:

R-squared	0.956584
-----------	----------

The coefficient of determination R-squared is used to understand how well the selected data fits the econometric model, or how well the regression line approximates the real data points. This important statistic demonstrates the *goodness of fit* of the model. In general, the higher the R-squared, the better the model fits the data (Keller, 2014, pg. 135). Since the result for  $R^2 = 0.956584$ , it can be concluded that 96.0% of the variation of  $y$  (USD/MKD exchange rate) is explained by the selected regressors  $x_{it}$ .

The coefficient of adjusted determination is:

Adjusted R-squared	0.954268
--------------------	----------

R-squared is generally higher as the number of variables in the model increases, so this is why it is important to also look at the values for the *adjusted  $R^2$* . The adjusted coefficient penalizes the statistic such as extra variables included in the model (Anderson, Sweeney, Williams, 2015, pg.733). The "raw"  $R^2$  value = 0.954268 is also taken into consideration which demonstrates that the dependent variable is still explained by 95.0% by the regressors.

#### **4.3.6 Econometric verification of the model**

The econometric verification tests whether the estimated model is trustworthy and whether it fulfills the linear regression model assumptions of being Best Linear Unbiased Estimator (BLUE). If the assumptions are fulfilled, it means that out of all possible linear unbiased estimators, the model gives the most precise estimates of gamma ( $\gamma$ ) and beta ( $\beta$ ). The following econometrics properties are tested: collinearity, autocorrelation, heteroskedasticity and normality of residual.

The first property that is being examined is *collinearity*. This phenomenon occurs when two or more variables of the regression model are highly correlated, meaning they are essentially expressing the same thing (Investopedia, 2016). As established by the test itself, values of variance inflation factors above 10.0 may indicate a collinearity problem. Based on the test, the estimated regression model does not have this problem.

**Table 3: Test for collinearity**

Variance Inflation Factors	
Minimum possible value = 1.0	
Values > 10.0 may indicate a collinearity problem	
MK_interest_rates	1.077
US_interest_rates_3	1.452
MK_CPI	1.056
US_CPI	1.105
MK_trade_balance	1.531
US_trade_balance	1.055
Financial_crisis	1.496
USD_MKD_1	1.634
VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient between variable j and the other independent variables	

Source: Gretl software, author's computation

The second test, checks for *autocorrelation*. A correlation is a measure that shows the extent to which the residuals (errors) fluctuate together. It occurs when each error is correlated with the error immediately before it and as a result the model exhibits a systematic lack of fit. The test detects if there is similarity between the time series observations as a function of the interval of time between them (Chatterjee, Hadi, 2012, pg. 209-210).

**Table 4: Test for autocorrelation**

Breusch-Godfrey test for autocorrelation up to order 12 OLS, using observations 2002:05-2015:07 (T = 159) Dependent variable: uhat
Test statistic: LMF = 1.420720, with p-value = P(F(12,138) > 1.42072) = 0.163366

Source: Gretl software, author's computation

*Conditions of the test*

if p-value >  $\alpha$  then Ho: hypothesis holds – No autocorrelation

p-value = 0.163366 and  $\alpha = 0.05$

0.163366 > 0.05 Conclusion: No autocorrelation of residuals

The third tests checks for *heteroskedasticity*. In statistical models, heteroskedasticity occurs when the standard deviations of the variables that are being monitored are not constant over time. Such inconsistencies diminish the accuracy of the model and underestimate the standard errors. The presence of heteroskedasticity is a major concern for regression models and it indicates that the model is inefficient (Chatterjee, Hadi, 2012, pg. 171).

**Table 5: Test for heteroskedasticity**

White's test for heteroskedasticity OLS, using observations 2002:05-2015:07 (T = 159) Dependent variable: uhat^2  Test statistic: $TR^2 = 53.839636$ , with p-value = $P(\text{Chi-square}(43) > 53.839636) = 0.124345$
--

Source: Gretl software, author's computation

*Conditions of the test*

if p-value  $> \alpha$  then Ho: hypothesis holds – No heteroskedasticity

p-value = 0.124345 and  $\alpha = 0.05$

$0.124345 > 0.05$  Conclusion: Heteroskedasticity is not present

The final test checks for *normality of residuals*. If the residuals are normal, the model implications and model predictions are reliable (Koch, 2010, pg. 107-108).

**Table 6: Test for normality**

Frequency distribution for uhat1, obs 5-163 number of bins = 13, mean = -5.3179e-015, sd = 1.09415  Test for null hypothesis of normal distribution: Chi-square(2) = 3.49621 with p-value 0.174104
--

Source: Gretl software, author's computation

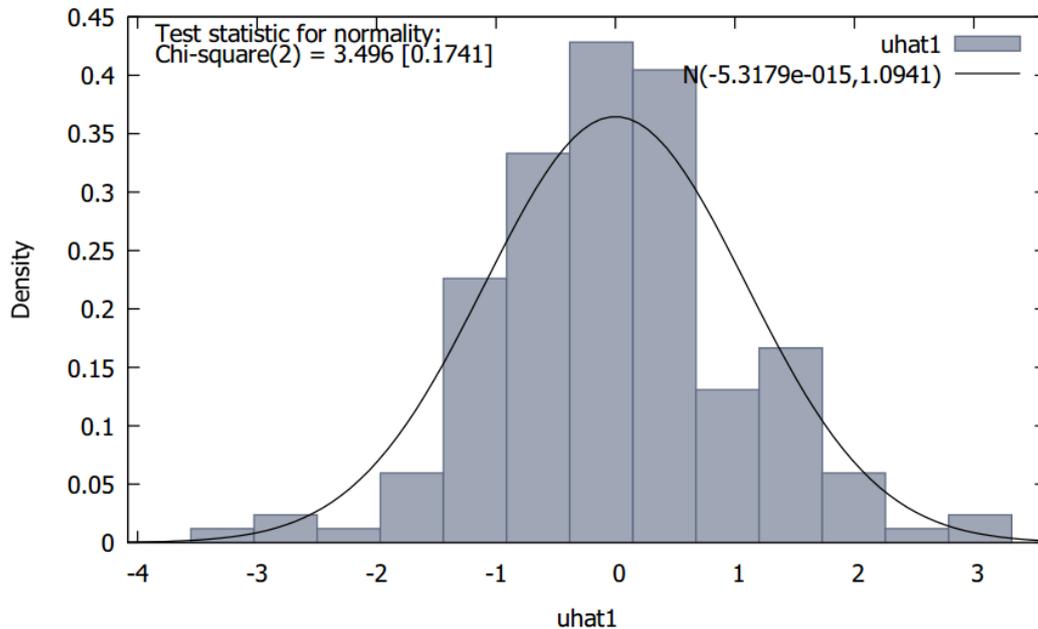
*Conditions of the test*

if p-value  $> \alpha$  then Ho: hypothesis holds – Normal distribution of  $u_t$

p-value = 0.174104 and  $\alpha = 0.05$

$0.51202 > 0.05$  Conclusion: Normal distribution of error term

**Graph 22: Test statistic for normality**



Source: Gretl software, author's computation

Based on the output, the error is normally distributed.

#### 4.3.7 Model application (scenarios simulation)

For the purposes of scenarios simulation, the elasticities for several months in 2013 are calculated. Elasticity demonstrates the sensitivity of response of one variable if there is a change in another. In other words, it expresses the relative effect that the independent variables have on the dependent variable, the USD/MKD exchange rate. The elasticity of an independent variable (x) expresses the percentage change in the dependent variable (y) for one percent change in x. The formula is as follows:

##### Function 4: Elasticity of independent variable

$$\frac{\% \Delta Y}{\% \Delta X} = \frac{dY}{dX} \cdot \frac{X}{Y}$$

Source: Barreto, Howland, 2006, pg. 157

where,

**dY/dX** is the estimated regression coefficient

**X** is the real value of independent variable x

**Y** is the theoretical value of dependent variable y

**Table 7: Elasticities MK variables**

Elasticities			
year-month	MK interest rates	MK CPI	MK trade balance
2013-04	0.00111	0.00320	-0.00035
2013-05	0.00005	-0.00393	-0.00036
2013-06	0.00028	0.00119	-0.00035
2013-07	0.00019	-0.00366	-0.00032
2013-08	0.00005	0.00376	-0.00032
2013-09	0.00077	-0.00029	-0.00032
2013-10	-0.00019	-0.00082	-0.00008

Source: Various sources, listed in chapter 7.4 Websites for historical data generation, author's computation

**Table 8: Elasticities US variables**

Elasticities			
year-month	US interest rates	US CPI	US trade balance
2013-04	-0.00009	0.00168	-0.00438
2013-05	0.00005	-0.00299	-0.00411
2013-06	-0.00005	-0.00389	-0.00216
2013-07	0.00005	-0.00072	-0.00169
2013-08	-0.00019	-0.00198	0.00100
2013-09	-0.00010	-0.00195	-0.00077
2013-10	0.00000	0.00431	0.00253

Source: Various sources, listed in chapter 7.4 Websites for historical data generation, author's computation

It is assumed that in year 2013, ceteris paribus, the scenarios are the following:

- ❖ If the National Bank of Macedonia increased the interest rate in June 2013 by 0.2%, the Macedonian denar will appreciate by 0.000056%.
- ❖ If the Federal Reserve raised the interest rate in same month by 1%, the denar will depreciate by 0.00005%.
- ❖ If inflation in Macedonia increased by 1.5% in April, the denar will appreciate by 0.00564%.
- ❖ If inflation in the United States increased by 0.8% in the same month, the Macedonian denar will depreciate by 0.001584%.
- ❖ If the trade balance of Macedonia increased by 9% in October, this will lead to an depreciation of the denar by 0.00072%.

❖ If the trade balance of United States increased by 12% in the same month, this will result in a appreciation of the Macedonian denar in terms of the US dollar by 0.03036%.

From these scenarios it is visible that the majority of the initial economic assumptions are accurate since the percentage change of the explanatory variables has an expected influence over the percentage change of the dependent variable.

#### 4.3.8 Forecast scenario

The last objective of the practical part is a medium-term forecast scenario for the Macedonian denar in the period of six months. The USD/MKD forecast scenario was created by firstly estimating the future values of the independent (exogenous) variables through the use of corresponding trend functions. The predicted values were then inserted into Gretl software and for 95% confidence intervals, the following values were obtained:

**Table 9: USD/MKD forecast statistics**

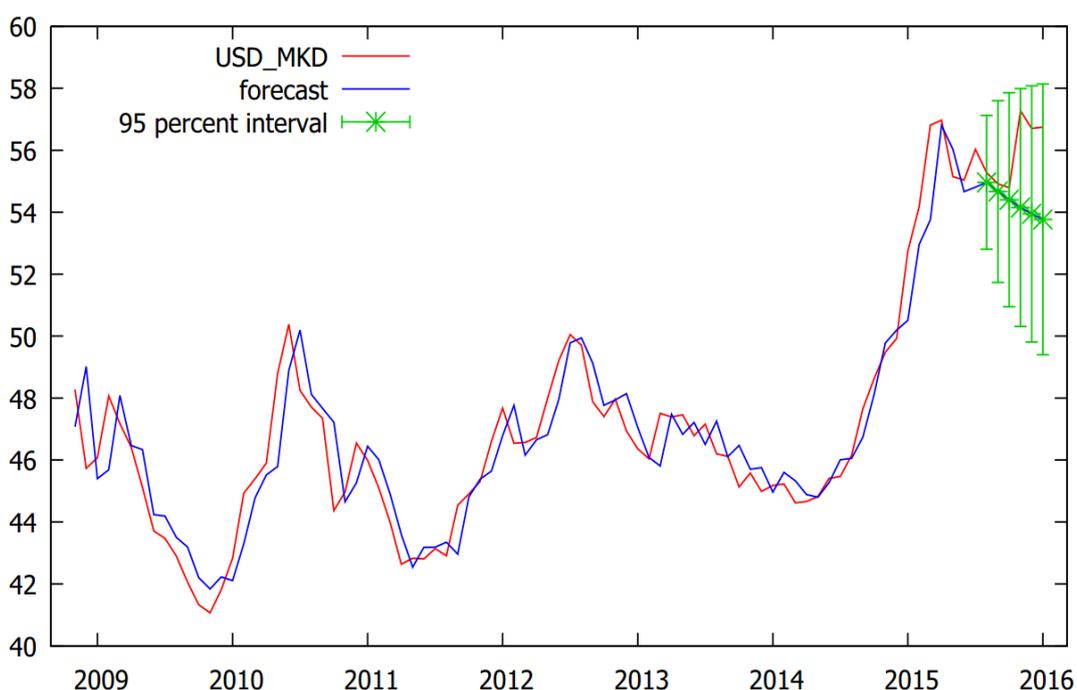
For 95% confidence intervals, $t(150, 0.025) = 1.976$				
Obs	USD_MKD	prediction	std. error	95% interval
2015:08	55.2770	54.9657	1.09415	(52.8038, 57.1277)
2015:09	54.9161	54.6684	1.48545	(51.7333, 57.6035)
2015:10	54.7953	54.4025	1.74863	(50.9474, 57.8576)
2015:11	57.2763	54.1536	1.94302	(50.3143, 57.9928)
2015:12	56.7048	53.9485	2.09295	(49.8130, 58.0840)
2016:01	56.7501	53.7699	2.21149	(49.4002, 58.1396)
Forecast evaluation statistics				
Mean Error		1.6351		
Mean Squared Error		4.4237		
Root Mean Squared Error		2.1033		
Mean Absolute Error		1.6351		
Mean Percentage Error		2.8825		
Mean Absolute Percentage Error		2.8825		
Theil's U		1.9547		
Bias proportion, UM		0.6044		
Regression proportion, UR		0.3008		
Disturbance proportion, UD		0.0948		

Source: Gretl software, author's computation

The output demonstrates the observations in months (2015:08 to 2016:01), the real USD/MKD exchange rate (retrieved for the purposes of forecast verification) and the predicted values based on the estimated regression model. The forecast evaluation statistics show a mean percentage error of 2.8825 which is the percentage by which the model predictions deviate from the actual (real) data. When the model is displayed graphically, it is visible that the predicted forecast is accurate for the first three months, and differs for the final three months.

**Graph 23: USD/MKD forecast scenario**

(For the time period August 2015 to January 2016)



Source: Gretl software, author's computation

The exchange rate in November 2015 was higher than the forecasted value and the model did not capture this occurrence. However, the predicted values are still in the 95% confidence level which indicates that the model demonstrated satisfactory results. Despite this weakness of the model, the USD/MKD exchange rate did follow the overall expected direction for the last two months. This is visible through the forecasted and actual appreciation of the Macedonian denar against the US dollar in December 2015 and January 2016.

## 5 Results and Discussion

This section covers the main findings of the thesis. The paper consists of three main chapters, each of them employing different methods of analysis. The empirical findings are chapter specific and are summarized accordingly.

The first chapter looked into the historical background of the Macedonian denar. Through the use of quantitative and qualitative research methods, a critical inquiry into past events was performed. The facts were interpreted in order to get a better understanding of historic occurrences and established the foundations of this paper.

The analysis concluded that being a part of the People's Federal Republic of Yugoslavia was a significant factor in the development of the Macedonian denar. The microeconomic environment in the early 90<sup>s</sup> in Macedonia was heavily influenced by the microeconomic situation of Yugoslavia. As a result, even after declaring independence the Macedonian economy had a long way to go in order to be able to stand on its own feet. Different economic and political events such as ethnic conflicts and wars, trade barriers and a significant dispute over Macedonia's constitutional name had a considerable impact on the situation in Macedonia. It took nearly four years until the country was able to break the hostile circle and experience its first independent economic growth.

The second chapter analyzed the denar with the use of specific methodological tools commonly used in the foreign exchange market. The technical analysis was performed based on past market activity statistics and reached the following results:

- ❖ A polynomial trend line identified an overall downtrend followed by a recent uptrend.
- ❖ A falling wedge technical pattern lasted for seven years prior to the financial crisis of 2007-08 and was used to predict a trend reversal.
- ❖ A triple-bottom formation was observed in the period following the 2008 crisis recovery that was broken in January 2015 and continued in an uptrend.
- ❖ The historical points in time when the US dollar was overbought/oversold in terms of the Macedonian denar were identified with the use of the technical indicator relative strength index.
- ❖ Long-term, short-term and key support and resistance levels have fluctuated between the support level of 73.6304 MKD per USD and a resistance level of

38.26 MKD per USD. The support and resistance levels also demonstrate the fact that the Macedonian denar nearly doubled in value in terms of the US dollar since it was first introduced.

- ❖ A simple moving average filtered the noise from the random rate fluctuations. The points in time when the averages crossed identified the start of a new trend.

As part of the second chapter, the paper also incorporates a fundamental analysis that looked deeper into macroeconomic and political factors and clarified the underlying reasons behind trends in the exchange rate. The analysis proved to be a very useful tool in the identification of fundamental forces that influenced the denar movement. In the years preceding the global financial crisis the Macedonian economy had to battle with political instability and slow GDP growth mostly due to factors related to neighboring countries. After the financial crisis, Macedonia was indirectly vulnerable due to the impaired economic conditions in the United States that was felt in countries worldwide.

The Macedonian denar was compared to several other Balkan currencies and the analysis reached a conclusion that the national currency can in fact serve as an indicator for the health of an economy. The denar is undervalued in terms of the Croatian kuna and the Bulgarian lev but is stronger in terms of the Serbian dinar.

In the last chapter, a linear regression model was used to determine the specific relationships between the selected macroeconomic factors stated in the hypothesis. The time-series data set for the period of January 2002 to July 2015 was entered into the statistical software Gretl and the parameters of each variable were estimated. The model was tested for economic, statistical and econometric significance and based on the tests the credibility of the proposed regression model was confirmed. With a 96% *goodness-of-fit*, it was concluded that the model fits the real data appropriately and it explains the greater part of variations in the exchange rate. The scenarios simulation confirmed the initial assumptions and with this the working hypothesis of the thesis was also confirmed.

A forecast scenario for a period of six months was created with the same statistical software. A mean percentage error of 2.8825 was the cause for deviation between the forecasted and the actual (real) data that was retrieved for the purposes of forecast verification. The forecast was accurate for the first three months but it failed to correctly predict the behavior of the USD/MKD exchange rate in the last three months. Despite this

weakness of the model, the linear regression analysis proved to be an effective tool in analyzing the Macedonian denar.

## **6 Conclusion**

This thesis was set out to explore the issue of the Macedonian denar and uncover the main factors that influence its movement. The research sought to confirm the working hypothesis that: “The exchange rate movement of the Macedonian denar is influenced by the following macroeconomic factors: inflation rate (expressed as purchasing power parity), key interest rates of the Central Bank, import and export volumes and various economic and political events”.

With technical analysis, the research was based on the study of data generated from both, the foreign exchange market and the actions of the people in the market. Although based on data such as charts, patterns and other indicators, the technical analysis uncovered one important fact - the movement of the USD/MKD exchange rate is due to the cumulative decisions of many buyers and sellers that are influenced by powerful market psychology. Given that human behavior is fallible, one can argue that technical analysis is rather short-term in nature and can be efficient in predicting the exchange rate mainly for the purposes of trading.

With fundamental analysis, the research was based on the study of underlying forces that affect the movement of the USD/MKD exchange rate and it built conclusions based on them. The analysis took a long-term approach in investigating various economic factors known as fundamentals. Following the Macedonian denar throughout each year of its existence also revealed the fact that it took a long time for the intrinsic value of the denar to be reflected in the market. As a result, it can be stated that fundamental analysis can be efficient in predicting the exchange rate in the long run and mainly for the purposes of investing.

With linear regression analysis, the research was based on selecting specific economic variables and estimating the quantitative relationship between them and the USD/MKD exchange rate movement. The analysis helped to understand how the typical value of the exchange rate is influenced by changes in the selected variables. A valuable outcome of the analysis is the fact that the validity of the assumed relationships was proved and with this the working hypothesis was also confirmed. Although a widely popular statistical

technique, the regression analysis exhibited some limitations when employed for the purposes of prediction and forecasting. The outcome provides evidence that a perfect linear regression model does not exist. Nonetheless, with a careful selection, application and testing of variables it can offer satisfactory results.

The theoretical methods that were used in this paper confirmed and explained the movements of the Macedonian denar with the help of theoretical thinking while the empirical methods reflected the researched subject through methods of measuring and experimenting. The evidence gathered in this paper suggests that technical, fundamental and regression analysis were efficient in analyzing and predicting the USD/MKD exchange rate and confirming the hypothesis.

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## 7 Appendix

### 7.1 Appendix 1

**Table 10: Data for OLS model generation 1 of 2**

<b>year-month</b>	<b>USD_MKD</b>	<b>MK_interest_rates</b>	<b>US_interest_rates</b>	<b>MK_CPI</b>
2002-01	68.99	13.57	1.73	101.1
2002-02	70.05	13.28	1.74	100.1
2002-03	69.6	11.42	1.73	100.5
2002-04	68.91	12.16	1.75	100.7
2002-05	66.69	12.18	1.75	100.3
2002-06	63.89	12.41	1.75	98.9
2002-07	61.4	11.96	1.73	98.3
2002-08	62.43	10.18	1.74	100.1
2002-09	62.13	9.51	1.75	100.4
2002-10	62.18	11.5	1.75	100.5
2002-11	60.94	12.92	1.34	100.2
2002-12	60.03	15.21	1.24	99.9
2003-01	57.64	14.75	1.24	100.4
2003-02	57.05	13.5	1.26	99.8
2003-03	56.83	9.6	1.25	100,0
2003-04	56.53	7.1	1.26	101.4
2003-05	53.23	7	1.26	100.6
2003-06	52.51	7	1.22	99.1
2003-07	53.85	7	1.1	99.8
2003-08	54.94	7	1.3	100.1
2003-09	54.69	7	1.1	100.2
2003-10	52.33	6.83	1.1	100,0
2003-11	52.36	6.12	1	100.6
2003-12	49.92	6.15	0.98	100.5
2004-01	48.55	6.75	1	100.3
2004-02	48.54	7.37	1.1	99.1
2004-03	50.01	7.49	1	99.9
2004-04	50.99	7.58	1	99.2
2004-05	51.07	7.55	1	100.5
2004-06	50.55	7.55	1.3	99.7
2004-07	50	7.4	1.26	98.8
2004-08	50.38	7.61	1.43	99.5
2004-09	50.23	7.66	1.61	100,0
2004-10	49.27	7.98	1.76	101.1
2004-11	47.37	8.82	1.93	100.5
2004-12	45.94	8.95	2.16	99.3
2005-01	46.69	8.71	2.28	100.2
2005-02	47.19	8.8	2.5	100.5

2005-03	46.57	9.31	2.63	99.9
2005-04	47.45	10	2.79	99.9
2005-05	48.27	10	3	100.4
2005-06	50.34	10	3.4	100.2
2005-07	50.82	10	3.26	99.2
2005-08	49.79	10	3.5	99.4
2005-09	49.86	10	3.62	100.6
2005-10	50.85	9.95	3.78	100.7
2005-11	51.9	9.8	4	99.7
2005-12	51.67	8.52	4.16	100.6
2006-01	50.75	7.31	4.29	101.7
2006-02	51.23	7.1	4.49	100.3
2006-03	50.94	6.78	4.59	100.1
2006-04	49.97	6.19	4.79	100.3
2006-05	47.96	5.7	4.94	101.2
2006-06	48.33	5.77	4.99	99.3
2006-07	48.21	5.57	5.24	99.9
2006-08	47.79	5.52	5.25	99.6
2006-09	48.01	5.36	5.25	99.8
2006-10	48.5	5.46	5.25	100.1
2006-11	47.57	5.66	5.25	100.9
2006-12	46.35	5.74	5.24	99.9
2007-01	47.06	5.71	5.25	100.4
2007-02	46.84	5.44	5.26	100.0
2007-03	46.2	5.3	5.26	100.3
2007-04	45.33	5.9	5.25	100.4
2007-05	45.25	5.4	5.25	100.7
2007-06	45.62	4.9	5.25	99.9
2007-07	44.66	5.13	5.26	99.7
2007-08	44.92	5.11	5.2	100.6
2007-09	44.08	4.83	4.94	100.9
2007-10	43.04	4.78	4.76	100.5
2007-11	41.74	4.66	4.49	101.4
2007-12	42.02	4.77	4.24	101.2
2008-01	41.69	4.89	3.94	101.6
2008-02	41.63	5.15	2.98	100.8
2008-03	39.54	5.85	2.61	100.8
2008-04	38.9	6	2.28	100.4
2008-05	39.37	6.8	1.98	100.2
2008-06	39.33	7	2	100.3
2008-07	38.79	7	2.1	99.1
2008-08	40.79	7	2	99.8
2008-09	42.59	7	1.81	99.8
2008-10	45.79	7	0.97	100.7
2008-11	48.27	7	0.39	100.2
2008-12	45.73	7	0.16	100.3
2009-01	46.08	7	0.15	99.4
2009-02	48.07	7	0.22	99.8

2009-03	47.18	7	0.18	100.3
2009-04	46.41	9	0.15	99.8
2009-05	45.12	9	0.18	101,0
2009-06	43.71	9	0.21	98.3
2009-07	43.47	9	0.16	99.5
2009-08	42.9	9	0.16	99.7
2009-09	42.06	9	0.15	99.9
2009-10	41.33	9	0.12	99.6
2009-11	41.07	9	0.12	100.28
2009-12	41.81	8.5	0.12	100.95
2010-01	42.83	8	0.11	100.7
2010-02	44.93	7.61	0.13	100.4
2010-03	45.4	7.26	0.16	100.5
2010-04	45.9	6.5	0.2	100.6
2010-05	48.79	6.24	0.2	99.4
2010-06	50.38	5.46	0.18	100.2
2010-07	48.25	5	0.18	99.6
2010-08	47.71	4.68	0.19	100.1
2010-09	47.35	4.5	0.19	100.1
2010-10	44.37	4.5	0.19	100.3
2010-11	44.97	4.5	0.19	100.4
2010-12	46.55	4.11	0.18	100.74
2011-01	45.99	4	0.17	100.87
2011-02	45.1	4	0.16	100.94
2011-03	43.99	4	0.14	101.74
2011-04	42.64	4	0.1	100.31
2011-05	42.83	4	0.09	99.8
2011-06	42.81	4	0.09	99.36
2011-07	43.14	4	0.07	99.22
2011-08	42.91	4	0.1	99.9
2011-09	44.54	4	0.08	99.89
2011-10	44.91	4	0.07	100.27
2011-11	45.31	4	0.08	100.6
2011-12	46.6	4	0.07	99.9
2012-01	47.68	4	0.08	101.18
2012-02	46.54	4	0.1	100.51
2012-03	46.57	4	0.13	100.44
2012-04	46.73	3.96	0.14	101.1
2012-05	48	3.75	0.16	99.71
2012-06	49.22	3.73	0.16	99.54
2012-07	50.05	3.73	0.16	99.06
2012-08	49.71	3.73	0.13	101.45
2012-09	47.88	3.73	0.14	101.37
2012-10	47.4	3.73	0.16	100.2
2012-11	47.97	3.73	0.16	100.04
2012-12	46.94	3.73	0.16	100.03
2013-01	46.36	3.49	0.14	100.29
2013-02	46.04	3.48	0.15	100.22

2013-03	47.51	3.42	0.14	100.06
2013-04	47.39	3.38	0.15	101.3
2013-05	47.46	3.37	0.11	99.8
2013-06	46.79	3.21	0.09	100.26
2013-07	47.16	3.25	0.09	98.87
2013-08	46.2	3.25	0.08	100.32
2013-09	46.12	3.25	0.08	100.21
2013-10	45.13	3.25	0.09	99.9
2013-11	45.58	3.25	0.08	99.86
2013-12	44.99	3.25	0.09	100.25
2014-01	45.18	3.25	0.07	99.87
2014-02	45.23	3.25	0.07	99.88
2014-03	44.62	3.25	0.08	99.7
2014-04	44.66	3.25	0.09	100.02
2014-05	44.82	3.25	0.09	100.28
2014-06	45.41	3.25	0.1	99.76
2014-07	45.47	3.25	0.09	100.19
2014-08	46.15	3.25	0.09	99.52
2014-09	47.65	3.25	0.09	100.04
2014-10	48.63	3.25	0.09	100.24
2014-11	49.48	3.25	0.09	99.95
2014-12	49.93	3.25	0.12	100,0
2015-01	52.74	3.25	0.11	99.23
2015-02	54.18	3.25	0.11	100,0
2015-03	56.81	3.25	0.11	100.46
2015-04	56.97	3.25	0.12	100.39
2015-05	55.15	3.25	0.12	100.46
2015-06	55.04	3.25	0.13	100.03
2015-07	56.03	3.25	0.13	99.28

**Table 11: Data for OLS model generation 2 of 2**

<b>year-month</b>	<b>US_CPI</b>	<b>MK_trade_balance</b>	<b>US_trade_balance</b>	<b>Financial_crisis</b>
2002-01	177.1	-0.17	-7.9	0
2002-02	177.8	-0.17	-4.5	0
2002-03	178.8	-0.17	-5	0
2002-04	179.8	2.83	-4.7	0
2002-05	179.8	2.83	-1.5	0
2002-06	179.9	2.83	-2.3	0
2002-07	180.1	5.31	-7.5	0
2002-08	180.7	5.31	-5.2	0
2002-09	181	5.31	-4.7	0
2002-10	181.3	10.71	-2.6	0
2002-11	181.3	10.71	-6.1	0
2002-12	180.9	10.71	-2.5	0
2003-01	181.7	2.7	-5	0
2003-02	183.1	2.7	-11.3	0

2003-03	184.2	2.7	-1.8	0
2003-04	183.8	-5.34	-3	0
2003-05	183.5	-5.34	-0.2	0
2003-06	183.7	-5.34	4.8	0
2003-07	183.9	4.99	-2.8	0
2003-08	184.6	4.99	-2.7	0
2003-09	185.2	4.99	-3.8	0
2003-10	185	13.89	-4.7	0
2003-11	184.5	13.89	-1.3	0
2003-12	184.3	13.89	-2.8	0
2004-01	185.2	1.49	-5.7	0
2004-02	186.2	1.49	-10.2	0
2004-03	187.4	1.49	-5.4	0
2004-04	188	2.49	-2	0
2004-05	189.1	2.49	-1.5	0
2004-06	189.7	2.49	-6.2	0
2004-07	189.4	12.2	-3	0
2004-08	189.5	12.2	-3.4	0
2004-09	189.9	12.2	-4.5	0
2004-10	190.9	7.92	-2.3	0
2004-11	191	7.92	-8.2	0
2004-12	190.3	7.92	-4.7	0
2005-01	190.7	-6.21	-3.3	0
2005-02	191.8	-6.21	-5.2	0
2005-03	193.3	-6.21	-0.2	0
2005-04	194.6	-0.2	10.8	0
2005-05	194.4	-0.2	-0.9	0
2005-06	194.5	-0.2	-3.2	0
2005-07	195.4	6.5	-4.6	0
2005-08	196.4	6.5	-1.8	0
2005-09	198.8	6.5	-3.6	0
2005-10	199.2	-0.84	-2.3	0
2005-11	197.6	-0.84	-2.5	0
2005-12	196.8	-0.84	0.2	0
2006-01	198.3	-2.27	-5.5	0
2006-02	198.7	-2.27	-8.9	0
2006-03	199.8	-2.27	-1.5	0
2006-04	201.5	-4.73	0.9	0
2006-05	202.5	-4.73	3.8	0
2006-06	202.9	-4.73	-3.6	0
2006-07	203.5	-3.89	-0.8	0
2006-08	203.9	-3.89	-1.4	0
2006-09	202.9	-3.89	-0.5	0
2006-10	201.8	-7.03	-1.3	0
2006-11	201.5	-7.03	-0.7	0
2006-12	201.8	-7.03	-0.3	0
2007-01	202.42	-10.39	-6.1	0
2007-02	203.5	-10.39	-1.3	0

2007-03	205.35	-10.39	-0.5	0
2007-04	206.69	-12.66	-1.7	0
2007-05	207.95	-12.66	1.6	0
2007-06	208.35	-12.66	1.2	0
2007-07	208.3	-3.48	-6.1	0
2007-08	207.92	-3.48	-0.3	0
2007-09	208.49	-3.48	-5.5	0
2007-10	208.94	0.8	-8.2	0
2007-11	210.18	0.8	1.1	0
2007-12	210.04	0.8	-13.3	0
2008-01	211.08	-17.14	-3.3	1
2008-02	211.69	-17.14	0.9	1
2008-03	213.53	-17.14	3.2	1
2008-04	214.82	-18.85	-10.2	1
2008-05	216.63	-18.85	-13.3	1
2008-06	218.82	-18.85	4.2	1
2008-07	219.96	-34.89	-4.6	1
2008-08	219.09	-34.89	-13.5	1
2008-09	218.78	-34.89	3.3	1
2008-10	216.57	-19.52	0.3	1
2008-11	212.43	-19.52	-0.7	1
2008-12	210.23	-19.52	-7.8	1
2009-01	211.14	-22.61	-4.4	0
2009-02	212.19	-22.61	0.8	0
2009-03	212.71	-22.61	-7	0
2009-04	213.24	-17.58	0.3	0
2009-05	213.86	-17.58	1.7	0
2009-06	215.69	-17.58	2	0
2009-07	215.35	-27.71	0.7	0
2009-08	215.83	-27.71	2.9	0
2009-09	215.97	-27.71	0.4	0
2009-10	216.18	-33.44	3.2	0
2009-11	216.33	-33.44	-0.6	0
2009-12	215.95	-33.44	-9.5	0
2010-01	216.69	-22.21	-1.5	0
2010-02	216.74	-22.21	-2.6	0
2010-03	217.63	-22.21	2.5	0
2010-04	218.01	-20.12	1.5	0
2010-05	218.18	-20.12	1.1	0
2010-06	217.97	-20.12	2.2	0
2010-07	218.01	-29.41	-2.1	0
2010-08	218.31	-29.41	1.1	0
2010-09	218.44	-29.41	-1	0
2010-10	218.71	-16.62	0.8	0
2010-11	218.8	-16.62	-2.3	0
2010-12	219.18	-16.62	-3.5	0
2011-01	220.22	-7.98	-4.2	0
2011-02	221.31	-7.98	-7.5	0

2011-03	223.47	-7.98	-6.9	0
2011-04	224.91	-12.02	-0.6	0
2011-05	225.96	-12.02	0.9	0
2011-06	225.72	-12.02	0.1	0
2011-07	225.92	-17.18	-3.5	0
2011-08	226.55	-17.18	-0.7	0
2011-09	226.89	-17.18	4	0
2011-10	226.42	-15.53	3.1	0
2011-11	226.23	-15.53	-5	0
2011-12	225.67	-15.53	-2.7	0
2012-01	226.67	-0.74	-8.4	0
2012-02	227.66	-0.74	-14	0
2012-03	229.39	-0.74	-4.2	0
2012-04	230.09	-3.42	-4.8	0
2012-05	229.82	-3.42	-2.5	0
2012-06	229.48	-3.42	1.6	0
2012-07	229.1	-20.37	-17.4	0
2012-08	230.38	-20.37	-7.2	0
2012-09	231.41	-20.37	0	0
2012-10	231.32	-1.94	-1.7	0
2012-11	230.22	-1.94	-5.9	0
2012-12	229.6	-1.94	-1.1	0
2013-01	230.28	-15.98	-6.3	0
2013-02	232.17	-15.98	-8	0
2013-03	232.77	-15.98	2.5	0
2013-04	232.53	-29.24	5.3	0
2013-05	232.95	-29.24	4.9	0
2013-06	233.5	-29.24	2.6	0
2013-07	233.6	-26.26	2	0
2013-08	233.88	-26.26	-1.2	0
2013-09	234.15	-26.26	0.9	0
2013-10	233.55	-6.65	-3	0
2013-11	233.07	-6.65	-6.8	0
2013-12	233.05	-6.65	-0.2	0
2014-01	233.92	-24.57	-4	0
2014-02	234.78	-24.57	-14.6	0
2014-03	236.29	-24.57	-12.4	0
2014-04	237.07	-40.04	-8.1	0
2014-05	237.9	-40.04	-5.5	0
2014-06	238.34	-40.04	-12.8	0
2014-07	238.25	-11.19	-9.8	0
2014-08	237.85	-11.19	-10.5	0
2014-09	238.03	-11.19	-13	0
2014-10	237.43	-13.94	-7.8	0
2014-11	236.15	-13.94	-22.8	0
2014-12	234.81	-13.94	-12	0
2015-01	233.71	-7.69	-13.9	0
2015-02	234.72	-7.69	-23.8	0

2015-03	236.12	-7.69	-14.5	0
2015-04	236.6	-18.81	-24.8	0
2015-05	237.81	-18.81	-7.1	0
2015-06	238.64	-18.81	-13.2	0
2015-07	238.65	-15.23	-13.4	0