Cost of capital adjustment related on stocks investments.
Study case for 11 European countries

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Abstract

This paper analyzes the risk size in emerging markets for investments in risky assets, especially shares. For each of the 11 countries we analyzed the role played by several indicators, some belonging to the capital market, such as size and liquidity, and others who refer to the whole economic situation (inflation, GDP, unemployment). In the analysis we used the daily values recorded by composite indices of those markets, based on which we calculated annual values. Concerning the macroeconomic indicators, we have the data from Eurostat reports.

The results indicate a weak influence of the variables included in the study. This can translate in two directions: 1) data are not sufficient, for each country have 6 observations per variable, and 2) the factors that determine the risk in emerging markets are of another nature, such as, for example, the evolution of indices developed markets (it is known that there is a strong correlation between the evolution of indices of emerging markets and the evolution of American index).

Introduction

Risk is one of the most elusive concepts in finance, and it is particularly so in emerging markets. There is little agreement about how to assess it and, therefore, about how to factor it properly into financial decisions.

The proper identification of the risk variables that explain the cross-section of returns in emerging markets has many and far-reaching implications for both companies and investors.

There is by now a large and growing literature on the cross-section of returns in emerging markets, whose obvious ultimate goal is to isolate the variables that determine substantial differences in returns across emerging stocks or countries.
Any project evaluation, company valuation or capital-structure optimization needs a cost of capital estimate, which is partially determined by the cost of equity, which in turn depends on the variables that explain the cross-section of stock returns.

Understanding the factors that make the risk and return of an asset constituted a challenge for both academic world and practitioners, in this case the portfolio managers. There are still many controversies regarding the variables that influence the price of a share and have been countless studies to see if it (the price) is more sensitive to risk (beta indicators, the factors in the APT model, liquidity) and/or the non-risk characteristics, or if the price itself is formed as a result of local or global factors. Recent studies have emphasized the importance of country indicators vs. industry indicators. They found that country indicators are supreme in front of the industry indicators. Another discussion is to identify the country indicators which explain more of the risk size and if they are related to local, industrial and macroeconomic factors.

In order to find a model to estimate the risk and return, primarily we have to identify the factors that influence the movement of the two. They can be of global importance, such as oil price variation, or local importance, even if they are the answer to global trends such as interest rate variation. Recent studies show that liberalization of capital markets together with increasing influence of foreign investors led the formation of a common lot (for more markets) of factors influencing the price of shares and of risk premiums also common (Bekaert and Harvey, 1998).

In the following I will try to determine the contribution of local nature factors in shaping the risk on 11 emerging markets in Europe, chosen randomly. I wanted to see generally how risk is influenced by two types of variables:

- variables related to the stock market itself, like size and liquidity;
- macroeconomic variables.

**Current state of knowledge**

A fundamental principle in finance is the trade-off between risk and return. This means that one portfolio can be expected to outperform another portfolio only if the former is riskier in some appropriate sense. Currently, the best two theories that provide a
rigorous foundation for computing trade-off between risk and return are the CAMP Model and the APT Model.

**Models for estimating risk and return**

1) **Market Model**

It is used to determine the return of an asset depending to market return. It is based on a linear regression equation:

\[ R_a = \alpha + \beta \times R_M + \varepsilon \]

Where:
- \( R_a \) – asset return;
- \( \alpha \) – the free factor, the asset’s characteristic coefficient, measuring the influence of all return’s factors except the market return;
- \( \beta \) – volatility coefficient which measures the sensitivity of assets return related to market return;
- \( R_M \) – market return;
- \( \varepsilon \) – residual factor, which measures the influence of all random factors, characterized by zero average and constant mean.

For the model to work, the variables included in the study have to fulfill some hypothesis:

- The average of residual factors has to be 0;
- The residual factors are not correlated;
- The constant variance of the residual factors;
- The covariance between residual factors and \( R_M \) is 0.

To estimate the risk using this model we can apply the following equation:
\[ \sigma^2(Ra) = \beta^2 \cdot \sigma^2(RM) + \sigma^2(\varepsilon) \]

In this equation, the risk is formed by two components:
- A systematic component \( \sigma^2(RM) \);
- A non-systematic component \( \sigma^2(\varepsilon) \).

**Disadvantages:**
- In practice, the portfolio manager faces with different alphas depending of the asset;
- Many restrictive hypothesis.

2) **Capital Asset Price Model (CAPM)**

This model sustains that the estimated return of an asset is determined by the quantity of systematic risk measured by beta, which is supposed to be constant on a certain time horizon, like in the previous model

\[ E(Ra) = Rf + \beta \cdot [E(RM) - Rf] \]

- \( E(Ra) \) – assets return;
- \( Rf \) – risk free rate;
- \( \beta \) – volatility coefficient which measures the sensitivity of assets return related to market return;
- \( R_M \) – market return;

**Hypothesis:**
- There are risk free assets on the market;
- The investors are rational and they have the same time horizon predictions;
- The market is efficient;
- There are no transaction fees;
- No investor can influence by himself the price of a stock;
- The stocks are perfectly divisible;
- The stocks are perfectly liquid and are traded at the “right” value.

3) **Arbitrage Pricing Theory (APT)**

The APT relates the expected rate of return on a sequence of primitive securities to their factor sensitivities, suggesting that factor risk is of critical importance in asset pricing (Gilles & Leroy, 1990). The APT is a new and different approach to determining asset prices. It tries to capture some of the non-market influences that cause securities to move together. It is based on the law of one price: two items that are the same cannot sell at different prices.

Unlike the CAPM, which requires strong restrictions on return distributions and preferences, the APT gives a characterization of expected returns on assets based only on the weak assumptions that there are no arbitrage opportunities, returns follow a factor structure and there are homogeneous expectations.

The APT formulated by Ross (1976) rests on the hypothesis that the equity price is influenced by limited and non-correlated common factors and by a specific factor totally independent from the other factors. By using this arbitrage reasoning it can be shown that in an efficient market, the expected return is linear combination of each factor’s beta. (Morel, 2001) The risk associated with holding a particular security comes from two sources. The first source of risk is the macroeconomic factors that affect all securities. Their influence pervades the whole asset market and cannot be diversified away. The second source of risk is the idiosyncratic element. This element is unique to each security and, according to the APT, in a broadly diversified portfolio it can be diversified away. Thus, an efficient market will only reward the risks associated with the systematic (macroeconomic) factors. (Watsham & Parramore, 1997)

The APT assumes that arbitrage profit opportunities are quickly eliminated through competitive forces – this means, that an investor can not earn a positive expected rate of return on any combination of assets without incurring some risk and without making some net investment (Berry et al., 1988). Broadly speaking, the APT implies that
the return of an asset can be broken down into an expected return and an unexpected or surprise component. Thus, the APT predicts that “general news” will affect the rate of return on all stocks but by different amounts. In this way the APT is more general than the CAPM, because it allows larger number of factors to affect the rate of return. (Cuthbertson, 2004)

\[ E(R_a) = R_f + \beta_1 \times [E(F_1) - R_f] + \beta_2 \times [E(F_2) - R_f] + ... + \beta_n \times [E(F_n) - R_f] \]

Where:

- \( F_n \) – factor of influence.

**Study Case**

The Study Case was made by applying the multiple linear regression. With this we can determine the impact of several independent variables on a given variable, called dependent variable, which in our case is the risk.

To estimate the risk of a market we included two types of variables:

1) **variables that are strictly related to the capital market**

   - *market size*, calculated as a share of market capitalization in total capitalization; in case there was no daily (or monthly) data available, the average capitalization was calculated as the arithmetic mean between the capitalization of the last day of the preceding year and the capitalization on the last day of current year
   - *liquidity*, calculated as the ratio between the amount transacted and capitalization, as in the previous case, the amount transacted is the daily average;
   - *the risk*, calculated as the standard deviation of daily return;

2) **macroeconomic variables**

   - *inflation rate*, an indicator of economic stability,
- **GDP**, an indicator of economic growth, which explores the economic situation in general; we used the real growth from one year to another, which means that inflation is removed;
- the *average unemployment rate*, another indicator of economic instability;
- **government debt**, calculated as a percentage of GDP.

The data are for 2003 – 2008 period.

**Results**

Firstly, we analyzed the influence of all factors over the risk. The variables included in the regression explain 63.6% of the risk. The rest of 36.4% is the influence of other factors that weren’t included in the model. Although the F-statistic test validates the model, the t-statistic test rejects it for some variables.

The equation obtained is:

\[
RISC = 0.01184072685 - 0.006925731897 \times \text{DAT GUV} - 0.008591218498 \times \text{INFLATIE} + 0.0490875812 \times \text{INTEREST} + 0.5721899149 \times \text{LICHIDITATE} + 0.07398894564 \times \text{MARIME} - 0.006272974493 \times \text{RENTABILITATE} + 0.01349881164 \times \text{SOMAJ} - 0.04983466481 \times \text{PIB}
\]

The results obtained when we tested the influence between risk and the two variables related to the market, size and liquidity showed us that these two variables explain 11.6% of the risk. On other words, investors look more at the macroeconomic indicators than at the characteristics of the market – the fundamental analyses is on the first place.

\[
RISC = 0.01141996828 + 1.487649314 \times \text{LICHIDITATE} + 0.004824249676 \times \text{MARIME}
\]

Both of liquidity and size have a direct influence over the risk. When the liquidity of a market rises by 1%, the risk rises by 1.49%. When the size is bigger by 1%, the risk is greater by 0.005%.
Because the t-statistic test rejected the model for size variable, we made another regression to see how the liquidity itself influences the risk on a market. We discovered that liquidity explains 10,5% of the risk. The equation obtained is as follows:

\[
RISC = 0.01191981267 + 1.473901998*LICHDITATE
\]

When we analyzed the influence on each market included in the study, we got valid result for Slovenia and Austria, as follows:

\[
R_{AU} = 0.005280875919 + 5.33177186*L_{AU}
\]

\[
R_{SLOVENIA} = -0.00934724212 + 44.67701837*L_{SLOVENIA}
\]

On the Austrian market the risk is explained by the liquidity in proportion of 84,34% and on the Slovenian market 93,7%. In both cases the relationship is positive.

The macroeconomic variables explain 15,32% of the risk and the regression equation is as follows:

\[
RISC = 0.0118525013 + 0.0212803066*INFLATIE - 0.003544057413*INTEREST - 0.05168592618*PIB + 0.01311001036*DAT_GUV + 0.007140384377*SOMAJ
\]

The statistic tests give good results only for inflation rate and the equation is:

\[
RISC = 0.01144079019 + 0.07276600278*INFLATIE
\]

Conclusions:

The study I made returned less clear results than I expected. The statistic tests accepted in most cases the null hypothesis, probably because I needed a longer period to analyze. Another problem is the particularity of emerging markets – these are very volatile, are inefficient and very correlated to developed countries, so sometimes their evolution contradicts the performances obtained by the local economy.

The variables related to the market itself, size and liquidity, explain 11,6% of the risk and the relationship is a direct one. Countries like Poland, Bulgaria or Austria, the most liquid ones of eleven analyzed, register the greater risks, 4,4%, 5,7% and 3,1%.
This how we can explain the drops registered by the main indices in these three countries in 2008; for example in Bulgaria the SOFIX Index lost 78.8% of its value.

Regarding the relation between size and risk, the influence is a direct one, a bigger market having a greater risk. This can be explained by the fact that on a big market the competition between the investors is higher which sometimes leads to higher volatility, especially if it’s an emerging market.

The macroeconomic variables explain 15.32% of the risk, and if we include in the regression the market variables also, the value is 63.57% of the risk. The rest is the influence of other factors, like country rating or certain news.

As a conclusion, the risk on a market is described both of the market characteristics – size and liquidity, but mostly by the macroeconomic results.
Bibliography:

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http://www.wienerborse.at/
http://www.bse.hu/
http://www.gpw.pl/
http://www.ljse.si/
Appendix 1 – Regression results between risk and market and macroeconomic variables

Dependent Variable: **RISC**  
Method: Panel Least Squares  
Sample: 2003 2008  
Cross-sections included: 8  
Total panel (unbalanced) observations: 46

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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R-squared 0.635737  Mean dependent var 0.014464  
Adjusted R-squared 0.556977  S.D. dependent var 0.008460  
S.E. of regression 0.005631  Akaike info criterion -7.347529  
Sum squared resid 0.001173  Schwarz criterion -6.989751  
Log likelihood 177.9932  F-statistic 8.071859  
Durbin-Watson stat 1.731768  Prob(F-statistic) 0.000003
## Appendix 2 - Regression results between risk and market variables

Dependent Variable: **RISC**
Method: Panel Least Squares
Sample: 2003 2008
Cross-sections included: 11
Total panel (unbalanced) observations: 61

<table>
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<th>t-Statistic</th>
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R-squared         | 0.116040     | Mean dependent var | 0.014636     |
Adjusted R-squared| 0.085558     | S.D. dependent var  | 0.009699     |
S.E. of regression | 0.009275     | Akaike info criterion | -6.475002   |
Sum squared resid  | 0.004990     | Schwarz criterion   | -6.371189    |
Log likelihood     | 200.4876     | F-statistic         | 3.806909     |
Durbin-Watson stat | 0.496579     | Prob(F-statistic)   | 0.027961     |
Appendix 3 - Regression between risk and liquidity

Dependent Variable: RISC
Method: Panel Least Squares
Sample: 2003 2008
Cross-sections included: 11
Total panel (unbalanced) observations: 61

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<th>Variable</th>
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R-squared 0.107421  Mean dependent var 0.014636
Adjusted R-squared 0.092292  S.D. dependent var 0.009699
S.E. of regression 0.009241  Akaike info criterion -6.498086
Sum squared resid 0.005038  Schwarz criterion -6.428877
Log likelihood 200.1916  F-statistic 7.100558
Durbin-Watson stat 0.497819  Prob(F-statistic) 0.009923
### Appendix 4 – Regression results for each country; the influence of liquidity over the risk

<table>
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<th>Probabilitatea testului t</th>
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Appendix 5 – Regression results for risk and macroeconomic variables

Dependent Variable: RISC
Method: Panel Least Squares
Sample: 2003 2008
Cross-sections included: 8
Total panel (unbalanced) observations: 46

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<th>Variable</th>
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R-squared    0.153203  Mean dependent var  0.014464
Adjusted R-squared  0.047353  S.D. dependent var  0.008460
S.E. of regression  0.008257  Akaike info criterion -6.634379
Sum squared resid  0.002727  Schwarz criterion -6.395860
Log likelihood  158.5907  F-statistic  1.447359
Durbin-Watson stat  0.613869  Prob(F-statistic)  0.228626
### Appendix 6 – Regression results for risk and inflation rate

**Dependent Variable:** RISC  
**Method:** Panel Least Squares  
**Date:** 06/20/09  
**Time:** 17:30  
**Sample:** 2003 2008  
**Cross-sections included:** 11  
**Total panel (unbalanced) observations:** 63

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**R-squared:** 0.062385  
**Mean dependent var:** 0.015115  
**Adjusted R-squared:** 0.047014  
**S.D. dependent var:** 0.010209  
**Akaike info criterion:** -6.348005  
**Schwarz criterion:** -6.279969  
**F-statistic:** 4.058701  
**Prob(F-statistic):** 0.048359