Buy/Sell Signal Detection in Stock Trading with Bollinger Bands and Parabolic SAR

with Web Application for Proofing Trading Strategy

Agung B. Prasetijo, Takdir A. Saputro, Ike P. Windasari, and Yudi E. Windarto

Department of Computer Engineering
Faculty of Engineering – Diponegoro University
Semarang, Indonesia
{agungprasetijo, mtakdir, ike, yudiekowindarto}@ce.undip.ac.id

Abstract—Technical analysis for stock market with its technical indicators is helpful for traders/investors to predict correct timings either for buying or selling stocks. Trading strategy can be realized with the use of selected trading indicators to know when accumulation or distribution of stocks occurs. This paper proposes trading strategies employing Bollinger Bands and Parabolic SAR indicators. A web-based application is developed to help testing the performance of the proposed strategies. Historical end-of-day (EOD) stock price for a sufficient period of time was used to back-test the proposed strategy performance. Several stocks from LQ-45 were selected to represent up-, down-, and sideway-trends. The results of the research are: the best strategy for an up-trending stock contributes to 17.06% profit and 1.19% for sideway market trend. Whilst when in down-trend, strategy #4 can minimize loss up to 2.62% than the only Bollinger Bands strategy.

Keywords—Bollinger Bands; Indonesian Stock Exchange; Parabolic SAR; Stocks

I. INTRODUCTION

The price movement of stocks can be with the use of technical indicators (e.g., RSI, MACD, BB, PSAR, and CMF). Technical analysis is the study of price in market to predict future stock trend, hence one can take trading decision or profitable investing [1]. In other words, patterns from historical data can be used to forecast future prices using extrapolation. Such indicators provide the predicted stock price in short-, mid-, and/or long-terms that helps traders/investors in trading. The selection of Bollinger Bands and Parabolic SAR is because both indicators suggest timings for an accumulation or distribution. However, the timings suggested by the Bollinger Bands may differ from the Parabolic SAR in which the Parabolic SAR is often more lagging than the Bollinger Bands.

The Bollinger Bands indicator developed by a technical trader, John Bollinger, is an indicator consisting of three lines or bands: lower-, mid-, and upper-lines. The mid line suggests a simple moving average and both lower and upper lines define price volatility based on price standard deviation from the midline [2]. The gap between the two lines widens if volatility increases, and in contrast, it narrows when decreases.

The Parabolic Stop and Reverse (SAR) developed by famous technician Welles Wilder sees the price trend based on price and time [3]. Wilder stated this Parabolic SAR as "Parabolic time/price system." To determine asset's momentum direction when such a momentum has a higher probability of turning trends. The position of dots suggests as follows: when the dots are located below the current price, the situation is considered as bullish (up-trending), otherwise, the bear period (down-trending) currently occurs. Worth to note, the reversal position of dots indicates that the trend changes.

With the use of two indicators, Bollinger Bands used as a measure of market trend and Parabolic SAR used as the momentum determinant to indicate an entry/exit point, it is expected that these two indicators generate more accurate buy/sell signal prediction. This research answers how to formulate trading strategy using both indicators (BB and PSAR) as well as suggests trading performance in three different market trends.

II. LITERATURE REVIEW

Bessembinder and Chan researched for several simple forms of trading using technical indicators in Asian markets. Rules/strategies were claimed to have a quite successful in the emerging market (.e.g. Malaysia, Thailand and Taiwan) but less power for developed markets (e.g. Hongkong and Japan) [4]. On Average, the strategies reaped 26.8% profit on annual basis.

Seviani developed a web-based decision support system for stock recommendation with Bayesian method [5]. This application is designed to maximize profit and minimize the loss in stock trading. Yazdi used Parabolic SAR to generate recommendation in Forex trading [6]. Deccasari studied the implementation of Bollinger Bands in short time transactions [7].

III. THE PROPOSED STRATEGIES

The decision for buying or selling stocks will be determined by values from the Bollinger Bands and Parabolic SAR. For trading with Bollinger Bands only, we modify the conditions for buying and selling as follow: the system generates a buy signal once the stock price at first touches the lower band. This ensures an earlier time for buying a stock. Otherwise, a sell signal is generated when the price reaches the

upper band. This increases assurance traders not missed the timing for entering/exiting from a stock. Whilst for trading with only Parabolic SAR, no modification is conducted: a buy signal is when there is a change of SAR value, from being under the stock price to the upper stock price. Otherwise, a sell signal is when there is a change of SAR value from being over the stock price to the lower stock price (see Fig. 1)

As shown in Fig. 1, the reversal values of SAR are too late if they are used as entry/exit points. The entry and the exit points are in earlier days. Meanwhile, when the stock price
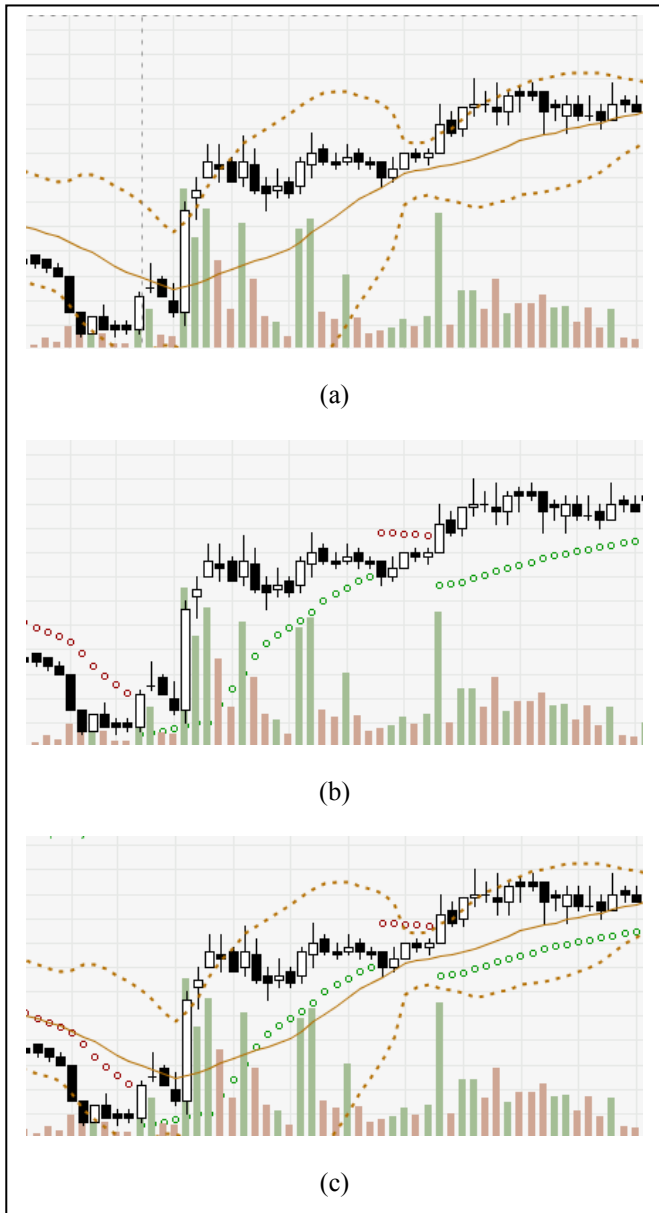

(a)

(b)

(c)

Fig. 1. Bollinger Bands and Parabolic SAR indicators overlay the ANTM stock price in a certain period of time. (a) Bollinger Bands indicator (b) Parabolic SAR indicator (c) Both Bollinger Bands and Parabolic SAR indicators

starts touching the Bollinger Bands, this will be an early indication of entry/exit points. Therefore, logically, the most probable entry/exit points are between the two conditions mentioned.

In a combination of the two indicators, a buy/sell signal is set as follows: when the Bollinger Bands generates a signal, the system delays this signal for a specific period prior to the Parabolic SAR issues the signal reversal.

The historical data is downloaded from the API provided by Google Finance (in .csv format) and imported to the database. The period of the historical data downloaded is within 1 year (October 2016 - September 2017). Several stocks are selected, and all are from LQ-45 index.

- Uptrend stocks: TLKM (PT. Telekomunikasi Indonesia, Tbk) and BBNI (PT. Bank Negara Indonesia, Tbk)

- Downtrend stocks: ASII (PT. Astra Internasional, Tbk) and ELSA (PT. Elnusa, Tbk), and

- Sideway stocks: AKRA (PT. AKR Corporindo, Tbk) and ANTM (PT. Aneka Tambang Persero, Tbk)

Note that the stocks were taken from LQ-45 (as per August 2017 data) as these stocks are sufficient in transaction volume, so the price movement may mostly smooth (having minimum abrupt changes).

Seven trading rules/strategies are proposed, where two from them are pure Bollinger Bands based and pure Parabolic SAR trading for comparison purposes.

1. Strategy #1: buy signal from Bollinger Band indicator is delayed until Parabolic SAR suggest a reversal. Otherwise for sell signal.

2. Strategy #2: similar to strategy #1 but the delayed until Parabolic SAR suggests a reversal OR Parabolic SAR equals to the middle band (average price) of the Bollinger Band. Otherwise for sell signal.

3. Strategy #3: similar to strategy #1 but delayed until Parabolic SAR suggests a reversal OR the SAR value reaches 60% of the width of the upper-lower bands' gap. Otherwise for sell signal.

4. Strategy #4: similar to strategy #3 but with SAR value reaches 70% of the upper-lower bands' gap.

5. Strategy #5: similar to strategy #3 but with SAR value reaches 80% of the upper-lower bands' gap.

6. Strategy #6: Bollinger Bands only.

7. Strategy #7: Parabolic SAR only.

Performance for every strategy will be tested and calculated with a proprietary web-based application by following the trading signals generated by every strategy at a certain period mentioned before. The performance will be the profit or loss in percentage from an initial sum of money. For example, a certain strategy is considered pocketing 10% profit when during the test period mentioned before, at an initial sum
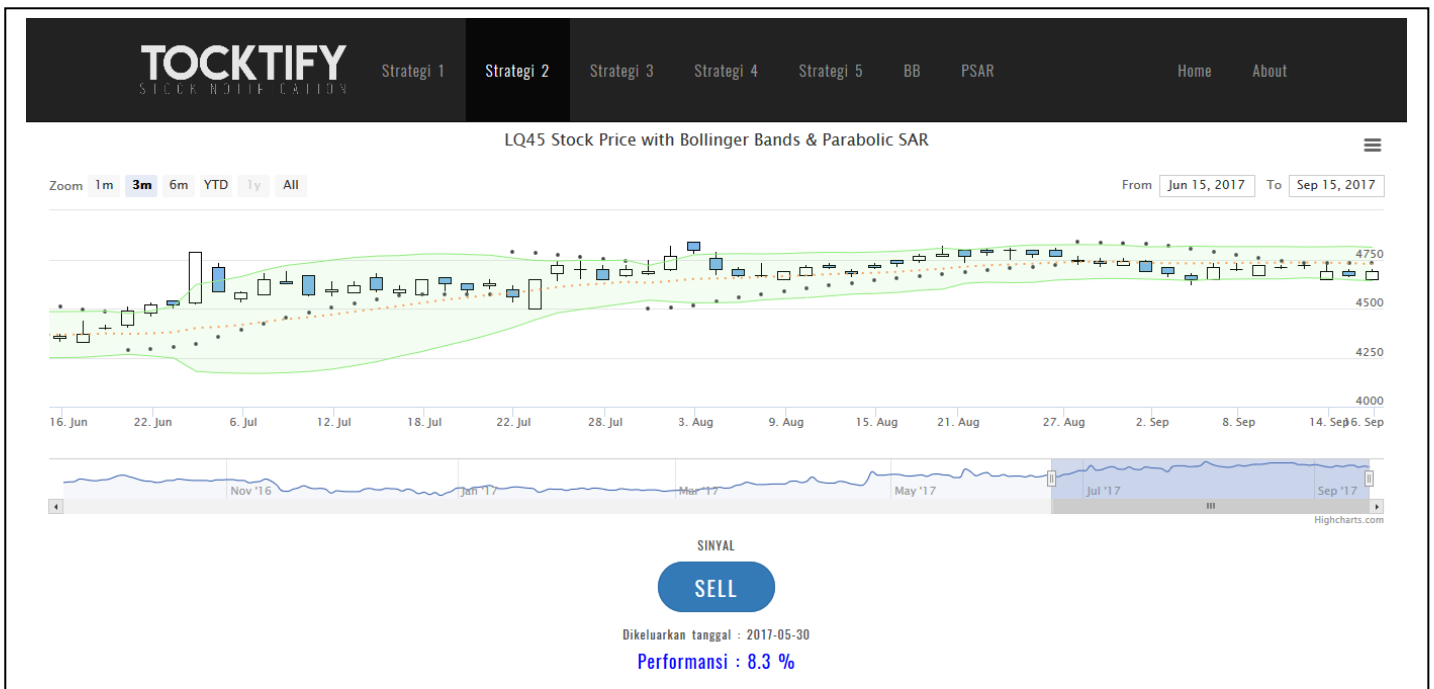
Fig. 2. The user interface for the web-based application to support the back-test strategies and signals buy/sell recommendation

of 100,000 IDR, one strategy gives an amount of 110,000 IDR profit at the end. The user interface of the application built (available in Bahasa only) can be seen in Fig. 2.

IV. RESULTS AND DISCUSSIONS

For performance back-test, historical data were downloaded for a year period. Gaps between upper and lower bands were calculated at every trading day in such a period. Likewise, the SAR values are also calculated. The back-test of the strategies reveals the performance. At an initial sum of 100,000 IDR, profit or loss (in percent) at the end of the period is recorded. Here, trading fees are not taken into account. The performance of the strategies are tested and presented according to its trends (up, down, sideway) in Table I to Table III as follows.

It is shown that in up-trending stocks, strategy #6 Bollinger Bands only significantly outperforms the other strategies (17.06%), whilst strategy #2 performance is the runner up (3.17%). In down-trend, strategy #4 shows the least loss among the strategies. The loss contributed by the Parabolic SAR when the market is down-trending is twofold compared to the other strategies.

TABLE I.   STRATEGY PERFORMANCE (PROFIT/LOSS) FOR UPTRENDING STOCKS (LQ-45 TLKM AND BBNI)

Stock Symbol	Strategy						
	#1	#2	#3	#4	#5	BBand	PSAR
TLKM	-0.27	8.3	-1.95	-1.72	0.62	10.63	-12.73
BBNI	-4.53	-1.96	1.35	-0.65	2.19	23.5	11.23
Average Profit (%)	-2.4	3.17	-0.3	-1.18	1.405	17.06	-0.75

TABLE II.   STRATEGY PERFORMANCE (PROFIT/LOSS) FOR DOWNTRENDING STOCKS (LQ-45 ASII AND ELSA)

Stock Symbol	Strategy						
	#1	#2	#3	#4	#5	BBand	PSAR
ASII	-4.9	-6.66	-4.9	-4.9	-3.73	-4.16	-22.75
ELSA	-27.84	-26.52	-26.77	-23.09	-27.1	-29.09	-38.53
Average Profit (%)	-16.37	-16.59	-15.83	-14.00	-15.41	-16.62	-30.64

TABLE III.   STRATEGY PERFORMANCE (PROFIT/LOSS) FOR SIDEWAY STOCKS (LQ-45 AKRA AND ANTM)

Stock Symbol	Strategy						
	#1	#2	#3	#4	#5	BBand	PSAR
AKRA	-9.73	-7.34	-7.34	-5.12	-4.08	1.69	-22.15
ANTM	-9.65	-6.52	-1.38	-6.47	-1.16	0.63	-5.17
Average Profit (%)	-9.69	-6.93	-4.36	-5.79	-2.62	1.19	-13.66

In a sideway trend, The Bollinger Bands strategy contributes a profit of 1.16% while the other show loss. In these three trials the Parabolic SAR consistently produces loss.

V. CONCLUSIONS

The pure Bollinger Band strategy performs the best in average. It consistently provides profit for upside and sideway trends of 17.06% and 1.19% respectively. Strategy #4 may reduce the loss up to 2.62% over the Bollinger Bands at down-trend market. The Parabolic SAR performs the worst after all in all trends.

ACKNOWLEDGMENT

REFERENCES

[1] A. Albadvi, S. K. Chaharsooghi, and A. Esfahanipour, "Decision making in stock trading: An application of PROMETHEE," Eur. J. Oper. Res., vol. 177, no. 2, pp. 673–683, 2006.

[2] J. Bollinger, "Bollinger Bands." [Online]. Available: https://www.bollingerbands.com/. [Accessed: 31-Aug-2017].

[3] "Parabolic SAR." [Online]. Available: http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:parabolic_sar. [Accessed: 31-Aug-2017].

[4] H. Bessemblinder, and K. Chan, "The profitability of technical trading rules in the Asian stock markets", Pacific-BAsin Finance Journal, Elsevier Volume 3, issues 2-3, July 1995, pp. 257-284.

[5] N. Sevani and M. Ariesta, "Web-Based Decision Support Systems Application of Stock Recommendation Using Bayesian Methods Aplikasi Sistem Pendukung Keputusan Rekomedasi Stok Berbasis Web dengan Metode Bayesian," vol. 8, no. 1, pp. 1–10, 2014.

[6] S.H.M. Yazdi and Z.H. lashkary, "Technical analysis of Forex by Parabolic SAR Indicator", International Islamic Accounting and Finance Conference, November 2012.

[7] D. D. Deccasari, "Penerapan analisis teknikal dengan metode Bollinger sebagai salah satu indikator dalam transaksi short time perdagangan saham", Dinamika Dotcom vol 5(1), pp. 64-79, 2014.