A LOOK AT THE VALIDITY OF THE CAPM IN LIGHT OF EQUITY MARKET ANOMALIES: THE CASE OF BELGIAN COMMON STOCKS

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Abstract

We re-examine the pricing of common stocks on the Belgium Stock Exchange in light of two related phenomena recently reported in the literature: the size effect and risk-premia seasonality. When these two phenomena are ignored we cannot reject the hypothesis that the behavior of common stock prices conform to the CAPM. However, when size and seasonality are accounted for in the stochastic process that generates stock returns, the hypothesis that the CAPM describes (and explains) the pricing of common stocks must be rejected, even during the month of January despite the presence of a positive systematic risk premium and the absence of an unsystematic risk premium during that month.

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1. INTRODUCTION

In a recent study of the price behavior of Belgian common stocks, Havawini and Michel (1982) (HM here after) examined the relationship between the average return and the risk of a comprehensive sample of 200 securities which traded continuously from 1966 to 1980 on the Brussels Stock Exchange (BSE) and concluded that the pricing of common stocks in the BSE conforms to the standard Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965). Using the testing methodology designed by Fama and MacBeth (1973), HM (1982) could not reject the hypothesis that, over their sample period, there exists a positive and linear relationship between the return on securities and their corresponding level of systematic risk. They also showed that no reward is received for bearing unsystematic or non-market related risk on the BSE (Hawawini (1984)).

In this paper we re-examine HM's evidence in light of two recent phenomena reported in the literature. The first is the size effect discovered by Banz (1981). The second is the reported seasonality in both the monthly returns of common stocks (Gultekin and Gultekin (1983)) and the monthly estimates of the risk premium based on the CAPM (Tinic and West (1984), (1986) and Corhay, Hawawini and Michel (1987a,b)).

Using a comprehensive sample of common stocks traded on the New York Stock Exchange (NYSE), Banz (1981) has shown that a portfolio containing the stocks with the smallest market value (capitalization) outperforms, on average, a portfolio containing the stocks with the largest market value, even after adjusting returns for differences in the systematic risk of portfolios. Rozeff and Kinney (1976) have shown that U.S. common stock returns are, on average, larger in January than during the rest of the year. And Tinic and West (1984), (1986) have shown that the relationship between average common stock returns and systematic risk is significantly positive only in January in the United States. That is, January is the only month of the year during which the estimated systematic risk premium earned by common stocks is positive.

We find that common stocks traded on the BSE exhibit a behavior similar to that of common stocks traded on the NYSE despite the considerably smaller size of the BSE compared to the NYSE. We show that there is a size effect on the BSE and that stock returns and estimated risk premia are seasonal. We also report evidence that seasonality and size effect are two related phenomena (for the U.S. evidence see Roll (1983) and Keim (1983)). We conclude that the price behavior of common stocks traded on the BSE does not conform to the CAPM.

The rest of the paper is organized as follows. In the next section we summarize our major results. In section 3 we describe the sample properties and the methodology we employ to perform our empirical work. We report evidence of risk-premia seasonality in section 4 and evidence of a size effect and its relationship to seasonality in section 5. In section 6 we re-examine the pricing of common stocks when both seasonality and size are taken into account. The last section contains concluding remarks.

2. Summary of major results

The results listed below are based on 20 portfolios of common stocks which traded continuously on the BSE from January 1969 to December 1983 (see section 3 for details):

2.1. The relationships between portfolio returns and systematic risk is, on average, negative over the entire sample period. It is positive only during the month of January and negative during the late summer months of August and September (section 4.1 and table 2).

2.2. Unsystematic risk is priced over the entire sample period as well as during August and September. In January only systematic risk is priced but the relationship between portfolio returns and systematic risk is concave (section 4.2 and table 4).

2.3. There is a negative relationship between portfolio returns and portfolio size over the entire sample period. This relationship is particularly pronounced during the month of January. During the month of December the size effect is positive (section 5 and tables 5 and 6).

2.4. The portfolio containing the smallest firms with the highest systematic risk achieved an average return of 10.31 percent in January alone (the average monthly return over the entire sample period for the equally-weighted market portfolio is 0.84 percent) (section 5 and table 8).

2.5. When size, unsystematic risk and seasonality are accounted for in the stochastic process that generates stock returns, the hypothesis that the CAPM describes (and explains) the pricing of common stock on the BSE must be rejected, even during the month of January despite the presence of a positive systematic risk premium and the absence of an unsystematic risk premium during that month (section 6 and table 9).

3. Sample properties and methodology

3.1. The data

The sample contains the 170 common stocks for which monthly returns were available continuously from January 1969 to December 1983 (a total of 180 monthly returns for each common stock in the sample). These 170 stocks represent 86 percent of all shares listed on the BSE. Returns are measured as percentage monthly price changes adjusted for dividends.

Two market indexes were constructed. An equally-weighted index and a value-weighted index. In the latter, market values were updated yearly (last trading day of December).

3.2. Seasonality in the monthly returns of the market indexes

The statistical properties of the two indexes are reported in table 1.

TABLE 1

Characteristics of the two market indexes based on 170 stocks from January 1969 to December 1983

Monthly Return Over	EQUALLY-WEIGHTED INDEX			VALUE-WEIGHTED INDEX		
	MEAN	MAX	MIN	MEAN	MAX	MIN
All months of the year[a]	0.84% (3.66)[b]	12.10%	-7.43%	0.71% (2.53)[b]	19.08%	-9.12%
JANUARY[c]	4.29% (4.48)[b]	10.91%	-2.78%	4.19% (4.43)[b]	12.10%	-0.69%
FEBRUARY	1.95% (2.95)[b]	9.58%	-0.01%	1.03% (1.63)	4.47%	-3.12%
MARCH	0.51% (0.71)	6.68%	-5.51%	0.09% (0.09)	8.27%	-8.74%
APRIL	2.04% (3.00)[b]	6.62%	-2.26%	2.45% (2.62)[b]	7.64%	-2.49%
MAY	0.16% (0.26)	3.15%	-4.28%	0.05% (0.07)	2.98%	-5.33%
JUNE	0.74% (1.27)	5.31%	-3.97%	0.65% (0.93)	6.22%	-4.82%
JULY	1.56% (2.55)[b]	5.49%	-1.78%	1.37% (2.32)[b]	4.69%	-2.20%
AUGUST	0.50% (0.68)	4.95%	-5.45%	-0.98% (1.10)	5.55%	-9.12%
SEPTEMBER	-1.06% (-1.40)	3.66%	-6.18%	-1.76% (1.99)[b]	3.24%	-8.86%
OCTOBER	-1.39% (-2.52)[b]	2.63%	-5.23%	-1.25% (1.50)	5.79%	-6.70%
NOVEMBER	-0.82% (-1.21)	2.73%	-7.43%	0.28% (0.28)	6.07%	-8.57%
DECEMBER	1.65% (1.71)	12.10%	-3.59%	2.36% (1.70)	19.08%	-5.78%

a. based on 180 monthly observations

b. t statistics in parentheses below average value. Framed returns are statistically significant at the 0.05 level.

c. based on 15 monthly observations

index (EWI) achieved an annualized rate of return of 10.08 percent and the value-weighted index (VWI) a return of 8.52 percent. The higher return of the former is a reflection of a size effect since small firm are given more weight in the EWI than in the VWI. Note that the EWI exhibits slightly less variability than the VWI despite its higher historical average return. The standard deviation of monthly returns is 3.10 percent for the EWI and 3.75 percent for the VWI.

Both indexes exhibit a similar pattern of return seasonality. Most of the annualized average monthly return is earned on the months of January (about one half of the total) and April (about one quarter of the total).

Finally, we could not reject the hypothesis that the returns of EWI are normally distributed. The returns on the VWI, however, deviate slightly (but significantly) from normality. The returns on both indexes are highly correlated (correlation coefficient of .88) as shown by the regression:

$$\underset{}{\text{Ret(EWI)}} = -\underset{(1.44)}{.0020} + \underset{(25.14)}{1.067}\ \text{Ret(VWI)}$$

with an R-square of .7803. We could not reject the hypothesis that the slope of the regression line is equal to one. We performed our tests with both indexes. Results were qualitatively the same but generally more significant when the EWI was used. The results we report below are all based on the equally-weighted index.

3.3. Methodology

The methodology employed to estimate the relationship between monthly returns, risk and size is similar to that described in Fama and MacBeth (1973) and Banz (1981). It involves three steps. First, an initial period of one year is used to construct 20 portfolios on the basis of size and risk (construction period). The following year of monthly data is then employed to estimate the risk of the portfolios (estimation period). The third and final step is the estimation of the risk premia and the examination of the size effect over the third year of monthly data (test period). The entire procedure is then repeated after dropping the first year of data and moving forward until we reach December 1983.

Portfolio Construction. We used the first 12 months of returns (1969) to construct five equally-weighted portfolios ranked according to their market value (size) as of the last trading day of December 1969. The first and fifth contain 37 securities and the middle portfolios contain 32 securities. Each of these five size-related portfolios were then divided into four subportfolios ranked according to the magnitude of their beta coefficients estimated over the 12-month construction period using a single-index market model (Sharpe (1963), Fama (1976). When the size portfolio has 37 securities, the subportfolio with the highest beta has 13 securities and the other three have 8 securities. When the size portfolio has 32 securities each subportfolio has 8 securities. This procedure led to twenty equally-weighted subportfolios constructed on the basis of both size and systematic risk (beta).

Risk estimation. We used the second 12 months of returns (1970) to estimate the risk of each stock in the sample. Two measures of risk are considered in this study: systematic risk (the beta coefficient) and unsystematic risk (the standard deviation of the residual of the single-index market model). The risk of a portfolio is then computed as the arithmetic average of the risk of the securities that make up the portfolio.

Model testing. Finally, the third 12-months of returns (1971) are used to estimate the monthly risk-premia according to the following set of regressions:

$$R_{Pt} = \gamma_{ot} + \gamma_{1t} \cdot \beta_{P,t-1} + \mu_{Pt} \tag{1}$$

$$R_{Pt} = \gamma_{ot} + \gamma_{1t} \cdot \beta_{P,t-1} + \gamma_{2t} \cdot \beta^2_{P,t-1} + \gamma_{3t} \cdot SE_{P,t-1} + \mu'_{Pt} \tag{2}$$

$$R_{Pt} = \gamma''_{ot} + \gamma_{4t} \left[\frac{V_p - V_m}{V_m} \right]_{t-1} + \mu''_{Pt} \tag{3}$$

$$R_{Pt} = \gamma^s_{ot} + \gamma^s_{1t} \cdot \beta_{P,t-1} + \gamma^s_{4t} \left[\frac{V_p - V_m}{V_m} \right]_{t-1} + \mu^s_{Pt} \tag{4}$$

$$R_{Pt} = \gamma^\star_{ot} + \gamma^\star_{1t} \cdot \beta_{P,t-1} + \gamma^\star_{2t} \cdot \beta^2_{P,t-1} + \gamma^\star_{3t} \cdot SE_{P,t-1} + \gamma^\star_{4t} \left[\frac{V_p - V_m}{V_m} \right]_{t-1} + \mu^\star_{Pt} \tag{5}$$

where :

R_{Pt} = the realized return of portfolio p in month t,

$\beta_{P,t-1}$ = the beta of portfolio estimated over a 12-month estimation period ending on the calendar year preceding month t and updated yearly,

$SE_{P,t-1}$ = the unsystematic risk (standard error of the market model's residuals) of portfolio p estimated over a 12-month estimation period ending on the calendar year preceding month t and updated yearly,

$\left[\frac{V_p - V_m}{V_m}\right]_{t-1}$ = the relative market value (size) of portfolio p (Vm= market value of all stocks) measured on the last trading day of the calendar year preceding month t and updated yearly,

γ_{1t} = the systematic risk premium in month t,

γ_{3t} = the unsystematic risk premium in month t,

γ_{4t} = the size premium in month t.

Regression (1) assumes that securities' returns are generated by a two-factor model (Black (1970) and Fama (1976)). Regression (2) assumes a four-factor return-generating model (Fama (1976)). If prices behave according to the CAPM then the regression coefficient of systematic risk (the systematic risk premium) should be positive and the estimated regression coefficient of the squared value of systematic risk should be zero (implying linearity). Also, the estimated coefficient of unsystematic risk should be zero (implying no reward for bearing diversifiable risk). Regression (3) is run to test for a size effect. If small firms outperform large firms, the estimated regression coefficient of relative size should be negative. Regression (4) and (5) are run to examine the pricing of common stocks when both risk and size are accounted for. Note that the five regressions are cross-sectional regressions. They are run each month of the calendar year yielding 12 estimates of the regressions' coefficients, one for each month of the year.

The entire procedure just described is repeated after dropping the first year of data. The second year of data is used to construct portfolios, the third to estimate risk and size and the fourth to test the models. We keep on dropping one year of data and moving forward until we reach the year

1983. This approach provides a total of 156 monthly estimates (12 months x 13 years) for each regression coefficients (risk premia and size premia). Finally, note that the variables in the regressions (1) to (5) are not contemporaneous. Risk and size are measured over the calendar period preceding the month over which returns are realized. Hence, the regressions provide tests of the predictive power of the various models.

4. Evidence of monthly risk premia seasonality

4.1. Systematic risk premia

Average values of the estimated coefficients of regression (1) are reported in table 2. Over the entire testing period (from January 1971 to December 1983) the relationship between realized returns and systematic risk is, on average, significantly negative. This result is consistent with the evidence reported by HM (1982). They found a significantly negative relationship over the period December 1976 to November 1980 (the reported slope coefficient in their table 1 is equal to -0.0076 with a t-statistic of -1.87).

But the month-to-month average values of the estimated systematic risk premia reveal another picture. January is the only month of the year during which the risk premium is significantly positive. It is equal to 1.49 percent or 17.52 percent on an annual basis, the largest of all months (in absolute value). If we exclude the month of January from the data the negative relationship between returns and systematic risk is even more pronounced mostly as the result of the contribution of August and September during which the systematic risk premium is equal to - 2.71 percent or -16.26 percent on an annual basis.

There is no definitive explanation of this phenomenon. The positive January effect may be tax-induced (Corhay, Hawawini and Michel (1987)) and possibly related to the trading activity of institutional investors. We have no explanation of the negative "late summer" effect.

In order to test the hypothesis of equal month-to-month average intercept and slope coefficients of the two parameters model (regression (1))

TABLE 2

Average values of the Fama and MacBeth estimates of the intercept (γ_o) and slope (γ_1) coefficients of the two-parameter model[a]:

$$R_{pt} = \gamma_{0t} + \gamma_{1t} \cdot \beta_{p,t-1} + \mu_{p,t-1}$$

Average over	$\bar{\gamma}_0$ (Intercept)	$\bar{\gamma}_1$ (beta)	Sample size
All months	0.0120 [b]	-0.0028 [b]	156
	(4.72)	(-1.89)	
All months except January	0.0104 [b]	-0.0044 [b]	143
	(3.97)	(-2.96)	
JANUARY	0.0296 [b]	0.0149 [b]	13
	(3.20)	(2.66)	
FEBRUARY	0.0234 [b]	-0.0027	13
	(3.18)	(-0.68)	
MARCH	0.0117	-0.0075	13
	(1.69)	(-1.44)	
APRIL	0.0255 [b]	-0.0043	13
	(2.60)	(-1.32)	
MAY	-0.0024	0.0033	13
	(-0.31)	(0.73)	
JUNE	0.0201 [b]	-0.0085	13
	(2.72)	(-1.65)	
JULY	0.0171 [b]	-0.0005	13
	(2.49)	(-0.10)	
AUGUST	0.0160	-0.0128 [b]	13
	(1.59)	(-2.17)	
SEPTEMBER	-0.0064	-0.0143 [b]	13
	(-0.68)	(-3.00)	
OCTOBER		-0.0049	13
	(1.58)	(-1.62)	
NOVEMBER	-0.0061	0.0004	13
	(-0.77)	(0.10)	
DECEMBER	0.0132	0.0031	
	(1.32)	(0.43)	

a. estimated with monthly data and the equally-weighted index from January 1971 to December 1983 we run the following dummy-variable regression:

$$\gamma_{kt} = a_1 + \sum_{J=2}^{12} a_j D_j + e_{kt}$$

where k=0 is the intercept and k=1 is the slope coefficient. The variable D_2 to D_{12} are dummy variables representing the months of the year from February to December. The coefficient a_1 is a measure of average γ_k in January while the coefficients a_2 through a_{12} are a measure of the difference between average γ_k in February to December and average γ_k in January. If the average systematic risk premium in January is the same as the average risk premium during month j, the estimate of a_j will not be statistically different from zero. Turning to table 3 we see that the estimated coefficients a_j are all negative from February to December. This means that γ_o and γ_1 are smaller during February to December than during January although not significantly so for all eleven months. In particular, the average systematic risk premium (γ_1) in May and December is not significantly smaller than in January.

4.2. Seasonality in the risk premia of the four-factor return-generating model

The average estimated coefficients of the four-factor regression model are reported in table 4. When all months are considered, only unsystematic risk is priced in the market. Excluding January from the data does not modify this result which is not consistent with the CAPM. The month-to-month risk premia indicate, again, that the relationship between returns and systematic risk is only significant in January but it appears to be concave rather than linear. Also, note that the negative systematic risk premia in the late summer months (August and September) reported in table 2 are now replaced by a positive unsystematic risk premia. This result may be explained by the fact that systematic risk and unsystematic risk are negatively related: securities with low betas tend to have above average level of unsystematic risk. Clearly, in August and September the unsystematic-risk effect prevails when both systematic and unsystematic risks are in the pricing equation (regression (3)).

TABLE 3

Test of the hypothesis of equal month-to-month average intercept (γ_0) and slope (γ_1) coefficients of the two-parameter model using the dummy-variable regression[a]:

$$\gamma_{kt} = a_1 + \sum_{j=2}^{12} a_j D_j + e_{kt}$$

Month of the year	SEASONALITY IN INTERCEPT	SEASONALITY IN SLOPE	Month of the year	SEASONALITY IN INTERCEPT	SEASONALITY IN SLOPE	SAMPLE SIZE
JANUARY	0.0296 [b]	0.0149 [b]	JULY	-0.0126	-0.0154 [b]	156
	(3.53)	(3.02)		(-1.06)	(-2.21)	
FEBRUARY	-0.0062	-0.0176 [b]	AUGUST	-0.0136	-0.0278 [b]	156
	(-0.52)	(-2.52)		(-1.14)	(-3.97)	
MARCH	-0.0179	-0.0224 [b]	SEPTEMBER	-0.0232 [b]	-0.0292 [b]	156
	(-1.51)	(-3.20)		(-1.96)	(-4.17)	
APRIL	-0.0041	-0.0193 [b]	OCTOBER	-0.0407 [b]	-0.0198 [b]	156
	(-0.35)	(-2.76)		(-3.42)	(-2.83)	
MAY	-0.0320 [b]	-0.0116	NOVEMBER	-0.0357 [b]	-0.0145 [b]	156
	(-2.70)	(-1.66)		(-3.01)	(-2.07)	
JUNE	-0.0095	-0.0234 [b]	DECEMBER	-0.0165	-0.0118	156
	(-0.80)	(-3.35)		(-1.39)	(-1.69)	
F-Test	2.357	2.584	F-Test	2.357	2.584	
Probability	0.010	0.005	Probability	0.010	0.005	

a. k=0 (intercept) and 1 (slope) respectively. The variable D2 through D12 are dummy variables representing the months of the year from February to December. The coefficient a_1 is a measure of average γ_k in January while the coefficients a_2 through a_{12} are a measure of the difference between average γ_k in February to December and average γ_k in January. The t-statistics are in parentheses.

b. Significant at the 0.05 level

TABLE 4

Average values of the Fama and MacBeth estimates of the coefficients of the four-parameter model[a]:

$$R_{pt} = \gamma'_{0t} + \gamma'_{1t} \cdot \beta_{p,t-1} + \gamma_{2t} \cdot \beta^2_{p,t-1} + \gamma_{3t} \cdot SE_{p,t-1} + \mu'_{p,t-1}$$

Average over	$\bar{\gamma}_0^*$ (Intercept)	$\bar{\gamma}_1^*$ (beta)	$\bar{\gamma}_2$ (beta)^2	$\bar{\gamma}_3$ (Unsyst.risk)	Sample size
All months	0.0050 (1.30)	-0.0021 (-0.55)	-0.0011 (-0.74)	**0.1502**[b] **(2.84)**	156
All months except January	0.0045 (1.13)	-0.0051 (-1.33)	-0.0005 (-0.31)	**0.1381**[b] **(2.65)**	143
JANUARY	0.0107 (0.69)	**0.0134**[b] **(2.44)**	**-0.0077**[b] **(-2.02)**	0.2830 (1.01)	13
FEBRUARY	0.0170 (1.56)	0.0063 (0.48)	-0.0063 (-1.39)	0.1321 (0.87)	13
MARCH	0.0054 (0.39)	-0.0235 (-1.54)	0.0082 (1.29)	0.1726 (1.30)	13
APRIL	**0.0282**[b] **(2.44)**	-0.0091 (-0.97)	0.0024 (0.56)	-0.0039 (-0.03)	13
MAY	-0.0009 (-0.08)	0.0158 (1.22)	-0.0053 (-1.16)	-0.0682 (-0.53)	13
JUNE	**0.0294**[b] **(2.65)**	-0.0198 (-1.77)	0.0026 (0.59)	-0.0551 (-0.39)	13
JULY	0.0069 (0.66)	-0.0078 (-0.92)	0.0041 (1.01)	0.1961 (1.14)	13
AUGUST	-0.0119 (-0.95)	-0.0116 (-1.18)	-0.0053 (-1.24)	**0.5945**[b] **(2.30)**	13
SEPTEMBER	-0.0054 (-0.39)	-0.0210 (-1.53)	-0.0001 (-0.02)	**0.3063**[b] **(2.00)**	13
OCTOBER	**-0.0278**[b] **(-2.05)**	-0.0000 (-0.00)	-0.0020 (-0.29)	0.2514 (1.39)	13
NOVEMBER	-0.0138 (-0.88)	0.0058 (0.40)	-0.0004 (-0.07)	0.1194 (0.59)	13
DECEMBER	0.0226 (1.47)	0.0088 (0.61)	-0.0032 (-0.60)	-0.1265 (-0.82)	13

a. estimated with monthly data and the equally-weighted index from January 1971 to December 1983.

b. t statistics are in parentheses below average values. Framed coefficients are statistically significant at the 0.05 level

5. Evidence of a size effect and its relationship to seasonality

The characteristics of the five size-portfolios ranked by decreasing market value are reported in table 5. The largest portfolio which includes about 22 percent of the stocks in the sample represents 86 percent of the total market capitalization whereas the smallest portfolio with the same number of stocks represents less than one half of one percent of the total market capitalization. Note that the five portfolios have roughly the same betas (approximately equal to one).

All months considered, the largest portfolio earned an average monthly return of 0.65 percent and the smallest earned 1.17 percent. The differential return between the smallest and the largest portfolios is not, however, statistically significant. There are only four months of the year during which some of the portfolio returns were significantly different from zero: these are January, August, September and December. During the first three, the smallest portfolio outperformed the largest but during December we have a reverse size effect: the largest portfolio outperforms the smallest but the differential return is not statistically significant.

Another way to look at the size effect is to examine the average values of the estimated slope coefficients (the size premium) of regression (3) reported in table 6. There is a significantly negative relationship between returns and size over the entire sample period. But the negative size effect is particularly pronounced in the months of January, July, August and September. In December we have a positive size effect. This positive December size effect which precedes the negative January size effect is consistent with any explanation of the size effect which predicts the sale of small firms during December and their subsequent repurchase during January. Selling pressure will lower the return of small firms vis-à-vis the return of large firms during December and buying pressure will raise the return of small firms vis-à-vis the return of large firms during January. Consequently, small firms will underperform large firms during December and outperform their during January.

Recall that the five size-portfolios have been divided into four subportfolios according to their level of systematic risk. The characteristics of the four subportfolios are reported in table 7 for the largest and

TABLE 5

Characteristics of five portfolios ranked by decreasing market capitalization measured in thousands of Belgian francs at the end of December. Values in the table are average over a 13-year period from January 1971 to December 1983.

PORTFOLIO SIZE			RISK	AVERAGE MONTHLY RETURNS				
IN THOUSANDS B.F.	PERCENT	No. STOCKS	(BETA)	ALL YEAR	JANUARY	AUGUST	SEPTEMBER	DECEMBER
6,586,917	86.05%	37	0.98	0.65% [a] (2.41)	3.04% [a] (3.23)	-0.60% (0.85)	-1.51% [a] (1.89)	2.72% [a] (2.11)
687,388	8.99%	32	1.13	0.62% [a] (2.33)	4.57% [a] (4.13)	-0.19% (0.15)	-2.15% [a] (2.75)	1.66% (1.50)
247,057	3.22%	32	1.02	0.93% [a] (3.69)	4.90% [a] (4.81)	0.61% (0.78)	-0.42% (0.52)	1.86% (1.76)
99,180	1.29%	32	0.93	0.87% [a] (3.87)	3.69% [a] (4.09)	0.93% (1.20)	-1.07% (1.43)	0.76% (0.85)
34,454	0.44%	37	1.01	1.17% [a] (4.65)	5.35% [a] (4.65)	1.88% [a] (1.92)	0.31% (0.84)	1.31% (1.28)
Differential return between smallest and largest portfolios (t-statistic in parentheses)				0.52% (1.41)	2.31% [a] (1.95)	2.48% [a] (2.05)	1.81% [a] (2.05)	-1.41% (0.89)

a. t statistics are in parentheses below average values. Framed coefficients are statistically significant at the 0.05 level.

TABLE 6

Average values of the estimated intercept and slope coefficients of the regression

$$R_{pt} = \gamma^{*}_{0t} + \gamma_{4t}\left[\frac{Vp - Vm}{Vm}\right]_{t-1} + \mu^{*}_{p,t-1}$$

Where Vp and Vm are the market capitalization of portfolio and the market, respectively[a].

Average over	$\bar{\gamma}^{**}_{0}$ (Intercept)	$\bar{\gamma}_4$ (Relative size)	Sample size
All months	0.0091 [b] (3.54)	-0.0007 [b] (-2.05)	156
All months except January	0.0058 [b] (2.38)	-0.0006 (-1.65)	143
JANUARY	0.0444 [b] (4.18)	-0.0019 [b] (-1.96)	13
FEBRUARY	0.0205 (2.73)	-0.0016 (-1.51)	13
MARCH	0.0042 (0.51)	-0.0008 (-0.69)	13
APRIL	0.0212 [b] (2.74)	0.0007 (0.52)	13
MAY	0.0009 (0.14)	-0.0004 (-0.64)	13
JUNE	0.0115 [b] (2.02)	0.0001 (0.14)	13
JULY	0.0164 [b] (2.63)	-0.0014 [b] (-2.47)	13
AUGUST	0.0027 [b] (0.34)	-0.0042 [b] (-3.42)	13
SEPTEMBER	-0.0083 (-0.98)	-0.0031 [b] (-4.20)	13
OCTOBER	-0.0160 [b] (-2.54)	-0.0014 (-1.47)	13
NOVEMBER	-0.0055 (-0.73)	0.0017 (0.86)	13
DECEMBER	0.0167 (1.50)	0.0036 [b] (2.17)	13

a. estimated with monthly data and the equally-weighted index from January 1971 to December 1983.

b. t statistics are in parentheses bel

T A B L E 7

Characteristics of the largest and smallest size portfolios which have been partioned into four subportfolios ranked by decreasing magnitude of their beta coefficient. Values in the table are average over a 13-year period from January 1971 to December 1983.

PORTFOLIO SIZE (Thousands BF)	SUBPORTFOLIOS RANKED BY BETAS			AVERAGE MONTHLY RETURNS				
	BETA	No STOCKS	SIZE	ALL YEAR	JANUARY	AUGUST	SEPTEMBER	DECEMBER
LARGEST (6,586,917) (see table 5)	1.75	13	5,984,648	0.82% [a] (2.01)	6.11% [a] (3.61)	-0.79 (0.71)	-2.42% [a] (2.04)	3.49% (1.56)
	1.11	8	6,048,503	0.77% [a] (2.60)	3.36% [a] 3.18)	-0.53 (0.63)	-1.59% (1.67)	2.54% (1.73)
	0.79	8	8,278,489	0.38% (1.55)	2.12% [a] (3.00)	-0.89 1.13)	-1.65% [a] (2.92)	3.21% [a] (2.87)
	0.28	8	6,036,027	0.61% [a] (3.47)	0.58% [a] (0.86)	-0.17 (0.36)	-0.39 (0.60)	1.65% [a] 3.07)
SMALLEST (34,454) (see table 5)	2.42	13	33,462	2.15% [a] (3.52)	10.31% [a] (3.99)	4.83% [a] (1.99)	-0.85% (0.45)	5.04% [a] (1.98)
	1.19	8	37,368	0.96% [a] (2.85)	5.77% [a] (3.77)	1.28% (1.31)	-1.52% (1.31)	1.01% (0.88)
	0.64	8	34,185	0.75% [a] (2.98)	3.58% [a] (3.26)	0.58% (0.59)	-0.24% (0.26)	-0.35 (0.41)
	-0.20	8	32,800	0.81% [a] (4.25)	1.74% [a] (2.87)	0.82% (1.01)	1.39% (1.84)	-0.43 (0.90)

a. t statistics are in parentheses below average values. Framed coefficients are statistically significant at the 0.05 level.

the smallest portfolio. Note that within each size-portfolio there is a clear positive relationship between average returns and systematic risk. This is true when all months are considered together as well as in January, August, September and December. A clear pattern emerges: (1) the smallest portfolio generally outperforms the largest portfolio, particularly during January; and (2) within in a size portfolio, high beta subportfolios outperform low beta portfolios, particularly during January. Hence the highest return is earned during January by the subportfolio with the smallest size and the highest beta: 10.31 percent which represents an annualized rate of return of 124 percent.

6. Seasonality, size and equity pricing

What is the relationship between common stock returns and risk when size and seasonality are taken into account? The answer to this question can be found by examining the average estimated coefficients of regressions (8) and (9) which are reported in table 8 and table 9, respectively.

Consider first regression (8) where risk is only systematic (beta). Over the entire sample period there is a negative size effect and no significant risk effect. This means that market value (size) is, on average, a better predictor of stock returns than systematic risk, a conclusion that is inconsistent with equity pricing according to the CAPM. Turning to the results for regression (9) in table 9 over the entire sample period we can see that when unsystematic risk is taken into consideration, it is the only significant variable in the pricing equation, a result which is again inconsistent with equity pricing according to the CAPM.

How does seasonality affect the results reported above? The answer is found in the month-to-month average estimated regression coefficients given in tables 8 and 9. January is the only month of the year during which the systematic risk premium is significantly positive with no premium earned for bearing unsystematic risk. One may conclude that equity pricing is consistent with the CAPM during January but unfortunately the relationship is _not_ linear and a significant size effect is present during January. These two characteristics are not consistent with the CAPM. The CAPM must be rejected even during January despite the positive systematic risk premium and the absence of an unsystematic risk premium.

TABLE 8

Average values of the estimated intercept and slope coefficients of the regression :

$$R_{pt} = \gamma_{0t}^{S} + \gamma_{1t}^{S}\beta_{p,t-1} + \gamma_{4t}^{S}\left[\frac{Vp - Vm}{Vm}\right]_{t-1} + \mu_{p,t-1}^{S}$$

Where Vp and Vm are the market capitalization of portfolio p and the market, respectively[a].

Average over	$\bar{\gamma}_0^S$ (Intercept)	$\bar{\gamma}_4^S$ (beta)	$\bar{\gamma}_4^*$ (relative size)	Sample size
All months	0.0110 [b]	-0.0020	-0.0008 [b]	156
	(4.45)	(-1.30)	(-2.30)	
All months except January	0.0096 [b]	-0.0037 [b]	-0.0007 [b]	143
	(3.73)	(-2.48)	(-1.86)	
JANUARY	0.0272 [b]	0.0172 [b]	-0.0022 [b]	13
	(3.22)	(3.05)	(-1.95)	
FEBRUARY	0.0213 [b]	-0.0007	-0.0022	13
	(3.83)	(-0.13)	(-1.56)	
MARCH	0.0099	-0.0058	-0.0010	13
	(1.42)	(-1.16)	(-0.86)	
APRIL	0.0242 [b]	-0.0030	0.0006	13
	(2.34)	(-0.79)	(0.43)	
MAY	-0.0023	0.0032	-0.0003	13
	(-0.29)	(0.67)	(-0.39)	
JUNE	0.0205 [b]	-0.0089	-0.0001	13
	(2.76)	(-1.64)	(-0.16)	
JULY	0.0156 [b]	0.0007	-0.0015 [b]	13
	(2.35)	(0.16)	(-2.76)	
AUGUST	0.0135	-0.0107 [b]	-0.0041 [b]	13
	(1.47)	(-2.22)	(-3.53)	
SEPTEMBER	0.0046	-0.0128 [b]	-0.0032 [b]	13
	(0.51)	(-2.45)	(-4.11)	
OCTOBER	-0.0119	-0.0041	-0.0012	13
	(-1.69)	(-1.33)	(-1.26)	
NOVEMBER	-0.0070	0.0015	0.0013	13
	(-0.86)	(0.34)	(0.68)	
DECEMBER	0.0168	-0.0002	0.0037 [b]	13
	(1.66)	(-0.03)	(2.41)	

a. estimated with monthly data and the equally-weighted index from January 1971 to December 1983.

b. t statistics are in parentheses below average values. Framed coefficients are statistically significant at the 0.05 level.

TABLE 9

Average values of the estimated intercept and slope of the regression :

$$R_{pt} = \gamma^*_{0t} + \gamma^*_{1t}\ _{p,t-1} + \gamma^*_{2t}\beta^2_{p,t-1} + \gamma^*_{3t}\ SE_{p,t-1} + \gamma^*_{4t}\left[\frac{Vp - Vm}{Vm}\right]_{t-1} + \mu^*_{p,t-1}$$

Where Vp and Vm are the market capitalization of portfolio p and the market, respectively[a].

Average over	$\bar{\gamma}^*_0$ (Intercept)	$\bar{\gamma}^*_1$ (beta)	$\bar{\gamma}^*_2$ (beta)^2	$\bar{\gamma}^*_3$ (Unsyst. risk)	$\bar{\gamma}^{**}_4$ (size)	Sample size
All months	0.0045 (1.18)	-0.0014 (-0.37)	-0.0010 (-0.65)	0.1390 (2.59) [b]	-0.0003 (-0.93)	156
All months except January	0.0037 (0.93)	-0.0047 (-1.23)	-0.0004 (-0.24)	0.1374 (2.60) [b]	-0.0002 (-0.48)	143
JANUARY	0.0138 (0.89)	0.0353 (2.81) [b]	-0.0076 (-1.99) [b]	0.1569 (0.54)	-0.0021 (-1.90) [b]	13
FEBRUARY	0.0144 (1.62)	0.0105 (0.65)	-0.0065 (-1.34)	0.1031 (0.76)	-0.0017 (-0.97)	13
MARCH	0.0024 (0.20)	-0.0206 (-1.34)	0.0070 (1.10)	0.2028 (2.01) [b]	0.0001 (0.11)	13
APRIL	0.0249 (2.19) [b]	-0.0120 (-1.25)	0.0037 (0.82)	0.0722 (0.52)	0.0007 (0.52)	13
MAY	0.0032 (0.26)	0.0188 (1.53)	-0.0059 (-1.32)	-0.1727 (-1.16)	-0.0017 (-3.41) [b]	13
JUNE	0.0277 (2.35) [b]	-0.0207 (-1.76)	0.0031 (0.70)	-0.0404 (-0.24)	0.0001 (0.10)	13
JULY	0.0082 (0.68)	-0.0060 (-0.68)	0.0042 (0.96)	0.1208 (0.52)	-0.0011 (-0.88)	13
AUGUST	-0.0094 (-0.78)	-0.0079 (-0.84)	-0.0058 (-1.37)	0.4880 (1.88) [b]	-0.0018 (-2.96) [b]	13
SEPTEMBER	-0.0028 (-0.21)	-0.0160 (-1.24)	-0.0009 (-0.19)	0.2097 (1.36)	-0.0021 (-2.56) [b]	13
OCTOBER	-0.0257 (-1.95) [b]	-0.0010 (-0.07)	-0.0017 (-0.24)	0.2128 (1.24)	-0.0004 (-0.41)	13
NOVEMBER	-0.0190 (-1.23)	0.0027 (0.20)	0.0003 (0.04)	0.2282 (1.15)	0.0021 (1.11)	13
DECEMBER	0.0163 (1.03)	0.0003 (0.03)	-0.0016 (-0.30)	0.0865 (0.52)	0.0037 (2.43) [b]	13

a. estimated with monthly data and the equally-weighted index from January 1971 to December 1983.

b. t statistics are in parentheses below average values. Framed coefficients are statistically significant at the 0.05 level

Finally, note that during August and September we have a significant negative size effect and that during December we have a positive size effect even after controlling for both systematic and unsystematic risks.

7. Conclusion

The purpose of this paper was to re-examine the pricing of common stocks on the Belgian Stock Exchange in light of two related phenomena recently reported in the literature: the size effect and risk premia seasonality. We have shown that if these two phenomena are ignored we cannot reject the hypothesis that the behavior of common stock prices conform to the CAPM. However, once size and seasonality are accounted for in the stochastic process that generates returns, the hypothesis that the CAPM describes (and explains) the pricing of common stocks must be rejected, even during the month of January despite the presence of a positive systematic risk premium and the absence of an unsystematic risk premium during that month.

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