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FOREIGN EQUITY INVESTMENT RESTRICTIONS AND SHAREHOLDER WEALTH MAXIMIZATION

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ABSTRACT

This paper provides a theory of foreign equity investment restrictions. In a setting where the demand function for domestic shares differs between domestic and foreign investors, domestic entrepreneurs can maximize firm value by discriminating between domestic and foreign investors. The empirical implications of this theory are supported by evidence from Switzerland. In contrast to mean-variance asset pricing models, the model correctly predicts that the relaxation of foreign equity investment restrictions decreases the value of shares available to foreign investors.

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Section 1. Introduction.

In many countries, foreign investors face some kind of restrictions on owning shares of domestic companies.[1] In some countries, such as Japan, these restrictions are imposed by law; in others, such as Switzerland, they are chosen by individual companies. Whereas legislated restrictions are sometimes motivated by a desire to preserve the independence of domestic industries, possibly because of national defense concerns, such a motivation cannot explain restrictions imposed by individual firms. In this paper, we propose a theory of foreign equity investment restrictions where the imposition of these restrictions maximizes firm value and show that this theory is consistent with the empirical evidence for Switzerland, where shares available to domestic investors only have traditionally traded at a substantial discount relative to shares available to all investors. Whereas we are aware of models that study how foreign equity investment restrictions affect share prices and explain why unrestricted shares generally trade at a premium relative to the restricted shares, we do not know of any theory of why such restrictions exist.[2]

Our basic argument is that, if the price elasticities of the demand functions for domestic shares differ for foreign and domestic investors, an

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[1] Eun and Janakiramanan (1986) provide a partial list of such restrictions.

[2] See Stulz (1981) for a general model of barriers to international investment. Eun and Janakiramanan (1986) analyze the effect of equity ownership restrictions on the pricing of shares when the fraction of shares that can be held by foreign investors is the same for all shares in a country. Hietala (1989) has a model where domestic investors cannot hold foreign shares and foreign investors can hold a limited quantity of domestic shares. Horner (1986) studies restrictions on foreign equity investment when restrictions can be bypassed at a cost. Errunza and Losq (1985, 1989) have a model where investors can invest in an unrestricted market and some investors can invest in a restricted market.

entrepreneur financing a project by issuing shares will find it advantageous to price discriminate between the two classes of buyers.[3] If the demand for domestic shares from domestic investors is highly price elastic whereas the demand from foreign investors is not, this price discrimination can be achieved by having shares whose ownership is restricted to domestic investors and shares available to all investors. The shares available to all investors will trade at a premium relative to the shares available to domestic investors only.

Our theory is also helpful in understanding the evolution of share ownership restrictions. As the foreign demand for domestic shares changes, it may become advantageous for the existing shareholders to modify the extent to which foreign investors can acquire domestic shares. In particular, if the demand from foreign investors increases, it may even become optimal to remove all restrictions on share ownership. A prediction of our model is that unexpectedly removing share ownership restrictions increases the value of the restricted shares and decreases the value of the unrestricted shares. This prediction differs strongly from the prediction obtained from international asset pricing models with investment barriers which suggest that the removal of restrictions has no effect on the unrestricted shares and increases the value of the restricted shares so that all shares have the same price. Since Nestlé abolished restrictions on foreign ownership of its shares in 1988, it is possible

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[3] Whereas it is traditional in finance to assume that the demand for shares by investors is perfectly elastic, it is now recognized that this assumption is not always appropriate. See Bagwell (1991) for a review of some evidence on the imperfect elasticity of demand curves for shares and for a discussion of the implications of that evidence. Loderer and Zimmermann (1988) provide evidence that the demand for Swiss shares is downward sloping by studying the price reaction to stock issues.

for us to test this prediction of our model directly.[4]

The paper proceeds as follows. In section 2, we present our model and derive its empirical implications. In section 3, we introduce our data. In section 4, we show how the time-series and cross-sectional properties of the data are consistent with our theory. In section 5, we argue that the change in the price of Nestlé shares around the announcement concerning the relaxation of its foreign equity restrictions is supportive of our theory. In section 6, we provide some concluding remarks.

Section 2. A theory of foreign equity investment restrictions.

The coexistence of shares with ownership restrictions and shares without these restrictions raises two major puzzles: (1) Why do we observe both types of shares? (2) Why are unrestricted shares generally more valuable than restricted shares? In section 2.1., we show that a traditional mean-variance asset pricing model with investment restrictions provides a solution for the pricing puzzle while deepening the existence puzzle. In section 2.2., we present our price discrimination model which explains both the pricing and existence puzzles. We conclude in section 2.3. with a discussion of why restrictions persist.

Section 2.1. The mean-variance approach.

To highlight the implications of the mean-variance approach, we consider a one-period model where risk-averse investors choose portfolios in

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[4] Loderer and Jacobs (1992), in a contemporaneous paper, show that the evidence associated with the Nestlé announement is consistent with the existence of finite demand elasticities.

mean-variance space and belong to one of two countries that have, for simplicity, the same numeraire. Investors from the domestic country face no ownership restrictions whereas investors from the foreign country face ownership restrictions in the domestic country. Investment opportunities consist of unrestricted or U shares, issued by domestic and foreign firms, and restricted or R shares, issued only by domestic firms. For each domestic firm that issues both R and U shares, we assume that these shares differ only in their ownership restrictions, so that in the absence of these restrictions they would sell for the same price. We assume further that issuing firms can successfully enforce the ownership restrictions on shares by allowing purchases of R shares only by qualified investors.[5] We finally assume that domestic investors cannot sell short unrestricted shares. In the absence of this restriction, domestic investors could eliminate price differences between the two types of shares through arbitrage transactions. Except for the ownership and short-sale restrictions, capital markets are assumed to be perfect, so that there are no transaction costs, taxes or additional obstacles to international investment. Finally, we assume that the domestic country is small enough that the asset demands of domestic investors have a negligible effect on the pricing of unrestricted securities.

In this model, domestic investors are forced to hold all restricted shares and expected returns have to be such that they are wiling to do so. Domestic investors can, however, partly hedge the risk of restricted shares through positions in unrestricted shares. The appendix shows that, in equilibrium, the expected excess returns of shares satisfy:

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[5] In the case of Switzerland, the restrictions are enforced by making the ownership rights of R shares contingent on registration with the issuing company.

$$T^R[E(r_{Ri}) - E(r_{hRi})] = \delta Cov(r_{Ri} - r_{hRi}, r_{MR}) \quad (1a)$$

$$E(r_{Ui}) = \left[\frac{Cov(r_{Ui}, r_{TU})}{Var(r_{TU})}\right] E(r_{TU}) = \beta_{Ui} E(r_{TU}) \quad (1b)$$

where T^R denotes the relative risk tolerance of the representative investor, E(a) is the expectation of a, Cov(a,b) is the covariance between a and b; r_{Ri}, r_{hRi}, r_{MR}, r_{Ui} and r_{TU} denote, respectively, the excess return of the i-th restricted asset, of the fund of unrestricted shares that forms a minimum-variance hedge for the i-th restricted share taking into account the short-sale constraints, of the market portfolio of R shares, of the i-th unrestricted share, and of the tangency portfolio of unrestricted shares. δ is the fraction of domestic wealth that has to be invested in restricted shares in equilibrium.

The asset pricing equation for restricted shares, equation (1a), states that the expected excess return on a restricted share net of the cost of hedging that share with unrestricted shares is proportional to the covariance of the return of the hedged restricted share with the return of the market portfolio of restricted shares. The appendix shows that, **ceteris paribus**, the cost of hedging a restricted share increases with the covariance of its return with the return of the tangency portfolio of unrestricted shares and that this covariance is the same for the hedge portfolio and for the restricted share. Consequently, the expected return of a restricted share increases with its covariance with the tangency portfolio of unrestricted shares. When domestic investors cannot hedge restricted shares perfectly through positions in domestic unrestricted shares, the expected excess return of a restricted share exceeds its expected excess return without restrictions by a risk premium that reflects its unhedgeable risks for domestic investors. If restricted shares have the same cash flows as unrestricted shares but a higher required expected excess return, they must sell for a lower price. According to equation (1b), the expected excess

return of an unrestricted share is equal to its beta with respect to the tangency portfolio of unrestricted shares, multiplied by the expected excess return of the tangency portfolio.

Consider now an increase in the supply of shares available to foreign investors brought about by an exchange of R shares for U shares with the R shares having a lower price than the U shares. An example is the relaxation of restrictions by Nestlé in 1988. With our small country assumption, the exchange of shares does not affect the expected excess return of U shares and hence leaves their price unchanged. Since the exchange reduces the amount of unhedgeable risk borne by domestic investors, it decreases the risk premium on existing restricted shares and hence increases their price. Consequently, the wealth of domestic investors who hold restricted shares increases and domestic shareholders are made better off by decreasing the restrictions on equity ownership. Whereas this model can explain the price premium of unrestricted shares, it cannot explain why the restrictions on equity ownership exist.

Section 2.2. Foreign share ownership restrictions and wealth maximization.

In this section, we modify the model of the previous section so that an entrepreneur who seeks to finance an investment through an equity issue would rather issue some U shares and some R shares rather than issue shares available to all investors.[6] In the mean-variance model discussed above, investors are indifferent about the country in which an asset is issued as long as the joint distribution of asset returns remains the same. Suppose now that

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[6] We do not address the question of whether alternative forms of financing would be even more advantageous. Although of great interest, the deeper security design issues would detract from the main theme of this paper.

the country in which an asset is issued matters to a different degree for foreign investors, so that some of them are willing to earn a lower return on an asset issued in the domestic country.

One way to motivate differential demands from foreign investors is in the spirit of Merton's (1987) model. In that model, investors only hold securities of firms they know about. Suppose that, in addition, investors only hold securities of countries they know about. In this case, some foreign investors will have no demand for assets of the domestic country, whereas other investors will want such securities. The evidence on the limited extent of international diversification is consistent with such a model.[7] If some foreign investors do not know about domestic securities, there will be differential demands for these securities since investors will have different portfolios and hence the diversification benefits of domestic securities will differ across investors. An alternative motivation is that some foreign investors might be willing to hold domestic securities even if they have a low expected return because they view these securities as safe from political risk. This "safe haven" argument has often been made for investments in Switzerland. The assumption that foreign investors have heterogeneous valuations for domestic shares implies that there is a downward sloping demand curve for domestic shares from foreign investors, since for high share prices, only those foreign investors that value the shares the most will choose to hold them. Although these differential demands for domestic shares can be incorporated in the mean-variance model by adding a term to the foreign investors' demand that reflects their valuation of domestic shares for reasons other than those posited by the model, doing so would complicate the exposition of our argument without obvious benefits.

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[7] See Cooper and Kaplanis (1990) and French and Poterba (1991).

To focus on the main contribution of our approach, we assume that the aggregate demand for domestic shares from domestic investors is perfectly price-elastic. The conclusion that firms can maximize their value through price discrimination between domestic and foreign investors holds as long as these two investor classes have different demand functions for domestic shares. However, if the demand from foreign investors is more price-elastic than the demand from domestic investors, price discrimination cannot be implemented unless domestic investors are prevented from holding the shares available to foreign investors. Since this case implies that shares available to foreign investors sell for less than the shares available to domestic investors, we ignore it in the following.

Consider now an entrepreneur who has a project that yields random cash flows in the future at a cost to be paid today. The cash flows are not under the discretion of management, their distribution at each date is common knowledge, and they are paid out when they accrue, so that there are no agency costs resulting from the separation of ownership and management. The entrepreneur wants to finance the project by selling equity claims to all cash flows and takes his compensation for implementing the project by keeping the difference between the cost of the project and the value of the securities sold.

If the asset demands do not depend on the country in which an asset is issued, the entrepreneur maximizes his wealth by issuing only unrestricted securities for the reasons discussed in section 2.1. However, with our assumption that there is a downward sloping demand curve for shares of the domestic country from foreign investors, the entrepreneur can benefit from issuing both restricted and unrestricted shares. The assumption of a downward sloping demand curve implies that the price of unrestricted shares depends on their supplies. The difference in the price elasticities of the demand curves from foreign and domestic investors makes it possible for the entrepreneur to choose

supplies of each class of shares so that his income is maximized.

Let P_R and P_U be, respectively, the price of a restricted and of an unrestricted share. There are n shares and θ is the fraction of those shares that is available to foreign investors. We formalize our assumption that there is a downward sloping demand curve for shares from foreign investors by assuming that P_U and θ are related through a downward sloping demand schedule - i.e., the larger θ, the lower the price of the unrestricted shares. Let the demand for unrestricted shares as a fraction of total shares be θ^d and assume that $P_U = F(\theta^d)$, where $F(\theta^d)$ is an inverse demand function assumed to have a negative first derivative. By assumption, P_R does not depend on θ.

With our assumption about the demand curve for unrestricted shares, the value of the firm is:

$$V = \theta nF(\theta) + (1-\theta)nP_R \tag{2}$$

where the demand for shares is assumed to equal its supply, θ. The entrepreneur chooses θ to maximize the value of the firm. To maximize V with respect to θ, we set the derivative of V with respect to θ equal to zero:

$$V_\theta = nF(\theta) + \theta nf(\theta) - nP_R = 0 \tag{3}$$

where f(.) denotes the partial derivative. We can rearrange equation (3) to obtain a relation between the price ratio P_U/P_R and θ:

$$\frac{P_U}{P_R} = 1 - \frac{\theta f(\theta)}{P_R} > 1 \tag{4}$$

Since $f(\theta)$ is negative, it immediately follows from this that the ratio of the price of unrestricted shares to the price of restricted shares is greater than one.

Figure 1 shows how the entrepreneur chooses the optimal θ by setting the marginal revenue from selling a share to foreign investors equal to the

marginal revenue from selling a share to domestic investors. θ^* is the value of θ that satisfies this condition. With our assumptions, the marginal revenue from selling a restricted share to domestic investors is constant and equal to the price of the share P_R, whereas the marginal revenue from selling an unrestricted share is declining in θ and equal to $P_U + \theta f(\theta)$. A shift to the right of the demand curve from F to F' increases the optimal value of θ from θ^* to $\theta^{*'}$. Note that the demand from foreign investors could increase so much that the marginal income from selling shares to foreign investors is greater than P_R for $\theta = 1$. In this case, there are no reasons for restrictions to exist.

The model developed here predicts that the price ratio of unrestricted and restricted shares increases with the demand from foreign investors for domestic unrestricted shares and that, **ceteris paribus**, an increase in the supply of unrestricted shares decreases the price ratio of unrestricted and restricted shares. The relaxation of ownership restrictions by a firm is equivalent to an increase in the supply of unrestricted shares and a decrease in the supply of restricted shares. Since the relaxation of restrictions increases θ, it decreases the ratio P^U/P^R. However, more importantly and in contrast to the mean-variance model, the increase in the supply of unrestricted shares decreases the price of these shares since their demand curve is downward sloping. So far, we have considered a single firm. To the extent that investors value shares because they were issued in the domestic country, domestic shares issued by different firms will be substitutes, so that an increase in the supply of unrestricted shares by one firm will lead to a decrease in the price ratio of unrestricted to restricted shares of other firms.

The model suggests that, as markets become more global, one would expect investors to learn more about foreign markets and be more willing to invest in them. This would make the demand for domestic shares more price elastic and would decrease the gain from having two classes of shares. In this

model, it could therefore be possible for the benefit from ownership restrictions to disappear without changes in share prices given the existing supply of restricted and unrestricted shares because the demand function from foreign investors becomes more elastic at the existing price. Since the demand for shares changes over time, however, the model does not predict that there is a long-term mean to the price ratio P_U/P_R.

Section 2.3. Dynamic consistency issues.

So far, the supplies of shares were assumed to be fixed. If the holders of restricted shares control the corporation, they could benefit from selling some of their shares to foreign investors at a price near P_U. Hence, if the holders of restricted shares are allowed to remove the foreign ownership restrictions on some of their shares, what prevents them from increasing the supply of the unrestricted shares so that after some time all shares are unrestricted? Further, if the buyers of unrestricted shares know that more unrestricted shares will be issued soon after they make their purchase, why would they value these shares highly? In this section, we discuss why the one-period equilibrium presented above does not unravel in a multiperiod setting.

Even if owners of restricted shares can convert their shares into unrestricted shares and sell them, it may not be optimal for them to do so quickly. These investors have an option to exchange one type of shares for another. The value of the option depends on the dynamics of the foreign demand for shares. Exercising the option immediately is costly since it precludes exercising it later when the foreign demand may be higher.[8] If

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[8] In the absence of an increase in the total number of shares, it is always possible to increase θ if $\theta < 1$, but decreasing θ is costly since holders of unrestricted shares will be willing to exchange them for restricted shares only if compensated to do so.

foreign investors do not believe that a firm will refrain from immediately increasing its supply of unrestricted shares by making restricted shares unrestricted, the firm can choose a charter that makes it impossible to do so without the consent of the foreign shareholders, however.[9]

The supply of shares available to foreign investors is affected by other factors besides those discussed so far. To the extent that restricted shares have higher voting rights than unrestricted shares, management can control the firm by owning a smaller claim to cash flows than it would have to in the absence of differential voting rights. Making restricted shares available to foreign investors could decrease the degree to which management controls the firm since owners of restricted shares favorable to management may sell their shares to rebalance their portfolio. The investors who value control and derive benefits from it will not make their shares available to foreign investors even if they can do so, so that there is an upper bound lower than one for θ. Control considerations do not prevent controlling shareholders from issuing shares without voting rights if the demand for unrestricted shares is high. This argument may explain why the Swiss corporations we examine later all issued such shares.

Finally, firms might compete away the benefits to be gained for the country as a whole from price discrimination. If a particular firm finds it optimal, assuming that all firms act the same, not to increase the supply of unrestricted shares, other firms will benefit from increasing the supply of their unrestricted shares and their actions will reduce the value of the option to increase the supply of restricted shares for the firm that is keeping the supply constant. How can this competition be restricted? Obviously, one solution is to have a law that limits, for each firm, the fraction of its shares that can be

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[9] No Swiss firm has this provision in its charter, suggesting that such a provision is typically unnecessary.

made available to foreign investors. As reported by Eun and Janakiramanan (1986), a number of countries have such laws. An alternative is for supply restrictions to be enforced by collusion among firms or by the investment banking community - for instance because banking firms have both types of shares and would lose if non-banking firms increased their supply of unrestricted shares.

Section 3. The Swiss data.

We now show that the Swiss evidence provides support for our theory of foreign equity investment restrictions. Earlier empirical investigations of the Swiss evidence focus on the control implications of the different supplies of shares outstanding and on the valuation of the voting rights attached to various types of shares.[10] Control implications are not inconsistent with our theory, in the sense that once the restricted shares exist, they may be a convenient instrument of entrenchment for management since it can deny access to those shares to unfriendly investors. However, the control aspects of the foreign ownership restrictions are incidental in the sense that management can entrench itself as effectively by refusing the sale of restricted shares to threatening shareholders irrespective of their nationality and by allowing the purchase of such shares for small, non-threatening foreign investors.

We construct a sample for which it is possible to assess directly the valuation implications of ownership restrictions by constructing restricted and unrestricted securities that differ only in their ownership restrictions.[11] The

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[10] See Horner (1986,1988) and Vock (1987).

[11] Restricted and unrestricted shares in our sample differ also because unrestricted shares are bearer shares whereas restricted shares are registered shares. Hence, shareholders who value anonymity will find unrestricted shares more

sample includes 19 firms that have both restricted and unrestricted shares outstanding. All these firms have two types of unrestricted shares outstanding at the beginning of 1985: unrestricted shares with voting rights (bearer shares) and unrestricted shares with no voting rights (participation certificates). The restricted shares, called registered shares are available to Swiss citizens or to Swiss residents only depending on the firm. Our sample includes 8 from the 10 Swiss firms with the largest stock market capitalization in 1985 and all firms listed in the **Swiss Stock Guide** edited by Union Bank of Switzerland that had all three types of shares outstanding at the beginning of 1985 except for one, Bank Leu, for which stock data was lacking. The **Stock Guide** lists 98 firms which, on September 15, 1985, had a total capitalization of 126 billion SFr. The firms in our sample had a capitalization of 78 billion SFr. on the same day, which amounts to about 62% of the total capitalization. Of the firms not in our sample, 17 seem to have only unrestricted shares; most of these companies are fairly small and controlled by one shareholder.[12]

In Switzerland, dividends are the same fraction of face value for all share types and each voting share has one vote. Hence, a share type can gain a voting rights advantage by having a lower face value. If registered and

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valuable. However, in Switzerland, the tax advantage of anonymity is limited because dividends are subject to withholding taxes on all types of shares. Consequently, whereas this difference between share types implies a higher valuation of unrestricted shares, its value appears limited.

[12] An exception is F. Hoffmann-La Roche & Co. which, as of September 15, 1985, is the sixth largest firm in terms of capitalization. As of that date, Roche has shares with and without voting rights, but all shares are unrestricted. However, Roche is controlled by one family that owns a majority of the voting rights.

bearer shares have different face values, it is always the case that registered shares have a lower face value so that investors who hold registered shares have more voting rights for a given stake in the firm's cash flows than investors who hold bearer shares. To isolate the effects of ownership restrictions, we construct for each firm a portfolio of bearer shares and participation certificates which pays the same dividend and has the same voting rights as registered or restricted shares. We call these portfolios unrestricted shares in the following. More formally, these unrestricted shares consist of one bearer share and [F(R) - F(B)]/F(P) participation certificates, where F(R), F(B) and F(P) are, respectively, the face values of the registered shares, bearer shares and participation certificates. Consequently, the face value of an unrestricted share is F(R) so that it has the same face value as a registered share and therefore pays the same dividend. If a firm's bearer and registered shares have identical face values, its unrestricted shares have no short position in participation certificates.

Our empirical tests presume that short-selling of participation certificates is feasible for foreign investors; since this may not be the case, we distinguish in our empirical work between unrestricted shares that require short-sales of participation certificates and those that do not to make sure that our results are not sensitive to this implicit assumption. Alternatively, we could focus directly on the comparison of bearer shares versus registered shares and adjusted for differential face values; however, in this case we would be comparing shares that have different voting rights except for eight firms for which there is no difference in face values between the bearer and registered shares. It is interesting to note, however, that the comparison of the price of bearer shares per Swiss Franc of face value and the price of registered shares per Swiss Franc of face value shows that the bearer shares are always more expensive. In cases where restricted shares have a lower face value than

bearer shares, it follows that an investment in restricted shares that pays the same dividends as an investment in unrestricted shares but has more voting rights always sells for less than the investment in unrestricted shares, so that voting rights considerations are always a second-order phenomenon.

Table 1 lists the firms in our sample and provides relevant information. The criteria used to register shareholders are those in effect at the end of the sample period as reported by the stock guide prepared by **Finanz und Wirtschaft** for 1989 and by Kaufmann and Kunz (1991). Hence, the requirements reported in the table are those in force after Nestlé decided to allow foreign investors to acquire restricted shares. In general, the cases where registration is at the discretion of the board should be interpreted as cases where foreign shareholders will not be registered. As far as we can ascertain, at the beginning of the sample period, Swiss residency was a requirement for registration for all firms and for a number of firms the stronger requirement of citizenship was in place.[13] Note further that satisfying the residency or citizenship requirement may not be sufficient to insure registration of registered shares, since a firm's Board of Directors generally has the right to reject registration for Swiss citizens. Finally, the information in table 1 shows that holders of registered shares typically control the firm as a group.

In the empirical work, we use weekly share prices, more precisely Wednesday closing prices, over the period from January 2, 1985 to December 27, 1989. Besides the whole period, we distinguish three subperiods. The first one is from the start of our sample to the end of September 1987, that is just before the stock market crash on October 16, 1987. The second subperiod goes from the beginning of November 1987 to the second week of November 1988, which is just before Nestlé announced on November 17, 1988, that it

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[13] No stock guide with information on the ownership restrictions is available for the beginning of our sample period.

would no longer exclude foreign investors from ownership of restricted shares. The third subperiod starts in the third week of November 1988 and goes to the end of our sample. We consider the post-Crash period separately to allow us to discern changes in the behavior of share prices following the Crash. The model developed in section 2.2. suggests that the behavior of restricted and unrestricted share prices ought to differ after the change in ownership restrictions by Nestlé in 1988.

Table 2 shows the values of the average ratio of the price of unrestricted and restricted shares. For all firms but five, the minimum price ratio is in excess of one. The price ratio exhibits substantial variation over time. Not surprisingly, the average values of the ratio fall for a number of firms in the last subperiod which follows the removal of the registration restrictions by Nestlé. Figure 2 plots the average price ratios for all firms, for firms where unrestricted shares require no short-sales of participation certificates and for firms where restricted shares require such short-sales. In that figure, the fall in the price ratio following the announcement by Nestlé (observation 204) is quite dramatic.

Section 4. Time-series and cross-sectional properties of the price ratio of unrestricted and restricted shares.

In this section, we argue that the time-series and cross-section evidence on the relative pricing of shares is supportive of our theory. We also show that the mean-variance model is inconsistent with the evidence.

To study the time-series properties of the price ratio of unrestricted and restricted shares, it is useful to use the log-linear approximation for the log of the price of shares derived by Campbell and Shiller (1988) and Campbell and Ammer (1991). With this approximation, the price of a share can be written as:

$$p(t) = E(t)[\sum_{j=0}^{\infty} \rho^j[(1-\rho)d(t+j+1) - R(t+j+1)] + k \qquad (5)$$

where p indicates the log of the price of the stock, E(t) the expectation conditional on information at t, d the log of the dividend and R the rate of return. ρ is a parameter that comes from the approximation procedure and is slightly smaller than one, and k denotes a constant that depends on ρ. Small changes in ρ have a trivial effect on the log of the price; hence, in the following, we assume that ρ is the same for restricted and unrestricted shares. With this notation and this additional approximation, the log price ratio is the discounted sum of the difference between the expected rates of return of the two types of shares:

$$p_U(t) - p_R(t) = E(t)\sum_{j=0}^{\infty} \rho^j[R_R(t+j+1) - R_U(t+j+1)] \qquad (6)$$

The log price ratio is positive, so that unrestricted shares sell at a premium, if the expected value of the sum of the discounted rates of return of restricted shares exceeds the expected value of the sum of the discounted rates of return of the unrestricted shares. From equation (6), if the discount rate applied to dividends is constant over time for restricted and unrestricted shares, the log price ratio of unrestricted and restricted shares is constant because all variation in the prices of restricted and unrestricted shares is due to the dividends which are common to both types of shares. It is obvious from table 3 that the price ratio is not constant. However, the price ratio could vary around a constant mean, in which case variation in the price ratio could be explained by noise in the data. For instance, because of infrequent trading, the prices of restricted and unrestricted shares issued by a given firm may be observed at different points in time. This lack of synchroneity in the price observations could lead to the false impression that the price ratio changes over time.

We investigate the hypothesis of a constant price ratio in table 3 using

co-integration tests for the prices of unrestricted and restricted shares. The co-integration tests consist of unit root tests for the natural logarithm of the price ratio. These tests generally reject the hypothesis that the price ratio has a long-run mean for the whole period and for all subperiods except the last one which follows the removal of ownership restrictions by Nestlé. Whereas for the whole period, co-integration can be rejected for 16 firms out of 19 at the 0.01 level, it is striking that for the last subperiod it can be rejected for only 8 firms out of 19. This evidence suggests that the removal of ownership restrictions by Nestlé made the price ratios stationary for a number of firms; this is as expected, since the removal of ownership restrictions makes the shares much closer substitutes. Finally, the evidence for the subperiods before the removal of restrictions by Nestlé is inconsistent with asset pricing models where the difference in expected returns for restricted and unrestricted shares is constant over time. The evidence is also inconsistent with alternative explanations for the premium for unrestricted shares which focus on differences in liquidity or the anonymity advantage of bearer shares over registered shares. One would expect liquidity differences or anonymity advantages to be relatively stable over time, so that these explanations would suggest the existence of a long-run mean. Some experiments with cross-sectional regressions relating the price paid to relative transaction volumes did not indicate any significant influences. However, volume data are only available starting in 1990 and not for all firms.

Table 4 provides statistics on the mean difference between the returns of unrestricted and restricted shares for each firm, as well as of equally-weighted indices of these shares. Equation (6) shows that, if the log price ratio is positive, the expected sum of the returns of the restricted shares has to be greater than the expected sum of the returns of the unrestricted shares. It is immediately apparent from table 5 that the average return of restricted shares

is higher than the average return of unrestricted shares for the sample as a whole, but not significantly so. This higher mean return of restricted shares is driven by the subperiod that follows the relaxation of ownership restrictions, however. For the periods before the Nestlé announcement, the average return on unrestricted shares is generally higher than the average return on restricted shares. This result holds whether we consider the whole sample of unrestricted shares or the subsample of unrestricted shares that requires short-sales and the one that does not. Whereas there is no evidence that on average expected returns are higher on restricted shares before the Nestlé announcement, the period before the Crash has ten firms where unrestricted shares have a higher return and nine where they do not. In contrast, in the period following the Crash, 15 firms have higher average returns on their unrestricted shares than on their restricted shares. For this period, a non-parametric test of the hypothesis that the sign difference is random would reject that hypothesis strongly.

A rough calculation suggests that the return difference predicted by equation (6) should be large. If we want to explain a price ratio of 2, a dividend discount model with a constant discount rate suggests that the expected return on restricted shares should be more than twice the expected return on the unrestricted shares. The probability that this might be the case given our estimate for the mean return is less than 0.1 for the most relevant period, namely the period before the Crash, assuming that returns are distributed normally.

For the evidence on mean returns to be consistent with equation (6), it is necessary that investors in unrestricted shares assign some positive probability to a large fall in share prices and/or investors in restricted shares assign some positive probability of a large increase in restricted share prices and that these large changes did not take place during the first two subperiods.

In the language of tests of the forward premium, the data exhibit a small sample bias due to the existence of a Peso problem.[14] If investors believe that such rare events have a non-trivial probability, one can argue that the evidence of excess returns is consistent with investors assigning before the Nestlé announcement some small probability to such an announcement. Since changes in supplies have no effect on the price of unrestricted shares in the mean-variance model but have an effect on the price of restricted shares, this interpretation of the evidence is not inconsistent with the mean-variance model.

The autocorrelations, also shown in table 4, indicate that the process governing differences in returns is very close to white noise. This evidence makes it difficult to believe that the difference in prices between restricted and unrestricted shares results from differences in liquidity that make the more liquid shares more valuable. Differences in liquidity would manifest themselves by significant autocorrelations in the difference between the rates of returns of the two types of shares since the shares with the least liquidity will have a larger bid-ask spread.

Table 5 presents evidence on the cross-sectional variation of log price ratios. One extreme version of the mean-variance model of section 2 is that domestic investors cannot hedge their holdings of restricted shares at all. In this case, our mean-variance model becomes equivalent to the one tested by Hietala (1989) for Finland, in the sense that restricted shares are priced as if domestic investors did not have access to foreign shares. Applying equation (1), the expected excess return of restricted shares increases with the covariance of the return of these shares with the domestic market portfolio whereas the expected excess return of unrestricted shares depends on the covariance of the return of these shares with the world market portfolio. Using

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[14] See Krasker (1980).

equation (6), it follows that in a regression of the log price ratio on the domestic beta of restricted shares and the world beta of unrestricted shares, we expect the domestic beta to have a positive coefficient and the world beta to have a negative coefficient. In table 5, we present cross-sectional regression estimates relating the average log price ratio over the indicated subperiod to the estimated betas for the previous subperiod.[15] To estimate the model, we use the Swiss franc return of the Morgan Stanley World index as a proxy for the world market portfolio and the Swiss Bank Corporation index as a proxy for the Swiss market portfolio. Before the Nestlé event (regression 1a), the domestic beta has a positive but weak effect on the log price ratio and the world beta of unrestricted shares has an even weaker positive effect. After the Nestlé event (regression 1b), the world beta has a positive significant effect that is barely significant at the 0.10 level; such an effect is contrary to what one would expect using Hietala's (1989) model. In regressions not reproduced here, we used as an alternative proxy for the Swiss market portfolio the value-weighted portfolio of the restricted shares in the sample; the regression coefficient on this portfolio is significant at the 1% level and both coefficients in the regression are significant after the Nestlé event.

If domestic investors can use unrestricted shares to hedge their holdings of restricted shares, the cost of hedging increases with the world beta of the restricted shares. Hence, in that setting, since the world betas of restricted and unrestricted shares are positively correlated, the price of both restricted and unrestricted shares falls with the world beta of unrestricted shares and the coefficient on the world beta of unrestricted shares is no longer predicted to be negative. This could explain the results we observe in the

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[15] Splitting the subperiod before the Crash in half yields and estimating the regressions on the second subperiod yield similar results.

regressions that use only the domestic beta of restricted shares and the world beta of unrestricted shares. To investigate this, we add the world beta of the restricted shares to the explanatory variables. Regression (2a) shows that none of the beta coefficients are significant before the Nestlé event, whereas afterwards, in regression (2b), the world betas of restricted and unrestricted shares are positive and significant whereas the domestic beta of restricted shares is insignificant. These results do not fit the mean-variance model of section 2 since one would expect the world beta of unrestricted shares to have a negative coefficient. If we use our alternative proxy for the Swiss market portfolio, the same results hold for the period before the Nestlé event; afterwards, the coefficient on the world beta of unrestricted shares is positive and significant, whereas the other coefficients are positive and insignificant.

The mean-variance model of section 2 shows that the risk premium on restricted shares should depend on the cost of hedging these shares and on the covariance of the return of these shares with a hedge portfolio and with the domestic portfolio of restricted shares. Hence, there is no role in that model for a firm's relative supply of unrestricted shares, defined as the total face value of bearer shares and participation certificates divided by the total face value of registered shares, to affect its log price ratio. The relative supply of unrestricted shares has a significant negative effect on the log price ratio for the period before the Nestlé announcement (regressions (4a) and (5a)). If we use our alternative proxy for the market portfolio, the relative supply variable has a t-statistic of -1.51 in the regression equivalent to (5a); in the the regression similar to (5b), no coefficient is significant. In regression (6a), we show that, whereas the beta coefficients are not significant by themselves before the Nestlé event, the relative supply variable is significant at the 1% confidence level when the beta coefficients are omitted; the supply variable has no significant effect after the event.

The evidence in table 5 is consistent with a model where there is a downward-sloping demand curve for unrestricted shares. For instance, our model would predict the cross-sectional variation in share prices documented in table 5 if firms with demand curves with a lower intercept and a lower slope in absolute value have a greater proportion of their shares available to foreign investors and a lower price of unrestricted relative to restricted shares. Further, this evidence cannot be explained as a liquidity effect since liquidity will depend on the total supply of a share type outstanding rather than on relative supplies. After the announcement by Nestlé, however, there is no longer any evidence of a supply effect. This is not surprising since for several firms the shares have become much closer substitutes so that their relative quantities should matter less.

Section 5. The Nestlé announcement of the relaxation of ownership restrictions.

On November 17, 1988, Nestlé announced that it would allow foreign investors to buy registered shares with a limit of 3% for any investor. This announcement more than doubled the number of shares of Nestlé with voting rights available to foreign investors. Viewed in another way, before the announcement, foreign investors could hold claims to at most slightly more than one-third of the total dividend payout of Nestlé. After the announcement, they had the right to hold all of it.

Suppose that the announcement conveyed no other information than the information about share ownership. The asset pricing model derived in section 2.1. implies that the price of unrestricted shares should be unchanged following the announcement since the distribution of future dividends is unchanged and since there is no reason for the discount rates to change. In contrast, the asset pricing model would imply an increase in the value of

restricted shares because these shares are now priced on world markets rather than on the market formed by Swiss investors. Figure 3 shows that the price of the restricted shares increased dramatically during the week of the announcement from SFr. 4,245 to 5,782. However, it also shows that the unrestricted shares fell by SFr. 2,079 from SFr. 8,688 to 6,609.

This fall of about 25% in the value of unrestricted shares cannot be understood in the context of the mean-variance model of section 2.1., but it is makes sense viewed from the perspective of our theory as explained in section 2.2. In that section, we argue that an increase in the supply of unrestricted shares leads to a fall in their price as well as in the price of unrestricted shares of other firms because foreign investors have a downward sloping demand curve for unrestricted shares.

The drop in the price ratio of unrestricted to restricted shares associated with the announcement is dramatic also. Table 2 shows that the price ratio for Nestlé is about 2 before the announcement. After the announcement, it drops to an average of 1.07. To explain a decrease in the price ratio of this magnitude through changes in the risk premium of unrestricted shares would require, in the simplest dividend discount model, almost a doubling of the risk premium. Since there is no dramatic decrease in stock prices throughout the world at that time, one would have to explain the fall by a change in beta. There is no evidence of a dramatic fall in beta either.

The price ratio falls for other firms at the time of the Nestlé announcement, but not for all firms. The typical firm for which the average price ratio for the subperiod after the announcement is more than two standard deviations lower than the average price ratio for the subperiod before the announcement is a firm with an average price ratio before the announcement in excess of 2. Hence, firms whose unrestricted shares were highly valued by foreign investors experienced a fall. This fall can be attributed to the increase

in the supply of unrestricted shares and to the belief that other firms would follow Nestlé in relaxing the ownership restrictions.

We have not been able to locate other news that could explain such a drop in the price ratio for so many firms during the week of the Nestlé announcement.[16] For most of these firms, the price ratio had little volatility before the announcement. The average price ratio for Nestlé for the subperiod before the announcement was 2.0 with a volatility of 0.04. Hence, the drop in the price ratio is equivalent to a drop of more than 20 standard deviations!

The dramatic loss in value of the unrestricted shares takes place against an increase in the market value of Nestlé of 10%, as measured by the total value of all three categories of shares. This increase is even more dramatic since during that week only two other firms experienced an increase in market value in our sample. Hence, the Nestlé announcement increases firm value as we would expect. The obvious question for which we have no answer is why Nestlé waited to make its announcement until it had such an impact on firm value.

Three explanations at least could be given for the increase in the market value of Nestlé that are not related to our theory. One view is that the ownership restrictions enable management to entrench itself. With this view, one could argue that the market reacted favorably because the announcement reflected confidence by management in how it would be evaluated by shareholders and hence confidence in the future of the company.[17] The second explanation is that Nestlé made that move so it could be a more active player in the European Economic Community. The third possible explanation

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[16] Neither can Loderer and Jacobs (1992).

[17] This view has been put forward by Hermann and Santoni (1989).

that the Nestlé shares became more liquid. None of these arguments, wever, can explain why the unrestricted shares fell so dramatically. The first o arguments suggest that the unrestricted shares should have increased in lue since the information represents good news for the company; the third gument predicts little or no effect on the unrestricted shares since their uidity would change little.

ction 6. Concluding remarks.

In this paper, we argue that in the presence of differential demands r domestic shares by domestic and foreign investors, firms will want to scriminate between these investors and that this discrimination explains why ms may want to restrict the ownership of some shares to domestic investors ly. Our evidence obtained using Swiss data is supportive of the price scrimination hypothesis for ownership restrictions.

Appendix

Assume that there are N_R restricted shares and N_U unrestricted shares. Let $\underline{V}_R$ be the N_R x N_R variance-covariance matrix of returns on the R shares, $\underline{V}_{RU}$ be the N_R x N_U covariance matrix of returns of R shares with returns of U shares, $\underline{V}_U$ be the N_U x N_U variance-covariance matrix of returns of U shares, $\underline{\mu}_R$ be the N_R x 1 vector of expected excess domestic returns on the R shares relative to the domestic risk-free rate, $\underline{\mu}_H$ be the N_U x 1 vector of expected excess returns on the U shares relative to the domestic risk-free rate, and T be the absolute risk-tolerance of the representative domestic investor.

Consider a domestic investor who maximizes E(W') - (1/2T)Var(W'), where E(W') is the expectation of the investor's terminal wealth W' and Var(W') is the variance of his terminal wealth. T has the interpretation of a coefficient of absolute risk tolerance if investors have negative exponential utility and returns are normally distributed (see, for instance, Eun and Janakiramanan (1986)). We henceforth use this interpretation. With our assumptions, the domestic investor maximizes his objective function subject to the short-sale constraints on unrestricted shares. Hence, the domestic investor's optimization problem is to maximize:

$$L = (\underline{w}_R'\underline{\mu}_R + \underline{w}_U'\underline{\mu}_U + r)W - \frac{1}{2T}(\underline{w}_R'\underline{V}_R\underline{w}_R + \underline{w}_U'\underline{V}_U\underline{w}_U + 2\underline{w}_U'\underline{V}_{UR}\underline{w}_R)W^2 + \underline{w}_U'\underline{\lambda}_U W \qquad (A1)$$

where r is the domestic risk-free rate, $\underline{V}_{UR}$ is the transpose of $\underline{V}_{RU}$, and $\underline{\lambda}_U$ is the vector of Lagrangean multipliers associated with the short-sale constraint. The first-order conditions for this problem with respect to the portfolio weights are:

$$\frac{\delta L}{\delta \underline{w}_R} = \underline{\mu}_R W - T^{-1}[\underline{V}_R \underline{w}_R + \underline{V}_{RU} \underline{w}_U]W^2 = 0 \qquad (A2)$$

$$\frac{\delta L}{\delta \underline{w}_U} = \underline{\mu}_U W - T^{-1}[\underline{V}_U \underline{w}_U + \underline{V}_{UR} \underline{w}_R]W^2 + \underline{\lambda}_U W = 0 \qquad (A3)$$

emultiplying (A2) by $\underline{V}_R^{-1}$ and (A3) by $\underline{V}_U^{-1}$ yields the N_R x 1 vector of manded portfolio weights for R shares, $\underline{w}_R$, and the respective N_U x 1 vector U shares, $\underline{w}_U$:

$$\underline{w}_R W = T\underline{V}_R^{-1}\underline{\mu}_R - \underline{V}_R^{-1}\underline{V}_{RU}\underline{w}_U W \qquad (A4a)$$

$$\underline{w}_U W = T\underline{V}_U^{-1}[\underline{\mu}_U + \underline{\lambda}_U] - \underline{V}_U^{-1}\underline{V}_{UR}\underline{w}_R W \qquad (A4b)$$

e asset demands of domestic investors have a straightforward interpretation. r each class of shares, the domestic investor's demand can be decomposed o investments in two mutual funds which have holdings proportional to the o terms of the asset demands. The first fund is the fund that maximizes the io of expected excess return to variance of excess return for that class of ıres subject to the short-sale constraints; if the short-sale constraints are non-ıding, this fund has investments proportional to the tangency portfolio in an-variance space for that class of shares. The second fund is a minimum riance hedge fund that hedges the domestic investor's holdings of the other ss of shares. Domestic investors take positions in these hedge funds because y want to lay off the diversifiable risks associated with the restricted and restricted shares they hold.

Since restricted and unrestricted shares have identical dividends, one uld expect their returns to be perfectly correlated in a one-period model. nce, in this model, the short-sale constraint on the holdings of unrestricted ıres by domestic investors are usually binding since these shares would ıerwise be sold short to hedge the holdings of restricted shares that

domestic investors have in equilibrium.

Let $\underline{M}_R$ be the N_R x 1 vector of supplies of restricted shares per domestic investor. In equilibrium, $\underline{M}_R = \underline{w}_R W$. Substituting this equilibrium condition in the asset demand equation (A4a) and using equation (A4b) to eliminate $\underline{w}_U$ yields:

$$\underline{M}_R = T\underline{V}_R^{-1}[\underline{\mu}_R - \underline{V}_{RU}\underline{V}_U^{-1}(\underline{\mu}_U + \underline{\lambda}_U)] + \underline{V}_R^{-1}\underline{V}_{RU}\underline{V}_U^{-1}\underline{V}_{UR}\underline{M}_R \qquad (A5)$$

Premultiplying by $\underline{V}_R$ and rearranging yields:

$$[\underline{V}_R - \underline{H}\underline{V}_{UR}]\underline{M}_R = T[\underline{\mu}_R - \underline{H}(\underline{\mu}_U + \underline{\lambda}_U)] \qquad (A6)$$

where $\underline{H}$ is a matrix where the i-th row is the minimum-variance hedge portfolio for the i-th restricted security, that is $\underline{H} = \underline{V}_{RU}(\underline{V}_U)^{-1}$.[18] Note now that $\underline{M}_R/W$ is equal to $\underline{w}_R$ in equilibrium. However, $1'\underline{w}_R = \delta < 1$, where δ is the fraction of domestic wealth invested in restricted shares. Hence, $\underline{w}_R/\delta = \underline{m}_R$ is a portfolio whose weights sum to one and we call it the market portfolio of restricted shares. In this case, we can rewrite equation (A6) as:

$$[\underline{V}_R - \underline{H}\underline{V}_{UR}]\delta\underline{m}_R = T^R[\underline{\mu}_R - \underline{H}(\underline{\mu}_U + \underline{\lambda}_U)] \qquad (A7)$$

where $T^R = T/W$. The i-th row of this vector corresponds to equation (1a). Note now that the covariance of the matrix of hedge portfolios with the tangency portfolio of unrestricted securities, $\underline{w}^* = \underline{V}_U^{-1}\underline{\mu}_U$, is the covariance of the restricted securities with the tangency portfolio as claimed in the text because:

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[18] The investment proportions of the various portfolios discussed here can be made to sum to one through risk-free lending or borrowing without changing the properties of the excess returns.

$$\underline{H}\underline{V}_U(\underline{V}_U^{-1}\underline{\mu}_U) = \underline{V}_{RU}\underline{V}_U^{-1}\underline{V}_U w^* = \underline{V}_{RU} w^* \qquad \text{(A8)}$$

The portfolio of risky securities held by foreign investors is simply the tangency portfolio of unrestricted securities. Premultiplying the demand from foreign investors by the variance-covariance matrix of unrestricted share returns yields the pricing equation (1b) for unrestricted shares.

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Table 1. Characteristics of Firms

Market value is total value of bearer and registered shares and participation certificates at average prices over 1989. Face values are in SFr. at the end of 1989. Number of shares are in thousands. Source: Swiss Stock Guide (various issues).

Firm	Symbol	Market value Mio.SFr.	Large shareholder	Bearer share Face value / Number	Registered share Ownership restrictions (1989)	Registered share Face value / Number	Participation certificate Face value / Number
Alusuisse	ALU	2,421	No	250 1,351	Up to 3% per holder	125 1,492	25 1,624
Brown-Boveri	BBC	5,956	No	500 1,007	Up to 7% per holder	100 1,007	100 1,875
Banca della Svizzera Italiana	BSI	987	2 holders jointly control	500 267	Residents only	100 320	100 663
Ciba-Geigy	CIG	15,790	No	100 749	Swiss only, up to 2% per holder	100 3,512	100 1,138
Feld-schlösschen	FEL	556	Several large holders	250 38	Swiss only	100 192	100 100
Georg Fischer	FIS	714	Employee fund holds 10%	500 280	Swiss up to 4,000 shares, foreigners up to 400 shares per holder	100 420	100 526
Globus	GLO	699	Trust controls	500 44	Residents only	500 22	100 267
Haldengut	HAG	195	Large minority holder	100 20	Discretion	100 40	100 20
Jacobs	JAC	4,887	Trust controls	500 435	Swiss only	100 1,066	50 632
Konsumverein Zürich	KVZ	383	No	250 41	Residents only, up to 2% per holder	100 160	50 65
Nestlé	NES	26,218	No	100 1,073	Up to 3% per holder	100 2,227	20 1,150
Oerlikon-Bührle	OEB	1,716	Trust holds 45% of votes	250 1,000	Up to 50,000 shares per holder	100 1,299	100 240
Rück-versicherung	RUK	1,611	No	100 44	Swiss only, up to 3% per holder	100 400	20 860
Sandoz	SAN	14,407	No	250 155	Up to 2% per holder	250 1,043	50 1,305

Table 1. Characteristics of Firms (cont.)

Firm	Symbol	Market value Mio.SFr.	Large shareholder	Bearer share Face value	Bearer share Number	Registered share Ownership restrictions (1989)	Registered share Face value	Registered share Number	Participation certificate Face value	Participation certificate Number
Schweiz. Bankgesellschaft	SBG	16,370	No	500	3,590	Residents only, up to 5% per holder	100	3,800	20	9,026
Schweiz. Bankverein	SBV	11,233	No	100	13,838	Swiss only, up to 2% per holder	100	14,204	100	8,936
Schindler	SCH	1,162	Trust controls	500	31	Residents only	100	751	100	282
Winterthur-Versicherung	WIN	4,854	No	100	270	Swiss only, up to 10,000 shares per holder	100	730	20	1,760
Zürich-Versicherung	ZUR	8,462	No	100	400	Swiss only, up 15,000 shares per holder	100	1,100	50	1,100

Table 2. Price Ratios

Price of unrestricted share/price of restricted share. Observations are weekly (Wednesday close). Total period extends from 1/2/85-12/-27/89. Subperiods: Before Crash (1/2/85-9/30/87), Crash-Nestlé (11/4/87-11/16/88), after Nestlé (11/23/88-12/27/89). Price ratios for portfolios are averages for individual shares. Short sales (no short sales) portfolios include all shares involving short sales (no short sales) of participation certificates to construct unrestricted share.

Firm	Average price ratio				Maximum	Minimum
	Total period	Before Crash	Crash-Nestlé	After Nestlé		
ALU	1.62	1.66	1.72	1.43	2.01	1.23
BBC	1.83	1.77	2.27	1.56	2.65	1.07
BSI	1.66	1.59	1.63	1.84	2.55	1.06
CIG	1.91	2.12	2.02	1.27	2.42	1.17
FEL	1.24	1.21	1.25	1.31	1.50	0.93
FIS	2.08	2.12	1.78	2.26	2.86	1.00
GLO	1.17	1.26	1.14	1.00	1.70	0.90
HAG	1.05	1.06	1.05	0.99	1.36	0.87
JAC	1.34	1.02	1.86	1.57	2.46	0.24
KVZ	1.50	1.50	1.39	1.48	1.95	0.60
NES	1.76	1.94	2.00	1.07	2.17	1.00
OEB	2.40	2.57	2.69	1.67	3.21	1.37
RUK	2.20	2.61	2.03	1.37	3.21	1.20
SAN	2.23	2.60	2.38	1.17	2.89	1.03
SBG	1.34	1.29	1.44	1.35	1.66	1.02
SBV	1.24	1.29	1.25	1.12	1.50	1.06
SCH	2.12	1.70	3.29	1.97	3.87	0.94
WIN	1.87	2.05	1.98	1.30	2.37	1.16
ZUR	1.88	2.04	2.10	1.28	2.37	1.16
Portfolios						
All shares	1.71	1.76	1.86	1.42	1.99	1.35
Short sales	1.71	1.65	1.93	1.64	2.16	1.48
No short sales	1.70	1.88	1.77	1.18	2.10	1.12

Table 3. Co-integration Tests

The test is a unit root test in the natural logarithm of the price ratio of unrestricted/restricted shares. The growth rate of the price ratio is regressed on a constant and the level of the price ratio (in logs) lagged one week. Therefore, the co-integrating vector is set equal to (α, 1). The growth rate lagged one week is included to account for possible autocorrelation in the dependent variable. Co-integration is not rejected if the t-value is larger in absolute value than the critical value. Observations are weekly (Wednesday close). Total period extends from 1.2.85-12.27.89. Subperiods: Before Crash (1.2.85-9.30.87), Crash-Nestlé (11.4.87--11.16.88), after Nestlé (11.23.88-12.27.89). Obs. is number of observations. Price ratios for portfolios are averages for individual shares. Short sales (no short sales) portfolios include all shares involving short sales (no short sales) of participation certificates to construct unrestricted share.

Firm	Total period	Before Crash	Crash-Nestlé	After Nestlé
Obs.	259	142	55	58
Critical values				
5 %	-2.88	-2.88	-2.91	-2.91
1 %	-3.48	-3.48	-3.55	-3.55
ALU	-2.83	-2.59	-1.88	-2.56
BBC	-3.18	-3.51	-3.41	-3.24
BSI	-3.05	-2.18	-1.22	-1.33
CIG	-0.93	-2.54	-2.29	-9.08
FEL	-3.07	-2.36	-2.79	-1.10
FIS	-3.03	-2.45	-1.49	-1.33
GLO	-1.57	-1.60	-3.20	-3.18
HAG	-4.07	-2.65	-4.22	-2.68
JAC	-2.11	-1.60	-2.38	-4.36
KVZ	-3.97	-2.75	-2.78	-2.39
NES	-0.47	-3.22	-3.63	-18.26
OEB	-1.50	-1.71	-3.01	-3.79
RUK	-0.79	-1.61	-2.71	-5.89
SAN	-0.08	-2.40	-0.95	-7.42
SBG	-4.97	-4.55	-2.34	-3.55
SBV	-1.80	-1.84	-1.53	-4.51
SCH	-2.01	-1.58	-2.32	-3.57
WIN	-1.07	-2.99	-2.44	-8.56
ZUR	-1.09	-2.27	-2.32	-8.17
Portfolios				
All shares	-1.07	-1.74	-2.13	-11.51
Short sales	-2.16	-1.44	-0.96	-6.54
No short sales	-0.33	-2.32	-2.58	-14.00

Table 4. Differences in Returns

Differences in returns in percent per week between unrestricted and restricted shares. Observations are weekly. Total period extends from 1/2/85-12/27/89. Subperiods: Before Crash (1/2/85-9/30/87), Crash-Nestlé (11/4/87-11/16/88), after Nestlé (11/23/88-12/27/89). Return differences for portfolios are averages for individual shares. Short sales (no short sales) portfolios include all shares involving short sales (no short sales) of participation certificates to construct unrestricted share. None of the average differences in returns is significantly different from zero. Underlined autocorrelations are significantly different from zero at the 10% level. Results are robust across subperiods (not shown).

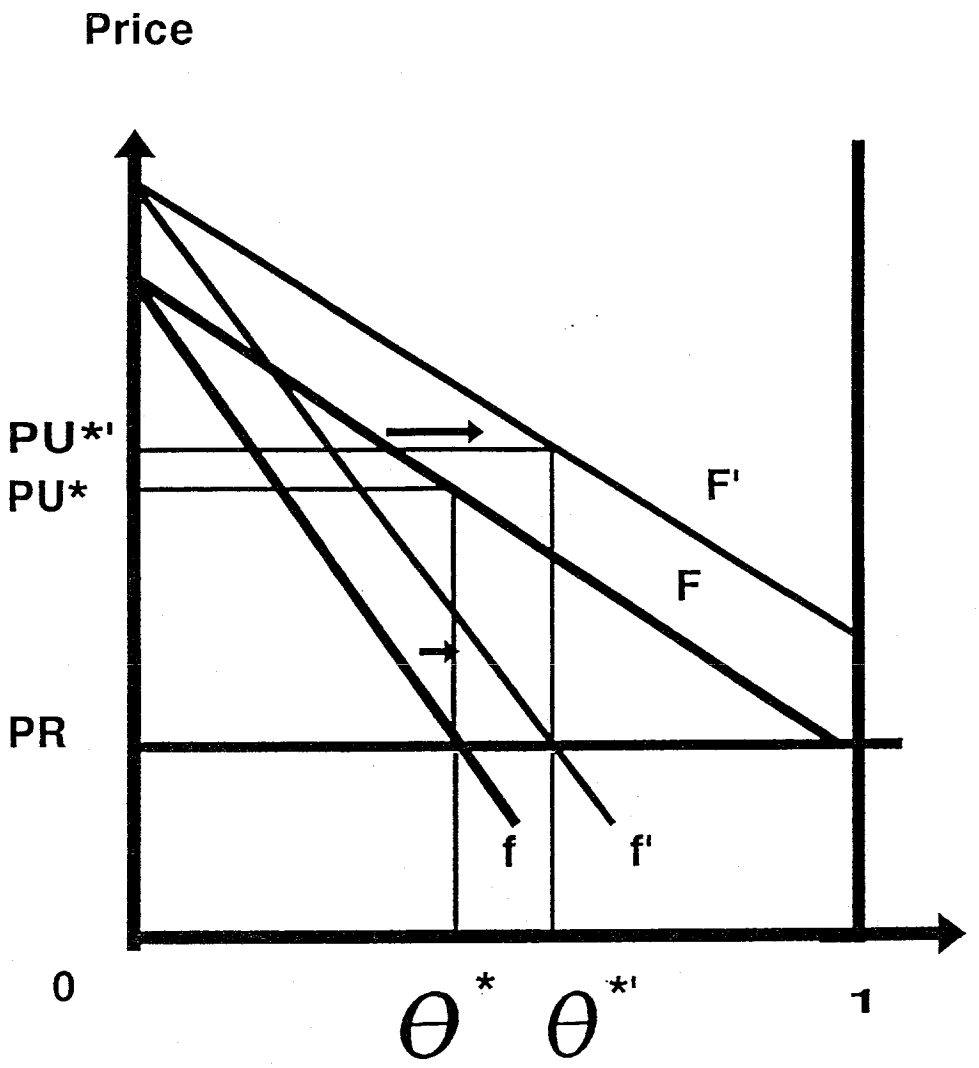
Firm	Average (%/week)				Autocorrelations (total period)			
	Total period	Before Crash	Crash-Nestlé	After Nestlé	Lag 1	Lag 2	Lag 3	Lag 4
ALU	0.0006	0.0695	0.3401	0.3071	-0.22	-0.08	-0.01	0.13
BBC	-0.0681	0.0873	0.5565	-0.6756	-0.26	-0.04	-0.10	0.03
BSI	-0.0020	0.1416	0.3692	-0.6708	-0.03	-0.17	-0.11	0.10
CIG	-0.2496	-0.1257	0.1198	-0.0609	0.12	-0.06	-0.12	0.07
FEL	0.0562	0.0863	-0.4004	0.4168	-0.25	-0.12	0.09	0.05
FIS	0.0316	-0.0413	1.4181	0.5048	-0.22	-0.03	-0.05	-0.02
GLO	-0.1268	-0.1912	0.2053	-0.2718	-0.27	-0.09	-0.04	0.07
HAG	-0.0732	0.0903	0.0332	-0.2095	-0.35	-0.02	-0.20	0.20
JAC	0.1294	0.5240	-0.3563	-0.2515	-0.16	-0.21	0.15	-0.13
KVZ	-0.0056	-0.1563	1.2525	0.1005	-0.17	-0.10	0.02	-0.02
NES	-0.2630	0.0652	0.0985	-0.2664	-0.01	0.00	0.02	-0.04
OEB	-0.2199	-0.0787	-0.2009	-0.2364	-0.11	-0.16	0.03	0.06
RUK	-0.2305	-0.0463	0.3800	-0.0862	0.01	0.06	-0.15	0.08
SAN	-0.3705	-0.1279	-0.1416	-0.3892	0.01	0.03	-0.02	0.10
SBG	-0.1336	-0.0959	0.1761	-0.4503	-0.10	-0.22	-0.11	-0.05
SBV	-0.1234	-0.0533	0.0446	-0.2168	-0.08	-0.02	0.00	-0.02
SCH	-0.0530	0.4193	0.3353	-0.7263	-0.36	0.01	-0.03	0.04
WIN	-0.1670	0.0210	0.4839	-0.0866	0.00	-0.02	0.03	-0.05
ZUR	-0.1114	0.1217	0.2794	-0.0179	-0.01	0.02	0.12	-0.11
Portfolios								
All shares	-0.0702	0.0767	0.3016	-0.2510	0.04	0.12	-0.02	-0.02
Short sales	0.0002	0.1291	0.4604	-0.2962	-0.06	0.01	-0.05	-0.12
No short sales	-0.1530	0.0184	0.1251	-0.2008	0.08	0.10	-0.06	0.10

Table 5. Cross-sectional Regressions of the Natural Logarithm of the Average Estimation Period Price Ratio Between Unrestricted Shares and Restricted Shares.

The sample consists of 19 firms. Estimation is by ordinary least squares using the correction for heteroskedasticity developed by White (1980). Estimation periods: Crash-Nestlé event (11/4/87-11/16/88) for a-labelled regressions and Nestlé event-end-of-sample (11/23/88-12/27/89) for b-labelled regressions. t-values are in parentheses under the estimated parameters. Underlined coefficients are significantly different from zero at the 10%. The various betas are estimated over the prior subperiod (the subperiod before the Crash is 1/2/85-9/30/87). The portfolio of restricted shares is a value weighted portfolio of the restricted shares in the sample. The domestic portfolio is measured by the stock market index compiled by Swiss Bank Corporation. The world portfolio is approximated by the Morgan Stanley Capital International World Stock Market Index, expressed in SFr. A firm's relative total face value is the total face value of bearer shares and participation certificates divided by total face value of registered shares.

Period	Constant	Beta of restricted shares with respect to		World beta of unrestricted shares	Relative total face value	Adjusted R^2
		Domestic portfolio	World portfolio			
1a	0.27 (1.79)	0.32 (1.59)		0.27 (1.15)		0.13
1b	-0.06 (-0.49)	0.13 (1.20)		0.27 (1.71)		0.22
2a	0.21 (1.20)	0.22 (0.87)	0.50 (0.87)	0.20 (0.72)		0.12
2b	-0.10 (-0.95)	-0.14 (-0.74)	0.38 (1.80)	0.28 (1.72)		0.28
4a	0.24 (1.30)	0.45 (1.74)		0.16 (0.54)	-0.01 (-1.80)	0.24
4b	-0.13 (-1.00)	0.22 (2.95)		0.30 (2.11)	-0.01 (-1.03)	0.34
5a	0.21 (1.09)	0.39 (1.19)	0.28 (0.46)	0.12 (0.38)	-0.01 (-1.71)	0.20
5b	-0.13 (-1.09)	0.20 (1.38)	0.04 (0.17)	0.29 (1.77)	-0.01 (-0.89)	0.29
6a	0.64 (7.84)				-0.02 (-3.32)	0.07
6b	0.35 (5.98)				-0.01 (-0.58)	-0.04

Figure 1

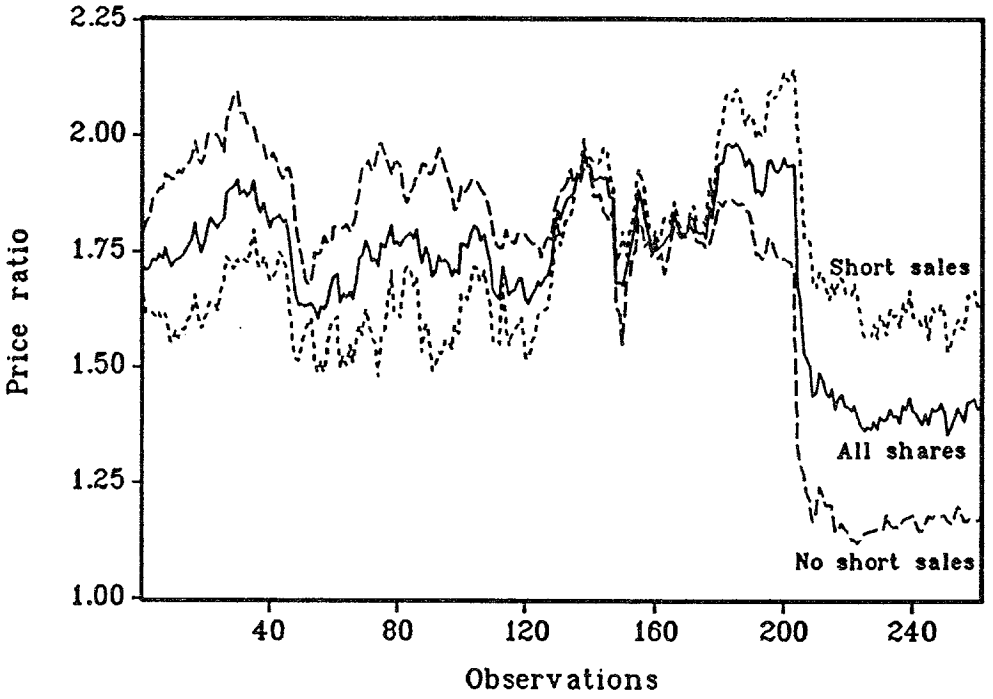


Marginal revenue for unrestricted shares

Demand for unrestricted shares

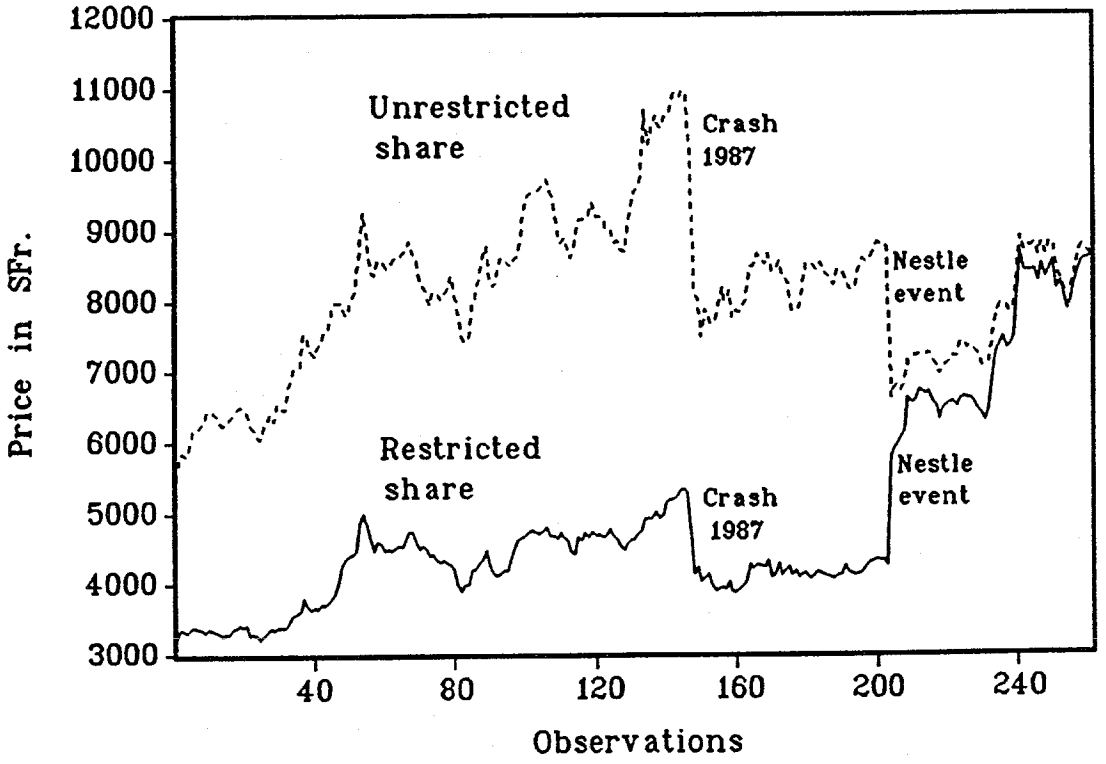
Demand for restricted shares

Figure 2. Price Ratio Unrestricted/Restricted Shares



This figure shows the average of the price ratios of restricted to unrestricted shares for the 18 firms in the sample from January 2, 1985, to December 27, 1989.

Figure 3. Prices for Nestle Shares



This figure shows the prices of restricted and unrestricted share for Nestlé from January 2, 1985, to December 27, 1989.