TESTING THE DAMODARAN APPROACH TO ESTIMATE THE COST OF EQUITY IN EMERGING MARKETS[1]

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Abstract: The cost of equity is one of the key financial and economic indicators in corporate finance. The purpose of this paper is to test the well-known approach of Damodaran in global emerging markets. The main result of the study is that the Damodaran approach needs to be improved as it maintains constant deviation from the observed ex-post cost of equity.

Keywords: cost of equity, SMAPE, the Damodaran approach.
JEL: G11, G32, C52

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Introduction

The correct calculation of the cost of equity is central to financial theory. Investors' expectations for the minimum return they should require in order to invest in a company are among the main indicators in corporate finance. One of the main problems related to choosing the most suitable calculation model is the lack of ex-post observations to compare results with. The **object** of the study is the well-known Damodaran equity valuation model, and the **subject** is to present the model under conditions of emerging financial markets. The **aim** is to test this approach in emerging markets conditions, as there is no model yet developed and the issue becomes more urgent. The main **hypothesis** is that the Damodaran approach can be improved due to the observed higher deviations from *ex post* cost of equity. The tasks assigned to prove the thesis are as follows: **first,** to review the theoretical models for

[1] The following article is based on a material intended for participation in the annual "Dr. Ivanka Petkova" International Finance Competition, organized by the Economic Policy Institute where the paper won the first place. Given the transparency of the competition, the papers of the laureates have been uploaded on the website of http://www.epi-bg.org/ images/Award_IP/1_K.Petkov_BG.pdf

calculating the cost of capital; **second,** to develop a model for calculating the *ex post* cost of equity which can be compared with the results of the studied approach; **third,** to test, through statistical tools, the result deviation of the Damodaran approach towards the *ex post* observations.

1. Theoretical formulations for calculating the cost of equity

The "risk-return" models are the basis of calculating the cost of equity. According to the consensus definition, the cost of equity is a profitability that should compensate for the risks associated with an investment in a company. Therefore, together with the increase in the risk of the company there should be an increase in the cost of equity. This also raises the question of what the risks associated with investing in shares of a company are and how they are measured. In terms of the financial theory the following risks can be mentioned: liquidity risk, insolvency risk, operational risk, financial risk, etc. From other sectors of the economy the following can be mentioned: management risk, insurance risk, etc. It seems like an impossible task to cover all these risks, but when it comes to public companies (as it is in this paper), price movement of company's shares can be used, because it is a powerful tool that reflects the overall position of the company. With the development of models for market equilibrium and the subsequent emergence of the "theory of efficient markets", it becomes clear that it is not necessary to examine separately all the risks associated with the company, because most of the information about the company is incorporated in the price of its shares. Treynor (1961, 1962)[2], Sharpe (1964)[3], Lintner (1965)[4], and Mossin (1966)[5], independent of one another, developed the famous CAPM[6] model, through which the minimum required rate of return for the company can be calculated. The main idea behind CAPM is that investors require the following three components from the companies:

- **risk-free rate of return (rf)**, which each economic agent should obtain;

[2] Cited in: French, **Craig W.** The Treynor Capital Asset Pricing Model. // Journal of Investment Management, Vol. 1, No. 2, pp. 60-72, 2003.

[3] **Sharpe, William F.** (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. // Journal of Finance, 19 (3), 425–442.

[4] **Lintner, John** (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. // Review of Economics and Statistics, 47 (1), 13–37.

[5] **Mossin, Jan** (1966). Equilibrium in a Capital Asset Market. // Econometrica, Vol. 34, No. 4, pp. 768–783.

[6] CAPM – Capital Asset Pricing Model.

- **equity market risk premium (rm-rf),** which is a reward for the investor that has invested in shares of companies. The risks facing all companies on the market are involved in this premium, according to the idea of market equilibrium;
- **compensation for the risks, specific** to the individual company – this risk is measured by coefficient β, which reflects the relative risk of a single company in relation to the market.

From a theoretical point of view, CAPM is the best and the most logical model for estimating the cost of equity of companies, but practically, its validity is quite another question. Roll (1972)[7] was the first to express the critical view that the market return (r_m) is an abstraction and can only be approximated by certain benchmarks. Later, Fama and French (1992, 1993)[8] proved that the market risk premium does not explain well enough the variation in returns on shares and in fact, there are other factors which they depend on. Later on, a lot of models for estimating the minimum required rate of return were developed, some of them modifications of CAPM, others were developed in entirely different direction[9]. The main problems that could be faced when applying these models are as follows:

- What is the risk-free asset? What should analysts use as a risk-free rate of return?
- What is the market portfolio and which benchmark should be used for approximation?
- The statistical significance of β – in most cases for many companies the historic β does not have the necessary statistical significance.
- The problem with the use of historical data and the question whether "history" will repeat itself.

Through a series of articles, Damodaran develops his approach to calculating the cost of equity, responding to the above mentioned questions. Generally, he gives interpretation and solves practical problems facing the calculation of rf and β. According to him, risk-free return must meet the following two requirements: 1) lack of default risk, and 2) lack of reinvestment risk.

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[7] **Roll, R.** (1977). A Critique of the Asset Pricing Theory's Tests. // Journal of Financial Economics 4: 129–176.

[8] In two articles: **Fama**, Eugene F.; French, Kenneth R. (1992). The Cross-Section of Expected Stock Returns. // Journal of Finance 47 (2): 427–465. And **Fama**, Eugene F.; French, Kenneth R. (1993). Common Risk Factors in the Returns on Stocks and Bonds. // Journal of Financial Economics 33 (1): 3–56.

[9] **Pavlov**, Ts. (2015). Prilozhenie na povedencheskite finansi pri modelirane na balgarskata riskova premiya na aktsiite. // Business management, issue 2, Tsenov, pp. 96-130.

In this case, the only capital instruments that meet these requirements are the 10-year government bonds, which are rated AAA[10]. Basically, these are government bonds in developed markets. According to Damodaran, choosing the country's securities to be used for risk-free return depends on the examined market and the type of currency denomination of the relevant debt to which the stock exchange belongs. For example, if companies listed on the stock exchange of Turkey are assessed, the 10-year USA securities should be used since Turkey has government bonds denominated in USD.

With regard to the β coefficient Damodaran proposes an elegant solution to the statistical problems. As mentioned, the financial effect of β is to measure the specific business risks of individual companies in relation to the market. However, the statistical nature of the method used to calculate this ratio – regression of historical data between the market return and that of the company – leads to a dilution of the concept. The risk associated with doing some kind of business does not change radically fast, as for example the weekly return on a share. Therefore, Damodaran proposes the following:

$$\textbf{(1)}\ \beta_i = Av.Unlevered\ \beta_{IND} * (1 + (1 - T) * \frac{D}{E}),$$

where:
β_i – the ratio of a particular company I;
T- tax rate;
D/E – the financial leverage of the company;
$Av.Unlevered\ \beta_{IND}$ – the average unlevered beta for the respective industry.

As it can be seen in equation (1), Damodaran proposes using the average unlevered β of the industry to which the company belongs, and then it can be levered with the relevant financial leverage of the company. The idea of Damodaran is simple and logical, because it brings back the calculation of β in its financial aspect. For the third component of CAPM, the risk premium on the stock market, Damodaran proposes using the implied premium for the expected return of the relevant benchmark. At this point, the proposed method of determining the risk premium on the stock market in developed countries is the best and that's why it will be replicated in this study.

Most theoretical studies, which were referred to, have as their subject the developed markets, mainly the USA. With the globalization and the development of capital markets, the image of the "global investor" has appeared for whom there are other asset classes besides the traditional markets of the

[10] AAA is the highest possible rate in the Fitch system. For more information see https://www.fitchratings.com/jsp/general/RatingsDefinitions.faces?context_ln=5&detail_ln=500&context=5&detail=509

USA, Western Europe, Singapore and Japan. In literature, several concepts are known for other countries that meet the different classifications – emerging, frontier, lagging, etc., as there is no clear criterion for division. In order not to enter into these theoretical disputes, we will unite under the term "emerging" those countries that meet the following criteria:

- Rates of GDP growth, anticipating the average for the world,
- Low income of population,
- Created, but still developing capital market,
- Growing market capitalization of the stock exchange.

These simplified criteria give the right idea of what markets are subject to examination whereas the very detailed selection of the examined markets will be explained later. The main problem facing the use of the so far established models to estimate the cost of capital is the information asymmetry, if in developed countries "semi-strong efficient capital markets" are observed, markets here fall within the criteria "weak efficient". Another problem is the lack of historical data, due to the short history of stock markets in most countries. All this leads to the idea that there is a significant difference between the costs of capital in the two types of countries. Reviewing the financial literature, we could see that this statement is given substance to.

In their development Riegar, Wang and Hens (2013)[11] compared the minimum required rate of return in 27 countries and found out that in countries where investors have shorter investment horizons, the cost of equity is higher. The short investment horizon is precisely the identifying mark of emerging markets – hence this study may serve as a proof of the essential differences. Hatchondo (2008)[12] also showed a significantly higher risk premium in countries with more uneven distribution of income, which are mostly developing. In another study, *Donadelli and Prosperi* (2011)[13] studied the cost of equity in 32 countries in the period 1988-2010, of which 13 developed and 19 developing. Their results indicate that in developing countries, the cost of capital is higher and at the same time there is a greater volatility of the equity market. The permanently higher cost of equity in developing countries is explained by the so-called country risk premium. The idea of it is that investors should require greater returns from their investments in emerging markets, due to higher levels of risk, associated with these markets.

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[11] **Rieger, Marc Oliver** and **Wang, Mei** and **Hens, Thorsten**. International Evidence on the Equity Premium Puzzle and Time Discounting (April 26, 2013). // Multinational Finance Journal, 2013, vol. 17, no. 3/4, pp. 149-163.

[12] **Hatchondo, J.C.** (2008). A Quantitative Study of the Role of Income Inequality on Asset Prices. // Economic Quarterly, v94, 73–96.

[13] **Donadelli, Michael** and **Prosperi, Lorenzo**. The Equity Risk Premium: Empirical Evidence from Emerging Markets (May 23, 2011).

The main argument against the existence of a country premium is that when it comes to the global investor, it can be diversified. Shtulz (1999)[14] argued that the country premium can actually be diversified if investors expand the geographic range of their investments enough, but the reduction of overseas investment reduces the possibility for diversification. This thesis for diversification of the country risk is correct insofar as there is a low correlation between global markets. In the 70s and 80s studies by Levy and Sarnat (1970)[15] showed the low levels of correlation between markets for that period. More recent research by Yang, Tapon and Sun (2006)[16] concluded that the correlation between global markets had risen over the past 10 years, thanks to the increasing pace of globalization; *Longin and Solnik* (2000)[17] came to the same conclusion. Meanwhile, Ball and Torous (2000)[18] showed that in times of crisis, the correlation between markets increases.

All these arguments for the existence of a country risk raise the question of how to calculate the cost of equity in emerging markets. One option is the use of GCAPM[19], whereby β of the company should be regressed against the global portfolio. Damodaran does not accept this method because finding a global benchmark is almost impossible and the results are always inaccurate. The MSCI World Index, which is considered a similar benchmark, is capitalization weighted and over 90% of the capitalization comes from companies listed on developed capital markets. Thus, the other option for calculation remains – to find a way to calculate the country risk premium. Damodaran offers a version, in which to the premium of a developed market to add a country risk premium calculated in the following ways: credit rating of governments; risk scoring of states; spread between government securities; CDS spreads; difference in market volatility.

The credit rating and **risk scoring** of countries are methods, used to calculate the respective risk premium on the basis of information published by specialized institutions. On the one hand, the global financial and economic

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[15] **Levy, H.** and **M. Sarnat** (1970). International Diversification of Investment Portfolios. // American Economic Review 60(4), 668-75.

[16] **Yang Li** , **Tapon, Francis** and **Sun, Yiguo** (2006). International correlations across stock markets andindustries: trends and patterns 1988-2002. // Applied Financial Economics, 16: 16, 1171-1183.

[17] **Longin, F.** and **B. Solnik** (2001). Extreme Correlation of International Equity Markets. // Journal of Finance, v56 , pg 649-675.

[18] **Ball, C.** and **W. Torous** (2000). Stochastic correlation across international stock markets. // Journal of Empirical Finance. V7, 373-388.

[19] GCAPM – Global Capital Asset Pricing Model.

crisis has shown that these institutions are not always right; on the other hand, transforming rating (scoring) in% is subjective.

CDS spread and the spread between **government securities returns** of the countries are the best measure of the risk status of an emerging market towards developed economies. They are the basis on which Damodaran develops his approach to estimate the cost of equity. In the next section, however, we will try to give a critical view of this approach and will raise some unresolved issues that could lead to more accurate results.

2. Methodology for testing the accuracy of the Damodaran approach

One of the main obstacles to the establishment of the best model for estimating the cost of equity is the absence of ex post observations. To resolve the problem, we will try to modify the model of residual income[20] in order to reach ex post cost of equity or, in other words, we will calculate the realized implicit minimum required rate of return. The model of residual income is chosen deliberately because of its advantages, namely:

- A number of studies show that of all valuation models RIM is the most accurate and explains in the best way the variation in returns on shares;
- The simplicity of the model allows for easier revision of equations in order to estimate the implicit ex post cost of capital.

The basic formula of the residual income model is:

$$\textbf{(2)}\ V_{ps} = \sum \frac{E(EPS) - BVPS * k_e}{(1+k_e)^n} + \frac{\frac{EPS}{k_e}}{(1+k_e)^{n+1}},$$

where:
E (EPS) – expected profit per share;
BVPS – book value per share;
V_{ps} – price per share for period t;
k_e – minimum required rate of return.

Equation (2) represents the generalized pattern of residual income, from which we can deduce the implicit cost of capital. This is done by equalizing the fundamental value of the market price, and if EPS and BVPS are known, we obtain an equation with one unknown quantity - ke. In his approach, Damodaran uses the model of valuation through free cash flow to calculate the implicit risk premium of a country benchmark. We should note the radical difference between the two ideas. While Damodaran uses the ap-

[20] Residual Income Model.

proach to obtain ex ante risk premium, the basic idea here is to obtain ex post, or, in other words, "realized" cost of capital. For this purpose the values of the two variables EPS (earnings per share) and BVPS (book value per share) will not be predicted / expected and their values will be the actually obtained during the next reporting period. Also, to simplify the calculations, we will remove the first part of equation (2), and will work with only one cash flow in the terminal value. So the equation by which the ex post cost of equity will be calculated is as follows:

$$\textbf{(3)}\ P_t = \frac{\frac{EPS_{t+1} - k_{e_t} * BVPS_{t+1}}{k_{e_t}}}{1 + k_{e_t}},$$

where:
EPS_{t+1} – achieved earnings per share for the following period;
$BVPS_{t+1}$ – book value per share for the following period;
P_t – price per share for period t;
k_{e_t} – minimum required rate of return.

In equation (3), the only unknown quantity is the cost of capital k_{e_t}, some simple mathematical transformations lead to a quadratic equation regarding k_{e_t} which has two real roots – negative and positive. These two solutions give two different values of k_{e_t}, but it should be reminded that the minimum required rate of return must be a positive number since, although an ex post (realized), it is simply something which is expected. Therefore, the negative root, although a mathematical solution does not have a real financial value and becomes invalid. Another problem that must be addressed are the cases when $EPS_{t+1}<0$, then the result for the ex post implicit cost of equity is negative again. To deal with this problem, we assume that when $EPS_{t+1}<0$, the global risk-free rate of return will be regarded as a realized minimum required rate of return, and the 10-year US government securities will be used as a proxy. Apparently, the implicit cost of capital calculated in this way is ex post and practically represents the discount rate with which the market has discounted the residual income from the period t+1 in order to get the price in period t. In fact, this percentage is the actually measured minimum rate of return which investors have required from a company, but as already mentioned, it is an ex post observation, which means that its practical value for the investment management is low. It is worthy because this rate can be used as a benchmark i.e. to what extent a model for calculating the cost of equity is closer to reality. This is exactly the role of the realized implicit minimum required rate of return in this paper i.e. on its basis to determine whether the Damodaran approach gives real results.

Of the well-known statistical tools for testing the accuracy of forecasts, we choose the two methods, namely, SMAPE – (Standard Mean Absolute Percentage Error) and MAE – Mean Absolute error[21]. The formula for MAE is the following:

$$\textbf{(4)}\ MAE_{dam} = \frac{1}{N}\left|k_{e_{it}}^{dam} - k_{e_{it}}^{impl}\right|$$

The mean absolute error is a good tool when comparing two models for calculating a given value, but when it comes to assessing the applicability of a model, the mean absolute error could mislead analysts, because the result is an absolute value that cannot be interpreted properly. Therefore, it is necessary to apply the SMPE (Standard Mean Absolute Percentage Error), which practically shows (in percentage) to what extent the predicted expected value deviates from the realized value. The formula for this type of measure is:

$$\textbf{(5)}\ SMAPE = \frac{1}{n}\sum_{t=1}^{n}\frac{\left|k_{e_{it}}^{dam} - k_{e_{it}}^{impl}\right|}{k_e^{imp} + k_e^{dam}}$$

The symmetric error is an indicator which is far easier to interpret, because the end result is within the range of 0 to 1. A hypothetical problem with SMAPE is that the demanded symmetry lacks because the undervaluation and overvaluation of the real result are not treated in the same way. But such symmetry in the forecast error cannot be included in an index as SMAPE, whose measurement error, unlike the previously discussed MAE indicator, is entirely difference-based. The last measure of forecast error that will be applied is a modified version of SMAPE. The idea of SMAPE′[22] is to eliminate the problem regarding the symmetry of the error and to examine the direction of this bias[23]. The formula is as follows:

$$\textbf{(6)}\ SMAPE' = \frac{\sum_{i=1}^{n}(k_{e_i}^{dam} - k_{e_i}^{dam})}{\sum_{i=1}^{n}(k_{e_i}^{dam} + k_{e_i}^{dam})}$$

In equation (6) the symbols are the same as in previous formulas. Since the theory so far has not specified which of these indicators is the best measurement of the forecast error, in the next part it is necessary to test the

[21] **Hyndman, R. J.** (2006). Another look at measures of forecast accuracy. // FORESIGHT Issue 4 June 2006, p46.

[22] SMAPE′ – a modified version of SMAPE.

[23] Bias – possibility of artificial change in the results of a statistical model.

three suggested models. The empirical results should show to what extent Damodaran's approach to calculating the cost of equity is realistic.

3. Empirical testing of the proposed modifications

The object of study was defined as the cost of capital of companies in the global emerging markets. Therefore, the database on which the empirical testing will be carried out includes companies listed on the world's major emerging markets.

Thus selected, the countries represent the most important markets for the global investor. However, there is no claim that the study covers all emerging markets or that the division by regions is the only division. Once we have the markets, in order for a company to fall in the sample, it must meet certain requirements, the most restrictive of which are the presence of financial data – a problem that any study of emerging markets faces. There are generally four conditions for including a company in the survey:

- Condition 1) It must be listed on the main stock exchange in the particular country;
- Condition 2) It must be a non-financial company;
- Condition 3) It must have available market prices for the previous 24 months of the given period;
- Condition 4) It must have accessible annual financial statement for the year following the period studied.

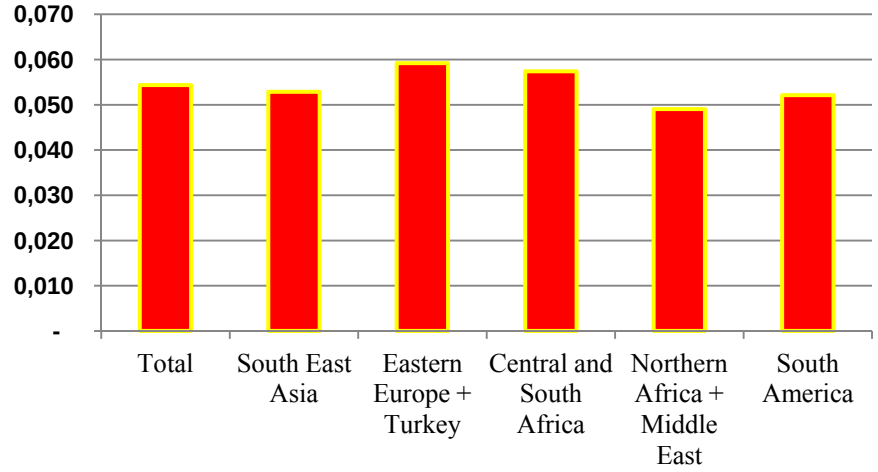
After filtering the companies according to the above criteria the following set of companies surveyed is received:

Table 1. **Number of companies surveyed**

Year	2008	2009	2010	2011	2012	2013
Number of companies	3315	3613	3879	4051	4188	2433

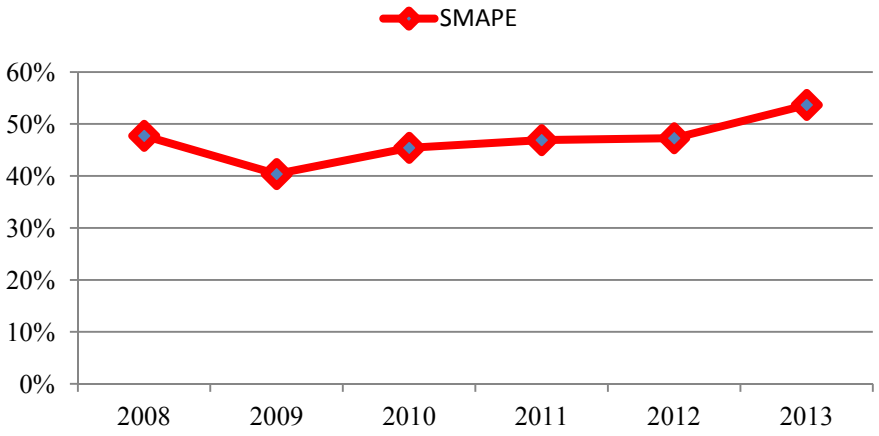
The varying number of companies over the years is a phenomenon frequently observed in emerging financial markets due to the rapid and erratic development of stock trading, where on most markets the traded companies doubled as of 2013 compared to the beginning of 2006. It must be noted that only the S&P Capital IQ database is used for comparing the data. The following chart shows the results of the mean absolute error of the model studied compared to the observed *ex post* cost of capital:

Figure 1. **Mean average error of the approach by different geographic areas for the whole period studied**



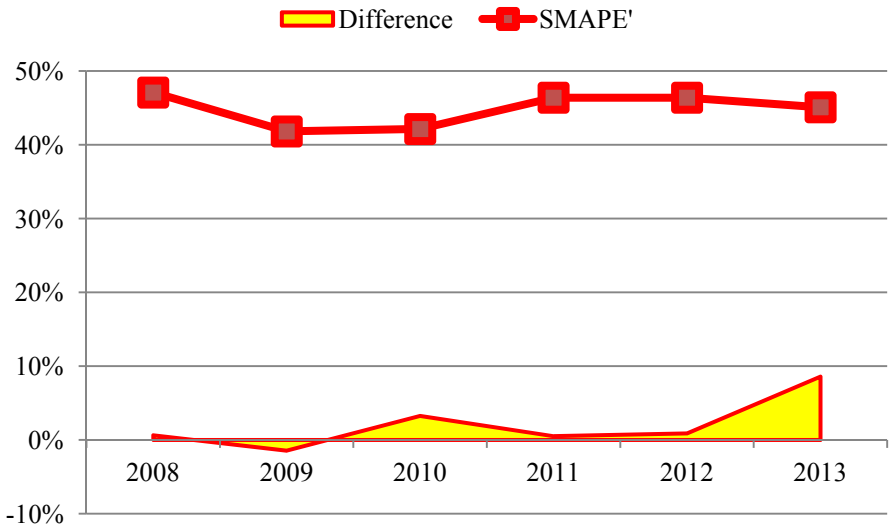
In the methodological section it was mentioned that the result of MAE is an absolute deviation. In Figure 1, this mean deviation is averaged for each geographical group of emerging markets. The Damodaran approach apparently gives the greatest error in the regions "Eastern Europe + Turkey" and "Central and South America", as the value of MAE is almost 6%, the average value being 5.4% for all 21 000 observations. However, as specified in testing the applicability of only one model, the information from MAE cannot be interpreted properly and mislead analysts. Therefore, the following graph shows the result of the SMAPE model:

Figure 2. **Value of SMAPE for the period 2008-2013**



Evidently the Damodaran model maintains a steady level of deviation from the observed *ex post* cost of capital, and at high values of about 50%. This result leads to the main conclusion that the Damodaran approach can be improved for the following reasons. First, the high levels of MAE emphasize the need to improve the model, because the results prove to be too unreliable. Second, the approximately constant error means that the model lacks a certain market effect, which maintains this constant deviation. In the previous section of the study it was noted that this traditional formulation of SMAPE has a bias, therefore the results of SMAPE' also have to be studied:

Figure 3. **Values of SMAPE' for the period 2008-2013. Difference between SMAPE and SMAPE' by years.**



The difference between SMAPE and SMAPE' increases significantly in the last years of the period studied, but as a whole, it does not exceed 10% and both models follow a common trend. This confirms the conclusions made regarding the opportunity to improve the Damodaran approach for calculating the price of the companies' equity. It is interesting to note, however, that in 2009 this approach gave the slightest error and the value of SMAPE fell below 40%. This is the year after the global financial crisis in developed markets, which is why in the first half of 2009 the developed financial markets were very much affected by the crisis and their recovery began in the second half of 2009. In a similar period of macroeconomic turbulence the Damodaran approach gives the slightest error and this argument can give rise to the statement that in periods when mainly global economic indicators move the markets, the Damodaran approach manages to cover this information in a very

good way. This additional conclusion finishes the empirical testing of the Damodaran approach.

Conclusion

Of all models known for calculating the cost of the equity of companies, the Damodaran approach is thought to be the best model for the conditions of emerging markets. This study describes the approach in detail and outlines some critical moments that are subject to improvement. The main contribution of the paper is characterized in the development of the model for finding the *ex post* cost of equity, allowing observation of real data on which to compare the results of the Damodaran approach. This model of finding the "realized" cost of equity is based on the model of residual income for a number of reasons. The MAE, SMAPE and SMAPE' statistical methods were used to test how the results of the Damodaran model reflect the real cost of equity. The empirical results lead to the confirmation of the need to improve the Damodaran approach.

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- graphs and figures– Word 2003 or Power Point.

4. Layout:

- title of article, name of author, academic position and academic degree – font Times New Roman, 14 pt, with capital letters Bold – centered;
- workplace, postal address, telephone and E-mail;
- abstract in Bulgarian up to 15 lines; key words–3 to 5;
- JEL classification of publications on economic topics (http://ideas.repec.org/j/index.html);
- main body (main text);
- tables, graphs and figures are software inserted in the text (they should allow linguistic corrections and translation in English). Numbers and text in them should be written with font Times New Roman 12 pt;
- formulas are inserted with Equation Editor;

5. Rules for footnote citations: When citing, meet the requirements of BDS 17377-96 Bibliographic Citations shown here:
http://www.uni-svishtov.bg/dialog/Bibl.%20Citirane.pdf.
Each author is responsible for promoting ideas, content and technical layout of the text.

6. Manuscripts of lecturers without an academic rank should be accompanied by a transcript of the minutes of the Department meeting at which the proposed paper was discussed.

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