ЛАФР

Equity risk premium in CAPM construction with downside risk measures in Russian capital market: from traditional unconditional CAPM to conditional three- and four-moment CAPM

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Abstract

Our research involves firm level testing of the expanded models in the CAPM construction on the Russian stock market (50 companies which constitute 95% of capitalization of Moscow Interbank Currency Exchange (MICEX)) during the period since 2004 to 2010. The expanded models overcome the background of the returns distribution normality and instationarity of the market's behavior. Moreover, using the sample of daily and weekly returns our study examines the preference of transition classical two-moment CAPM model to the expanded higher-moment models (mean-variance-skewness and mean-variance-skewness-kurtosis) and to the models with downside risk measures. The results of the testing of the conditional three-moment CAPM and conditional four-moment CAPM prove the supposal of using different return forecasting models practicality depending on the macroeconomical situation. The unconditional version of classic CAPM considered on the Russian market in the context of crisis periods must be rejected. Systematic skewness demonstrates the best forecasting ability among the reviewed levels of risk during the period 2008-2010.

Key words: *Downside CAPM; Higher Moment CAPM, conditional CAPM*

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1. Purpose and objectives of the research

One of the main problems of portfolio managers investing in emerging capital markets is to quantify expected return and risk, and also the risk return relationship. The Capital Asset Pricing Model (CAPM)[4] like market equilibrium model of capital assets pricing develops the relationship

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[4] Sharpe (1965), Lintner (1966), Black (1972)

between the systematic risk of an asset, measured as its equity beta, and the expected rate of return on that asset. The most common application of the CAPM is to estimate the expected return on equity, that is used for financial assets and business valuation, capital budgeting, portfolio performance evaluation and in setting regulated returns. CAPM is widely applied in practice. Despite the fact that there is an enormous number of already existing critical works on reviewing practical applications CAPM on many emerging and developed capital markets commercial non-financial companies' investors, consultants and analysts continue using traditional CAPM construction. Survey of the 11 Thousand financial directors which are usually made by Duke University and CFO Magazine[1] had shown that both in 2008 and 2009 nearly 75% respondents in asset valuation followed the CAPM construction. This model is described in every classic financial textbook[2] and in every guideline of making analytic reports of the investment companies with using DCF method of calculation stocks' fair price. Prevalence of the CAPM is supported by the presence of organisations such as Bloomberg, ValueLine, DataStream, Merrill Lynch provide CAPM -beta estimates as well as other data.

The DCF model usage in the Russian market analysis proves that this model is highly popular among Russian analysts. The traditional way of using the model is transition to the hybrid construction when non-risk rate and market bonus corrected on the countries' risks while beta-index is fixed either on the industry average level of the global market either or is counted of the prototype companies considering the level of the financial leverage. Emerging markets are characterized as markets with lower level of capitalization; low number of stocks which are passed through listings and exchanged on the stock exchanges; low level of trading and weak liquidity; few market-dominating companies. Significantly more important market characteristics are missed in traditionally involved country risk bonuses[3]: mean-variance-skewness and mean-variance-skewness-kurtosis, which cause significant problems when using CAPM in a long term, in particular lowering counted by a method of regression analysis beta-index (value is less than one), and lowering the demanded return rate like the rate of discounting cash flow.

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[3] In practice of the Russian analysts country risk premium is entered through correction of the market risk premium of the global market, or addition country credit default spread, or introduction of factor relative volatility of the markets

Many researchers suppose that developing CAPM construction for the emerging markets has to take place not only in the sphere of key model parameters (non-risk rate, market bonus for the risk, beta-index) but in consideration of specific characteristics of the circulating assets on these markets.

The important moment of the CAPM's practical usage is detecting time periods when the model can be used (when the function «higher systematic risk – higher returns» is real) and the periods of time when the model does not fit the outer conditions and must be rejected.

In our research within testing the CAPM for the Russian market we suggest following:

1. Extend the market two-moment model to the higher-moment models including systematic mean-variance-skewness and mean-variance-skewness-kurtosis. According to our hypothesis the addition of higher-order moments explains systematic equity risk better which is incidental to the Russian market's stocks.
2. Include downside risk measures in the pricing model. Our hypothesis – taking into account the systematic downside deviation will help receive a more adequate relation between market risk and return.
3. Test the significance of standard risk measures on the conditional CAPM that includes the higher moment distribution to prove the hypothesis that the relation between risk and return become negative on "the down-market" (with a negative market risk premium).

CAPM's cornerstone is recording two moments of returns' distribution (average and variance) and reviewing bilateral variance as a risk indicator (*Mean Variance Analysis framework)*. We suppose that «average returns-dispersion» does not indicate systematic risk fully, it doesn't indicate the risk which is incidental to the one or another stock on the developing capital market. Analysis's limitation with first two moments of the returns' distribution means ignoring the importance of higher moments which is acceptable only in two cases:

1. When investors' utility function transforms into quadric form *e.g.* growth of risk rejection is taking place along with growth of the financial result (in the emerging markets the growth of wealth may cause risk aversion)
2. When returns' distribution is normal (bell-shaped).

According to the few markets' reviews (Harvey, 1995) simultaneous carrying-out of requirements of the symmetry and normality of distribution of the expected stock returns is not achieved and this may lead to the investors' higher grade distribution (Rubinstein,1973; Scott and Horvath, 1980). In the study by Gibbons et al. (1989) it is shown that the skewness and kurtosis can not be diversified by increasing the size of assets portfolio, thus the non-diversified skewness and kurtosis (coskewness and cokurtosis) become important measures in asset valuation. In the researches of Arditti (1971) and Francis (1975) it is shown that total skewness is not that important during the transmission from total skewness to systematic like it is done in Kraus and Litzenberger (1976) research. Basing on the American Stock Exchange data they had demonstrated the preference over coskewness in three-moment linear CAPM. The same results on systematic coskewness are shown in the Lim's research (1989) where American Stock Exchange since 1950's to 1982 is analyzed. The author made a conclusion that investors prefer positive systematic coskewness. When market is positively skewed there is no negative attitude to the systematic coskewness even when the whole market is negatively skewed. In the Smith's work (2006) systematic coskewness is introduced as a measure of market risk in a popular three-factor model Fama and French (1993) and the conclusion is made that introducing conditional systematic coskewness to the factors suggested by Fama and French makes the quality of the model better comparing to the original three-factor model.

Many of empirical researches which were made since 1970's and were related to the effect of systematic skewness on asset pricing show a mixed result depending on a choice of a market portfolio and other conditions: Arditti and Levy (1972), Jean (1971), Kane (1982), Lee (1977), Schweser (1978), Ingersoll (1975), Lim (1989), Friend and Westerfield (1980), Sears and Wei (1988), Harvey and Siddique (1999). Introducing the systematic kurtosis into the research and testing a model with four moments of distribution which were taking place since the late 1980's: Homaifar and Graddy (1988), Fang and Lai (1997) and Iqbal et al. (2007), Cook and Rozeff (1984), Doan et al. (2009), Chi-Hsiou Hung (2007), Javid and Ahmad (2008). Authors use different techniques of testing the influence of systematic coskewness and cokurtosis: traditional linear, quadric (Barone-Adesi, 1985) and cubic models (Ranaldo and Favre (2005), Christie-David and Chaudhry (2001), Chang et al. (2001), Hwang and Satchell (1999), Jurczenko and Maillet (2002), Galagedera et al. (2002)). Considering both the stock and the derivatives markets the mentioned instruments do not give the unilateral conclusion about the importance of this risk measure in assets valuation as well.

In the research of Doan et al. (2009) two markets are compared: American and Australian. They came to the conclusion that systematic coskewness and systematic kurtosis influence on the price forming assets depends on companies' characteristics and how investors ready to risk. Systematic skewness plays a more important role in the pricing of Australian shares (statistically significant at the 1% significance level), and on the American market a significant impact on the formation of asset prices is the systematic kurtosis, while on the Australian stock market, the degree of influence of systematic kurtosis varies depending on the size of the portfolio.

We believe that switching to downside measures of risk (semivariance frameworks) has the following advantages for Russian market: first, the negative volatility of returns is something that investors are really concerned about, and second, application of the downside variance does not require compliance with the symmetry of the distribution. As a downside measure of systematic risk we suggest to use downside factor beta (as an indicator of negative sensitivity to market risk, the coefficient of downside coskewness and the coefficient of systematic downside kurtosis.

In their research, based on the returns in the British market, Pedersen and Hwang (2003) came to a conclusion that, although the downside beta could explain the return on shares in addition to the CAPM beta, this risk metric doesn't lead to any significant improvements in pricing models of financial assets. In the Ang et al. (2006) study was shown that cross-sampling on the returns of U.S. stock prices reflect the premium for downside risk, and that the premium for downside risk is not simply a compensation for the market beta coefficient and cannot be explained by such features as systematic asymmetry, size company. In Galagedera and Brooks (2007) studied downside risk measures testing on 27 emerging markets over the period 1987-2004 concluded that downside systematic skewness is preferred measure of risk than downside beta.

Moreover, testing design CAPM in circumstances where implemented (actual, realized) returns act as a proxy of expected values of profitability, leads to biased results.[1] The reason for this shift is the aggregation of periods with positive and negative excess market returns (excess return periods). When the market return is less than the risk-free, there is an inverse relationship between the return of securities (portfolio) and the coefficient beta. Conditional CAPM allow us to test the hypothesis: the "growing" (down) market portfolio beta coefficients and returns should be positively (negatively) related. Empirical research on the U.S. market over the period 1936 - 1990 years. shows a positive beta slope in growing market and a negative on the incident.[2]

Further analysis of the unconditional and conditional systematic association of return and risk (beta) at the Brussels Stock Exchange showed that the unconditional models have low ability in explaining the observed cross-sectional returns, while the conventional models showed better results[3].

Conditional CAPM models can also identify the particularities in relationship between return and moments of the distribution of higher order. Thus, in the study by Galagedera et al. (2003) of the expanded version of the CAPM (with the inclusion of third-and fourth-order) on the Australian market

[1] In Pettengill et al. (1995) it is proved empirically
[2] Pettengill et.al. (1995)
[3] Crombez et.al. (2000)

in the interval between 1985 and 2000 demonstrated that the "incident" market beta, gamma and delta coefficients as indicators of risk of securities have a negative relationship with profitability

In the paper by Friend & Westerfield (1980) the testing of extended CAPM taking into account the systematic asymmetry of the U.S. market showed that the beta coefficient is significant on the «growing» as well as on the «incident or down» markets. Moreover, the sign of the risk premium is consistent with the CAPM, while systematic skewness plays a role in explaining the returns only on the «growing» market. Other works (Ang and Chen (2002, 2006), Dittmar (2002), Smith (2007)), testing the conditional higher-moment CAPM indicate similar results.

Several interesting studies have been conducted on the Russian market. It is worth mentioning the work of Goryaev and Zabotkin (2006) on the analysis of factors affecting the profitability of equity capital of Russian companies, the applicability of the approach of "risk-return" in Teplova and Selivanova (2007).

The main purpose of our research - building and comparing risk return relationship on the Russian stock market at different time periods, the stability of the financial asset pricing models with an extension of the classical CAPM construction through: 1) the inclusion of the moments of the distribution of higher order (higher order moments), 2) the imposition of downside measures of risk (D-CAPM), 3) analysis of the conditional CAPM in two time intervals (2004-2007, 2008-2010). The achievement of this goal is realized in the following three-step algorithm.

2. Stages of our research of the extended models based on CAPM construction

In the stage 1, we explore the relationship between stock returns and the higher order moments, acting as systematic risk factors. The stock return during the period from 2004 to 2010 is estimated to meet the normal distribution, for each company from this sample there were calculated the coefficients of asymmetry and kurtosis. The three-factor systematic risk was estimated: beta (as a traditional measure of risk), the systematic asymmetry (coskewness) as the ratio of gamma and systematic kurtosis (co kurtosis) as the ratio of delta with the following formulas employed:

(1) $$\beta_{im} = \frac{E\left[(R_{it} - E(R_i))(R_m - E(R_m))\right]}{E\left[(R_m - E(R_m))^2\right]}$$

(2) $$\theta_{im} = \frac{E\left[(R_{it} - E(R_i))(R_m - E(R_m))^3\right]}{E\left[(R_m - E(R_m))^4\right]}$$

(3) $$\gamma_{im} = \frac{E\left[(R_{it} - E(R_i))(R_m - E(R_m))^2\right]}{E\left[(R_m - E(R_m))^3\right]}$$

The next step of the first stage was the cross - sectional analysis. There were tested the regressions of mean values of stock returns for selected time periods to the estimated coefficients on the first step of beta, gamma and delta. Cross-sectional analysis allows us to estimate the risk premium, corresponding to each selected parameter of risk (traditional beta coefficient, coskewness and cokurtosis) and to identify the significance of these model parameters.

Cross-sectional analysis based on single-factor, two-factor and three-factor model allows us to select the most adequate model with the introduction of risk measures in describing the behavior of the returns of selected companies.

The first phase tested the traditional unconditional CAPM.

The second stage of our research is the analysis of applicability of downside risk models (test D-CAPM). Various downside systematic risk measures have been evaluated for a sample of Russian public companies. The study evaluates four options for calculating the risk of unilateral action: Bawa and Linderberg (1977), Harlow and Rao (1989), Hogan and Warren (1974), Estrada (2002). For to demonstrate the results obtained by different methods designations of BW, HR, HW and E are used.

The calculation of β_i^{HW} and β_i^{HR} takes into account downside deviation of the market return, whereas the calculation of β_i^{D} in the Estrada model takes into account downside deviation of return on assets as well.

On the basis of cross-sample formed by regression model relating average return on equity and the estimated systematic risk of unilateral's there was performed a hypothesis testing concerning the importance of communication "rate of return - risk" for different treatment options for risk. The analysis of risk models are constructed downside single-factor model with the inclusion of a downside factor beta and downside skewness (the slope), two-factor model consisting of downside coefficients beta and gamma (index of asymmetry of risk).

The third stage of research suggests testing of hypotheses the difference of predictive power of measures of risk at different stages of development of economy and the stock market. It was assumed that the period of market instability, the adequacy of the models of formation rates of return is reduced. The tested hypothesis: applicability of the models depends on the period of market stability / instability. At different time intervals there are the advantages of various models.

Testing at the third stage is based on conditional CAPM. This is done in order to test our hypothesis that the excess market return has asymmetric effects on the parameters of models depending on the sign of a market risk premium. On the "growing" market (up market) relationship is positive. The relationship is negative on the "down" market with the negative market risk premium (down market), when the market returns lower than the risk-free interest rate, i.e. there is an inverse relationship between the return of security and measures of risk (as traditional factor beta, and higher order moments).

$$R_{it} = \delta_{0t} + \delta_{1t} k\beta_{im} + \delta_{2t}(1-k)\beta_{im} + \delta_{3t} k\gamma_{im} + \delta_{4t}(1-k)\gamma_{im} + \delta_{5t} k\theta_{im} + \delta_{6t}(1-k)\theta_{im} + \varepsilon$$

where $k = 1$ when $(R_{mt} - R_{ft}) > 0$ and $k = 0$ when $(R_{mt} - R_{ft}) < 0$

Our study tested the hypothesis of the existence of a systematic conditional relationship between stock returns in the Russian market and higher order moments, which is formalized as follows:

Testing the conditional models for the periods 2004-2007 and 2008-2009 confirmed our assumption.

3. Sampling and research results

Our research is based on daytime data of exchange auctions of 50 financial assets of the Russian market (general stock and preference stock), that determine the capitalization of the 95% on Moscow Interbank Currency Exchange (MICEX)[1]. This study analyzes a period of 6 years starting January 14th 2004 to January 14th 2010. Moscow Interbank Currency Exchange index is considered as a market portfolio. Effective interest rate on a short-term government instruments used as a risk-free return for the specified period. Quality of models rating is based on the cross-section analysis of weekly returns. Weekly return is calculated as difference between closing price logarithm by the end of the week (Friday) and closing price logarithm by the beginning of the week (Monday). Whenever the required data is not available closing prices of the previous day are applied. The following table calculated on MICEX index gives a good image of index dynamics.

Table 1 Indicators of risk and return on index MICEX (Russia)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Average Daily Volatility, %	2.92%	2.11%	1.66%	1.94%	2.17%	1.51%	2.41%	1.53%	4.52%	3.17%
Average Weekly Volatility, %	6.83%	4.87%	3.75%	4.20%	4.89%	3.01%	5.15%	2.88%	9.67%	6.32%
Average Daily	-0.07%	0.20%	0.12%	0.19%	0.03%	0.25%	0.21%	0.04%	-0.45%	0.40%

[1] http://micex.ru/marketdata

Return, %										
Average Weekly Return, %	-0.50%	1.09%	0.42%	0.92%	0.14%	1.19%	1.01%	0.21%	-2.14%	1.83%
Average Annual Return, %	-25.5%	57.6%	21.8%	47.7%	7.0%	60.5%	51.6%	10.9%	-111.5%	
Sharpe Ratio (Daily)	-0.032	0.088	0.062	0.088	0.002	0.159	0.081	0.020	-0.104	0.114
Sharpe Ratio (Weekly)	-0.087	0.212	0.092	0.193	0.004	0.377	0.184	0.052	-0.229	0.261
Sharpe Ratio (Monthly)	-0.185	0.468	0.198	0.419	0.008	0.801	0.390	0.111	-0.496	0.456
Sortino Ratio (Daily)	-0.031	0.084	0.060	0.079	0.002	0.150	0.075	0.019	-0.101	0.118
Sortino Ratio (Weekly)	-0.094	0.220	0.074	0.163	0.004	0.391	0.145	0.046	-0.233	0.243
Sortino Ratio (Monthly)	-0.167	0.512	0.197	0.399	0.059	0.868	0.328	0.138	-0.489	0.471
Asymmetry	0.002	-0.442	-0.187	-0.944	-0.236	-0.439	-0.633	-0.531	0.270	-0.105
Excess	0.508	1.668	0.094	4.933	1.980	2.109	3.361	2.032	8.650	0.618

As shows the analysis of dynamics of Russian companies' stocks, the simultaneous meeting of the symmetry and normalcy of distribution requirements is never reached. Leptokurtosis, skewness and volatility clustering are evident. Same results are seen at different exchange houses (Harvey, 1995) or e.g. for Karachi Stock Exchange: Hussain and Uppal (1998), Javid (2009).

Table 2 shows leptokurtosis in almost all the companies selected[1]. Same situation witnessed in 2008 to 2009. The majority of the companies demonstrate negative asymmetry (in 2004 to 2007 25 financial assets out of 50, and 30 financial assets out of 50 in 2008 to 2010).

Table 2 Summary statistics of weekly returns of 50 Russian companies : January 2004–December 2007

Asset Code	Mean (in %)	Standard deviation	Sample dispersion	Excess kurtosis	Asymmetry	Min (in %)	Max (in %)	Data begin
MSNG RM Equity	0,034	8,453	71,460	32,373	-1,772	-20,738	48,273	02.01.2004
SIBN RM Equity	0,272	4,359	18,997	1,591	-0,257	-16,336	15,270	02.01.2004
GAZP RM Equity	0,566	4,302	18,506	1,314	-0,542	-15,274	9,423	27.01.2006
GMKN RM Equity	0,556	5,631	31,709	1,881	-0,264	-20,229	19,885	02.01.2004
IRGZ RU Equity	0,803	4,863	23,644	1,732	0,551	-11,229	20,365	02.01.2004
KMAZ RU Equity	1,376	5,637	31,772	7,140	1,912	-10,038	29,126	18.02.2005
VTBR RM Equity	-0,229	4,333	18,779	3,870	1,125	-8,213	14,812	01.06.2007
SCON RU Equity	0,574	4,372	19,114	4,310	-0,277	-20,516	16,372	14.01.2005
OGK2 RM Equity	0,313	3,449	11,894	2,575	0,943	-6,768	12,344	11.08.2006

[1] Only for Novatech and System Gals the index of excess coefficient is close to zero.

OGK3 RM Equity	0,859	3,873	15,001	2,474	0,716	-10,011	13,683	17.02.2006
OGK4 RM Equity	0,891	3,957	15,656	1,681	0,987	-6,914	12,043	01.12.2006
OGK5 RM Equity	0,964	4,376	19,146	5,237	1,536	-9,585	21,383	23.09.2005
MTSI RM Equity	0,502	4,249	18,055	0,927	0,341	-10,514	17,982	02.01.2004
PIKK RU Equity	1,262	7,516	56,483	13,237	3,209	-6,805	33,117	06.07.2007
PMTL RM Equity	-0,538	4,617	21,317	3,422	0,468	-12,729	14,248	09.03.2007
PLZL RM Equity	-0,283	4,706	22,143	1,525	-0,480	-13,872	11,988	19.05.2006
LKOH RM Equity	0,361	4,185	17,514	2,722	-0,118	-16,359	17,356	02.01.2004
MGNT RU Equity	1,035	4,339	18,824	3,241	-0,844	-16,252	9,531	30.06.2006
MGTS RU Equity	0,409	3,550	12,602	9,977	1,569	-9,471	24,599	02.01.2004
MAGN RM Equity	0,953	4,082	16,663	1,497	0,795	-9,219	14,560	27.01.2006
NLMK RU Equity	0,858	5,092	25,927	1,520	-0,714	-17,284	10,817	21.04.2006
NOTK RM Equity	0,319	4,530	20,517	0,873	0,106	-12,711	13,879	25.08.2006
OGK1 RM Equity	0,342	4,547	20,672	-0,196	-0,438	-9,385	8,119	27.07.2007
RASP RM Equity	1,225	5,438	29,575	1,892	0,988	-11,744	19,398	17.11.2006
ROSB RM Equity	-0,805	5,473	29,952	4,098	0,347	-17,895	22,037	24.02.2006
ROSN RM Equity	0,572	3,071	9,434	1,995	-0,355	-10,449	7,843	28.07.2006
RTKM RM Equity	0,437	4,635	21,479	5,408	0,985	-10,898	25,682	02.01.2004
SBER03 RM Equity	1,038	4,514	20,377	1,613	0,379	-10,728	19,003	02.01.2004
SBERP03 RM Equity	1,001	4,976	24,760	3,027	0,511	-14,815	23,576	02.01.2004
CHMF RM Equity	0,909	4,413	19,477	1,354	-0,106	-14,332	16,275	24.06.2005
HALS RM Equity	-0,657	3,435	11,798	0,645	-0,660	-11,264	5,530	17.11.2006
SNGS RM Equity	0,086	4,776	22,809	2,867	-0,379	-20,393	18,319	02.01.2004
SNGSP RM Equity	0,182	4,679	21,892	3,499	-0,279	-19,249	21,247	02.01.2004
TATN3 RM Equity	0,631	5,060	25,608	2,027	-0,747	-19,172	13,711	02.01.2004
TGKA RM Equity	-0,468	2,979	8,877	1,405	-0,405	-9,015	6,531	30.03.2007
TGKD RU Equity	-0,299	3,386	11,468	1,495	0,759	-6,357	9,560	09.03.2007
TGKI RM Equity	0,943	8,883	78,912	11,354	2,623	-20,764	41,664	27.10.2006
TRMK RM Equity	0,411	4,910	24,106	0,891	-0,545	-13,496	9,626	27.04.2007
TRNFP RM Equity	0,475	4,866	23,681	0,685	0,321	-11,806	15,383	02.01.2004
URSI RM Equity	0,162	4,411	19,453	0,689	0,445	-11,367	14,963	02.01.2004
TGKJG RU Equity	-0,002	2,225	4,949	0,651	0,434	-5,220	4,936	25.05.2007
AVAZ RM Equity	0,770	5,601	31,373	3,240	0,697	-16,329	22,761	02.01.2004
AKRN RU Equity	0,511	3,902	15,226	4,356	1,152	-10,727	15,990	27.10.2006
AFLT RM Equity	0,654	4,465	19,940	4,796	1,076	-13,684	22,342	02.01.2004
PKBA RM Equity	0,086	1,809	3,271	0,350	-0,307	-4,966	4,033	08.09.2006
MMBM RU Equity	1,270	6,751	45,579	3,359	1,118	-16,938	26,953	24.12.2004
WBDF RU Equity	1,019	4,728	22,353	1,735	0,297	-12,747	14,524	22.09.2006
MFGS RU Equity	0,198	4,362	19,024	1,429	0,605	-11,545	16,003	02.01.2004
RBCI RU Equity	0,476	3,948	15,589	3,203	0,606	-14,321	16,700	02.01.2004
KLNA RU Equity	0,304	4,580	20,980	1,715	-0,355	-14,705	12,114	20.05.2005

Normality test was performed using *Jarque-Bera*[1] statistics, which showed that normality hypothesis can be discarded at the 0.1 level of significance (on the representative set of valuation

[1] Assumes examination of simultaneous equity to zero of asymmetry coefficients and excess

assets shown in Table 3). The data does not exhibit the normal distribution (43 out of 50 in the financial stability period and 49 in crisis period).

Table 3. Normality test of the distribution of returns

*Significant at the 5 percent level, ** significant at the 10 percent level	Period of financial stability 2004-2007		Period of financial instability 2008-2010	
	Jarque-Bera	*P-value*	*Jarque-Bera*	*P-value*
MSNG RM Equity	2186.32*	0	52.07*	0
SIBN RM Equity	22.16*	0	148.99*	0
GAZP RM Equity	10.52*	0.01	361.72*	0
GMKN RM Equity	30.36*	0	127.19*	0
IRGZ RU Equity	33.96*	0	5.67**	0.06
KMAZ RU Equity	378.62*	0	204.07*	0
VTBR RM Equity	18.21*	0	36.42*	0
SCON RU Equity	110.75*	0	288.61*	0
OGK2 RM Equity	22.97*	0	21.01*	0
OGK3 RM Equity	29.18*	0	22.91*	0
OGK4 RM Equity	12.00*	0	260.31*	0
OGK5 RM Equity	165.01*	0	28.54*	0
MTSI RM Equity	10.52*	0.01	472.46*	0
PIKK RU Equity	161.34*	0	186.89*	0
PMTL RM Equity	16.53*	0	14.78*	0
PLZL RM Equity	9.63*	0.01	159.57*	0
LKOH RM Equity	59.71*	0	69.22*	0
MGNT RU Equity	36.28*	0	20.17*	0
MGTS RU Equity	887.50*	0	108.91*	0
MAGN RM Equity	17.98*	0	15.36*	0
NLMK RU Equity	14.09*	0	23.83*	0
NOTK RM Equity	1.67	0.43	24.58*	0
OGK1 RM Equity	0.8	0.67	63.50*	0
RASP RM Equity	15.38*	0	91.67*	0
ROSB RM Equity	59.69*	0	388.37*	0
ROSN RM Equity	11.29*	0	92.08*	0
RTKM RM Equity	269.28*	0	278.27*	0
SBER RM Equity	25.08	0	193.77*	0
SBERP03 RM Equity	81.41*	0	62.27*	0
CHMF RM Equity	8.8*	0.01	33.20*	0
HALS RM Equity	4.48	0.11	407.43*	0
SNGS RM Equity	70.67*	0	29.51*	0
SNGSP RM Equity	101.05*	0	51.78*	0
TATN3 RM Equity	51.48*	0	93.77*	0
TGKA RM Equity	2.99	0.22	20.34*	0
TGKD RU Equity	6.38*	0.04	393.42*	0

TGKI RM Equity	338.70*	0	8.58*	0.01
TRMK RM Equity	2.19	0.33	291.52*	0
TRNFP RM Equity	6.29*	0.04	48.71*	0
URSI RM Equity	10.27*	0.01	0.85	0.65
TGKJG RU Equity	1.09	0.58	1749.44*	0
AVAZ RM Equity	95.03*	0	85.16*	0
AKRN RU Equity	51.68	0	35.87*	0
AFLT RM Equity	224.86*	0	166.15*	0
PKBA RM Equity	1.18	0.55	1357.88*	0
MMBM RU Equity	98.36*	0	115.18*	0
WBDF RU Equity	7.25*	0.03	185.78*	0
MFGS RU Equity	28.39*	0	305.81*	0
RBCI RU Equity	94.77*	0	158.44*	0
KLNA RU Equity	17.31*	0	102.74*	0
Index MICEX	29.94*	0	248.78*	0

Calculated alternative measures of risk are shown in Tables 4 and 5 for the two time intervals: pre-crisis (2004-2007) and crisis (2008-2010).

Table 4 Comparative analysis of the systematic risk of the third and fourth moment in the traditional and downside framework of 50 Russian financial assets for the period 2004-2007

Asset Code	E(Ri)	Gamma	Delta	Downside gamma Estrada with τ=μ	Downside gamma Estrada with τ=0	Downside gamma HR with τ=μ	Downside gamma HR with τ=0
MSNG RM Equity	0.03	0.89	0.49	0.59	0.62	0.55	0.58
SIBN RM Equity	0.27	0.85	0.60	0.71	0.72	0.69	0.70
GAZP RM Equity	0.57	1.10	1.03	1.04	1.04	1.04	1.03
GMKN RM Equity	0.56	1.11	1.22	1.20	1.21	1.20	1.20
IRGZ RU Equity	0.80	1.00	0.60	0.75	0.69	0.73	0.67
KMAZ RU Equity	1.38	-0.03	0.57	0.51	0.44	0.45	0.33
VTBR RM Equity	-0.23	-0.78	0.84	0.73	0.86	0.73	0.86
SCON RU Equity	0.57	1.15	0.17	0.42	0.40	0.36	0.34
OGK2 RM Equity	0.31	0.26	0.33	0.39	0.38	0.32	0.31
OGK3 RM Equity	0.86	1.61	0.16	0.37	0.31	0.34	0.27
OGK4 RM Equity	0.89	0.53	0.71	0.70	0.65	0.63	0.58
OGK5 RM Equity	0.96	1.12	0.41	0.53	0.46	0.52	0.45
MTSI RM Equity	0.50	1.03	0.70	0.78	0.77	0.77	0.76
PIKK RU Equity	1.26	0.53	0.55	0.63	0.42	0.62	0.36
PMTL RM Equity	-0.54	0.72	0.96	0.96	1.17	0.95	1.16
PLZL RM Equity	-0.28	4.73	0.57	0.90	0.98	0.89	0.98
LKOH RM Equity	0.36	1.02	1.01	0.98	1.00	0.98	1.00
MGNT RU Equity	1.04	0.38	0.21	0.38	0.27	0.24	0.10
MGTS RU Equity	0.41	0.10	0.23	0.32	0.30	0.22	0.19
MAGN RM Equity	0.95	-0.42	0.38	0.34	0.25	0.33	0.23

NLMK RU Equity	0.86	4.02	0.80	1.06	1.03	1.04	1.01
NOTK RM Equity	0.32	0.42	0.99	0.90	0.91	0.89	0.91
OGK1 RM Equity	0.34	1.94	0.53	0.85	0.83	0.66	0.62
RASP RM Equity	1.23	0.23	0.55	0.55	0.40	0.51	0.35
ROSB RM Equity	-0.81	-3.33	0.72	0.38	0.46	0.28	0.39
ROSN RM Equity	0.57	0.97	0.77	0.78	0.79	0.77	0.77
RTKM RM Equity	0.44	0.33	0.76	0.70	0.69	0.69	0.68
SBER RM Equity	1.04	0.69	0.89	0.84	0.76	0.84	0.75
SBERP03 RM Equity	1.00	1.45	0.86	0.95	0.88	0.95	0.88
CHMF RM Equity	0.91	0.54	0.81	0.76	0.73	0.72	0.68
HALS RM Equity	-0.66	0.20	0.16	0.29	0.39	0.17	0.30
SNGS RM Equity	0.09	1.12	1.17	1.12	1.19	1.11	1.18
SNGSP RM Equity	0.18	1.06	1.12	1.06	1.11	1.03	1.08
TATN3 RM Equity	0.63	1.91	1.04	1.20	1.20	1.18	1.18
TGKA RM Equity	-0.47	0.98	0.59	0.72	0.83	0.62	0.78
TGKD RU Equity	-0.30	0.63	0.62	0.69	0.81	0.63	0.77
TGKI RM Equity	0.94	2.22	1.68	1.74	1.77	1.63	1.67
TRMK RM Equity	0.41	0.06	0.63	0.74	0.70	0.60	0.54
TRNFP RM Equity	0.47	0.87	0.83	0.90	0.90	0.84	0.84
URSI RM Equity	0.16	0.83	0.73	0.77	0.80	0.77	0.80
TGKJG RU Equity	0.00	-0.01	0.17	0.33	0.36	0.19	0.22
AVAZ RM Equity	0.77	0.49	0.91	0.78	0.74	0.76	0.71
AKRN RU Equity	0.51	0.39	0.37	0.44	0.41	0.35	0.32
AFLT RM Equity	0.65	1.24	0.31	0.61	0.58	0.47	0.43
PKBA RM Equity	0.09	0.25	0.23	0.25	0.27	0.20	0.23
MMBM RU Equity	1.27	1.54	0.70	0.89	0.83	0.84	0.78
WBDF RU Equity	1.02	0.31	0.85	0.74	0.68	0.66	0.58
MFGS RU Equity	0.20	0.75	0.22	0.42	0.43	0.34	0.34
RBCI RU Equity	0.48	1.47	0.53	0.70	0.69	0.69	0.68
KLNA RU Equity	0.30	0.66	0.42	0.56	0.60	0.43	0.47

Table 5 Comparative analysis of the systematic risk of the third and fourth moment in the traditional and downside framework of 50 Russian financial assets for the period 2008- 2010

Asset Code	E(Ri)	Gamma	Delta	Downside gamma Estrada with τ=μ	Downside gamma Estrada with τ=0	Downside gamma HR with τ=μ	Downside gamma HR with τ=0
MSNG RM Equity	-0.303	0.671	0.613	0.871	0.875	0.679	0.701
SIBN RM Equity	0.076	1.174	1.164	1.125	1.098	1.114	1.086
GAZP RM Equity	-0.611	1.401	1.185	1.042	1.069	1.041	1.068
GMKN RM Equity	-0.144	1.888	1.430	1.227	1.220	1.177	1.170
IRGZ RU Equity	0.078	0.907	0.405	0.214	0.222	0.177	0.186
KMAZ RU Equity	-0.340	1.143	0.800	0.739	0.759	0.658	0.680
VTBR RM Equity	-0.529	1.183	0.927	0.846	0.877	0.841	0.873
SCON RU Equity	-0.295	0.118	0.243	0.328	0.331	0.202	0.224
OGK2 RM Equity	-1.018	-0.112	0.588	1.111	1.158	1.029	1.085
OGK3 RM Equity	-0.453	-0.835	0.446	1.284	1.286	1.230	1.235
OGK4 RM Equity	-0.297	-1.157	0.093	0.985	0.993	0.969	0.980

OGK5 RM Equity	-1.130	-0.085	0.130	0.393	0.471	0.355	0.445
MTSI RM Equity	-0.641	0.679	1.116	1.291	1.302	1.282	1.296
PIKK RU Equity	-0.978	-1.120	0.164	1.082	1.125	0.980	1.042
PMTL RM Equity	0.164	0.737	0.459	0.417	0.409	0.291	0.282
PLZL RM Equity	-0.690	1.064	0.908	0.828	0.862	0.759	0.800
LKOH RM Equity	-0.128	0.973	0.955	0.960	0.952	0.953	0.946
MGNT RU Equity	0.271	-1.092	0.070	0.790	0.760	0.772	0.739
MGTS RU Equity	-0.342	0.373	-0.058	0.282	0.299	-0.199	-0.143
MAGN RM Equity	-0.154	0.299	0.993	1.370	1.354	1.358	1.341
NLMK RU Equity	-0.255	0.632	0.965	1.185	1.186	1.157	1.158
NOTK RM Equity	-0.634	0.516	0.775	0.941	0.968	0.922	0.953
OGK1 RM Equity	-1.138	-0.454	0.728	1.462	1.497	1.354	1.398
RASP RM Equity	-0.136	1.476	1.149	1.023	1.020	0.980	0.978
ROSB RM Equity	-0.457	0.680	0.529	0.628	0.652	0.407	0.441
ROSN RM Equity	-0.063	1.111	1.093	1.092	1.076	1.081	1.065
RTKM RM Equity	-0.842	1.247	0.482	0.116	0.159	0.023	0.099
SBER RM Equity	-0.256	1.309	1.296	1.275	1.265	1.256	1.246
SBERP03 RM Equity	-0.315	1.063	1.201	1.274	1.271	1.256	1.252
CHMF RM Equity	-0.609	-0.376	0.557	1.140	1.169	1.139	1.168
HALS RM Equity	-1.126	-0.308	0.227	0.313	0.369	0.178	0.282
SNGS RM Equity	-0.392	1.107	0.793	0.679	0.704	0.672	0.699
SNGSP RM Equity	-0.214	0.837	0.853	0.853	0.853	0.828	0.828
TATN3 RM Equity	-0.284	0.877	1.083	1.252	1.255	1.242	1.244
TGKA RM Equity	-0.415	-0.115	0.521	0.943	0.959	0.913	0.930
TGKD RU Equity	-0.942	-0.375	0.129	0.591	0.639	0.548	0.619
TGKI RM Equity	0.090	0.397	0.205	0.407	0.412	0.268	0.276
TRMK RM Equity	-0.731	-1.190	0.434	1.395	1.423	1.382	1.409
TRNFP RM Equity	-0.977	1.002	1.190	1.293	1.331	1.270	1.314
URSI RM Equity	-0.141	0.415	0.399	0.591	0.599	0.457	0.472
TGKJG RU Equity	-0.782	2.322	1.122	0.438	0.482	0.405	0.471
AVAZ RM Equity	-1.564	0.483	0.664	0.836	0.939	0.820	0.930
AKRN RU Equity	-0.818	-1.105	0.417	1.312	1.342	1.289	1.322
AFLT RM Equity	-0.560	-0.159	0.055	0.275	0.317	0.222	0.272
PKBA RM Equity	-0.255	0.726	0.764	0.786	0.790	0.774	0.781
MMBM RU Equity	-0.346	0.267	0.454	0.511	0.524	0.500	0.518
WBDF RU Equity	-0.469	0.562	1.108	1.302	1.300	1.288	1.286
MFGS RU Equity	-0.040	1.199	0.984	0.840	0.827	0.805	0.793
RBCI RU Equity	-1.868	-1.118	0.200	1.056	1.155	1.012	1.132
KLNA RU Equity	-0.868	-0.034	0.277	0.670	0.715	0.586	0.647

The traditional CAMP construction in view of beta coefficient for each company in the standard algorithm (regressional relationship bonus to shareholders' funds versus market bonus to risk) in both time periods show poor results (Table 6). Cross-sectional analysis in period from 2004 to 2007 demonstrates explanatory power on beta level 0,5% (R^2 in unifactor regression of average weekly return in the period of survey of each paper the beta coefficient for each asset is equal to 0,005). In period from 2008 to 2010 the beta explanatory power falls even lower (R^2 equal to 0,2%). Downside measures for beta-coefficient (Table 6) rather exceed explanatory ability of the unifactor model for the time period of sustainable economic development. The best measure for the time period of sustainable economic development becomes the downside beta of Harlow and Rao (*βHR)* with benchmark (target return) $\tau=0$ (R^2 equal to 36,2%).

Table 6. Cross - sectional analysis of traditional and downside framework of CAPM on the basis of the 50 largest Russian companies for the periods 2004-2007 and 2008-2010

$r_{it}=\lambda_0+\lambda_1\beta+\varepsilon$				
		λ_0	λ_1	Adj R2
2004-2007	Estimate	0.843	0.613	0.076
	P-value	0.005	0.120	
2008-2010	Estimate	-0.700	0.067	-0.019
	P-value	0.000	0.755	
$R_{it}=\lambda_0+\lambda_1\beta_E+\varepsilon$ with $\tau=\mu$				
2004-2007	Estimate	1.016	0.774	0.091
	P-value	0.009	0.099	
2008-2010	Estimate	-0.540	-0.117	-0.018
	P-value	0.007	0.750	
$rit=\lambda 0+\lambda 1\beta HR+\varepsilon$ with $\tau=\mu$				
2004-2007	Estimate	0.886	0.665	0.094
	P-value	0.004	0.096	
2008-2010	Estimate	-0.598	-0.061	-0.013
	P-value	0.000	0.553	
$Rit=\lambda 0+\lambda 1\beta E+\varepsilon$ with $\tau=0$				
2004-2007	Estimate	1.189	1.033	0.357
	P-value	0.000	0.003	
2008-2010	Estimate	-0.383	-0.279	0.015
	P-value	0.057	0.193	
$Rit=\lambda 0+\lambda 1\beta HR+\varepsilon$ $\tau=0$				
2004-2007	Estimate	0.999	0.874	**0.362**
	P-value	0.000	0.002	
2008-2010	Estimate	-0.444	-0.237	0.021
	P-value	0.011	0.160	

For the time period from 2008 to 2010 there are no benefits of the downside coefficient seen.

Benefits of risk measures based on asymmetry index (gamma coefficient) are significantly noticeable in the period on the financial instability (2008-2009), which is demonstrated in Table 7, which shows the two-factors and three-factor models testing with simultaneous introduction of various measures of systematic risk. All the tested parameters of a downside risk, a measure which appears coasymmetry: downside beta Harlow and Rao, beta Estrada and downside beta with different versions of the target return, demonstrated higher values of R squared ($AdjR^2$), than models with a standard (total) asymmetry. The best explanatory power has been revealed in the model with downside coskewness Harlow and Rao formula with zero yield benchmark (AdjR^2 = 0.275) - Table 7.

Table 7. Cross - sectional analysis of different modifications downside co-skewness on the basis of the 50 largest Russian companies for the periods 2004-2007 and 2008-2009

$r_{it}=\lambda_0+\lambda_1\gamma_E+\varepsilon$ при $\tau=\mu$					$R_{it}=\lambda_0+\lambda_1\Gamma_{hr}+\varepsilon$ при $\tau=\mu$				
SubPeriods		λ_0	λ_1	Adj R2	Period		λ_0	λ_1	Adj R2
2004-2007	Estimate	0.887	-0.655	0.074	2004-2007	Estimate	0.837	-0.609	0.079
	P-value	0.007	0.123			P-value	0.005	0.116	
2008-2010	Estimate	-0.573	-0.087	-0.015	2008-2010	Estimate	-0.588	-0.075	-0.016
	P-value	0.001	0.616			P-value	0.000	0.634	
$r_{it}=\lambda_0+\lambda_1\gamma_E+\varepsilon$ *with* $\tau=0$					$r_{it}=\lambda_0+\lambda_1\gamma_{HR}+\varepsilon$ *with* $\tau=0$				
Period		λ_0	λ_1	Adj R2	Period		λ_0	λ_1	Adj R2
2004-2007	Estimate	1.023	-0.873	0.262	2004-2007	Estimate	0.949	-0.812	**0.275**
	P-value	0.000	0.010			P-value	0.000	0.009	
2008-2010	Estimate	-0.489	-0.179	0.001	2008-2010	Estimate	-0.508	-0.168	0.003
	P-value	0.005	0.309			P-value	0.001	0.294	

We record both: the downside gamma factor and the downside beta coefficient, the best results in explaining variations in returns of Russian companies are seen using zero as the target return (benchmark for investing). Downside coskewness measures in Harlow and Rao and Estrada while benchmarking equal to zero is statistically significant at the level of 5%, while the other factors of systematic risk aren't important.

So, the explanatory ability of single-factor models, where skewness measure stands for a single factor, in the classical and the traditional approach is influenced by market conditions, which means, results vary depending on when the model is tested.

Table 8 Estimated coefficients of the three and four - moment unconditional CAPMS

		λ_0	λ_1	λ_2	λ_3	R2
$r_{it}-rf=\lambda_0+\lambda_1\beta+\lambda_2\gamma+\varepsilon$						
2004-2007	Estimate	0.253	0.052	0.088		0.038
	t-value	1.332	0.187	**1.262**		
2008-2010	Estimate	-0.663	-0.086	0.190		0.126
	t-value	-4.002*	-0.411	2.585*		
$r_{it}-rf=\lambda_0+\lambda_1\beta_E+\lambda_2\gamma_E+\varepsilon$						
2004-2007	Estimate	0.215	-0.055	0.257		0.014
	t-value	0.728	-0.036	0.192		
2008-2010	Estimate	-0.505	-0.365	0.225		0.009
	t-value	-2.242*	-0.440	0.308		
$r_{it}-rf=\lambda_0+\lambda_1\beta_{HR}+\lambda_2\gamma_{HR}+\varepsilon$						

2004-2007	Estimate	0.266	-0.741	0.868		0.031
	t-value	1.387	-0.790	1.023		
2008-2010	Estimate	-0.643	0.416	-0.431		0.011
	t-value	-3.655*	0.527	-0.621		
$r_{it}-rf=\lambda_0+\lambda_1\beta+\lambda_2\delta+\varepsilon$						
2004-2007	Estimate	0.266	0.109	0.033		0.006
	t-value	1.381	0.183	0.065		
2008-2010	Estimate	-0.606	-0.562	0.583		0.100
	t-value	-3.507*	-1.627	2.255*		
$r_{it}-rf=\lambda_0+\lambda_1\gamma+\lambda_2\delta+\varepsilon$						
2004-2007	Estimate	0.245	0.088	0.063		0.039
	t-value	1.451	1.289	0.269		
2008-2010	Estimate	-0.677	0.214	-0.095		0.126
	t-value	-5.069*	2.044*	-0.423		
$r_{it}-rf=\lambda_0+\lambda_1\beta+\lambda_2\gamma+\lambda_3\delta+\varepsilon$						
2004-2007	Estimate	0.255	-0.067	0.090	0.112	0.039
	t-value	1.329	-0.111	1.267	0.221	
2008-2010	Estimate	-0.670	-0.029	0.207	-0.066	0.127
	t-value	-3.718*	-0.051	1.193	-0.110	
*Significant at the 5 percent level and ** significant at the 10 percent level						

Classical systematic skewness is statistically significant at 5% level in single-and multiple-factor models, and the explanatory power of models including systematic asymmetry improves relatively to the other considered structures: R^2 = 0,123 in one-factor and R^2 = 0,126 in the two-factor model (Table 8). In such manner, systematic skewness demonstrates the best predictive ability among the examined risk measures from 2008 to 2010.

It should be noted that the transition to downside asymmetry index (Table 8) doesn't improve the explanatory power of pricing models (R^2 = 0,005 in the models including the downside systematic skewness under Estrada and Harlow and Rao constructions). Cross-sectional analysis of the four-factor model demonstrated that the risk bonus associated with beta, gamma and delta aren't significant, only the constant term is statistically significant at 5% level explanatory ability R^2 = 0,127, which is much higher compared to the quality of the market model form 2008 to 2010 (R^2 = 0,002) and slightly superior to single-factor model with gamma inclusion (R^2 = 0,123). This doesn't permit us to conclude the advantages of multi-factor unconditional model with higher orders of the traditional market model, CAPM inclusion.

Therefore we come to a conclusion that the unconditional CAPM does not show a very high explanatory capacity during 2004 to 2007 and is not applicable in the interval 2008-2010. Introduction of asymmetry increases the explanatory power of CAPM.

Testing the conditional pricing models involves plotting two data sets: the values of return of financial assets in the event of a positive market risk bonus and a negative (denoted in Table 9 - Up market and the Down market).

Table 9. Estimates of risk premium in two -moment conditional pricing models

Traditional conditions – positive market risk premium *«Up market»*						Negative market risk premium (weekly returns), i.e. market return is less than the risk-free rate *«Down market»*				
$r_{it}-rf=\lambda_0+\lambda_1\beta+\varepsilon$										
		λ_0	λ_1	R2				λ_0	λ_1	R2
2004-2007	Estimate	1.279	0.825	0.148		2004-2007	Estimate	-1.167	-1.017	0.189
	t-value	6.020*	2.888*				t-value	-4.914*	-3.343*	
2008-2010	Estimate	1.968	0.856	0.075		2008-2010	Estimate	-2.352	-2.201	0.456
	t-value	5.502*	1.976**				t-value	-6.416*	-6.348*	
	t-value	5.202*	2.035*				t-value	-7.354*	-6.180*	
$r_{it}-rf=\lambda_0+\lambda_1\gamma+\varepsilon$										
2004-2007	Estimate	1.724	0.117	0.010		2004-2007	Estimate	-1.638	-0.245	0.022
	t-value	10.853*	0.703				t-value	-7.022*	-1.029	
2008-2010	Estimate	2.060	0.800	0.087		2008-2010	Estimate	-3.118	-1.708	0.375
	t-value	6.817*	2.143*				t-value	-10.315*	-5.371*	
	t-value	6.034*	1.886**				t-value	-9.341*	-5.762*	

Notes: * Significant at the 5 percent level and ** significant at the 10 percent level

One-factor model of the motion on the "incident" and "growing" markets have a significant impact on the systematic asymmetric bonus for beta risk. According to the results of testing beta-risk bonus in all models is positive and statistically different from zero in a growing market, and negative and statistically significant at the level of 5% in a down market, as was expected.

Explanatory power of traditional two-stage CAPM (one-factor model with the classical beta-coefficient) to the «incident» the market is much higher (average entire period R^2 equal to 32%) than the quality of the model on the «growing market» with positive market risk premiums (the average entire period R^2 is 11 %).

The results for the crisis time period (2008-2010) proved to be even more important. E.g., explanatory power of the model with the inclusion of classical beta coefficient for the situation of negative market weekly data premiums («Down market») equaled 45,6% and the coefficient of beta is statistically significant at 5%. In general, it should be noted that in the period 2004-2007, and 2008-2010 in a «down market» volatility ratio showed a higher explanatory power than other measures being considered at risk (gamma and delta).

The research results demonstrate that systematic skewness, added to the beta coefficient is statistically insignificant either at the "growing" or the "incident" markets (t statistic = -1.662 at the "growing" and 0,844 on the "down") during the period of financial stability. However, we see that, as we've expected, the risk premium for systematic skewness is negative of the "growing" market, and positive on the "incident".

Table 10. Estimates of Slope Coefficients for Up Markets and Down Markets (mean-skewness-kurtosis framework)

«Up market» $r_{it}=\lambda_0+\lambda_2\gamma+\lambda_3\delta+\varepsilon$					
		λ_0	λ_2	λ_3	**R2**
2004-2007	Estimate	1.357	-0.564	1.214	0.169
	t-value	7.093	-2.055	2.999	
2008-2010	Estimate	2.048	-2.628	1.781	0.112
	t-value	6.791	-1.591	1.136	
«Down market» $r_{it}=\lambda_0+\lambda_2\gamma+\lambda_3\delta+\varepsilon$					
2004-2007	Estimate	-1.492	0.317	-0.879	0.207
	t-value	-6.264	0.868	-1.981	
2008-2010	Estimate	-2.892	3.704	-5.669	0.449
	t-value	-9.619	1.702	-2.511	

It should be noted that two-factor model with only gamma and delta coefficients (indexes of systematic skewness and systematic kurtosis), shows the best results on the "R squared" criterion, and both factors are statistically significant (Table 10). On the "growing" market average R^2 equals 14% for 2004-2010. On the «down market» average R^2 significantly higher (33%). Risk premium asymmetry (with the factor of gamma) is negative on "growing" and positive on the «down market», the risk premium for the co-kurtosis is negative in the "down" and positive on "growing" market, which confirms our hypothesis (Table 10).

Cross-sectional analysis four-factor CAPM shows that the risk premium for beta and delta coefficients are positive, skewness risk premium (delta factor) is negative, the variables were not statistically significant, however R^2 takes a high value equal to 48% (Table 11).

Table 11. Estimates of Slope Coefficients for Up Markets and Down Markets (four - moment conditional CAPM)

«Up market» $r_{it}=\lambda_0+\lambda_1\beta+\lambda_2\gamma+\lambda_3\delta+\varepsilon$						
Subperiods		λ_0	λ_1	λ_2	λ_3	**R2**
2004-2007	Estimate	1.205	0.871	-0.508	0.544	0.210
	t-value	5.656	1.540	-1.859	0.922	
2008-2010	Estimate	1.667	1.871	3.120	-3.710	0.140
	t-value	3.869	1.229	1.845	-1.677	
«Down market» $r_{it}=\lambda_0+\lambda_1\beta+\lambda_2\gamma+\lambda_3\delta+\varepsilon$						

2004-2007	Estimate	-1.098	-2.163	-0.216	1.278	0.239
	t-value	-4.243	-2.930	-0.561	1.515	
2008-2010	Estimate	-2.471	-1.382	2.729	-3.557	**0.480**
	t-value	-6.312	-1.639	1.229	-1.386	

Thereby, uniquely in the "down" market is an inverse relationship between stock returns and beta – all tested models coefficient and for both time intervals. The relationship between the slope of the systematic and profitability during the crisis period is characterized by a negative sign, in periods of financial stability (2004-2007) - positive. The main conclusion derived from the testing of conventional models - the dependence of "risk-return" to financial assets, changes in situations of negative market risk premiums (Table 9).

Conclusion

Our study adds to the existing literature by testing unconditional and conditional higher moment downside CAPM for the firm level weekly data on Russian capital market.

Based on analysis of data on a weekly returns of 50 financial assets of largest companies listed on the MICEX for the period from January 2004 to January 2010. The research concludes that the Russian market is featured by leptokurtosis, skewness and volatility clustering. The distribution of returns is far from normal, which allows us to suggest the existence of interest for portfolio investors to the higher order moments (third and fourth moments of the distribution as a measure of risk used in the model of asset pricing), as in the classical and the downside framework. We tested unconditional one-, two-and three-factor model for two time periods (2004-2007 and 2008-2010.) Systematic higher order moments (second, third and fourth) weakly statistically explain the role of market risk in the formation of the expected return on ordinary and preferred shares on the Russian market. Introduction of the third and fourth moment of the unconditional model does not improve its explanatory power. Moreover the results did not confirm our hypothesis that a downside risk interpretation is more productive on the Russian stock market.

Dividing the investigated time intervals in two sub-periods depending on the market risk premium and the transition to conditional models yielded more interesting results with the introduction of higher order moments. Conditional CAPM models let us confirm our hypothesis: 1) there is a statistically significant positive relationship between profitability and the beta coefficient on the "growing market", and negative correlation, respectively, to "down market" and 2) there is negative correlation between return and the gamma coefficient on "growing" market, and positive relationship to the "down" market in the period of financial stability (2004-2007; 3) the ambiguous behavior of the sign of the risk premium of systematic skewness in the different models and different time periods. In the period 2004-2007, and 2008-2010 in a «down market» volatility ratio showed a higher explanatory power than other measures being considered at risk (gamma and delta) in one-factor model.

Our study confirms the advantage of conditional models with the incorporation of such higher-order moments of distribution as a systematic asymmetry (coskewness) and systematic kurtosis (cokurtosis). Thus, this model specification with the inclusion of systematic skewness and cokurtosis shows the best results in explaining variations in stock returns of companies on the Russian stock market.

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