DAILY SEASONALITIES ON THE BRUSSELS SPOT EQUITY MARKET

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This paper reveals a persitent lower return on Tuesday in the rates of return on the Brussels Stock Exchange which is not explained by various adjustments for the measurement errors and does not appear either as a mere reflection of the “Monday effect” observed in the American returns.

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1. Introduction

The aim of this paper is to study daily seasonalities in the spot equity returns of the Brussels Stock Exchange and to test some explanations for these anomalous empirical regularities. Generally, security return distributions are not independent of the day of the week. Persistent daily seasonalities have indeed been observed in the distributions of index and security returns of a number of stock exchanges. Using the Standard and Poor's Composite Index, Cross (1973) and French (1980) documented a Monday effect or Weekend effect, that is the average return on Friday is abnormally high while it is abnormally low, even negative, on Monday. The existence of this anomaly has been confirmed by subsequent research by Gibbons and Hess (1981), Lakonishok and Levi (1982) and Keim and Stambaugh (1984) on various American stock market indexes and for longer periods of time. This effect has also been observed at different degrees in market indexes of other countries: in Finland by Berglund, Liljeblom and Wahlroos (1984) and in the U.K., Japan, Canada and Australia, France and Singapore by Jaffe and Westerfield (1985) and Condoyanni, O'Hanlon and Ward (1987 and 1988). Besides, Jaffe and Westerfield and Condoyanni et al. also identified in countries like France, Japan, Australia and Singapore, a Tuesday effect that dominates the Monday effect, the returns being at their lowest level on Tuesday.

The presence of such a "day of the week" effect in equity pricing has received considerable interest from the academic community. Several explanations have been examined in the literature: the measurement errors due, for example, to non-synchronous trading, holidays, bid-ask spread or specialist activity by Gibbons and Hess (1981) and Keim and Stambaugh (1984); the settlement procedure by Gibbons and Hess (1981), Lakonishok and Levi (1982) and Theobald and Price(1984); the firm size by Rogalski (1984) and Keim and Stambaugh (1984); the January effect by Rogalski (1984); the international integration by Jaffe and Westerfield (1985) and Condoyanni, O'Hanlon and Ward (1987 and 1988) and the overreaction effect by Pettengill and Jordan (1990). But despite the effort and time devoted to their study, the suggested explanations were never unanimous, nor did any of them completely account for the existence of these anomalies.

This paper shows that the stock returns on the Brussels Stock Exchange markets exhibit a Tuesday effect. Because of the friction on the trading process, it also appears that this "day of the week" effect mainly concerns frequently traded stocks. None of the adjustments related to measurement errors, i.e. adjustment for heteroscedasticity, autocorrelation, holiday and dividend distribution, does appear to explain the daily seasonality. This study does not either reveal any relationship between the Tuesday effect in the Belgian returns and the U.S. Monday effect, which means that the Tuesday effect is not merely a reflection of the U.S. Monday effect due to the difference in the zone time.

The sample consists of all domestic equities traded on the spot market of the Brussels Stock Exchange (BSE) from 1st January 1977 to 31st December 1985. Stock prices and dividends were gathered by the author from tapes of the Brussels Stock Exchange. The returns are calculated as rates of return, they include dividends and are adjusted for changes in capital. To simplify the calculation and the presentation of the results, the analysis will be conducted only on market indexes. The index returns this study uses are returns of an equally weighted and a value weighted market portfolio consisting of all common stocks listed on the spot market.

2. Daily Seasonalities in the Returns: the Evidence

The weak form of the efficient market hypothesis assumes that current prices fully and instantaneously reflect all information from historical sequences of prices. According to this hypothesis the distribution of the returns should not exhibit a seasonal pattern. Concerning daily returns more specifically, the average daily returns should not vary across the days of the week. With respect to this, French (1980) pointed out that two attitudes can be considered according to whether the process that generates the returns is continuous on the whole calendar week or on the trading period of the week only. Under the calendar time hypothesis, the average Monday return should be three times the average return of the other days of the week if the trading period is five days. And under the trading time hypothesis, no difference should be observed between the daily average returns.

These two hypotheses have been tested by French on the returns of the Standard and Poor's composite portfolio and both were not supported by the data. French's results show indeed not only that the average Monday return is not equal to or greater than the average return of the other days, but also that it is significantly negative while it is generally positive for the other days. Friday average return is, on the other hand, very large.

Daily statistics for the two spot indexes are presented in table 1. The table displays the average percentage return per day of each index and the value of their t-test statistic. To test the joint hypothesis that all average daily returns are equal to zero, the dummy variable regression (1) is also run. In this regression $\tilde{R}_{kt}$ is the daily return for index k in period t, D_{it} is the dummy variable for day i, that is, $D_{it}=1$ for day i and $D_{it}=0$ otherwise, and $\tilde{\varepsilon}_{kt}$ is the error term. The value of the F-test statistic of this regression is also presented in table 1.

(1)
$$\tilde{R}_{kt} = \sum_{i=1}^{5} \hat{\beta}_{ki} D_{it} + \tilde{\varepsilon}_{kt}$$

Interestingly, there is no Monday or Weekend effect as such in the Belgian market index returns. The average Monday return is significantly positive at the five per cent level and above the average daily return. With regard to the average return on Friday, it is, just as in the studies on the American indexes, generally the highest return of the week.

Table 1
Mean Return by Day of the Week

	Mon.	Tues.	Wed.	Thurs.	Fri.	All Days	F-test
Number of observations	424	456	460	446	427	2213	
Equally Weighted Index							
Mean (a)	.0795	.0262	.0464	.0437	.0623	.0511	
t-test (b)	<u>3.33</u>	1.84	<u>3.66</u>	<u>3.73</u>	<u>4.00</u>	<u>7.14</u>	<u>11.48</u>
Value Weighted Index							
Mean (a)	.0984	-.0319	.0406	.1110	.1301	.0682	
t-test (b)	<u>3.42</u>	-1.14	1.65	<u>4.79</u>	<u>5.19</u>	<u>5.84</u>	<u>12.10</u>

(a) in per cent.
(b) t-test and F-test coefficients significant at the 5% level are underlined (two tails test).

The most important feature of table 1 is that it reveals a seasonal pattern which is concentrated on Tuesday. The Tuesday return is indeed low, even negative as far as the value weighted index is concerned, compared to the returns of the other days of the week. The t-test statistics indicate that the hypothesis of a zero average Tuesday return is not rejected at a five per cent significance level for both indexes. Therefore, the seasonal pattern appears to be concentrated on Tuesday although the average Wednesday return of the value weighted index is also low compared to the daily returns of the rest of the week.

The importance of the Tuesday effect in the index returns can be tested with the following dummy variable regression

(2)
$$\tilde{R}_{kt} = \hat{\beta}_{k2} + \hat{\beta}_{k1} D_{1t} + \hat{\beta}_{k3} D_{3t} + \hat{\beta}_{k4} D_{4t} + \hat{\beta}_{k5} D_{5t} + \tilde{\varepsilon}_{kt}$$

where $\tilde{R}_{kt}$ is the return of the market index k in period t, D_{it} is the dummy variable for day i (D_{it}=1 if observation t falls on day i and 0 otherwise), and $\tilde{\varepsilon}_{kt}$ is the error term. The regression intercept $\hat{\beta}_{k2}$ measures the average Tuesday return, and the slopes $\hat{\beta}_{k1}$, $\hat{\beta}_{k3}$, $\hat{\beta}_{k4}$ and $\hat{\beta}_{k5}$ measure the difference between the average return of the other days of the week and that of Tuesday. If the F-test of the regression is statistically significant, the joint hypothesis of equality between the average Tuesday return and those of the other days of the week, i.e. $\hat{\beta}_{k1}=\hat{\beta}_{k3}=\hat{\beta}_{k4}=\hat{\beta}_{k5}=0$, is rejected. The results are presented in table 2.

At the five per cent significance level, the F-test statistic rejects the hypothesis of equality of the returns for the value weighted index only. Furthermore all t-test coefficients of the slopes are statistically significant for this index. When the equally weighted index is the dependent variable, the hypothesis of equality of the average daily returns is not rejected, the average Tuesday return is positive and none of the slopes, but Monday's, is statistically significant.

Table 2

Test of Hypothesis of Equal Day-to-Day Mean Returns[(a)(b)]

$$\tilde{R}_{kt} = \hat{\beta}_{k2} + \hat{\beta}_{k1}D_{1t} + \hat{\beta}_{k3}D_{3t} + \hat{\beta}_{k4}D_{4t} + \hat{\beta}_{k5}D_{5t} + \tilde{\varepsilon}_{kt}$$

	$\hat{\beta}_{k2}$ Tues.	$\hat{\beta}_{k1}$ Mon.	$\hat{\beta}_{k3}$ Wed.	$\hat{\beta}_{k4}$ Thurs.	$\hat{\beta}_{k5}$ Fri.	F-test
Equally weighted index	.0262	.0533	.0202	.0175	.0361	1.58
	<u>1.66</u>	<u>2.35</u>	.91	.78	1.59	
Value weighted index	-.0319	.1304	.0725	.1429	.1620	<u>6.50</u>
	-1.25	<u>3.54</u>	<u>2.01</u>	<u>3.93</u>	<u>4.40</u>	

(a) the estimated coefficients are multiplied by 100. The t-test statistics are given below the coefficients.

(b) F-test and t-test coefficients which are significant at the 5% level are underlined (two tails test)

Comparing the two indexes, one can observe that the seasonal behaviour is more pronounced for the value weighted index than for the equally weighted index. Such result is consistent with the Theobald and Price hypothesis (1984) which predicts a stronger seasonal behaviour in the returns of the value weighted index than in those of the equally weighted index. Theobald and Price argued that any test of seasonality necessitates independently and identically return distributions through time. If this condition is not satisfied, a diffusion of the daily seasonalities across the days of the week will occur. According to their hypothesis, the daily returns of the market indexes composed of a small number of frequently traded securities should then exhibit a stronger daily seasonality than larger indexes, or indexes which include smaller and less traded securities. Because of friction in the trading process, infrequently and thinly traded securities have longer adjustment delays of their price to a change in information than have frequently traded securities. Therefore any daily seasonality in their returns is diffused among the days of the week. One would then expect that large indexes, that is, indexes which are composed of a large number of small firm securities, as well as equally weighted indexes, which give more weight to the returns of small firm securities, present weaker evidence of a seasonal pattern in their returns than do value weighted indexes or indexes composed of a small number of large and frequently traded securities.

The conclusion at this stage is that there is a Tuesday effect in the returns on the spot market of the BSE. The return on Tuesday is lower, or even negative, compared to the returns of the other days of the week. But because of the infrequent trading which diffuses the seasonal pattern across the days, the effect mainly concerns the large and frequently traded securities. Such a result has indeed been observed by Corhay (1990) who examined the relationship between the seasonal pattern in the returns and the level of trading of five portfolios constructed on the basis of the frequency of trading of the securities.

3. Some Possible Explanations

The objective of this section is to ensure that the seasonal pattern observed in the returns is not caused by some statistical properties in the distribution of the returns or some characteristics of the market. To this end some plausible explanations related to measurement errors are tested.

A. Adjustment for Heteroscedasticity

As Gibbons and Hess (1981) remarked, equation (1) assumes that the covariance matrix is constant across the days of the week. Therefore, since the value of the standard deviation of the daily returns of stock indexes depends on the day of the week, they suggested to avoid heteroscedasticity by standardizing the variables of equation (1) by the estimated standard deviation of the returns of each day respectively.

(3)
$$\frac{\tilde{R}_{kt}}{\sigma_i} = \sum_{i=1}^{5} \hat{\beta}_{lt} \frac{D_{it}}{\sigma_i} + \tilde{\varepsilon}_{kt}$$

This test has been conducted on the two indexes, and it can be concluded that the adjustment for heteroscedasticity cannot explain the fluctuations in the daily returns. Table 3 shows indeed that the seasonal pattern in the parameters of the dummy regression is not changed.

Table 3

Test of Hypothesis of Equal Returns with an Adjustment for Heteroscedasticity [a] [b]

	β_1 Mon.	β_2 Tues.	β_3 Wed.	β_4 Thurs.	β_5 Fri.	F-test
Equally weighted index	.1618	.0860	.1706	.1765	.1938	<u>11.56</u>
	<u>3.33</u>	1.84	<u>3.66</u>	<u>3.73</u>	<u>4.00</u>	
Value weighted index	.1664	-.0537	.0766	.2269	.2510	<u>13.12</u>
	<u>3.42</u>	-1.14	1.65	<u>4.79</u>	<u>5.19</u>	

(a) The coefficients are multiplied by 100. Their t-statistics are given below.
(b) F-statistics and t-statistics significant at the 5% level are underlined (two tails test)

B. Adjustment for Autocorrelation

Another inappropriate statistical assumption concerns the presence of autocorrelations in the distribution of the daily returns. Number of studies revealed that most daily stock returns are negatively autocorrelated and that market index returns, especially when they include a number of infrequently traded stocks, are positively autocorrelated.[1] Corhay (1989) showed that the Belgian market index returns act according to that rule, and furthermore that the first order autocorrelation in the daily Belgian index returns, especially the equally weighted one of the spot market, exhibits a seasonal pattern. In order to eliminate the effect of the autocorrelation and its seasonal pattern, the modified dummy variable regression is run:

$$\tilde{R}_{kt} = \hat{\beta}_{k2} + \hat{\beta}_{k1} D_{1t} + \hat{\beta}_{k3} D_{3t} + \hat{\beta}_{k4} D_{4t} + \hat{\beta}_{k5} D_{5t} + \sum_{i=1}^{5} \tilde{R}_{kt-1}\, \hat{\gamma}_{lt}\, D_{it} + \tilde{\varepsilon}_{kt} \tag{4}$$

where D_{it} is the dummy variable representing day i of the week, $\hat{\beta}_{ki}$ (i=1,3,4,5) is the difference, corrected for the first order autocorrelation, between the average return of day i and the average return of Tuesday (intercept), and γ_i is the first autoregressive parameter corresponding to day i. In addition to the regression F-test, the F-statistics of the two following joint hypotheses are also computed,

$$H(\beta): \quad \hat{\beta}_{k1} = \hat{\beta}_{k3} = \hat{\beta}_{k4} = \hat{\beta}_{k5} = 0$$

$$H(\gamma): \quad \hat{\gamma}_{k1} = \hat{\gamma}_{k2} = \hat{\gamma}_{k3} = \hat{\gamma}_{k4} = \hat{\gamma}_{k5} = 0$$

If there is a seasonality in the first order autocorrelation, H(γ) will be rejected, and similarly, if there is still a seasonality in the returns after they are corrected for the first order autocorrelation, H(β) will be rejected.

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[1]) Cohen et al. (1980) demonstrated that even if individual stock return distributions present a small negative first order autocorrelation, the friction in the trading process causes a positive and often very large autocorrelation in the market index returns. Because of the friction in the trading process, there are some delays in the adjustment of the stock prices to changes in information. These delays induce some positive intertemporal cross-covariances between stock prices which, in turn, generate a positive autocorrelation in the market index returns. Consequently, the larger an index is and the larger its proportion of small firms is, the larger its autocorrelation coefficients are.

The results of the regression and the tests are reported in table 4. Both tests of H(γ) are rejected. This supports the hypothesis of a seasonal pattern in the autocorrelation function; the autocorrelation is higher between Monday and Friday and between Thursday and Friday than it is between any other adjacent days. This also suggests that the correction for the first order autocorrelation can have an impact on the seasonality in the returns. But as one can observe in table 4, the adjustment intensifies the Tuesday effect in the spot market returns. Tuesday average return is negative for both indexes, even significantly for the value weighted one, and the differences in return between the last three days of the week and Tuesday become larger. The F-test statistic of the hypothesis H(β) is, however, still not significant for the equally weighted index.

Table 4

Test of Hypothesis of Equal Return with an Adjustment for Autocorrelation [(a) (b) (c)]

$$\tilde{R}_{kt} = \hat{\beta}_{k2} + \hat{\beta}_{k1}D_{1t} + \hat{\beta}_{k3}D_{3t} + \hat{\beta}_{k4}D_{4t} + \hat{\beta}_{k5}D_{5t} + \sum_{i=1}^{5} \hat{\gamma}_{ki}\tilde{R}_{kt-1}D_{it} + \varepsilon_{kt}$$

Index	Tue. $\hat{\beta}_{k2}$	Mon. $\hat{\beta}_{k1}$	Wed. $\hat{\beta}_{k3}$	Thu. $\hat{\beta}_{k4}$	Fri. $\hat{\beta}_{k5}$	$\hat{\gamma}_{k1}$	$\hat{\gamma}_{k2}$	$\hat{\gamma}_{k3}$	$\hat{\gamma}_{k4}$	$\hat{\gamma}_{k5}$	F-test	F(β)	F(γ)
Equally Weighted	-.0061	.0281	.0415	.0323	.0437	1.013	.3324	.3238	.3879	.6539	<u>101.18</u>	1.62	<u>180.35</u>
	-.44	1.43	<u>2.16</u>	1.66	<u>2.24</u>	<u>23.57</u>	<u>8.89</u>	<u>7.16</u>	<u>7.87</u>	<u>12.41</u>			
Value Weighted	-.0643	.1142	.1134	.1631	.1377	.3876	.3078	.2755	.3405	.5195	<u>40.33</u>	<u>6.59</u>	<u>66.68</u>
	<u>-2.64</u>	<u>3.24</u>	<u>3.33</u>	<u>4.76</u>	<u>3.93</u>	<u>8.18</u>	<u>7.53</u>	<u>6.86</u>	<u>7.39</u>	<u>10.40</u>			

(a) Printed estimated parameters of the betas are multiplied by 100.
(b) t-statistics of the estimated coefficients are given below the coefficients.
(c) Values of the t and F statistics which are significant at the five percent level are underlined (two tails test).

C. Adjustment for Holiday Returns

Disregarding the weekend's returns, the series of returns of the market indexes still includes holiday returns. This means that if the process generating the returns is continuous on the first five days of the week, some returns are returns on more than one day. Furthermore, most of the holidays take place at the end or at the beginning of the week. Out of 86 holiday returns, 31 are Monday returns and 35 Tuesday returns. This suggests that the average daily returns for these two days can be influenced by the holiday returns.

In order to avoid such impact in the tests, the average daily returns of table 1 have been recalculated after eliminating the holiday returns. The resulting average daily returns figure in table 5, as well as the average value of the returns after a one day and a two days' holiday.

The comparison between table 1 and table 5 reveals that when the holiday returns are taken into consideration, the magnitude of the seasonal pattern in the daily returns is to some extent strengthened. Excluding holiday returns from the series substantially tends to increase the average Monday return and to decrease the average Tuesday return.

Table 5

Daily Mean Returns after Eliminating the Holiday Returns (a) (b)

	Mon.	Tues.	Wed..	Thurs.	Fri.	Holiday Returns One day	Two days
Observations	393	421	449	438	426	40	46
Equally W. Index	.0864	.0168	.0492	.0449	.0711	.0700	-.0602
	<u>3.43</u>	1.14	<u>3.61</u>	<u>3.79</u>	<u>5.51</u>	1.16	-.66
Value W. Index	.1212	-.0426	.0486	.1134	.1300	.019	-.1395
	<u>4.08</u>	-1.48	1.95	<u>4.84</u>	<u>5.17</u>	.19	-1.79

(a) Mean returns are multiplied by 100. Their t-test statistics are given below
(b) t-statistics significant at the 5% level are underlined (two tails test)

D. Adjustment for Dividend Distribution.

As one can observe in table 6, the distribution of dividends, expressed as an average dividend per day and per security, often takes place on Tuesday. More than 40 per cent of the dividends are distributed on Tuesday.

Table 6

Mean Return by Day of the Week when the Ex-Div Days are Excluded (a) (b)

	Observ.	Mon.	Tues.	Wed.	Thurs.	Fri.
Div. Distribution(c)		180.7	562.9	185.2	208.6	215.8
Equally W. Index	1491	.0467	.0034	.0318	.0233	.0669
		<u>2.14</u>	.16	1.69	1.24	<u>3.57</u>
Value W. Index	1491	.1631	-.0166	-.0006	.1021	.1310
		<u>4.82</u>	-.50	-.02	<u>3.49</u>	<u>4.50</u>

(a) The mean returns are multiplied by 100. Their t-test statistics are given below.
(b) t-statistics significant at the 5% level are underlined (two tails test)
(c) Average dividends distributed per day and per security in thousands of Belgian francs.

The fact that a number of securities go ex-div on Tuesday can contribute to giving a lower value to the Tuesday return. In order to avoid the impact of the ex-div days on the daily mean returns, these were again computed after excluding the ex-div days. The results, which are displayed in table 6, show that the seasonal pattern is more or less the same. The distribution of dividends does not seem to boost or impede significantly the day of the week effect.[2]

4. Day of the Week Effect and International Integration

The issue examined here is whether the Tuesday effect observed in the Belgian stock returns is a reflection of the Monday effect that has been put in evidence in the U.S. index returns. Because of the difference in the time zone, it turns out that the BSE markets are closed when the NYSE opens.[3] Returns on the BSE markets cannot therefore be influenced by the behaviour of the NYSE on the same day, but by those of the preceding trading day.

This kind of international relationship with the U.S. has been investigated by Jaffe and Westerfield (1985) for Japan and Australia, and by Condoyanni et al. (1987) for France, Japan, Singapore and Australia. Both studies examined the cross-correlations conditional upon the day of the week between the returns of these countries, which exhibit a Tuesday effect, and those of the NYSE leaded by one day, and they found no significant differences in the cross-correlations across the days of the week. From these cross-correlations, Condoyanni et al. deduced that the seasonal pattern in the stock returns of these countries could be partially attributed to the American Monday effect. As for Jaffe and Westerfield, they went further in the tests and they concluded that the difference in the time zone can partially explain the Australian Tuesday effect, but not the Japanese.

Three American indexes from the tape of the Center for Research in Security Prices (CRSP) are used in this study. They are respectively the Standard and Poor's 500 Composite Index (S&P) and the equally weighted (USEW) and value weighted (USVW) market portfolio of all stocks quoted on the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX).[4] The mean returns by day of the week for the three American indexes are displayed in table XIII, and as expected, they exhibit a Monday effect, the effect being particularly large for the USEW index.

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2) This test presents a weakness for the spot market insofar as each time there is a dividend distribution for one security, the corresponding index return is deleted. This means that for this market, 722 out of 2213 returns are suppressed.

3) The Corbeille market of the BSE opens at at 12:50 local time and the *Parquet* at 13:00. The closing time of these markets is not determined in advance. These markets are auction markets and they close when there is no new orders issued. On the *Parquet*, there is only one auction per day, while on the *Corbeille* markets successive auctions are possible. Trading on these markets is nevertheless always ended by 13:30 local time, that is, two hours before the NYSE opens.

4) For reason of availability of the American index returns, all tests in this section are carried out on the period 1977 to 1984.

Table 7

Mean Return on U.S. Indexes by Day of the Week.[a]

	Mon.	Tues.	Wed.	Thurs.	Fri.	F-test
S&P	-.0916	.0248	.0773	.0284	<u>.0843</u>	<u>2.65</u>
USEW	<u>-.1184</u>	.0154	<u>.1464</u>	<u>.1494</u>	<u>.2571</u>	<u>15.19</u>
USVW	-.0825	.0343	.1012	.0587	<u>.1278</u>	<u>3.86</u>

[a] All returns are multiplied by 100. Significant values at the 5% level are underlined (two tails test).

The cross-correlations, conditional upon the day of the week, between the returns of the market indexes of the BSE and those, leaded by one day, of the three U.S. indexes have been calculated. Their values, which are reported in table 8, show that the cross-correlation varies across the days of the week, the pattern being more or less consistent for all pairs of Belgian and American indexes. The value of the cross-correlation is at its lowest level on Monday and tends to increase continuously across the days of the week. This suggests that the Tuesday effect on the BSE is not a reflection of the Monday effect. Some autocorrelations are larger on Tuesday for the equally weighted index. But since this index exhibits a weaker Tuesday effect, nothing can be inferred from this observation.

The hypothesis of a reflection of the Monday effect can also be tested by running a dummy variable regression which accounts for the cross-autocorrelation with the American returns.

$$\tilde{R}(B)_{kt}=\hat{\beta}_{k2}+\hat{\beta}_{k1}D_{1t}+\hat{\beta}_{k3}D_{3t}+\hat{\beta}_{k4}D_{4t}+\hat{\beta}_{k5}D_{5t}+\sum_{i=1}^{5}\hat{\gamma}_{mi}\tilde{R}(US)_{mt-1}D_{it}+\tilde{\varepsilon}_{kt} \tag{8}$$

for k=1 to 2 and m=1 to 3.

Table 8

Cross-Correlations Between Belgian and Leaded American Index Returns.

Belgian Index	U.S. Index	Mon.	Tues.	Wed.	Thurs.	Fri.	All Days
Equally W.	S&P	.077	.169	.135	.120	.303	.158
	USEW	.068	.214	.183	.140	.351	.196
	USVW	.084	.181	.142	.127	.320	.169
Value W.	S&P	.157	.258	.329	.308	.356	.285
	USEW	.111	.265	.293	.253	.352	.265
	USVW	.151	.262	.327	.306	.366	.287

The regression coefficients $\hat{\beta}_{ki}$, that is, the mean return on Tuesday and the differences in mean return between the other days of the week and Tuesday, after they are adjusted for the cross-correlation with the U.S. returns, are presented in table 9. A F-test statistic of the hypothesis that $\hat{\beta}_{k1}$, $\hat{\beta}_{k3}$, $\hat{\beta}_{k4}$ and $\hat{\beta}_{k5}$ are jointly equal to zero also appears in this table.

The results show that after adjusting for the cross-correlation with the U.S., the Tuesday effect is still present in the returns. The comparison with table 2 reveals that the seasonal pattern in the indexes is more or less similar. Furthermore, the value of their F-statistic rejects the hypothesis that all differences in returns from the other days are jointly equal to zero.

Table 9

Mean Returns when Cross-Correlations with U.S. Indexes are Taken into Account.[(a)]

$$\tilde{R}(B)_{kt}=\hat{\beta}_{k2}+\hat{\beta}_{k1}D_{1t}+\hat{\beta}_{k3}D_{3t}+\hat{\beta}_{k4}D_{4t}+\hat{\beta}_{k5}D_{5t}+\sum_{i=1}^{5}\hat{\gamma}_{mi}\tilde{R}(US)_{mt-1}D_{it}+\tilde{\varepsilon}_{kt}$$

Belgian Index	U.S. Index	$\hat{\beta}_{k1}$ Mon.	$\hat{\beta}_{k2}$ Tues.	$\hat{\beta}_{k3}$ Wed.	$\hat{\beta}_{k4}$ Thurs.	$\hat{\beta}_{k5}$ Fri.	F-test[(b)]
Equally W.	S&P	$\underline{.0709}$	$\underline{.0344}$	.0070	.0047	$\underline{.0467}$	$\underline{5.18}$
	USEW	.0614	$\underline{.0386}$	.0026	-.0031	.0287	$\underline{3.72}$
	USVW	$\underline{.0691}$	$\underline{.0343}$	.0065	.0037	$\underline{.0438}$	$\underline{4.88}$
Value W.	S&P	$\underline{.1063}$	-.0283	.0526	$\underline{.1128}$	$\underline{.1480}$	$\underline{4.76}$
	USEW	$\underline{.0847}$	-.0206	.0466	$\underline{.0961}$	$\underline{.1107}$	$\underline{2.75}$
	USVW	$\underline{.1022}$	-.0292	.0514	$\underline{.1092}$	$\underline{.1417}$	$\underline{4.40}$

(a) The estimated coefficients of the regressions are multiplied by 100. Those which are significant at the 5% level are underlined (two tails test).

(b) The F-statistics which are significant at the 5% level are underlined.

It can therefore be concluded that the daily seasonal pattern in the Belgian returns can at the very most be partially explained by the U.S. Monday effect, the Tuesday effect on the BSE appearing to be mainly an indigenous effect.

5. Conclusions

The evidence presented in this study tends to support the existence of a persistent and indigenous Tuesday effect in the Belgian stock returns. Tuesday average return appears to be systematically lower than the return of the other days of the week. Neither the various adjustments for the measurement errors, nor the analysis of the relationship between this effect and the Monday effect in the U.S. returns did strongly support a plausible explanation of the lower return on Tuesday.

These seasonal patterns in the distribution of the returns contradict the hypothesis of the efficiency of the market insofar as they would permit investors to obtain abnormal returns from trading strategies based on these anomalous behaviours of the security prices. But can these daily anomalies be really considered as inefficiencies? On the one hand, it can indeed be argued that, because of the importance of the costs of transaction, a daily seasonality cannot easily be used in order to generate profit, and therefore cannot be considered as an inefficiency. But on the other hand, a daily seasonality can be considered as an indirect inefficiency insofar as the investors can plan their orders so as to obtain a better price, postponing, for example, their selling to Friday and their buying to Tuesday.

6. References

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