Using technical analysis indicators in the terms of currency hedging

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Abstract Static hedging methods used just plain vanilla derivates and their combinations with no revision during hedged period. As hybrid hedging methods is considered using indicators of technical analysis for prediction of spot price in future and on the basis of this prediction it is decided between hedge company portfolio or stay unhedged.

For prediction are used these indicators: moving average, Relative Strength Index and Stochastic. Main goal of this work is to use technical analysis indicators for prediction currency pair value and on the basis of this prediction get positive part of risk. Effects of this strategy to cash flow of one hedged crown are tested on 11 years long time series of CZK/EUR currency pair. Starting days of historical testing are changed severa times due to providing better information. It helps us to find out hit ratio of this method. Further testing is advised.

1   Introduction

Economics is a science where every rule every condition and every principle happens in the terms of probability. It means that we can not easily be sure about future. This elementary fact has to be realized by any decision making.

Events have their probability and are connected with risks. Risk is a deviation from expected situation which could be positive or negative. For example volatility of stock prices or commodity prices could have an effect (positive or negative) on cash flow of a company. It causes that medium and large companies have usually specialized department which is concentrated on risk management. Total risk can be divided between systematic and non-systematic risk. Non-systematic risk is connected with a specific asset and can be eliminated by diversification. Systematic risk is joined by whole market and only way how to lower it is a hedging. This text is focused on currency hedging using technical analysis indicators (e.g. Lo, Mamaysky, Wang [6]) as a tool for prediction which helps economics subjects to improve cash flows.

Using hedging eliminates negative and positive part of risk. Aim of this article is to quantify getting positive part of risk by using technical analysis indicators as moving average, Relative Strength Index and Stochastic. It will be tested on eleven years long time series of CZK/EUR currency pair.

Theoretical part is divided into two sections. Risks and basic classification is described in the first section. The rest of the first section is focused on hedging. Next section targets technical analysis. Described indicators are moving average. Relative Strength Index and Stochastic. Application of the technical analysis in currency hedging is evaluated in the last section. Achieved results are complied with a critic. Summary and implications are in conclusion.

2   Risks

Risk is a deviation of expected state which could be positive of negative. Corporations which make business in mining raw materials, manufacturing or providing services undergo risks joined by their entrepreneurial activity – e.g. Dubofsky and Miller [2].

Then there is a financial risk. This type of risk is connected with financial assets. Financial risks can have huge impact on company cash flows – e.g. Stulz [7]. The parting of the financial risks is in figure 1.

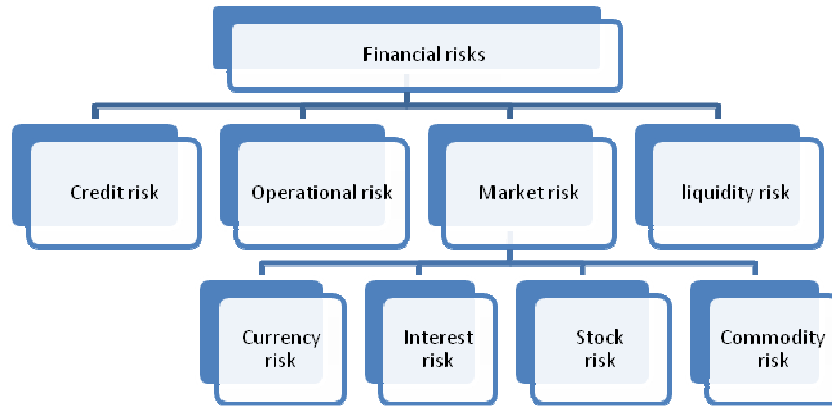[1] VSB-Technical University of Ostrava, finance, Sokolská 33, Ostrava, R.Kolar@seznam.cz.

Figure 1 Classification of risks

Credit risk is caused by default of other side of agreement or contract. Operational risk is joined with failure of system or human factor. Market risk is connected with specific type of asset as it is seen in the Figure 1. At the end there is liquidity risk which is caused by not having enough current assets to pay debts or other liabilities. By the way of elimination there are systematic and non-systematic risks which are described in introduction.

There are many types of risks as it is seen in Figure 1. In practical part of this text will be described method using chosen technical analysis indicators for getting positive part of chosen risk in the terms of hedging. It is necessary to describe hedging and its basic classification.

3 Hedging

Key point about hedging is creation of a portfolio which consists of risk asset and one or more other assets with inverse payoff function. Hedgers try to eliminate influence of volatility of the risk asset to value of portfolio – e. g. Stulz [7]. Value of the hedge portfolio can be evaluated by followed equation:

$$\Pi_t = Q \cdot S_t - h \cdot N \cdot f_{t,T} \tag{1}$$

Π_t is value of the portfolio. S_t s price of risk asset at time "t" and $f_{t,T}$ is price of financial derivate used for hedging. Q represents quantity of risk asset and N represents quantity of underlying asset per unit of financial derivate. Last symbol is h which represents hedge ratio.

There are many ways how to class hedging strategies. Classification can be following:

According to hedging level:

- perfect hedging,
- super hedging,
- partial hedging,
- unhedged portfolio.

According to frequencies of revisions:

- continues,
- discrete.

According to type of eliminating risk:

- total risk,
- systematic risk,
- market risk,
- credit risk,
- operational risk.

According to number of revision during time:

- static hedging,
- dynamic hedging.

Corporations can use internal methods of hedging or external methods of hedging. AS the internal hedging methods can be considered netting, matching, lagging, leading, monetary diversification and set up of agree-

ments. External methods of hedging use financial derivates to close up risky position. Financial derivates are wide group of assets which can be specified as agreements between two parties with different number of conditions vide Hull [4].

There are many ways how companies can hedge against different type of risk. Technical analysis indicators give corporations information about future spot price o asset with some probability. Used indicators are described in next section.

4 Technical analysis

Using technical analysis for predicting development of assets price is known for a long time. There are a lot of books and articles about using or testing it – e. g. Elder [3]; Blume, Lawrence, David Easley and Maureen O'Hara [1]; or Lo, Mamaysky, Wang [6] etc. .

In practical part of the text are described methods using indicators of technical analysis for a prediction. On the basis of the prediction company decides between staying unhedged or be hedged.

There are two quite huge approaches how to analyze charts by technical analysis. The first one are technical formations in charts as double bottom, support/resistance, trend lines etc. Conception of technical formations is too subjective. On the other hand there are indicators which are calculated by more or less difficult algorithms vide Elder [3]. There are used these indicators: moving average. Relative Strength Index and Stochastic.

Moving averages (further also MA) are used by statistic science for a long time. This indicator displays directly into price chart. Formula of simple moving average is following:

$$SMA(N) = \frac{p_t + p_{t-1} + \ldots + p_{t-N}}{N} \tag{2}$$

where N is period of moving average and P_t is symbol for price of assets.

Relative Strength Index (further RSI) is the indicator which develops into their oven secondary chart. Curve of RSI oscillates between 0 and 100. The first step for calculation is to count upward change and downward change. There is a formula for upward change:

$$U = P_t - P_{t-1}; D = 0 \tag{3}$$

Where U is absolute upward change and D is absolute downward change which is 0. In the same analogy is counted downward change which formula is followed:

$$D = P_{t-1} - P_t; U = 0 \tag{4}$$

Symbols are the same. Next step is to count Relative Strength by this formula:

$$RS = \frac{MA(U, N)}{MA(D, N)} \tag{5}$$

Where $MA(U,N)$ is moving average upward changes during the period and $MA(D,N)$ is moving average of downward change during the period. RSI is counted by this formula:

$$RSI = 100 - \frac{100}{1 - RS} \tag{6}$$

Stochastic also oscillates in secondary chart between 0 and 100 but way how to calculate them is different. This indicator uses two curves (%K and %D). %K curve also known as pure Stochastic can be calculated by this formula:

$$\%K = \frac{C_t - P_{low, n}}{P_{high, n} - P_{low, n}} \tag{7}$$

where C_t is today close price, $P_{low,n}$ is the lowest price during the period and $P_{high,n}$ is the highest price during the period. %D Stochastic is calculated as an exponential mowing average of %K Stochastic with period 3 vides Elder [3].

5 Using of indicators of technical analysis in the terms of hedging

Hedging is about effort to minimize risks but indicators of technical analysis can be used for prediction of future price of any assets. On the basis of the prediction company can decide about be hedged or staying unhedged (trying to get positive part of risk). Let´s calculate how useful the described indicators can be.

We have to mention some general information about hedged position at the beginning of this section. Total amount of an asset was 60 300 000 EUR. For short hedge were used these financial derivates: short forward, put option. There were also used these option spreads: long strangle, long straddle, strip, strap. Using the short forward for hedging contributed to stabilized cash flows. On the other hand using put options and options spreads leads to higher volatility of cash flow with some probability to reach gain. All further information is in Kolar [5]. Results of using technical analysis indicators will be calculated in Crowns per one hedged Euro. Whole procedure of testing is described in following paragraphs.

There are many technical analysis indicators and described ones before are just small sample. Each of these indicators instead of moving average oscillates between 2 extreme values and it causes that there are one exact middle value (between extremes) which is used as a border. If the value of indicator is below this border, it will be considered as a signal for decline of CZK / EUR and vice versa. Moving average does not oscillate in its own chart and this is why the prediction is a little bit different. If the moving average is below current parity of CZK / EUR, it will be considered as a signal for a rise and vice versa. RSI and both Stochastics are computed in their origin settings. The best Settings of moving average have to be found out.

For testing of indicators' hit rate is used historical time series CZK / EUR from 1 January 2000 to 31 December 2011 (daily data). Indicators' values will be calculated for each day of 11 years long time series. In order to above mentioned scheme they will be used for prediction. We suppose that value of indicator today predicts value of parity in 21 working days. For example suppose that starting day is on 31 March 2000 and indicators' values are used for prediction of the parity CZK / EUR on 2 May 2000 (period lasts 21 working days). Starting day will be several times changed which gives us better information about this strategy.

Now we know how to use indicator for prediction. But there is no specification of company. In next section is supposed Czech company which has receivable in Euros. If the indicator predicts rise in parity CZK / EUR, company stay unhedged to proof cash flows and vice versa. There is no need for quantification of monetary exposition (results will be calculated in CZK per on hedged Euro). Used hedging method in case of predicting decrease of the parity is also not important because this article is focused on using technical analysis indicators and their contribution to company's cash flow.

According to above mentioned assumption were calculated cash flows of hedging strategies using indicators of technical analysis. Starting day is 31 March 2000. Results are in Table 1 (results are in crowns for one hedged euro). During eleven years long time series there are 149 observations. For better information about using indicators we can change starting day a find out how results will change.

Year	Non-hedged	MA	RSI	%K	%D
2000	-0.9450	-1.0850	-0.2550	-0.1000	-0.1700
2001	-1.5400	-1.2700	-1.1050	0.0000	0.6150
2002	-1.9100	0.1800	-1.0900	1.5500	1.4800
2003	1.3300	1.1250	1.0000	0.7400	1.3250
2004	-1.7750	-0.3150	-0.0550	0.6300	0.3600
2005	-1.8300	-1.1050	-0.1650	-0.2600	0.2200
2006	-0.9850	-0.7250	0.1350	-0.4450	0.1700
2007	-1.9300	-0.2450	-0.2450	0.7750	0.7750
2008	0.2750	1.0200	1.1800	0.2250	0.2500
2009	-0.5650	0.2150	0.2100	-1.0850	0.5400
2010	-0.4950	-1.0150	0.2600	1.0150	1.1200
2011	0.5450	0.2450	-0.2450	0.9450	0.7050
Sum	**-8.8800**	**-1.8900**	**-0.1200**	**4.0900**	**7.5600**

Table 1 Yearly comparison of indicators

We can see that only both Stochastic indicators could make profit in total sum. In comparison with non-hedged approach were results of all indicators much better. On the basis of data from Table 1 is the best %D Stochastic which increases cash flows in almost each year.

For better information about using indicators we can change starting day and find out how results will change. Total sum of each indicator is calculated in Table 2 for different starting days.

Starting day	Non-hedged	MA	RSI	%K	%D
31. 3. 2000	-8.8800	-1.8900	-0.1200	4.0900	7.5600
4. 4. 2000	-8.8950	-1.2200	-2.5900	2.9200	3.0450
6. 4. 2000	-9.1000	-1.0500	-3.8000	3.4700	2.6150
10. 4. 2000	-9.2900	-3.5200	-3.0060	5.0350	6.5810
12. 4. 2000	-9.3600	-2.9000	-0.0300	8.1350	8.9500
14. 4. 2000	-9.3800	-1.3350	0.9600	6.8050	6.7300

Table 2 Influence of different starting day to total sum of earnings

Starting days were changed by 2 working days as you can see in the Table 2. The best results still keeps stochastic indicator but we can see high volatility of results. High volatility of total sums improves that using indicators of the technical analysis can raise cash flows at the cost of higher risks. If we have a look at the best tested indicator which is %D Stochastic we can figure out mean about 5.9135 Crowns per one hedged Euro. Standard deviation is 2.3149 Crowns per one hedged Euro. All indicators reached better results than non-hedged approach but just Stochastic indicator could reach gain which is very variable as we can see at Table 2.

6   Conclusion

In the first section is described classification of risks. The second section is focused on hedging and its classification. The end of theoretical part of text is the third section which is concentrated on technical analysis. Practical part of this text is represented by the fourth section.

The target of this work is to quantify of using technical analysis indicators by currency hedging. Used indicators are moving average, Relative Strength Index, %K Stochastic and %D Stochastic. Results of the first observation with starting day in 30 March 2000 were quite good. The best results reached Stochastic with total gain 7.56 crowns per one hedged euro. Testing on historical time series gives us 149 possibilities for hedging. On the basis of Stochastic signals there were 47 unhedged periods. 14 signals were false and caused loss. Changing of starting day causes high volatility of results. Both Stochastic indicators reached gain in total sum. %K Stochastic reached average 5.0758 crowns per 1 hedged euro with standard deviation 1.8506 crowns per 1 hedged euro. %D stochastic reached average total sum and standard deviation 5.9135 and 2.3149 crowns per 1 hedged euro. Changing starting day just about several days can cause high volatility of outcomes and that is why using of this approach for hedging is controversial.

Companies with risk-averse management have higher total utility due to elimination of total risk but there are also risk seeking subjects which can try to undergo higher risk with a possibility of higher profit and for these companies can be using indicators of technical analysis more interesting. It was shown that there is higher profit potential but the price for it is higher risk. Each company using hedging can use this approach because of no transaction costs and high variability of risky assets which price can be predicted by technical analysis indicators. All that matters is relation to risk of the subject.

Acknowledgements

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