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**BEATING THE MARKET IN LESS DEVELOPED
FINANCIAL EXCHANGE**

The foundations of the efficient market hypothesis (EMH) are being tested in this article. We propose that using public information (consensus target price), one can develop a strategy that will outperform the benchmark. The average of the target prices is compared to the security's current price in order to calculate the target-to-real-price (TRP) ratio. As the ratio is observed to be stationary, we build upon the feature and propose various ways to implement it into the trading strategy. We create clear and simple-to-implement rules which indicate whether the stock is over/undervalued. We simulate the value of the portfolio based on the buy/sell signals. Backtesting is used in order to compare the return of the model to the benchmark. Results of the trading strategy are positive, as the model outperforms the passive portfolio by more than 50%. The strategy is implemented on the emerging market securities, but we note that stationarity of the ratio has already been observed in the developed market, which indicates consistency of the results.

Keywords: TRP ratio; target price; technical analysis.

JEL: G17.

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**ЯК ВИПЕРЕДИТИ РИНОК: ЗА МАТЕРІАЛАМИ ФОНДОВИХ
РИНКІВ КРАЇН, ЩО РОЗВИВАЮТЬСЯ**

У статті представлено основи для гіпотези ефективного ринку, запропоновано використовувати публічну інформацію (узгоджена цільова ціна) для розробки стратегії задля перевищення показників еталону. Для розрахунку співвідношення цільових і реальних цін середні цільові ціни порівняно з чинними цінами на цінні папери. Оскільки дане співвідношення виявилось постійним, запропоновано враховувати його при розробці трейдингової стратегії. Розроблено чіткі та прості правила, за якими можна визначити, переоцінені акції чи недооцінені. На основі сигналів про купівлю-продаж змодельовано портфель акцій, його результати порівняно з еталонами на ринку. Результати розробки трейдингової стратегії можна вважати позитивними, оскільки змодельований портфель на 50% ефективніший за еталон на ринку. Дана стратегія може бути використана не тільки на ринках, що розвиваються, а й на розвинених.

Ключові слова: співвідношення цільових та реальних цін; цільова ціна; технічний аналіз.

Форм. 2. Рис. 2. Табл. 7. Літ 14.

Себастьян Стразек, Гал Мунда
**КАК ОБОГНАТЬ РЫНОК: ПО МАТЕРИАЛАМ ФОНДОВЫХ
РЫНКОВ РАЗВИВАЮЩИХСЯ СТРАН**

В статье представлены основы для гипотезы об эффективном рынке. Предложено использовать публичную информацию (согласованная целевая цена) для разработки стратегии по повышению показателей эталона. Для расчета соотношения целевых и реальных цен средние целевые цены сравнены с текущими ценами на ценные бумаги. Поскольку данное соотношение оказалось постоянным, предложено учитывать его при разработке трейдинговой стратегии. Разработаны четкие и простые правила, по которым

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можно определить, переоценены акции или недооценены. На основе сигналов о купле-продаже смоделирован портфель акций, его результаты сравнены с эталонами на рынке. Результаты разработки трейдинговой стратегии можно считать позитивными, поскольку смоделированный портфель на 50% эффективней эталона на рынке. Данная стратегия может быть использована не только на развивающихся рынках, но и на развитых.

Ключевые слова: соотношение целевых и реальных цен; целевая цена; технический анализ.

1. Introduction. In recent years, both technical and fundamental analysis has been seriously challenged by the random walk and efficient market hypothesis. The extent to which the markets are efficient is still subject to considerable debate. An efficient market is one in which securities fully reflect all possible information quickly and accurately. This concept postulates that investors will assimilate all relevant information into prices in making their buy and sell decisions. The modern version of the concept of market efficiency does not require that the adjustment be literally instantaneous, only that it occurs very quickly as information becomes known. (Shapiro, 2000).

A strong case can be made for U.S. and other high developed financial markets being efficient. Unlike these markets, the Central and East European (predominantly transition economies) markets are much less analyzed. Information tends to be scarcer and less reliable in many cases, hence investors may have chances to pursue an active strategy with the goal to outperform some benchmark portfolio.

In our research, we use the concept of target-to real price ratio. We take 3 years of daily and (consensus) target prices of 10 shares, included in the STOXX® EASTERN EUROPE 300 index from 01/06/2007 to 28/06/2010. Initial analysis was conducted on the Eurostoxx 50 index where 5-year window was chosen and the statistical results for that index and timeframe were identical. All data was obtained from the Bloomberg Terminal.

2. Characteristics of the observed markets. South-Eastern Europe (SEE) is a region of predominantly transition economies with background of state-owned enterprises without the help of market signals. The EU enlargement and the adoption of *acquis communautaire* provide that these markets are increasingly changing the role of financial sector. This process is marked by a number of activities: regulation and supervision of financial sector have been reformed, bank privatization is now widespread, domestic credit and cross-border flows are rising strongly, key financial infrastructure and networks are in place.

The joint impact of macroeconomic and microeconomic reforms has made the financial sector deeper, more profitable and resilient but also highlighted several dilemmas for policy makers (Herzberg, Watson, 2007): these include the difficulty of diagnosing risky credit booms in an environment characterized by equilibrium shifts in credit, asset prices and the real exchange rate; the difficulty of assigning policies to safeguard financial stability, without abusing them as a substitute for capital controls; and the difficulty of influencing the pace of credit growth or the level of external current account deficit.

Substantial economic literature (Rajan and Zingales, 1998, Wachtel, 2001) finds significant positive relationships between the development of a stock market in a country and the economic development of it. The results suggest a clear bidirection-

al relationship between economy and stock market, further indicate the importance of the stock market for corporate finance and risk allocation and emphasize that the economy and the domestic stock market should develop simultaneously. The importance of stock markets in SEE countries in comparison to major Western European stock markets show that former lag behind both in absolute terms and relatively to GDP. Therefore, security and stock markets play in some of them only a marginal role in financial intermediation.

Although transition countries in SEE vary considerably in history and current institutional setup, they share certain important features: (1) the persistence of soft budget constraints, (2) poor investor protection (especially minority), (3) concentration of ownership that also undermines the liquidity of equity markets, (4) high court delays, (5) weak corporate governance, (6) limited supply of institutional investors, (7) slow progress on private sector development. At the beginning of the 1990s, a number of SEE economies established capital markets, which thereafter displayed considerable growth in size and openness and become increasingly important for both institutional and individual investors.

Bekaert and Harvey (2000) suggest that the correlation between emerging markets which open up their capital markets to foreign investors and developed markets tends to increase over time. Recent studies, which examine the relationship between developed and emerging equity markets show interesting findings. Voronkova (2004) found evidence of long-run relationship between the German and Polish stock indices as well as German and Hungarian indices over the period between 1993 and 2002. Li and Majerowska (2008), using a GARCH approach, find evidence that Hungarian and Polish equity market are linked to the German stock market in terms of return and volatility. Guidi and Gupta (2010) find that the correlations between the German and individual CEE markets have increased since the accession of these countries into the EU. Syllignakis and Kouretas (2009) examine long-term linkages between 7 Central and Eastern emerging stock markets and 2 developed stock markets (Germany and USA) and also reveal that the financial linkages between these markets increased with the beginning of the EU accession process. Furthermore, the application of the Gonzalo and Granger methodology indicates that the examined stock markets are partially integrated, while there is also evidence that the emerging stock markets of Central and the US stock markets have a significant common permanent component, which drives this system of stock exchanges in the long-run.

For capturing stock market movements Rousova (2009) studied 3 CEE markets (Czech, Hungarian, Polish), the Western European market, the US and Russian market. She found that the short-run linkages among the markets were stronger after the EU enlargement as the markets became synchronized. This is evidenced by the emergence of two new equilibrium relations in the post-accession period that link the movements of the Western European, US and Russian markets, whereas no such relations can be detected before the EU enlargement.

3. Time series and the Mean Reversion. In order to create guidelines for the use of Target-to-real price ratio, some assumptions have to be made. The most important feature is the mean reversion. 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".

We therefore first test whether the TRP ratio is in fact stationary. 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 is 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.

Example below shows 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 other 19 shares were statistically similar and therefore we do not present them on individual basis.



Figure 1. Target Prices and Daily Close Prices of "Allianz"

Figure 1 shows 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 – Dickey-Fuller test for Unit Root.

Null hypothesis (H0) 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 H0, we say that the data is not stationary. This test was conducted in STATA and the results are shown in Table 1 and 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 H0. We conclude that the regression of Target price (as the predictor) on real stock price would not be efficient as we could obtain biased results (due to the phenomenon of spurious regression).

4. TRP Ratio. Non-stationarity does not imply that the data is useless – in contrast, the data has to be modified to become stationary. There are two common transformation methods to achieve that (Maddala and Kim, 2002): (1) Difference-Stationary process (DS) and (2) Trend-Stationary process (TS). Close to DS process is the method of developing ratio between the two variables. According to Kennedy (2003), if both of them are non-stationary, but cointegrated, they still have a meaningful long-run relationship.

We perform the Engle-Granger test for co-integration between TP and PX. Analysis yields the test statistic value of -4.931. From that, we conclude that the Target Prices and Actual Stock Prices of the analysed securities are cointegrated.

It is now possible to develop a ratio between both correlated variables, Target Price and the Last Stock Price (TP and PX):

$$TRP = \frac{TP}{PX}$$

Even though we proved 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 individual Target and Actual prices, already presented.

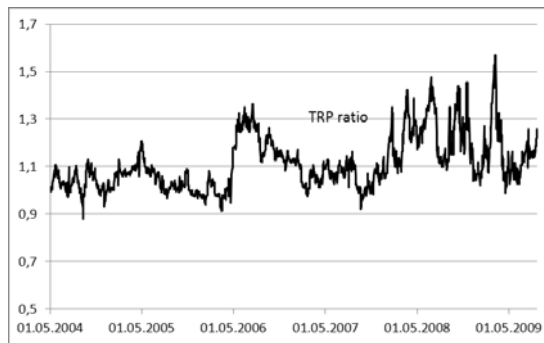


Figure 2. TRP ratio of "Allianz"

Figure 2 shows development of the TRP ratio for "Allianz" from May 2004 to August 2009. Notice that the ratio mainly fluctuates around the same value over time. Figure 2 demonstrates that Target price decreased less than the Actual stock prices. Consequently, the target to real price ratio showed enormous potential (especially when it rose over 1.5) in 2009. Although analysts reduced their expectations, they thought that the stock market overreacted and as a consequence, the TRP ratio increased.

The Unit Root test represents more formal assessment of TRP ratio. Results of 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 the H0.

Table 3. Dickey-Fuller test for Allianz TRP ratio

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

Table 4 shows set of values obtained for the individual shares in STOXX® EASTERN EUROPE 300 index. Unit Root test has confirmed our predictions about the stationarity of the TRP ratio which is crucial for empirical implications of the ratio. Comparison between 'Emerging' and 'Developed' market indices shows 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	krkg:sv	mol:hb	otp:hb	pkn:pw	richt:hb
Dickey-Fuller t-value	-4.21	-3.36	-3.82	-2.99	-4.76	-2.31	-4.23	-3.43	-4.33	-4.02
Constant	0.0396	0.0202	0.0341	0.0273	0.0445	0.0122	0.0368	0.0270	0.0360	0.0333
1 Lag variable	0.9688	0.9817	0.9744	0.9841	0.9604	0.9906	0.9690	0.9794	0.9674	0.9710
Mean value	1.27	1.11	1.33	1.72	1.12	1.29	1.18	1.31	1.10	1.15

The detailed analysis of the TRP Ratio also shows that individual companies (especially from different markets) have diverse long-term TRP ratios. It is interesting to see that even though TRP ratios differ between companies, long term ratio for each company remains constant (i.e. stationary) over time.

5. 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. "Trading portfolio" consists of 10 shares, presented in Table 5. The initial investment is 10 mln. where 1 mln. was assigned to each asset. The rules were implemented on the Excel spreadsheet and backtesting was performed using the VBA programming language.

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
Komerční 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

The procedure was divided into 2 main stages: (a) calculation of the TRP potential which enables 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 whole 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, 14-day average TRP ratio was used for estimation of the trading signals.

The next step in the first stage of the model is to create rules which 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.

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

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 its value and the target price increased, then we can 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 the target prices. In determining technical potential of the stock, the 'nil-percent' rule was used. That means, if the 14-day return on stock was negative and the return on the target price during the same period was positive, programme indicates a 'buy' opportunity. In case 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 has to be emphasized that these constraints can easily be adjusted according to trader's perception of the market.

6. Backtesting. Implementation of the trading rules was backtested on the sample of 10 shares as shown in the Table 5. Size of the order that was placed was the same for the long and short strategy and it accounted 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 portfolio is dependent on the investor's risk profile. In real life, transaction costs will often impact the size of order. We also assume that exchange rate movements do not influence our analysis (i.e., we hedge our position).

Daily value of investment in a stock is the value of outstanding number of shares multiplied by 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" to "u"; 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 risk-free rate on the 'bank balance'.

Results in the Table 7 indicate that ROI obtained by using our trading model is 29.23%. We compare this to the 'passive' investment strategy and realise that by trading based on the TRP ratio signals, our strategy outperformed the market by 55% over 3 years.

Table 7. Results of the 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
aefesti	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
rich:thb	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

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

7. Conclusion. Equity analysts have become an influential factor on the capital markets. Some of the previous researches, such as Womack (1996), Barber et al. (2001) and Espahbodi et al. (2001) 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.

In this research, different approach to "exploiting" the analysts' knowledge is proposed. The main focus is placed on the target-to-real-price ratio (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 showed that the ratio is in fact stationary. This represents the most important factor in the research, as it enables to find the mean-reverted value and identify the 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. To say differently, there is no ultimate TRP ratio for the whole 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 and obtained 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 by using publically available information (which consensus target price definitely is). There are a few possible interpretations for the results; one could say that the three-year investment period is too short and that results were obtained in the 'non-normal' market conditions. Others might suggest that assumptions are not realistic. Considering all remarks, the fact that our portfolio outperformed benchmark by more than 55% and returned 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 "to value companies' assets more accurately". In line with this statement, we presume that if everyone started using TRP ratio as the proper measure of stock's value, assets would be priced more efficiently and the opportunity of earning higher abnormal returns would disappear. We therefore conclude that there are clear indications 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 to build on in the future.

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