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COMPARISON OF FOREX MODELS

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Abstract:

This article is devoted to mathematical models that were created for internal project Moravian College Olomouc: Information system for trading in Forex environment. Mathematical models describe business strategies based on technical market analysis. Their goal is to find out the current trend and create a rational estimate of how the market will behave in the future. The models form the basis of an information system that is designed to support forex trading in currency pairs.

Key words:

FOREX, currency pairs, line graph, technical analysis, candle stick graph, trend, resistance, support

JEL: C6, C63, G12, G15, G17.

Introduction

Forex (Foreign Exchange) is a worldwide exchange network that trades currency pairs (e.g. EUR / USD, GBP / USD, AUD / CAD, etc.). The price of the pair is expressed by the exchange rate between the two currencies. In addition to large investors, retail investors can also trade in this non-localized over-the-counter market. Every trader is trying to increase his investment or to increase his investment depending on the movements of specific currencies. insure currency risk. Trading takes place over the Internet, either through a default web broker platform or universal software (such as Meta Trader) that allows you to track exchange rate movements and invest in financial markets. As a result, business transactions can be made immediately and in real time [13].

Trading on FOREX can bring a high profit to participants in a short period of time. Of course, this only if they estimate the future development of the currency pair's exchange rate correctly. A good forecast of currency pair behaviour depends not only on the trader's intuition and experience, but also on information obtained from fundamental and technical market analysis. Unlike fundamental analysis, technical analysis does not take economic or political considerations into account. It uses only historical data to observe trends and predict future exchange rate behaviour. At the same time, it is assumed that

- Factors that affect the exchange rate are already included in the data,
- exchange rates show a trend that lasts for some time,
- market behaviour is repeated because people react similarly to similar situations,
- the interaction between supply and demand is seen only in terms of consequences [5].

At present, it is possible to use various interactive software systems to support decision-making in trading, to which we could also assign the Information System for Trade Management in Forex (FORSUP). It is a system that, based on technical analysis, provides traders with the information they need to make rational decisions. The system is the result of a project implemented at the Ministry of

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Education, Youth and Sports in 2015-2018. It is based on a group of 6 mathematical and 11 language expert models (see [9], [10] for details). In this publication, we present 3 mathematical models of FORSUP [11].

Methods used:

In trading currency pairs, traders try to predict which of the two currencies will weaken or strengthen against the other currency. As an example, let's mention the EUR / USD currency pair, which is the most traded pair on the Forex market. For example, if we speculate on strengthening the US dollar, we will buy the dollar. What is important, however, we will buy it for the euro. Hence, at the same time, when we decide to speculate on the strengthening of the dollar, we will also speculate on the weakening of the euro. The trader can base his decision to buy or sell a currency on a technical analysis of the problem, which can be done either as an analysis of the graphic formations or through the analysis of technical indicators. The analysis of graphic formations serves to identify trends, levels of support and resistance and to predict future exchange rate developments. Moving averages and exponential alignment are often used to analyse technical indicators.

[1] Different graphs are used for quick orientation in the exchange rate development. By linking the closing prices, we get a line graph from which the exchange rate trend can be deduced. It is typical for the growing trend that the local maxima and minima of the graph are gradually increasing, for the decreasing trend, the local maxima and minima of the graph are gradually decreasing. A straight line that connects two local extremes in a graph is called a trend line. By linking local minima in the exchange rate graph, a rising trend line is obtained and a downward trend line decreases by linking local maxima. The growing trend line is a signal for buying, falling for sales. The trend ends when the trend line breaks. This occurs when the trend line is pierced by at least three percentage points of the exchange rate value and the last three exchange rate values are rising. In the technical analysis of the problem, longer trendlines and trendlines with a smaller directive are more important because they are more difficult to break. The risk of breaking the trend line can be managed using the Stop-loss instruction.

[2] There are also two other important lines in the graphs – support level or support and resistance or resistance. These are temporary boundaries in which the exchange rate is moving. Support defines the level of the exchange rate when the strength of demand induces a change in the exchange rate, the downward trend changes to growing and traders no longer want to sell the currency. That is, if the course value approaches the support level, a purchasing signal is generated. Resistance is the exchange rate level, when supply strength causes a change in exchange rate, the upward trend changes to declining and traders no longer want to buy currency. That is, when the course value approaches the resistance level, a sales signal is generated. If the exchange rate has a rising trend and the resistance level is broken, the roles of the resistance level and the support level are exchanged. Technical analysis very often uses a candlestick chart. Each candle consists of body (wicks) and wicks and provides four important information about the assets: Open, Close, Low, and High. The candle body shows the difference between the opening and closing price and serves to assess the volatility that plays an important role in the market. It is also possible to find out from the parameters of the candle where the market opened and closed in the given time period, i.e. whether the market in the given segment grew, declined or moved only to the side (market trend). Candles are colour coded. The green (white) body of the candle displays a situation where the opening price is less than the closing price. In the case of a red (black) candle, the situation is exactly the opposite.

[3] Moving averages or double exponential alignment are technical indicators. These generate signals for entering or repositioning the position. to exit position. The moving average is determined as the arithmetic average of the last n exchange rate values. If the objective of the analysis is to forecast

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values for the near future and the time series of average exchange rate values has a linear trend, the double exponential offset method can be used. The essence of the method is to calculate the moving average from the moving average. The first moving average is determined from a shorter period of time and is referred to as being faster than the second – slower moving average. The position input signal is when a slow-moving average cross with a faster one. The signal to buy is when the slow-moving average crosses and it goes up. The signal to sell is when the intersection occurs and the slow-moving average goes down [7].

[4] The exchange rate prediction can be done using the statistical double exponential offset method. With this type of exponential levelling, we assume that the trend can be aligned with a straight line in a short series row. In this method, the time point t is based on all available past values. The least squares weighted method is used to estimate the parameters, with the weights exponentially decreasing in the past. It is therefore clear that the observation at this point plays the greatest role in the time series value at point t, the previous observation plays a slightly smaller role, and the effect of observation on the value at point t fades in the past. We are working here with the equalizing constant α. If the value of α is close to one, the effect of past observations will only fade slowly. In contrast, if α is very small (approaching zero), the effects of past observations will fade very quickly. It is therefore obvious that the choice of the equalization constant plays a key role in this method (see [3], [1]).

Achieved results

We will now briefly describe 3 mathematical models based on the methods described above. We will briefly describe them and introduce the basic ideas from which the algorithms of these models are based.

Model MLSA

MPSV is a mathematical model of candle parameter calculation. The model describes the business strategy of using Pin Candles. As part of the current Forex data and with the contribution of historical MLSA data, it will find the dominant candle, whose parameters are based on the trader's activity.

Principle of MLSA

The body of the dominant candle must be short (less than 20% of the length of the largest candle body according to historical data), the wick of the candle must be only one side long. In the case of a purchase formation, a significantly longer portion of the wick points down, the colour of the candle is green and the candle usually lies at the support level. In the case of a sales formation, a significantly longer portion of the wick points up, the colour of the candle is red and the candle usually lies at the level of resistance.

The mathematical model also follows the trend of the market - the properties of candles before the dominant. If the market has been declining in the period under review, the MLSA recommends a small business transaction (purchase in the case of a green dominant candle and a sale when the candle is red). If the market grew in a given segment, the model recommends a large financial investment (again buying or selling depending on the colour of the dominant candle). If the market only moved to the side of the MLSA, medium-sized deals are expected.

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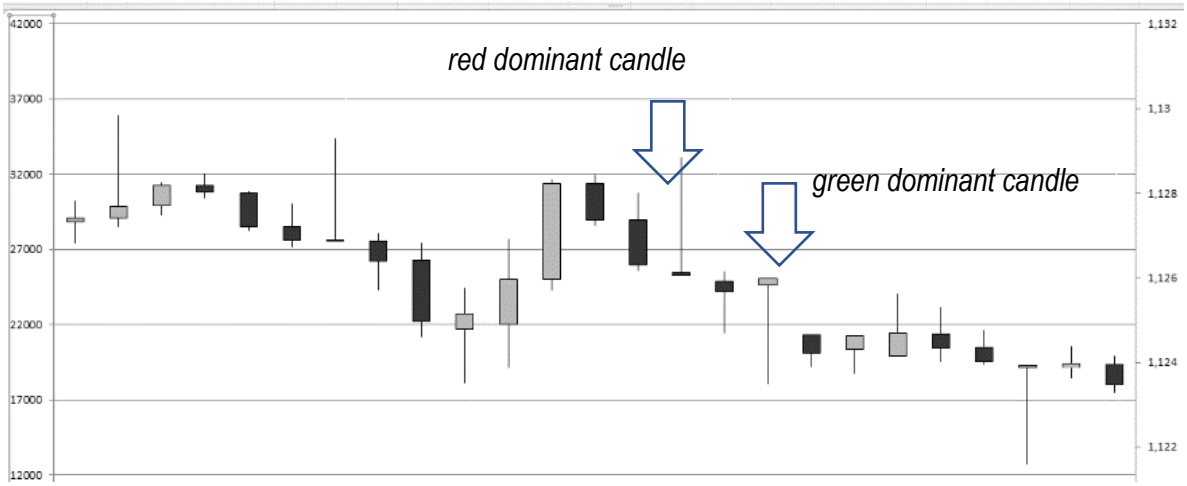
Fig. 1: Candlestick chart with dominant candles



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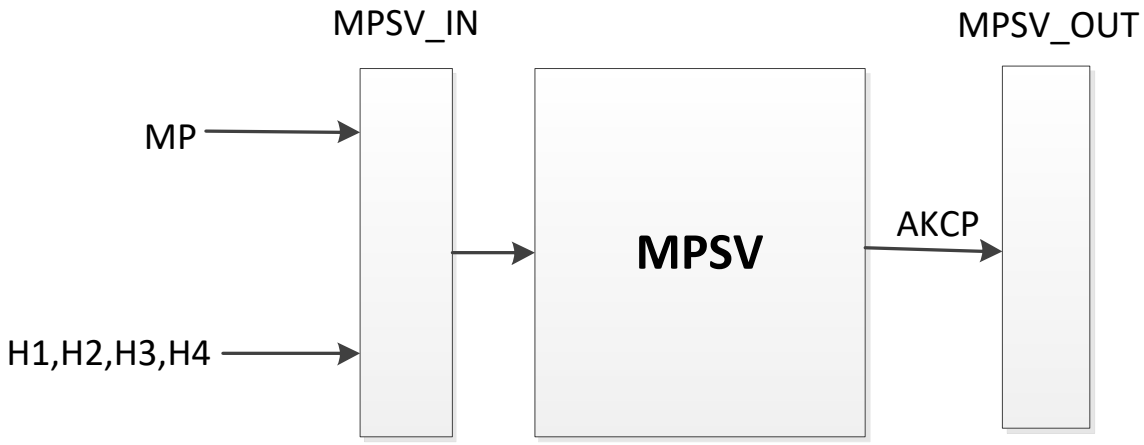
Brief description of MPSV

Fig. 2: MPSV model scheme



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The MPSV model works with five input variables and one output variable (see Figure 2)

Input variables:

- MP - Selection of the currently traded currency pair (model with 6 currency pairs):

1 = EUR/USD
2 = GBP/USD
3 = USD/CHF
4 = USD/JPY
5 = AUD/CAD
6 = USD/NZD

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The MPSV model counts the 6 most traded currency pairs on the Forex market. However, MPSV is universally designed and will be fully functional for other standard and exotic currency pairs.

- H1, H2, H3, H4 - Values of selected currency pair: H1 - Open, H2 - High, H3 - Low, H4 – Close.

These values will be retrieved from online applications (e.g. DS Watch) at hourly intervals, and the model always works with 24 current values.

Output variable:

- AKCP - variable with language values: MAN, STN, VEN, MAP, STP, VEP, CEK:

MAN = small purchase
STN = Medium Purchase
VEN = large purchase
MAP = small purchase
STP = Medium Purchase
VEP = big purchase
CEK = wait

Language values of the AKCP output variable represent recommended business activities at the current time (the recommendation is valid until the end of the hour - or until new actual values H1, H2, H3, H4 are read).

Model MSSR

MSSR is a mathematical model for identifying support and resistance decision levels. It determines the location of significant support and resistance price levels and determines the current merchant activity by interval numeric method.

Principle of MSSR

Support and resistance (S / R levels) are among the most important concepts of technical analysis. Their analysis is one of the most frequently used procedures for trading on Forex. Various methods can be used to determine support and resistance levels, such as the Fibonacci retracement, the Pivot points method, the moving average method, or the graphical method [3]. In the MSSR, the Pivot points method was used to determine support and resistance levels using the High, Low, and Close parameters of the selected currency pair.

The MSSR model continually calculates at least 3 support levels and 3 resistance levels for current data and is based on the business strategy of breaking these price levels. The model recommends buying and buying support when breaking through resistance levels. The size of the purchase depends on which level of resistance is currently being traded. Similarly, the size of sales determines the breakdown of a particular price level of support. Practically this means that when the lowest resistance level R1 is breached, the MSSR model recommends a large purchase, while a small purchase when breaking the highest R3 level. In case of support breakdown at the lowest level of S3, the biggest sale is assumed, and maximum loss is recommended at the stop loss level, which is usually around 5 pips below the lowest support level, in order to minimize potential losses.

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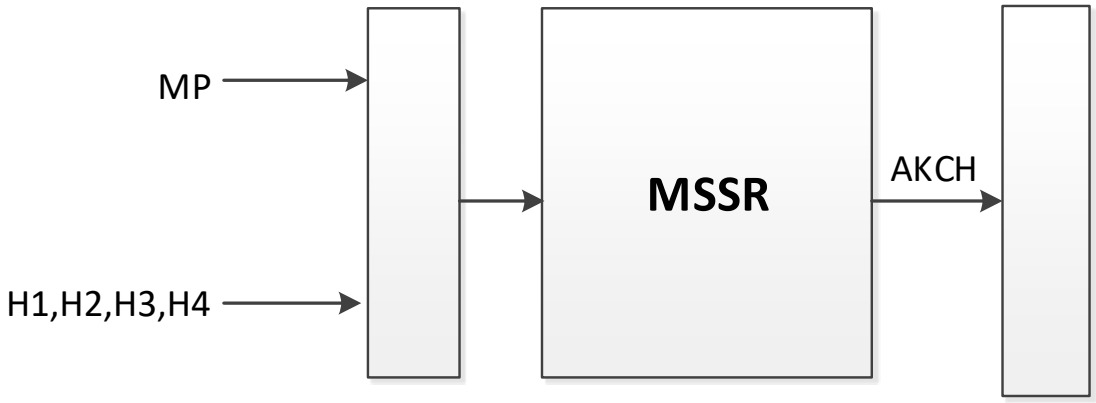
Fig. 6 Support and resistance levels

source: [8]

Brief characteristics of MSSR

Fig. 7: MSSR model scheme



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The MSSR model works with five input variables and one output variable (see Figure 7)

Input variables:
- MP - selection of currently traded currency pair (model counts with 6 currency pairs, see MLSA model)
- H1, H2, H3, H4 - values of the selected currency pair (see MLSA Model for more details).

Values will be obtained from online applications.

The MSSR will determine from 24 historical values (previous day values) daily pivot and at least 3 S / R levels. Subsequently, the current data H1, H2, H3, H4 are read in hourly intervals and the puncture of the support and resistance levels is tested.

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Output variable:

- AKCH - variable with language values: MAN, STN, VEN, MAP, STP, VEP, TOP, CEK

MAN = small purchase
STN = medium purchase
VEN = big purchase
MAP = small purchase
STP = medium purchase
VEP = Big Purchase
TOP = total sales
CEK = wait

The language values of the output variable AKCH represent the recommended business activities at the current time (This recommendation applies to the current hour or until the new actual values H1, H2, H3, H4 are loaded).

MPVK model

MPVK is a model of exchange rate prediction of a selected currency pair that predicts the trend of the traded pair at the current time and for a relatively short time in advance (predicts 3 values). However, the MPVK model is versatile, and after simple adjustment, the user can specify the number of predicted values required.

Principle of MPVK

When trading on the stock exchange, it is important to correctly estimate the evolution of currency pair prices on the market. The currency pair rate values create a time series. The time series is determined by MPVK from the input data (parameters of the candlestick graph values of the selected currency pair) as the centers of the bodies of the candle pair. When predicting exchange rate values, the MPVK model uses the double exponential offset method.

Fig. 8: Demonstration of development prediction optimization (3 values predicted with decreasing trend)

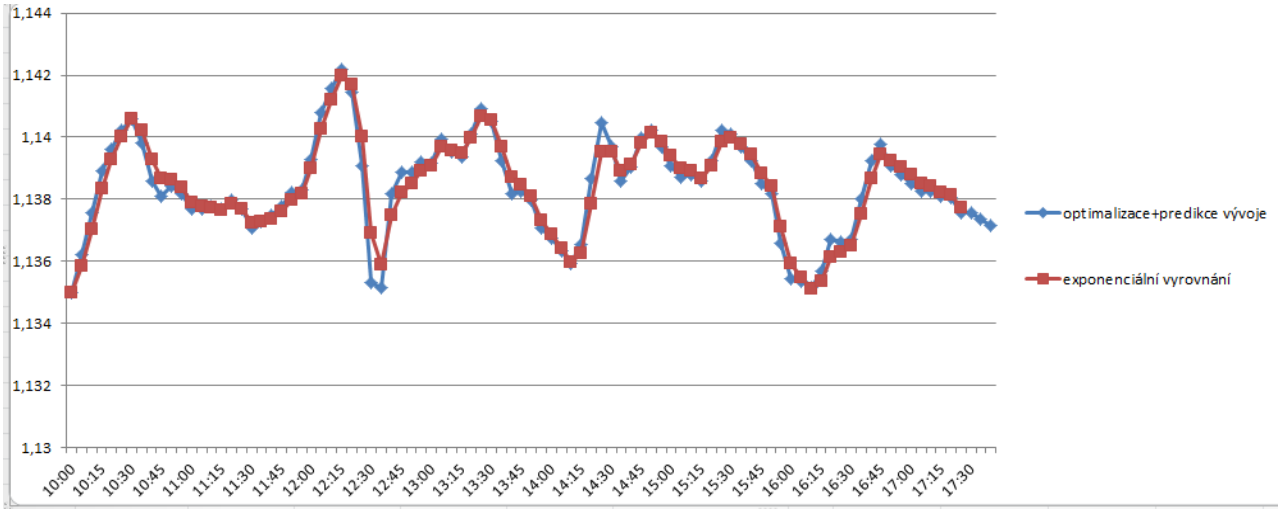

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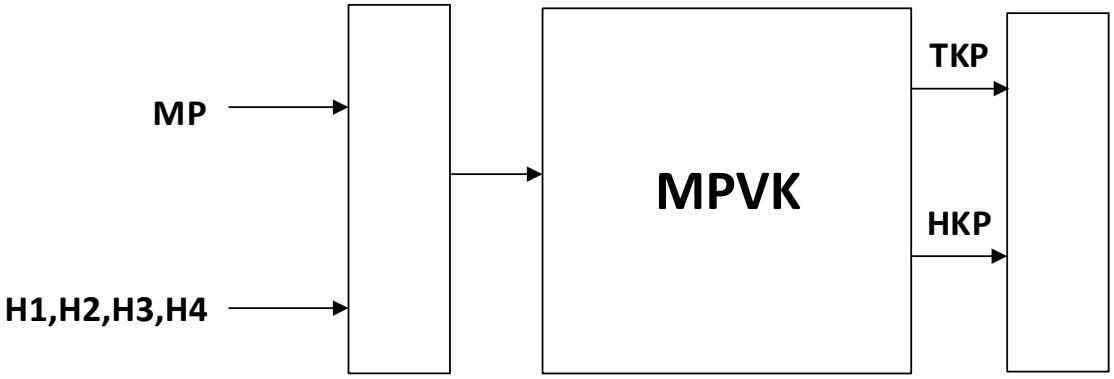
Fig. 9: Scheme of MPVK model



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The MPVK model works with five input variables and two output variables (see Figure 9).
Input variables:
MP - selection of currently traded currency pair (model counts with 6 currency pairs, see MLSA model)
H1, H2, H3, H4 - parameters of the selected currency pair (see MPSV Model for more details).
Values will be obtained from online applications. Data is read in 5-minute intervals.

Output variables:
TKP - The predicted trend of the exchange rate of a traded couple - a number from the interval <-1, + 1>, indicating a decreasing or increasing trend.
HKP - predicted value of the exchange rate of the traded couple.

Discussion

Decision-making and planning is always the basis of any activity within the financial markets. For these activities, it is important to have sufficient information about the principles and functioning of the financial market, as well as knowledge of business strategies. At the same time, it is necessary to have a plan how to use these indices in trading.

An important prerequisite for successful Forex trading is the knowledge and use of generally accepted market analysis principles. Using them we can find patterns in price dynamics of currency pairs. The most well-known and unused approach to market analysis is fundamental and technical analysis.

The publication introduces models based on the principles of technical analysis.

"The aim of technical analysts is to analyse the development of share prices and subsequently to predict the direction of their future exchange rate changes, and to determine the most appropriate timing for trading, the so-called timing." [12]

Professor Rejnuš's words reflect the true nature of technical analysis. It does not seek to determine the intrinsic value of the currency pair, but deals with movements in exchange rates within individual time frames. While the elements of fundamental analysis try to say which trading instruments to choose, technical analysis tries to answer the question when to trade these instruments and in which direction.

Fundamental analysis is used for long-term investments rather than for short-term trades, because it can determine the direction of currency exchange rate. However, the experience and ability of a fundamental analyst also play a role in determining the correct direction of exchange rate movements. They must have sufficient knowledge of macroeconomics, business finance and the economy in general. Fundamental analysis gives investors an opinion on the intrinsic value of the currency. The investor knows that there will be a price rise in the currency or a price fall or stop for a certain period of time, but he does not know when this will happen. Technical timing should be used for this timing.

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Technical analysis focuses on making profits from currency price differences, from this perspective it is appropriate to consider technical analysis as short-term. When analysing very short-term business opportunities, investors are using only a technical approach, because, above all, by technical analysis, the investor is able to analyse even the smallest price fluctuations that take place here.

There are a number of differences between fundamental and technical analysis that can be further worked on. It is advisable to combine the two completely different approaches appropriately and fill the weaknesses of one approach with the strengths of the other, thus creating a coherent trading system that would be able to bring the required profit to the trader.

Our mathematical models are still using technical analysis tools, in the further development of the FORSUP system we would like to focus more on the fundamental factors affecting currency price movements. We want to further develop and supplement the FORSUP system with language fuzzy logical models that will be based on fundamental principles. By a suitable combination and utilization of the strengths of technical and fundamental analysis, we want to develop a system in the future that will ensure profitable trading for the user.

Conclusion

The mathematical models described above are part of the subsystems, which were created within the framework of the project Information system for business management in Forex environment. These subsystems allow each user to assemble a software tool that meets their specific investment objective. On the basis of the obtained outputs, the user can then make a qualified and quick decision on how to execute his trades on FOREX. A complete set of models, along with algorithms and sample examples, is given in Part 1 of the Final Project Report [10]. The codes of the individual algorithms can be found in Part 2 of the Final Report [4]. Let us also point out that the presented project is not a closed system and permits further expansion and addition of new subsystems, resp. improving user comfort.

Resources:

[1] Artl J., Artlová, M., Rublíková, E.: *Analýza ekonomických časových řad s příklady*, VŠE Praha. 2004
[2] Haartman, O.: *Jak se stát forexovým obchodníkem: naučte se vydělávat na měnových trzích.* 2., rozš. vyd. Praha: FXstreet, c2014. ISBN 978-80-904418-3-5.
[3] Hindls, R. *Statistika pro ekonomy.* 8. vyd. Praha: Professional Publishing, 2007. ISBN 978-80-86946-43-6.
[4] Martinů J.: *Informační system pro správu obchodů v prostředé Forexu – 2.část: Výpisy programových kódů. MVŠO- Závěrečná zpráva o řešení projektu 2016-2018.*
[5] Moosa,I., A.: *Exchange rate forecasting: techniques and applications.* London: Macmillan Bussiness, 2000.ISBN 03-337-3644-3
[6] Mrkvička, T., Petrášková, V.: *Úvod do statistiky.* Jihočeská univerzita, České Budějovice, 2006, 147 s., ISBN 80-7040-894-4.
[7] Nesnídal, T., Podhajský, P.: *Obchodování na komoditních trzích. Průvodce spekulanta.* 2. rozš. vyd. Praha: Grada, 2006. ISBN 80-247-1851-0
[8] Pivot points. [online]. [cit. 2014-01-12] Dostupné z: http://www.babypips.com/
[9] Pokorný, M., Zimmermanová, J., Závodný J., Pospíšil, J., Lavrinčík, J., Zdražil,T., Sanetrník, P., Krišová, Z., Čermák, J., Martinů, J., Mošová, V., Říhová, V., Vítoslavská, M.: *Informační systém pro řízení a správu obchodů v prostředí Forexu.* MVŠO Olomouc. 2017 (in Czech)
[10] Pokorný M. a kol: *Informační system pro správu obchodů v prostředé Forexu – 1. část: Programové moduly a vzorové subsystémy systému FORSUP. MVŠO- Závěrečná zpráva o řešení projektu 2016-2018.*

EMI, Vol. 11, Issue 2, 2019
ISSN: 1804-1299 (Print), 1805-353X (Online)
www.emijournal.cz

[11] Pokorný M., Krišová Z., Zimmermanová J., Závodný J., Lavrinčík J., Mošová V., Říhová V.: *Decisionmaking Support for Systém Forex Trading,* EMI MVŠO Olomouc. 2018 (in Czech)
[12] Rejnuš, O. Finanční trhy. Brno: Grada, 2014. ISBN 978-80-247-3671-6.
[13] *Základy obchodování na FOREXu,* dostupné z: https://www.fxglobal.com/ebook/
[14] Miner, C. Robert.: *High Propability Trading Strategies: Entry to Exit Tactics for the Forex, Futures, and Stock Markets.* 1st edition. Wiley, 2008. 288 p. ISBN 978-0470181669.
[15] Nekritin, Alex., Walter Peters.*: Naked Forex: High-Propability Techniques for Trading Without Indicators.* 1st edition. Wiley, 2012. 288 p. ISBN 978-1118114018.