Philippine Stock Market Technical Analysis Modeling System

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# ABSTRACT

In the Philippines, finding reliable technical indicator is a challenge for most stock investors given the big number of existing technical indicators. Possibility of bankruptcy would increase if investors will continue on guessing the indicator that will give them the right prediction. Our proposed work was to apply five technical analysis indicators (Momentum(MOM), Accumulation/ Distribution Line(ADL), Moving Average Convergence Divergence (MACD), Stochastics(STO), On-Balance Volume(OBV)) on gathered past stock market data from 2007 up to 2015 in order to identify the best indicator. Through this, investors can have higher probability of getting the right prediction on their investments. This proposed work was tested by simulating the buy and sell signals that were produced from modeling each indicators. A starting investment money and number of shares to buy and sell were asked from the user. The revenue for each indicator showed the best indicator among the five. With 357 companies evaluated, OBV was concluded to be the most effective indicator with a percentage of **91.25%.** The study will extend the computer science skills in the business analytics where real-world set of data are interpreted. The future way of Philippine stock trading can now be based on indicators that are proven effective and can give the best output from the trade. **INTRODUCTION** Stock market, basically known as stock exchange, is a market in which distributing and trading of companies’ shares occurs through exchanging on a particular place or communicating over telephone, email and some exclusive electronic trading systems[3]. In recent times, as reported on Philippine Daily Inquirer News, declining of Philippine stocks continue [2]. It was stated that the Philippine Stock Exchange Index was down 0.14 percent on September 24, 2015[2]. It is a situation that is affecting the condition of the country together with the lives of the countrymen. In addition to this, finding a reliable technical indicator is a challenge for most stock investors given the big number of existing technical indicators which leads them to guessing the indicator that will give them the right prediction.

This study will be conducted for the investors and traders to have higher probability of getting the right prediction on their investments in the Philippines. Through having the knowledge of the most reliable technical indicator on analyzing trend on Philippine stock, these practitioners will be guided on deciding when to buy or sell Philippine stocks. This is a powerful tool for handling Philippine stocks.

The study primarily aims to provide an analysis of the common trend that can be observed on Philippine stock market history through a technical approach. This can be achieved by identifying the most effective technical indicator nowadays that will be a tool for forecasting the appropriate time for buying and selling stocks in Philippines. A web-based system will be created which will serve as a mathematical model for manipulating the gathered past data of stock prices and volumes of Philippine stock market from year 2007 up to 2015. This model will provide an interpretation of the trend on Philippine stock which includes the buy and sell signals based on the provided pattern of a particular technical indicator. This study will improve the skill of ICS Community on interpreting real-world set of data. It will also help them to have a better strategy on making decisions specifically on business analytics. **REVIEW OF RELATED LITERATURE** In recent years, different approaches were directed for predicting stock trend.

There are researches regarding Artificial Neural Networks (ANN) which displays its ability to recognize patterns and to solve problems which involve learning from the previous data it classified. With these capabilities, it is considered as an effective solution for distinguishing future new patterns on stock market. In 2010, based on an international conference [8], neural networks have a great capacity of predicting new patterns even if it was not observed on the recent data. Though it was proven that simple linear regression has the highest capacity in terms of predicting the direction of changes of stock market trend, Elman network reach its capability to detect error on recognizing changes on values and MLP has the most accurate values of changes compared to the two methods (Naeini, Taemian, & Hashemi, 2010).

Another technique conducted for stock market prediction is the finite state machine called Hidden Markov Model (HMM) [5]. The researchers include four inputs for the model: closing price, opening price, low price and high price. With these variables, the model predicts the next day’s closing price for a specific stock market share. It focuses on constructing framework for the probability of occurrence of the observation sequence and interprets broadly the observed data which greatly help on finding future patterns. This method was concluded to have a strong foundation on statistics but still it was on the process on improving its accuracy for recognizing new patterns on stock trend (Hassan & Baikunth, 2005).

In 2013, another new process called Kappa Measure was introduced on an international conference [4]. Aside from being a tool for evaluating the accuracy of the forecasted trend for a specific stock market, the system serves as a test for predictors since its input data involves searching for the share’s worth in which all of the predictors agree (Gupta, Nidhi, & Sanjay, 2013).

Recently, Foreign exchange (FX), a financial product, was generated and many FX companies were established. An increase in the number of investors was noted due to the spread of transactions on the Internet. However, difficulty in gaining profits by FX has been observed. Due to this problem, on a study conducted by Kato et al.(2010), technical analysis was applied for identifying trend on foreign exchange [7]. A gain in efficient transaction strategy was proposed by using Genetic Algorithm (GA) that consider price trend. The researchers considered starting transactions around the beginning of the trend that would earn much benefit. Technical indicators were used in the study to gain the technical transaction strategy. The researchers supported GA strategy by Exponential Moving Average lines (EMA) indicator which was noted by Tanaka et al.(2007) [10] and Jiang et al. (2003) [6] on their studies as an effective indicator for trend prediction as it puts higher weight on more recent date’s price [7].

In 2014, efficiency of technical analysis and predictive modeling was explored by Stankovic et al. in reaching the optimal strategy for investing stocks of emerging markets [9]. Technical strategies are set for different technical indicators based on moving averages and volatility of the value and returns on stock indices. Basic trading rules were implemented in the study using two moving averages: a long period and a short period moving average, and Moving Average Convergence-Divergence (MACD) and relative Strength Index (RSI). Features used in defining predictive model based on Least Squares Support Vector Machines (LS-SVMs) are preselected technical indicators. The LS-SVM classifier was used to predict trend of the stock indices’ value. The acquired outputs of the LS-SVM model are binary signals that can be used for defining the trading strategy. Through the model used in the study, EMA and MACD were accepted as indicators for the trend on emerging markets [9].

As mentioned on the earlier section, this study will adopt the use of technical indicators with modeling system. Technical indicators function as a key on it. On the other hand, scope of this study, technical indicators to be tested and modeling system to be used are the factors that set it apart from the others. It will focus on developing a modeling system for Philippine stock market using technical analysis. **METHODOLOGY** For this study, the advanced knowledge on Philippine stock market movement was managed through a modeling system. The information regarding the Philippine stock market from year 2007 to 2015 was acquired from Philippine Stock Exchange Inc. This time-series data including stock volume and stock price functioned as input of the model. Array structure was used as the storing agent for the given inputs. A total of five arrays with the same length were constructed for organizing data. Date, high price, low price, closing price and volume were used as input.

In terms of analyzing the model inputs, a method called technical analysis was implemented for predicting the graph of Philippine stock market movement. The crowd behavior is the foundation of technical analysis where the perception of technician centers on similarity of the occurrence of events (Burch, 2011). Though some people view this as a weak method, on the study conducted by Wong et al. (2010), concrete evidences was provided regarding the reliability of using technical indicators as tools on forecasting the right time for practitioners to buy or sell stocks. Aside from the test statistics prepared with some technical indicators which prove the effectiveness of this analysis on a specific stock market, its significance was also proven by old researchers [11]. It was noted by Frankel and Froot (1990a) that technical analysis was used by most market professionals in predicting the market. Moreover, according to the survey done by Euro money, a shift from fundamental analysis into technical analysis was held during 1980s [11].

The model for analyzing Philippine stock market through technical analysis was developed on a web-based system with real-time and responsive environment. This received array of stock prices, trade date and volumes which were analyzed based on a pattern given for a specific technical indicator. For this study, five powerful indicators will be considered such as:

1. Momentum- It is the ratio of the following two averages: short term and long term. It finds the price levels and measures the velocity of price change.
2. Accumulation/Distribution Line - It tracks the amount of money that flows in and out of stock through weighted sum of price and volume.
3. Moving Average Convergence Divergence (MACD) - It is similar to momentum which compares two moving averages but instead of dividing them, their difference is being computed.
4. Stochastics - It is based on the day’s closing price position.
5. On-Balance Volume - It measures the positive and negative flow of volume.

After analyzing data, the model generated the numerical values of stock indices which were then interpreted into buy and sell signals. **EVALUATION** To prove the accuracy and stability of the model output, the buy and sell signals were used for trading simulation. The user was asked for a starting investment and number of shares to buy and sell. If the first signal is selling, the simulator ignores it until a buy signal was encountered. The simulation is a cycle of buying then selling of shares, if the current signal is similar to the previous one, the simulation is put on hold until a different signal is reached. Buying and selling outputs the product of the trade date’s closing price and the number of shares given by the user.

The simulation outputs the final revenue for each indicator. Total income or loss of a company using an indicator was computed using the formula: Income/Loss = Total Revenue – Initial Investment.

Income or Loss of the company per indicator was sorted to get the maximum value. The indicator that has the maximum value was then concluded as the most effective indicator for the company among the five evaluated indicators.

The modeling of each indicator to get the buy and sell signal and the simulation was repeated for each 357 companies to get the best technical indicator.

**RESULTS**

The simulation of 357 companies’ buy and sell signals showed that On Balance Volume (OBV) can be concluded as the best technical indicator to most Philippine companies with 91.25% of the companies declaring it as the best indicator. Accumulation Distribution Line (ADL), Momentum, Moving Average Convergence Divergence (MACD) and Stochastic got 17.0833333%, 0.4166667%, 0% and 1.25% of the 357 companies’ most effective indicator respectively.

There are instances that the system’s running time slows down. The use of array list structure was valuable on interpreting and fetching data from the database.

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| --- | --- | --- | --- |
| **MOM** | **ADL** | | **STO** |
| PTC | AAI  AGF  ATRK  BCOR  TSI  TDY  STI  SMPH | SMCP1  SMCP2F  SMC2A  RRHI  PPREF  PORT  PEP  OMW2 | ATSP  BH  NXT |

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| --- | --- | --- | --- |
| OBV | | | |
| AAA  AB  ABA  ABG  ABS  ABSP  AC  ACE  ACPB1  ACPB2  ACPR  ACR  AEV  AGI  ALCO  ALHI  ALI  ALPHA  ALT  AMC  ANI  ANS  AP  APC  APM  APO  APX  APXB  AR  ARA  ASIA  AT  ATI  ATN  ATNB  AUB  BC  BCB  BCP  BDO  BEL  BHI  ZHI  YEHEY  X  WPI  WIN  WEB  VVT  VUL  VMC  VLL  VITA  V  UW  URC | UPM  UNI  UBP  TWOGOP  TWOGO  TUGS  TOL  TFHI  TFC  TEL  TECH  TBGI  TAPET  TA  T  SUN  STR  SSI  SRDC  SPM  SPH  SPC  SOC  SMP  SMDC  SMC2E  SMC2D  SMC2C  SMC2B  SMC  SMB  SM  SLI  SLF  SINO  SHNG  SGP  SGI  SFIP  SFI  SEVN  SERVICE  SENSEX  SECB  SCC  SBS  RWM  ROX  ROCK  RLT  RLC  RFM  REG  RCM  RCI  RCB | PXP  PX  PSPC  PSEi  PSE  PSB  PROPERTY  PRMX  PRIM  PRF2B  PRF2A  PRC  PPC  POPI  PO  PNX3B  PNX3A  PNX  PNB  PMPC  PLC  PIP  PHN  PHES  PHC  PHA  PGOLD  PFP2  PFP  PF  PERC  PECB  PEC  PCP  PCOR  PCKH  PCEV  PBC  PBB  PAX  PAL  PA  OV  ORE  OPMB  OPM  OM  NRCP  NOW  NIKL  NI  MWP  MWIDE  MWC  MVC  MRSGI | MRC  MPI  MMI  MJIC  MJC  MININGOI  MIHB  MIH  MHC  MG  MFIN  MFC  MER  MEGW2  MEGW1  MEG  MED  MCP  MCB  MC  MBT  MBC  MB  MAXS  MARC  MAKE  MAHB  MAH  MACAY  MAC  MAB  MA  LTG  LSC  LRW  LRP  LRI  LR  LPZ  LOTO  LMG  LIHC  LIB  LFM  LCB  LC  LBC  LAND  KPHB  KPH  KEP  JTH  JSI  JOH  JGS KD |

**DISCUSSION**

ADL’s and OBV’s final revenues are close to each other and have a noted higher price than the three mainly because of the number of buy and sell signals they produce. Both are interpreted in a weekly basis. Their interpretation is based on the trend of the line graph from the current price to the price after a week. A buy or sell signal is consistently produced unlike the other indicators that follows conditions which limits the number of signals produced. Momentum’s buy and sell signal are determined by how the indices cross the zero line. When it crosses above the line a buy signal is produced while the sell signal is produced when it crosses below the line. The said interpretation limits the number of signals if a long range of indices stay at above or below the zero line. The same is true for stochastic but instead of buying when the indices cross the zero line, it buys when it is below the twenty (20) level and the fast line rises above the slow line. The rationale of getting sell signal is the same as getting the buy signal. When the fast line dips below the slow line at the eighty (80) level, sell signal is produced.

In the Moving Average Convergence Divergence(MACD), like the momentum its buy or sell signal are determined on how its line crosses the zero line. For its case, MACD line is the 12-period EMA while the zero line is the 26-period EMA. It produces a buy signal when the MACD line crosses above the zero line otherwise, sell signal.

Because of the number of companies, the web application’s analyzer is slow. A company can have as much as 3000 lines of data that equates to the number of days it was used in trading from 2007 to 2015. The web application’s lag time may affect the user experience.

**CONCLUSION**

This study was conducted for the investors and traders to have higher probability of getting the right prediction on their investments in the Philippines. Our proposed work applied five technical analysis indicators (Momentum, Accumulation/ Distribution Line, Moving Average Convergence Divergence (MACD), Stochastic, On-Balance Volume) on gathered past stock market data from 2007 up to 2015 in order to identify the best indicator. Array structure was used as the storing agent for the given inputs. A total of five arrays with the same length were constructed for organizing data. Date, high price, low price, closing price and volume were used as input. After analyzing data, the model generated the numerical values of stock indices which were then interpreted into buy and sell signals. These buy and sell signals can be a guide for investors in trading stocks. For the evaluation process of the study, a simulator for trading stock was made. The signals, together with the initial investment and shares to buy and sell input of the user, are the parameters for the simulation. The signals from the indicators were strictly followed in trading to have an accurate and unbiased result from the simulation. The simulation showed that OBV is the best indicator for Philippine Stock Exchange trading with \_\_% of the companies declaring it as the best indicator.

In the future, it can be suggested that an optimized way of storing and retrieving data in the database is necessary. Additional indicators that other investors want to analyze can be added. A better user-interface for a more user-friendly system is recommended. Charts that can visualize real-time analysis and simulation will improve the user experience.

**REFERENCES**

[1] Burch, C. (2011, September 7). *Stock Market Technical Analysis*. Retrieved from Simple Talk: A technical journal and community hub from Redgate: https://www.simple-talk.com/dotnet/.net-framework/stock-market-technical-analysis/

[2] Camus, M. (2015, September 25). *PH stocks continue decline | Inquirer Business.* Retrieved from Inquirer.net: http://business.inquirer.net/199721/ph-stocks-continue-decline

[3] *Financial Dictionary | Investopedia*. (n.d.). Retrieved from Investopedia: http://www.investopedia.com/dictionary/http://www.investopedia.com/dictionary/

[4] Gupta, R., Nidhi, G., & Sanjay, S. (2013). Stock Market Prediction Accuracy Analysis Using Kappa Measure. *International Conference on Communication Systems and Network Technologies* (pp. 635-639). IEEE.

[5] Hassan, M. R., & Baikunth, N. (2005). Stock Market Forecasting Using Hidden Markov Model: A New Approach. *International Conference on Intelligent Systems Design and Applications(ISDA'05).* IEEE.

[6] Jiang, R., & K.Y., S. (2003). Extraction of investment strategies based on moving averages:A genetic algorithm approach. *CIFEr'03.* Hongkong: IEEE.

[7] Kato, D., Yata, N., & Nagao, T. (2010). Evolutionary Trend Prediction using Plural Technical Indicators for Foreign Exchange Transaction. *Annual Conference 2010* (pp. 1171-1175). Taiwan: SICE.

[8] Naeini, M. P., Taemian, H., & Hashemi, H. B. (2010). Stock Market Value Prediction Usng Neural Networks. *International Conference on Computer Information Systems and Industrial Management Applications(CISIM)* (pp. 132-136). IEEE.

[9] Stankovic, J., Markovic, I., & Stojanovic, M. (2015). Investment Strategy Optimization Using Technical Analysis and Predictive Modeling in Emerging Markets. *Procedia Economics and Finance 19*, 51-62.

[10] Tanaka, M., & Tokuoka, S. (2007). Adaptive use of technical indicators for the prediction of intra-day stock price. *Elsevier B.V.*

[11] Wong, W. K., Manzur, M., & Chew, B.-K. (2010). How rewarding is technical analysis? Evidence from Singapore stock market.. *Applied Financial Economics, 13.7*, 543-551.