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CAPM in Up and Down Markets:

Evidence from Six European Emerging Markets

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Abstract: The pricing of equity in six European emerging capital markets is analyzed using both the conventional CAPM and a "conditional" CAPM wherein up and down markets are separated. International influences on the stock markets are also analyzed. The empirical evidence from a sample of 1131 firms from the six markets indicates that there exists a significant relationship between beta and returns when up and down markets are separated. The international CAPM performs well in some markets that have become increasingly integrated with the world market. The general implication of the analysis is that beta can be a useful risk-measure for investors and portfolio managers considering investments in emerging markets.

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Abstract: The pricing of equity and in six European emerging capital markets is analyzed using both the conventional CAPM and a "conditional" CAPM wherein up and down markets are separated. International influences on the stock markets are also analyzed. The empirical evidence from a sample of 1131 firms from the six markets indicates that there exists a significant relationship between beta and returns when up and down markets are separated. The international CAPM performs well in some markets that have become increasingly integrated with the world market. The general implication of the analysis is that beta can be a useful risk-measure for investors and portfolio managers considering investments in emerging markets.

1 Introduction

What is the appropriate formulation of the Capital Asset Pricing Model (CAPM) in emerging capital markets?[1] The question arises because each individual emerging market is immature by Western standards and each may have its unique institutional background, history, and level of integration with the established Western markets. Local risk-free returns, inflation rates and political risk consideration can also differ across countries. Moreover, whether the CAPM is an appropriate model for asset pricing in developed markets is still controversial. The Fama-French (1992) three-factor model and the APT model offer competing views. Although we do not explicitly ask whether additional factors affect asset pricing our objective is to establish whether the beta factor in the CAPM is an important factor to consider in investment decisions and cost of capital calculation by firms.

The CAPM states that there is a positive, linear relationship between a stock's expected return and its systematic risk, beta, and that beta is a sufficient variable to explain the cross-sectional variation in stock returns. Empirical tests of the CAPM usually follow the Fama and MacBeth (1973) two-pass regression method. The empirical evidence from the developed equity markets have almost always showed a week relationship between the beta and returns (Fama and French 1992). Pettengill et al. (1995) propose a different methodology to estimate the relationship between the beta and returns. Their argument is that, since the CAPM deals with the expected returns while the realized returns are only proxies, negative ex post risk premiums can be observed in some periods. The model of Pettengill et al. is "conditional" on whether the ex post risk premium is positive or negative.[2] When the ex post risk premium is positive, the relationship between betas and returns should be positive, and when the premium is negative betas and returns should be negatively related ex post. The reason is that high beta stocks will be more sensitive to the negative realized market risk premium and, therefore, they should have lower returns than low beta stocks in down

[1] The original developments of CAPM can be found in Sharpe (1964), Lintner (1965) and Mossin (1966)

[2] The word conditional is not used in the conventional sense in this literature. It does not refer to expectations conditional on information (Harvey, 1989; Ferson and Harvey, 1991; Jagannathan and Wang, 1996; Lettau and Ludvigson, 2001; Hodrick and Zhang, 2001; Lewellen and Nagel, 2006; Ang and Chen, 2007) but to *ex post* observations of individual stock returns conditional on *ex post* observations of market movements. For this reason we will refer to relationships in up and down markets.

markets. Empirical results based on estimation conditional on the sign of the market excess return indicate that betas and (positive) expected returns are positively related in the US capital market as the CAPM suggests. This relationship is also observed in the UK (Fletcher, 1997), Germany (El-Shaer et al. 2000), Brussels (Crombez and Bennet, 1997), and 18 developed markets (Fletcher, 2000) as well.

This paper focuses on the pricing of equity in six European emerging capital markets, i.e. Cyprus, Czech Republic, Hungary, Poland, Russia, and Turkey, with the purpose of estimating the return-risk relationship and, indirectly, the cost of equity capital of the firms in these countries. Firm level data is used in this study, while most previous studies used index data for a number of countries or cross industry. Thus, the range of risk across firms in these markets has not been analyzed systematically.

Most emerging markets went through a period of liberalization during the 1990s. This is especially true in four of our countries which were behind the iron curtain prior to the 1990s. Stock markets did not exist prior to the early 90s in these countries. Thereafter, stock exchanges were established quite quickly along with the privatization of banks and state owned enterprises.

The data period in this study is 1996-2006. Active trading in the stock markets was established in the countries we study by 1996 but the volume of trading in many stocks was still not high. At the same time, uncertainty about economic and political developments was high. We divide the data period into two parts, 1996-2001 and 2002-2006 in order to analyze whether the risk-return relationships in the countries changed substantially over time. Both increased liquidity and increased integration with world markets and the EU in particular, can be expected to have had a substantial impact on price behavior in the different markets.

It is difficult to identify an exact date that would be suitable as a dividing line between segmentation and integration. Integration is likely to be a gradual process. Furthermore, the removal of legal restrictions on foreign investment does not automatically lead to greater integration. Our choice of sub-periods is based on the observations that market restrictions in the sample countries were gradually lifted during the 1990s and that the announcement of the European Union enlargement occurred in November 2001. Thereby, political uncertainty about the integration process was de facto resolved. This date is considered the starting point for deeper integration with the European in countries other studies as well (Chari and Henry, 2004; Dvorak and Podpiera, 2006).

Emerging equity markets usually exhibit high-expected returns, high volatility, and low correlations with the developed countries' equity markets (Harvey 1995, Goetzmann and Jorion 1999). We expect that the distinction between up and down markets is particularly important for the analyses of the relationship between betas and returns in emerging markets where periods with negative realized market risk premiums are likely to be observed frequently. Furthermore, stock markets have not existed for a long period and, as a result, there is a strong possibility that the average realized market return is a biased proxy for the expected return.

According to Pettengill et al. (1995), in order to guarantee a positive risk and (expected) return tradeoff as the CAPM predicts, the distribution of the up market periods (positive risk premiums) and the down market periods (negative risk premiums) should be symmetric. This symmetric distribution seems to exist in most of the markets and periods under study.

We also expect that the domestic CAPM will outperform the international one in these markets in the early period because of a relatively high level of market segmentation and because investment barriers were only recently dismantled or in the process of being dismantled. The international CAPM is more likely to outperform the domestic one in our second estimation period, 2002-2006.

The rest of the paper is organized as follows. Section 2 presents the methods for the CAPM tests with and without the separation between up and down periods. Section 3 introduces the dataset. Section 4 reports the empirical results for the full period and for sub-periods, and for both the domestic and the international version of CAPM. Finally, Section 5 summaries the findings with respect to the validity of CAPM and with respect to market segmentation relative to the industrialized countries.

2 CAPM and the two-pass method in up and down markets

The CAPM predicts a positive linear relation between risk and expected return of risky asset of the form:

$$E\{R_i\} = R_f + \beta_i \left(E\{R_m\} - R_f \right) \tag{1}$$

where $E\{R_i\}$ is the expected return of asset *i*, $E\{R_m\}$ is the expected return on the risky market portfolio, R_f is return on the risk-free asset, and $\beta_i = \sigma_{i,m} / \sigma_m^2$ is the systematic risk of asset *i*. In order to guarantee a positive risk-return tradeoff, the expected return on the market must be greater than the risk-free return. Otherwise, no one would want to hold the risky asset.

Empirical tests of Eq. (1) usually follow the Fama and MacBeth (1973) two-pass regression method. In the first step, beta is estimated using the following specification:

$$R_{it} - R_{ft} = \hat{\alpha}_i + \hat{\beta}_i (R_{mt} - R_{ft}) + \varepsilon_{it} . \quad (2)$$

where R_{it} is the realized return of asset *i* in period *t*, R_{mt} is the realized the return on the market portfolio in period *t*; ε_{it} is an *iid* random error term, and $\hat{\beta}_i$ is the estimated beta of asset *i*.

In the second step, the relationship between the beta and return is estimated for all periods as

$$R_{it} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t} \hat{\beta}_i + u_{it} \quad (3)$$

where $\hat{\beta}_i$ is estimated from Eq. (2). In Eq. (3), $\hat{\gamma}_{0t}$ and $\hat{\gamma}_{1t}$ are first estimated by OLS. Then, they are averaged by the *t*, respectively. The average value, $\bar{\gamma}_0$ or $\bar{\gamma}_1$ is tested whether they are significantly different from zero using the *t*-test of Fama and MacBeth (1973). Based on Eq. (2), $\bar{\gamma}_0$ should be equal to zero and $\bar{\gamma}_1$ should be significantly positive for a positive risk premium. Most empirical tests have found only a weak relation between the risk and return in Eq. (3).

Pettengill et al. (1995) notes that the CAPM models the expected returns, yet, in empirical research the realized returns are used as proxies for the expected ones. Since the realised return on the market portfolio often falls below the risk-free return, negative ex post risk premiums are observed in these periods. If the realized market return were above the risk-free returns in all periods, no one would be willing to hold the risk-free asset. They propose an alternative to the second step in eq. 3 for the purpose of estimating the relationship between betas and returns. Their model is “conditional” on the market return being above or below the risk-free rate. In an up market when the realised risk premium is positive, there should be a positively relationship between the beta and return, while in a down market when the realized premium is negative, the beta and the return should be negatively related since high beta stocks will be more sensitive to the negative realized risk premium and have a lower return than low beta stocks.

According to the method of Pettengill et al., the relationship between betas and returns is estimated using a procedure that distinguishes between up and down periods in the market: They propose the following specification:

$$R_{it} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{2t} D\hat{\beta}_{i,u} + \hat{\gamma}_{3t}(1-D)\hat{\beta}_{i,d} + e_{it}\,, \tag{4}$$

where D is a dummy variable that equals one if the realized market risk premium is positive in up periods and zero if it is negative in down periods, $\hat{\gamma}_{2t}$ is the estimated risk premium in the up market periods and $\hat{\gamma}_{3t}$ is the estimated risk premium in the down market periods. The average values, $\bar{\gamma}_0$, $\bar{\gamma}_2$, or $\bar{\gamma}_3$ are tested for whether they are significantly different from zero using the same *t*-test of Fama and MacBeth (1973). Thus, the null hypotheses can be tested $\bar{\gamma}_0 = 0$, $\bar{\gamma}_2 = 0$, $\bar{\gamma}_3 = 0$ against $\bar{\gamma}_0 \neq 0$, $\bar{\gamma}_2 > 0$, $\bar{\gamma}_3 < 0$. In Eq. (4), either γ_{2t} or γ_{3t} will be estimated in a given time period depending on the sign of the realized risk premium. Pettengill et al. (1995) point out that in order to guarantee a positive risk-return tradeoff, two conditions should be met: *i*) the average risk premium should be positive, and *ii*) the distribution of the up market periods and down market periods should be symmetric. The second condition can be tested by a two-population *t* test but the sign of $\hat{\gamma}_{3t}$ coefficient needs to be reversed and the average value recalculated. The null hypothesis can be tested as $\bar{\gamma}_2 - \bar{\gamma}_3 = 0$ against $\bar{\gamma}_2 - \bar{\gamma}_3 \neq 0$.

3 Data

The sample used in this study consists of two datasets. The first one consists of monthly firm-level stock prices in six European emerging markets, i.e. Cyprus, Czech Republic, Hungary, Poland, Russia, and Turkey. The second set includes monthly macro prices; stock market indices, consumer prices, and risk free returns for the same six markets, a world market index (Morgan Stanley World Index), and an emerging market index (Morgan Stanley Emerging Market Index). The datasets come from three databases, DataStream, IMF Statistics, and Reuters (EcoWin). In order to avoid survivorship bias, non-survival shares are included. The total sample period is 1996.01-2006.12 since few firms were listed on the exchanges before 1996. The sample is further divided into two sub-periods: 1996.01-2001.12, and 2002.01-2006.12 for reasons mentioned in the introduction; market restrictions in the sample countries were gradually lifted during the 1990s and that the announcement of the European Union enlargement occurred in November 2001. Thereby, it was established that the Eastern and Central European countries as well as Cyprus were going to be part of the internal market and its regulatory framework for securities markets.

The first sample from DataStream includes a total of 1556 firms (Cyprus 178, Czech Republic 195, Hungary 116, Poland 547, Russia 111, and Turkey 409 firms). In order to have many observations for each individual firm, we include only those firms that were listed on the stock exchanges before 2004.01. Therefore 425 firms were eliminated, which gives us a final sample of 1131 firms (Cyprus 175, Czech Republic 188, Hungary 93, Poland 245, Russia 74, and Turkey 356).

Returns are calculated by taking the log price differences between t-1 and t. The return on the Morgan Stanley World Index is used as the return on the world market portfolio, while the return on the Morgan Stanley Emerging Market Index is used as a proxy for the return on the emerging market portfolio. The return on the market index in each country is used as the proxy for the return on the market portfolio in the country, while the short term Treasury bill rate of the country is used as the proxy for the risk free return. For Russia, the Treasury bill rate is not available after 2004.08, so the repo rate is used instead. The consumer price index for each country is used to calculate real returns in the country.

Table 1 reports the descriptive statistics of the market returns and risk free returns for the six markets in local currency. The returns on the world market portfolio and the returns on the emerging market portfolio are reported in the table as well. We can see that the returns and risks in nominal terms in these six markets are much higher than those in the world market and even emerging market. The real returns are much lower than the nominal ones as a result of high inflations in these countries during this period. Table 2 shows the correlation coefficients among the nominal as well as the real (in parentheses) returns on the six markets, the world market, and the emerging market. We can see that the nominal returns in these six markets are not highly correlated with each other, with the world market and the emerging markets. The low correlation coefficients for the nominal returns could be due to the different inflation rates in different countries. Therefore, we further check the correlations for the real returns, which are reported in the parentheses of Table 2. We can see that the coefficients in nominal and real terms are not much different. These results are consistent with most findings in emerging markets: high-expected returns, high volatility, and low corrections with developed countries' equity markets (Harvey 1995, Goetzmann and Jorion 1999).

(Insert Tables 1 to 2 here)

Table 3 reports the descriptive statistics for the excess market returns. These excess market returns are plotted in Figure 1 as well. The excess return series here is calculated as the difference between the average market return and the risk-free rate. An adjustment is made by dividing each market's excess return by one plus the risk-free rate of this market in order to avoid that the market excess returns as measures of risk premiums become upward biased in high interest rate (inflation) economies.[3] We can see that, in most of the countries, negative realized risk premiums occurred in more than 40% of the periods, and the null hypothesis that the mean equals zero cannot be rejected in all the markets based on the t-tests. The distribution of the up market periods and down market periods could be symmetric and the distinction between up and down periods could be important when estimating the betas. According to the CAPM, on the average, the realized market excess return should be positive although in some periods it can be negative. In the table, the average monthly excess return on the market is positive in five markets, while negative in one market, i.e. Turkey. A negative realized market excess return is observed when the average risky return is lower than the risk free return as shown in Table 1.

(Insert Table 3 and Figure 1 here)

[3] If the excess return (market risk premium) is defined as $R_m - R_f$, there is an upward bias in the risk premium of high interest (inflation) economies.

In Figure 1 it can be noticed that August 1998 is the month with the largest negative risk premium in all the markets except Cyprus. The reason is that the Russian financial crisis hit Russia on August 17 1998. If we go back to check the correlations among the markets in Table 2, we can find the Cyprus is less correlated with the rest of the five markets, the world and emerging markets.

We test for normality of the distributions for equity market indices in the six countries using the Skewness-Kurtosis test in Stata.[4] Normality is rejected for the indices in Cyprus, Hungary and Russia. Thus, beta is likely to be an incomplete risk-measure in these countries. Normality is not rejected for the Czech Republic, Poland and Turkey. Turkey had a well developed stock market prior to our estimation period. The other two countries were the Eastern European markets on the leading edge of the transition, and they established and liberalized stock markets relatively quickly in the early 90s. We return to this issue.

4 Testing Alternative Formulations of CAPM

We turn now to the tests of CAPM. Table 4 shows the two-step parameter estimates of the CAPM in Eqs (2) and (3) where no distinction between up and down periods. Table 5 shows the two-step parameter estimates of the conditional CAPM of Eqs (2) and (4) where a dummy for down periods is introduced. The testing procedure is as follows. In the first step of the analysis, the coefficients of β_i are estimated. In the second step, the monthly cross-sectional regression is conducted. The estimated monthly γ_i -coefficients are then averaged. We test whether the mean of the coefficients are significantly different from zero using a t-test.

In both Table 4 and Table 5 results are presented for the domestic version of CAPM as well as for the international CAPM. The international CAPM would be preferred in markets integrated with world equity markets. Bekaert (1995) argues that most emerging markets are not fully integrated with the world markets because of investment barriers set by the local government. Stulz (1995) argues that the local CAPM should be used when the market is segmented and the international CAPM should be used when the market is integrated. In reality markets are neither fully

[4] The test in Stata (2005) is conceptually similar to the Jarque-Bera test. The test can applied to a sample with N >= 9. The null hypothesis is normality. Rejection occurs for $p<0.05$.,

segmented nor fully integrated. Our hypothesis is that the emerging stock markets in Europe have become increasingly integrated during the period under consideration. The information flow to international investors has improved and transaction costs have been reduced during the period. Restrictions on international transactions have also been reduced during the 1990s.

In the domestic CAPM, the difference between the local market return and the local risk free return is used as a measure of the market excess return. In the international CAPM two market excess return measures are used. First, taking the perspective of the local investor with full access to world equity markets we use the difference between the world market return in local currency and the local risk-free rate. Second, taking the perspective of a US-based, internationally diversified investor we use the difference between the return on the world market and the US risk free asset. In perfectly integrated markets the two market excess returns are equivalent. In this case, all investors have access to world equity markets and risk-free interest rates are equalized.

In the following we study the whole sample period as well as two sub-periods. It is expected that the level of the market integration has increased and, therefore, that the international versions of CAPM are more appropriate in the second period 2002-2006.

The results in Table 4 for the domestic CAPM as well as for the two versions of the international CAPM indicate either a flat or no relationship between beta and returns. According to the CAPM, the $\bar{\gamma}_0$-coefficients should be zero and the $\bar{\gamma}_1$-coefficients should be significantly positive. The average excess return on the market portfolio is expected to be positive since investors are assumed to be risk averse, thus, they should be rewarded for taking risk. The coefficient for beta, $\bar{\gamma}_1$, is significant only in one of the sub-periods for Poland while most of the constant terms, $\bar{\gamma}_0$, are significant in contradiction to CAPM. In the one case where the coefficient for beta is significant, it indicates that the market risk premium is as low as 1 percentage point.

(Insert Table 4 here)

Only results for the full period are presented in Table 4 but the results for the two sub-periods are equally negative for CAPM when no distinction is made between up and down periods.[5] These results are consistent with, for example, Fama and French (1992).

In Table 5 we turn to the tests of CAPM based on Eqs (2) and (4) where a dummy has been introduced to allow for different coefficients for beta in up and down periods. These coefficients represent the ex post risk-premiums in up and down periods, respectively. They are expected to be positive in up periods and negative in down periods. If the average return for a firm equals the expected return the coefficients for beta in up and down periods should be the same and the absolute value would be the risk premium.

The results in Table 5 indicate a strong relation between the beta and returns when the domestic CAPM is tested in each market for the full period as well as for the two sub-periods. The signs of the coefficients are as be expected; the coefficients for $\bar{\gamma}_2$ are positive and those for $\bar{\gamma}_3$ are negative. All the coefficients are significant. These results indicate that shares with high betas have relatively high returns when the local market excess return is positive and relatively low returns when the local market excess return is negative. The last column in Table 5 shows that the symmetric distribution cannot be rejected for the domestic CAPM except for Turkey in the tests for the first and the full period. The domestic CAPM is not rejected by this test in any of the countries for the second period.

The results are consistent with those in Pettengill et al. (1995) and they explain why the tests without distinguishing between up and down periods in Table 4 indicate rejection of CAPM. The results in Table 5 imply that there exists a positive risk- return trade-off as the CAPM suggests and the domestic risk premium in most of the countries lies generally in a more reasonable range of 3-7 percent for the full period. In Russia and Turkey the risk-premiums appears to be larger.

(Insert Table 5 here)

Table 5 reports the estimates for the two versions of the international CAPM as well. The coefficient for beta relative to the one of the two measures of world market returns is rejected for the full period only in the case of Russia. One of the coefficients

[5] The sub-period results are available from the authors.

is rejected for the first period for Russia, Cyprus and Turkey. These rejections occur when the world market risk premium is calculated relative to the local risk free interest rate. All the coefficients are significant in the second period when the market risk premium refers to the US risk free rate. Thus, it appears that the international CAPM has gained validity in the second period.

The symmetry tests confirm the above interpretation. In no case is symmetry rejected for the international CAPM in the second period when the US risk free rate is used in the world market risk premium although symmetry is rejected for the Czech Republic and Turkey when the local risk free rate is used. Symmetry is rejected in more cases for the first period in the international CAPM; in particular when the local risk free rate is used.

An overall assessment of the up and down tests in Table 5 indicates that the pricing of risk is more consistent with both the domestic and the international CAPM in the second subperiod. In the Czech Republic and Poland the international CAPM performs as well as the domestic CAPM in both sub-periods as well as in the full period. These two countries seem to have been integrated with world markets at an early stage after the transition in the early 90s.

The international CAPM performs better in the second period in all countries when the market risk premium is defined relative to the US riskfree rate. Thus, integration with world markets may have been driven by international investors diversifying into the local markets to a greater extent than by local investors diversifying internationally.

Tests of CAPM like those performed in this paper are joint tests of assumptions about expectations formation along with the tests of CAPM per se. Results that are inconsistent with the model indicate either that expectations assumptions are false or that the model is deficient. Two related aspects of expectation assumptions are often questioned in relation to CAPM. One is the assumption that the expected return for each security equals the average return for the estimation period. Another is that beta is constant over the estimation period.

To begin with the assumption about a constant beta, which is also an expectation variable, we have allowed for limited time variation by dividing the period into two subperiods. Certainly, risk perceptions can fluctuate more frequently but it is also true that observed short term fluctuations in ex post measures of beta are likely to exaggerate fluctuations in market participants' perceptions about beta.[6] Our choice of subperiods based on the acceptance of several countries as EU members is likely to be associated with a substantial change in risk of investments in these countries.

The assumption about equality between the average return and the expected return is most likely to be violated in countries with observed average returns that seem improbably high or low. Table 3 shows that the mean excess returns are particularly high in Hungary and Russia, and negative in Turkey. These countries are also the ones where the percent negative ex post market risk premiums differ the most from 50 percent in the same table. In Table 5 Turkey is the country where the symmetry of up and down coefficients for beta is either rejected or weakly supported. Thus, it is likely that assumptions about expectations formation go a long way in explaining country results that are inconsistent with both the domestic and the global CAPM.

Expectations assumptions could be analyzed further by testing under assumptions about adaptive expectations or mean-reverting expectations. Such analyses would constitute a paper in itself since solid foundations for assumptions about expectation formation are required.

5 Conclusions

This paper investigates whether the CAPM applies in six European emerging markets and whether the domestic or international version applies. In order to test the CAPM in the emerging markets with high volatility and frequent negative excess market returns it is necessary to distinguish between up and down markets in the test of the model. Without this distinction the CAPM tests rejects the model in most of the countries and where the model is not rejected the estimated market risk-premium is unreasonably low. The CAPM performs well when we distinguish between up and down markets in all the countries although there are results for some countries that violate predictions of the CAPM. In particular, the symmetry of coefficients for periods with positive and negative ex post risk premiums is rejected for Turkey in particular. We argue that these results can be explained to a large extent by a discrepancy between observed average

[6] Several papers reject stability of beta in both developed and developing markets. See for example, Ohlson and Resenberg (1982), Harvey (1989) and Shah and Moonis (2003)

returns and expected average returns. Turkey’s ex post average market return in excess of the riskfree rate was negative for the whole estimation period.

The empirical results based on monthly return observations of 1131 firms in six European emerging markets; Cyprus, Czech Republic, Hungary, Poland, Russia, and Turkey, indicate that the CAPM in its domestic version remains a useful model for pricing in equity markets and the estimation of the cost of capital for firms in these countries. However, the results indicate that integration with world markets has increased in all the countries. The international version of the CAPM performs well for all six countries for the second subperiod 2002-2006. Overall, the international CAPM outperforms the domestic CAPM in this period. In the first subperiod, 1996-2001 the international CAPM is supported only for Poland and the Czech Republic. These two countries were on the leading edge of the transition to market economies in the early 90s and they established stock markets at an early stage. The end of 2001 was a milestone for Cyprus and Hungary as well since the four countries’ acceptance as members of the EU was granted.

One practical implications of the analysis is that the pricing of firm’s equity in the six emerging markets is strongly linked to corporate betas. Thus, the betas are useful measures of individual securities’ risk from the perspective of investors and portfolio managers, as well as from the perspective of firms in need of measures of cost of capital. The betas should be calculated relative to a world market risk premium rather than a domestic one.

Our analysis does not preclude that other factors than the world market risk-premium affect the pricing of securities in these and other emerging markets. Such analysis could be an avenue for further research. The risk-premiums explained by the model employed in this paper generally lie within the range between three and seven percent except in Russia and Turkey where they appear to be larger.

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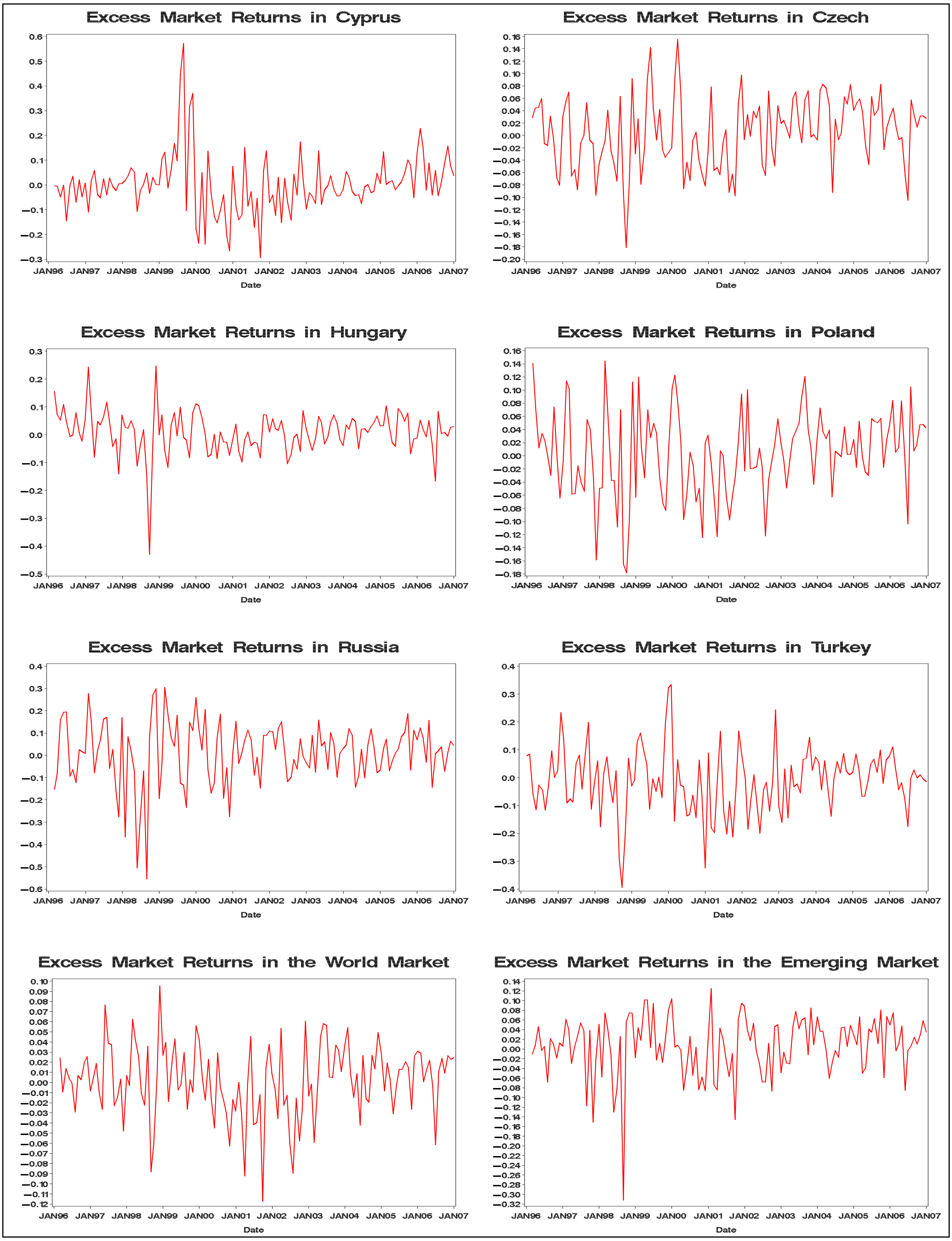

Figure 1 Excess Market Returns in Six European Emerging Markets

Table 1 Descriptive Statistics for the Market Return and Risk-free Rate Series in Six European Emerging Markets

The following table reports the descriptive statistics for the monthly market returns and risk free returns in six European emerging markets in local currency, the world market in USD, as well as the emerging markets in USD. The time period is 1996.01- 2006.12.

Variable	Nominal Returns		Real Returns	
	Mean	Standard Deviation	Mean	Standard Deviation
Panel A: Market Returns				
Cyprus	0.94%	11.96%	0.74%	12.11%
Czech Republic	1.01%	5.63%	0.68%	5.61%
Hungary	2.10%	7.90%	1.42%	7.71%
Poland	1.43%	6.46%	0.91%	6.31%
Russia	3.87%	14.73%	2.26%	14.44%
Turkey	3.46%	12.17%	0.49%	11.43%
World market	0.54%	3.51%	0.33%	3.54%
Emerging market	1.01%	6.13%	0.80%	6.14%
Panel B: Risk Free Rates				
Cyprus	0.40%	0.09%	0.18%	0.98%
Czech Republic	0.50%	0.34%	0.17%	0.63%
Hungary	1.07%	0.46%	0.39%	0.42%
Poland	1.02%	0.55%	0.51%	0.59%
Russia	2.90%	2.39%	1.32%	2.98%
Turkey	4.73%	2.73%	1.73%	1.62%
US	0.31%	0.14%	0.11%	0.34%

Table 2 Correlations of the Series of Nominal and Real Market Returns

The following table reports the correlation coefficients for the nominal returns as well as the real returns (in parentheses) on the six European emerging markets, the world market, and the emerging market in the period 1996.01-2006.12.

	Cyprus	Czech	Hungary	Poland	Russia	Turkey	World Market	Emerging Market
Cyprus	1.000							
	(1.000)							
Czech Republic	0.181	1.000						
	(0.191)	(1.000)						
Hungary	0.105	0.674	1.000					
	(0.126)	(0.659)	(1.000)					
Poland	0.128	0.665	0.707	1.000				
	(0.154)	(0.666)	(0.692)	(1.000)				
Russia	0.064	0.335	0.355	0.352	1.000			
	(0.064)	(0.379)	(0.423)	(0.383)	(1.000)			
Turkey	0.087	0.401	0.561	0.452	0.323	1.000		
	(0.093)	(0.423)	(0.565)	(0.454)	(0.367)	(1.000)		
World Market	0.226	(0.462)	0.565	0.575	0.368	0.487	1.000	
	(0.234)	0.435	(0.559)	(0.556)	(0.372)	(0.506)	(1.000)	
Emerging Market	(0.241	(0.391)	0.374	0.470	0.688	0.383	0.620	1.000
	(0.249)	0.374	(0.373)	(0.459)	(0.664)	(0.405)	(0.625)	1.000

Table 3 Market Returns above riskfree rates (*Ex post* Risk Premiums) and positive/negative observations in Six European Emerging Markets, the World Market, and the Emerging Market

The following table reports the monthly excess returns on the markets or the *ex post* risk premiums for six European emerging markets in local currency, the world market and, the emerging markets in USD. The adjusted excess returns are calculated by: $(R_m - R_f)/(1+ R_f)$. The time period is 1996.01-2006.12.

Country	Observations			Mean	Standard Deviation	Sharpe Ratio
	Total	Pos./Neg.	% of Neg.			
Cyprus	131	65/66	50.38%	0.54% (0.52)	11.92%	0.045
Czech Republic	131	68/63	48.09%	0.51% (1.03)	5.68%	0.090
Hungary	131	76/55	41.98%	1.02% (1.52)	7.71%	0.131
Poland	131	72/59	45.04%	0.41% (0.72)	6.45%	0.063
Russia	131	80/51	38.93%	0.96% (0.78)	14.10%	0.065
Turkey	131	59/72	54.96%	-0.01% (1.18)	11.49%	-0.104
World Market	131	73/58	44.27%	0.22% (0.73)	3.50%	0.063
Emerging Markets	131	81/50	38.17%	0.70% (1.31)	6.13%	0.114

1. The *t*-values are in parentheses, which test the null hypothesis that the mean is zero.
2. * Significant at the 0.10 level; ** Significant at the 0.05 level; *** Significant at the 0.01 level or better.

Table 4 Test of CAPM without Distinguishing between up and down Markets

This table contains the parameter estimates of the following unconditional CAPM model in the period 1996.01-2006.12. The data frequency is monthly. All returns are in the local currency. For each country there are three panels with different assumptions about the relevant market portfolio and risk free rate (local market/local risk-free, world market/local risk free, and world market/US risk free).

$$R_{it} - R_{ft} = \hat{\alpha}_i + \hat{\beta}_i (R_{mt} - R_{ft}) + \varepsilon_{it}$$
$$R_{it} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t} \hat{\beta}_i + u_{it}$$

	$\bar{\gamma}_0$	$\bar{\gamma}_1$
Cyprus		
Local market excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.014*** (-3.585)	0.003 (0.263)
Global excess returns relative to domestic risk-free = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.011 (-1.382)	0.001 (0.081)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	-0.014* (-1.738)	0.011 (0.930)
Czech Republic		
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.008*** (-4.105)	-0.001 (-0.173)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.009*** (-3.488)	0.002 (0.305)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	0.001 (0.251)	0.002 (0.323)

Table 4 continues

Hungary		
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.014*** (-4.550)	0.015 (1.485)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.013*** (-3.641)	0.009 (1.042)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	-0.014 (-0.912)	0.028 (1.357)
Poland		
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.006 (-1.504)	-0.004 (-0.523)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.003 (-0.074)	-0.013* (-1.949)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	0.125* (1.770)	-0.001 (-0.074)
Russia		
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.019* (-1.685)	0.010 (0.553)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	-0.014 (-1.383)	-0.001 (-0.107)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	0.038* (1.905)	-0.006 (-0.351)

Table 4 continues

Turkey		
Local excess returns = $R_{M\ (Local)} - R_{f\ (Local)}$		
Total period (1996.01 – 2006.12)	-0.415*** (13.13)	0.023 (1.633)
Global excess returns = $R_{MSWI\ (Global)} - R_{f\ (Local)}$		
Total period (1996.01 – 2006.12)	-0.025** (-2.295)	-0.001 (-0.047)
Global excess returns = $R_{MSWI\ (Global)} - R_{f\ (US)}$		
Total period (1996.01 – 2006.12)	-0.001 (-0.008)	0.034 (1.287)

1. The *t*-values are in parentheses.
2. * Significant at the 0.10 level; ** Significant at the 0.05 level; *** Significant at the 0.01 level or better.

Table 5 Test of CAPM Distinguishing between up and down Markets

This table contains the parameter estimates of the following conditional CAPM model in the period 1996.01-2006.12. The data frequency is monthly. All returns are in the local currency. For each country there are three panels with different assumptions about the relevant market portfolio and risk free rate (domestic market/domestic risk-free, world market/domestic risk free, and world market/US risk free).

$$R_{it} - R_{ft} = \hat{\alpha}_i + \hat{\beta}_i (R_{mt} - R_{ft}) + \varepsilon_{it}$$
$$R_{it} - R_{ft} = \hat{\gamma}_{0t} + \hat{\gamma}_{2t} D\hat{\beta}_{i,u} + \hat{\gamma}_{3t}(1-D)\hat{\beta}_{i,d} + e_{it}$$

	$\bar{\gamma}_2$	$\bar{\gamma}_3$	Test $\bar{\gamma}_2$ - $\bar{\gamma}_3$ = 0 * indicates rejection of symmetry
Cyprus			
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.072*** (4.623)	-0.067*** (-6.419)	(0.31)
Period 1 (1996.01 – 2001.12)	0.084*** (3.359)	-0.072*** (-4.517)	(0.42)
Period 2 (2002.01 – 2006.12)	0.094*** (3.908)	-0.064*** (-6.341)	(-0.27)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.019*** (2.628)	-0.026*** (-3.299)	(-0.74)
Period 1 (1996.01 – 2001.12)	0.013 (1.488)	-0.022*** (-2.369)	(-0.70)
Period 2 (2002.01 – 2006.12)	0.023*** (3.629)	-0.032*** (-3.061)	(-0.75)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$			
Total period (1996.01 – 2006.12)	0.042** (2.524)	-0.034* (-1.974)	(0.33)
Period 1 (1996.01 – 2001.12)	0.013 (1.516)	-0.027** (-2.636)	(-0.40)
Period 2 (2002.01 – 2006.12)	0.056** (2.156)	-0.045** (-2.261)	(0.33)

Table 5 continues

Czech Republic			
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.039*** (6.226)	-0.045*** (-4.446)	(-0.53)
Period 1 (1996.01 – 2001.12)	0.060*** (5.974)	-0.045*** (-4.419)	(1.00)
Period 2 (2002.01 – 2006.12)	0.038*** (3.917)	-0.029*** (-2.678)	(0.49)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.032*** (4.614)	-0.032*** (-3.167)	(0.01)
Period 1 (1996.01 – 2001.12)	0.036*** (3.468)	-0.032*** (-3.166)	(0.31)
Period 2 (2002.01 – 2006.12)	0.025*** (3.236)	-0.065*** (-5.345)	(-2.45)**
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$			
Total period (1996.01 – 2006.12)	0.047*** (4.201)	-0.050*** (-4.609)	(-0.22)
Period 1 (1996.01 – 2001.12)	0.067*** (3.400)	-0.061*** (-4.856)	(0.26)
Period 2 (2002.01 – 2006.12)	0.052*** (3.734)	-0.047*** (-3.452)	(0.24)

Table 5 continues

Hungary			
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.061*** (5.206)	-0.049*** (-3.294)	(0.66)
Period 1 (1996.01 – 2001.12)	0.078*** (4.929)	-0.047** (-2.469)	(1.28)
Period 2 (2002.01 – 2006.12)	0.041** (2.285)	-0.044* (-1.867)	(-0.11)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.044*** (3.195)	-0.023** (-2.169)	(1.19)
Period 1 (1996.01 – 2001.12)	0.040*** (3.551)	-0.019 (-1.547)	(1.26)
Period 2 (2002.01 – 2006.12)	0.048*** (2.847)	-0.031*** (-2.636)	(0.20)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$			
Total period (1996.01 – 2006.12)	0.073** (2.544)	-0.079*** (-3.212)	(-0.15)
Period 1 (1996.01 – 2001.12)	0.044** (2.207)	-0.054** (-2.497)	(-0.29)
Period 2 (2002.01 – 2006.12)	0.077* (1.810)	-0.099* (-1.866)	(-0.35)

Table 5 continues

Poland			
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.034*** (4.844)	-0.050*** (-4.488)	(-1.24)
Period 1 (1996.01 – 2001.12)	0.060*** (5.974)	-0.044*** (-4.419)	(1.00)
Period 2 (2002.01 – 2006.12)	0.038*** (3.917)	-0.030*** (-2.678)	(0.49)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.016** (2.385)	-0.049*** (-4.561)	(-2.58)**
Period 1 (1996.01 – 2001.12)	0.031*** (2.163)	-0.049*** (-3.707)	(-1.08)
Period 2 (2002.01 – 2006.12)	0.065*** (2.638)	-0.051*** (-2.988)	(0.36)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$			
Total period (1996.01 – 2006.12)	0.047*** (3.415)	-0.064*** (-4.861)	(0.89)
Period 1 (1996.01 – 2001.12)	0.043** (2.278)	-0.084*** (-5.382)	(-1.72)
Period 2 (2002.01 – 2006.12)	0.389*** (3.653)	-0.061*** (-3.594)	(-1.15)

Table 5 continues

Russia			
	Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	0.089*** (5.054)	-0.112*** (-3.625)	(-0.68)
Period 1 (1996.01 – 2001.12)	0.123*** (4.518)	-0.149*** (-3.286)	(-0.52)
Period 2 (2002.01 – 2006.12)	0.056*** (5.414)	-0.086*** (-4.721)	(-1.54)
	Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$		
Total period (1996.01 – 2006.12)	0.015 (0.752)	-0.019 (-1.435)	(-0.16)
Period 1 (1996.01 – 2001.12)	0.020 (0.498)	-0.028 (1.499)	(-0.17)
Period 2 (2002.01 – 2006.12)	0.030*** (2.738)	-0.012* (-1.772)	(1.18)
	Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$		
Total period (1996.01 – 2006.12)	0.024 (0.919)	-0.068*** (-2.988)	(-1.06)
Period 1 (1996.01 – 2001.12)	0.023 (0.485)	-0.081*** (-2.951)	(-0.97)
Period 2 (2002.01 – 2006.12)	0.038*** (4.241)	-0.055* (-1.718)	(-0.62)

Table 5 continues

Turkey			
Local excess returns = $R_{M\,(Local)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.023* (1.633)	-0.060*** (-3.440)	(2.67)***
Period 1 (1996.01 – 2001.12)	0.021*** (3.302)	-0.003 (-0.433)	(2.10)**
Period 2 (2002.01 – 2006.12)	0.081*** (5.671)	-0.050*** (-3.718)	(1.59)
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(Local)}$			
Total period (1996.01 – 2006.12)	0.065*** (3.331)	-0.019* (-1.621)	(2.08)**
Period 1 (1996.01 – 2001.12)	0.077*** (6.346)	0.003 (0.377)	(3.46)***
Period 2 (2002.01 – 2006.12)	0.045*** (5.760)	-0.022** (-1.971)	(1.67)*
Global excess returns = $R_{MSWI\,(Global)} - R_{f\,(US)}$			
Total period (1996.01 – 2006.12)	0.172*** (4.088)	-0.121*** (-3.421)	(0.91)
Period 1 (1996.01 – 2001.12)	0.171*** (3.117)	-0.112*** (-3.460)	(0.98)
Period 2 (2002.01 – 2006.12)	0.082** (2.373)	-0.142*** (-3.968)	(1.21)

1. The *t*-values are in parentheses.
2. * Significant at the 0.10 level; ** Significant at the 0.05 level; *** Significant at the 0.01 level or better.