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# SUPER PREMIUMS IN THE FINNISH STOCK MARKET
## Evidence on international asset pricing

PEKKA T. HIETALA*

*INSEAD, F-77305 Fontainebleau Cedex, France*

*In this paper we analyze international asset pricing in a market setting where different investors have different investment opportunity sets depending on their nationality. In this kind of market setting different investors may require different required rate of returns on their investments. This occurs, e.g., if the riskless interest rates and the market risk premiums are the same for all investors but investors perceive the undiversifiable risk of a stock differently depending on their investment opportunity sets. In the paper we derive the equilibrium required rate of returns for different investors in this kind of setting which perfectly occurs in Finland and furthermore test several hypotheses of this equilibrium model in the Finnish stock market. Empirical results are consistent with the hypotheses derived from the equilibrium model.*

## 1. Introduction

The Finnish Law states that at most 20 % of the shares of any Finnish company are allowed to be owned by foreign investors. The purpose of this law has been to restrict foreigners from owning and controlling Finnish natural resources — mainly forests and mines — and from controlling industries which are regarded as strategically important to national interests — e.g., publishing and telecommunication industries, and energy production.[1] This law does not apply to insurance companies or to companies established by foreigners (e.g., Ford and IBM have subsidiaries in Finland), but these companies are prohibited from owning natural resources and from entering those industries mentioned above. Because of this »20%-law» at least 80 % of the shares of many Finnish companies must have an indication (normally a stamp) that the stock is a so called restricted stock, i.e., it is not allowed to be sold to foreign investors. The rest of the shares, so called unrestricted shares, are allowed to be owned both by Finnish and foreign investors. In all other respects restricted and unrestricted shares are identical; in particular they have

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[1] *Finland is by no means the only country having this kind of restriction in its law. For example, France and Sweden have almost identical restrictions in their laws, and several other countries, including Australia, Canada, Norway, and Spain, have foreign ownership restrictions which vary across different industries. See Eun and Janakiramanan (1986) for a more complete list of countries having this kind of restriction in their laws.*

equal voting rights and equal rights to monetary distributions.

The Finnish Law also restricts the available opportunity set for Finnish investors, in that Finnish investors are not allowed to invest in foreign securities without special permission from the Bank of Finland.[2] Because of this restriction Finnish investors may require a higher return on their investments in Finnish companies than foreign investors do. This happens, e.g., if the riskless interest rates and the market risk premiums are the same both in the foreign and in the Finnish stock market, and Finnish stocks are insensitive to the foreign market risk but sensitive to the Finnish market risk. In this case there exists an idiosyncrastic risk across Finnish stocks which is an undiversifiable risk for the Finnish investors but a diversifiable risk for the foreign investors. In fact, the existence of such country factors has been documented. In Solnik's (1974a) study the average proportion of security risk explained by national factors exceeded the proportion explained by international factors in all stock markets he studied.

If foreign investors require a lower rate of return on their investments in Finnish companies than Finnish investors do, we expect to see unrestricted shares trading at higher prices than their restricted counterparts. This is, in fact, the situation on the Helsinki Stock Exchange [HSE], where most unrestricted stocks trade at a premium above the corresponding restricted stocks. Some of these premiums are very high which motivates us to use the term 'super premium' in the title of this paper. From now on we use the terms 'premium' and 'super premium' interchangeably. However, for some stocks no premium exists, and occasionally unrestricted shares trade at a negative premium.

In this paper our objective is to develop and test an asset pricing model which is able to explain different premiums across companies. In section 2 we specify the market structure in the Finnish stock market in more detail by explaining the relevant legal restrictions affecting the market. We also present some descriptive statistics on the price premiums in the Finnish stock market. In section 3 we develop an equilibrium asset pricing model which takes into account the legal restrictions in the Finnish stock market. The model is able to explain why some of the unrestricted stocks are traded at super premium prices [i.e., their prices contain premiums above the prices of the restricted stocks] while some other unrestricted stocks do not carry any premiums. However, our model is not able to explain the occurrence of negative premiums. In section 4 we empirically test whether the investment barriers in the Finnish stock market have the effects hypothesized by our model. We first attack the problem of observed price discounts in some unrestricted stocks, which is an anomaly at least with respect to our model. We are able to show that only for one stock have the discounts been persistent, and we offer an explanation for the existence of this persistent discount. After explaining this anomaly we test several hypotheses derived from our model. In section 5 we analyze the effects of the legal restrictions in the Finnish stock market on the financing and investment decisions of Finnish companies having unrestricted shares in their capital structure. Section 6 concludes the paper.

## 2. *The Finnish market structure and the super premiums*

In the Finnish stock market there are two basic restrictions affecting investors' possible portfolio holdings: Restrictions on the stocks which different investors can hold in their portfolios, and restrictions on short sales which apply to all investors.

Foreign investors can invest only in unrestricted stocks on the HSE. Foreign investors' opportunity sets naturally also include foreign stocks. Finnish investors are prohibited from investing in foreign securities. The eligible stocks for Finnish investors are the restricted and unrestricted stocks on the HSE. Figure 1 below shows graphically how the opportuni-

[2] *Such permission was virtually never given to investors before the beginning of 1986: Only Finnish banks and insurance companies operating abroad were allowed to invest abroad to some extent. Investors could indirectly invest in foreign securities by buying shares of these banks and insurance companies. These companies' investments in foreign securities have, however, been small compared to their investments in domestic securities. Starting January 1, 1986 the Bank of Finland has allowed individual investors to invest a maximum amount of 10,000 FIM (≈ $2,000) in foreign assets.*

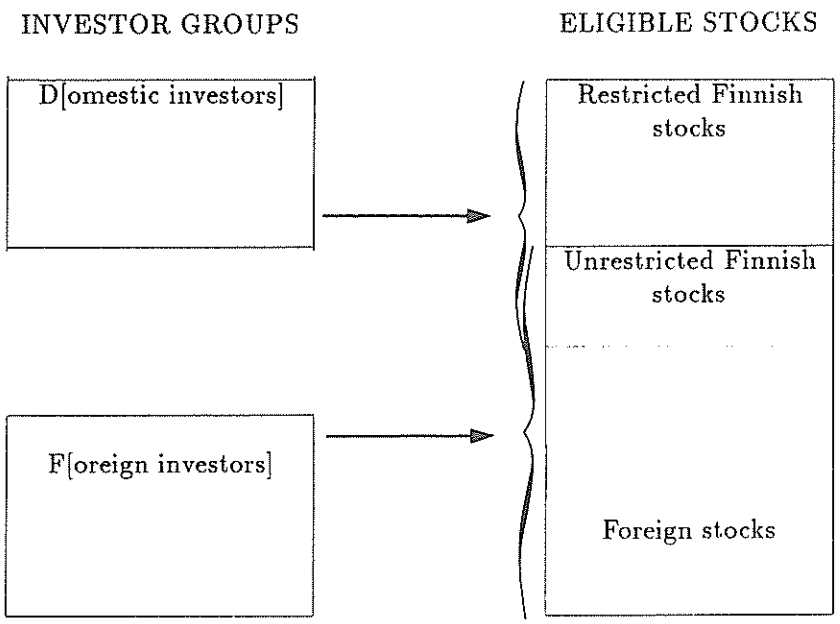


Figure 1. Investor groups and eligible stocks in the Finnish stock market.

ty sets of eligible stocks differ between the two non-overlapping investor groups.

The second restriction affecting possible stock holdings in the Finnish stock market concerns negative holdings of the stocks listed on the HSE. No short selling is allowed, and due to the lack of an options market in Finland, it is difficult for an investor to try to even approximate a short position in any restricted or unrestricted Finnish stock.[3]

The restriction on foreign investors' holdings of Finnish stocks did not prove to be binding prior to 1983. Thus, before 1983 domestic investors owned all the restricted shares of Finnish companies and most unrestricted shares. On the HSE restricted and unrestricted stocks were not quoted separately and there was a common price for both stocks. Generally Finnish investors were not interested in which type of shares they were holding.

Circumstances changed during 1983 when more and more foreign investors started to show keen interest in Finnish companies.[4] As more and more unrestricted shares were bought by foreign investors stockbrokers had an increasing difficulty in finding willing domestic (or foreign) sellers for these unrestricted shares because the HSE still quoted restricted and unrestricted stocks at the same price. Even though this price quotation was officially for both restricted and unrestricted stocks, it was too low for unrestricted stocks given the growth in the demand for the stocks and their scarce supply. By the second half of 1983 it was clear that the situation was untenable. Sellers were willing to sell only restricted stocks at the quoted prices, and stockbrokers organized an unofficial market for unrestricted stocks.

From the start of January 1984 the HSE began to quote companies' unrestricted and restricted stocks separately. This does not mean, however, that for every listed company there

[3] *See, e.g., Black and Scholes (1973) for a discussion of how an investor can approximate a short position in stock by issuing call options and borrowing risklessly.*

[4] *Foreign investors first became interested in Swedish companies in 1982 and subsequently widened their interest in Finnish companies. The Swedish stock market soared 128 % (according to the index used by Capital International Perspective) in the 8 months from July 1982 to February 1983 — this rise may partially be due to the foreign investors' rush to the stock market. We are not aware of why foreign investors became interested in these two stock markets exactly at that time.*

Table 1. Categorization of the 55 listed companies on the HSE as of 6/28/1985.

| Category | # of companies | Comments |
|---|---|---|
| I All stocks are unrestricted | 4 | 2 insurance companies<br>1 Swedish company<br>1 U.S. subsidiary |
| II All stocks are restricted | 11 | |
| III Company has both restricted and unrestricted stocks but unrestricted stocks are not listed | 17 | |
| IV Both restricted and unrestricted stocks are listed | 23 | Six companies have two classes of unrestricted stocks listed |

are now two separate price quotations because:

1. Some listed companies have either no unrestricted shares outstanding, or so trivial an amount of unrestricted shares that they are not listed on the HSE.

2. Some listed companies have more than one class of common stocks[5] listed on the HSE and so may have, for instance, three or four separate price quotations in the list [e.g., two price quotations for restricted stocks and one or two price quotations for unrestricted stock[6]].

Table 1 above shows how the 55 companies listed on the HSE are divided into different categories with respect to their restricted and unrestricted stocks.

From the beginning of the system of separate price quotations unrestricted stocks have traded at substantial premiums relative to the restricted stocks. Figure 2 shows the mean monthly premiums on unrestricted stocks from January 1984 to June 1985.[7] The graph shows that the average premium doubled during the first half of 1984, levelled off during the second half of 1984 and sharply declined in the first quarter of 1985. In the second quarter of 1985 the average premium somewhat recovered. The highest average monthly premium occurred in June 1984 when the mean premium was 41 % [the standard error of the mean was 4.2 %]. The lowest average monthly premium occurred in April 1985 when the mean premium was 11.7 % [with a standard error of 4.0 %].

Figure 2 also shows the maximum and minimum monthly premiums along with the number of unrestricted stocks which traded at discounts each month. The minimum monthly premium and the number of unrestricted stocks traded at discounts each month are closely related to the mean premium. During 1984 unrestricted stocks traded at discounts on only five occasions using monthly observations, and the minimum monthly premium was typically nonnegative. This changed dramatically during the first five months of 1985: The minimum monthly premiums were clearly negative, and eight of the unrestricted stocks traded at discounts in April 1985 — almost 30 % of our sample (the monthly sample size varied between 24 and 28 stocks; in April 1985 there were 27 stocks in the sample). The maximum monthly premium does not seem so clearly connected with the other measures — with few exceptions the maximum monthly premium has fluctuated between 60 % and 90 % during the sample period. The average monthly premiums for individual stocks [for the time period January 1984 to June 1985] varied from 2.3 % [for *Fiskars*] to 63 % [for *Wärtsilä, class II*]. The average monthly premium was significantly greater than zero at the 1 % level for all but 4 of the 29 unrestricted stocks. The distribution of the average premiums is given in table 2.

[5] *Different classes of common stocks have differences in their voting rights and/or in their rights to monetary distributions.*

[6] *Many companies want to hold voting power firmly in domestic hands and so all the shares with superior voting rights often are restricted shares.*

[7] *The trading system on the HSE considerably differs from that on the NYSE. The HSE trading system and its implications on financial research in general, and on this paper in particular, are explained in appendix II.*

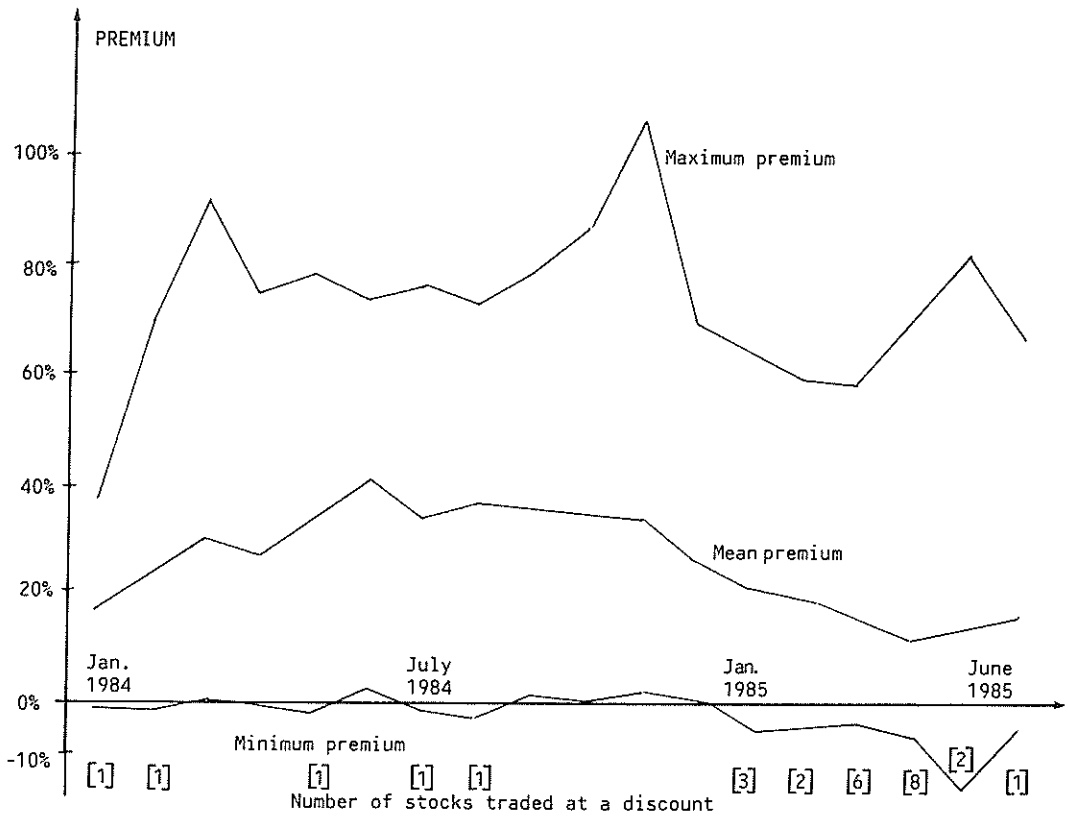


Figure 2. The maximum, minimum, and mean monthly premiums[a], and the number of unrestricted stocks traded at a discount each month on the HSE from January 1984 to June 1985.[b]

[a] Premiums are calculated using the following formula:

$$\frac{\text{Price of the unrestricted stock} - \text{Price of the restricted stock}}{\text{Price of the restricted stock}}$$

[b] Only real transaction prices were used when the premiums were calculated [for explanation, see appendix II]. For the unrestricted stock, which invariably is the less frequently traded, the first transaction price in each month was used. For the restricted stock the price of the transaction, which occurred closest to the first transaction in the unrestricted stock, was used. For most of the stock pairs the transaction prices for both the restricted and unrestricted stocks are from the same day. The time difference in the transaction prices for the remainder of the stock pairs does not systematically affect our results. That is, for some stock pairs the transaction in the restricted stock occurs first, for some other stock pairs the reverse is true.

Table 2. The distribution of the average monthly premiums for individual stocks for the time period January 1984 to June 1985.

| average premium | number of stocks |
|---|---|
| 2.3 %—10 % | 7 |
| 10 %—20 % | 5 |
| 20 %—30 % | 8 |
| 30 %—40 % | 4 |
| 40 %—50 % | 2 |
| 50 %—60 % | 1 |
| 60 %—63 % | 2 |

From above we can conclude that there exists a lot of variation in monthly premiums across companies. So an acceptable explanation for the super premiums must not only explain their existence, but also the variation across companies. Lower taxes for foreign investors than for domestic investors may be able to explain the general level of the premiums, but cannot satisfactorily explain the variation across companies.[8] According to this

[8] *The relevant Finnish Tax Laws are described in ap-*

simple tax-explanation the premiums should be constant across companies; this implicitly assumes that potential differences in the taxation on dividends and capital gains does not cause foreign investors to prefer either high or low yield Finnish companies. If this were the case, the tax explanation could also explain the different premiums across companies and the premiums would be correlated with the dividend yields of the stocks. However, the rank correlation between average monthly premiums and the dividend yields was .04 using dividend yields from 1983 and -.16 using dividend yields from 1984.[9] Both of these numbers are insignificantly different from 0 even at the 40 % probability level, and thus it seems that the tax explanation itself cannot satisfactorily explain the super premiums on the unrestricted stocks. Because of the problems discussed in appendix I, in particular the problem involved in determining foreign investors actual marginal tax rates, we do not incorporate taxes into our formal model. Section 3 shows that the premiums are not inconsistent with equal taxation of domestic and foreign investors.

In the next section we develop equilibrium pricing relations for Finnish companies' restricted and unrestricted stocks taking into account the portfolio restrictions described in this section. The analysis explicitly demonstrates that these legal restrictions potentially cause some unrestricted stocks to trade at super premium prices from the domestic investors' point of view. The model is also consistent with the observed variation in the super premiums across different stocks.

The model's predictions are empirically tested in section 4. This paper is the first [to our knowledge] to test an asset pricing model in an international setting which explicitly takes into account the actual investment barriers that prevail. For instance the Sharpe (1964) — Lintner (1965) — Mossin's (1966) Capital Asset Pricing Model [CAPM] has been tested numerous times at a national level, i.e., with an implicit assumption that international security markets are fully segmented. Most of the tests in an international setting have examined whether international capital markets are fully integrated or fully segmented (e.g., Solnik (1974a), Stehle (1976), and Jorion and Schwartz (1986)). Solnik (1977) presents a pessimistic view about whether an empirical mean-variance analysis will ever be able to discriminate between these two hypotheses.

At a theoretical level Solnik (1974b) develops an equilibrium model of the international capital market assuming complete integration in the international capital markets. Trying to relax Solnik's unrealistic assumption, Black (1974) and Stulz (1981) develop equilibrium models of the international capital market with special taxes if an investor invests in foreign assets. The assumptions in Black's model are, however, unattractive since he effectively assumes a negative tax (i.e., a subsidy) when an investor sells foreign securities short. Stulz improves Black's model by assuming positive taxes on both long and short positions. But the assumption that unlimited short sales are allowed does not seem attractive in an international setting.

Solnik (1977, p. 505) suggests in his 'pessimistic paper' that »the efficient way to test for segmentation would seem to be to specify the type of imperfection which might create it and study its specific impact on portfolio optimality and asset pricing.» This is the view adopted in this paper, and in the recent papers by Errunza and Losq (1985) and Eun and Janakiramanan (1986). Errunza and Losq study the effect of barriers to U.S. investment in LDCs (less developed countries) when residents of LDCs can invest in U.S. markets. They do no, however, specify the legal nature of the barriers against U.S. investors, but mainly rely on barriers which they term 'perceived'. By their definition these 'perceived' barriers against U.S. investors exist if in some LDC market U.S. investors are almost nonexistent. Eun and Janakiramanan independently study a problem similar to that investigated here, i.e., a market setting with a constraint on foreign equity ownership. However, they fail to empirically test their model because they do not study existing restrictions

*pendix I. The appendix shows that it is not clear that foreign investors pay lower taxes than Finnish investors.*

[9] *In both cases dividend yields were calculated from the prices of the restricted stocks. Use of the prices of the unrestricted stocks would induce spurious correlation in our test. Those unrestricted stocks which have the highest premiums would also tend to have the lowest dividend yields. However, the correlation remains insignificantly different from zero even if we use the dividend yields of the unrestricted stocks.*

in any specific market. Our market setting differs from theirs because we incorporate the specific restrictions related to the Finnish market into our model. Because of this we can also empirically test our model.

## 3. *Equilibrium pricing relations in the Finnish stock market*

In this section we first derive general pricing relations between restricted and unrestricted stocks assuming only that investors prefer more to less. In subsection 3.2 we then make more restrictive assumptions to obtain closed-form equilibrium prices for both restricted and unrestricted stocks.

### 3.1. *Equilibrium pricing relations using first order stochastic dominance*

Assuming that investors prefer more to less we can derive the following theorems regarding the prices of restricted ($P_a$) and unrestricted ($P_b$) stocks:

THEOREM 1. In equilibrium $P_b \geq P_a$.

PROOF: If $P_b < P_a$, then no domestic investor would hold the restricted stock because she can get an identical dividend stream and an identical voting power by purchasing the unrestricted stock. The market does not clear because domestic investors are the only investors who can hold restricted stocks. Thus, in equilibrium $P_b \geq P_a$.

THEOREM 2. If in equilibrium $P_b > P_a$, then all unrestricted stocks are held by foreign investors.

PROOF: If $P_b > P_a$, then no domestic investor would hold the unrestricted stock because she can get an identical dividend stream and an identical voting power by purchasing the restricted stock. In equilibrium the market must clear which implies that all unrestricted stocks are held by foreign investors.

Theorem 1 above shows that just using first order stochastic dominance rules our pricing relations are consistent with the observed existence of super premiums in the Finnish stock market, as well as with zero premiums on some unrestricted stocks. Furthermore, theorem 2 shows that the unrestricted stocks which trade at super premiums are held by foreign investors. Theorem 2 thus shows that the premiums are caused by the different demands for unrestricted and restricted stocks. It does not, however, tell us why foreign investors are willing to pay higher prices for some unrestricted stocks than domestic investors are. Since the payoffs from the unrestricted stocks are identical to domestic and foreign investors, the difference in demands must arise from different required rates of return. The rate of return required by foreign investors can be lower than that required by domestic investors either because the riskless interest rate is lower abroad than in Finland[10] or because the excess return on unrestricted stocks required by foreign investors is lower than that required by domestic investors. While it is not clear that the riskless interest rate is lower abroad than in Finland, it is very plausible that the excess returns required by foreign investors are lower than those required by domestic investors. This occurs because Finnish stocks probably are quite insensitive to the risk factors priced by foreign investors while they are sensitive to the risk factors priced by domestic investors. In the next subsection we illustrate this »diversification effect» with an equilibrium asset pricing model.

### 3.2. *An equilibrium Asset Pricing Model in the Finnish stock market*

To derive the equilibrium asset prices for both the restricted and unrestricted stocks we extend Sharpe-Lintner-Mossin CAPM to take into account the restrictions in the Finnish stock market. The assumptions of our model are:

1. Investors in both investor groups (D and F; see figure 1) are risk averse and choose their portfolios solely on the basis of the expected value and the variance of the probability distribution of the end of period portfolio value.
2. All investors have identical beliefs concerning the joint probability distribution of stock returns.
3. All investors can borrow and lend in un-

[10] *The riskless interest rate can differ between investor groups because Finnish investors are prohibited from selling debt issues to foreign investors and, as mentioned before, from investing in foreign securities.*

limited amounts at the riskless interest rate, which is the same for both investor groups.[11]

4. There are two mutually exclusive investor groups D and F. The stock universe is separated into three mutually exclusive sets: Set A contains restricted Finnish stocks, set B contains unrestricted Finnish stocks and set C contains all foreign stocks. The opportunity set facing investor $d \in D$ consists of stock in sets A and B [$A \cup B = G$]. The opportunity set for investor $f \in F$ consists of stock in sets B and C [$B \cup C = H$]. Finally, no investor is allowed to take a short position in any stock in set A or B.[12]
5. Aside from the investment restriction described in assumption 4 above capital markets are perfect, i.e., there are no differential taxes, transaction costs are zero, and all assets are infinitely divisible.

The somewhat tedious derivation of the equilibrium model is relegated to appendix III and only the main results from the appendix are presented here.

Formula (17a) in appendix shows that domestic investors' security market plane for their investment opportunity set G is

$$(17a)\quad E[\tilde{R}_g] \leq R_f + (E[\tilde{R}_{G^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{G^*})\ \mathrm{cov}\,(\tilde{R}_g, \tilde{R}_{G^*})\ \forall\, g \in G,$$

where G refers to domestic investors' investment opportunity set and G* refers to the set of stocks which domestic investors hold in equilibrium; g and $g^*$ are generic elements from these sets. $R_g$, $R_{G^*}$ and $R_f$ are the return on security g, the return on domestic investors' equilibrium portfolio, and the riskless rate of interest, respectively.

To emphasize the difference between sets G* and G—G* we can split [17a] into two parts

$$(17b)\quad \begin{cases} E[\tilde{R}_{g^*}] = R_f + (E[\tilde{R}_{G^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{G^*})\ \mathrm{cov}\,(\tilde{R}_{g^*}, \tilde{R}_{G^*})\ \forall\ g^* \in G^*. \\ E[\tilde{R}_g] \leq R_f + (E[\tilde{R}_{G^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{G^*})\ \mathrm{cov}\,(\tilde{R}_{g^*}, \tilde{R}_{G^*})\ \forall\ g \in G - G^*. \end{cases}$$

Formula [17b] tells us that for those stocks which domestic investors hold in positive amounts, the expected return is the riskless return plus the market's risk premium times the risk which is priced in the market. The market's risk premium is the excess return on domestic investors' equilibrium portfolio, and the market risk of a stock is the stock's covariance with the return on the domestic investors' equilibrium portfolio relative to the variance of the return on the equilibrium portfolio.

For those stocks in the domestic investors' opportunity set, which domestic investors are not holding, the expected return is less[13] than the equilibrium return considered by domestic investors. These are the stocks in which domestic investors would have a short position if there were no legal restrictions against short selling. We know that domestic investors hold all the restricted stocks in positive amounts and so all the stocks in G—G* must be unrestricted stocks. The converse does not have to be true, i.e., domestic investors may hold some (or even all) unrestricted stocks in positive amounts.

Similarly, formula (18a) in appendix shows that foreign investors' security market plane for their investment opportunity set H is

$$(18a)\quad E[\tilde{R}_h] \leq R_f + (E[\tilde{R}_{H^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{H^*})\ \mathrm{cov}\,(\tilde{R}_h, \tilde{R}_{H^*})\ A\ h \in H,$$

where H refers to foreign investors' investment opportunity set and H* refers to the set of stocks which foreign investors hold in equilibrium. The interpretation of other variables is similar to the one in [17a].

Once again to emphasize the difference between sets H* and H—H* we can split (18a) into two parts

$$(18b)\quad \begin{cases} E[\tilde{R}_{h^*}] = R_f + (E[\tilde{R}_{H^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{H^*})\ \mathrm{cov}\,(\tilde{R}_{h^*}, \tilde{R}_{H^*})\ \forall\ h^* \in H^*. \\ E[\tilde{R}_h] \leq R_f + (E[\tilde{R}_{H^*}] - R_f)\ \mathrm{var}^{-1}(\tilde{R}_{H^*})\ \mathrm{cov}\,(\tilde{R}_{h^*}, \tilde{R}_{H^*})\ \forall\ h \in H - H^*. \end{cases}$$

The stocks [in set H—H*] which foreign investors do not hold in equilibrium are unres-

[11] *The model could be extended to include different riskless interest rates for different investor groups. In that case the $R_f$ in equations (17a) and (17b) would differ from the $R_f$ in equations (18a) and (18b).*

[12] *None of the model's conclusions would change if we assumed that short selling is not allowed in any stock in set C either.*

[13] *Only in degenerate cases the equality holds in the second equation in formula (17b).*

tricted stocks because foreign investors have a positive holding in all foreign stocks $c \in C$. Thus formula [18b] implies that some unrestricted stocks may sell at prices which are too high from foreign investors' point of view. The prices of these unrestricted stocks are determined by the demand from domestic investors.

### 3.3. *Conclusions from the equilibrium Asset Pricing Model*

The most important conclusion from the equilibrium model presented above is the fact that for all stocks in sets A, B, and C there exist two separate risk premiums, one for each investor group evaluating the stock. This fact is not crucial for stocks in sets A and C, because all stocks in set A are held in equilibrium by domestic investors and all stocks in set C by foreign investors. However, for unrestricted Finnish stocks [set B] both risk premiums are relevant because both domestic and foreign investors can hold these stocks. The equilibrium market prices for these stocks are determined by the demand from the investor group for which the required risk premium is lower. By coincidence, for some stocks the two risk premiums may be equal, and these stocks are held in equilibrium by both investor groups. The normal situation is, however, that the equilibrium price of a stock will be determined solely by the demand from one investor group and the stock will appear overpriced to the other investor group. Moreover, there will be no pressure toward price revisions because the legal restrictions prohibit investors from shorting these 'mispriced' stocks.

Thus this equilibrium model is able to explain the super premiums seen in the Finnish stock market. More specifically, an unrestricted stock is traded at a super premium if and only if the price of the unrestricted stock is determined by foreign investors. This happens if foreign investors require a lower risk premium on this stock than domestic investors do.

Our model is also consistent with different premiums across stocks. The smaller the beta of the unrestricted stock calculated with respect to the foreign investors' optimal portfolio relative to the beta of the restricted stock calculated with respect to the domestic investors' optimal portfolio, the larger the equilibrium premium.

## 4. *Empirical evidence*

The main aim of this paper is to examine super premiums in the Finnish stock market. The phenomenon is explained by the model developed in section 3 which takes into account the legal restrictions in the Finnish stock market. The model was able to explain the existence of price premiums on unrestricted stocks shown in figure 2 in section 2. Further, our model predicts that the unrestricted stocks will never sell at price discounts relative to the restricted stocks.

In this section we first in subsection 4.1 look more closely at the observed price discounts. Subsections 4.2 and 4.3 contain the results of further tests of the ability of the model to explain observed price behaviour in the Finnish stock market.

### 4.1. *Unrestricted stocks traded at discounts*

Our model in section 3 predicts that the price premiums on unrestricted stocks can vary from 0 % upwards depending on the risk premiums of the stock for domestic and foreign investors. Our data in figure 2 show that price premiums on unrestricted stocks have varied from —16 % to 107 % between January 1984 and June 1985. Several unrestricted stocks traded at price discounts relative to the restricted stocks, particularly in early 1985.

Table 3 shows a list of all companies whose unrestricted stock traded at a discount at the beginning of any month between January 1984 and June 1985. All the premiums are calculated from real transaction prices.[14] For all these 27 discount cases the two transactions occurred on the same day. Table 3 also shows the months when the unrestricted stocks were traded at discounts and the size of the discounts.

As can be seen from Table 3 more than half of the discounts [14 out of 27] are 'temporary discounts', i.e. discounts which disappeared before the beginning of the next month. For these 'temporary discounts' it is possible that no real discounts existed in the first place, and the apparent discount simply reflected mea-

[14] *See footnotes a and b in figure 2 for explanations of how the premiums are calculated. For further information about the trading process on the HSE, see appendix II.*

Table 3. Companies whose unrestricted stocks were traded at discounts at the beginning of any month between January 1984 and June 1985.

| Company | Month when traded at a discount | | Size of the discount |
|---|---|---|---|
| Amer | April | 1985 | 3.0 % |
| Enso, class A | February | 1984 | 1.5 % |
| class R | April | 1985 | .8 % |
| Fiskars | May | 1984 | 1.8 % |
| | August | 1984 | 2.9 % |
| | February | 1985 | .7 % |
| | March | 1985 | .2 % |
| Kajaani | January | 1984 | 1.2 % |
| | July | 1984 | 1.3 % |
| | January | 1985 | 5.4 % |
| | March | 1985 | 4.2 % |
| | April | 1985 | 6.1 % |
| Kone | January | 1985 | .8 % |
| | February | 1985 | 4.4 % |
| | March | 1985 | 2.1 % |
| | April | 1985 | 3.5 % |
| | May | 1985 | .4 % |
| Medica | January | 1985 | 2.9 % |
| | March | 1985 | .7 % |
| Rosenlew | April | 1985 | 4.0 % |
| Schaumann | April | 1985 | 1.1 % |
| Serlachius, class A | March | 1985 | 3.9 % |
| | April | 1985 | 1.6 % |
| Stockmann | March | 1985 | 1.6 % |
| | April | 1985 | 3.2 % |
| Suomen Trikoo | May | 1985 | 16.0 % |
| Tampella | June | 1985 | 3.8 % |

surement errors caused by non-synchronous trading. Even when the discounts are calculated from transactions which occur during the same day, it is possible that several hours elapsed between the two observations.[15] Non-synchronous trading can explain occasional small observed discounts. We analyzed whether non-synchronous trading can explain the magnitude of the observed discounts in the following way: We first calculated the daily variance of the returns of the restricted stocks for year 1984.[16] We then analyzed how many of the observed discounts could be explained by these daily variances. Thus we implicitly assume that the variances are zero for periods when the stock exchange is closed. By doing this we overestimate the variance for the three-hour period when the stock exchange is open. We also overestimate the time difference between the trades in unrestricted and restricted stocks by assuming it to be 3 hours which is the maximum time difference between the trades. Even then eight out of all 27 discounts (three out of 14 'temporary discounts') are too large to be explained by the non-synchronous trading at the 1 % probability level. If non-synchronous trading were the only reason for discounts, we would expect to see less than five discounts which were too large to be explained by non-synchronous trading at 1 % level. This statement implicitly assumes that for all 458 observations the true premium/discount is 0. If we take into account the fact that for most of the stocks the true premium appears to be above 10 %, it becomes even more clear that the magnitude of the observed discounts seem to be too high to be explained by non-synchronous trading alone. This is also true for the 'temporary discounts'.

Thus, a more probable explanation is that at least some of these 'temporary discounts' were real discounts. However, when they appeared, domestic investors switched their demand from restricted stocks to unrestricted stocks eliminating the observed discounts. One may ask why such discounts appeared in the first place. This may happen in the Finnish stock market which is sufficiently small that relatively small excess demand [or supply] of some stock on a particular day may cause large fluctuations in the stock price.

The remainder of the observed discounts form four runs of two months [*Fiskars* over time period February-March 1985, *Kajaani, Serlachius, class A*, and *Stockmann* over time period March-April 1985] and one five month run [*Kone* over time period January-May 1985]. These kinds of consecutive negative premiums seem to indicate that domestic investors do not perceive the restricted and unrestricted stock as perfect substitutes and con-

[15] *A trading day lasts approximately 3 hours on the HSE. Unfortunately, we do not have time-stamped data from the HSE, so we do not know the exact time difference between the transactions.*

[16] *The variance of the restricted stock was chosen because restricted stocks are traded almost every trading day while unrestricted stocks are traded, on average, only every third trading day.*

tinue to purchase restricted shares despite their higher price. It should be recognized, however, that our analysis is based on beginning-of-the-month prices.[17] It is possible that while the price of the restricted stock exceeded the price of the unrestricted stock at the beginning of, say, March and April, it was below the price of the unrestricted stock for most of March. Analyzing the daily price series, we found that of the five runs mentioned above this was the situation for *Fiskars, Stockmann* and for *Kone* for the months of January and February. So these cases also belong to the category where the domestic investors have switched their demand pattern after noticing the existing discounts. As mentioned above, these discounts may have been artifacts caused by non-synchronous trading. However, two out of these 6 discounts could not be explained by non-synchronous trading at 1 % level.

The cases of *Kajaani, Serlachius,* and also *Suomen Trikoo,* whose unrestricted stock was traded at an unusually large discount in May, illustrate particularly well another reason for the observed discounts. The unrestricted stocks of all these companies are extremely infrequently traded: For both *Kajaani* and *Serlachius,* the unrestricted stocks were traded only twice during time period 3/1/1985—4/15/1985. Not only was trading infrequent, but only a small number of shares were traded in these transactions. Although the unrestricted stocks were traded at discounts, it may well have been optimal for the domestic investors to continue purchasing the restricted shares rather than place a purchase order for the unrestricted stocks and not know whether and when this order would be fulfilled. This is true because first we can assume that investors incur some costs if their purchase is delayed, and second data suggest that only a small number of unrestricted shares can be purchased at 'the discount price' recorded. The costs of waiting to possibly obtain a small discount on a small number of shares may exceed the gains of the waiting. The case of *Suomen Trikoo* is an extreme example of this: The unrestricted stock was traded only once during the second quarter of 1985, and only 100 shares of the unrestricted stock were traded. This example clearly shows that even very high discounts [16 %] do not necessarily imply that the domestic investors are behaving irrationally.

Thus, most of the observed discounts [24 out of 27] seem to be either 'temporary discounts' or caused by infrequent trading. There is, however, one persistent run of discounts which is more troubling. The unrestricted stock of *Kone*[18] traded at a discount continually [this was checked from the daily price series] from the beginning of March to mid-May. Furthermore, large amounts of the stock were traded almost daily. In fact, the volume of trade in the unrestricted stock exceeded that in the restricted stock. The discount disappeared around the time when the volume of trade in the two classes of stock became more even.

Interviews with some stockbrokers confirmed that the persistent discounts in the unrestricted stock of *Kone* were caused by the fact that some big foreign investor(s) wanted to sell a large quantity of this stock, and he was (they were) unable to do so without causing downward price pressure.[19] This need not have caused discounts between the unrestricted and restricted stocks, because domestic investors could have shifted their demand from the restricted stock to the temporarily cheaper unrestricted stock. The discounts arose in the market because at that time many Finnish investors were still unaware of the fact that the two classes of stock give identical claims for domestic investors.[20] Thus, the discounts prevailed in the market because although some domestic investors switched their demand from the restricted stock to the unrestricted stock, other domestic investors continued purchasing the restricted stock in spite of the discount. The discounts were typically below the round-trip transaction costs on the HSE [3 %], and domestic stockholders were thus

[17] *Or to be accurate, for the unrestricted stock the first transaction price in each month was used. For the restricted stock the price of the transaction, which occurred closest to the first transaction in the unrestricted stock, was used. For all these 27 discount cases the transactions occurred on the same day.*

[18] *Kone Corporation is one of the most internationalized companies in Finland. Its main lines of business are lifts and materials handling equipments. It has grown mainly by foreign acquisitions. These acquisitions have been financed, in part, by unrestricted shares.*

[19] *For the evidence on price pressure effect in the U.S. stock markets, see for example Scholes (1972), Kraus and Stoll (1972), and Dann, Mayers, and Raab (1977).*

[20] *This was confirmed by stockbrokers.*

unable to earn arbitrage profits by selling their restricted shares and simultaneously purchasing an equivalent number of unrestricted shares.[21] This existence of 'unaware domestic investors' can, of course, also explain the other discounts above.

After now going through the different reasons for the observed discounts in the unrestricted stocks, we turn to test some other hypotheses of our asset pricing model.

### 4.2. *Super premiums and the betas of the stocks*

In this subsection we analyze the cause of the different price premiums across unrestricted stocks. In our equilibrium pricing model the price premiums originate solely from the differences in the excess returns required by domestic and foreign investors. The excess return on an unrestricted stock required by foreign investors is the beta of the unrestricted stock with respect to the foreign investors' equilibrium portfolio times the excess return on their equilibrium portfolio, i.e.

$$(19) \quad E[R_I] - R_f = \beta_I \lambda_I$$

where
$R_I$ = the required rate of return on the unrestricted stock by foreign investors.
$R_f$ = the riskless interest rate.
$\beta_I$ = the beta of the unrestricted stock with respect to the foreign investors' equilibrium portfolio.
$\lambda_I$ = $(E[\tilde{R}_{H^*}] - R_f)$ in equation (18a).

Similarly, the excess return on a restricted stock required by domestic investors is

$$(20) \quad E[R_D] - R_f = \beta_D \lambda_D$$

where
$R_D$ = the required rate of return on the unrestricted stock by domestic investors.
$\beta_D$ = the beta of the restricted stock with respect to the domestic investors' equilibrium portfolio.
$\lambda_D$ = $(E[\tilde{R}_{G^*}] - R_f)$ in equation (17a).

We estimated the two betas for 25 stocks as follows:[22]

1. $\beta_D$'s are estimated from the market model using monthly returns for the period 1979—83:

$$(21) \quad R_{jt} = \alpha_{Dj} + \beta_{Dj} R_{Dt} + \epsilon_{Djt}$$

where
$R_{jt}$ = the return on stock j in month t.
$\alpha_{Dj}$ = the domestic 'alpha' for stock j.
$\beta_{Dj}$ = the domestic 'beta' for stock j.
$R_{Dt}$ = the return on the Finnish market portfolio in month t. $R_{Dt}$ is estimated by the return on the WI-index which is a value-weighted market index consisting of all stocks listed on the HSE [for further details about this index, see Berglund, Wahlroos and Grandell (1983)]. The return on the WI-index is adjusted for dividends. During the period 1979—83 restricted and unrestricted stocks were traded together on the HSE.

2. $\beta_I$'s are estimated from the market model using monthly returns for the period 1979—83:

$$(22) \quad R_{jt} = \alpha_{Ij} + \beta_{Ij} R_{It} + \epsilon_{Ijt}$$

where
$\alpha_{Ij}$ = the international 'alpha' for stock j.
$\beta_{Ij}$ = the international 'beta' for stock j.
$R_{It}$ = the return on the world market portfolio in month t. $R_{It}$ is estimated by the return on the world index used by Capital International Perspective. This index is a value-weighted average of the performance of some 1200 securities listed on the stock exchanges of the U.S.A., Europe, Canada, Mexico, Australia and the Far East. No Finnish stocks are included in the index. The return on this index is not adjusted for dividends. The return on this index is calculated in U.S. dollars, thus we also calculate $R_{jt}$ in (22) in U.S. dollars.

[21] *Levy (1982) finds that investors could have occasionally earned arbitrage profits in the Israeli Stock Exchange by switching their portfolio holdings between different classes of common stock of the same company.*

[22] *Four of the 29 stocks in our sample have entered the HSE since 1981 and were omitted from the tests performed in this subsection.*

Two major assumptions have been made in estimating the $\beta_i$'s:

1. $R_{jt}$ reflects the return on the restricted stock because during the 1979—83 period unrestricted stocks were not listed separately. Thus, we assume that the betas of the unrestricted and restricted stocks are identical. We did not try to calculate the betas of the unrestricted stocks on the one hand because we had data only for 18 months, and on the other hand because we would have had a serious non-trading problem with the data.
2. By using $R_{lt}$ in (22) we assume that the equilibrium portfolio of foreign investors, who invest in the unrestricted Finnish stocks, is well approximated by the Capital International Perspective index.

We first test whether the international betas of the 25 Finnish stocks significantly differ from zero. That is, we test whether we can reject the joint hypothesis $\beta_{1,1}=\beta_{1,2}=\ldots=\beta_{1,25}=0$. This hypothesis is tested using multivariate regression model:

$$(23)\quad \begin{bmatrix} R_{1,1} & \ldots & R_{25,1} \\ \vdots & \ddots & \vdots \\ R_{1,60} & \ldots & R_{25,60} \end{bmatrix} = \begin{bmatrix} 1 & R_{1,1} \\ \vdots & \vdots \\ 1 & R_{1,60} \end{bmatrix} \begin{bmatrix} \alpha_1 & \ldots & \alpha_{25} \\ \beta_1 & \ldots & \beta_{25} \end{bmatrix} + \begin{bmatrix} \epsilon_{1,1} & \ldots & \epsilon_{25,1} \\ \vdots & \ddots & \vdots \\ \epsilon_{1,60} & \ldots & \epsilon_{25,60} \end{bmatrix}$$

The disturbance terms are assumed to have the following properties:

$$(24)\quad \mathrm{Cov}(\epsilon_{is}, \epsilon_{jt}) = \begin{cases} \sigma_{ij} & \forall\ s=t \\ 0 & \text{otherwise.} \end{cases}$$

The F-statistics for the constraint $\beta_j=0\ \forall\ j$ is 0.648, which is insignificant at any conventional probability level. Thus, we cannot reject the hypothesis that the international betas for the stocks in our sample are zero. Also none of the 25 individual $\beta_i$'s were significantly different from zero at the 5 % probability level using standard t-statistics.

The result $\beta_j=0\ \forall\ j$ implies that $E[R_{ij}]=R_f\ \forall\ j$.[23] The correlation between the returns on Finnish stocks and on the world market portfolio is so minimal that foreign investors' required rate of return on Finnish stocks practically is the riskless interest rate. To derive a testable hypothesis about the price premiums we now assume that the dividend-perpetuity model [i.e., $P=\frac{D}{r}$] holds. We get

$$P_a=\frac{D}{R_f+\beta_D\lambda_D} \text{ and } P_b=\frac{D}{R_f}.$$

And thus

$$\frac{P_b-P_a}{P_a}=\beta_D\cdot\frac{\lambda_D}{R_f}.$$

That is, the price premium of an unrestricted stock is a constant, $\frac{\lambda_D}{R_f}$, times the domestic beta of the corresponding restricted stock. We test this hypothesis by running the following regression:

$$\text{Premium}_j=a+b\cdot\beta_{Dj}+\epsilon,$$

where $\text{Premium}_j$ is the average monthly premium for stock j over the time period January 1984 to June 1985, and $\beta_{Dj}$ is estimated in (21). Our model predicts that $a=0$ and $b=\frac{\lambda_D}{R_f}>0$. The results of the regression are:

$$\text{Premium}_j=.0227+.2491\cdot\beta_{Dj}+\epsilon$$
$$(.306)\quad(3.221)$$

*t-values are in the parentheses.*

[23] *This result gives rise to the following test: Using the realized returns on the unrestricted stocks we could test the hypothesis that* $E[R_j]=k\ A\ j$, *where k is a constant. The following multivariate regression model would be the appropriate way to test this hypothesis:*

$$\begin{bmatrix} R_{1,1} & \ldots & R_{25,1} \\ \vdots & \ddots & \vdots \\ R_{1,T} & \ldots & R_{25,T} \end{bmatrix} = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix} [\alpha_1 \ldots \alpha_{25}] + \begin{bmatrix} \epsilon_{1,1} & \ldots & \epsilon_{25,1} \\ \vdots & \ddots & \vdots \\ \epsilon_{1,T} & \ldots & \epsilon_{25,T} \end{bmatrix}$$

*The disturbance terms have properties explained in [24]. The hypothesis to be tested would be* $\alpha_1=\alpha_2=\ldots=\alpha_{25}=k$. *This test requires, however, that* $T>25$. *Unfortunately, we only have returns on unrestricted stocks for 18 months. For these 18 months the average monthly return for unrestricted stocks in our sample was —0.75 %.*

The constant term of our regression is insignificantly different from 0 and b is positive and significant as predicted by our model.[24] Thus our data support our model's hypothesis that the size of the super premiums can be explained by the $\beta_I$'s and $\beta_D$'s of the stocks. In particular, because the $\beta_I$'s are insignificantly different from zero, the domestic beta of a stock solely determines the size of the super premium.

There is, however, one disturbing thing in our results. The value of b in our regression seems to be too low; that is, we would expect the ratio $\frac{\lambda_D}{R_f}$ be higher than 1/4. For instance, if we reasonably assumed $R_f = 10$ % and $\lambda_D = 5$ %, we would get an average price premium across stocks to be 50 %, while in our sample the average price premium exceeded 50 % only for 3 out of 29 unrestricted stocks. That is, if the $\beta_I$'s are zero our model predicts the price premiums to be larger than they are in the Finnish stock market.

Footnote 24 explains one reason why the value of b turns out to be so low. That is, the measurement errors in $\beta_{Dj}$'s cause a downward bias in the coefficient of $\beta_{Dj}$ in the regression.

There also exists an obvious reason why our model's predictions exceed the observed premiums. There are many kinds of barriers to international investment in reality, e.g., legal barriers, informational barriers, and barriers arising from the fear of expropriation. In this paper we do not try to model all these barriers, but we incorporate only the legal restrictions prevailing in the Finnish stock market in our model. The second assumption of our model precludes any informational asymmetries from our model. It is very plausible that in the reality foreign investors face an informational disadvantage relative to domestic investors. If this were the case, we would expect the model to overestimate the price premiums.

Furthermore, in subsection 4.1 we saw that many unrestricted stocks are very illiquid. Thus, as seen in the case of *Kone*, it may be difficult for large foreign investors to make quick portfolio changes without causing a large shift in the stock price. Assuming that foreign investors place a value on liquidity, we would once again expect the model to overestimate the price premiums.[25]

### *4.3. Empirical evidence on different returns on different classes of stocks*

The empirical evidence presented in the previous subsections concentrated on the model's implications concerning the size of super premiums on unrestricted stocks. The model also has direct implications about the returns on restricted versus unrestricted stocks for domestic investors.

Formula [8ab] in appendix III tells us that all stocks held by domestic investors plot on the domestic investors' security market line, and those unrestricted stocks held by foreign investors plot below the domestic investors' security market line. Unrestricted stocks held by foreign investors trade at a super premium. Thus, the model predicts that[26]

1. the expected return on both restricted and unrestricted stock is the same if the unre-

[24] *Our t-values are not, however, adjusted to the fact that there exist measurement errors in $\beta_{Dj}$'s. Because of these measurement errors both the coefficient of $\beta_{Dj}$ and the standard error of the coefficient is downward biased.*

[25] *In this case we would expect to see a negative correlation between the average monthly premium and the illiquidity of the unrestricted stock. This assumes that all restricted stocks are liquid. For the companies having their unrestricted stocks listed, this is not an unreasonable assumption. To see whether illiquidity can explain some of the variation in price premiums we ran the following regression:*

$$\frac{P_h - P_a}{P_a} = a + b \cdot \beta_D + c \cdot \textit{illiquidity} + \epsilon,$$

*where the illiquidity of a stock is estimated by the average interval [in trading days] between two transactions in the unrestricted stock. We would expect to see $b > 0$ and $c < 0$. Since we do not have any theory of how illiquidity should affect the super premiums, we do not have any predictions of the magnitude of c (or b). The results of the regression were:*

$$\frac{P_h - P_a}{P_a} = .1528 + .2102 \cdot \beta_D - .0401 \cdot \textit{illiquidity} + \epsilon.$$
$$\qquad\qquad (1.59)\quad (2.79)\quad (-1.98)$$

*The signs of both b and c are as predicted. It seems that while the domestic beta of a stock is the most important factor to determine the size of the super premium, also other factors affects the premiums — both their average magnitude and their cross-sectional variation.*

[26] *These predictions would be tautological in a one-period model where the company is liquidated at the end of the period. They are not tautological in our test design.*

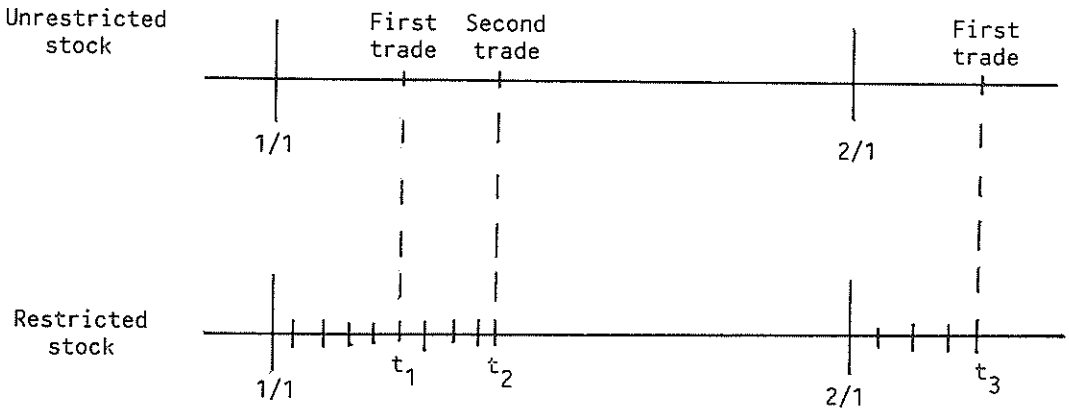


Figure 3. Calculating the price premiums and monthly returns in the test design of subsection 4.3. The price premium is calculated using the transaction prices at $t_1$. The monthly returns are calculated over the period $t_2$ to $t_3$.

stricted stock is traded at a zero premium, i.e., if it is held by domestic investors.

2. The expected return on a restricted stock is higher than the expected return on the unrestricted stock if the unrestricted stock is traded at a super premium, i.e., if it is held by foreign investors.

*Test design*

Our hypothesis is:[27]

$$\text{If} \quad P_b^t > P_a^t \Rightarrow \frac{E[\tilde{P}_a^{t+1}]}{P_a^t} > \frac{E[\tilde{P}_b^{t+1}]}{P_b^t}$$

$$\text{and if} \quad P_b^t = P_a^t \Rightarrow \frac{E[\tilde{P}_a^{t+1}]}{P_a^t} = \frac{E[\tilde{P}_b^{t+1}]}{P_b^t}.$$

Assuming that investors have rational expectations we can use realized returns instead of the unobservable expected returns in our tests. Formula [7ab] holds for all time periods; in our test design we calculate monthly returns for all restricted and unrestricted stocks for the period January 1984 to June 1985. In the beginning of each month each stock pair is assigned to one of eight groups depending on how large the price premium on the unrestricted stock is. The eight groups are in this order: The premium [X] is $\geq 70$ %; 70 % $> X \geq 50$ %; 50 % $> X \geq 30$ %; 30 % $> X \geq 20$ %; 20 % $> X \geq 10$ %; 10 % $> X > 0$ %; $X = 0$ %; and $X < 0$ %.

The monthly returns are calculated as shown in figure 3 below. For the unrestricted stock the first transaction after the transaction, which was used to determine the price premium, is used as the price at the beginning of the return period.[28] The first transaction price of the following month is used to value the stock at the end of the return period. For the restricted stock the same time period is used to calculate its monthly return.[29] By using this method to calculate the monthly returns we prevent measurement errors from affecting our results in a systematic way. That is, let us assume that there is some measurement error [due to, e.g., non-synchronous trading] in the prices used to calculate the beginning-of-the-month price premiums. If we used these same prices in calculating monthly returns, we would induce a spurious correlation between the price premiums and the difference in the monthly returns. The differ-

[27] *Prices at $t+1$ ($\tilde{P}_a^{t+1}$ and $\tilde{P}_b^{t+1}$) include the dividend payments made between $t$ and $t+1$.*

[28] *Those cases, where the unrestricted stock was traded only once in the whole month, were discarded from our sample.*

[29] *Because we want to use only real transaction prices, the lengths of the periods over which returns were calculated for unrestricted and restricted stocks occasionally differ by a few days. Although we have not adjusted the returns to control for this, our results are not biased, i.e., in some cases the time period is longer for the restricted stock, and in other cases for the unrestricted stock.*

ence in the returns on the restricted and unrestricted stock would be biased upwards for the high premium groups and downwards for the low premium groups. Using our method measurement errors do not affect the results in any systematic way.

For all eight groups we test the null hypothesis that the expected difference in the returns on restricted and unrestricted stocks is zero. The model predicts that for groups I through VI the average differences should be positive, and for group VII the average difference should be 0. The model does not have any direct predictions for group VIII.

*Results*

The results in table 4 show that the returns on restricted stocks have exceeded the returns on unrestricted stocks when the unrestricted stocks traded at a premium at the beginning of the month [see the third row of the first column of table 4]. The average monthly difference in returns has been .67 %. This difference is not, however, significantly different from 0 at the 5 % level. One reason for this is that in group VI the average difference is clearly negative. If we aggregate groups I to V, the average difference in returns is 1.245 % which is significantly above 0 at the 5 % level. Thus the difference in returns is significant in the groups where we can be sure that the measurement errors (non-synchronous trading) have not caused the observed premiums. For separate groups, in which unrestricted stocks were traded at premiums [groups I to VI], we find that the larger the premium the larger the difference in the returns on restricted and unrestricted stocks. This is in accord with our model, i.e., large price premiums indicate that the risk premium required by foreign investors is much lower than that required by domestic investors. Because of this the required return on these unrestricted stocks is much lower than the required return on the corresponding restricted stocks. In groups I and II the difference in returns is significantly different from 0 at the 5 % level. For the remainder of the groups the effect is too weak to show up, i.e., even though the unrestricted stocks are trad-

Table 4. Differences in the returns on the restricted and unrestricted stocks.

| | Group I $[P_b^t \geq 1.7P_a^t]^c$ | Group II $[1.7P_a^t > P_b^t \geq 1.5P_a^t]$ | Group III $[1.5P_a^t > P_b^t \geq 1.3P_a^t]$ |
|---|---|---|---|
| Observations | 21 | 55 | 87 |
| $[\tilde{R}_a]^a$—$[\tilde{R}_b]^b$: mean | 6.406 % | 2.869 % | —.262 % |
| standard deviation | 8.590 % | 9.763 % | 9.544 % |
| t-value | 3.42 | 2.18 | —.26 |
| | Group IV $[1.3P_a^t > P_b^t \geq 1.2P_a^t]$ | Group V $[1.2P_a^t > P_b^t \geq 1.1P_a^t]$ | Group VI $[1.1P_a^t > P_b^t \geq P_a^t]$ |
| Observations | 60 | 61 | 79 |
| $[\tilde{R}_a]$—$[\tilde{R}_b]$: mean | 1.095 % | .302 % | —1.399 % |
| standard deviation | 12.714 % | 9.676 % | 9.089 % |
| t-value | .67 | .24 | —1.37 |
| | Group I—VI $[P_b^t \geq P_a^t]$ | Group VII $[P_b^t = P_a^t]$ | Group VIII $[P_b^t < P_a^t]$ |
| Observations | 363 | 16 | 21 |
| $[\tilde{R}_a]$—$[\tilde{R}_b]$: mean | .670 % | .336 % | —3.335 % |
| standard deviation | 10.238 % | 5.952 % | 9.777 % |
| t-value | 1.25 | .23 | —1.56 |

[a] The monthly return on the restricted stock.
[b] The monthly return on the unrestricted stock.
[c] $P_b^t$ and $P_a^t$ refer to the beginning of the month prices of the unrestricted and restricted stocks, respectively.

ed at premiums the differences in the required rate of returns are small.

For group VII, which contains zero premium stocks, the average difference in returns is insignificantly different from zero as predicted by the model. It should be recognized though that due to the small sample size, the power of this test is low.

Group VIII contains those stock pairs in which the unrestricted stocks were traded at discounts in the beginning of the month. If we assumed that these negative premiums are measurement errors and that the true premiums are zero in these cases, our model would predict that the expected returns on the two classes of stock are the same. Table 4 shows that in this group the returns on unrestricted stocks exceeded, on average, the returns on restricted stocks.[30] This fact indicates that domestic investors should invest in the unrestricted stocks instead of restricted stocks when discounts appear. However, as mentioned in the previous subsection, domestic investors can get their purchase orders filled more quickly in restricted stocks than in unrestricted stocks. For example, in these 21 discount cases the average time between the first two trades during the discount month in the unrestricted stocks was 2.4 trading days, whereas the same difference in the restricted stocks was .1 trading days [i.e., almost all restricted stocks were traded daily]. Furthermore, we had to drop 6 discount cases from our sample for table 4 because the unrestricted stock traded only once during the whole month. It may be that domestic investors optimally stay away from the unrestricted stocks trading at discounts, if they value liquidity sufficiently enough.

Interestingly enough, if we had assumed in our model in section 3 that domestic investors invest in restricted stocks only [e.g., because of liquidity reasons] and foreign investors thus hold all unrestricted stocks, our model would have been able to explain the discounts. The discount would appear in this model when the risk premium required by foreign investors is higher than that required by domestic investors. In these discount cases the expected returns on the unrestricted stock would then exceed the expected returns on the restricted stocks. Our empirical evidence gives some, although statistically insignificant, support on this fictious scenario.

In the aggregate table 4 supports our model: The restricted stocks earn higher returns than the unrestricted stocks in the cases where the unrestricted stocks are traded at a premium. This relation is statistically significant when the premium is above 10 %. When neither a premium nor a discount exists, the difference in returns is very small. The discount cases seem to indicate either informationally inefficient markets (i.e. domestic investors continue to buy restricted stocks although unrestricted stocks stochastically dominates them) or that domestic investors value liquidity.

## 5. *The effect of the market structure on corporate finance*

The legal restrictions explained in section 2 also affect the financing and investment decisions of Finnish companies. The first main implication for companies' financing decisions is that 20 % of the shares of the company, whose unrestricted shares are held by foreign investors, should be unrestricted shares. This happens because the price of the unrestricted stock exceeds the price of the restricted one in this case, and so the company maximizes the value of its equity by issuing the maximum percentage [20 %] of the unrestricted shares. In this case the company provides a means to stockholders to evade legal restrictions against shortselling. That is, domestic investors are not allowed to issue unrestricted shares themselves [i.e., short selling is prohibited] but companies are allowed to issue unrestricted shares. In the absence of legal restrictions domestic investors could issue these super premium stocks themselves to foreign investors. The firms whose unrestricted stocks are held by domestic investors [and so no price premium exists between restricted and unrestricted stocks] are not any worse off either by having the maximum amount of unrestricted stocks in their equity mix [i.e., the ratio of unrestricted shares to restricted shares]. In this sense we can conclude that the optimal equity structure for all Finnish companies includes the maximum feasible amount of unrestricted shares.

[30] *The result would be unchanged if we dropped Kone from out sample. For Kone the negative premiums seem to have been real discounts.*

The restrictions also affect the optimal debt/equity-ratio for a firm. We first study the situation where debt financing is tax-advantageous compared to equity financing.[31] If a firm has no unrestricted stocks in its equity mix, or the unrestricted stocks are optimally held by domestic investors, a 'normal' situation arises in this case. That is, debt financing will be used up to the point where the expected marginal tax-benefits, which are non-increasing with the amount of debt,[32] exceed the expected marginal costs from debt financing, which include, e.g., expected bankruptcy costs and are increasing with the amount of debt. This creates some firm-specific optimal value for the debt/equity-ratio.[33]

However, when foreign investors hold the unrestricted stocks, the situation changes.[34] Now the expected marginal tax-benefits from debt financing must exceed not only the expected marginal costs from debt financing but also the opportunity cost which arises from the fact that every fifth stock could be issued at a premium price to foreign investors. This additional benefit of equity financing lowers the firm-specific optimum debt/equity-ratio for the firms which are able to issue unrestricted shares at super premium prices. However, 100 % equity financing is an optimal solution only in the case where the marginal tax-benefits from debt financing are even at the zero debt level lower than the marginal agency costs from debt financing plus the forgone marginal benefit associated with equity financing.

However, it is not clear that debt financing is tax-advantageous compared to equity financing. Miller (1977) argues that the marginal personal tax disadvantage of debt offsets the corporate tax advantage of debt, and drive market prices to an equilibrium implying leverage irrelevancy to any given firm. If we assume that a firm having no unrestricted shares in its equity mix faces this 'Miller world', then a firm, which can issue unrestricted shares at super premium prices, prefers 100 % equity financing. That is, the additional benefit associated with equity financing makes the firm to choose the corner solution.

The main implication for companies' investment decisions is the fact that according to our model all investments have two values. We get one value if we use the domestic investors' discount rate and another value if we use the foreign investors' discount rate. Management of a company, which has both domestic and foreign stockholders, faces the problem of which discount rate to use. Some of the investments probably fall into the gray area where one investor group would like to carry out the investments but the other investor group would oppose. This problem is completely analogous to the classical investment problem under certainty when the borrowing and lending rates differ. Thus, it is clear that an investment does not have a unique value in a company, whose unrestricted shares are held by foreign investors. The essential question in this situation is: »Whose wealth the management is maximizing?» Since domestic stockholders have at least 80 % of the voting stock, domestic investors' wealth is likely to be maximized. If this is the case, the management values the investments using the domestic investors' discount rate.

### *5.1. Some evidence on the optimality of Finnish firms' financing decisions*

The following implications for Finnish companies' financing decisions were derived above:

1. Firms whose unrestricted stocks are trading or would be trading above their restricted stocks, should have the maximum amount of unrestricted stocks in their equity structure.
2. Firms whose unrestricted stocks are not traded at premium prices, are indifferent with respect to their equity mix.

As seen in section 2 the unrestricted stocks are trading significantly above the restricted

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[31] *At the corporate level debt financing is tax-advantageous compared to equity financing in Finland, because interest payments are fully deductible in taxation whereas dividend payments are only partially deductible.*

[32] *The expected marginal tax-benefits are non-increasing because with the higher amount of debt it becomes increasingly uncertain whether the firm can deduct all interest expenses in taxation.*

[33] *See the model presented by DeAngelo and Masulis (1980).*

[34] *The Bank of Finland has prohibited Finnish firms [and investors] from selling debt issues to foreign investors and thus all debt can be considered to be 'restricted' debt.*

stocks for most Finnish companies with unrestricted stocks in their equity mix. These companies should have the maximum feasible amount of unrestricted stocks in their equity mix. If though the costs of changing a firm's equity mix exceed the increase in the firm's value, it will not be optimal to change the mix. Firms may optimally choose the status quo even if their unrestricted stocks are traded at a premium.

At the end of June 1985 the percentage of unrestricted stocks in the equity capital of companies with listed unrestricted stocks averaged 13.1 %. The distribution of the percentage of unrestricted stock is given below:[35]

| Percentage | Number of companies |
|---|---|
| 18 %—20 % | 6 |
| 15 %—17 % | 4 |
| 11 %—14 % | 4 |
| 8 %— 9 % | 3 |
| 3 %— 4 % | 3 |

Although the figures given above show that for many companies the 20 % rule is not binding, there is additional evidence that Finnish companies are aware of the optimality of issuing the maximum feasible amount of unrestricted stocks. First, four of the 20 companies above have issued new unrestricted shares [without issuing new restricted shares] to foreign investors between June 1985 and June 1986, and additional 5 out of the 20 companies have obtained shareholders' approval of a new unrestricted share issue. Second, three of the 11 listed companies, whose stocks were all restricted as at the end of June 1985, have now issued unrestricted stocks. This includes two large commercial banks which issued unrestricted stocks within the first few months of 1986 when the absolute prohibition on unrestricted issues by banks was lifted. Third, and most importantly, since 1984 Finnish companies have been lobbying intensively for less restrictive rules regarding foreign ownership in Finnish companies.[36]

[35] *We were not able to get information from three companies.*

[36] *There is expected to be a change in the Finnish Law which would allow either a 33⅓ % or a 40 % foreign interest in Finnish companies.*

## 6. *Conclusion*

In this paper we have analyzed various implications of the legal restriction that at most 20 % of the stocks of many Finnish companies can be owned by foreign investors. Our main interest has been in explaining the observed super premiums in the Finnish stock market, i.e., why unrestricted stocks are traded at premiums relative to the restricted stocks. The premiums are explained by the legal restrictions in the Finnish stock market. Besides the 20 %-rule, a restriction concerning short-selling and a restriction concerning Finnish investors' possibilities to invest abroad are incorporated into an equilibrium pricing model. In the model an unrestricted stock is traded at a price premium relative to the corresponding restricted stock if foreign investors require a lower rate of return on this stock than domestic investors do. If the rate required by foreign investors is higher or the same as the rate required by domestic investors, the unrestricted and restricted stocks are traded at identical prices according to the model.

In the empirical analysis we observed that on several occasions the unrestricted stock has actually been trading at a discount relative to the restricted stock. It was suggested that these discounts were probably due to very illiquid trading in unrestricted stocks, and ignorance by some Finnish investors of the characteristics of unrestricted stocks. We showed that the international betas of Finnish stocks are insignificantly different from zero. With an additional assumption that the dividend-perpetuity model holds this implies according to our model that the size of a price premium is a constant times the domestic beta of the restricted stock. This hypothesis was supported by our data. However, we presented some evidence that factors omitted in our model — like the foreign investors' informational disadvantage relative to the domestic investors — may also affect the size of the super premiums. We also showed that the returns on the two classes of stock are consistent with our model: The restricted stocks earn higher return than unrestricted stocks when the unrestricted stocks are traded at a premium. When no premium exists, the difference in returns is very small.

Section 5 showed that for most Finnish

companies the optimal financing strategy is to have the maximum feasible amount of unrestricted stocks in their equity mix. In subsection 5.1 we examined some evidence that Finnish companies are moving in this direction.

*APPENDIX I*

## IMPORTANT FACTS ABOUT FINNISH TAX LAW

### *General*

In Finland individuals have to pay taxes both on income and property. An average income tax bracket is around 30 %, but the highest income tax brackets are around 70 %. Property tax is much more moderate, but for some individuals total taxes can reach 100 % or more on their income.

Corporations pay taxes only on income and the tax rate is approximately 50 % (the tax rate increases from 0 % to 50 % as corporate income increases from $ 0 to $ 20,000 and thereafter is 50 %).

### *Tax on interest and dividend income*

#### *Individuals*

For individuals income from bonds [issued by the Government or by mortgage banks] and from normal bank accounts [normal bank accounts are defined to mean those accounts whose interest rates do not exceed the rate imposed by regulations (≈ 9 %)] are non-taxable.

All other investment income [e.g., interest on debentures, on special bank accounts, dividends, and rents] is taxable after an investment income deduction. This deduction is 3800 FIM [≈ $750] on 1986 [a corresponding deduction of $100 exists in the U.S.].

#### *Corporations*

All interest income [including interest income from bonds] is taxable for all corporations.

Dividend income is always taxable for banks, insurance companies, and stockbrokers. For other corporations dividend income is non-taxable [i.e. the dividend deduction, which is 85 % in the U.S., is 100 % in Finland]. However, for holding companies dividend income is taxable unless they distribute it directly to their stockholders.

#### *Foreign investors*

Foreign investors have to pay a withholding tax of 25 % on all investment income.

### *Tax on capital gains*

Realized capital gains are taxed at the same rate as dividends and interest in Finland [= ordinary income tax rate]. For banks, insurance companies, and stockbrokers, capital gains are always taxable and capital losses always tax-deductible. For individuals and other companies capital gains [losses] are taxable [tax-deductible] only if a security is held for less than 5 years. For individuals and other companies capital losses can be deducted, however, only from capital gains occurred in the same year.

### *Conclusions*

It is extremely difficult to assess whether the total taxation on stocks is heavier for domestic or foreign investors in Finland. Foreign investors have to pay at least a 25 % tax on dividends, whereas domestic corporations, tax-exempt foundations and small investors get their dividends tax-free. On the other hand wealthy domestic individuals have to pay effective taxes on dividends which can exceed the received dividends [because of the property tax]. Depending on the investment period [whether it is less or more than 5 years] and on the institutional form of the investor, capital gains taxes may be higher or lower for foreign investors than for domestic investors.

*APPENDIX II*

## THE TRADING SYSTEM ON THE HELSINKI STOCK EXCHANGE

The Helsinki Stock Exchange [HSE], like most European exchanges, is a silent stock exchange with separate price fixing auction and free trading phases. There are no dealers holding inventories of securities on the HSE. Only stock brokers exist; their job is to match investors' sell and buy orders. Thus, the recorded prices are actual trading prices between two investors, rather than bid or ask prices between an investor and a dealer. Stock brokers accept both market and limit orders from investors, and their commission is a fixed percentage of the value of the transaction.

The exact trading process on the HSE is as follows:

All stocks are first double auctioned issue by issue in the same order every trading day. It usually takes between 2 and 3 hours for the auction to cover all the listed stocks, bonds, and debentures. This double auction may or may not produce actual trades. The purpose of the auction is to establish a trading price range. After the auction more trading is permitted, but only at prices in the closing 'bid-ask' range established in the auction.

Newspapers publish trading prices [if any trades occur] and the closing 'bid-ask' range in the auction. Typically one, and at most two, trading prices are recorded and virtually all trading takes place at these prices.

For most of the listed stocks the closing 'bid-ask' range in the auction is considerably narrow — from 0.2 % to 3 %. But for some infrequently traded stocks, and unfortunately most of the unrestricted stocks are in this group, the closing bid-ask range can be as high as 20 %.

*Implications for financial research*

Because of these facts a financial researcher has to be careful using the data from the HSE. Trading prices are free from distracting noise caused by dealers' spreads and, where possible, should be used in all research. A normal practice in financial research is to use a bid price [or an average of bid and ask price] on days when no trade occurs. However, with the data from the HSE this practice should be employed with care because it may lead to some undesirable biases. This happens because for frequently traded stocks the bid price is an good estimate for the real equilibrium price of the stock [e.g., if the closing bid-ask range is FIM 18 — FIM 18.10 one does not make a big mistake using FIM 18 as the true value of the stock], but for infrequently traded stocks the bid price may clearly be a downward biased estimate of the real equilibrium price of the stock [e.g., if the closing bid-ask range is FIM 18 — FIM 22 one must be cautious about using FIM 18 as the true value of the stock]. To use the average of bid and ask prices causes a bias because ask prices often are inflated.

In this paper we would underestimate the premiums on unrestricted stocks if we used bid prices. This would occur because the restricted stocks are generally frequently traded stocks and bid prices reflect the underlying equilibrium values reasonably well but the unrestricted stocks are normally infrequently traded stocks and bid prices tend to underestimate the equilibrium values for these stocks. Because of this fact we use only transaction prices in this study.

## *APPENDIX III*

## DERIVATION OF THE EQUILIBRIUM ASSET PRICING MODEL

In this appendix we derive the equilibrium relations for the capital market described in section 2 using assumptions laid down in subsection 3.2. Before proceeding it is convenient to have a summary of the terms and notations used in the model:

| | | |
|---|---|---|
| Investors: | $d \in D$ | [domestic investors] |
| | $f \in F$ | [foreign investors] |
| Securities: | $a \in A$ | [restricted Finnish stocks] |
| | $b \in B$ | [unrestricted Finnish stocks] |
| | $c \in C$ | [foreign stocks] |
| | ff | [the riskless security] |

Portfolio variables:

| | |
|---|---|
| $\tilde{W}_i$ | [investor i's end of period wealth] |
| $W_i^0$ | [the market value of investor i's endowment] |
| $X_{i,x}$ | [the number of units of security x (a, b, c, or ff) held by an investor i] |
| $X_{i,x}^0$ | [investor i's endowed holding of security x (a, b, c, or ff)] |

Security characteristics:[37]

| | |
|---|---|
| $P_x^0$ | [the price of security x at the beginning of the period] |
| $\tilde{P}_x^1$ | [the end of period value of security x] |
| $r_{ff}$ | [one plus the riskless rate of interest] |

The equations describing the pure exchange model of capital market equilibrium are as follows:

*Wealth constraints for investors in both investor groups:*[38]

$$(1)\quad X_{ff} + \Sigma_a P_a^0 X_a + \Sigma_b P_b^0 X_b + \Sigma_c P_c^0 X_c = X_{ff}^0 + \Sigma_a P_a^0 X_a^0 + \Sigma_b P_b^0 X_b^0 + \Sigma_c P_c^0 X_c^0 = W^0$$

*End of period wealth for investors in both investor groups:*

$$(2a)\quad \tilde{W} = X_{ff} r_{ff} + \sum_a \tilde{P}_a^1 X_a + \sum_b \tilde{P}_b^1 X_b + \sum_c \tilde{P}_c^1 X_c$$

Solving (1) for $X_{ff}$, and substituting in (2a) gives

$$(2b)\quad \tilde{W} = r_{ff} W^0 + \Sigma_a X_a (\tilde{P}_a^1 - r_{ff} P_a^0) + \Sigma_b X_b (\tilde{P}_b^1 - r_{ff} P_b^0) + \Sigma_c X_c (\tilde{P}_c^1 - r_{ff} P_c^0)$$

In formula (2b) the first term represents the end of period wealth of an investor who invests all his endowment in the riskless security, and the terms $(\tilde{P}^1 - r_{ff} P^0)$ are the excess dollar returns (per stock) for securities in sets A, B, and C.

*Utility functions for investors in both investor groups:*

The only utility function satisfying our first assumption is quadratic utility function:

$$(3)\quad U(\tilde{W}) = \tilde{W} - e_i \tilde{W}^2,$$

where $e_i$ is a positive constant which may differ across investors.

*Legal restrictions for domestic investors:*

$$(4)\quad X_{d,c} = 0 \quad \forall\, d \in D \text{ and } \forall\, c \in C.$$

*Legal restrictions for foreign investors:*

$$(5)\quad X_{f,a} = 0 \quad \forall\, f \in F \text{ and } \forall\, a \in A.$$

*Legal restrictions concerning short-selling:*

$$(6)\quad X_{d,a}, X_{d,b}, X_{f,b} \geq 0, \quad \forall\, d \in D,\ f \in F,\ a \in A, \text{ and } b \in B.$$

---

[37] *All prices are expressed in domestic currency. This assumption is not crucial because our model does not attack the problem of exchange risk.*

[38] *Investor subscripts are omitted when they are not necessary.*

We now determine investors' optimal portfolios; first the optimal portfolio for a domestic investor and then for a foreign investor.

*Optimality Conditions for Domestic Investors*

Domestic investors try to maximize the expected value of their end of period utility taking into account the legal restrictions[39] that $X_{d,b} \geq 0$ and $X_{d,c} = 0$.[40] A domestic investor's choice problem may be expressed as the maximization of the Lagrangian L formed by appending the short selling constraint to the investor's expected utility:

$$(7) \quad \max_{X_a X_b} L = E\,[U(\tilde{W})] - \sum_b \lambda_b X_b,$$

where
$$\tilde{W} = r_{ff} W^0 + \sum_a X_a (\tilde{P}^1_a - r_{ff} P^0_a) + \sum_b X_b (\tilde{P}^1_b - r_{ff} P^0_b),$$

and the $\lambda_b$ are non-positive Lagrangian multipliers corresponding to the short selling restrictions.

The first-order conditions are:

$$(8a) \quad \frac{\partial L}{X_a} = E\,[U'(\tilde{W})\,(\tilde{P}^1_a - r_{ff} P^0_a)] = 0, \ \forall\ a \in A$$

$$(8b) \quad \frac{\partial L}{X_b} = E\,[U'(\tilde{W})\,(\tilde{P}^1_b - r_{ff} P^0_b)] - \lambda_b = 0, \ \forall\ b \in B$$

$$(8c) \quad \frac{\partial L}{\lambda_b} = X_b \geq 0, \ \forall\ b \in B.$$

In addition, the complementary slackness condition requires that $\lambda_b X_b = 0 \ \forall\ b \in B$. If $X_b > 0$ then the corresponding Lagragian multiplier is 0 and the barrier against short selling is nonbinding for this particular stock. If $\lambda_b < 0$ the marginal expected utility from the stock is negative. The investor would like to take a short position in that stock but is precluded from doing so by the legal restriction, and $X_b = 0$.

It will be advantageous to refer to domestic investors' opportunity set as G, the union of A and B. The set of stocks which domestic investors hold in equilibrium will be referred to as G* which is a subset [not necessarily proper] of G.

[39] *The risk tolerance functions of the domestic investors are linear in wealth and the wealth coefficient is identical for all domestic investors. Moreover, domestic investors have identical expectations and portfolio opportunity sets. Cass and Stiglitz (1970) have shown that these conditions, coupled with the existence of a riskless asset, are sufficient for domestic investors' stock portfolios to be identical. Because domestic investors are the only investors who can hold stocks from set A, this implies directly that $X_{d,a} > 0$, $\forall\ a \in A$, $d \in D$. Because of this the restriction $X_{d,a} \geq 0$ is dropped as redundant.*

[40] *A natural extension of our model is to a multiperiod setting. This task is left for future research.*

Because we know that $\lambda_b \leq 0 \ \forall\ b \in B$, we can combine (8a) and [8b] to get

$$(8ab) \quad E[U'(\tilde{W})\,(\tilde{P}^1_g - r_{ff} P^0_g)] \leq 0 \ \forall\ g \in G.$$

Condition [8ab] states that the equilibrium marginal expected utility from a portfolio shift does not have to be identical for all stocks in the opportunity set of the domestic investors. In particular, the marginal expected utility to the domestic investors for some stocks $b \in B$ may be negative. However, for stocks actually held in the equilibrium portfolios of domestic investors[41], by definition elements of set G*, the expected marginal utility of the excess returns at equilibrium prices will be identically equal to zero for all domestic investors.

*Optimality Conditions for Foreign Investors*

Optimality conditions for foreign investors are similar to those for domestic investors. Foreigners maximize the expected value of their end of period utility taking into account the legal restrictions $X_{f,a} = 0$ and $X_{f,b} \geq 0$. Their Lagragian are thus:

$$(9) \quad \max_{X_b X_c} L = E\,[U(\tilde{W})] - \sum_b \gamma_b X_b,$$

where
$$\tilde{W} = r_{ff} W^0 + \sum_b X_b (\tilde{P}^1_b - r_{ff} P^0_b) + \sum_c X_c (\tilde{P}^1_c - r_{ff} P^0_c),$$

and the $\gamma_b$ are non-positive Lagrangian multipliers corresponding to the short selling restrictions.

The first-order conditions are:

$$(9a) \quad \frac{\partial L}{\partial X_c} = E\,[U'(\tilde{W})\,(\tilde{P}^1_c - r_{ff} P^0_c)] = 0 \quad \forall\ c \in C.$$

$$(9b) \quad \frac{\partial L}{\partial X_b} = E\,[U'(\tilde{W})\,(\tilde{P}^1_b - r_{ff} P^0_b)] - \gamma_b = 0 \quad \forall\ b \in B.$$

$$(9c) \quad \frac{\partial L}{\partial \gamma_b} = X_b \geq 0, \ \forall\ b \in B.$$

In addition, the complementary slackness condition requires that $\gamma_b X_b = 0 \ \forall\ b \in B$.

Henceforth the foreign investors' opportunity set will be referred to as H, the union of sets B and C. The set of stocks which foreign investors hold in equilibrium will be referred to as H* which is a subset [not necessarily proper] of H. Because $\gamma_b \leq 0 \ \forall\ b \in B$, we can combine (9a) and [9b] to obtain

$$(9ab) \quad E\,[U'(\tilde{W})\,(\tilde{P}^1_h - r_{ff} P^0_h)] \leq 0 \quad \forall\ h \in H.$$

The interpretation of condition [9ab] is identical to that of condition [8ab].

[41] *As explained in footnote 39 the equilibrium portfolios for all domestic investors are identical.*

*Capital Market Equilibrium*

In addition to the optimality conditions given above, equilibrium requires that markets clear.

*Conservation equations:*[42]

$$(10a)\quad \sum_d X^0_{d,a} + \sum_f X^0_{f,a} = \sum_d X_{d,a} + \sum_f X_{f,a} \quad \forall\, a \in A.$$

$$(10b)\quad \sum_d X^0_{d,b} + \sum_f X^0_{f,b} = \sum_d X_{d,b} + \sum_f X_{f,b} \quad \forall\, b \in B.$$

$$(10c)\quad \sum_d X^0_{d,c} + \sum_f X^0_{f,c} = \sum_d X_{d,c} + \sum_f X_{f,c} \quad \forall\, c \in C.$$

$$(10d)\quad \sum_d X^0_{d,ff} + \sum_f X^0_{f,ff} = \sum_d X_{d,ff} + \sum_f X_{f,ff}$$

Now our capital market equilibrium model is complete. Properties and implications of the solution to this system of simultaneous equations are now analyzed.

The optimality conditions [8a] and [8b] for domestic investors can be combined by noticing that $\lambda_b = 0$ for all stocks b held in positive amounts by domestic investors. By definition domestic investors hold positive amounts of the stock in set G* and thus

$$(11)\quad [E(\tilde{P}^1_g) - r_{ff}P^0_g]\left[\frac{1}{2e_d} - r_{ff}W^0_d\right] =$$

$$\sum_{k\in G^*} X_k[\sigma_{gk} + [E(\tilde{P}^1_g) - r_{ff}P^0_g][E(\tilde{P}^1_k) - r_{ff}P^0_k]] \quad \forall\, g \in G^*,$$

where $\sigma_{gk}$ = the covariance between the end of period values of assets g and k.

For any domestic investor d, the $|G^*|$ equations[43] in (11) describe the equilibrium conditions for the $|G^*|$ stocks in his equilibrium portfolio. For all other stocks in either C or G—G*, domestic investors' equilibrium position is zero.

Investor specific characteristics only affect the equilibrium quantities through the term

$$\left[\frac{1}{2e_d} - r_{ff}W^0_d\right].$$

This implies that if the vector $\overline{X}_{G^*}$ is the solution of

$$(12)\quad [E(\tilde{P}^1_g) - r_{ff}P^0_g] =$$

$$\sum_{k\in G^*} X_k[\sigma_{gk} + [E(\tilde{P}^1_g) - r_{ff}P^0_g][E(\tilde{P}^1_k) - r_{ff}P^0_k]]$$

then

$$(13)\quad \overline{X}^*_{d,g} = \overline{X}_{G^*}\left[\frac{1}{2e_d} - r_{ff}W^0_d\right] \quad \forall\, d \in D.$$

The equilibrium portfolio of stocks is identical up to a scaling factor across domestic investors. Summing [13] over all domestic investors $d \in D$ gives the aggregate amount of stocks held in domestic investors' optimal portfolios:

$$(14)\quad \sum_{d\in D} \overline{X}^*_{d,g} = \overline{X}_{G^*}\left(\sum_d \frac{1}{2e_d} - r_{ff}\sum_d W^0_d\right) = \overline{X}_{D,G^*}$$

where $\overline{X}_{D,G^*}$ is the aggregate equilibrium amount of the stock in set G* held by domestic investors.

Combining [13] and [14] we get the following expression for $\overline{X}^*_{d,g}$:

$$\overline{X}^*_{d,g} = \left[\frac{1}{2e_d} - r_{ff}W^0_d\right]\left(\sum_d \frac{1}{2e_d} - r_{ff}\sum_d W^0_d\right)^{-1}\overline{X}_{D,G^*}.$$

The domestic investors' security market line for the stock in set G* is now obtained by substituting this result into (11) by noticing that $X_k$ in [11] is a element of $\overline{X}^*_{d,g}$. After simplifications we obtain:

$$(15)\quad \frac{E(\tilde{P}^1_g)}{P^0_g} = r_{ff} + \left[\sum_d \frac{1}{2e_d} - E\left(\sum_d \tilde{W}_d\right)\right]^{-1}$$

$$W^0_{G^*}\mathrm{cov}\left(\frac{\tilde{P}^1_g}{P^0_g}, \frac{\tilde{W}_{G^*}}{W^0_{G^*}}\right) \quad \forall\, g \in G^*$$

where $\tilde{W}_{G^*} = \Sigma_g \tilde{P}^1_g X_{D,G^*}$ and the $X_{D,G^*}$ are the elements of $\overline{X}_{G^*}$.
and $W^0_{G^*} = \Sigma_g P^0_g X_{D,G^*}$.

This security market line holds for all stocks in G*, and hence must hold for the domestic investors' equilibrium portfolio, which is characterized by the vector $\overline{X}_{D,G^*}$. The beginning and ending values of this portfolio are $W^0_{G^*}$ and $\tilde{W}_{G^*}$, respectively.

Substituting $W^0_{G^*}$ and $\tilde{W}_{G^*}$ for $P^0_g$ and $\tilde{P}^1_g$ in [15], solving for

$$\left[\sum_d \frac{1}{2e_d} - E\left(\sum_d \tilde{W}_d\right)\right]^{-1} W^0_{G^*}$$

and substituting this value into [15] gives

$$(16)\quad \frac{E(\tilde{P}^1_g)}{P^0_g} = r_{ff} + \left[\frac{E(\tilde{W}_{G^*})}{W^0_{G^*}} - r_{ff}\right]\mathrm{var}^{-1}$$

$$\left(\frac{\tilde{W}_{G^*}}{W^0_{G^*}}\right)\mathrm{cov}\left(\frac{\tilde{P}^1_g}{P^0_g}, \frac{\tilde{W}_{G^*}}{W^0_{G^*}}\right) \quad \forall\, g \in G^*.$$

To extend this security market line to include also stocks $g \in G$ but $\notin G^*$, we have to notice that for these stocks $X_{d,g} = 0$, and that $\lambda_b$ in [8b] is non-positive. Taking these two facts into account we finally get domestic investors' security market plane for their whole opportunity set G:

$$(17a)\quad \frac{E(\tilde{P}^1_g)}{P^0_g} \leq r_{ff} + \left[\frac{E(\tilde{W}_{G^*})}{W^0_{G^*}} - r_{ff}\right]\mathrm{var}^{-1}$$

$$\left(\frac{\tilde{W}_{G^*}}{W^0_{G^*}}\right)\mathrm{cov}\left(\frac{\tilde{P}^1_g}{P^0_g}, \frac{\tilde{W}_{G^*}}{W^0_{G^*}}\right) \quad \forall\, g \in G.$$

[42] *One of these equations is, of course, redundant.*
[43] $|G^*|$ *refers to the number of stocks in set* $G^*$.

Or, to emphasize the difference between the sets G* and G—G*,

$$(17b)\quad \begin{cases} \dfrac{E[\tilde{P}^1_{g^*}]}{P^0_{g^*}} = r_{ff} + [\dfrac{E(\tilde{W}_{G^*})}{W^0_{G^*}} - r_{ff}]var^{-1} \\ (\dfrac{\tilde{W}_{G^*}}{W^0_{G^*}})\ cov\ (\dfrac{\tilde{P}^1_{g^*}}{P^0_{g^*}}, \dfrac{\tilde{W}_{G^*}}{W^0_{G^*}}) \quad \forall\ g^* \in G^*. \\ \dfrac{E[\tilde{P}^1_g]}{P^0_g} \leq r_{ff} + [\dfrac{E(\tilde{W}_{G^*})}{W^0_{G^*}} - r_{ff}]var^{-1} \\ (\dfrac{\tilde{W}_{G^*}}{W^0_{G^*}})\ cov\ (\dfrac{\tilde{P}^1_g}{P^0_g}, \dfrac{\tilde{W}_{G^*}}{W^0_{G^*}}) \quad \forall\ g \in G-G^*. \end{cases}$$

Similarly, we obtain the foreign investors security market plane for their opportunity set H:

$$(18a)\quad \frac{E[\tilde{P}^1_h]}{P^0_h} \leq r_{ff} + [\frac{E(\tilde{W}_{H^*})}{W^0_{H^*}} - r_{ff}]var^{-1}$$

$$(\frac{\tilde{W}_{H^*}}{W^0_{H^*}})\ cov\ (\frac{\tilde{P}^1_h}{P^0_h}, \frac{\tilde{W}_{H^*}}{W^0_{H^*}}) \quad \forall\ h \in H.$$

where $\tilde{W}_{H^*} = \Sigma_h \tilde{P}^1_h X_{F,H^*}$
$W^0_{H^*} = \Sigma_h P^0_h X_{F,H^*}$
$X_{F,H^*}$ is an element of $\overline{X}_{F,H^*}$
$\overline{X}_{F,H^*} = \Sigma_{f \in F} \overline{X}^*_{f,h}$ = the aggregate equilibrium amount of stocks in set H* held by foreign investors.

Or, to emphasize the difference between the sets H* and H—H*,

$$(18b)\quad \begin{cases} \dfrac{E[\tilde{P}^1_{h^*}]}{P^0_{h^*}} = r_{ff} + [\dfrac{E(\tilde{W}_{H^*})}{W^0_{H^*}} - r_{ff}]var^{-1} \\ (\dfrac{\tilde{W}_{H^*}}{W^0_{H^*}})\ cov\ (\dfrac{\tilde{P}^1_{h^*}}{P^0_{h^*}}, \dfrac{\tilde{W}_{H^*}}{W^0_{H^*}}) \quad \forall\ h^* \in H^*. \\ \dfrac{E[\tilde{P}^1_h]}{P^0_h} \leq r_{ff} + [\dfrac{E(\tilde{W}_{H^*})}{W^0_{H^*}} - r_{ff}]var^{-1} \\ (\dfrac{\tilde{W}_{H^*}}{W^0_{H^*}})\ cov\ (\dfrac{\tilde{P}^1_h}{P^0_h}, \dfrac{\tilde{W}_{H^*}}{W^0_{H^*}}) \quad \forall\ h \in H-H^*. \end{cases}$$

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## COMMENT ON HIETALA

ESKO HAAVISTO

*Kansallis-Osake-Pankki, SF-00100 Helsinki*

In his paper Pekka Hietala formulates and tests a hypothesis concerning the determination of the price differential between free and restricted shares in Finland. The approach adopted by Hietala fits in well with the mainstream of financial research. He has ventured to study one of the peculiarities of the Finnish stock market without falling into the trap of *ad hoc* explanation.

The economic logic behind Hietala's hypothesis is simply that in an internationally diversified portfolio changes in share prices in different countries tend to offset each other. Part of the risk involved in Finnish securities is eliminated when the Finnish securities are included in an internationally diversified portfolio. Finnish shares are therefore more valuable as part of an international portfolio than if held alone. For this reason international investors capable of spreading their risks internationally are willing to pay more for Finnish shares than Finnish investors.

The return requirements set on free and restricted shares can be expressed as follows:

Required return on restricted shares (a):

$$(1) \quad E[R_a] = R_f + \beta_a (E[R_M] - R_f)$$

where

$R_f$ = rate of interest available on a riskless investment in the Finnish financial markets;

$\beta_a$ = the domestically undiversifiable risk of the share;

$R_M$ = average return of shares in the Finnish market

Required return on free shares (b):

$$(2) \quad E[R_b^*] = R_f^* + \beta_b (E[R_M^*] - R_f^*)$$

where

$R_f^*$ = rate of interest available on riskless investments in the international financial markets;

$\beta_b$ = the internationally undiversifiable risk of the share;

$R_M^*$ = average return of shares in the international markets

Define:

$$E[R_M] - R_f = \lambda_a \text{ and } E[R_M^*] - R_f^* = \lambda_b$$

$\lambda_a$ illustrates the »market price of risk» in the Finnish equities market and $\lambda_b$ the »market price of risk» in the international equities market.

The risk premium included in the return requirement is equal to the return requirement less the yield of a riskless investment. To simplify matters, Hietala assumes that the riskless rate of interest available in the Finnish market is the same as that in the international markets, i.e. that $R_f^* = R_f$. Consequently, the risk premium requirements on restricted and free share are:

$$(3) \quad E[R_a] - R_f = \beta_a \cdot \lambda_a$$

$$(4) \quad E[R_b^*] - R_f = \beta_b \cdot \lambda_b$$

Hietala then proceeds to estimate $\beta_a$ and $\beta_b$ and finds that none of the estimated $\beta_b$ parameters deviates significantly from zero. In other words, international investors can totally eliminate the risk involved in Finnish shares. In this light the return requirement to be set on free shares contains no risk premium and is therefore the same as that on riskless investments:

$$(5) \quad E[R_b^*] = R_f$$

What exactly follows from Hietala's observations is the following relation between the return expectations on restricted and free shares (from equations (3) and (5)):

$$(6) \quad E[R_a] - E[R_b^*] = \beta_a \cdot \lambda_a$$

Ruling out the possibility that investors' return expectations could be systematically biased, as Hietala has done, the above implies:

$$(7) \quad \bar{R}_a - \bar{R}_b^* = \beta_a \cdot \lambda_a$$

This, in turn, implies a specific hypothesis on the price differential between free and restricted shares. Hietala does not, however, test the specific hypothesis implied by his model. Instead, he tests the more general hypothesis that there is a positive correlation between the price differential and the β-coefficient of the

restricted share. He obtains a correlation of .558, which is consistent with any model that implies a positive relationship between the price differential and the β-coefficient. The specific hypothesis on this relationship implied by Hietala's model remains untested.

Hietala then moves on to study the dependence of actual returns on the size of the price differential between free and restricted shares. He comes to the conclusion that when the price of free shares is at least 50 per cent higher than that of restricted shares, the return of restricted shares is significantly higher than the return of free shares.

In his paper Hietala does not take exchange rate expectations into account. His analysis is based on an implicit assumption that international investors do not expect the exchange rate of the Finnish mark to change, i.e. that

$$(8) \quad E[\dot{S}] = 0$$

where $\dot{S}$ = the change in the FIM exchange rate against the U.S. dollar.

The assumption would be valid if the FIM were a freely floating currency. In this case any expectations about changes in its exchange rate would be immediately reflected on the spot rate, and the spot rate (adjusted for the interest rate differential) would be the best indication of the future rate. However, Finland pursues a policy of fixed exchange rates. For this reason the FIM exchange rate may at times deviate from what it would be if determined entirely by market forces. In a situation like this, investors may have definite expectations about future trends in the FIM exchange rate. They may e.g. believe that the mark will be devalued, in which case

$$(9) \quad E[\dot{S}] < 0$$

If international investors expect the Finnish mark to weaken, the return requirement on free shares will include a corresponding premium. In my view the exchange rate expectation should be explicitly included in the equation illustrating the return requirement on free shares.

The expected *foreign currency* return of a free share is the total of the expected FIM return and the expected change in the exchange rate:

$$(9) \quad E[R_b + \dot{S}] = R_f + \beta_b \lambda_b$$

where $\dot{S}$ = the change in the FIM exchange rate.

However, the *Finnish mark* price of a free share is determined by the FIM return requirement and not the foreign currency return requirement. The FIM return requirement is:

$$(10) \quad E[R_b] = R_f + \beta_b \lambda_b - E[\dot{S}]$$

The requirement to be set on the FIM return of a free share thus depends on market expectations about the value of the Finnish mark. A negative sign in front of the exchange rate expectation means that an expected appreciation of the mark lowers the return requirement, while an expected depreciation of the mark will increase the return requirement.

With the exchange rate expectation taken into account, the following hypothesis can be formulated concerning the return differential between restricted and free shares:

$$(11) \quad \overline{R}_a - \overline{R}_b = \beta_a \lambda_a + E[\dot{S}]$$

It can be seen from the above that with a negative expectation about the FIM exchange rate, i.e., if $E(\dot{S})$ is negative, the return differential between restricted and free shares is smaller than Hietala's analysis would suggest.

The measurement of expected changes in the FIM exchange rate requires a method of measuring expectations about a devaluation. A useful auxiliary device for this purpose could be the Leading Indicators of Currency Devaluation by John Bilson (Columbia Journal of World Business, Winter 1979).

The inclusion of exchange rate expectations in the model might make it possible to explain not only the average price differential between restricted and free shares but also variations in this differential over different time spans.

Hietala's research paper is a stimulating piece of research, and it opens interesting perspectives for further studies in this field.