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Integration of the Finnish Stock Market into the Swedish and US Stock Markets

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ABSTRACT *This paper investigates the level of integration of the Finnish stock market with the Swedish and US stock markets using an internationally extended market model for Finnish stocks. The return of a given Finnish asset is assumed to be dependent on the returns of the Finnish, Swedish and US stock markets. Several Finnish stocks have significant Swedish risk components, while the interrelationship between Finnish and US markets is significantly lower. The cross-sectional variation of the estimated systematic risk components of this model, which results largely from industry differences across firms, is also investigated.*

1. Introduction

1.1 Background

The level of international integration of financial markets has received increasing attention during recent years. This is because the major national markets have experienced rapid deregulation and integration. A typical approach has been to study the sensitivities of individual assets to an international or foreign market portfolio (for a review on other approaches, see Solnik (1988)). As is suggested by Solnik (1988), the efficient way to test for market integration would be to specify the type of imperfection which might create it, and to study its specific impact on portfolio optimality and asset pricing. Assuming that this specific imperfection results from the inability of a group of investors to trade in a subset of securities, as a result of portfolio restrictions imposed by some governments, Errunza and Losq (1985) defined the conditional market risk based on the return behaviour of different stock markets. Some empirical evidence of mild segmentation the world's capital markets was reported. Their results were further extended by Bradfield (1990) for South African markets. A large proportion of shares in the Johannesburg Stock Exchange appeared to be affected by the movements in the New York Stock Exchange, but only a small proportion of stocks was affected by the UK and Japanese stock markets. In general, the proposed multi-market model seemed to

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provide useful information about the risk characteristics of individual South African stocks. However, the cross-sectional variation of these risk components was not researched. Together with proving information about the characteristics of the thin Finnish stock markets, this can be regarded as the main task of this study.

This study investigates the level of integration of the Finnish stock market into Swedish and US stock markets, using a multi-market model. As a result of the rapid deregulation of Finnish stock markets, this is an important task to carry out. In Finland, the relative importance of other stock markets in generating the risk characteristics of listed firms may be especially high. This is because of the thin trading in the Helsinki Stock Exchange, and because of the considerably increased direct investments of Finnish companies abroad. As an open country which carries on foreign trade to a great extent, Finland is highly dependent on overseas establishment and macro-economic conditions. However, the Finnish stock market has generally been regarded as being very different from the major exchanges of the US, Japan and Western Europe. It is a very small market comprising generally thinly traded stocks. In addition, it has been suggested that the efficiency of the Finnish stock market is not especially high (see, for example, Virtanen & Yli-Olli, 1987; Booth *et al.*, forthcoming). This being the case, the return behaviour of the Finnish stock market may be very different from that of the more developed stock markets (see also Hietala, 1989).

The remainder of this paper is organized as follows. In Section 2, the multi-market models used in the study are presented. In Section 3, the data used in this study are described. Section 4 contains the empirical results of the study. Finally, some conclusions are drawn in Section 5.

2. The Multi-market Model

The capital asset pricing model (CAPM) assumes that the expected return of a stock is linearly related to its systematic risk, measured by the covariance of the asset return, with the return of the market portfolio divided by the variance of the market portfolio return. The systematic risk is typically measured by the market model (Sharpe, 1963):

$$R_i = \alpha_i + \beta_i R_m + \varepsilon_i \tag{1}$$

where random variables are italicized (including ε). In the above model, R_i represents the return of security i, α_i is the intercept term for security i, β_i is the measure for systematic risk (beta) of security i, R_m is the return of the market and ε_i is the idiosyncratic risk of security i. The model thus assumes that the return of an individual stock is a function of the return of the national stock market.

To investigate the notion of segmentation and integration of the world's stock markets, and also the international risk components of securities, a multi-market model in the spirit of Errunza and Losq (1985) is used in this paper. To obtain tractable expressions for the risk components of individual assets (national market risk, international market risk and idiosyncratic risk), the vectors of the returns of local and international markets are orthogonalized. This means removing the effect of an international index from the index describing the behaviour of the local stock market, using the following simple bivariate regression:

$$R_m(\text{loc}) = \alpha + \beta R_m(\text{int}) + \varepsilon \tag{2}$$

where R_m(int) represents the returns of the international markets and R_m(loc) the returns of the local market. The residual term ε is the part of the local returns with international returns removed. It should be noted that the residual term in equation (2) can be denoted as $R_m(\text{loc} - \text{int})$. The multi-market model can now be expressed as

$$R_i = \alpha_i + \beta_{1i} R_m(\text{int}) + \beta_{2i} R_m(\text{loc} - \text{int}) + \varepsilon_i \tag{3}$$

Similarly, equation (3) also can be extented to several markets.

The components of risk for security i can be obtained by considering the expression for the variance of the returns of a security i

$$\text{Var}(R_i) = \beta_{1i}^2 \text{ Var}(R_m(\text{int})) + \beta_{2i}^2 \text{ Var } (R_m(\text{loc} - \text{int})) + \text{Var}(\varepsilon_i) \tag{4}$$

The multi-market model makes it possible to investigate the level of segmentation across different stock markets in terms of individual securities. First, let us assume that the local and international markets are totally integrated. Then, the second term in equation (3), i.e. $\beta_{2i} R_m(\text{loc} - \text{int})$ does not produce significant incremental information with respect to the first term, i.e. $\beta_{1i} R_m(\text{int})$, when the returns of individual assets are investigated. Making an assumption concerning partial segmentation across the two investigated markets, both of the terms should be significant in the process of generating the returns of individual assets.

The approach applied here offers an efficient way to study the level of segmentation between markets. However, it should be noted that there may be several underlying reasons for the segmentation which may be observed. The segmentation may arise from government policies or from market inefficiencies. It may also be due to the unrealized underlying assumptions of a universal logarithmic utility function (Adler & Dumas, 1983), of purchasing power parity (Grauer *et al.*, 1976) or of no correlation between exchange rate movements and stock returns as well as deterministic domestic consumption deflators (Gultekin, *et al.*, 1989). Market segmentation has many practical implications in international portfolio diversification.

3. The Data

Monthly stock returns from the Helsinki Stock Exchange from January 1980 to December 1986 are used. The individual asset returns are collected from a database originally introduced by Berglund *et al.* (1983). Our sample consists of 28 firms that have had their ordinary shares listed for the entire research period. The price indexes used in the study are the closing values for each month. The prices are corrected for splits, new issues, etc., assuming that dividends are reinvested with zero transaction cost. The returns for each month are determined as the first differences of the natural logarithms of these price indexes.

There are two main reasons for the use of logarithmic transformation in our study. Firstly, significant changes have occurred in the levels of the price indexes during the period. The use of logarithmic values reduces this problem, which otherwise might invalidate the assumption of a constant relationship between dependent and independent variables. Secondly, the efficiency of the estimates is improved, owing to the reduced heteroskedasticity in the regression analysis.

The general index in use for the Helsinki Stock Exchange is the value-weighted market index collected from the same data base. For Swedish returns, a general index published by the Swedish journal *Affarsvärlden* is in use. For US market returns, the Dow-Jones index is collected from the same journal. Also, these indexes are used in their logarithmic form.

4. Empirical Results

To obtain some preliminary evidence on the relationships of the returns on the stock markets investigated, simple ordinary least squares (OLS) regressions between the market returns were run first. Table 1 presents the results of these regression analyses. All three markets are positively related to each other. The strongest relationship between the three markets is found in model (5a), i.e. between the Finnish and Swedish stock markets, when the returns are measured from the same month. Also, between the Swedish and US markets, there seems to exist some connection, especially when a lag of one month is applied in model (7b). However, the relationship between the Finnish and US markets is clearly lower by nature.

Table 1. Regression analysis estimates (t values in parentheses)

Model	Constant	Coefficients	R^2	F	N
(5a)	0.0156 (3.530)[b]	0.2250 (2.864)[a]	0.0919	8.200[a]	83
(5b)	0.0167 (3.667)[b]	0.1852 (2.304)[c]	0.0622	5.307[c]	82
(6a)	0.0205 (4.690)[b]	0.0303 (0.264)	0.0009	0.070	83
(6b)	0.0196 (4.491)[b]	0.1648 (1.432)	0.0250	2.049	82
(7a)	0.0210 (3.602)[b]	0.2197 (1.439)	0.0249	2.070	83
(7b)	0.0209 (3.587)[b]	0.2819 (1.831)[d]	0.0402	3.353[d]	82

Notes: (5a) R_{mt} (Fin) $= \alpha + \beta R_{mt}$ (Swe) $+ \varepsilon_t$; (5b) R_{mt} (Fin) $= \alpha + \beta R_{mt-1}$ (Swe) $+ \varepsilon_t$; (6a) R_{mt} (Fin) $= \alpha + \beta R_{mt}$ (USA) $+ \varepsilon_t$; (6b) R_{mt} (Fin) $= \alpha + \beta R_{mt-1}$ (USA) $+ \varepsilon_t$; (7a) R_{mt} (Swe) $= \alpha + \beta R_{mt}$ (USA) $+ \varepsilon_t$; (7b) R_{mt} (Swe) $= \alpha + \beta R_{mt-1}$ (USA) $+ \varepsilon_t$. [a] Significant at 0.01 level. [b] Significant at 0.001 level. [c] Significant at 0.05 level. [d] Significant at 0.10 level.

There are several reasons why the Finnish and Swedish stock markets behave more homogeneously than do the Scandinavian and US markets. Firstly, the economies of Scandinavian countries are more integrated into each other. Secondly, the US investors apparently have psychological barriers to investing in Scandinavian stocks, owing to risks associated with their unfamiliarity with Scandinavian firms. The analyzing and transaction costs of foreign investment are apparently high for US investors. Finally, the exchange risks must be taken into account.

To produce evidence on the appropriateness of the so-called multi-market model in Finland, a market model extended to the Swedish stock market was first tested. The non-diversifiable risk components of these models appear in Table 2.

The results are based on the model

$$R_i = \alpha_i + \beta_{1i} R_m(\text{Swe}) + \beta_{2i} R_m(\text{Fin} - \text{Swe}) + \varepsilon_i \tag{8}$$

where R_m(Swe) represents the returns of the Swedish stock market and R_m(Fin – Swe) the returns of the Finnish market orthogonalized with respect to the returns of the Swedish market, i.e. the residual term from the regression $R_m(\text{Fin} = \alpha + \beta R_m(\text{Swe}) + \varepsilon_i$. In the following, this model is called the Scandinavian market model for Finnish securities.

Table 2. Results of the Scandinavian market model (8) and traditional national market model (1) for Finnish stocks. Systematic risk measures obtained by β_{1i}^2 Var (R_m(Swe)) and β_{2i}^2 Var (R_m(Fin – Swe))

Firm	Sweden	Finland	Total	Traditional market model
Effoa	0.0011	0.0504	0.0515	0.0415[a]
Kesko	0.0674[a]	0.2081[b]	0.2755	0.2636[b]
Ford	0.0043	0.1137[a]	0.1180	0.0909[b]
Stockmann	0.0648[c]	0.1501[b]	0.2149	0.1992[b]
Talouskauppa	0.0036	0.0650[c]	0.0686	0.0682[b]
Tamro	0.0614[c]	0.0206	0.0819	0.0449[a]
Enso	0.0130	0.0614[c]	0.0743	0.0732[b]
Fiskars	0.0020	0.1768[b]	0.1787	0.1499[b]
Huhtamäki	0.0625[a]	0.3697[b]	0.4322	0.4293[b]
Instru	0.0352[d]	0.2208[b]	0.2560	0.2547[b]
Kajaani	0.0790[a]	0.1992[b]	0.2783	0.2607[b]
Kemi	0.0042	0.0625[c]	0.0667	0.0666[b]
Kymi	0.0145	0.3031[b]	0.3176	0.3149[b]
Lassila	0.0209	0.0689[c]	0.0898	0.0864[b]
Lohja	0.0363[c]	0.4707[b]	0.5070	0.5063[b]
Nokia	0.0688[a]	0.4218[b]	0.4906	0.4878[b]
Otava	0.0016	0.0169	0.0184	0.0125
Partek	0.0656[a]	0.3346[b]	0.4002	0.3955[b]
Rauma	0.0203	0.3322[b]	0.3525	0.3510[b]
Rosenlew	0.0040	0.0809[b]	0.0849	0.0843[b]
Schauman	0.0270[e]	0.0653[c]	0.0923	0.0375[c]
Serla	0.0011	0.1791[b]	0.1802	0.1707[b]
Sokeri	0.0152[d]	0.2277[b]	0.2549	0.2547[b]
Trikoo	0.0116	0.0550[c]	0.0667	0.0657[b]
Tamfelt	0.0049	0.0965	0.1014	0.1007[b]
Tampella	0.0190	0.0487[c]	0.0677	0.0635[b]
Wärtsilä	0.1102[b]	0.3078[b]	0.4180	0.3961[b]
Yhtyneet	0.0927[b]	0.3159[b]	0.4086	0.3943[b]

Notes, [a] Beta significant 0.01 level. [b] Beta significant at 0.001 level. [c] Beta significant at 0.05 level. [d] Beta significant at 0.10 level. [e] Beta negative.

The first column in Table 2 presents the systematic risk components of securities (as percentages of the total risk associated with the variability of the returns of the security in question), as appointed to the Swedish market index. For 12 securities, the estimated β coefficient for the Swedish markets has been statistically significantly different from zero. Only in one case, i.e. in the context of Schauman, has β been negative. The results support the integration between the Finnish and Swedish security markets. Swedish risk components are important in the return-generating process of Finnish stocks.

The second column in Table 2 contains information about the part of the total risk associated with the general return of the Finnish market, after first controlling for the behaviour of the Swedish market. All the estimated β values have the expected positive signs and almost all of them are statistically different from zero. These results give support to the so-called 'mild segmentation hypothesis'. There is significant incremental information in the Finnish market returns after removing the effect of the Swedish market returns.

Next, the segmentation of the Finnish and US markets was investigated. This was carried out similarly to the Swedish market. Thus, regression analysis estimates were produced for the model.

$$R_i = \alpha_i + \beta_{1i} R_m(\text{USA}) + \beta_{2i} R_m(\text{Fin} - \text{USA}) + \varepsilon_i \qquad (9)$$

where R_m(USA) represents the returns of the Swedish stock market and R_m(Fin – USA) the returns of the Finnish market orthogonalized with respect to the returns of the US market, i.e. the residual term from the regression $R_m(\text{Fin}) = \alpha + \beta R_m(\text{USA}) + \varepsilon$. In the following, this model is called the worldwide market model for Finnish securities. The results concerning the proportions of the systematic risk of this model are given in Table 3.

The results in Table 3 do not give support to the importance of the US market in generating individual assets returns in Finland. The β values differ from zero for only three stocks. In addition, it should be emphasized that, for 10 stocks, the β coefficient is negative. Thus, the worldwide market model created does not give support to the worldwide segmentation of the Finnish stock market.

There are many apparent reasons for the low level of worldwide integration of the Finnish stock market has obviously made the transactions of foreign investors very difficult in the Finnish stock market. In addition, it should be noted that Finnish shares are divided into restricted and non-restricted shares. Only non-restricted shares can be bought by foreigners. In addition, knowledge about Finnish firms has been quite limited globally. As a result of the complicated accounting system used in Finland, the foreigner investors' investment analysis is made complex, and the comparability of Finnish firms' well-being with that of overseas companies is very difficult indeed. These explanations are naturally quite speculative by nature but, apparently, are among the reasons for the low level of worldwide segmentation of the Finnish stock market.

Thus, our worldwide market model did not achieve significant empirical support. In the following, we concentrate on the Scandinavian market model (equation (8)) only. As described earlier, one of the main purposes of this study is to discover whether or not it is possible to explain the cross-sectional variation of systematic risk components across firms. With this aim, we explained the increase in explanatory power between the Scandinavian multi-market model and the traditional single-market model. This increase was then explained by the industrial differences across firms. To this end, three industrial dummies representing trade, forest and metal industries, were created. Thus, the following regression analysis was performed:

$$\text{INC} = \lambda_0 + \lambda_1 D_1 + \lambda_2 D_2 + \lambda_3 D_3 + \varepsilon \qquad (10)$$

where INC (a random variable) is the increase of explanatory power in the Scandinavian multi-market model with respect to the traditional single-market model, λ_0, λ_1, λ_2 and λ_3 are regression coefficients; D_1 is a dummy variable with a variable with a value of one for trade firms and zero otherwise; D_2 is a dummy

Table 3. Results of the worldwide market model (9) for Finnish stocks. Systematic risk measures obtained by β_{1i}^2 Var (R_{mt}(USA)) and β_{2i}^2 Var (R_{mt}(Fin − USA))

Firm	USA	Finland	Total
Effoa	0.0073[a]	0.0426[b]	0.0499
Kesko	0.0291[b]	0.2587[c]	0.2878
Ford	0.0125[a]	0.0930[d]	0.1054
Stockmann	0.0032	0.1979[c]	0.2011
Talouskauppa	0.0065	0.0671[e]	0.0736
Tamro	0.0136	0.0435[b]	0.0570
Enso	0.0053[a]	0.0744[b]	0.0797
Fiskars	0.0000	0.1500[c]	0.1500
Huhtamäki	0.0086[a]	0.4322[c]	0.4418
Instru	0.0006[a]	0.2556[c]	0.2563
Kajaani	0.0473[e]	0.2544[c]	0.3018
Kemi	0.0000	0.0665[e]	0.0666
Kymi	0.0011	0.3141[c]	0.3151
Lassila	0.0025	0.0856[d]	0.0882
Lohja	0.0134	0.5116[c]	0.5250
Nokia	0.0001[a]	0.4887[c]	0.4888
Otava	0.0053[a]	0.0130	0.0183
Partek	0.0125[a]	0.3977[c]	0.4001
Rauma	0.0000	0.3512[c]	0.3512
Rosenlew	0.0077	0.0828[d]	0.0906
Schauman	0.0548[a]	0.0403[b]	0.0951
Serla	0.0019	0.1698[c]	0.1717
Sokeri	0.0193	0.2509[c]	0.2702
Trikoo	0.0020	0.0664[e]	0.0684
Tamfelt	0.0041[a]	0.1020[d]	0.1061
Tampella	0.0000	0.0637[e]	0.0677
Wärtsilä	0.0033	0.3943[c]	0.3976
Yhtyneet	0.0000	0.3944[c]	0.3944

Notes: [a] Beta negative. [b] Beta significant at 0.10 level. [c] Beta significant at 0.001 level. [d] Beta significant at 0.01 level. [e] Beta significant at 0.05 level.

variable with a value of one for forest industry firms and zero otherwise; D_3 is a dummy variable with a value of one for metal industry firms and zero otherwise, and ε is the error term with zero mean and constant variance. The results of equation (10) are given in Table 4.

Table 4. Regression analysis estimates of equation (10) (t values in parentheses; $N = 28$)

λ_0	λ_1	λ_2	λ_3	R^2	F
0.0029	0.0156	0.0080	0.0220	0.292	3.306[a]
(0.798)	(2.343)[a]	(1.545)	(2.468)[a]		

Note: [a] Significant at 0.05 level.

The results in Table 4 give support to industry differences being an important determinant of the cross-sectional variation of the importance of multi-market models. Firms from different industries apparently differ in many important aspects in this context. Firstly, their level of internationalization is apparently different. Secondly, their dependence on the exchange risks and development in the international economy differs.

5. Conclusions

This study focused on the level of integration of the Finnish stock market into the Swedish and US stock markets. This was carried out by exploiting an internationally extended market model for Finnish stocks. This multi-market model of Finnish securities revealed that several Finnish stocks have significant Swedish risk components, while the interrelationship between the Finnish and US markets is significantly lower. The cross-sectional variation of the estimated systematic risk components of this model was also investigated. It was shown that this cross-sectional variation in systematic risk components can be attributed to industry differences in firms.

Our results do not give support to the worldwide integration of the Finnish stock market. This finding is very much consistent with some recent findings, indicating that the return behaviour of the Finnish stock market is typically very different from that of the major stock markets of the world (Malkamäki *et al.*, 1991; Booth *et al.*, 1993). The results show that the use of the most typical model in international asset pricing and portfolio diversification, where the sensitivities of individual assets to a worldwide market portfolio are investigated, may not be very well specified for Finnish stocks. This may be, for example, due to the thin trading in the Finnish stock market making the transactions of foreign investors very difficult, Finnish shares being divided into restricted and non-restricted shares, relatively poor global knowledge of Finnish firms, and the complicated Finnish accounting system making foreigner investors' investment analysis complex. Thus, our results indicate that the forthcoming deregulation in international capital markets may well have drastic effects especially on thin security markets, such as the Finnish stock market.

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