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ABSTRACT

How does a firm in one country evaluate an investment in a firm in another country, or how does it evaluate a foreign project that the firm itself is undertaking? The firm must estimate future free cash flows just as in a domestic project, but choosing an appropriate discount rate is a particular challenge. This study examines the determinants of the discount rate for an international acquisition or project by examining the sources of risk in an international setting. These risks include stock-market price risk measured with various versions of the capital asset pricing model, as well as exchange rate risk and political risk. To measure stock market risk, both segmented and integrated models of the world equity markets are considered. The emphasis of the study is on some of the practical aspects of estimation, particular for markets where no comparable investments exist on which to base estimates of risk premiums. To show how each of these risks might be measured, the study reports estimates for a representative French firm, Thalès. The estimates range widely depending on whether or not the equity market is globally integrated.

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How does a firm in one country evaluate an investment in a firm in another country, or how does it evaluate a foreign project that the firm itself is undertaking? Both questions are increasingly important as international mergers and acquisitions grow and as firms become more multinational in their operations. As in domestic finance, answers to these questions require that the firm estimate future free cash flows to equity of the investment and discount these cash flows at some appropriate discount rate. The discount rate reflects the investment's cost of equity financing.

Domestic finance teaches us that the classic Capital Asset Pricing Model (CAPM) allows a systematic comparison of the costs of equity of various traded firms. The classic CAPM recognizes but one source of risk and one risk premium to be charged on a share of stock; namely, the systematic risk or risk of covariation of the stock with the broader equity market, captured by the equity's β.[2] The discount rate for equity-financed projects is based on this β times the ***equity market premium***, or the excess return of the broad equity market portfolio over the risk-free rate. In the international setting, it's not obvious which country's equity market premium should be used in the evaluation, that of the acquiring firm or that of the target firm. In the international setting, moreover, the matter is more complicated because there may be more dimensions of risk for which financial market participants require a premium. The focal point of the discussion is then the method by which the various dimensions of risk are incorporated in the cost of equity that we seek.

[2] More recent forms of the CAPM recognize that there may exist more than one risk premium that the market charges on a share of stock. See Fama and French (1996).

The following example will help to illustrate some of the issues involved in cross-border cost of capital estimation. In July 1998, the Indonesian government decided to privatize a cement firm, PT Semen Gresik, opening the bidding to firms throughout the world. Cemex, a Mexico based firm, competed with Holcim, a Switzerland based firm, in the bidding process. In advising Cemex, the French investment bank Paribas proposed to base the bid on a discounted cash flow model using CAPM as the basis for valuation. But which country's stock market premium should be used for this valuation, that of the Indonesian market or the Mexican market? The valuation might vary widely depending on whether the CAPM was applied to one market or another. Would Holcim evaluate the Indonesian firm differently because it was based in Switzerland? How should Cemex take into account the political risk associated with ending of the Suharto regime? The CAPM is not suited to measure political risk, so how should the discount rate for the project be adjusted to account for this additional risk?

If the world's stock markets were fully integrated, acquiring firms from different countries would evaluate an acquisition in the same way. Cemex, and Holcim, would base their discount rates for the acquisition on the same (world-wide) equity premium. Since both potential acquirers would measure the beta of PT Semen Gresik vis-à-vis the same world index, they would use the same discount rate for the cash flows (in a given currency). If the cash flows expected by each bidding firm were identical, Cemex and Holcim would come up with the same valuation for the Indonesian firm. But what if markets are not fully integrated? What approach does one use then? ? This study will consider these questions directly.

A second example will illustrate an additional problem with measuring the cost of equity capital. In November 1994, Westmoreland Coal Company, a U.S. based firm, intended to invest $ 540 million in an electric power project located in Zhangze, China. In the Chinese market, there is no comparable publicly-traded project from which to calculate a local β. This is a common problem in many projects in developing economies. Should Westmoreland measure the beta using the returns of electric companies in the U.S.? How should it adjust those returns for the beta of China's market vis-à-vis the U.S. market? If so, should it use China's equity premium or the U.S. equity premium? And how should it account for China's political risk? These are the types of questions addressed in this study.

Let's just focus on equity premiums alone. A record of equity premiums in sixteen countries, based on one hundred yearly observations is provided in a recent book by Dimson, Marsh and Staunton, Triumph of the Optimists (2002). Figure 1 displays these equity premiums measured in the respective local currency. Because the currency units differ, these numbers are not directly comparable. Currency movements, however, are not so large as to dramatically alter the general picture: equity premiums differ from country to country. Their differences are economically meaningful: many more investment projects would be deemed acceptable when using the equity premium of Denmark (below 4%/year) than when using the equity premium of Italy (11%/year). Furthermore, differences would be even more stark if more countries were considered, or if sub-periods of the 20th century were examined.

Nonetheless, many of these differences are not statistically significant.[3] This observation led Goetzman and Jorion (1997) to entertain the hypothesis that the differences observed across countries were only differences arising from statistical sampling. Investors invested in Italy during the 20th century turned out to be lucky but they did not expect such a return. Therefore, one should not look at the numbers in

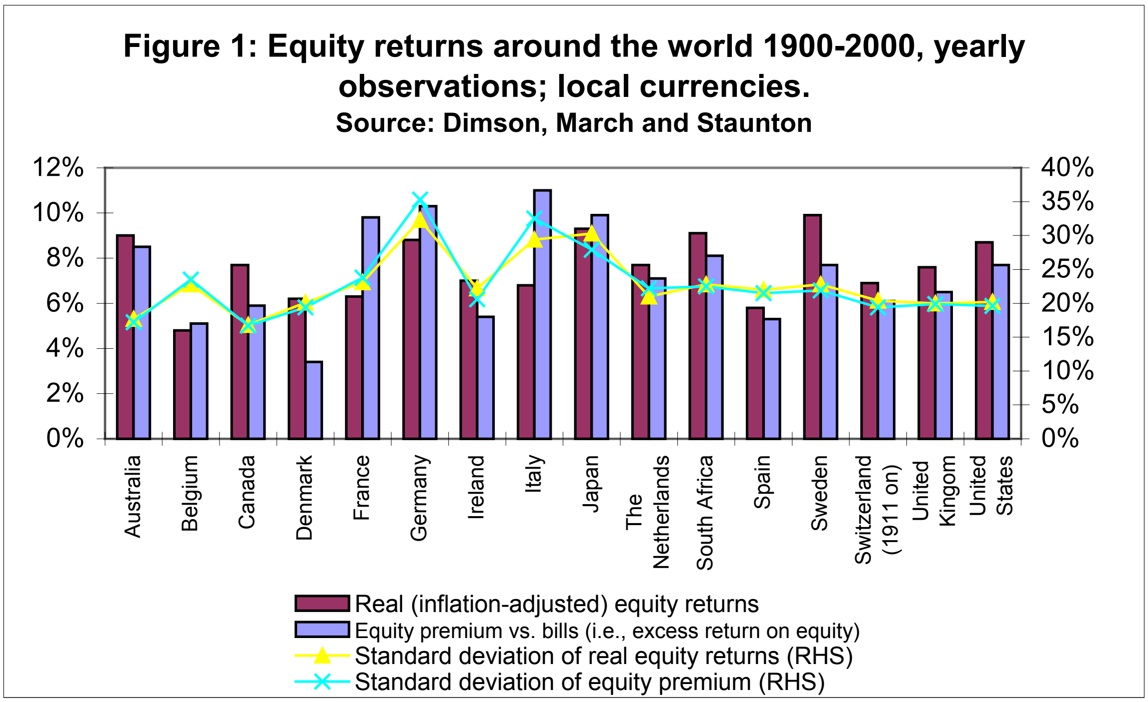

Figure 1 as having differed *ex ante* or as representing expected returns that were required by investors. They are just differences in the realized averages. Under this hypothesis, the premium based on the largest number of observations, namely the world premium, is the best estimate we have.[4] It turns out to be equal to 6.2%.[5]

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[3] In Figure 1, the right-hand scale is for standard deviations. The lines, as opposed to the bars, indicate the standard deviations of the realized premiums of each year (the rate of return of that year in excess of the riskless rate in the local currency) or of the deflated return. The standard deviations of the estimates of expected values of equity premiums are equal to these numbers divided by $\sqrt{100} = 10$, since there are 100 years of observations in this sample. This gives a visual impression of the degree of significance.

[4] The world equity premium is weighted by the market capitalizations of the various countries, whereas the most reliable estimate (the most efficient, in statistical language) should be weighted in inverse proportion to the variance of the average equity premium of each country.

To the extent that equity premiums differ across the world in an economically meaningful way and to the extent that some are statistically significantly different from each other, one would like to know, when evaluating a project in a country, whether one should use the local premium (the premium observed in the country where the project is to be undertaken), the home premium (the premium observed in the country where capital comes from) or the world premium. One would also like to know whether the differences in premiums are the sign of some segmentation of the financial markets of the world along country lines. In other words, is capital cheaper in some places than others? If it is, a further recommendation can be provided concerning the market where capital should be raised.

The balance of this study is organized as follows. In Section 1, we review briefly the dimensions of risk that prevail in the world economy and that are systematic enough to receive a non-zero price in the financial market(s) of the world. In Section 2, we describe the way in which the classic CAPM could be applied in a world context. In Section 3, we consider the possibility that each dimension of risk could receive a different price, the various premiums being added together to reach the total required rate of return. We call this model the multi-β, or hybrid, CAPM. In Section 4, we show that currency risk is a dimension of risk, which theoretically should receive a special price, leading to the so-called "International CAPM". In Section 5, we briefly discuss the pricing of political risk. Finally, in Section 6, we consider the delicate problem of

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[5] Fama and French (2002) take that line of reasoning one step further. Even the most reliable estimate, say the world average, is only an estimate, or a realized number, not an expected rate of return. We may have legitimate reasons to argue that the realized average is too large or too small. Suppose, for instance, that it can be argued that required returns have slowly drifted down during the second half of the 20th century. During that period, therefore, stock prices rose, producing higher than expected rates of returns. When we look at these realized returns *ex post* as estimates of *ex ante*, or expected, or required, returns, we make a mistake.

transposing required premiums observed on a subset of securities, say the equity of corporations operating in a subset of countries, to another subset of securities, a problem which arises in many practical situations, especially when investing in developing countries. Section 7, the conclusion, recapitulates the main points made in this study.

1. The dimensions of risk in the world

The main lesson of portfolio theory is that only systematic risks, i.e. risks to which many securities are exposed, can fetch a non-zero premium in the financial market. An investor who bears other dimensions of risk, that are specific to each security, receives no reward because he could have diversified that risk away.

What are the dimensions of risk in the world financial market that are sufficiently systematic to receive a non-zero reward? We can think of at least six such dimensions. For each dimension, it is not enough to surmise that it receives a non-zero price. We need also have in mind some index of security market prices that uniquely carries this risk and can, therefore, help us determine what the going price is.

- The ***world*** stock-market price risk. The classic CAPM says that this is the only systematic source of risk but we intend to go beyond the classic CAPM. The index of traded securities that carries this risk is, of course, the worldwide stock market index. The fundamental source of this dimension of risk is the fluctuation in worldwide business activity.
- The stock-market price risk of each ***country***. This risk is specific to the securities of that country, but systematic to all of them. The index that carries this risk is each

country's stock market index.[6] The fundamental source of this dimension of risk is the fluctuation in the country's business activity. When world and country dimensions are taken into account jointly, the fundamental source of this dimension of risk is the fluctuation in the country's business activity that deviates from world business activity.

- The stock-market price risk of each ***industry***. This risk is specific to the securities issued by firms of that industry, but systematic to all of them. The index that carries this risk is each industry's stock market index calculated across the world.[7] The fundamental source of this dimension of risk is the worldwide fluctuation in the industry's business activity. When world, country, and industry dimensions are taken into account jointly, the fundamental source of this dimension of risk is the fluctuation in the industry's business activity that deviates from world and countries' business activity.
- ***Exchange rate*** risk affects many firms, depending on their foreign-exchange exposures. The index of return is provided by returns on foreign-currency deposits.
- ***Political*** risk *cum* crisis risk comprises the risk that the securities issued by entities of a country may be in default. It is the risk generally that legal, financial contracts will not be enforced. A possible return index is provided by sovereign bonds returns. We discuss in Section 5 the validity of these returns as indexes of political risk pricing.

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[6] As an alternative to calculating stock market index return for each country, which is an arithmetic average of securities return that trade on the stock market of the country, one can utilize a cross-sectional statistical technique that reveals the factor, i.e., the dimension of rates of return, that is common to all the securities of the country (here this can mean the securities that trade on the stock market of the country, or it can mean the securities of the firms that operate in the country). See the various models of the consulting firm BARRA, or the work of Heston and Rouwenhorst (1994). The drawback of this approach is that it posits that a firm listed in one country has an exposure equal to 1 to the country factor.

[7] Here again, one can utilize a cross-sectional statistical technique that reveals the factor that is common to all the securities of the industry. This approach would posit that a firm belonging to an industry has an exposure equal to 1 to the industry factor.

- ***Liquidity*** risk is a dimension of risk that is especially present in developing capital markets. It represents the risk that capital gains indicated by stock market quotes can never be realized, because an attempt to realize them would produce a negative price impact. An index can be provided by the difference in rates of return between less liquid and highly liquid company shares, or by differences in rates of return between country capital markets where liquidity is low and those where liquidity is high. We do not discuss this dimension of risk any further in this study.[8]

2. The classic CAPM applied to the world

The classic CAPM asserts that the risk carried by the market portfolio is the only dimension of risk that is priced. However, when applying the classic CAPM to the securities that exist in the world, one is confronted with a decision: which is the relevant market portfolio, the portfolio of the country of the investment, the portfolio of the country of the investor, or a global market portfolio? It depends whether we are ready to believe that the world financial market is fully integrated or, to the opposite, fully segmented along country borders. Intermediate situations will be discussed in Section 3.

2.1. Full segmentation

If the world is fully segmented, investors of one country only have access to the securities issued by the companies that trade in that country. A "domestic CAPM" prevails in each country. According to that form of the CAPM, β is measured relative to

[8] On this point, see: Chordia, Brennan and Subrahmanyam (1998) and Chordia, Roll and Subrahmanyam (2001).

the country's market index and the equity premium to be applied is the local market premium:[9]

$$E[R_i - r] = \beta_{i/c} \times E[R_c - r] \quad (1)$$

In this expression, $\beta_{i/c}$ and the expected equity premium on the local stock market, $E[R_c - r]$, together determine the risk premium on the firm's equity, $E[R_i - r]$.

In the situation of complete market segmentation, it is necessarily the case that the shareholders of a company are home stockholders, unless the company is listed in several countries or has issued Depositary Receipts in foreign countries. If a firm contemplates an investment abroad, therefore, it should use the CAPM of its home country. It should measure the β of the foreign investment, or that of a comparable traded company, relative to its *home* equity market, but it should charge the market premium that prevails in its *home* market:

As an illustration, Table 1 shows the calculation of the required premium (or required excess expected rate of return) in dollar units on the French firm Thalès (ex Thomson-CSF) from the point of view of US stockholders in the hypothetical, full-segmentation situation in which they hold US assets only. This required premium is to be added to the current value of the riskless dollar rate of interest, to obtain a required rate of return. Table 2, by contrast, shows the same calculation, with a different result, from the point of view of a French investor who holds only French assets, abstracting from the fact that a French investor would not want to calculate a required rate of return in dollar units.

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[9] As is well known, the coefficient β is equal to the slope coefficient of a simple regression, in this case, of the (excess) rate of return of a firm's equity in the stock market on the (excess) rate of return of the country market portfolio. It is the exposure of that firm's equity to the home market risk.

Table 1: Required USD premium on Thalès in a segmented market, from the point of view of US investor					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** β of Thalès vis-à-vis US market		**"Price of risk"** Equity premium on the US market		Required premium %/month
U.S. market risk	0.789	x	0.654%	=	0.516%

Table 2: Required USD premium on Thalès in asegmented market, from the point of view of French investor					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** β of Thalès vis-à-vis French market		**"Price of risk"** Average excess return on the French market		Required premium %/month
French market risk	1.065	x	0.529%	=	0.529%

The betas measured relative to the two markets are quite different. However, perhaps by accident, the risk premiums are almost the same.

2.2. Full integration

If the world is fully integrated, a company's stockholders come from many different countries because it is assumed that each one holds a globally diversified portfolio. For all investors, a "worldwide, classic CAPM" prevails in which the return premium to any investment, when measured in a specific currency unit, is the same for all investors. This is because each security's β is measured vis-à-vis the world market index and the market premium to be used is the world equity premium:

$$E[R_i - r] = \beta_{i/w} \times E[R_w - r] \tag{2}$$

If a firm contemplates an investment abroad under a full integration assumption, it should use the "worldwide, classic CAPM". It should measure the β of the foreign investment, or that of a comparable traded company, relative to the *world* equity market portfolio. It should charge the market premium for the *world* equity market portfolio. We defer to Section 4 the issue of the currency of measurement.

Table 3 shows the calculation of the required premium (or required excess expected rate of return) in dollar units on the French firm Thalès from the point of view of worldwide stockholders for the hypothetical, full-integration situation in which they hold a worldwide, diversified portfolio of equity. This required premium is to be added to the current value of the riskless USD rate of interest, to obtain a required rate of return in USD. The risk premium obtained using this method is quite different from those reported in Tables 1 and 2 using the segmented-market model. So the valuation of a project would change markedly depending on which model applied.

Table 3: Required USD premium on Thalès in the world integrated financial market

1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** β of Thalès vis-à-vis world market		**"Price of risk"** Average excess return on the world market		Required premium %/month
World market risk	0.870	x	0.267%	=	0.232%

The reader might think that currency risk is absent from the analysis, but this is not true. If the beta of Thalès were measured after being hedged for exchange risk, the result would be somewhat different from Table 3. To demonstrate this we first calculate the beta of a bank deposit denominated in Euros against the world market portfolio. The result is reported in Table 4. Observe that this foreign-currency deposit, as is typical for major currencies, has a low β vis-à-vis the world market and consequently, a low required excess rate of return.

Table 4: Required USD premium on a deposit denominated in Euros, in the world integrated financial market					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** β of deposit vis-à-vis world market		**"Price of risk"** Average excess return on the world market		Required premium %/month
World market risk	0.046	x	0.267%	=	0.012%

If Thalès obeys the "worldwide, classic CAPM" and if a currency deposit denominated in Euros obeys the "worldwide, classic CAPM", a combination of these two assets must do so as well. A share of Thalès hedged against the currency risk of the Euro is one such combination. From the USD point of view, the exposure elasticity of a Thalès share to the Euro is 0.391. This estimate can be ascertained by running a regression of the USD excess rate of return on Thalès on the USD excess rate of return on a deposit denominated in Euros. The slope coefficient is the exposure elasticity . This means that one percent increase in the USD price of a euro results in a 0.391% increase in the price of a share of Thalès. So to hedge the Thalès share from currency risk, one would need to go short a euro deposit (borrow euro) in an amount equal to 39.1% of the Thalès investment. Thus, one dollar invested in shares of Thalès hedged is one dollar invested in a unhedged share of Thalès accompanied by an Euro borrowing equal to 39.1 US cents. The net excess rate of return from this combination is equal to the excess rate of return on Thalès minus 0.391 times the excess rate of return on a deposit (loan) denominated in Euros. That net excess rate of return has a expected level required in the world financial market which is equal to the required excess rate of return on Thalès (0.232%; see Table

3) minus 0.391 times the required excess rate of return on a deposit denominated in Euros (0.012%; see Table 4). The result is equal to 0.228%.[10]

2.3. Testing integration and the classic CAPM

A person using the "worldwide classic CAPM" may want to know whether this model is compatible with actual rate of return observations in the financial market. It is difficult to produce a definitive answer to this question. If the dataset includes only returns on the equity portfolios of various countries, a typical cross-sectional picture, shown here as Figure 2, is not conclusive. However, if the dataset includes foreign-currency denominated deposits in addition to equity portfolios , a picture such as Figure 3 emerges. A slightly distinct cross-sectional line seems to appear within the cloud of points. [11]

[10] Another way to obtain the same result is to calculate the β of Thalès hedged. It is equal to the β of Thalès before hedging (0.870; see Table 3) minus 0.391 times the β of a currency deposit denominated in Euros (0.046; see Table 4). The result is 0.853. This value of β times the world premium (0.267% per month) is equal to 0.228%.

[11] Modern tests of the CAPM would not be performed simply by taking a line through the cloud of points of Figure 2 or 3. Doing so assumes that the CAPM line one is trying to estimate never moves and that the position of each security on the line never changes. Modern tests would utilize variables (called "indicator variables", "instrumental variables" or "information variables") that track these movements. A CAPM with moving parts is called a "conditional CAPM". See Harvey (1991) for an application to world data. When currencies are included in the dataset, the classic CAPM tends to be rejected by statistical tests, in favor of the more sophisticated models we are about to explore.

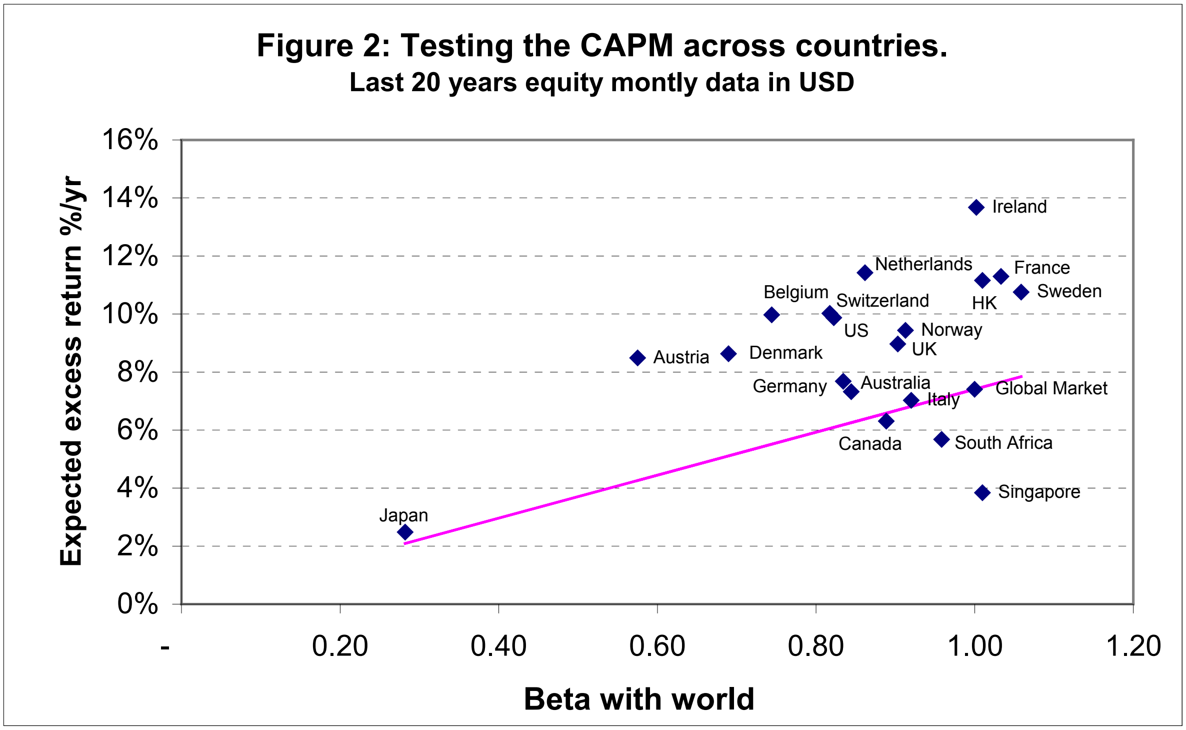
Figure 2: Testing the CAPM across countries.
Last 20 years equity montly data in USD
Expected excess return %/yr
Beta with world
16%
14%
12%
10%
8%
6%
4%
2%
0%
-
0.20
0.40
0.60
0.80
1.00
1.20
Ireland
Netherlands
France
Belgium
Switzerland
HK
Sweden
US
Norway
UK
Austria
Denmark
Germany
Australia
Italy
Global Market
Canada
South Africa
Singapore
Japan

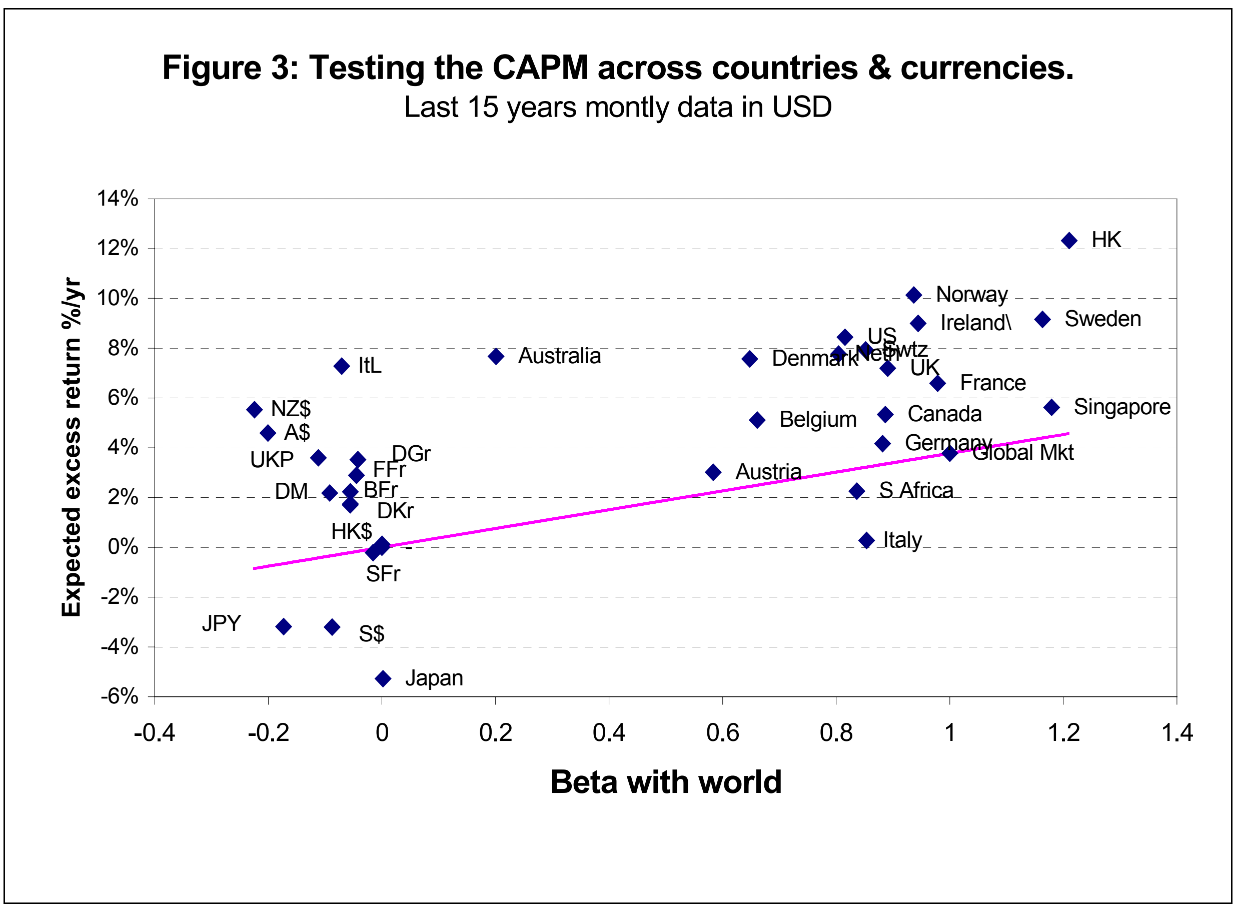
Figure 3: Testing the CAPM across countries & currencies.
Last 15 years montly data in USD
Expected excess return %/yr
Beta with world
14%
12%
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
HK
Norway
Ireland\
Sweden
US
ItL
Australia
Denmark
UK
France
NZ$
Singapore
Belgium
Canada
A$
Germany
DGr
UKP
Global Mkt
FFr
Austria
BFr
DM
S Africa
DKr
HK$
Italy
SFr
JPY
S$
Japan

3. Multi-β CAPM

Figure 2 represents an approximate test of the classic CAPM under the hypothesis of full market integration. A rejection signal from the statistical test can mean that the classic CAPM is incorrect and/or that the world financial market is not integrated. Since the test is unlikely to be conclusive on either count, we need to remain agnostic on the question of knowing whether we should use a country risk premium (as is the case under full segmentation) or, instead, a world risk premium (under full integration). Driven by the desire to remain agnostic and by the belief that the world financial market is probably neither fully integrated nor fully segmented, one might be tempted to use a CAPM including both kinds of premiums, determined on the basis of distinct βs and different prices of risk for each dimension of risk. This leads to the idea of a multi-β or "hybrid" CAPM.

3.1. A "hybrid", multifactor CAPM

In a multi-factor, or multi-beta model, the measurement of risk is not one-dimensional. Instead, there exist several dimensions to which an investor is sensitive simultaneously. For instance, we mentioned above that a mean-variance investor should only care about the security's sensitivities (exposure) to its portfolio return. At the market level this implies that the market requires a premium only for a security's exposure to the return on the market portfolio.

But when investors care only about the mean and variance of their return, it means that they do not care when they receive a high return and when they receive a low return. That may not be a realistic assumption. People may be interested in getting high returns from their worldwide, diversified portfolio when their own country is in a recession and are ready to accept lower returns from their portfolio when their own country is in expansion. This may be because they collect some other income (such as wages) intrinsically tied to the economic activity in their own country.[12] Under these circumstances, they may want to look carefully at their portfolio's exposure to their own country, probably reducing the weight of their country's shares in order to diversify away from their other income. Alternatively, consider a different case in which investors may have a special liking for the shares of their own country's firms because they feel better informed about them.

Whatever may be the reason for it, it can happen that the financial market prices a portfolio or a security's exposure to countries differently from the way it prices exposure to the world financial market as a whole.

In order to implement a model of this sort, one must generalize the concept of β as a one-dimensional exposure to risk, to reach a concept of multidimensional exposure. This is easily done by using the tool of multiple regression. The following equation is an example of a multifactor model where the two "factors" are world rate of return risk, as in the integrated version of the classic CAPM, and country rate of return risk as in the segmented version of the classic CAPM. . Accordingly, it relates the excess rate of return of the equity of firm i in country c, $R_i - r$, to the excess rate of return on the world market portfolio, $R_w - r$, and the excess rate of return on the country market portfolio, $R_c - r$:

$$R_i - r = \alpha_{i/c,w} + \hat{\beta}_{i/w} \times (R_w - r) + \hat{\beta}_{i/c} \times (R_c - r) + \varepsilon_{i/c,w} \qquad (3)$$

[12] Non financial wealth can also be broadly seen as the underpinning of the well-accepted multifactor CAPM of Fama and French (1996).

In the above, we have placed a ^ on the exposure coefficients to highlight the fact that they are not equal to the β coefficients that we have considered in the previous subsection. Those were coefficients in a simple regression. The coefficients in (3) are calculated jointly by the procedure of multiple regression applied to the time series (i.e., history) of past returns.

What we have just explained is a multifactor statistical model that simply captures the way in which random *ex post* returns relate to each other. A decomposition such as (3) can always be achieved. It is only a matter of getting the computer to calculate the β coefficients. This has no economic content. It does not tell us, for instance, what mean rates of return on securities should be, so that investors would be willing to hold them.

The multifactor pricing model, however, gives us specifically that answer. It says that the expected rate of return of each security should be linearly related to the security's multiple exposures to the various dimensions of risk:

$$E[R_i - r] = \hat{\beta}_{i/w} \times E[R_w - r] + \hat{\beta}_{i/c} \times E[R_c - r] \tag{4}$$

$E[R_c - r]$ – expected value of the excess return on the world stock market -- and $E[R_w - r]$ – expected value of the excess return on the country’s stock market -- are the risk premiums per unit of exposure risk, charged by the market to bear the systematic risks inherent in the local market portfolio, $R_c - r$, and the world market portfolio, $R_w - r$ respectively. The total risk premium required of any security *i* is the sum of two premiums: one for country risk equal to security *i*'s exposure to country risk times the premium per unit of country risk, and one for world market risk equal to security *i*'s exposure to world risk times the premium per unit of world risk. Again, the exposures to the two risks are partial, or joint, exposures (also called "loadings") calculated by a multiple regression.

Let us illustrate on our example of Thalès how the "hybrid" model would incorporate the two factors. The betas for the two-factor model are reported in Table 5. The influence of the French market is evidently the dominant one, since the beta for the world market is not even positive. Modifying the French-only model of Table 2 with the addition of a world market return as in Table 5 seems to make little difference. Thalès appears to be priced primarily with respect to the French market.

Table 5: Required USD premium on Thalès according to the "hybrid model" incorporating world and country factors

1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** Joint βs of Thalès vis-à-vis two markets		**"Price of risk"** Average excess return on the two markets		Required premium %/month
World market risk	-0.36	x	0.267%	=	-0.097%
French market risk	1.266	x	0.497%	=	0.629%
Total					0.532%

To gain some perspective on whether this phenomenon is a general one, we produce Tables 6, 7, 8 and 9. These tables display the values of the joint $\hat{\beta}$ s calculated on an arbitrary sample of firms of an arbitrary subset of countries: the United States, Belgium, France and Poland. Each table gives us, for each firm, the two joint $\hat{\beta}$ s obtained by regressing the firms' excess rates of return on the local and the world stock markets.[13] In these tables, the excess rates of return are measured in the local currency

[13] Admittedly, some of the firms in our list are part of the local country stock index. That fact undermines a straight comparison of the sizes of the local and the word betas. Even when a firm is part of the local, the betas we have calculated remain those that are relevant for CAPM application. Their relative sizes explain

but the exposure $\hat{\beta}$ numbers would be roughly similar if the rates of return had been measured in some other currency.[14]

Table 6 Joint βs and hybrid pricing model for a few U.S. firms							
US MARKET		MULTIFACTOR					
NAME %/year	Average excess return	β stock to country	β stock to world	Risk premium for country risk	Risk premium for world risk	Total premium
Riskless USD return	0%	0	0	0.00%	0.00%	0.00%
US INDEX	7.84%	1	0	7.84%	0.00%	7.84%
WORLD	2.49%	0	1	0.00%	2.49%	2.49%
ABBOTT LABS.		0.56	-0.07	4.43%	-0.18%	4.25%
AMER.HOME PRDS.		0.68	-0.17	5.37%	-0.44%	4.93%
ANDERSEN GROUP		0.88	-0.10	6.90%	-0.26%	6.65%
AT & T		0.86	-0.02	6.76%	-0.04%	6.72%
BANK OF AMERICA		1.42	-0.44	11.17%	-1.09%	10.08%
FORD MOTOR		0.84	0.02	6.58%	0.05%	6.63%
GEN.ELEC.		1.16	-0.05	9.08%	-0.12%	8.95%
HEWLETT - PACKARD		1.38	0.11	10.83%	0.28%	11.11%
INTL.BUS.MACH.		0.76	0.23	5.96%	0.58%	6.54%
JOHNSON & JOHNSON		0.80	-0.13	6.28%	-0.33%	5.95%
MOTOROLA		1.40	0.19	10.98%	0.47%	11.45%
PFIZER		0.84	-0.11	6.59%	-0.28%	6.31%
CATERPILLAR		0.91	0.18	7.14%	0.44%	7.58%
NTHN.TRUST		0.92	0.14	7.20%	0.35%	7.54%
KIMBERLY – CLARK		0.58	-0.02	4.51%	-0.05%	4.46%
WELLS FARGO & CO		0.94	0.00	7.39%	-0.01%	7.38%
COCA COLA		0.76	-0.06	5.98%	-0.14%	5.85%
DU PONT E I DE NEMOURS		0.77	0.13	6.03%	0.33%	6.36%
INTEL		1.59	0.07	12.49%	0.17%	12.66%
WALT DISNEY		1.23	-0.01	9.66%	-0.02%	9.65%

that the risk premium for country risk is almost always larger in the multi-factor CAPM than the risk premium for world risk.

[14] Compare for instance, the $\hat{\beta}$ s for Thalès in Table 5 (where they have been calculated in US$) and Table 8 (where they have been calculated in Euros).

Table 7 Joint βs and hybrid pricing model for a few Belgian firms

BELGIUM MARKET 1/28/1987 to 1/28/2002 BEF		MULTIFACTOR				
NAME %/year	Mean excess return	β stock to country	β stock to world	Risk premium for country risk	Risk premium for world risk	Required excess return
Riskless BFR return	0%	0	0	0.00%	0.00%	0.00%
BELGIUM INDEX	4.26%	1	0	4.26%	0.00%	4.26%
WORLD	3.30%	0	1	0.00%	3.30%	3.30%
ALMANIJ		1.03	-0.13	4.40%	-0.43%	3.97%
BARCO NEW		0.92	0.53	3.91%	1.76%	5.67%
FORTIS (BRU)		0.98	0.12	4.17%	0.40%	4.57%
DELHAIZE		0.99	0.12	4.21%	0.41%	4.62%
GLAVERBEL		1.02	-0.03	4.34%	-0.08%	4.25%
ELECTRABEL		0.63	-0.18	2.68%	-0.61%	2.07%
TRACTEBEL		1.07	-0.25	4.56%	-0.82%	3.73%
SOLVAY		1.23	0.04	5.23%	0.13%	5.36%
UCB		1.14	-0.03	4.85%	-0.09%	4.77%
TESSENDERLO		0.87	0.28	3.71%	0.92%	4.63%
GBL NEW		0.89	0.03	3.81%	0.11%	3.91%
KBC BKVS.HDG.		1.16	-0.06	4.96%	-0.20%	4.76%
ARBED (BRU)		0.89	0.58	3.80%	1.93%	5.73%

Table 8 Joint βs and hybrid pricing model for a few French firms

FRENCH MARKET (last 15y)		MULTIFACTOR				
NAME %/year	Average excess return	β stock to country	β stock to world	Risk premium for country risk	Risk premium for world risk	Total risk premium
Riskless FRF return	0.00%	0.00	0.00	0.00%	0.00%	0.00%
FRANCE INDEX	4.80%	1.00	0.00	4.80%	0.00%	4.80%
WORLD	2.93%	0.00	1.00	0.00%	2.93%	2.93%
ACCOR		1.09	0.01	5.24%	0.04%	5.28%
AIR LIQUIDE		0.83	-0.22	3.99%	-0.65%	3.34%
AXA		1.42	-0.12	6.81%	-0.37%	6.45%
BOUYGUES		1.41	-0.11	6.76%	-0.32%	6.45%
CARREFOUR		0.84	0.06	4.01%	0.18%	4.19%
CIMENTS FRANCAIS		1.14	-0.23	5.50%	-0.68%	4.82%
DANONE		0.83	-0.16	3.98%	-0.46%	3.52%
SOCIETE GENERALE		0.95	-0.07	4.57%	-0.20%	4.38%
TOTAL FINA ELF SA		0.61	0.06	2.94%	0.19%	3.13%
SANOFI – SYNTHELABO		0.93	-0.23	4.46%	-0.68%	3.78%
SUEZ		1.13	-0.21	5.44%	-0.62%	4.81%
PERNOD – RICARD		1.16	-0.49	5.58%	-1.44%	4.14%
PEUGEOT SA		1.03	0.06	4.97%	0.19%	5.15%
MICHELIN		1.08	0.09	5.18%	0.27%	5.45%
DASSAULT AVIATION		0.53	0.06	2.56%	0.17%	2.72%
PINAULT PRINTEMPS		1.26	0.03	6.05%	0.08%	6.12%
THALES (EX THOMSON - CSF)		1.32	-0.34	6.34%	-0.99%	5.35%
VALEO		1.07	0.12	5.13%	0.34%	5.46%
COLAS		1.10	-0.24	5.29%	-0.72%	4.57%
VIVENDI UNIVERSAL		1.27	-0.22	6.08%	-0.64%	5.44%

Table 9 Joint βs and hybrid pricing model for a few Polish firms						
POLISH MARKET (last 5y)		MULTIFACTOR				
NAME %/year	Average excess return	β stock to country	β stock to world	Risk premium for country risk	Risk premium for world risk	Total premium
Riskless zloty return	0.00%	0	0	0.00%	0.00%	0.00%
PLN INDEX	-18.37%	1	0	-18.37%	0.00%	-18.37%
WORLD	-7.67%	0	1	0.00%	-7.67%	-7.67%
BIG BANK GDANSKI		1.18	0.59	-21.59%	-4.50%	-26.09%
BPH PBK SA		0.89	-0.42	-16.41%	3.24%	-13.18%
BRE		0.80	0.17	-14.70%	-1.31%	-16.01%
BROWARY ZYWIEC		0.47	-0.18	-8.57%	1.42%	-7.15%
BUDIMEX		0.74	0.15	-13.61%	-1.18%	-14.79%
DEBICA		0.58	-0.16	-10.72%	1.26%	-9.46%
ELEKTRIM		1.13	-0.07	-20.68%	0.56%	-20.12%
EXBUD		0.83	-0.15	-15.23%	1.18%	-14.05%
KETY		1.08	-0.22	-19.81%	1.69%	-18.12%
OKOCIM		0.57	-0.01	-10.43%	0.05%	-10.38%
PETROBANK		0.56	-0.19	-10.28%	1.47%	-8.80%
BOS		0.41	-0.14	-7.46%	1.04%	-6.42%
STOMIL OLSZTYN		0.79	-0.41	-14.42%	3.16%	-11.27%

For all countries, it is clear that the joint $\hat{\beta}$ vis-à-vis the local market is much larger than the joint $\hat{\beta}$ vis-à-vis the world market and that local-country risk premium dominates the pricing. This is a striking empirical fact, although it is a difficult one to understand in theoretical terms. Unless the world is segmented generally – and not just financially -- why should local stock indexes have such a dominant influence on stocks in that country?

The CAPM by itself does not dictate what βs should be; it only indicates how expected returns should differ from one security to another given the structure of βs. However, βs come from somewhere; they are calculated from rates of return. In a broader dynamic-pricing theory, prices – not just expected returns -- would be entirely calculated from the fundamental cash flows paid by the security under consideration.[15] In the context of such a theory, under the hypothesis of full integration, common stochastic discount factors are applied to all securities of the world. As these discount factors fluctuate, so do the prices of all securities. The theory is likely to tell us that securities are more exposed to the world market index than to country market index, contrary to what we observed above in Tables 6-9.

The fact that βs do not seem to reflect very well the degree of international involvement of firms was pointed out in an early paper by Jacquillat and Solnik (1978). They focused on a set of U.S. multinationals and showed that their price movements are markedly related to those of the NYSE, while they are poorly related to the stock indexes of the countries where the multinationals are active.[16]

What we have observed in Tables 6-9 is also reminiscent of the phenomenon of "local pricing" whereby, for unknown reasons, the securities traded on one stock exchange seem to follow the gyrations of that stock exchange index. Consider an unusual example discussed in Froot and Dabora (1999), the pricing of the shares of Royal Dutch Shell. Since 1909, the sister companies of the Royal Dutch Shell group have shared all dividends. Yet the stocks of the British company, Shell Trading and Transport, and the Dutch company, Royal Dutch Shell, have often fetched different prices (when expressed in the same currency). And, even more interestingly, the ratio of these prices follows the ratio of the stock price indexes in London and Amsterdam. In other words, the local

[15] For one such theory applied to the international context, see Dumas, Harvey, Ruiz (2000).
[16] A recent paper by Diermeir and Solnik (2001) provides intriguing evidence about the relative influence of domestic and foreign markets. They develop a domestic stock index consisting of firms that are primarily exposed to the domestic economy only. They then find that the domestic index has a much smaller influence on firms in that market than does an index consisting of rest-of-world stocks. More research is needed to reconcile their results with earlier work by Jacquillat and Solnik (1978) and others similar to that of Tables 6-9 showing the predominance of home country influences on stock prices.

stock market influence seems to pertain even for sister companies sharing the same dividends.

Another example of local market pricing concerns closed-end country funds. These funds, which typically invest in the stocks of a single foreign country, are offered to investors in the American market as a convenient way to buy a diversified portfolio of the foreign country's stocks. When the prices of these closed end funds are compared with the net asset value (NAV) of the underlying stocks, large differentials are often discovered. This by itself is not surprising, since these differentials cannot be "arbitraged away" unless the fund is forced to liquidate its holdings. But what is strange about the differentials is that they are correlated with the American market.[17] Why should the differential between closed end fund prices and their NAV be correlated with the home market of the investors in the fund? The U.S. market exerts an influence on closed end fund prices even though the stocks in the fund are overseas.

We may have done well to have remained agnostic and, by applying the "hybrid" model, to have left open the possibility that the world financial market may, at least partially, be segmented. As is the case for many multi-factor CAPMs, it is not easy to produce a rigorous theoretical foundation for the hybrid CAPM. This model is a strange mix of the full-integration and the full-segmentation CAPMs. An intermediate situation of partial segmentation may not lead to anything resembling the hybrid CAPM. In fact, it is not easy to define a situation of partial segmentation in the first place. Partial segmentation is a configuration in which each individual investor has access to an incomplete but well-specified list of securities. Just specifying the situation in the first

[17] Lee, Shleifer, and Thaler (1991) provide evidence regarding such pricing.

place requires information of $I \times N$ dimension, where I is the number of individuals and N is the total number of existing securities![18]

4. The pricing of currency risk

The world CAPM that have discussed in Section 2 was implicitly based on an important assumption – that every investor has the same currency. When we applied the CAPM in question to rates of return measured, for instance, in US$, we were implicitly assuming that all investors of the world were choosing their portfolios on the basis of anticipated US$ returns, or that all investors were US$ based investors, presumably living and consuming the income from their portfolio in the United States. In reality, the world is populated with investors who live in different countries. This creates among them a degree of heterogeneity that has not been taken into account. When that heterogeneity is taken into account, we have a picture of the world financial investor population that is described in Figure 1.

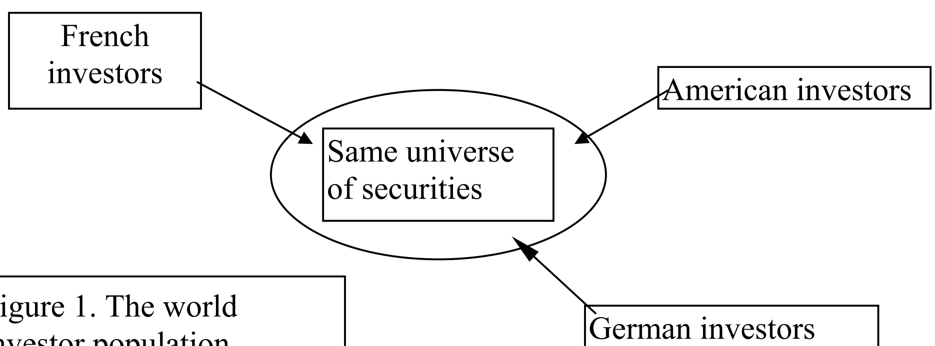

Figure 1. The world investor population

[18] For a full-fledged partial-segmentation equilibrium, see Errunza and Losq (1985).

4.1. Description of the IAPM

We shall now show that, when the world investor population is heterogeneous in this manner, foreign exchange risk cannot be priced the same way as world market risk. The reason for this difference is the following. As far as world equity risk is concerned, every investor in the world basically holds a long position. Firms issue stock securities to finance their investment and most everyone buys those securities. The cases in which some investors short stocks only arise from a difference of opinion about the anticipated returns of stocks; in that case, even more investors dollar-wise hold the same stocks long.

In order to reap the benefits of diversification, investors of the world hold positively the stock securities of all countries. All these stock securities – but especially the foreign stocks -- expose the investors to equity risk but also to currency risk. This last risk may or may not be worth bearing depending on the equilibrium rates of return in the market for currency deposits, to which we turn in the next paragraph. If it so happens that the currency risk imbedded in foreign stock securities is not worth bearing (which means that the cost of hedging is sufficiently low), investors who invest into foreign stocks will want to hedge this investment against currency risk.

In the market for currencies, the situation is vastly different. Investors who reside in one country consider the deposit denominated in their home currency to be a riskless or quasi-riskless asset, since it guarantees a future purchasing power. Even if inflation in their country is very volatile, the home currency deposit will often be the safest asset available.[19]

[19] Case situations in which residents of one country regard a foreign-currency deposit as less risky than the home currency fall outside the theory that we are trying to develop.

Provided their risk aversions are sufficiently high,[20] the investors of each country hold the home-currency deposit positively. They stand ready to hold it because they want to invest some of their wealth in what they view as a riskless asset. This is just an application of the familiar Tobin separation theorem, whereby investors choose the composition of a portfolio of risky securities and then, depending on their level of risk aversion, decide what fraction of their wealth to invest in the riskless and what fraction in the portfolio of risky securities. By holding the home-currency deposit, home investors maintain the home-currency rate of interest at a level lower than it would otherwise be. Foreign investors who are holding stocks of the country, in contrast, are candidates for hedging. They may wish to borrow the home currency, or, equivalently, sell it forward or generally hold it short. They will do so if the cost of hedging is sufficiently low. But a low cost of hedging is precisely what home-country resident investors tend to bring about since their situation induces them to hold the currency. The equilibrium that obtains is one in which foreign investors short the home currency, taking advantage of the vast pool of home residents who, by holding their home currency, stand ready to provide hedging services, at a cost which is lower than it would be in their absence.

In this equilibrium, stock market risk is priced by investors who are all basically holding that risk long, while each of the currency risk dimensions is priced by investors some of whom structurally hold it long while others short it. Because of this structural difference, the equilibrium pricing of currency risk cannot be subsumed in the pricing of world stock market risk. It cannot be a redundant dimension of risk. To price it, we need

[20] See Adler and Dumas (1983).

a separate risk premium, with a price of risk that is determined separately from the price of world stock market risk. The result is the International Asset Pricing Model (IAPM):[21]

$$E[R_i - r] = \hat{\beta}_{i/w} \times E[R_w - r] + \hat{\beta}_{i/S} \times E[R_S - r] \tag{6}$$

where $\hat{\beta}_{i/w}$ and $\hat{\beta}_{i/S}$ are the coefficients of a multiple regression of the rate of return of security *i* on the world market portfolio rate of return and on the rates of return of non-measurement currency deposits, all measured in some measurement currency, and where $E[R_S - r]$ is the expected excess rate of return on a non-measurement currency, also measured in the measurement currency. Currency risk is priced by the average excess returns on currencies. $\hat{\beta}_{i/S}$ can be interpreted as the "exposures" of security *i* to currency risks.[22]

4.2. IAPM applied to Thalès

In Table 10, we illustrate the working of the IAPM on the Thalès example. Since the equity return on Thalès is measured in dollars, the table reports joint betas with respect to both the world stock market and the Euro deposit (representing the foreign currency risk factor). Adding the resulting risk premium to the dollar rate of interest gives the dollar required rate of return on Thalès in a world market in which the investor population is heterogeneous.

[21] See Solnik (1974).

[22] The sources of the exposures to currency risks are analyzed in Bodnar, Dumas and Marston (2002). Key parameters are the firm's market share abroad, the product's elasticity of substitution with foreign products and the fraction of inputs imported from abroad, all captured in some cases simply by the fractions of revenues and costs originating from abroad and the rate of profit (see Bodnar and Marston (2001)).

Table 10: Required USD premium on Thalès according to the IAPM incorporating world and currency factors					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** Joint βs of Thalès vis-à-vis two factors		**"Price of risk"** Average excess return on the two factors		Required premium %/month
World market	0.856	x	0.267%	=	0.229%
Euro deposit	0.303	x	-0.038%	=	-0.011%
Total					0.217%

In Table 11, we perform the same task on the same Thalès but using the Euro as the measurement currency. This table indicates the required risk premium in Euro units. This is the same required excess rate of return as in Table 9, only translated into Euros. Adding it to the Euro rate of interest would give the Euro required rate of return on Thalès.

Note the way in which exposures are translated from one currency to the other. The exposure to the world remains unchanged at 0.856. The exposure to the currency, -0.159 is the result of the following formula: -0.159 = 1 – (0.856 – 0.303). This formula is exact, and can be demonstrated by calculus, for returns calculated on extremely short holding periods. When changing currency units, the currency exposure calculated from the point of view of the new currency is equal to 1 minus the sum of the exposures measured in the old currency.[23]

[23] The proof of this result is based on a simple approximation, which is exact in the limit as the length of the holding period becomes extremely small. Start with the statistical exposure relationship written in $ units:

$$R_i^\$ - r^\$ = \hat{\beta}_{i/w} \times \left[R_w^\$ - r^\$\right] + \hat{\beta}_{i/S} \times \left[R_S^\$ - r^\$\right] + \varepsilon_{i/w,S}$$

We want to turn this relationship into one where returns are measured into Euros. An excellent approximation to $R_i^€ - r^€$ is $R_i^\$ - r^\$ - \left[R_S^\$ - r^\$\right]$. Let us calculate that quantity. First, we subtract $\left[R_S^\$ - r^\$\right]$ from both sides of the equation:

$$R_i^\$ - r^\$ - \left[R_S^\$ - r^\$\right] = \hat{\beta}_{i/w} \times \left[R_w^\$ - r^\$\right] + \left(\hat{\beta}_{i/S} - 1\right) \times \left[R_S^\$ - r^\$\right] + \varepsilon_{i/w,S}$$

Table 11: Required Euro premium on Thalès according to the IAPM incorporating world and currency factors					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** Joint βs of Thalès vis-à-vis two factors		**"Price of risk"** Average excess return on the two factors		Required premium %/month
World market	0.856	x	0.271%	=	0.232%
Dollar deposit	-0.159	x	0.123%	=	-0.020%
Total					0.213%

Finally, in Table 12, we compute the required excess rate of return on Thalès according to the IAPM, but after hedging. To hedge Thalès shares, it is necessary to determine the "exposure" of Thalès to the Euro by which we mean the sensitivity of Thalès' share price to movements in the Euro. From the USD point of view, the simple exposure of a Thalès share to the Euro is equal to 0.391. One dollar invested in shares of Thalès hedged is one dollar invested in a share of Thalès accompanied by an amount of Euro borrowing equal to 39.1 US cents.[24]

But then we also want to express the world equity premium in Euro units. An excellent approximation to $R_w^{€} - r^{€}$ is $R_w^{\$} - r^{\$} - [R_S^{\$} - r^{\$}]$:

$$R_i^{\$} - r^{\$} - [R_S^{\$} - r^{\$}] = \hat{\beta}_{i/w} \times \{[R_w^{\$} - r^{\$}] - [R_S^{\$} - r^{\$}]\} + (\hat{\beta}_{i/S} + \hat{\beta}_{i/w} - 1) \times [R_S^{\$} - r^{\$}] + \varepsilon_{i/w,S}$$

Finally, from the Euro point of view, we wish to show on the right-hand side, not the excess dollar rate of return on a Euro deposit but the excess Euro rate of return on a dollar deposit. To the same degree of approximation, they are equal and opposite to each other. Hence we get, as claimed:

$$R_i^{€} - r^{€} = \hat{\beta}_{i/w} \times [R_w^{€} - r^{€}] + (1 - \hat{\beta}_{i/S} - \hat{\beta}_{i/w}) \times [R_S^{€} - r^{€}] + \varepsilon_{i/w,S}$$

[24] Trivially, a Euro deposit, from the dollar point of view, has a zero joint exposure to the world market and a 100% exposure to itself. Hence, after hedging, the joint exposure of Thalès to the world market remains at 0.856, where it was before hedging, and the joint exposure to the Euro is equal to: -0.303 – 1×0.391 = -0.089.

Table 12: Required USD premium on Thalès hedged, according to the IAPM incorporating world and currency factors					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** Joint βs of Thalès hedged vis-à-vis two factors		**"Price of risk"** Average excess return on the two factors		Required premium %/month
World market	0.856	x	0.267%	=	0.229%
Euro deposit	-0.089	x	-0.038%	=	0.003%
Total					0.232%

The reader might wonder why Thalès in Table 12, after hedging, still has a non zero joint exposure, -0.089, to the currency. The reason is that the table displays the joint coefficients of a multiple regression of Thalès hedged on the world market *unhedged* and on the currency. Hence, the coefficient –0.089 reflects the exposure of the world market to the currency.[25]

In Table 13, we show another way to use the International Asset Pricing Model. The coefficient of a regression of the return on a hedged share of Thalès on the *hedged* world market portfolio is equal to 0.856. And the exposure to the currency is then reduced to zero. When all returns are hedged against currency risk, the IAPM reduced to a single-factor model.

[25] In fact, it is equal to minus 0.856 times the simple exposure of the world market to the currency, which, by a simple regression, would be found to be 0.104.

Table 13: Required USD premium on Thalès hedged, according to the IAPM incorporating the world factor hedged against currency risk					
1/28/1987 to 1/28/2002 %/month	**"Quantity of risk"** Joint βs of Thalès hedged vis-à-vis the world market hedged		**"Price of risk"** Average excess rate of return on the world market hedged[26]		Required premium %/month
World market	0.856	x	0.271%	=	.232%

All the CAPMs we have discussed prior to this section have one major weakness in common. If the CAPM in question applies to the rates of return measured in one currency, then the same CAPM will no longer hold after translation into another currency. If all securities lined up when their returns are measured in one unit, they no longer will when measured in another unit. This deficiency is shared by any CAPM that does not include a separate term for a currency risk premium. The International Asset Pricing Model enjoys a property of consistency under a change of measurement unit. One can show that the choice of the measurement currency, in terms of which the IAPM is stated, is immaterial.[27]

The IAPM is not without drawback, however. One drawback of the IAPM is that the list of non-measurement currency dimensions of risk to which security *i* may be exposed is potentially very long. Moreover, premiums for these currency risk are often much smaller than world market risk premiums[28] and the calculation of the currency risk

[26] The world hedged expected excess rate of return is equal to the expected excess rate of return on the world before hedging minus the exposure of the world market times the cost of hedging: 0.271% = -0.267% - 0.104×(-0.038%).

[27] See Sercu (1980).

[28] Nonetheless, Dumas and Solnik (1995) are able to show empirically, in a conditional version of the IAPM, that these premiums are statistically significant. Furthermore, while they may appear small when an average over many months is calculated, they fluctuate a great deal from month to month and may not be small at all, in any given month. That is the reason for which their statistical significance can be

is based on a price of risk that is estimated with a wide margin of error. This is because it is based on the average excess rate of return on just one asset, namely, the average excess rate of return on each of the foreign currencies considered one by one. This is in contrast to the price of world market risk, which is based on the average excess rate of return on the wide world market portfolio. By a statistical analog of the diversification effect, the average excess rate of return on a wide portfolio is a much better estimate of the corresponding expected excess return than would be the average return on a single asset.

Nonetheless, the required risk premium on a security, incorporating the sum of all premia, is likely to be estimated more reliably than is each individual term of the multi-factor CAPM. Errors on average currency movements that are contained in the world market premium are largely offset by errors on the average currency movements contained in the currency premiums themselves. In fact, when the IAPM is applied to rates of return after hedging, as in Table 12, average currency movements no longer play any role at all. This is a comforting aspect of that particular formulation of the International Asset Pricing Model.

5. The pricing of political risk

As far as financial-market pricing is concerned, there is a strong similarity between currency risk and political risk. Both are borne differentially by the residents and the non residents of a country. For similar reasons, therefore, it may be a good idea to recognize a separate risk premiums for political risks. This again leads to a multi-β

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demonstrated only in a conditional version of the IAPM, in which a number of indicator variables are used to track these movements.

CAPM in which we would recognize a premium for world, or country, market risk and one or several premiums for political risk.[29]

But what index can properly represent the political risk factor? Abuaf (1997) proposes to treat political risk by including foreign, sovereign bonds or Brady bonds in the multiple regression for the estimation of joint βs and, correspondingly, to estimate the market price of political risk. There are both empirical and conceptual problems with this approach. The empirical problem is that, for the last fifteen years, the Brady bonds of some countries have had negative returns (as will be seen below). The conceptual problem is that Brady bonds may not capture political risk properly. For one thing, they are partly backed by U.S. Treasury bills. More crucially, the risk that a government will not repay may differ from the risk that a company of the country will see its stock return affected by political factors.

To illustrate the empirical problem with using Abuaf's approach, we apply his methodology to a sample of Latin American firms in Table 14. We calculate the required risk premium on a number of ADRs which are written on Latin American stock securities and which are traded on the NYSE. This is done on the basis of the excess dollar rate of return on the corresponding Brady bonds of the respective Latin American country.[30]

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[29] For clarity of exposition, we consider each type of risk premium separately and discuss it in separate sections but they can obviously be combined, provided that care is taken to estimate the βs in a joint multiple regression.
[30] To clarify the calculation, the required excess rate of return on "BBVA BANCO FRANCES SPN. ADR.", -11.76%, is equal to: $0.812 \times 0.32\% + 0.948 \times (-12.68\%)$.

Table 14: A multi-beta model that prices political risk					
1/28/97 to 1/28/2002		βs			
%/year	AVERAGE EXCESS RETURN	US STOCK INDEX	US BRADY BOND INDEX	Required dollar excess return	COUNTRY
US - DS MARKET	0.320%				
SALOMON BROS.BRADY BOND ARGENTINE - RETURN IND. (OFCL)	-12.68%				
SALOMON BROS.BRADY BOND BRAZILIAN - RETURN IND. (OFCL)	3.15%				
JPM ELMI+ CHILE ($) - RETURN IND. (OFCL)	-4.29%				
SALOMON BROS.BRADY BOND MEXICAN - RETURN IND. (OFCL)	4.33%				
SALOMON BROS.BRADY BOND PHILIPPINE - RETURN IND. (OFCL)	1.82%				
SALOMON BROS.BRADY BOND VENEZUELAN - RETURN IND. (OFCL)	1.20%				
BBVA BANCO FRANCES SPN. ADR.		0.812	0.948	-11.76%	ARGENTINA
IRSA INVERSIONERS Y REP.S A GDR		0.710	0.839	-10.41%	ARGENTINA
METROGAS SPN.ADR.B 1 ADR = 10 B SHS.		0.066	0.432	-5.46%	ARGENTINA
TELF.DE ARGN.CL.B SPN. ADR 1 ADR =10 SHS		0.824	0.834	-10.31%	ARGENTINA
TELECOM ARGN.B SPN.ADR 1 ADR = 5 SHARES		0.609	0.936	-11.68%	ARGENTINA
TSPA.GAS DEL SUR SPN.ADR1 ADR=5 B SHS.		0.098	0.430	-5.42%	ARGENTINA
YPF D SPN.ADR 1 ADR = 1 SHARE		0.694	0.133	-1.46%	ARGENTINA
ARACRUZ PNB SPN.ADR 1 ADR = 10 B PF.SHS		0.994	0.771	2.75%	BRAZIL
CMPH.BRASL.DE DISTB.ADR.		0.333	1.704	5.48%	BRAZIL
COPEL PNB SPN.ADR 1 ADR = 1000 SHARES		-0.203	2.472	7.73%	BRAZIL
SID NACIONAL ON ADR 1 ADR = 1000 SHARES		0.726	1.488	4.93%	BRAZIL
UNIBANCO GDR GDR=500 UNITS		0.683	2.420	7.85%	BRAZIL
ANDINA 'A' SPN.ADR 1 ADR = 6 SHARES		0.657	1.255	-5.17%	CHILE
BBV BANCO BHIF SPN.ADR. 1 ADR = 10 SHARES		0.002	1.167	-5.01%	CHILE
BNC.CTL.HISPANO ADR DEAD - EXPD 16/04/99		0.524	0.153	-0.49%	CHILE

BANCO SANTANDER CHILE SPN.ADR.SVS.A	0.674	0.238	-0.80%	CHILE
CRISTALES SPN.ADR. 1 ADR = 3 NPV SHARES	0.092	1.783	-7.62%	CHILE
CTC 'A' SPN.ADR 1 ADR = 4 SHARES	1.113	1.959	-8.05%	CHILE
ENERSIS SPN.ADR. 1 ADR = 50 SHARES	0.737	0.946	-3.82%	CHILE
ENDESA CHILE SPN.ADR.	0.583	1.137	-4.69%	CHILE
SANTA ISABEL SPN.ADR. 1 ADR = 15 SHARES	0.719	1.083	-4.42%	CHILE
MADECO SPN.ADR. 1 ADR = 10 SHARES	1.072	3.498	-14.66%	CHILE
MASISA SPN.ADR 1 ADR = 30 SHARES	0.957	1.438	-5.86%	CHILE
BANCO SANTIAGO SPN.ADR.	0.389	0.639	-2.61%	CHILE
TELEX - CHILE SPN.ADR. 1 ADR = 10 SHS.	-0.610	0.134	-0.77%	CHILE
CONCHATORO SPN.ADR. 1 ADR = 50 SHARES	0.721	0.051	0.01%	CHILE
DESC 'C' 1 ADR = 4 SHARES	0.745	1.381	6.22%	MEXICO
ICA SPN.ADR 1 ADR = 1 SHARE	-0.218	2.762	11.89%	MEXICO
CERAMIC SPN.ADR. 1 ADR = 5 LTD.VTG.UNT.	0.078	1.781	7.74%	MEXICO
MASECA 'B' ADR 1 ADR = 15 SHARES	0.013	2.450	10.61%	MEXICO
RADIO CENTRO CPO SPN.ADR1 ADR = 9 CPO SHARES	0.459	2.301	10.11%	MEXICO
GRUPO CASA AUTREY 1 ADR = 10 SHARES	-0.431	2.913	12.48%	MEXICO
TMM L ADR.144A 1 ADR = 1 SHARE	0.925	0.152	0.96%	MEXICO
GRUPO TELEVISA SPN.ADR. 1 ADR = 20 SHS.	1.257	1.254	5.83%	MEXICO
SAVIA SA DE CV SPN.ADR 1 ADR=4 SHARES	1.071	-0.517	-1.90%	MEXICO
VITRO SOCIED.SPN.ADR. 1 ADR = 3 SHARES	0.358	2.556	11.18%	MEXICO
PHILP.LONG DSN.TEL.SPN. ADR.1 ADR = 1 COM SHARE	1.114	0.168	0.66%	PHILIPPINES
CORIMON CA SPN.ADR. 1 ADR=500 SHARES	1.387	1.708	2.49%	VENEZUELA
CANTV ADR 'D' 1 ADR = 7 SHARES	0.307	1.581	1.99%	VENEZUELA

The results in this table are not satisfactory because, during the sample period under consideration, the average realized excess dollar rate of return on the Brady bonds turned out to be negative or in several cases implausibly small. It is unlikely that negative risk premiums or small positive risk premiums reflect the rates of return that investors expected and required on these securities. And the relative ranking of countries appears to be wrong. Surely the *ex ante* excess return on Argentina (which had defaulted twice since the early 1980s even prior to its recent default) would be larger than the excess return on Mexico (which had avoided defaults since the early 1980s and has recently been upgraded to investment grade).

We might obtain more sensible estimates of the political risk factor if we replaced the realized returns on Brady bonds by an estimate of the *ex ante* excess returns that investors expected. In Table 14, the excess return on Mexican Brady bonds is 4.33%. This is similar to the 4 % excess return on high yield bonds in the U.S. from 1984 to 2001. If we use 4 % as a lower bound on the *ex ante* excess return on Brady bonds, we can obtain estimates of the political risk premiums for each firm in Table 14 by applying the betas reported in that table. Although these numbers would be conditional on the 4% figure and therefore must be treated as illustrative only, they do indicate that political risk factors are potentially quite large.

How might these estimates be refined? We need to take into account differences across countries in the political risk premium rather than use a 4 % figure for all countries. Several avenues might be explored. First, we could consult yield spreads on Brady bonds. The spreads themselves provide upward biased estimates of the excess return on Brady bonds because the spreads reflect the probability of default as well as the risk premium on the bonds. But the spreads might indicate the relative rankings of the country premiums. The same can be said of ratings of Brady bonds by services such as

Moody's.[31] Third, we could use models of country risk based on objective indicators. J.P. Morgan has a model for determining sovereign spreads based on a "scoring system" for both external and internal "country risk factors". External factors include exchange rate, current account/GDP ratio, external debt/GDP ratio, debt service as percent of foreign-exchange reserves, and interest services as percent of exports. Domestic factors include change in growth rate of GDP, inflation rate, growth or fiscal deficit as percent of GDP, real bank credit growth as percent of GDP. It's not clear how successful these factors would be in explaining political risk, but they could also help us to rank countries vis-à-vis one another.

All of these approaches suggest the relative ranking of countries in terms of political risk, but none give us a quantitative measure of the *ex ante* risk premium. Clearly there is much work to be done in estimating political risk premiums.

6. Transposing required rates of return from one country to another

In many situations encountered in practice, the exposure measurements that are required for the application of the various CAPMs are not possible. For instance, a U.S. automobile manufacturer wants to build a plant in Brazil. It is not possible to obtain directly the βs of the project. The usual escape is to find a firm operating in Brazil that would be comparable to the project. But there may not exist such a firm. It is then necessary to measure stock-return relationships in one country (for instance, the U.S.), and then transpose them to another country (Brazil). This guesswork can be aided by a number of approximation methods, each one suggested by the form of a CAPM.

[31] Pricing of political risk in Mexico is explored in Adler and Qi (2003).

6.1. The hierarchical statistical model: an approximate way to obtain a security's β vis-à-vis the world

Consider the excess rate of return, $R_i - r$, of a firm i. Let us assume for the purposes of this model, that it is possible to say that firm i "belongs" to country c. The operational meaning of that assumption will be apparent shortly.

In an attempt to represent the way in which the returns on the various firms co-vary with each other within a country, we first relate the excess rate of return of firm i to the excess rate of return on the stock market of the country:

$$R_i - r = \alpha_{i/c} + \beta_{i/c} \times (R_c - r) + \varepsilon_{i/c} \qquad (7)$$

Recall that, the way a regression such as this is computed, the residual $\varepsilon_{i/c}$ is (linearly) independent of the regressor $(R_c - r)$. That means that $\varepsilon_{i/c}$ is purely specific to the firm against the background of a common country movement.

Then, in an attempt to represent the way in which the various *countries* co-vary with each other, we relate the country's excess rate of return to the excess rate of return on the world stock market:

$$R_c - r = \alpha_{c/w} + \beta_{c/w} \times (R_w - r) + \varepsilon_{c/w} \qquad (8)$$

In this regression again, the residual $\varepsilon_{c/w}$ is (linearly) independent of the regressor

$(R_w - r)$.

Now substitute Equation (8) into Equation (7):

$$R_i - r = \alpha_{i/c} + \beta_{i/c} \times [\alpha_{c/w} + \beta_{c/w} \times (R_w - r) + \varepsilon_{c/w}] + \varepsilon_{i/c}$$

$$R_i - r = (\alpha_{i/c} + \beta_{i/c} \times \alpha_{c/w}) + \beta_{i/c} \times \beta_{c/w} \times (R_w - r) + (\beta_{i/c} \times \varepsilon_{c/w} + \varepsilon_{i/c})$$

In that new relationship, the intercept term is $(\alpha_{i/c} + \beta_{i/c} \times \alpha_{c/w})$, the slope coefficient of firm *i* against the world is equal to $\beta_{i/c} \times \beta_{c/w}$, or the product of the firm's β against its country by the country's β against the world. The new residual is equal to: $(\beta_{i/c} \times \varepsilon_{c/w} + \varepsilon_{i/c})$. Notice, however, that there is nothing to guarantee that this new residual is linearly independent of the regressor, since $\varepsilon_{i/c}$ has not been constructed to be independent of $(R_w - r)$. For this reason and this reason alone, the above relationship would differ from the relationship one would obtain by relating directly the excess return of firm *i* to the world index as in:

$$R_i - r = \alpha_{i/w} + \beta_{i/w} \times (R_c - r) + \varepsilon_{i/w}$$

We are saying that generally:

$$\beta_{i/w} \neq \beta_{i/c} \times \beta_{c/w}$$

because it is generally not true that $\varepsilon_{i/c}$ is independent of $(R_w - r)$.

What would it mean in practical terms for $\varepsilon_{i/c}$ to be independent of $(R_w - r)$? It would mean that, when firm *i*'s return has been broken down as in Equation (7), the firm's excess rate of return $R_i - r$ is related to the world market only via the country return $(R_c - r)$. There would exist no separate relationship between the firm-specific return (calculated relative to the country) and the world. The relationship between the firm and the world would be channeled "hierarchically" through the country effect only.

This seems a very unlikely occurrence given that firm *i* presumably belongs to some industry and there exist common worldwide industry movements, which are not fully captured solely by country factors.

To illustrate the nature of the approximation, multiply Thalès' exposure to the French market risk (equal to 1.065; see Table 2) by the exposure of the French market to the world market (found to be equal to 0.975):

$$1.065 \times 0.975 = 1.0389$$

which differs from the full, direct exposure of Thalès to the world market, equal to 0.870 (see Table 3).

In the case of Thalès, there would be no point in settling for such an approximate number. If we need its β because we intend to utilize the world classic CAPM, we can measure it directly. The approximate procedure can become valuable, however, when attempting to price an asset that is not yet traded and for which no comparable firm exists. In the example of the U.S. automobile plant in Brazil, we could go through the following steps:

- The β of the Brazilian plant vis-à-vis the world is approximately equal to the β of the Brazilian plant vis-à-vis the Brazilian stock market multiplied by the β of the Brazilian stock market vis-à-vis the world.
- The second term of that product can be calculated directly.
- The first term cannot be calculated since the Brazilian plan is not traded in the financial market. But we can assume further that the β of the Brazilian plant vis-à-vis the Brazilian stock market is similar in magnitude to the β of any automobile plant vis-à-vis the country stock market measured in another country. So, perhaps the β of GM vis-à-vis the U.S. stock market can be used instead.[32]

[32] Needless to say, if leverage differs, a leverage adjustment must be performed.

How good an approximation is provided by this procedure?[33] Tables 15 to 18 attempt to address this issue. It compares the direct and the approximate βs of a number of firms in four countries: France, the U.S., Belgium and Poland. Poland is the only country out of the four where the approximation is very bad. Does that mean that there is a tendency for the approximation to not work well in countries whose capital market is not well integrated with the rest of the world. That would be bad news as developing capital markets may be the ones for which we need this approximation most often.

Table 15: FRENCH MARKET
in EUROS (last 15y)

NAME %/year	β to France index	β to world index	Product of βs = $\beta_{i/c}\times\beta_{c/w}$
FRANCE INDEX		0.92	
ACCOR	1.10	1.02	1.02
AIR LIQUIDE	0.69	0.54	0.63
AXA	1.34	1.19	1.24
BOUYGUES	1.34	1.19	1.24
CARREFOUR	0.87	0.83	0.81
CIMENTS FRANCAIS	1.00	0.83	0.92
DANONE	0.73	0.61	0.67
SOCIETE GENERALE	0.91	0.82	0.84
TOTAL FINA ELF SA	0.65	0.63	0.60
SANOFI - SYNTHELABO	0.78	0.63	0.72
SUEZ	1.00	0.83	0.92
PERNOD - RICARD	0.85	0.58	0.78
PEUGEOT SA	1.08	1.02	0.99
MICHELIN	1.14	1.09	1.05
DASSAULT AVIATION	0.57	0.55	0.53
PINAULT PRINTEMPS	1.28	1.19	1.18

Table 16: US MARKET
In USD 1/28/1987 to 1/28/2002

NAME %/year	β to US index	β to world index	Product of βs = $\beta_{i/c}\times\beta_{c/w}$
US INDEX		0.82	
ABBOTT LABS.	0.51	0.40	0.41
AMER.HOME PRDS.	0.58	0.43	0.47
ANDERSEN GROUP	0.66	0.51	0.54
AT & T	0.86	0.69	0.71
BANK OF AMERICA	1.09	0.68	0.89
FORD MOTOR	0.84	0.68	0.68
GEN.ELEC.	1.13	0.90	0.92
HEWLETT - PACKARD	1.44	1.21	1.17
INTL.BUS.MACH.	0.98	0.90	0.80
JOHNSON & JOHNSON	0.70	0.53	0.57
MOTOROLA	1.46	1.25	1.19
PFIZER	0.74	0.58	0.61
CATERPILLAR	0.99	0.88	0.81
NTHN.TRUST	1.00	0.88	0.81
KIMBERLY - CLARK	0.54	0.45	0.44
WELLS FARGO & CO	0.94	0.76	0.77

[33] The procedure was suggested by Lessard (1996).

THALES (EX THOMSON - CSF)	1.10	0.88	1.02	COCA COLA	0.72	0.57	0.59
VALEO	1.14	1.10	1.05	DU PONT E I DE NEMOURS	0.85	0.74	0.69
COLAS	0.94	0.77	0.87	INTEL	1.57	1.29	1.28
VIVENDI UNIVERSAL	1.13	0.95	1.04	WALT DISNEY	1.17	0.94	0.95

Table 17: BELGIUM MARKET
in EUROS 1/28/1987 to 1/28/2002

NAME %/year	β to Belgium index	β to world index	Product of βs = $\beta_{i/c}\times\beta_{c/w}$
BELGIUM INDEX		0.67	
ALMANIJ	0.95	0.57	0.63
BARCO NEW	1.28	1.15	0.86
FORTIS (BRU)	1.06	0.78	0.71
DELHAIZE	1.07	0.79	0.72
GLAVERBEL	1.00	0.66	0.67
ELECTRABEL	0.50	0.24	0.34
TRACTEBEL	0.90	0.47	0.60
SOLVAY	1.25	0.86	0.84
UCB	1.12	0.74	0.75
TESSENDERLO	1.06	0.86	0.71
GBL NEW	0.92	0.63	0.61
KBC BKVS.HDG.	1.12	0.72	0.75
ARBED (BRU)	1.29	1.18	0.86

Table 18: POLISH MARKET (last 5y)
In ZLOTYS

NAME %/year	β to PLN index	β to world index	Product of βs = $\beta_{i/c}\times\beta_{c/w}$
PLN INDEX		0.48	
BIG BANK GDANSKI	1.24	1.14	0.59
BPH PBK SA	0.84	0.00	0.40
BRE	0.82	0.55	0.39
BROWARY ZYWIEC	0.44	0.04	0.21
BUDIMEX	0.76	0.51	0.36
DEBICA	0.56	0.11	0.27
ELEKTRIM	1.12	0.46	0.53
EXBUD	0.81	0.23	0.39
KETY	1.05	0.29	0.50
OKOCIM	0.57	0.26	0.27
PETROBANK	0.54	0.07	0.26
BOS	0.39	0.05	0.19
STOMIL OLSZTYN	0.74	-0.04	0.35

6.2. Implications of the hybrid CAPM

We have repeatedly used the example of Thalès, a French company. Could we try to guess what the stock market return on Thalès would have to be, if Thalès, instead of being a company operating in France, were a company operating in the U.S.?

The model recognizing a world and a country factor may be helpful in this respect. In Table 19, we have constructed the premium on the actual French Thalès in

Euros. This table is analogous to Table 5 above but, unlike Table 5, measurements have been done in Euros directly from the original data.[34]

If we try to imagine what the exposure coefficients would have been if Thalès were a U.S. company, one might venture the hypothesis that the coefficients (factor loadings) would be identical to what they are for the actual French company, except that the loading that falls on the French stock market factor would now fall on the U.S. stock market factor. In addition,[35] one might prefer to think that the coefficients, applying to USD returns, would be identical to what they are for the actual French company's Euro returns.

This idea is implemented in Table 20 where the unit of measurement is the dollar. Table 20 also contains the calculation of risk premiums for an actual U.S. company engaged, like Thalès in the manufacturing of electrical equipment, namely General Electric. The similarity of the two firms' cost of equity capital and exposure coefficients is intriguing.

[34] Unlike the International Asset Pricing Model, the hybrid model, if it does not contain any premium for currency factors, is not amenable to direct translation of the terms of the equation. A change of unit requires that one go back and re-measure returns in the new currency.
[35] But this is not intrinsic to this model, which does not emphasize currency differences.

Table 19: Required Euro premium on Thalès, according to the "hybrid model" incorporating world and country factors					
1/28/1987 to 1/28/2002 %/year	"Quantity of risk" Joint β of Thalès vis-à-vis two markets		"Price of risk" Equity premia on the two markets		Required premium %/month
World market	-0.337	x	0.271%	=	-0.091%
French market	1.320	x	0.400%	=	0.528%
Total					0.437%

Table 20: Required USD premium on fictional U.S. Thalès, according to the "hybrid model" incorporating world and country factors					
1/28/1987 to 1/28/2002 %/year	"Quantity of risk" Joint β vis-à-vis two markets		"Price of risk" Equity premia on the two markets		Required premium %/month
World market	-0.337	x	0.267%	=	-0.090%
U.S. market	1.320	x	0.654%	=	0.863%
Total					0.773%
General Electric					
World market	-0.049	x	0.267%	=	-0.013%
U.S. market	1.157	x	0.654%	=	0.756%
Total					0.743%

The transposition that we have performed is quite naïve. Thalès presumably has some activities in the U.S. and General Electric in the European Union. Furthermore, General Electric, and perhaps also Thalès, have other activities than the manufacturing of electrical equipment. It might be possible, along the lines of Diermeier and Solnik (2001) to make use of information on the firm's activities in order to refine the transposition procedure.

6.3. Implications of the International Asset Pricing Model

There exists a third method of transposing returns from one country to another. It is based on the International Asset Pricing Model, in which, as we saw, currency risk plays center-stage.

Let us try to answer in this context the same question we asked in Subsection 6.2. Could we try to guess what the stock market return on Thalès would have to be, if Thalès, instead of being a company operating in France, were a company operating in the U.S.?

In Table 11, we calculated the required excess rate of return of Thalès in Euros. This required rate of return reflected Thalès' exposures to the world market and to the dollar denominated deposit excess return, both measured in Euros. If Thalès had been a company operating in the U.S., one might surmise that its exposures, *measured in dollars*, would have been similar to what they are, when measured in Euros, for the actual Thalès operating in France. This, of course, is pure guesswork but it makes some sense if the U.S. version of Thalès conducts business vis-à-vis the rest of the world in a way that is similar to the actual Thalès, the only difference being that it conducts it from a home base functional currency that is the U.S. dollar, instead of being the Euro. In actuality, of course, many other aspects of business in the U.S. may differ from business in Europe.

Presuming that the reader is willing to humor us in our flight of fancy, we show in Table 21 our calculation of the rate of return on the fictional U.S. version of Thalès. To illustrate the verisimilitude of our fictional story, Table 21 also contains a similar calculation for General Electric, an actual U.S. company engaged, like Thalès, in the manufacturing of electrical equipment. The similarity of the exposures of the two companies – the fictional Thalès and the actual G.E. – is uncanny, although it may just be a coincidence.

Table 21: Required USD premium on fictional Thalès U.S. according to the IAPM					
1/28/1987 to 1/28/2002 %/month Thalès U.S.	**"Quantity of risk"** Joint β vis-à-vis two markets		**"Price of risk"** Equity premia on the two markets		Required premium %/month
World market	0.856	x	0.267%	=	0.229%
Euro deposit	-0.159	x	-0.038%	=	-0.038%
Total					0.235%
1/28/1987 to 1/28/2002 %/month General Electric	Joint β vis-à-vis two markets		Equity premia on the two markets		
World market	0.916	x	0.267%	=	0.245%
Euro deposit	-0.426	x	-0.038%	=	0.016%
Total					0.261%

This exercise illustrates how the IAPM operates a neat separation between currency risk and "business risk". Transposing from one country to another, leaving the exposures unchanged, only involves translating the risk premiums. Once risk premiums have been obtained, the only remaining task needed to obtain required rates of return is the replacement of one rate of interest with another.

The two approaches to evaluating Thalès' risk premium, using the hybrid model and the IAPM, give us intriguing results. In both cases, the risk premiums estimated for Thalès are remarkably similar to those of General Electric. But another feature of the results is important. The hybrid model leads to a much higher risk premium for Thalès (0.773 %/month) than does the IAPM (0.235 %). So we have not resolved the problem of choosing the "right model" for pricing a firm internationally. What the examples suggest is that the cost of capital for a French firm like Thalès may not be that different from that of an American firm like G.E. – as long as a similar model of pricing is used and the conditions under which the firm operates are taken into account. But the examples leave unresolved the issue of which model is right.

7. Conclusion

The main issue in determining the cost of equity capital on a venture internationally is the degree of integration of the world financial markets. If it is believed that some segmentation prevails along national borders, a home β and a home equity premium is to be used. If it is believed that integration prevails, a world β and a world equity premium is to be used. One way perhaps to remain agnostic on the issue is to use a hybrid CAPM containing several risk premiums for home and world risks.

The general approach that we have tried to illustrate relies on an identification and separation of individual dimensions of risk: home vs. world stock market risk, industry risk (not discussed here), currency risk and political risk. It is not enough to identify each dimension of risk. The price of each one must also be readable by watching the tickertape. Dimensions of risk must be recognized in such a way that there exist traded securities capable of indicating to us the price of each dimension. In some cases, some audacious transposition must be performed so that a particular venture can be priced, even if only approximately.

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