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Technical analysis of Forex by Parabolic SAR Indicator

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Abstract: In these days, trading automation is one of the major topics in the field of financial research. Buy and sell are the key rule to an automated trading system which is possible to generate by various technical indicators in Forex (Foreign Exchange) market. Each indicator has its advantages and disadvantages. The evaluation is based on application of the Parabolic-SAR indicator for four currencies namely EURUSD, GBPUSD, USDCHF and USDJPY individually to identify effectiveness of the indicator regarding to the amount of profit generated, using hourly data of market stretch from January 2001 to December 2010. Virtual Historical Trading Software (VHTS) is developed for the purpose of computing the indicator based on its original formulas and interpretations; for applying the assumptions; for trading based on buy and sell signals generated by the Parabolic SAR (P-SAR) indicator.

Keywords: *Forex, Parabolic SAR, Technical analysis, Fundamental Analysis, Indicator*

1. Introduction

Trading in foreign currencies began in 1973 following the collapse of the Bretton Woods agreement under which gold held by central banks underpinned currency values. Forex is a free market in which currency prices are based on supply of and demand for a particular currency [1].

The Forex market has several distinct advantages over other financial markets, such as: operation on a 24-hour basis 5 days a week, no fixed location, and an over-the-counter market. Besides, Forex market currently generates a daily volume of over USD 3.2 trillion thereby making it the largest financial market [2]. Any currency can be traded as long as there is no restriction by central banks issuing the currencies [3]. Ding et al. (2010) added that rapid technological changes to increase efficiency in Forex transactions have enabled the market to grow at a tremendous pace by reducing entry and transaction costs as well as overcoming geographical limitations.

1.1. Fundamental Analysis in Forex Trading

Fundamental analysis (FA) is a method of determining asset valuation based on key underlying factors. For Forex transactions, significant factors are economic indicators of a country and predictions of future economic performance which would provide a basis to determine that country's currency's value. Emphasis is also placed on interest rate differentials between that country and other countries to arrive at a fair value of the currency, fundamentalist is an agent who trade by utilizing fundamental analysis [4].

1.2. Technical Analysis in Forex

Technical analysis (TA) or charting arrives at future currency price movements by using historical data generated by market and usually include price and volumes [5]. Although TA in general has been used for more than hundred years, the field had received scant attention until recently by academicians who had been more focused on fundamental approaches [6-8]. There are two main analytical concepts for TA; quantitative and qualitative. The quantitative- based analysis attempts to generate indicators such as MACD and P-SAR while the qualitative-based analysis relies on elucidation of the shape of geometric patterns like levels of support and resistance and double bottoms[7]. Successful TA is built on these three essential principles [1]:

1.3. Profitability

Many studies show that TA provides valuable financial signals [8] and recent empirical studies also provide increasing support for TA. Furthermore, the following researchers agree with this fact; Sweeney (1986, 1988); Brock, Lakonishok, and LeBaron (1992); Blume, Easley, and O'Hara (1994) ; Neely, Weller, and Dittmar (1997); Chan, Jegadeesh, and Lakonishok (1996, 1999); Gencay (1996, 1998, 1999); Brown, Goetzmann, and Kumar (1998); Rouwenhorst (1998); Neely and Weller (1999); Chang and Osler (1999); Lo, Mamaysky, and Wang (2000); Chan, Hameed, and Tong (2000); and Hsu and Kuan (2004) [9-18].

Their findings imply the popularity of TA over FA is due to the fact that the former can “beat the market”.

Moreover, (Papadamou and Tsopoglou, 2001) indicated that TA approach can generate higher profit against a simple “buy and hold” strategy which is a fundamental analysis [19]. They have assessed USDDEM and USDGBP in their study for about 8 years from 1989 to 1996 to find out whether TA is profitable. Also, according to Lui (1998), more than 85% of Forex traders in Hong Kong using both fundamental and technical analysis together to forecast future price movements but they believe TA is more useful in predicting trends than FA [20].

2. Indicators

Indicators are mathematical computations based on currencies data such as volume and prices (opening, low, high and closing) with a specific formula. The value of result is used to forecast upcoming changes in prices. They are used to provide clearer and extra information about market to be used by investors to make better decisions. Indicators are classified to four main categories based on their functions; trend indicators, volume (strength) indicators, volatility indicators and momentum indicators as follow [5].

2.1. Trend Indicators

Trend is a term used to explain the persistence of exchange-rate movement over time in one direction. There are three directions for trends; sideways, down and up. Trend indicators level variable rate data to generate a combination of market direction. Moving Averages (MA), MACD, P-SAR and Trend lines are some example of Trend Indicators.

2.2. Volume (Strength) Indicators

Market strength illustrates the market attitude intensity with reference to a rate by inspecting the market positions in use by a variety of buyers and sellers. The basic data to compute these indicators is volume. Their hints for buyers and sellers are coincident or leading the market. Volume, Money Flow Index (MFI), On-balance volume (OBV) and Force Index (FI) are some example of Volume Indicators.

2.3. Volatility Indicators

Volatility is a common term used to explain the size or magnitude of tick-to-tick price oscillation independent of their trend direction. By and large, variations in volatility tend to direct variations in prices. Average True Range (ATR), Bollinger Bands (BB) and Standard deviation (σ) are some example of Volatility Indicators.

2.4. Momentum Indicators

Momentum is a general term used to illustrate the rapidity at which rates move over a particular time period. Momentum indicators specify the weakness or strength of a trend as it grows over time. Momentum indicators provide clear signals

for market participants. Relative Strength Index (RSI), Stochastic Oscillator (STOCH) and Williams’ %R are some example of Momentum Indicators.

2.5. Function of Indicators

Thus, there are many indicators in market with different formula and usage. The main function of them is giving signal to enter; open the buy or sell orders, and exit; close the opened orders from market. Since, finding the optimum point of price to buy or sell is the main concern of traders, indicators are trying to solve this problem and they are used to find the best point of price for buying or selling. There are several indicators which are more popular among traders such as Moving Averages; Bollinger Bands; Relative Strength Index (RSI); P-SAR (Stop And Reverse); Moving Average Convergence/Divergence (MACD); and Stochastic Oscillator.

3. P-SAR

The P-SAR first introduced in 1978 by Welles Wilder, Jr. in his book, “New Concepts in Technical Trading Systems”. The components of P-SAR are time and price. The expression of “parabolic” is used in the P-SAR because when run for a chart make a parabola with a string which made by spots. In addition to that, “Stop and Reverse” abbreviated to “SAR” which is the main characteristic of this indicator; when touched by price, it stops the present parabola and reverses the dots to make another one. Calculation of P-SAR is easy, although it is complicated. LO SIP stands for low significant point while HO SIP stands for high significant point in a SAR cycle. The first point in each SAR cycle equals to either the LO SIP or HI SIP of the previous SAR cycle so that the value of starting point of each SAR cycle equals to LO SIP when downward P-SAR reverses to upward, and vice versa as given in Equation 1.

$$SAR_1 = LO\ SIP_{Previous} \text{ or } HI\ SIP_{Previous} \quad (Eq. 1)$$

Besides, Upward and Downward SAR are calculated according to the aforesaid factors differently as given in Equations 2 and 3. Note that for calculating the value of the rest of the SAR cycle (not the first point), SIP is determined by checking the same SAR pattern with respect to the SAR situation; upward or downward.

$$\text{Upward: } SAR_{Current} = SAR_{Previous} + AF (LO\ SIP_{Previous} - SAR_{Previous}) \quad (Eq 2)$$

$$\text{Downward: } SAR_{Current} = SAR_{Previous} - AF (SAR_{Previous} - HI\ SIP_{Previous}) \quad (Eq 3)$$

As can be seen in Figure 1, every time the price contacts the SAR, it reverses to the converse trend telling an entry signal opposed to the previous trade.



Figure1: SIP points in a SAR cycle

AF; acceleration factor, starts at 0.02 and whenever the SIP varies in a cycle of Parabolic SAR, the new AF calculated by adding 0.02 to the previous AF while AF does not exceed 0.20. These assumptions are default and could be adjusted by traders [21].

3.1. PSAR Critical factors

The critical factors of P-SAR are time and price. P-SAR gives clear signals to traders and its interpretation is so simple and easy. Whenever the P-SAR changes its direction, a signal is generated as shown in Figure 4. In this study, if the value of SAR is downward in the first hour and reverses the direction to upward in second period, there is a buy signal in third hour. In addition to that, if the direction changes from upward to downward the signal is considered the sell signal [21].



Figure 4: Buy and sell signal from P-SAR indicator

3.2. P-SAR advantages and Properties

P-SAR is not useful for short term fluctuations in a choppy market but it is useful over real trends lasting several hours or days. This indicator helps to maximize profits with free forex charts. Also, the P-SAR is more capable in whipsaws in the market and it can generate a large volume of losing signals in the stock with trading sideways (up and down rapidly). It means, this indicator works very well for buying and selling in trending markets only.

One of the other benefits of this indicator is the mechanical nature of the signals given with little to no interpretation necessary. Dislike to most of the technical analysis tools, it is unambiguous and clear in the signals given.

Totally, we can highlight four major attributes and properties for P-SAR indicator namely:

- Good for trending markets

- Creates an objective trading environment
- Clear signals
- Great for exits

4. Scope of the Study

The data used in this study are real and worldwide some which are selected within the scope of this study; trading on hourly basis and for 10 years starting from January 2001 until December 2010. The hourly data for ten years makes it huge with more transaction to have reliable results. This study is conducted to evaluate the one main indicator for predicting the market in order to buy or sell on the right time to gain profit and avoid loss.

Four currencies; EURUSD, GBPUSD, USDJPY, USDCHF are evaluated with the employment of P-SAR at which buy and sell signals are identified. Period of the study is ten years starting from January 2001.

To avoid the effects of one indicator on the other's result, the currencies evaluated separately. It means for each currency, indicator applied and evaluated separately; so there are one indicator and four currencies and combination of them are four cases which are called traders. Thus, there are four virtual traders that each one working just with the indicator and currency.

5. Methodology, Data Acquisition and Assumptions

The research areas on this project are based on the preface and literature review prior this chapter. This chapter will outline the research design for this project and the way in which the research was accomplished. The methodology as presented in Figure 2 has been adopted in order to meet the objectives of this study.

Data types required for the current study are hourly opening, high, low, closing prices and trade volume for four currencies within 24 hours a day of weekdays from January 2001 to December 2010. The data are obtained from online data base of Foreign Exchange Market on MetaTrader software.

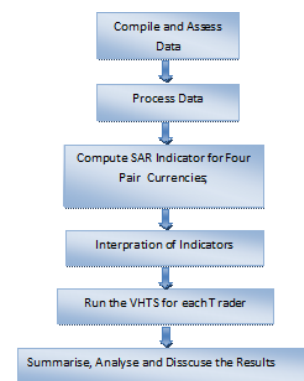


Figure 2: The research process flow diagram

The data from this online data base are exported into the spreadsheets including over 60,000 rows for each currency; frequency is hourly (period 2001-2010). An example of the data on MetaTrader software is shown in Figure 3. After

compiling the data, they are analyzed and processed. It covers the first research question: what are the volume and open, high, low and close prices for each currency in hourly basis for the years 2001 -2010.

Time	Open	High	Low	Close	Volume
2010.12.07 22:01	1.3260	1.3268	1.3254	1.3264	590
2010.12.07 21:00	1.3273	1.3276	1.3257	1.3261	1187
2010.12.07 20:00	1.3285	1.3291	1.3266	1.3273	2722
2010.12.07 19:00	1.3304	1.3314	1.3282	1.3285	2413
2010.12.07 18:00	1.3300	1.3316	1.3285	1.3303	2732
2010.12.07 17:00	1.3321	1.3339	1.3294	1.3301	2253
2010.12.07 16:00	1.3244	1.3244	1.3313	1.3222	1905
2010.12.07 15:00	1.3261	1.3272	1.3222	1.3243	2465
2010.12.07 14:00	1.3385	1.3400	1.3362	1.3362	2078
2010.12.07 13:00	1.3360	1.3397	1.3358	1.3384	1873
2010.12.07 12:00	1.3364	1.3395	1.3359	1.3361	1076
2010.12.07 11:00	1.3259	1.3277	1.3253	1.3263	1123
2010.12.07 10:00	1.3281	1.3295	1.3255	1.3260	1232
2010.12.07 09:00	1.3259	1.3261	1.3238	1.3260	1500
2010.12.07 08:00	1.3205	1.3232	1.3228	1.3238	1970
2010.12.07 07:00	1.3225	1.3247	1.3311	1.3236	1400
2010.12.07 06:00	1.3244	1.3248	1.3212	1.3224	1706

Figure 3: An example of the data on MetaTrader software

MetaTrader is one of the key tools for this study. It is Forex trading online software which widely used by foreign exchange traders. The traders can sell or buy via this online software. To provide facility for traders, MetaTrader generates the graphs and charts of the indicator based on live and historical data.

The other tool is used for analysis and processing the data, is Microsoft Excel software. Since the data are wide and calculations are based on each item, Virtual Historical Trader Software (VHTS) is developed based on Microsoft Excel to apply assumptions and trade based on them on historical data. Moreover, to cover the lack of Microsoft Excel formulas and to increase accuracy of calculations, TA-Lib program is added to Excel. It is a program which adds indicator's formulas to Microsoft Excel function list.

VHTS is developed for application of assumptions in order to create a virtual circumstance for investors to trade like real trading on historical data considering the assumptions. VHTS has ability to calculate indicator for each row or period of spreadsheet based on given data. Besides, it can open and close sell and buy orders based on assumptions and signals created by indicator. Finally, it can calculate profit/loss for all and each order.

Empirical method has been applied for evaluating the profitability of using SAR indicator applied on four currencies. After collecting historical data from Meta Trader software the data are assessed to make sure they are the required data. The assessed data are used to calculate indicator. This indicator is calculated in VHTS with its unique formula which is explained and default assumptions suggested by its inventor. To prevent any error and mistake in VHTS, all formulas and assumptions have been rechecked and the software has been run several times to make sure that the results are correct and reliable. It covers the second research question: what are the hourly values of the selected indicators for each currency.

6. Data Collection and Assumptions

After computing and interpretation the data, from 2001 till 2010, based on P-SAR indicator, VHTS generated the results

as shown in Table 1. However, the results are different for each currency; it is considerable that the circumstances of all currencies for using P-SAR are the same; trading with the same assumptions and interpretations. Moreover, the results indicate that P-SAR is not a suitable indicator for these currencies with applying its interpretations considering this study's assumptions. However, application of P-SAR for EURUSD is the most profitable result compared to other currencies since it generated 1459 pips profit. Although, this profit could not increase the capital a lot due to time which it is created.

Table 1 demonstrates results of implementing P-SAR for four different pair-currencies which are shown in four separate columns. First three rows are showing produced profit that is split to two parts, sell and buy profit. The same thing is displayed for loss in second three rows. The third three rows are demonstrating total profit/loss and its sell and buy division. Fourth three rows are showing the number of sell and buy transactions and total number of transactions for each pair-currency. Finally, the last three rows are displaying ending balance, last trading date and paid commission to broker.

The following assumptions are considered in this study in order to unification the twenty traders' condition. With the employment of these assumptions, each trader will be isolated from everything that can deflect the results. These assumptions have been chosen based on researcher's experiences in Forex market and studying Forex market, capital management and risk management to make the result comparable and unified.

- Trading period is ten years starting from 1st January of 2001. It is because for less than ten years period the results are not reliable and useful. In addition, more than that the data become huge and difficult to process them and out of scope of this study.
- Traders can only trade one of the four pair currencies which are EUR/USD, GBP/USD, USD/JPY and USD/CHF. These currencies are chosen because according to Oh (2007) European, North American and Japan Forex market efficiency is higher than the other foreign exchange market and it helps to eliminate effects of other variables on results.
- Traders cannot open more than one position at the same time and upon a new order, the previous order would be closed if still is open.
- Take profit (TP) and stop loss (SL) for each order is 30 pips. It reduces the risk of losing big amount and of course makes the profits small too.
- The volume of order cannot be more than 7% of the traders' capital balance. This assumption is to reduce lack of capital risk when the fluctuation and volatility are high.
- Initial capital for each trader is \$10,000
- Trading time is 24 hours and 5 days a week and upon receive the buy or sale signal from the P-SAR
- If a position do not reach to its level of take profit or stop loss and there is no new order, the order will be closed automatically after 10 periods (hours) and profit/loss is calculated based on the last 10 hours.
- There is no limitation in amount of each order since it is 7% of the capital balance.

- Minimum order is 0.01 of the lot

Table 1: Summary of the final outcomes using P-SAR indicator and its related interpretations for the years 2001 to 2010

Indicator	Parabolic SAR			
	EURUSD	GBPUSD	USDCHF	USDJPY
Sell Profit (pip)	33,344	22,173	15,065	29,973
Buy Profit (pip)	34,173	23,275	17,368	28,810
Total Profit (pip)	67,517	45,448	32,433	58,783
Sell Loss (pip)	(33,778)	(25,863)	(19,517)	(28,912)
Buy Loss (pip)	(32,280)	(24,659)	(17,345)	(29,302)
Total Loss (pip)	(66,058)	(50,522)	(36,862)	(58,214)
Profit/Loss (pip)	1,459	(5,074)	(4,429)	569
Profit/Loss Sell (pip)	(434)	(3,690)	(4,452)	1,061
Profit/Loss Buy (pip)	1,893	(1,384)	23	(492)
Buy counter	2,470	1,683	1,182	2,205
Sell counter	2,497	1,692	1,196	2,228
Total Orders	4,967	3,375	2,378	4,433
Ending Balance	10,715.06	142.95	141.73	4,590.59
Date of Closing Trader	2010.12.31	2007.08.07	2005.07.21	2010.12.31

7. Process

Results and discussion is presented according to the research methodology format: data collection and assessing; data processing; calculating the P-SAR with the aid of Virtual Historical Trading Software (VHTS). Then buy and sell signals from interpretations of the indicator for the four currencies EURUSD, GBPUSD, USDCHF and USDJPY have been determined. After that, the trading software based on the assumptions has been run to obtain profit/loss of each currency regarded to application of the indicator, so there are four virtual traders.

7.1. EURUSD

With the employment of P-SAR for EURUSD in order to identifying the signals to enter and exit the market, 4967 orders include 2470 buy orders and 2497 sell orders has been proceeded. Total numbers of buy and sell of EURUSD with the employment of P-SAR indicator during ten years (2001-2010) is presented in Figure 5.



Figure 5: Final percentage of EURUSD buy and sell using P-SAR indicator for the years 2001 to 2010

The ordering did not stop during 10 years period of this study which show the capital could reach to end of project. Moreover, the total profit generated by buy orders is 1893 pips which is resulted from 34173 pips profit and 32280 pips loss while the total loss created by sell orders is 434 pips which is resulted from 33344 pips profit and 33778 pips loss. The 1459 pips profit generated by 434 pips loss from sell transactions and 1893 pips profit from buy orders. Application of P-SAR for EURUSD is more effective compared to other three currencies in term of high profitability.

Table 2: Yearly outcome of EURUSD trading using P-SAR indicator

Year	Profit/ Loss Buy	Profit/ Loss Sell	Profit/ Loss
2001	(183)	424	241
2002	265	(946)	(681)
2003	277	646	923
2004	624	(514)	110
2005	(53)	766	713
2006	(846)	(71)	(917)
2007	(2)	(361)	(363)
2008	387	(25)	362
2009	1,255	(621)	634
2010	169	268	437
Total	1,893	(434)	1,459

The more detail results of using this indicator for EURUSD is given in Table 2 and as it is clear from the Table, 1459 pips profit created within first 10 years. It indicates that even though in most of the year buy and sell signal made loss but the generated profits were enough to cover losses and result an overall profit.

7.2. GBPUSD

There are 3375 transactions including 1683 buy and 1692 sell orders which are created by employment of P-SAR indicator for GBPUSD that continued trading until 2007 August. Total numbers of buy and sell of GBPUSD with the employment of P-SAR indicator during seven years (2001-2007) is presented in Figure 6.

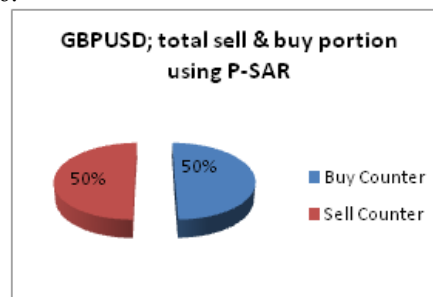


Figure 6: Final percentage of GBPUSD buy and sell using P-SAR indicator for the years 2001 to 2007

As a result of those transactions 5074 pips loss has been made which included 45448 pips profit and 50522 pips loss. In other

word, 3690 pips loss of sell transactions and 1384 pips loss of buy transactions created 5074 pips total loss within seven years. The 3690 pips loss which created by sell transactions included 22177 pips profit and 25863 pips loss. While, the 1384 pips loss generated by buy orders included 23275 pips profit and 24659 pips loss.

Yearly details of profit and loss using the foresaid indicator for GBPUSD are presented in Table 3. The table shows the progress of the 5074 pips loss production within seven years. As it is clear in Table 3, both sell and buy signals created loss however the loss generated by sell signal is almost triple of buy signals' loss.

Table 3: Yearly outcome of GBPUSD trading using P-SAR indicator

Year	Profit/Loss Buy	Profit/Loss Sell	Profit/Loss
2001	(781)	520	(261)
2002	(175)	(707)	(882)
2003	463	(982)	(519)
2004	110	(628)	(518)
2005	(947)	(1,086)	(2,033)
2006	189	(330)	(141)
2007	(243)	(477)	(720)
Total	(1,384)	(3,690)	(5,074)

7.3. USDCHE

With the implement of P-SAR for USDCHE in order to discovering the signals to buy and sell the market, 2378 orders include 1182 buy orders and 1196 sell orders has been proceeded. Total numbers of buy and sell of USDCHE with the employment of P-SAR indicator during five years (2001-2005) is presented in Figure 7.

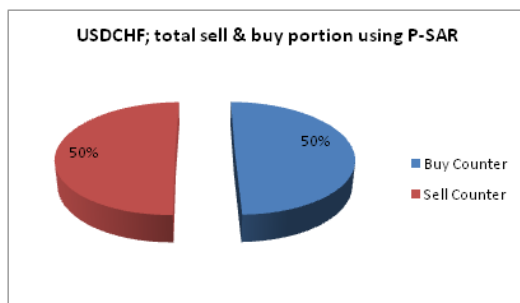


Figure 7: Final percentage of USDCHE buy and sell using P-SAR indicator for the years 2001 to 2005

The ordering stopped after five years since the capital was not enough to continue the trading. It means trading with P-SAR results loss more than profit and it caused decreasing capital while the time is passing. Moreover, the total profit created by buy orders is only 23 pips which is resulted from 17368 pips profit and 17345 pips loss while the total loss created by sell orders is 4452 pips which is resulted from 15065 pips profit and 19517 pips loss. Finally, there are 4429 pips loss created by sell and buy orders from 32433 pips profit and 36862 pips loss.

Table 4: Yearly outcome of USDCHE trading using P-SAR indicator

Year	Profit/Loss Buy	Profit/Loss Sell	Profit/Loss
2001	(5)	(1,169)	(1,174)
2002	(163)	(832)	(995)
2003	(232)	(815)	(1,047)
2004	488	(713)	(225)
2005	(65)	(923)	(988)
Total	23	(4,452)	(4,429)

As it can be seen in Table 4 all transactions created loss during the five years period of trading except buy orders in 2004 which made profit and it was enough to cover all loss of buy signals and generate overall profit for buy orders.

7.4. USDJPY

P-SAR signals for USDJPY results 569 pips profit which included 58783 pips profit against 58214 pips loss and the trading period did not last within the ten years. This 569 pips profit contained 1061 pips profit from sell transactions and 492 pips loss from buy transactions. There are 2228 sell orders and 2205 buy orders generated by P-SAR interpretations. Total numbers of buy and sell of USDJPY with the employment of P-SAR indicator during ten years (2001-2010) is presented in Figure 8.

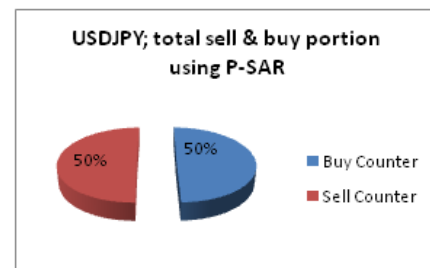


Figure 8: Final percentage of USDJPY buy and sell using P-SAR indicator for the years 2001 to 2010

Moreover, these sell orders made 1061 pips profit which includes 29973 pips profit and 28912 pips loss while buy transactions generated 492 pips loss which includes 28810 pips profit and 29302 pips loss. Table 5 showing the yearly details of buy and sell transactions, demonstrates that the sell orders worked better than the buy orders and there is overall profit for sell transactions that could cover buy orders' loss. However, buy transactions generate profit in five years but it was not enough to cover the loss and there is overall 492 pips loss for buy orders.

Table 5: Yearly outcome of USDJPY trading using P-SAR indicator

Year	Profit/Loss Buy	Profit/Loss Sell	Profit/Loss
2001	(323)	(196)	(519)
2002	(342)	256	(86)
2003	(285)	650	365
2004	28	(84)	(56)

2005	628	(288)	340
2006	730	(894)	(164)
2007	322	23	345
2008	(918)	326	(592)
2009	(371)	720	349
2010	39	548	587
Total	(492)	1,061	569

8. Analysis

Final profit/loss of all four currencies trading with the employment of P-SAR indicator for the period of ten years (2001-2010) is presented in Figure 9.

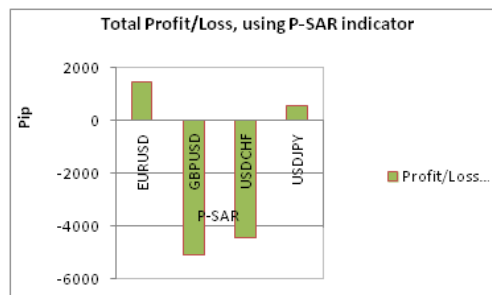


Figure 9: Final profit/loss with the employment of P-SAR Indicator for trading the four currencies within ten years (2001-2010)

9. Conclusion

Effectiveness of the P-SAR indicator for four pair currencies; EURUSD, GBPUSD, USDCHF and USDJPY based on profitability of the buy and sell signals has been evaluated.

To unify the trading condition in order to make the results comparable, a series of assumptions has been applied as follows:

- Trading period was ten years starting from 1st January of 2001.
- Traders can only trade one of the four pair currencies which are EUR/USD, GBP/USD, USD/JPY and USD/CHF.
- Traders cannot open more than one position at the same time and upon a new order, the previous order would be closed if still is open.
- Take profit and stop loss for each order is 30 pips.
- The volume of order cannot be more than 7% of the traders' capital balance.
- Initial capital for each trader is \$10,000
- Trading time is 24 hours and 5 days a week and upon receive the buy or sale signal from the indicators
- If a position do not reach to its level of take profit or stop loss and there is no new order, the order will be closed automatically after 10 periods (hours) and profit/loss is calculated based on the last 10 hours.
- There is no limitation in amount of each order since it is 7% of the capital balance.
- Minimum order is 0.01 of the lot.

These assumptions have been chosen based on researchers' experiences in Forex market and studying Forex market,

capital management and risk management to make the result comparable and unify. The following findings have been obtained from the current study:

- The most effective combination of P-SAR-Currency regarding generation of profit has been identified to be P-SAR-EURUSD with considering the assumptions of this study. P-SAR performed well with EURUSD as it has created \$10,715.06 cash at the end of ten years period of trading (Table 1).
- The other finding was that the total profit generated by buy signals for all four traders is 40 pips however sell signals generate 7,515 pips loss which the difference is considerable. It shows P-SAR produces more profitable buy signals than sell signals.

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