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REVISITING MULTIFACTOR MODELS ON THE BUCHAREST STOCK EXCHANGE

Abstract. *The CAPM offers a simplistic representation of the relationship between asset returns and market risk (one factor model), as such, alternative multifactor models that use macroeconomic or microeconomic factors have been sought to gain further insight into this relationship.*
This article has its main focus on multifactor models that consider microeconomic factors. More specifically, we look at the following factors and their role in explaining the variation of stock returns: market capitalization, stock beta, market-to-book (MB) and price-to-earnings (PE) ratios, leverage ratio, return on assets (ROA) and return on equity (ROE).
Considering different panel regression methods, we find the variation of percentage changes in market capitalisation and in MB ratio as the leading variables in explaining the variation of stock returns. Although statistically significant, changes in market beta volatility actually decrease slightly the explanatory power of the model.
Keywords:*stock returns, macroeconomic multifactor models, microeconomic multifactor models, market beta coefficient, cross-sectional and period fixed effects.*

JEL Classification: C31, G11, G12

1. Introduction

The capital market model is a simple one factor regression model where returns of stock prices (R_i) are explained with the help of one macroeconomic factor, the return of the stock market (R_M, empirically, equal with the stock market index of a country)

$$R_i = \alpha_i + \beta_i \cdot R_M + \varepsilon_i$$

Because of this simplistic representation, a large proportion of the variation in stock prices is still left unexplained. This is why researchers have sought other variables that might improve the explanatory power of the model. Multifactor models can be classified into three main types, depending on the structure of the variables used:

1. Multifactor models using macroeconomic factors (e.g. GDP, interest rate, inflation, exchange rate, etc.)
2. Multifactor models using microeconomic factors (e.g. market beta, market capitalisation, leverage ratio, ROE, ROA, etc.)
3. Multifactor models using statistical factors (composite factors derived from statistical analysis)

Multifactor models with either macroeconomic factors, microeconomic factors, or a mix of the two are most popular throughout the related literature. This paper belongs to the second type of multifactor models. The sample used consists of 34 companies traded on the Bucharest Stock Exchange (BVB) and spans over a period from Q1 2005 to Q3 2013, with quarterly frequency.

Our contribution is twofold. First, we want to document how stock returns relate to microeconomic factors such as market capitalization, stock beta coefficient, market-to-book (MB) and price-to-earnings (PE) ratios, leverage ratio, return on assets (ROA) and return on equity (ROE). Second, we intend to determine which model specification best fits our panel data. In other words, we compare whether a model with cross-sectional fixed effects or with period effects are more appropriate in explaining the variation in stock returns. Although the theory behind panel data analysis has been around for many years, estimating panel regressions have recently gained more attention as larger and larger data sets of financial data are made available.

When comparing across model specifications, we find that using period fixed effects performs best for our data sample. This is not surprising given that our sample coincides with the time period of the most recent financial crisis. We therefore base our next findings on the regression estimates that consider period fixed effects.

Our results suggest that the variation of percentage changes in market capitalisation and the variation of percentage changes in the MB ratio are the leading variables in explaining the variation of stock returns. Both of these have a positive coefficient and explain roughly 28.9% of the variation in stock returns, as measured by the adj-R^2. These findings hold when using period fixed effects or when just pooling the data. Most surprising, when the beta coefficient is also added as an explanatory variable in the model, the adj-R^2 decrease slightly (from 28.9% to 28.7%) and the Akaike information criterion, AIC, also increase (from1.2 to 1.21). We conclude that the market beta coefficient is not relevant for explaining the variation of stock returns.

Our paper is organised as follows. Section 2 reviews the related literature on the CAPM and multifactor models. Section 3 describes the data, cleaning procedures implemented and variables definitions. Empirical findings and results are presented in section 4. Section 5 concludes.

2. Literature review

There are numerous studies that document various other fundamental factors besides the risk of stock market movements, as shown by the CAPM.

In a seminal paper, Banz[1] (1981) prove that US stock returns of small/large market cap firms are higher/lower than the ones obtained through the use of CAPM. This negative correlation between market capitalisation and market beta (size effect) has been found on many other markets. Some examples include Japan (Ziemba, 1991), UK (Levis, 1985) or Australia (Brown et al., 1983).

Another factor that has been found important in explaining the variation of stock returns is the leverage ratio. If CAPM holds, all financial risks are expressed through the market risk factor, or beta coefficient. Thus, the leverage ratio is also considered to be part of market beta.

Bhandari (1988) finds a positive correlation between the leverage ratio and earnings per share over price (*earnings per share/price = 1 / PE*). Basu (1977, 1983) and Peavy and Goodman (1983) present similar findings but also document a positive correlation between earnings per share over price and market capitalisation and market beta.

Staatman (1980) and Rosenberg, Reid and Lanstein (1985) observe a positive correlation between US stock returns and the PE ratio (*price/earnings per share*). This finding is confirmed on other markets such as Japan (Pontiff and Schall, 1998, Chan, Hamao and Lakonishok, 1991) or Europe (Capaul, Rowley and Sharpe, 1993).

The most significant extension of the CAPM model is done by Fama and French[2] (1992, 1998) by adding two other variables besides the market beta when analysing the variation of US stock prices. One is obtained as the return difference between a small cap portfolio and a large cap portfolio (*Small minus Big, or SMB*) while the other variable is computed as the return difference between portfolios with a high book-to-market ratio and a low book-to-market ratio (*High minus Low, or HML*). These findings have been tested and found to hold under different data specifications (e.g. Dennis et al., 1995 also account for transaction costs and different rebalancing periods) and for many other markets globally.

Daniel and Titman (1997), Lakonishok and Shapiro (1986) and many other studies present a low explanatory power for the beta coefficient and propose another

[1]Banz, Rolf, *The relationship between return and market value of common stocks*, Journal of Financial Economics 9, 1981, 13-18;

[2]Fama, Eugen, Kenneth French, *The cross-section of expected stock returns*, Journal of Finance 47, 1992,, 427-465;Fama, Eugen, Kenneth French, *Value versus growth: the international evidence*, Journal of Finance 53, 1998, 427-465.

factors (leverage ratio, market capitalisation, PE and MB ratios, etc.) that influence stock returns. All of these put a question mark on the reliability of the CAPM.
Closest to our analysis is the work of Cristiana Tudor (2009) which studies the correlation between stock returns and various microeconomic factors on the Romanian capital market.

3. Data

Our data sample comprises of stock returns and microeconomic factors of companies traded on the Bucharest Stock Exchange over a period from Q1 2005 to Q3 2013. Data is sampled quarterly, same as the reporting frequency of financial reports. Only 34 companies were selects on the basis of data availability. However, all sectors are represented by these companies and, therefore, our results should be a good characterisation of the Romanian capital market as a whole. The variables used have been downloaded from Thompson Reuters Eikon and Bloomberg. The series are completed with the help of the KTD and BVB databases.
Stock returns are computed quarterly and should, therefore, include most of the information embedded in the microeconomic factors. We consider the following explanatory variables, all taken at a quarterly frequency:

1. Market **beta** coefficient,
2. Market capitalization, **MC** (total number of stocks * stock price),
3. Free-float value, **FF** (Free Float * stock return)
4. **MBR** ratio(stock price / net asset per share),
5. **PER** ratio(stock price / earnings per share),
6. Leverage ratio **D/Eq** (Total debt / Shareholder's Equity),
7. **ROE** ratio(Net Income / Shareholder's Equity),
8. **ROA** ratio((Net Income + Interest Expenses * (1 – Tax Rate))/ Total assets).

Some further comments must be made on defining the beta coefficient. The beta is a measure of market risk that expresses the relationship between the variation of stock prices and the variation of the market. This coefficient is estimated each period on the base of the previous 24 months against the market stock index BET-C.
As is the case with most data sets, some preliminary cleaning procedures were implemented before the analysis. One issue relates to the tendency of market betas to converge, with time, to one (Blume[3], 1975). If any of our betas comply with this trend, the following adjustment is implemented:

Beta adjusted = 0.333 + 0.667 · Beta estimated on the last 2-3 quarters

[3]Blume, M., *Betas and Their Regression Tendencies*, Journal of Finance 30, 1975, 785-795.

Fortunately, only two companies present this behaviour, SIF1 and SIF4. Fig. 1 presents the evolution of the beta coefficients for the two companies together with the adjusted beta coefficients. The beta coefficient of SIF1 starts to approach the value of one after Q1 2011, whereas the beta coefficient of SIF4 starts to approach unity after Q1 2009.
The beta adjustment procedure for these two companies only impact 2.8% of betas (or 30 out of a total of 1063) and has a very small impact on the regression estimates, whatever the specification. Therefore, we only present the regression output using the initial set of unadjusted betas.

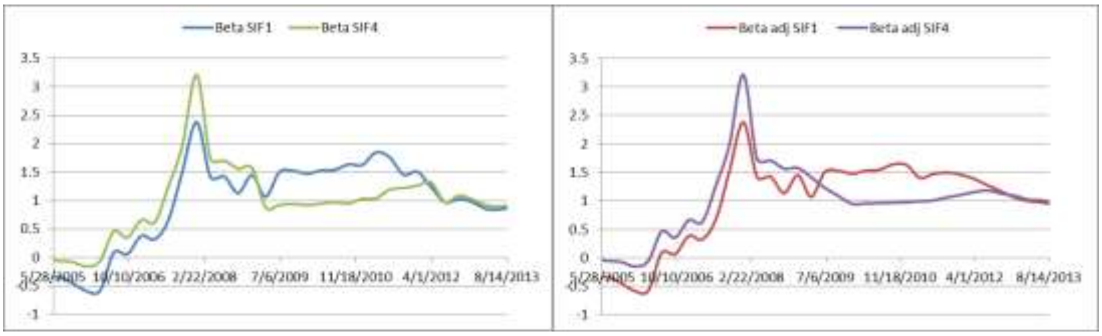

Figure 1: The evolution of beta coefficients (left graph) and beta adjusted coefficients (right graph) of SIF1 and SIF4

Another issue is the non-stationary that usually describes financial statements data. Not surprising, most of the variables used are highly persistent in absolute values. As the first difference didn't take care of the problem, all variables used in the final panel regressions have been differenced twice. The leverage (D_Eq) variable was eliminated from the regression models because it proved to be non-stationary after both first and second differentiations.
The final series of data that are not balanced (complete) because, in the financial crisis, some companies have losses, other companies became insolvent and others were delisted. The number of observations used in regressions can vary between 1,173 records (when MBR variable is considered) and 991 records (when PER variable is considered). However, we don't consider these difficulties, in setting up the data, to affect the conclusions of our statistical analysis.

4. Empirical findings

We begin our analysis with pooled regression models considering all 34 companies, each with 34 quarterly records[4]. All statistical procedures are implemented with the help of Excel and EViews software.

The multifactor model, which will be validated through statistical analysis, will be used later as an efficient portfolio selection model alternative to those obtained in model selection by Markowitz.

Table 1 presents different regression model estimates of our dependent variable, VPRICE, against individual factors (models 1 to 7) and group micro-economic factors (models 8 and 9). Just four of the seven variables considered are statistically significant at 5% in individual regression models, with adjusted R^2 values between 0.13% and 22.2%. Model (8) is constructed by grouping these significant independent variables together, respectively, the percentage change in the beta coefficient (VBETA), market capitalization of companies (VMKT_CAP), the free float (VFREE_FLOAT), and the ratio between market and book values of the shares (VMBR). As expected, the free float variable becomes insignificant in the presence of the market capitalization variable.

Table 1: Pooled regression model estimates

VPRICE ~	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VBETA	0.008**							0.009**	0.008**
VMKT_CAP		0.386***						0.208***	0.208***
VFREE_FLOAT			0.005**					0.000	
VMBR				0.403***				0.334***	0.333***
PER					0.000				
ROE						0.003			
ROA							0.015		
	0.24%	0.13%	0.40%	22.20%	0.00%	-0.05%	0.02%	25.30%	25.40%
	34	34	34	34	34	34	34	34	34
-	34	34	34	34	34	34	34	34	34
	1127	1136	1136	1150	965	1118	1137	1107	1119

*** Significant at 1% For brevity, constant coefficients are not reported.
** Significant at 5%
* Significant at 10%

[4] By calculating the percentage change of some variables we lose a period, respectively, starting from the initial reporting.

Therefore, in the model (9), the stock returns are explained only by the market beta factor, the percentage change in the market capitalization and the market-to-book ratio of the 34 securities. We find the adjusted R^2 of 25.4% satisfactory as we expect a lot of noise given the time period considered. Also, there might be other factors not considered in the current analysis that are important in determining stock returns. Some examples are represented by the macro-economic factors which will be the topic for further research.

As model (9) represents a simple pooled regression and, thus, no adjustments are made to take into account the differences between companies of through time, we next proceed to estimate panel regression with cross-sectional and period fixed effects. Estimated are reported in table 2. Model (10) presents the panel regression results with cross-section fixed effects (intercept varies on the companies, but remains constant on the periods). We notice a small drop in explanatory power as compared to the pooled regression results (R^2 = 25.2% < 25.4%).

The likelihood ratio test for testing the significance of the cross-sectional fixed effects reveals that there is a 65% probability for these intercepts to be zero (see Appendix B). Therefore, adding cross-sectional fixed effects doesn't result in an improved model as compared to the pooled regression.

Table 2. Panel regression models with fixed effects

VPRICE ~	Constant intercept	Fixed effects		
		cross-	period	
	(9)	(10)	(11)	(12)
VBETA	0.008**	0.009**	0.006*	
VMKT_CAP	0.208***	0.203***	0.193**	0.196**
VMBR	0.333***	0.343***	0.287***	0.284***
	25.4%	25.2%	28.7%	28.9%
	34	34	34	34
-	34	34	34	34
	1119	1127	1119	1136

*** Significant at 1% For brevity, constant coefficients are not reported.
** Significant at 5%
* Significant at 10%

Model (11) considers period fixed effects (intercept varies throughout the 34 quarters of data series, but remains constant at company level). In this specification, the likelihood ratio test finds the period fixed effects highly statistically significant (see Appendix C). These important differences from quarter

to quarter signal that the financial crisis did have an important effect on the relationships that describe stock returns. Model (11) provides the best explanatory power (adjusted R^2 = 28.7%) when compared to all previous models considered.
We notice that the market beta coefficient decreases in significance when period fixed effects are considered. Interestingly, dropping this variable from the regression (model (12)) brings a slight increase in adjusted R^2 coefficient (28.9 % > 28.7 %), the Akaike information criterion improves (1.2 < 1.21), and a better statistically significance is achieved for the remaining variables.
Consequently, the stock returns of the 34 securities are explained, in a proportion of 29 %, by the quarterly percentage change in the market capitalization (VMKT_CAP, with sensitivity coefficient = 0.196) and the ratio between the market value and the book value of the securities analyzed (VMBR coefficient = 0.284). In other words, the performance of stock returns is mostly influenced by the company's size and financial value[5]. The variable VBETA seems to have a low relevance in explaining stock returns which is contrary to what one expects from the theoretical CAPM.

5. Conclusion

Because the market model greatly simplifies the relationship between stock returns and capital market risk (one-factor model), alternative multifactor models that use macroeconomic factors (GDP, interest rate, inflation, exchange rate etc.) and microeconomic (beta, market capitalization, leverage, ROE, ROA, etc.) should be better suited to explain more of the variation in stock returns.
In in this paper, we use microeconomic factors aimed at explaining stock returns: the beta coefficient, market capitalization, free float, MBR and PER multiples, leverage ratio, ROE and ROE rates of return.
We were aware of several issues that might describe our dataset. First, beta coefficients tend, with time, to approach the value of one. Applying the beta adjustment proposed by Blume (1975) doesn't significantly alter the statistical properties of the data sets considered. Thus, our statistical analysis uses the original unadjusted beta coefficient series. Second, non-stationary feature of the series has led us to forego their differentiation. All variables were calculated as percentage changes from one to other quarter.
The pooled regression results indicate that stock returns (VPRICE) are mainly explained by the percentage change in beta coefficients (VBETA), market capitalization (VMKT_CAP) and market value / book value ratio (VMBR). To find better models, we consider the influence of both cross-sectional and period fixed

[5]A third attempt to identify fixed companies effects, while period fixed effects analysis, failed due to lack of statistical significance of fixed companies effects (see AppendixD).

effects through panel regressions. The cross-sectional fixed effects proved not to be significantly different from zero. Contrary, the period fixed effects were highly significant, which is expected given the time period studied.

Using just 2 variables in the panel regression model with period fixed effects offered the highest explanatory power (29%) for the 34 BVB stock return series. The stock market performance of securities on the Romanian stock exchange market seems to be mainly explained by the percentage change in market capitalization (VMKT_CAP, with a sensitivity coefficient = 0.196) and by the market-to-book ratio (VMBR, with a coefficient = 0.284). Interestingly, the beta factor has low relevance in explaining stock returns and, thus, provides a basis for invalidating the CAPM.

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Appendix A
Regression equations of analysed stock returns:

a) initial beta coefficients (unadjusted)
b) adjusted beta coefficients

a)

Dependent Variable: **VPRICE**				
Method: Panel Least Squares Sample (adjusted): 2005Q1 2013Q2 Periods included: 34 Cross-sections included: 34 Total panel (unbalanced) observations: 1119				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.02	0.01	1.40	0.16
VBETA	0.01	0.00	2.17	0.03
VMKT_CAP	0.21	0.03	6.93	0.00
VMBR	0.33	0.02	13.62	0.00
Adj R-squared	**0.2563**	Mean dependent var		0.05
F-statistic	**128.12**	Akaike info criterion		1.23
Prob(F-statistic)	**0.00**	Durbin-Watson stat		2.25

Dependent Variable: **VPRICE**				
Method: Panel Least Squares Sample (adjusted): 2005Q1 2013Q2 Periods included: 34 Cross-sections included: 34 Total panel (unbalanced) observations: 1119				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.02	0.01	1.40	0.16
VBETA_**ADJ**	0.01	0.00	2.17	0.03
VMKT_CAP	0.21	0.03	6.93	0.00
VMBR	0.33	0.02	13.62	0.00
Adj R-squared	**0.2543**	Mean dependent var		0.05
F-statistic	**128.11**	Akaike info criterion		1.23
Prob(F-statistic)	**0.00**	Durbin-Watson stat		**2.25**

Appendix B
Panel regression with companies fixed effects

	FIRM	Effect
1	Aerostar	0.011413
2	Amonil	-0.027469
3	Antibiotice	0.005780
4	Armatura	-0.065210
5	Artrom	-0.011296
6	Azomures	0.042845
7	Biofarm	0.023055
8	Carbochim	0.009080
9	Comelf	0.005167
10	Compa	0.009520
11	Electroputere	-0.205253
12	Energopetrol	0.035388
13	Gr.ind.electr.	-0.023626
14	Mecanica	-0.004918
15	Mefin	0.008037
16	Oil	-0.003851
17	Oltchim	0.101218
18	OMV	0.003926
19	Petrolexim	-0.043689
20	Prodplast	-0.030842
21	Rompetrol Ref.	0.021793
22	Rompetrol Well	0.022486
23	SC Transilvania	-0.011779
24	SIF1 Bat Crisa	-0.014441
25	SIF4 Muntenia	-0.005527
26	Sinteza	-0.011274
27	Titan	-0.013037
28	Turbomecanica	-0.045442
29	UAMT Oradea	-0.009744
30	UCM Resita	0.045821
31	Voestalpine	-0.050826
32	Vrancart	0.329106
33	Zentiva	-0.005413
34	Zimtub	-0.055275

Redundant Fixed Effects Tests
Equation: VPRICE_3IND_CROSS
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.888901	(33,1082)	0.6492
Cross-section Chi-square	29.932890	33	0.6206

Cross-section fixed effects test equation:
Dependent Variable: VPRICE
Method: Panel Least Squares
Date: 01/12/14 Time: 02:16
Sample (adjusted): 2005Q1 2013Q2
Periods included: 34
Cross-sections included: 34
Total panel (unbalanced) observations: 1119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018885	0.013457	1.403373	0.1608
VBETA	0.008068	0.003720	2.169131	0.0303
VMKT_CAP	0.208388	0.030090	6.925449	0.0000
VMBR	0.333164	0.024466	13.61765	0.0000

R-squared	0.256346	Mean dependent var	0.047597
Adjusted R-squared	0.254345	S.D. dependent var	0.517319
S.E. of regression	0.446712	Akaike info criterion	1.229761
Sum squared resid	222.4997	Schwarz criterion	1.247707
Log likelihood	-684.0515	Hannan-Quinn criter.	1.236545
F-statistic	128.1177	Durbin-Watson stat	2.254818
Prob(F-statistic)	0.000000		

Appendix C

Panel regression with period fixed effects

	TIME	Effect
1	2005-03-31	-0.153468
2	2005-06-30	0.411530
3	2005-09-30	0.145549
4	2005-12-30	-0.036640
5	2006-03-31	-0.043284
6	2006-06-30	-0.004982
7	2006-09-29	0.140952
8	2006-12-29	0.048906
9	2007-03-30	0.001907
10	2007-06-29	0.206533
11	2007-09-28	-0.073029
12	2007-12-31	-0.076971
13	2008-03-31	-0.011777
14	2008-06-30	-0.133317
15	2008-09-30	-0.242930
16	2008-12-31	-0.145574
17	2009-03-31	0.279996
18	2009-06-30	-0.012071
19	2009-09-30	0.020297
20	2009-12-31	-0.016855
21	2010-03-31	-0.030175
22	2010-06-30	-0.050426
23	2010-09-30	-0.022411
24	2010-12-31	-0.070962
25	2011-03-31	0.081831
26	2011-06-30	-0.074348
27	2011-09-30	-0.060582
28	2011-12-30	0.088960
29	2012-03-30	-0.129095
30	2012-06-30	0.016777
31	2012-09-30	-0.047600
32	2012-12-30	0.055523
33	2013-03-30	-0.039307
34	2013-06-30	-0.009385

Redundant Fixed Effects Tests
Equation: Untitled
Test period fixed effects

Effects Test	Statistic	d.f.	Prob.
Period F	2.545539	(33,1082)	**0.0000**
Period Chi-square	83.667974	33	**0.0000**

Period fixed effects test equation:
Dependent Variable: VPRICE
Method: Panel Least Squares
Date: 01/12/14 Time: 03:02
Sample (adjusted): 2005Q1 2013Q2
Periods included: 34
Cross-sections included: 34
Total panel (unbalanced) observations: 1119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018885	0.013457	1.403373	0.1608
VBETA	0.008068	0.003720	2.169131	0.0303
VMKT_CAP	0.208388	0.030090	6.925449	0.0000
VMBR	0.333164	0.024466	13.61765	0.0000

R-squared	0.256346	Mean dependent var	0.047597
Adjusted R-squared	0.254345	S.D. dependent var	0.517319
S.E. of regression	0.446712	Akaike info criterion	1.229761
Sum squared resid	222.4997	Schwarz criterion	1.247707
Log likelihood	-684.0515	Hannan-Quinn criter.	1.236545
F-statistic	128.1177	Durbin-Watson stat	2.254818
Prob(F-statistic)	0.000000		

Appendix D

Panel regression with cross-sectional and period fixed effects

	FIRM	Effect		TIME	Effect
1	Aerostar	0.010602	1	2005-03-31	-0.151785
2	Amonil	-0.029985	2	2005-06-30	0.409583
3	Antibiotice	0.002397	3	2005-09-30	0.143074
4	Armatura	-0.064185	4	2005-12-30	-0.041121
5	Artrom	-0.011296	5	2006-03-31	-0.044232
6	Azomures	0.045043	6	2006-06-30	-0.005448
7	Biofarm	0.022658	7	2006-09-29	0.139045
8	Carbochim	0.008424	8	2006-12-29	0.049733
9	Comelf	0.004760	9	2007-03-30	0.001428
10	Compa	0.010225	10	2007-06-29	0.202360
11	Electroputere	-0.181054	11	2007-09-28	-0.073071
12	Energopetrol	0.035403	12	2007-12-31	-0.077144
13	Gr.ind.electr.	-0.026833	13	2008-03-31	-0.012525
14	Mecanica	0.005567	14	2008-06-30	-0.132882
15	Mefin	0.006149	15	2008-09-30	-0.240941
16	Oil	-0.006567	16	2008-12-31	-0.142125
17	Oltchim	0.098127	17	2009-03-31	0.276168
18	OMV	0.001179	18	2009-06-30	-0.013169
19	Petrolexim	-0.048637	19	2009-09-30	0.018100
20	Prodplast	-0.032688	20	2009-12-31	-0.017951
21	Rompetrol Ref.	0.033013	21	2010-03-31	-0.031845
22	Rompetrol Well	0.024210	22	2010-06-30	-0.051204
23	SC Transilvania	-0.003809	23	2010-09-30	-0.023689
24	SIF1 Bat Crisa	-0.014265	24	2010-12-31	-0.074331
25	SIF4 Muntenia	-0.009038	25	2011-03-31	0.078689
26	Sinteza	-0.007929	26	2011-06-30	-0.075316
27	Titan	-0.018591	27	2011-09-30	-0.061368
28	Turbomecanica	-0.049406	28	2011-12-30	0.085668
29	UAMT Oradea	-0.011244	29	2012-03-30	-0.128988
30	UCM Resita	0.051400	30	2012-06-30	0.013218
31	Voestalpine	-0.049523	31	2012-09-30	-0.051329
32	Vrancart	0.328244	32	2012-12-30	0.061518
33	Zentiva	-0.007001	33	2013-03-30	-0.028991
34	Zimtub	-0.058395	34	2013-06-30	0.000871

Redundant Fixed Effects Tests
Equation: VPRICE_3IND_MIXT
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.885429	(33,1049)	**0.6548**
Cross-section Chi-square	30.742773	33	**0.5800**
Period F	2.492705	(33,1049)	**0.0000**
Period Chi-square	84.477857	33	**0.0000**
Cross-Section/Period F	1.711037	(66,1049)	**0.0005**
Cross-Section/Period Chi-square	114.410747	66	**0.0002**

Cross-section and period fixed effects test equation:
Dependent Variable: VPRICE
Method: Panel Least Squares
Date: 01/13/14 Time: 17:47
Sample (adjusted): 2005Q1 2013Q2
Periods included: 34
Cross-sections included: 34
Total panel (unbalanced) observations: 1119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.018885	0.013457	1.403373	0.1608
VBETA	0.008068	0.003720	2.169131	0.0303
VMKT_CAP	0.208388	0.030090	6.925449	0.0000
VMBR	0.333164	0.024466	13.61765	0.0000

R-squared	0.256346	Mean dependent var	0.047597
Adjusted R-squared	0.254345	S.D. dependent var	0.517319
S.E. of regression	0.446712	Akaike info criterion	1.229761
Sum squared resid	222.4997	Schwarz criterion	1.247707
Log likelihood	-684.0515	Hannan-Quinn criter.	1.236545
F-statistic	**128.1177**	Durbin-Watson stat	**2.254818**
Prob(F-statistic)	**0.000000**		