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12 Ways to Calculate the International Cost of Capital

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ABSTRACT

In a survey of U.S. Chief Financial Officers, Graham and Harvey (2001) find that 73.5% of respondents calculate the cost of equity capital with the capital asset pricing model (CAPM). They also present evidence that many use multifactor versions of this model. In countries like the U.S., the different methods often yield similar results. However, when we move outside the U.S. – particularly to developing markets – different methods can produce widely varying results. There is considerable disagreement as to how to approach the international cost of equity capital. This paper critically reviews 12 different approaches.

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Introduction

The goal of this paper is to critically examine the different methods of calculating the international cost of capital.

A long-standing problem in finance is the calculation of the cost of capital in international capital markets. There is widespread disagreement, particularly among practitioners of finance, as to how to approach this problem. Unfortunately, many of the popular approaches are ad hoc and, as such, difficult to interpret.

Cost of Capital: The Current Practice

There are remarkably diverse ways to calculate country risk and expected returns. The risk that I will concentrate on is risk that is “systematic.” That is, this risk, by definition, is not diversifiable. Importantly, systematic risk should be rewarded by investors. That is, higher systematic risk should be linked to higher expected returns.

Model 1: The World Capital Asset Pricing Model

A simple, and well known, approach to systematic risk is the Capital Asset Pricing Model (CAPM) of the Sharpe (1964), Lintner (1965) and Black (1970). This model was initially presented and applied to U.S. data. The classic empirical studies, such as Fama and MacBeth (1973), Gibbons (1982) and Stambaugh (1982) presented some evidence in support of the formulation. The original formulation defined systematic risk as the contribution to the variance of a well-diversified market portfolio (the beta). The market portfolio was assumed to be the U.S. market portfolio. This model was first applied in an international setting by Solnik (1974a,b, 1977). Stulz (1981) developed a consumption-based model. Today, it is more appropriate to consider ‘the market’ as the world market – rather than just the U.S. market portfolio:

$$E[R_{i,t}] = \beta_{i,w} E[R_{w,t}]$$

Where $E[R_{i,t}]$ is the expected rate of return for country *i* equity in excess of a risk free rate, $\beta_{i,w}$ is the beta of country *i* and world returns *w*, and $E[R_{w,t}]$ is the world risk premium. Typically, assumptions like purchasing power parity are invoked and the returns are measured in a common currency, such as the U.S. dollar.

The evidence on using the beta factor as a country risk measure in an international context is mixed. The early studies find it difficult to reject a model that relates average beta risk to average returns. For example, Harvey and Zhou (1993) find it difficult to reject a positive relation between beta risk and expected returns in 18 markets. However, when more general models are examined, the evidence against the model becomes stronger.

Harvey (1991) presents evidence against the world CAPM when both risks and expected returns are allowed to change through time:

$$E[R_{i,t} \mid Z_{t-1}] = \beta_{i,w,t-1} E[R_{w,t} \mid Z_{t-1}]$$

where $E[R_{i,t} \mid Z_{t-1}]$ is the expected rate of return for country *i* equity based on information Z available at time *t-1* (the cost of equity capital) in excess of a risk free rate, $\beta_{i,w,t-1}$ is the dynamic beta of country *i* and world returns *w*, and $E[R_{w,t} \mid Z_{t-1}]$ is the time-varying world risk premium.

However, most of the evidence against the model was concentrated in one country, Japan. At that time (1989), the model showed that the price of Japanese equity was too high. The discrepancy caused the model to be rejected. However, in hindsight, it appears as if the model was correct. Beginning in 1990, there was a long decline in Japanese equity prices.

One might consider measuring systematic risk the same way in emerging as well as developed markets. Harvey's (1995a) study of emerging market returns suggests that there is no relation between expected returns and betas measured with respect to the world market portfolio. A regression of average returns on average betas produces an R-square of zero. Harvey documents that the country variance does a better job of explaining the cross-sectional variation in expected returns.

Indeed, the evidence in Harvey (1995a) shows that, over the 1985-1992 period, the pricing errors are positive in every country in the IFC database. This implies that the model is predicting too low of an expected return in each country. In other words, the risk exposure as measured by the world model is too low to be consistent with the average returns.

One interpretation of Harvey (1995) is that the prices in emerging markets were too high and the model was correct. That is, the positive pricing error means that the model expected return was much lower than the realized return. Harvey (2000) revisits this analysis after significant adjustments in emerging market stock price levels after various financial crises. Here the CAPM model fares better. However, his evidence also shows that variance rather than beta does a better job of explaining returns across different emerging markets. This is clear evidence against the CAPM formulation.

Model 2: The World Multifactor Capital Asset Pricing Model

Ferson and Harvey (1993) extend this analysis to a multifactor formulation that follows the work of Ross (1976) and Sharpe (1982). Their model also allows for dynamic risk premiums and risk exposures. Fama and French (1998) extend their multifactor model to developed and emerging market returns.

$$E[R_{i,t} \mid Z_{t-1}] = \sum_{j=1}^{k} \beta_{i,j,t-1} E[F_{j,t} \mid Z_{t-1}]$$

where now there are k different betas, $\beta_{i,j,t-1}$ ($j=1,...,k$) which are dynamic and k factors $E[F_{j,t} \mid Z_{t-1}]$ ($j=1,...,k$).

The bottom line for these studies is that the beta approach has some merit when applied in developed markets. The beta, whether measured against a single factor or against multiple world sources of risk, appears to have some ability to discriminate between high and low expected return countries. The work of Ferson and Harvey (1994, 1995, 1999) is directed at modeling the conditional risk functions for developed capital markets. They show how to introduce economic variables, fundamental measures, and both local and worldwide information into dynamic risk functions. However, this work only applies to 21 developed equity markets. Figures 1 and 2 show that if all countries are combined, there is no significant relation between beta and the measured expected return.

Model 3: The Bekaert and Harvey Mixture Model

If world capital markets are integrated, then the CAPM should hold and expected returns are determined by their covariance with world returns. If a country is segmented from the rest of the world, then an asset's expected return should be related to the covariance with the local market return.

$$E[R_{h,i,t} \mid Z_{t-1}] = r_{f,t} + \lambda_t \beta_{h,i,w,t-1} E[R_{w,t} \mid Z_{t-1}] + (1-\lambda\ )\beta_{h,i,i,t-1} E[R_{i,t} \mid Z_{t-1}]$$

where $\beta_{h,i,w,t-1}$ is the dynamic beta of security *h* in country *i* and world returns *w*, $\beta_{h,i,i,t-1}$ is the dynamic beta of security *h* in country *i* and local market returns *i*, $E[R_{w,t} \mid Z_{t-1}]$ is the time-varying world risk premium, and $E[R_{i,t} \mid Z_{t-1}]$ is the time-varying local market premium. Importantly, the process of market integration for many developing countries is gradual. Bekaert and Harvey (1995) propose a mixture model. λ_t measures the degree of integration which changes through time. If λ_t =1, then markets are perfectly integrated. If λ_t =0, markets are perfectly segmented.

For country indices, in integrated markets, the expected return is determined by the covariance with world markets. In segmented markets, the expected return is driven by the volatility of the local market return.

Model 4: The Sovereign Spread Model (Goldman Model)

The following problem exists when applying a world CAPM to individual stocks in emerging markets. When regressing the company return (measured in U.S. dollars) on the benchmark return (either U.S. portfolio or the world portfolio), the beta is either indistinguishable from zero or negative. Given the correlations between many of the emerging markets and the developed markets are low and given the evidence in Harvey (1995a,b), it is no surprise that the regression coefficients (betas) are small. The implication is that the cost of capital for many emerging markets is the U.S. risk free rate or lower. This, of course, is a problematic conclusion. Importantly, the fitted cost of capital is contingent on the market examined being completely integrated into world capital markets. If this is not the case, then one has reason not to put much faith in the fitted cost of capital from the CAPM.

The following is a popular modification used by a number of prominent investment banks and consulting firms. A regression is run of the individual stock returns on the Standard and Poor's 500 stock price index returns. The beta is multiplied by the expected premium on the S&P 500 stock index. Finally, an additional "factor" is added which is sometimes called the "sovereign spread" (*SS)*. The spread between the country's government bond yield for bonds denominated in U.S. dollars and the U.S. Treasury bond yield is "added in." The bond spread serves to increase an 'unreasonably low' cost of capital into a number more palpable to investment managers. For the details of this procedure, see Mariscal and Lee (1993).

$$E[R_{i,t}] = SS_i + \beta_{i,w}E[R_{w,t}]$$

There are many problems with this type of model. First, the "additional factor" is the same for every security – even though different companies might have different exposures to country-specific risk. It is possible that the company is more or less risky than the country as a whole. Second, this factor is only available for countries whose governments issue bonds in U.S. dollars. Third, there is no economic interpretation to this additional factor. In some way, the bond yield spread represents an ex ante assessment of a country risk premium that reflects the credit worthiness of the government. However, beyond this, it is difficult to know how to fit this factor into a cost of capital equation. Finally, and most importantly, the premium we attach to debt is different than the premium attached to equity. It doesn't seem correct to assume, for example, that the credit spread on a company's rated debt is the risk premium on its equity.

Model 5: The Implied Sovereign Spread Model

One of the problems with the sovereign spread model is that the sovereign bonds are not available for many countries. Erb, Harvey and Viskanta (1996) offer a simple modification. They propose running a regression of observed sovereign spreads on country risk ratings.

$$SS_i = \alpha_1 + \alpha_2 RR_i + \varepsilon_i$$

The country risk ratings *(RR)* are available for many more countries than the sovereign spread. The α are the regression intercept and slope coefficients. This regression can be estimated at a single point in time or a panel framework whereby many different cross-sections of spreads and ratings are simultaneously examined. In this case, the intercept would be expanded to include an intercept for each time period (known as time effects).

Using the regression model, one can determine the 'implied' sovereign spread for a country that does not have government bonds denominated in U.S. dollars. Simply take the country's risk rating and apply the regression coefficients to get the fitted spread. Often this model is estimated using the natural logarithm of the risk rating. If the risk rating is a letter grade, then the letter needs to be parsed into a number.

Model 6: The Sovereign Spread Volatility Ratio Model

There is another version of the Goldman model. In this alternative setup, which is focused on segmented capital markets, the traditional beta (covariance of market with S&P 500 divided by the variance of the S&P 500) is replaced by a modified beta. The modified beta is the ratio of the volatility of the market to the volatility of the S&P 500.

$$E[R_{i,t}] = SS_i + \frac{\sigma_i}{\sigma_w} E[R_{w,t}]$$

Since the volatility is the segmented market is much greater than the covariance with the world, this serves to "jack up" the beta. It produces a higher risk premium. However, there is no economic foundation for such an exercise. Further, it is difficult to assess how well this fits the data.

The previous model suffers from the problem that sovereign spreads may not exist for a country. Indeed, a country may not even have an equity market. We can use the Erb, Harvey, Viskanta (1996) method to get the implied sovereign spread. A similar exercise can be undertaken for the local volatility. Given the equity markets that exist, a regression can be estimated:

$$\sigma_i = \delta_1 + \delta_2 RR_i + \varepsilon_i$$

where δ are the intercept and slope coefficients. With a given risk rating, we can get a fitted local volatility and, hence, a fitted volatility ratio. Again, in practice, it is common to use the natural logarithm of the risk rating.

Model 7: Damodaran Model

One of the main critiques of the sovereign spread model is that it incorrectly uses bond spreads for an equity cost of capital. Equity is riskier than debt. Damodaran (1999) offers a proposed soluation for this problem. His formula is

$$E[R_{i,t}] = \frac{\sigma_{i,e}}{\sigma_{i,d}} SS_i + \beta_{i,w} E[R_{w,t}]$$

In contrast to the model that just additively includes the sovereign yield spread, this model modifies the spread by multiplying by the ratio of country *i*'s equity to bond return volatility. One can imagine an implied version of this model too. However, a lot of things need to be implied: the local equity volatility, the sovereign spread, and the country beta. In addition, the problem of a company having different exposure to the adjusted sovereign spread still remains.

Model 8: The Ibbotson Bayesian Model

Ibbotson Associates is a leading vendor of the cost of capital in the U.S. It offers a number of different models to its customers. One early model in Ibbotson (1999) was a hybrid of the world capital asset pricing model. The security's return minus the risk free rate is regressed on the world market portfolio return minus the risk free rate. The beta times the expected risk premium is calculated. An additional factor is also included. In this model, the additional factor is one half the value of the intercept in the regression. Half the value of the intercept plays a similar role as country spread in the previous model. The beta times the expected risk premium is 'too low' to have credibility. When the intercept is added, this increases the fitted cost of capital to a more 'reasonable' level. The evidence in Harvey (1995a,b) suggests that the intercept is almost always positive.

The advantage of this model is that it can be applied to a wider number of countries (i.e. you do not need government bonds offered in U.S. dollars). The intercept could be proxying for some omitted risk factor. However, there is no formal justification for including half the intercept. Why not include 100% or 25%? The best way to justify this model is in terms of Bayesian shrinkage. One might have a prior that the model is correct. In implementing the model going forward, the pricing error (intercept) is 'shrunk'. Alternatively, one can think of two competing models: the average return and the CAPM. Adding half the intercept value, effectively averages the predictions of these two models.

Model 9: The Implied Cost of Capital Model

Lee, Ng, and Swaminathan (2005) propose an implied cost of capital based on the level of market prices. The idea is straightforward and has been applied for many years to U.S. equities. Given forecasts of cash flows, what is the discount rate that makes the present value of these cash flows equal to the market price that we observe today. This model delivers an implied cost of capital. However, it is also the case that this model critically relies on the forecasted cash flows. Indeed, one could equivalently think of this as a representation of the forecasted cash flows. If the forecasts are wrong, then the model's cost of capital would be inaccurate. The model also relies on the assumption that the market price is correct.

Model 10: The CSFB Model

Hauptman and Natella (1997) have proposed a model for the cost of equity in Latin America. Their model is hard to explain. Consider the equation:

$$E[r_{i,t}] = rf_t + \beta_{i,us}\{E[r_{us,t} - rf_{us,t}] \times A_i\}K_i$$

where $E[r_{i,t}]$ is the expected cost of capital; rf_t is the stripped yield of a Brady bond, $\beta_{i,us}$ is the covariance of a particular stock with the broad based local market index, $E[r_{us,t} - rf_{us,t}]$ is the U.S. risk premium, A_i is the coefficient of variation in the local market divided by the coefficient of variation of the U.S. market (where coefficient of variation is the standard deviation divided by the mean) and K_i is an adjustment factor to allow for the "interdependence between the riskfree rate and the equity risk premium." In their application, Hauptman and Natella assume that K=0.60.

So you can see why this one is hard to explain. It has some similarity to the CAPM if we ignore the A and the K. However, the beta is measured against the local market return and the beta is multiplied by the risk premium on the U.S. market - which is not intuitive. Multiplying by the ratio of coefficients of variation is the same as multiplying by the ratio of the standard deviation of the local market to the standard deviation of the U.S. market - which is similar to the to the Goldman modified beta. You then need to multiply again by the ratio of the average return in the U.S. divided by the average return in the local market. In a way, the average return in the U.S. is squared in this unusual formula. In addition, if the average return in the denominator is small, this formula could get wildly high costs of equity capital.

This model is a perfect example of the confusion that exists in measuring the cost of capital.

Model 11: Expected Returns are the Same Globally

This model is throws out all the models. A corporation calculates their cost of equity capital in the U.S. and applies the same rate to all countries. This would appear to ignore all risk differences that exist across borders. In addition, value might be destroyed by accepting projects with a discount rate that is too low or bypassing projects whose risk is less than the U.S. risk.

In practice, a number of companies use a seemingly similar approach. However, differences in risk across countries are recognized. Risk is factored into the cash flows forecasts – not the denominator (discount rate). While it is equivalent to either increase the discount rate or to reduce the expected cash flows, the problem with the cash flow technique is in its implementation. How much do you reduce the cash flows by to reflect the risk? How can you ensure that a common method is used across countries?

Practically speaking, an important step in project evaluation is some sort of Monte Carlo model to reflect different cash flow states of the world. In this case, it makes sense to put the risks into the cash flows (rather than simulating both the cash flows and the discount rate). However, a model is needed. For example, suppose you are using one of the models and the model says the discount rate in Argentina is double that of the U.S. discount rate. In our Monte Carlo work, we can use a U.S. discount rate and reduce the average cash flows by 50% to reflect the risk from the model.

Model 12: The Erb-Harvey-Viskanta Model

This model specifies an external ex ante risk measure. Erb, Harvey and Viskanta (1996) require the candidate risk measure to be available for all 135 countries and available in a timely fashion. This eliminates risk measures based solely on the equity market. This also eliminates measures based on macroeconomic data that is subject to irregular releases and often-dramatic revisions. They focus on country credit ratings.

The country credit ratings source is *Institutional Investor's* semi-annual survey of bankers. *Institutional Investor* has published this survey in its March and September issues every year since 1979. The survey represents the responses of 75-100 bankers. Respondents rate each country on a scale of 0 to 100, with 100 representing the smallest risk of default. *Institutional Investor* weights these responses by its perception of each bank's level of global prominence and credit analysis sophistication [see Erb, Harvey and Viskanta (1995)].

How do credit ratings translate into perceived risk and where do country ratings come from? Most globally oriented banks have credit analysis staff who estimate the probability of default on their bank's loans. One dimension of this analysis is the estimation of sovereign credit risk. The higher the perceived credit risk of a borrower's home country, the higher the rate of interest that the borrower will have to pay. There are many factors that simultaneously influence a country credit rating: political and other expropriation risk, inflation, exchange-rate volatility and controls, the nation's industrial portfolio, its economic viability, and its sensitivity to global economic shocks, to name some of the most important.

The credit rating, because it is survey based, may proxy for many of these fundamental risks. Through time, the importance of each of these fundamental components may vary. Most importantly, lenders are concerned with future risk. In contrast to traditional measurement methodologies, which look back in history, a credit rating is forward looking and dynamically changes through time depending on fundamental conditions.

The idea in Erb, Harvey and Viskanta (1996) is to fit a model using the equity data in 47 countries and the associated credit ratings. Using the estimated reward to credit risk measure, they forecast "out-of-sample" the expected rates of return in the 88 which do not have equity markets.

Erb, Harvey and Viskanta (1996) is to fit:

$$R_{i,t} = a_0 + a_1 Log(RR_{i,t-1}) + \varepsilon_{i,t}$$

where *R* is the semi-annual excess return in U.S. dollars for country *i*, Log(*RR)* is the natural logarithm of the country credit rating which is available at the end of March and the end of September each year (the risk ratings are lagged), time is measured in half years and ε is the regression residual. They estimate a time-series cross-sectional regression by combining all the countries and credit ratings into one large model. In this sense, the coefficient is the 'reward for risk' – for this particular measurement of risk. Consistent with asset pricing traditions, this reward for risk is worldwide -- it is not specific to a particular country.

It is important to use the log of the credit rating. A linear model may not be appropriate. That is, as credit rating gets very low, expected returns may go up faster than a linear model suggests. Indeed, at very low credit ratings in a segmented capital market, such as the Sudan, it may be unlikely that any hurdle rate is acceptable to the multinational corporation considering a direct investment project.

Convincing evidence is presented in Erb, Harvey and Viskanta (1996) about the fit of the credit rating model. They find that higher rating (lower risk) leads to lower expected returns. Figure 3 shows a significant negative relation. It should be noted that the R-square in the 1990s is 30% which is about as good as you can get - even in the U.S. market with the best multifactor model. Appendix A shows an example implementation for Argentina.

Recommendations and further research

There is widespread disagreement as to how to approach the international cost of equity capital. My recommendation is as follows. In developed, liquid markets, it is best to use either a capital asset pricing model or a multifactor model. It is important to allow for time-varying risk premiums. Figure 4, from Graham and Harvey (2005), shows that the risk premium for the U.S. has declined in recent years.

For emerging markets, it is not so simple. It really depends on the how segmented the market is. Given that the assumptions of the CAPM do not hold, I avoid using the world version of the CAPM in these markets. I never use the CSFB model, the Ibbotson model, or the sovereign spread volatility ratio model. I will often examine a number of models such as the sovereign spread, Damoradan and the Erb, Harvey and Viskanta model and average the results.

There are other important issues that need to be addressed in addition to the basic choice of model.

One of the most important is the term structure of country risk. Emerging markets, in particular, are subject to crises. In and around the crisis, risk spikes. However, as Erb, Harvey and Viskanta (1996), there is evidence of mean reversion in country risk ratings. This implies that it would be inappropriate to use the current risk to evaluate cash flows for, say, 10 years of a project life. There is a term structure of country risk that needs to be taken into account in project evaluation.

There are many other issues that take us well beyond the standard asset pricing frameworks. Stulz (1995, 2005) argues that variation in the degree of agency costs will induce differences in the cost of capital across countries. This poses a considerable challenge for all of the current models. Stulz's analysis suggests that differences in corporate governments and the general institutional environment need to be explicitly accounted for in making statements about the cost of capital.

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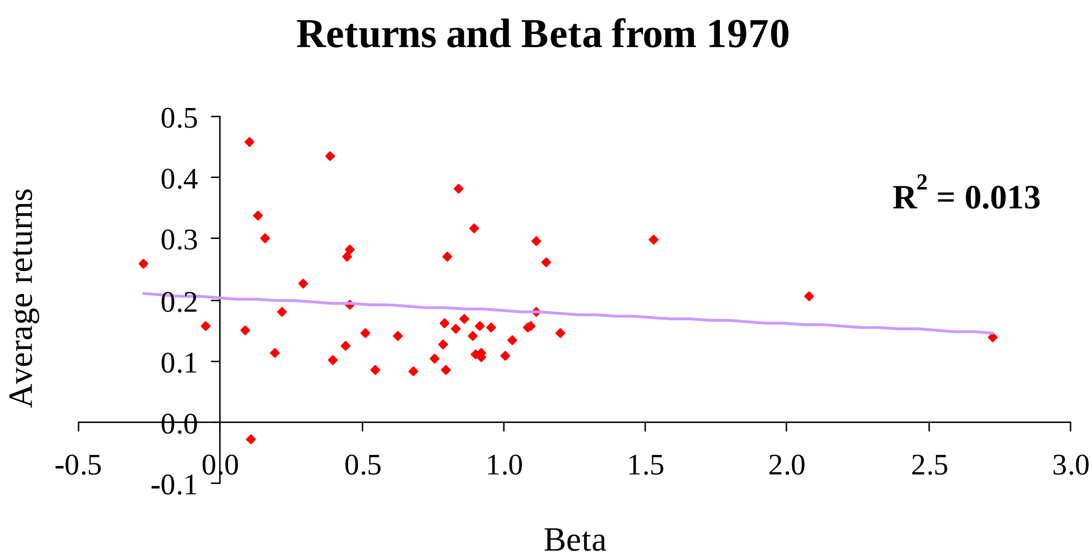
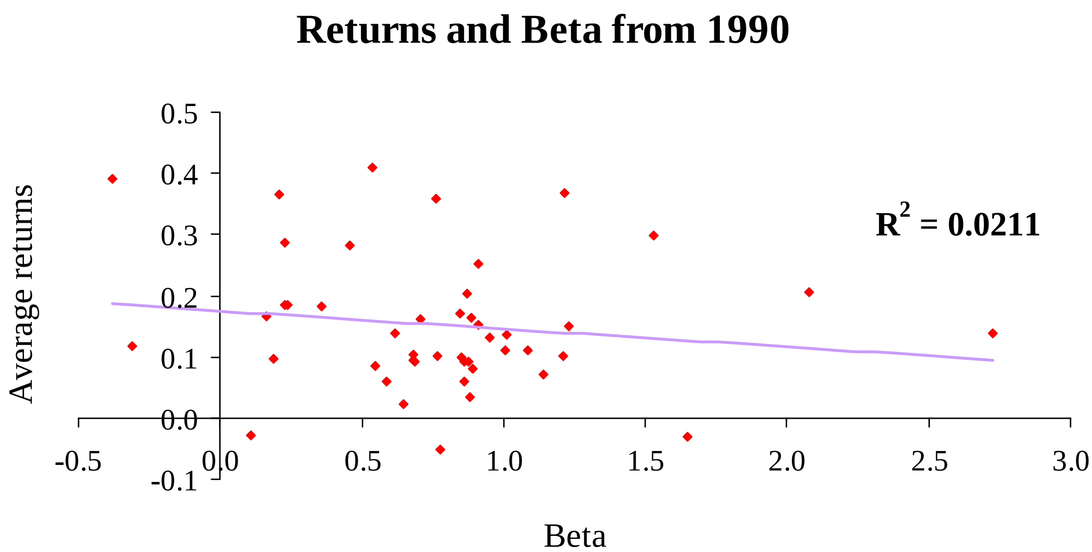
Figure 1



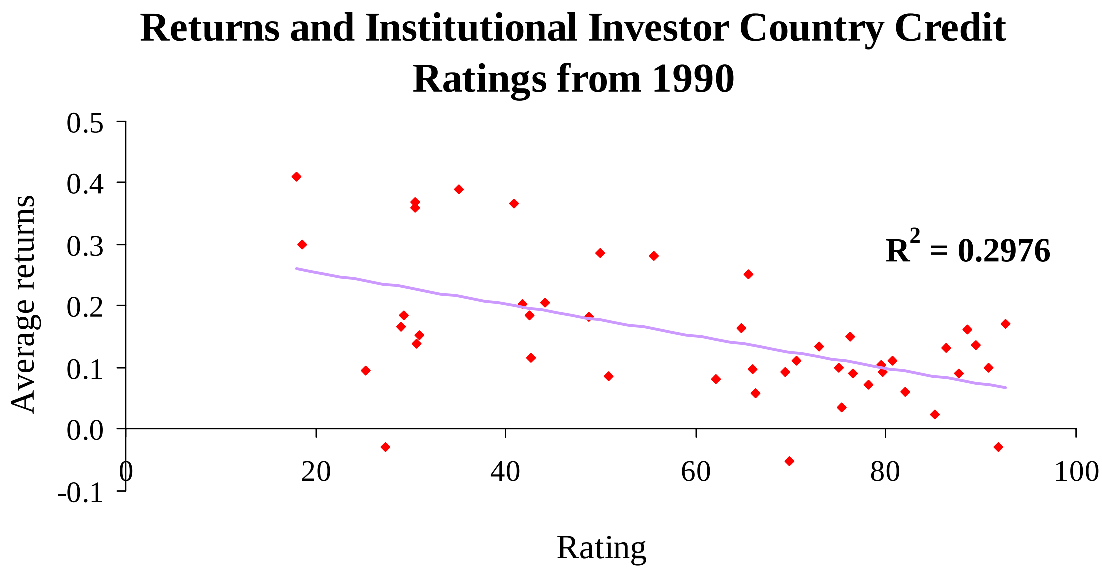
Notice the relation goes the wrong way. Higher risk (beta) is associated with lower returns.

Figure 2



Even, if we use more recent data, the risk-return relation goes the wrong way.

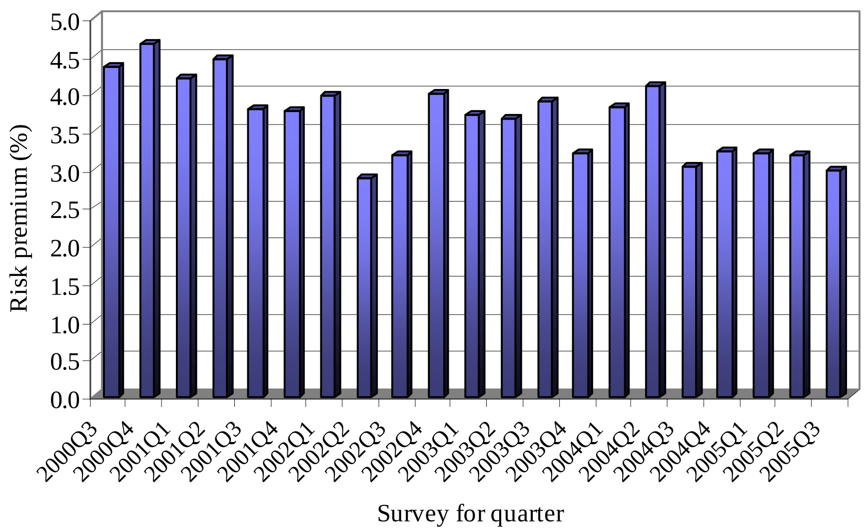
Figure 3



Notice that lower rating means higher risk – and associated higher expected return.

Figure 4

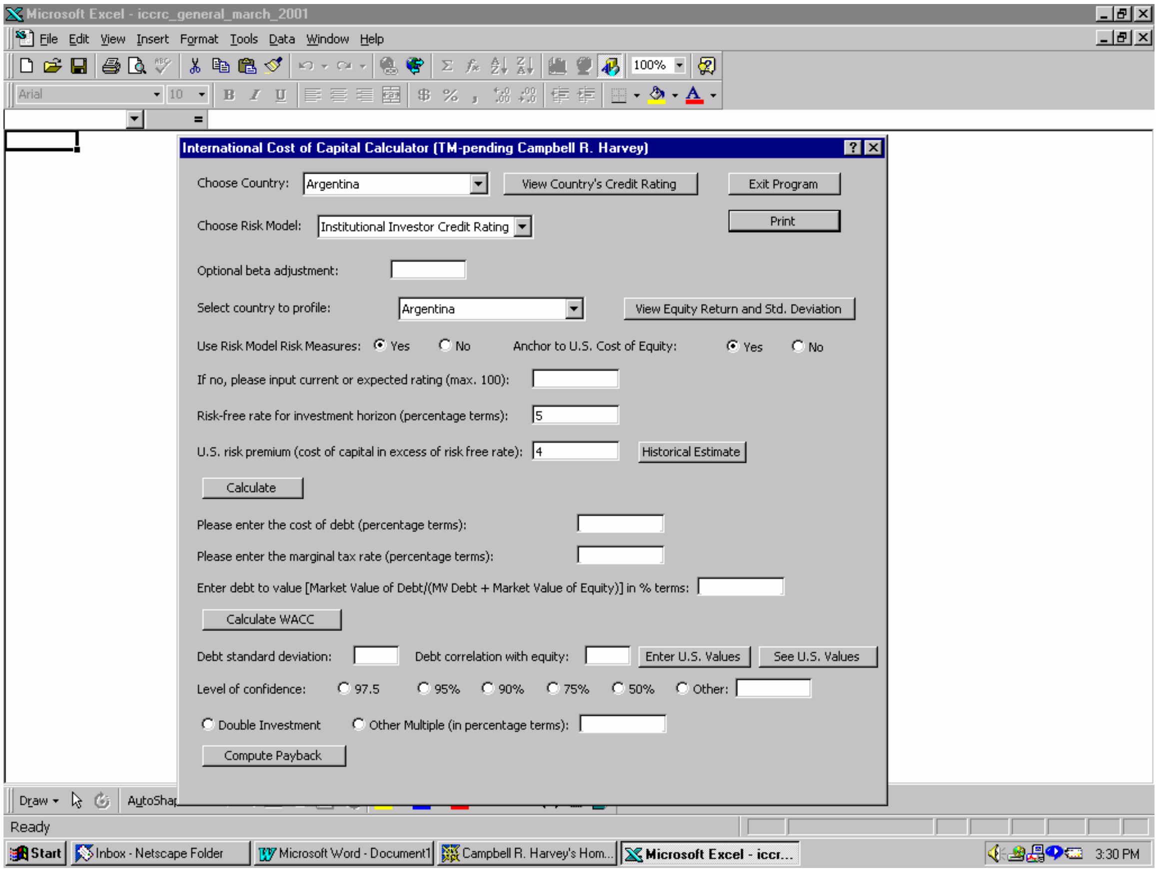
10-year U.S. Equity Risk Premium



10-year Risk Premium based on 21 quarterly surveys detailed in Graham and Harvey (2005).

Appendix A: Sample IICRC Excel Screen

Inputs: (i) Select country, (ii) anchor to your view of U.S. risk premium, (iii) current risk free rate, (iv) your view of U.S. risk premium



Appendix A: Sample IICRC Excel Screen (continued)

Outputs: Press "Calculate" button and obtain (i) expected return in U.S. dollars, (ii) expected volatility and (iii) expected correlation with the world market portfolio.