An assessment of risk in thinner markets: the Belgian case

Gabriel Hawawini

1979

TEMPLE UNIVERSITY
School of Business Administration

Journal of Economics and Business

Volume 31 1978-1979

REPRINT

An assessment of risk in thinner markets: the Belgian case

Gabriel A. Hawawini and Pierre A. Michel

This study uses the Market Model (MM) to assess the risk of individual securities and portfolios of securities traded on the Brussels Stock Exchange (BSE) in Belgium. It then compares the Belgian results to similar findings from the equity markets in France and the United States.

The BSE is a smaller, thinner, and less liquid market than the American equity market and, to some extent, than the French stock market. Altman, Jacquillat and Levasseur [1] have shown that the MM applies well to the French equity market despite this market's smaller and less liquid character (p. 1510). Compared to the American stock market, they observed more stationary results for the French equity market with respect to individual firm estimates of risk over time (p. 1510). In this study, the MM is shown to apply well to the BSE yielding estimates of risk measures on the BSE that are shown to be more reliable and more stationary than equivalent estimates for either the French or the American equity markets.[1] These observations suggest the existence of a relationship between the reliability and stability of estimates of risk derived from the MM and the size and structure of the equity markets to which this model is applied. This possible relationship and some of the factors that may cause it are examined in this study.

Market model and sample properties

The MM asserts that the statistical process generating the return on any given security i over the time interval Δt, $\tilde{R}_{it}$, is a linear function of the return of the market portfolio, $\tilde{R}_{mt}$, over the same time interval.[2] Symbolically one writes:

$$(1) \quad \tilde{R}_{it} = \alpha_i + \beta_i \tilde{R}_{mt} + \tilde{\xi}_{it}$$

$i = 1, \ldots, N$ securities
$t = 1, \ldots, n$ observations

where α_i and β_i are constant parameters unique to security i and ξ_{it} are random variables assumed to be serially uncorrelated with zero expected values and constant variance. The model further assumes that the random variables ξ_{it} are uncorrelated across securities and uncorrelated with the return of the market portfolio.[3] Given the preceding set of assumptions it follows that $\beta_i = cov\,(\tilde{R}_{it}, \tilde{R}_{mt})/var(\tilde{R}_{mt})$. The parameter β_i is an appropriate measure of the risk of security i when it is held in a well diversified portfolio, even if the stochastic process generating the return of security i is not the MM.

To test the validity of the model for Belgian securities and portfolios, weekly prices (i.e., closing prices for the last day of the week) and dividend data were used for 30 common stocks listed on the BSE. The companies used in the sample are the largest in terms of market value of shares outstanding, and they are representative of the various sectors of the economy. Their stocks comprise about two-thirds of the market value of all listed shares at the end of the period. After adjusting the data for stock dividends and splits, percentage returns were generated. The market rate of return was computed from the index of the Commission de la Bourse de Bruxelles[4] for the period January 1963 to December 1976. This fourteen-year span is of sufficient diversity to serve as an adequate test of the MM.

Dr. Hawawini is assistant professor of finance in the graduate school of business administration at New York University; Mr. Michel is premier assistant at the Ecole d'Administration des Affaires at the Université de Liège in Belgium. The authors are indebted to Professor J. C. Francis, Bernard Baruch College of the City University of New York, for his helpful comments. They wish to express their appreciation to the Commission de la Bourse de Bruxelles for providing the data on which the study is based.

1. For similar studies on the U.S. market see Blume [3] and Levy [10]. For the study of the French market see Altman et al. [1]. For studies of other European markets see Pogue and Solnik [11].

2. This model was initially presented by Sharpe in [13, 14].

3. For a discussion of the assumptions of the Market Model see Beja [2] and Fama [4, 5].

4. This is a daily selective index based on a sample of 87 stocks out of approximately 350 listed stocks. Prices are weighted by each stock's capitalization value based on the number of shares outstanding.

Validity of the market model: empirical evidence

In order to determine whether the MM applies to the BSE, the parameters α_i and β_i were estimated using equation (1) for various lengths of securities' returns (weekly, monthly, and quarterly) for the period 1963–76. The statistical results[5] indicate that the average beta coefficient is close to one and increases slightly with the length of securities' returns,[6] with estimates of betas ranging from .35 to 2.05. (Such magnitudes are similar to those observed on other equity markets.) These estimated risk measures display relatively large statistical significance (reliability) with an average t-statistic of 7.11 for monthly returns compared to an average value of 5.64 in France and an average value of 4.36 in the United States for comparable estimation periods.[7] The average alpha coefficient was found to be statistically insignificant and essentially equal to zero.

Another important measure of the validity of the MM is its explanatory power. The percentage of variation in security movement explained by the market movement (average R-squared) is 16 percent for weekly returns, 29 percent for monthly returns, and 43 percent for quarterly returns.[8] It is striking that a 29 percent value for the average R-squared was reported in similar studies performed in the United States Blume [3] and in France by Altman et al. [1] using monthly returns for equivalent sample periods. Similar results were obtained for two seven-year, non-overlapping subperiods as well as for subperiods corresponding to the market performance. It appears then that the way in which the estimation period is segmented does not affect significantly the average values of the estimated parameters of the MM.

The analysis carried out so far assumes that security i does not lead or lag the general market movement. Because of the thinness of the market and the fact that some stocks are not traded every day or for any reason related to the economic and investment climate, equation (1) may not be the correct statistical process generating securities' returns. Some stocks may systematically lead or lag the market movement producing a biased estimate of the parameter beta. In order to detect the existence of possible leads or lags a modified version of equation (1) is used:

$$(2)\quad \tilde{R}_{it} = \alpha_i + \beta_{ik}\tilde{R}_{m,\,t+k} + \tilde{\xi}_{it}$$

$i = 1, \ldots, N$ securities
$t = 1, \ldots, n$ observations

Returns were computed for weekly intervals with k taking any integer value between $k = -4$ and $k = +4$, i.e., a maximum lag or lead of four weeks. The statistical estimate of the parameter β_{ik} corresponds to the leading or lagging beta coefficients.

Results indicate that the average alpha and beta coefficients for $k \neq 0$ are not significantly different from zero and that the explanatory power of the model for $k \neq 0$ is close to zero.[9] It should be pointed out that some coefficients were significant statistically but none was more significant than its corresponding coincident beta coefficients ($k = 0$). Nevertheless, no systematic lag or lead was observed for a given firm; i.e. the firm having a significant coefficient for a given $k \neq 0$ is usually not the same for the other values of k. These results are evidence of the absence of any significant leads or lags in the market for weekly rates of return despite the market's thinness.[10] The empirical findings examined here can be interpreted as evidence that the MM expressed in equation (1) yields statistically reliable estimates of risk measures with somewhat better results for securities traded on the BSE than those obtained on larger equity markets.

Stability of Belgian risk measures and comparison with other markets

The stability over time of the estimated beta coefficients are now examined for individual

5. For the sake of conciseness the empirical results are not presented in a table form. The reader is refered to Hawawini and Michel [8] for details.
6. The slight increase in the average values of betas and the sharp improvement in the average values of R-squared as the return interval is lengthened have been observed on other equity markets. For a theoretical explanation of these phenomena the reader is referred to Hawawini [7] and Schwartz and Whitcomb [12].
7. The results for the French and American markets are from Pogue and Solnik [11] who also report smaller t-statistics, compared to the BSE, for weekly and biweekly returns.
8. See footnote 6.
9. Complete results can be found in Hawawini and Michel [8].
10. This conclusion is similar to that of Francis [6] for the U.S. stock market.

Table 1

Temporal Stability of Betas for Securities
Average Coefficients or Correlation, 1963–1976

Subperiods		Number of coefficients of correlation	Differencing Interval			
Length	Number		Weekly	Biweekly	Monthly	Quarterly
7 years	2	1	0.789	0.743	0.699	0.468
2 years	7	6	0.617	0.479	0.376	(a)
1 year	14	13	0.483	0.423	(a)	(a)

(a) = insufficient number of observations.

securities and for portfolios of securities. These results are then compared to those obtained on the American and French stock markets.

The stability of betas for individual securities has been examined for various lengths of the return interval and for consecutive sample subperiods of different length. Average correlation coefficients are summarized in Table 1. Observe that the stability of the beta coefficients for individual securities varies directly with the length of the estimation period irrespective of the length of the return interval chosen, and inversely with the length of the return interval irrespective of the length of the estimation period chosen. These results may be explained by the fact that the statistical significance of the beta coefficients increases with the length of the estimation period and decreases with the length of the return interval.

Results for the stability of betas for individual securities over non-consecutive subperiods are found in the first column of Table 3 for portfolios of one security. No significant relationship is found between the value of the average correlation and the number of lags separating non-consecutive two-year subperiods between 1963 and 1976. The beta coefficients are, however, less stable over non-consecutive subperiods (average correlation of .5531) than they are for consecutive subperiods (average correlation of .6168). Since risk-averse investors are diversifiers the relevant measure of risk is actually the beta coefficient for portfolios rather than the beta coefficient for individual securities. Residual risk, or unsystematic risk, is eliminated through diversification. A portfolio's systematic risk is the weighted average of the beta coefficients of individual securities with weights equal to the proportion of wealth invested in each security. Table 2 presents a summary of the correlation coefficients for consecutive subperiods for portfolios of two, three, and five securities.[11] The results for individual securities are also reproduced for comparison with other stock markets.

As expected, the stability of beta increases with the number of securities included in the portfolio and with the length of the estimation period. Thus investors holding a portfolio of low (high) beta tend to find the risk of their portfolio low (high) in the following period.

Comparing the average values of correlation across markets, one observes higher average coefficients in France [1] than in the United States [10] for securities as well as for portfolios. Comparing the French results to the Belgian results, one notes that the beta coefficients for securities are more stable on the BSE for comparable periods. Similarly, for portfolios, the Belgian and French average correlations are of the same magnitude. It seems then that the stability of beta coefficients for securities and for portfolios increases as one moves from the U.S. stock market, which is a broad and highly liquid market characterized by heavy trading, to smaller and thinner markets such as the Paris and Brussels stock markets. Some factors that may be responsible for this phenomenon are discussed below.

Referring to Table 3, which shows correlation coefficients over non-consecutive subperiods, one observes that the average correlations for

11. The constitution of portfolios is as follows: the betas for securities are ranked in ascending order; the first portfolio includes the first p securities (p = 2, 3). The second portfolio contains the following p securities, and so on, until all available securities are exhausted. For portfolios of five securities, the lowest two betas are dropped and the sixth and seventh betas are added, and so on. This method is dictated by the small size of the sample resulting in overlapping portfolios of five securities. Assuming that an equal proportion of wealth is invested in each security, the beta for the portfolio is the arithmetical average of the included securities' betas.

Table 2

Temporal Stability of Betas for Portfolios
Coefficients of Correlation: Consecutive Periods, 1963–1976*
Compared Stability

Number of Stocks	1	2	3	5
2 periods of 7 years each: 1963–1969 with 1970–1976	0.7886	0.8182	0.8550	0.8843
7 periods of 2 years each:				
1963–1964 with 1965–1966	0.6319	0.6660	0.6721	0.8273
1965–1966 with 1967–1968	0.5395	0.6640	0.6900	0.8656
1967–1968 with 1969–1970	0.6174	0.7020	0.8261	0.9256
1969–1970 with 1971–1972	0.7177	0.7758	0.8814	0.8333
1971–1972 with 1973–1974	0.6287	0.6412	0.7619	0.7989
1973–1974 with 1975–1976	0.5656	0.6484	0.6583	0.6729
Average of 6 correlations	0.6168	0.6829	0.7483	0.8206
Average of the first 4 correlations, for Belgium, 1963–1972	0.6266	0.7020	0.7674	0.8630
Average for France, 1964–1971 [1]	0.587	0.701	0.774	0.840
Average for the U.S., 1962–1970 [10]	0.486			0.769

* based on weekly rates of return data.

portfolios are close to those obtained when portfolios are readjusted at the beginning of each period to take into account the latest available beta coefficients. This result implies that investors holding portfolios constituted during the initial period 1963-64 found that the relative risk of their portfolio in the final period 1975-76 tended to be about the same as in the case in which portfolios were readjusted at the beginning of each two-year period between 1963-64 and 1975-76.

The preceding empirical evidence indicates that the estimates of risk measures for securities and for portfolios of securities traded on the BSE are stable over time with better results than those obtained on the American and, to some extent, the French equity markets, which are both larger than the BSE.

Table 3

Temporal Stability of Betas for Portfolios
Coefficients of Correlation: Non-Consecutive Periods, 1963–1976*

Number of Stocks	1	2	3	5
1963–1964 with 1967–1968	0.5921	0.7819	0.8954	0.9176
1963–1964 with 1969–1970	0.6104	0.7187	0.7442	0.7845
1963–1964 with 1971–1972	0.5023	0.6288	0.6497	0.8086
1963–1964 with 1973–1974	0.5312	0.6352	0.6831	0.7839
1963–1964 with 1975–1976	0.5295	0.6049	0.6886	0.7814
Average of 5 correlations (Non-consecutive periods)	0.5531	0.6739	0.7322	0.8152
Average of 6 correlations (Consecutive periods)	0.6168	0.6829	0.7483	0.8206

* based on weekly rates of return data.

An interpretation of the results

The empirical findings of the preceding discussion suggest an inverse relationship between the stability and significance of estimated risk measures and the size and structure of equity markets. More significant and more stable estimates of risk seem to be associated with smaller and thinner markets. Before attempting to explain these observations, it should be pointed out that the validity of the MM in itself does not constitute a test of the efficiency of securities markets. Some characteristics of small and thin markets such as the BSE may explain the observed higher significance and stability of estimated betas. At least four factors deserve attention: share ownership and the behavior of investors; the isolation of the market; firms' dividend policy; and the obsolescence problem.

In the case of share ownership and the behavior of investors, holding and trading by individuals dominate the BSE with limited institutional participation in the market. A recent survey of investment policies in Belgium [15] indicates that Belgian investment companies hold less than 25 percent of the value of their portfolios in Belgian securities, with a large percentage of Belgian holdings in fixed-income securities, particularly in government bonds. Belgian stocks held by foreigners and by investment companies registered outside of Belgium are considered negligible. Fixed-income securities constitute the largest part of the portfolios of all other institutional investors. Individuals, therefore, play an important role on the BSE and their attitudes affect greatly the behavior of the market. One discerns a tendency by Belgian stockholders to hold the same securities for relatively long periods with infrequent readjustments in the composition of portfolios in response to short-term changes in prices. For example, in recent years the same companies consistently made the list of the twelve most actively traded stocks, as compiled annually by the BSE. The loyalty of investors to particular stocks is illustrated further by the fact that newly issued common stocks are reserved traditionally for existing shareholders who are given priority over non-holders in purchasing new issues, an option they often exercise. Another indicator of infrequent portfolio readjustments, particularly with respect to switching from stocks to bonds, is the absence of disruptions in the value and in the volume of shares traded on the BSE when new issues of municipal and government fixed-income securities are offered to the public, despite the thinner and less liquid character of the stock market. Small institutional activity and individuals' loyalty to stocks coupled with infrequent portfolio readjustments reduces wide fluctuations in stock price returns, bringing them closer to the general market movement and, thus, yielding estimates of risk that are highly significant.

Second, a small and thin market such as the BSE has a regional character which isolates it from the external disturbances that usually affect equity markets in larger countries. The market is not often subjected to shocks resulting from a turbulent economic and investment environment as in the case of larger markets such as in the United States. Based on a value of 100 as of December 1963, the market index rarely exceeded 105 or dropped below 80 over the fourteen-year period covered by the empirical analysis. The bull market that started in 1966 on European Stock Exchanges has produced market advances of 75 to 90 percent on the Paris, London, Amsterdam and Frankfurt exchanges, with a rise of 130 percent in Switzerland, compared to only a 38 percent increase on the BSE [15]. Market movements within a relative narrow band associated with the absence of wide fluctuations in securities price returns may explain the increased reliability and higher stability of risk estimates on the BSE.

Third, the majority of firms traded on the BSE pay usually regular, high dividends, and, therefore, dividend yields constitute a large part of the total securities' returns. This fact, in turn, increases the stability of stock price returns. For instance, the average yield spread between the yield on corporate bonds and the dividend yield on common stocks has not exceeded 3 percent in the 1970's. More specifically, the yield spread was one percent on the average for public utilities which constitute 15 percent of the sample [9].

Finally, the conditions in large, well-established firms representing the basic sectors of the economy, which constitute approximately half of the sample firms, do not vary significantly over a fourteen-year sample period. Consequently, the relative riskiness of these firms is not altered drastically over time, thus yielding stable estimates of firms' systematic risk.

REFERENCES

[1] E. I. Altman, B. Jacquillat, and M. Levasseur, "Comparative Analysis of Risk Measures: France and the United States," *Journal of Finance*, pp. 1495–1511 (December 1974).

[2] A. Beja, "On Systematic and Unsystematic Components of Financial Risk," *Journal of Finance*, pp. 37–46 (March 1972).

[3] M. E. Blume, "On the Assessment of Risk," *Journal of Finance*, pp. 1–10 (March 1971).

[4] E. F. Fama, "Risk, Return and Equilibrium," *Journal of Political Economy*, pp. 30–55 (January-February 1971).

[5] _____, "A Note on the Market Model and the Two-Parameter Model," *Journal of Finance*, pp. 1181–85 (December 1973).

[6] J. C. Francis, "Intertemporal Differences in Systematic Stock Price Movements," *Journal of Financial and Quantitative Analysis*, pp. 205–20 (June 1975).

[7] G. A. Hawawini, "The Covariance-Time Function and the Short-Run Time-Behavior of Systematic Risk," *Salomon Brothers Center for the Study of Financial Institutions*, New York University, Working Paper No. 130, (December 1977.)

[8] G. A. Hawawini and P. A. Michel, "On the Validity of the Market Model in Thinner Markets: The Case of the Brussels Stock Exchange," *Salomon Brothers Center for the Study of Financial Institutions*, New York University, Working Paper No. 135 (January 1978).

[9] Kredietbank, *Bulletin hebdomadaire*, No. 49, December 24, 1976.

[10] R. A. Levy, "On the Short-Term Stationarity of Beta Coefficients," *Financial Analysts Journal*, pp. 55–63 (November-December 1971).

[11] G. A. Pogue and B. H. Solnik, "The Market Model Applied to European Common Stocks: Some Empirical Results," *Journal of Financial and Quantitative Analysis*, pp. 917–44 (December 1974).

[12] R. A. Schwartz and D. K. Whitcomb, "The Time-Variance Relationship: Evidence on the Properties of Common Stock Returns Distributions," *Journal of Finance*, pp. 41–55 (March 1977).

[13] W. F. Sharpe, "A Simplified Model for Portfolio Analysis," *Management Science*, pp. 277–93 (January 1963).

[14] _____, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance*, pp. 425–42 (September 1964).

[15] Société Générale de Banque, *La Bourse en Belgique et gestion de portefeuille*, 1973.