IZVIRNI ZNANSTVENI ČLANEK – ORIGINAL SCIENTIFIC PAPER

6

Prejeto/Received:
September 2010

Popravljeno/Revised:
December 2010

Sprejeto/Accepted:
Januar 2011

USE OF THE TRP RATIO IN SELECTED COUNTRIES

Uporaba TRP indikatorjev v izbranih državah

Gal Munda
PricewaterhouseCoopers LLP, Thames Valley, Uxbridge

Sebastjan Strašek
University of Maribor, Faculty of Economics and Business

Abstract

This article proposes a new way of using publically available information in order to outperform the market. We suggest that, under the assumption that the "target-to--real ratio" is stationary, it could be implemented in several trading and/or portfolio optimization techniques. We use the target price—the price analysts "predict" when issuing recommendations, which always includes a time frame—to develop the TRP ratio. In practice, almost all target prices are estimated prices for the subsequent 6 to 12 months. It should be emphasized that such research has only recently become feasible as the historic data became pub lically available at the end of 2008. We then test the stationarity of the TRP ratio using the Dickey-Fuller Unit Root test. Upon confirming stationarity, we develop an autoregressive (AR1) model to estimate the mean reverted target price. The final part of this research implements this information into the trading model. It uses deviation from the mean-reverted TRP ratio to indicate stock's future potential. Results of the research are astonishing, as our model outperforms the benchmark (a passive, equally weighted strategy) by 55%.

Keywords: efficient market hypothesis, capital markets, target price

Izvleček

V raziskavi smo predstavili novo metodo za dosego nadpovprečnih rezultatov na borznih trgih. Predlagamo, da borzni posredniki in upravljavci premoženja razmislijo o uporabi kazalnika TRP kot enega izmed odločilnih faktorjev pri ocenjevanju cenovnega potenciala delnice na srednji rok. V prvem delu članka testiramo stacionarnost količnika TRP, ki je prvi pogoj za uporabo kazalnika v praksi. Nato razvijemo ekonometrični model (model AR1), ki nam omogoča »predvideti« gibanje kazalnika TRP v prihodnosti. Končni rezultat modela je povprečna vrednost, razvita na podlagi zgoraj omenjenega modela, h kateri se količnik TRP nagiba na dolgi rok. Povprečno vrednost TRP posamezne delnice uporabimo pri t. i. metodi testiranja na preteklih podatkih (backtesting), ko simuliramo portfelj desetih delnic na podlagi informacije o podcenjenosti oz. precenjenosti delnice. Rezultat raziskave je presegel pričakovanja, saj je portfelj, ki uporablja količnik TRP, presegel referenčni (benchmark) portfelj za kar 55 %. Pri tem je bil uporabljen referenčni pasivni portfelj, sestavljen iz enakih desetih delnic, kjer vsaka delnica na začetku predstavlja 10 % portfelja.

Ključne besede: hipoteza učinkovitega trga, kapitalski trgi, ciljna cena

Time Series and the Mean Reversion

In order to create guidelines for the use of the TRP ratio, some assumptions have to be made. The most important feature is the mean reversion. The TRP ratio statistically represents time series observations. Gujarati (p. 792, 2003) acknowledged that successful "empirical work based on time series data assumes that the underlying time series is stationary". Thus, we first test whether the TRP ratio is in fact stationary. To this end, we use three years of daily and (consensus) target prices of 10 shares included in the STOXX® EASTERN EUROPE 300

NG

Naše gospodarstvo / Our Economy
Vol. 57, No. 1–2, 2011
pp. 55–60

JEL: G12
UDC: 336.76:336.67

index from 1 June 2007 to 28 June 2010. Initial analysis was conducted 12 months ago on the Eurostoxx 50 index, where a five-year window was chosen; the statistical results for that index and time frame were identical. All data (past and recent) were obtained from the Bloomberg Terminal.

Before testing stationarity of the TRP ratio, we test whether stock prices or consensus target prices are stationary as isolated variables. It would not be logical to develop a TRP ratio if we were able to predict future stock prices directly from the target prices. As recommended by Gujarati (2003), we use graphical analysis and the unit root test in order to test whether the data are mean-reverted. It is often said that a time series is mean reverted if it tends to fall (rise) when its level is above (below) its mean value.

The following example illustrates our testing approach which was the same for individual shares in both indices (EuroStoxx50 and STOXX® EASTERN 300). We illustrate the process for the German insurance company Allianz. Results obtained from testing the remaining 19 shares were statistically similar; therefore, we do not present them on an individual basis.

Analysis of stock prices and consensus target prices

Figure 1 shows the movements of the actual stock price and the target price of Allianz from May 2004 to August 2009. The first impression is that both prices follow two trends (albeit short-term fluctuations): an upward trend from 2004 to mid 2007 and a downtrend from that point on. The variables do not seem to be stationary. In order to confirm the impression of non-stationarity, we conduct more a formal test—namely, the Dickey-Fuller test for unit root.

The null hypothesis (H_0) of the unit root test is that the time series has a unit root and is therefore non-stationary. In other words, if we cannot reject H_0, we say that the data are not stationary. This test was conducted in STATA; the results are shown in Table 1 and Table 2.

Table 1: *Unit Root Test for Actual Stock Prices of Allianz*

Interpolated Dickey-Fuller	Number of obs = 1803		
Test Statistic (Z(t))	1% Critical Value	5% Critical Value	10% Critical Value
-0.829	-3.43	-2.86	-2.57

Table 2: *Unit Root Test for Consensus Target Prices of Allianz*

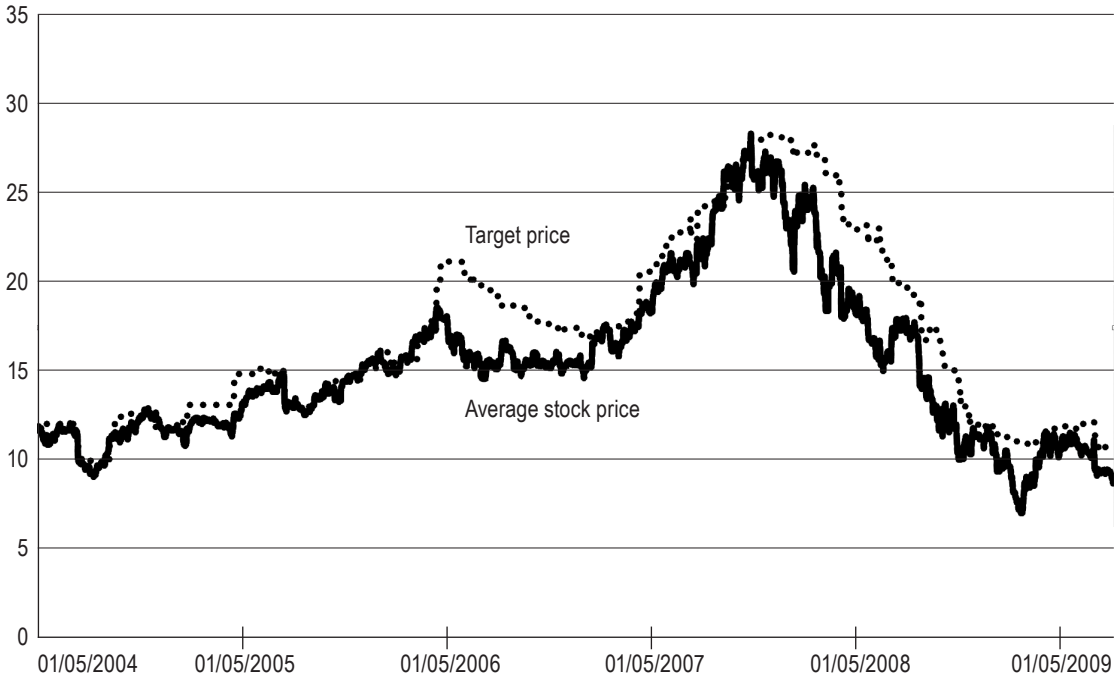
Interpolated Dickey-Fuller	Number of obs = 1803		
Test Statistic (Z(t))	1% Critical Value	5% Critical Value	10% Critical Value
-0.910	-3.430	-2.860	-2.570

Results are in line with expectations, as we confirm that it is not possible to reject the H_0. We conclude that the regression of the target price (as the predictor) on real stock prices would not be efficient as we would obtain biased results (through the phenomenon of spurious regression).

TRP Ratio

Non-stationarity does not imply that the data used are useless; rather, the data have to be modified to become stationary. Two common transformation methods can be used to achieve this (Maddala and Kim 2002): (1) Difference-

Figure 1: *Target Prices and Daily Close Prices of Allianz*



-Stationary process (DS) and (2) Trend-Stationary process (TS). Similar to the DS process is the method of developing the ratio between the two variables. According to Kennedy (2003), if they are not both non-stationary, but cointegrated, they still have a meaningful long-run relationship.

We perform the Engle-Granger test for co-integration between the TP (Target Price) and PX (Spot Price). The analysis of Allianz shares yielded the test statistic value of -4.931. Based on the result of the Engle-Granger test, we conclude that the target prices and actual stock prices of analysed securities are cointegrated.

It is now possible to develop a ratio between both correlated variables—namely, the target price and the last stock price (TP and PX):

Although we observed that the variables are cointegrated, the TRP ratio has to be stationary to be statistically meaningful (i.e., to be able to predict its future value). We use the same unit root test as for the previously presented individual target and actual prices.

Figure 2 shows the development of the TRP ratio for Allianz from May 2004 to August 2009. The ratio fluctuates primarily around the same value over time. Figure 1 demonstrates that the target price decreased less than the actual stock price. Consequently, the target to real price ratio showed enormous potential (especially by rising over 1.5) in 2009. Although analysts reduced their expectations, they thought that the stock market overreacted; consequently, the TRP ratio increased.

The unit root test represents a more formal assessment of the TRP ratio. Results of the DF test for Allianz are presented in Table 3. The obtained value of -5.021 is (in absolute terms) higher than the critical values, which means that we can finally reject H_0.

Table 3: *Dickey-Fuller Test for Allianz TRP Ratio*

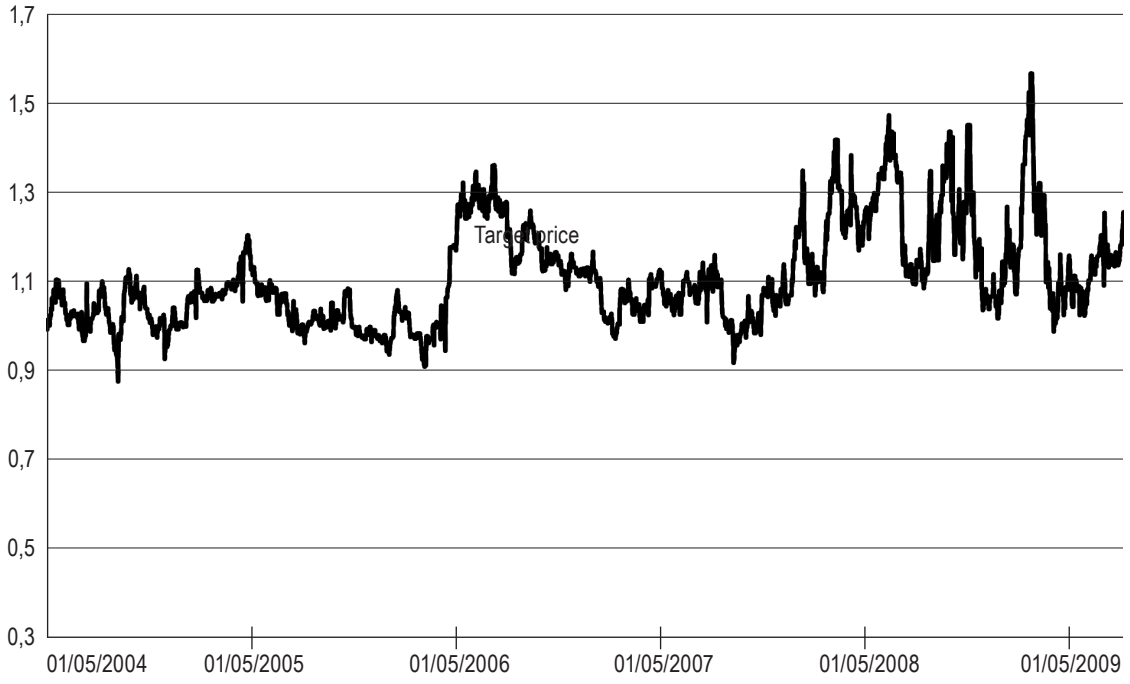
Interpolated Dickey-Fuller	Number of obs = 1803		
Test Statistic (Z(t))	1% Critical Value	5% Critical Value	10% Critical Value
-5.021	-3.430	-2.860	-2.570

Table 4 shows the set of values obtained for the individual shares in the STOXX® EASTERN EUROPE 300 index. The unit root test confirmed our predictions about the stationarity of the TRP ratio, which is crucial for empirical implications of the ratio. A comparison between "emerging" and "developed" market indices indicates that their patterns remain similar.

Table 4: *Results of the Unit Root Test for the STOXX® EASTERN EUROPE 300*

Share	alpha:ga	aefes:ti	brd:ro	gazp:rx	komb:cd
Dickey-Fuller t-value	-4.21	-3.36	-3.82	-2.99	-4.76
Constant	0.0396	0.0202	0.0341	0.0273	0.0445
1 Lag variable	0.9688	0.9817	0.9744	0.9841	0.9604
Mean value	1.27	1.11	1.33	1.72	1.12
Share	krkg:sv	mol:hb	otp:hb	pkn:pw	richt:hb
Dickey-Fuller t-value	-2.31	-4.23	-3.43	-4.33	-4.02
Constant	0.0122	0.0368	0.0270	0.0360	0.0333
1 Lag variable	0.9906	0.9690	0.9794	0.9674	0.9710
Mean value	1.29	1.18	1.31	1.10	1.15

Figure 2: *TRP Ratio of Allianz*



A detailed analysis of the TRP ratio also shows that individual companies (especially from different markets) have diverse long-term TRP ratios (mean value). The constant and 1 Lag values in Table 4 are used to predict the mean value. Mean value was calculated using the following equation:

$$Mean\ Value = \frac{Constant}{(1 - 1\ Lag)}$$

Interestingly, although TRP ratios differ among companies, the long-term ratio for each company remains constant (i.e., stationary) over time.

Implications of TRP Ratio

We now present one of many options on how to implement the TRP ratio. We test the most active approach to managing portfolios: active trading technique. The trading portfolio consists of 10 shares, as presented in Table 5. The initial investment is €10,000,000, with €1,000,000 being assigned to each asset. The rules were implemented on the Excel spreadsheet, and backtesting was performed using the VBA programming language.

The procedure was divided into two main stages: (a) calculation of the TRP potential, which enabled us to develop two indicators for buy (sell) signals and (b) implementation of the strategy and backtesting.

In order to develop buy/sell indicators, some inputs were required. The starting points are the "daily stock prices" and the "daily analysts' consensus target prices". These are used to calculate the daily TRP ratio for the entire investment period. Comparing the daily TRP ratios to the long-term (mean reverted) TRP value gives us the current "TRP potential". On average, consensus target prices in our sample changed every 14 days. Consequently, the 14-day average TRP ratio was used to estimate the trading signals.

Table 5: *Trading Portfolio (equally weighted)*

Share	Bloomberg Ticker	Country	Industry
Alpha Bank	alpha:ga	Greece	Commercial Bank
Efes	aefes:ti	Turkey	Brewery
BRD	brd:ro	Romania	Commercial Bank
Gazprom	gazp:rx	Russia	Oil
Komercni Banka	komb:cd	Czech	Commercial Bank
Krka	krkg:sv	Slovenia	Pharmacy
MOL	mol:hb	Hungary	Oil
OTP	otp:hb	Hungary	Commercial Bank
PKN	pkn:pw	Poland	Commercial Bank
Gedeon Richter	richt:hb	Hungary	Pharmacy

Table 6: *Decision-making Process for Buy or Sell Orders*

Indicator 1	Indicator 2	Action
Sell	Not Conclusive	No Action
Buy	Sell	No Action
Not Conclusive	Not Conclusive	No Action
Sell	Sell	Sell
Buy	Buy	Buy

The next step in the first stage of the model is to create rules to indicate whether the stock is over-/undervalued. Two indicators need to be identical in order to create a buy/sell order. Table 6 shows the decision-making process for placing the orders.

The first indicator tests whether the 14-day average TRP ratio is currently higher than the long-term TRP ratio for the stock, adjusted for the confidence level. This research applies a ±10% confidence level.

The rationale behind the second indicator is the fact that when we trade, we are trying to spot temporary inefficiencies on the market. To achieve that, we consider historical stock price movements and consensus target prices. If we can find a period in which the stock price lost value and the target price increased, we can then test whether the market is "wrong" and if the analysts "know better".

The inputs required to assign the second indicator are therefore calculated from the 14-day geometric returns on both the stock and target prices. In determining the technical potential of the stock, the "nil-percent" rule was used. Thus, if the 14-day return on stock was negative and the return on the target price during the same period was positive, the programme indicates a "buy" opportunity. If both variables increased/decreased, the programme would not make a recommendation. The "sell" rating is issued when the target price falls over the last 14 days, but the actual stock price increases. It must be emphasized that these constraints can easily be adjusted according to traders' perception of the market.

Backtesting

Implementation of the trading rules was backtested on the sample of 10 shares as shown in Table 5. The size of the order that was placed was the same for the long and short strategy, accounting for 2% of the initial investment. The size of orders for individual share was therefore:

$$Number\ of\ shares = \frac{Initial\ investment \times 2\%}{Current\ stock\ price}$$

The 2% mark was chosen randomly. For further investigation, we suggest that the proportion of a single position to the portfolio be dependent on the investor's risk profile. In real life, transaction costs will often impact the size of the order. We also assume that exchange rate movements do not influence our analysis (i.e., we hedge our position).

The daily value of investment in a stock is the value of the outstanding number of shares multiplied by the current market price. This is then added to the value "on the bank":

$$V_u = \sum CF_u + n_u P_u$$

where

V_u = Value of the strategy at "u"

$\sum CF_u$ = Future value of all cash-flows from time "t" (starting date) to "u" (closing date)

n_u = Balance of shares on the trading account at "u"

P_u = Price per share at "u"

For the purpose of this article, we neglect the borrowing costs and opportunity to earn a risk-free rate on the bank balance.

The results in Table 7 indicate that ROI obtained using our trading model is 29.23%. We compared this to the passive investment strategy and realized that, by trading based on the TRP ratio signals, our strategy outperformed the market by 55% over three years.

Although these results are astonishing, we remain cautious. The fact is that the procedure is based on individual assumptions that may appear arbitrary. In order to develop more reliable results for assessing the trading methods, the procedure would have to be standardized, which would require further research, such as sensitivity analysis.

Conclusion

Equity analysts have become an influential factor on the capital markets. Some previous research, such as Womack (1996), Barber et al. (2001), and Espahbodi et al. (2001), has even proved that analysts' coverage is associated with the positive abnormal returns on the stock. These studies focused on the "buy" ratings, issued by analysts.

The current research proposed a different approach to exploiting analysts' knowledge, focusing primarily on the target-to-real-price (TRP) ratio to test whether it has some predictive value for future returns. This was done by testing statistical features of the TRP ratio. Results indicated that the ratio appears to be stationary for the given set of data. This represents the most important factor in the research, as it enabled us to find the mean-reverted value and identify long-term TRP ratios for different stocks. It was also noted that the mean-reverted values of the ratio differ significantly between the assets, included in the portfolio. In other words, no ultimate TRP ratio exists for the entire market.

Based on the stationarity of the TRP ratio, several approaches for its implementation can be developed. We tested whether it is possible to outperform the passive investment strategy, obtaining extremely positive results. In fact, we obtained results that are not consistent with the efficient market hypothesis (EMH), which suggests that investors cannot outperform the market using publically available information (which consensus target price definitely is). Several interpretations for the results are possible; one could say that the three-year investment period is too short and that results were obtained in "non-normal" market conditions. Others might suggest that assumptions are not realistic. Considering all remarks, the fact that our portfolio outperformed the benchmark by more than 55% and returned a 29% ROI in the downturn suggests that there might be time in the future when portfolio managers and traders start considering TRP ratio as one of the factors when they place their buy/sell orders.

In 1991, Schipper showed that the information analysts produce improves the market efficiency by helping investors "value companies' assets more accurately". In line with this statement, we presume that, if everyone started using the TRP ratio as the appropriate measure of stocks' values, assets would be priced more efficiently and the opportunity for earning higher abnormal returns would disappear. We therefore conclude clear indications suggest that the market currently operates inefficiently but, with more frequent use of this important information, it could become efficient. Implementation of the TRP ratio should therefore exceed the frames of this article. It cannot be ignored that the outcomes of this study raise several interesting research questions and represent very exciting grounds upon which to build in the future.

Table 7: *Results of Backtesting and Comparison to Passive Investment Strategy*

Company	Initial Investment	Final Inv. Value	ROI	Passive	Passive ROI	Outperformance
alpha:ga	1,000,000	1,904,950	90.50%	191,319	-80.87%	1,713,632
aefes:ti	1,000,000	1,113,462	11.35%	1,441,276	44.13%	-327,814
brd:ro	1,000,000	1,478,138	47.81%	434,959	-56.50%	1,043,179
gazp:rx	1,000,000	2,009,736	100.97%	627,854	-37.21%	1,381,882
komb:cd	1,000,000	1,036,104	3.61%	923,768	-7.62%	112,336
krkg:sv	1,000,000	1,103,113	10.31%	719,427	-28.06%	383,686
mol:hb	1,000,000	888,535	-11.15%	780,658	-21.93%	107,877
otp:hb	1,000,000	1,455,154	45.52%	476,667	-52.33%	978,487
pkn:pw	1,000,000	1,084,756	8.48%	742,574	-25.74%	342,182
richt:hb	1,000,000	849,186	-15.08%	1,079,661	7.97%	-230,475
Total	10,000,000	12,923,135	29.23%	7,418,163	-25.82%	5,504,972

Literature

1. Barber, B., Lehavy R., McNichols M. and Trueman B. (2001) Can investors profit from the prophets? Consensus analyst recommendations and stock returns. *Journal of Finance*, 56, 341-72.
2. Espahbodi, R., Dugar, A. and Tehranian H. (2001) Further Evidence on Optimism and Underreaction in Analysts' Forecasts. *Review of Financial Economics,* 10, 1-21.
3. Gujarati, D. (2003) *Basic econometrics*. New Jersey: McGraw Hill.
4. Maddala, G.S. and Kim, I.M. (2002) *Unit roots, cointegration, and structural change*. Cambridge: Cambridge University Press.
5. Kennedy, P. (2003) *A guide to econometrics*. 5th ed. Bodmin: MPG Books.
6. Womack, K. L. (1996) Do brokerage analysts' recommendations have investment value? *Journal of Finance*, 51, 137-67.

Gal Munda je leta 2008 diplomiral na smeri Podjetništvo na Ekonomsko-poslovni fakulteti v Mariboru. Zadnje leto študija je deloval kot analitik tujih vrednostnih papirjev v oddelku investicijskega bančništva v Raiffeisen Banki. Po opravljeni diplomi se je odpravil na podiplomski študij v Anglijo in jeseni 2009 z odliko magistriral na Nottingham University Business School na smeri Finance in investicije. Trenutno je zaposlen pri podjetju PricewaterhouseCoopers LLP v Londonu. Ob delu pridobiva strokovni kvalifikaciji ACA in CFA.

Gal Munda graduated in 2008 from the Faculty of Economics and Business at the Univiersity of Maribor, majoring in entrepreneurship. He started his financial career working as an equity analyst in the Investment Banking Department of Raiffeisen Bank. He resumed his studies at The University of Nottingham, where he completed the master's programme (Finance and Investment) with distinction. He is working in the West London office of PricewaterhouseCoopers LLP. He is studying towards ACA and CFA qualifications.

Dr. Sebastjan Strašek je redni profesor za področji Ekonomska politika in Uvod v ekonomsko teorijo ter predstojnik Katedre za ekonomsko politiko na Ekonomsko-poslovni fakulteti Univerze v Mariboru. Njegov akademski opus sestavljajo znanstvenoraziskovalna dela s področja finančnih kriz, poslovnih ciklov in finančnih trgov.

Dr. Sebastjan Strašek is a full professor of economic policy and introduction to economic theory. In addition, he serves as chief of the Department for Economic Policy at the Faculty of Economics and Business at the University of Maribor. His professional interest is devoted to the research of financial crises, business cycles, and financial markets.