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The Equity Risk Premium in Emerging Markets:

The Case of Chile*

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1. Introduction

The Equity Risk Premium (ERP) is defined as the difference between the expected return on common stock and the return on government securities; for example, in the U.S. it is common practice to compute it over the 1- month treasury bill, or the 20- year Treasury bond. This is a general definition, but in practice it is important to distinguish between conditional, short- term forecasts of the equity premium, and estimates of the unconditional mean(see Constantinides, 2002).[1] Conditional estimates are based on evidence that price-dividend and price- earnings ratios forecast aggregate equity returns; whereas if the equity premium is a stationary process, the long term historical average is an unbiased estimate of the unconditional equity premium. Our interest in this paper is in the unconditional, long-term equity premium.

This parameter is important in many areas of finance; for instance, in the asset allocation decisions of a portfolio manager, the decision of how to divide a financial investment between stocks and fixed income securities depends on the ERP and their different risk characteristics. Also, the ERP is a critical input to pension planning decisions in defined contribution pension plans: the level of pension assets available at retirement, and hence the future pensions will depend on the rate of return earned by the pension assets over time, which in turn depends on the ERP. As a third example, in capital budgeting decisions at the corporate level, the ERP is an input in the cost of capital, the discount rate used to compute the Net Present Value of an investment. Finally, in many countries, including Chile, the ERP is an important input in cost of capital calculations that contribute to determine maximum prices to the goods or services of regulated utilities.

The estimation of the equity risk premium is in general a difficult task, but in emerging markets the challenge is simply formidable, for at least two reasons. First, usually in emerging markets researches have to cope with the general lack of relevant data, particularly the long series that are needed to study the equity premium. Second, even if the world equity premium were stable, the equity risk premium of an emerging market may change over time, as its degree of integration to world capital markets change.

The organization of this paper is as follows. In Section 2 we explore the historical performance of equities and short- term government bills in Chile. Due to the lack of long series of historical data and the endemic iliquidity of emerging markets, frequently practitioners tend to estimate the equity risk premium for an emerging market based on some estimate of the premium in a mature market. In Section 3 we review and discuss the approaches available, as well as the difficulties in producing direct estimates of the equity

[1] As Constantinides (op. cit.) argues, the the conditional forecasts of the mean equity return and premium at the end of the twentieth century and the beginning of the twenty- first are substantially lower than the estimates of the unconditional mean. This can be seen by the value of price- dividend and price- earnings ratios at the beginning of the twenty first century, which well above their historic averages; analysts' earnings forecasts; and Welch (2001) reports of the conditional premium (3.1%)

risk premium in a non- developed economy. Since many methods rely in an estimation of the ERP in a mature market, as a sort of anchor for the estimates in an emerging market, and the ERP in a mature market itself has been a subject of much discussion and research recently, in Section 4 we review the literature on the ERP in developed markets. Finally, in Section 5 we summarize and conclude our results.

2. Historical record of the ERP in Chile.

The traditional method consists in estimate the sample mean of the longest time series available of the difference between the market return of a diversified portfolio and a risk free rate (assuming that the ERP is stationary). The return of the market portfolio was estimated using the General Stock Price Index (IGPA). This price index includes all the stocks that have been transacted over a specific period. This is a better index as a proxy of the market portfolio than the Selective Stock Price Index (IPSA), which includes the 40 stock with highest market transaction. The problem with the latter index is that it is strongly influenced by the price of utilities and therefore it is not a good proxy for a well-diversified portfolio.

One of the limitations for working with the IGPA is that the index is not corrected by dividends.[2] Therefore, it is necessary to correct the index to obtain a good proxy for the market return. Thus the market return in period t (R_{mt}) will be defined in the usual way:

$$R_{mt} = \frac{p_{t+1} + d_{t,t+1}}{p_t} - 1$$

where p_t is the price of the portfolio in period t, d_t represent the dividend payments in t. The dividend yield is defined as d/p.

We need a risk free rate to estimate the equity risk premium. Our first choice is the interest rate paid by a promissory note issued by the Central Bank. One candidate for a short-term maturity is the interest rate paid by the 90 days promissory note (called PRBC).[3] This series is relatively short since these notes exist only since 1986. For that reason we also used the 90 days deposit interest rate, which is available since November 1976. Both type of instruments, PRBC and 90 days deposit are denominated in an CPI-indexed unit of account called UF (unidad de fomento). This unit of account varies every day accordingly to the previous month inflation. Therefore the variation of the value of this unit of account from the 10th day of any month until the 9th day of the following month correspond exactly to the previous month inflation. These interest rates are not real interest rate but are highly correlated with the ex – post real interest rate. To make comparable the risk free rate with the market return portfolio we also express the variation of the stock price index in UF terms.

The equity risk premium is estimated using annual data to compare internationally. Table 3.1 presents some descriptive statistics for the case of two definitions of the risk free

[2] Another problem is that many of the stocks that compose the IGPA do not trade frequently. As a result, as a institutional portfolio manager told us, it is not possible to invest in the IGPA.

[3] This is a measure of the ERP in short horizons; for longer horizons, a bond issued by the Central Bank would be advisable.

rate. As shown, for the longest period 1977-2001, the ERP estimated is 17.3% (using deposit rate as a proxy of risk free rate). Using the PRBC for the period that we have data the ERP is 20.5%. To make it comparable, we also report the ERP using the deposit rate as risk free for the same period (1986-2001) obtaining 20.4 as average. The choice of risk free rate does not matter for obtaining an estimation of ERP. The estimated value seems too high for international standards.

Table 3.1 Estimation if the Equity Risk Premium

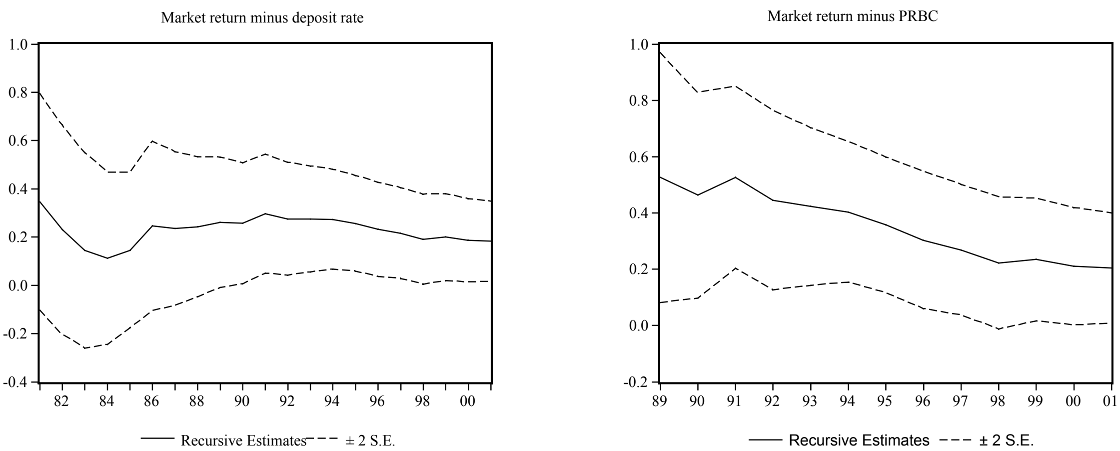
Definitions Periods	$R_m - i_{cap}$ 1977-2001	$R_m - i_{cap}$ 1986-2001	R_m – PRBC 1986-2001
Mean	0.1730	0.2039	0.2046
Median	0.1680	0.1746	0.1680
Maximum	1.1525	1.1547	1.1525
Minimum	-0.4254	-0.3436	-0.3433
Std. Dev.	0.4116	0.3911	0.3903
Skewness	0.6028	0.9243	0.9269
Kurtosis	2.8860	3.4936	3.4974
Jarque-Bera	1.5889	2.4404	2.4559
Probability	0.4518	0.2952	0.2929
Observations	25	16	16

An important feature of the ERP in Chile is the large fluctuation over the sample period, from a minimum of –42% up to a maximum of 150%. The standard deviation of the mean is 8.2% for the risk premium over deposit rate (1977-2001) and 9.8% over the PRBC, therefore the 95 confidence interval for the ERP over the PRBC is (0.9% – 40.0%). The high standard deviation is showing that we can estimate an ERP with very low precision. The null hypothesis of normality cannot be rejected using the Jarque-Bera test. Another important question is the estimated risk premium is stable over time. To answer this question the following regression is estimated:

$$R_{mt} - R_{ft} = \alpha \quad t = 1,...,T$$

The estimated α will be equal to the sample mean showed in Table 3.1. To the estimated α we apply the recursive coefficient estimation to check for stability. The following graphs show those test for the PRBC and the deposit rate. The ERP estimated with deposit rate seems reasonable stable, while in the case of the estimation using the PRBC the stability property is doubtful. The CUSUM and the CUSUM of squares test in some cases reject the stability hypothesis.

Graph 3.1. Recursive Coefficients Estimation



These tests have contradictory results on the hypothesis of stability. Therefore we applied a third test that has a clear interpretation and result, which is the Hansen test[4]. The computed values for this test are showing in Table 3.2. According to them the null hypothesis of stability cannot be rejected at any level for the ERP calculated using the deposit rate. However, for the case of the PRBC the test reject the stability hypothesis at the 10% level of significance.

Table 3.2. Hansen Stability Test for each estimation of ERP

Premium over	Calculated value of the test	Value for rejecting at 1%	Value for rejecting at 5%	Value for rejecting at 10%
Deposit rate	0.279	0.75	0.47	0.35
PRBC	0.431	0.75	0.47	0.35

In summary if one assumes that the deposit rate is a good proxy for the ERP, then the traditional method provides an estimated ERP of 17.3% that is reasonably stable. However, the estimation of this ERP is very imprecise; so much so that the estimated mean value cannot be considered a reliable estimate of the Chilean ERP. The problem is that 24 years of data is far from a long enough series when it comes to estimate the expected return on the market portfolio.

[4] See Johnston y DiNardo (1997).

3. Estimates of the ERP of an emerging market

Emerging markets do not behave like mature markets, and hence the emerging market equity premium is not necessarily equal to the equity premium of a mature market. For instance, Bekaert et al (1997) find that the CAPM fails to explain emerging market returns; when Poland, an outlier, is removed from a sample of 27 countries in the period July 1991- June 1996, the R- square of the market model regression falls to 0 per cent. These results contrast with the empirical evidence for mature markets, where the beta approach is found to have some value.

Harvey (1991) tests the conditional version of the Sharpe- Lintner capital asset pricing model for a sample of mature markets, and reports that for most countries (with the notable exception of Japan, which he suggests could be less than fully integrated on the sample period), a single source or risk appears to adequately describe the cross- sectional variation in returns across different countries.[5] There are reasons that explain the different behavior. The same author, in a more recent work (2001) suggests four reasons, all of which arise from violations of the standard assumptions of the well known Sharpe- Lintner capital asset pricing model. First, the assumption of perfect markets implies, in international finance, that markets are perfectly integrated, meaning that the same risk asset commands the same expected return regardless of geographical location (country); and so the model may fail because of lack of market integration in some emerging markets. The intuition is the following: consider the extreme case of a completely segmented country, where local investors are not allowed to own foreign securities, nor foreign investors to own local securities. If the CAPM holds in that country, the local investors hold the (local) market portfolio, and they care about the variance of the country portfolio, not its covariance with world returns. Then, in a less polar case, if markets are partially integrated, expected returns could reflect some reward for the covariance with world market returns as well as some reward for the market's own variance.[6] Second, the CAPM assumes that returns follow a multivariate normal distribution; however Bekaert and Harvey (1997) report that emerging market returns are highly non-normal; moreover, they appear to have more "down- side risks" than mature markets, being more vulnerable to suffer from sharp crisis. If investors dislike negative skewness (as they appear to do), it is also important the contribution of the asset to the portfolio's skewness, called coskewness. Harvey (2000) presents evidence that mature markets are not affected by country variance and country skweness (consistent with full integration), but that these variables do add explanatory power in emerging markets, suggesting that they are not completely integrated. Third, perfect markets imply no transaction costs, but the execution fees and liquidity costs[7] are higher in emerging than developed markets. Fourth, there may exist important information asymmetries between local and foreign investors.

Note also that it is not only legal restrictions to capital movements that limit market integration, but also information asymmetries, (Michael Brennan and Henry Cao, 1997).

[5] In a number of studies of US equity returns the traditional CAPM has been questioned, see Fama and French (2002). However, the international evidence is more generous to the traditional framework.

[6] See the early work of Errunza and Losq (1985), and the later time- varying market integration model of Bekaert and Harvey (1995).

[7] Many securities suffer from chronic infrequent trading, making the price data unreliable.

The well documented "home equity bias" is consistent with this vision of less than complete market integration. Once this view is accepted, the lower possibilities of portfolio diversification for local investors of an emerging market suggest a higher ERP for these economies. Several authors recognize this relation between higher market risk and return, including Black (1976), Merton (1980), French, Schwert y Stambaugh (1987), Poterba y Summers (1988), Breen, Glosten y Jagannathan (1989), Turner, Startz, y Nelson (1991), Campbell y Hentschel (1992), y Glosten, Jagannathan y Runkle (1993).

Given the previous evidence on partial integration for emerging markets, the equity risk premium should be higher for emerging markets, but how much higher? The literature in this area is still in its infancy, and the models used by practitioners are ad- hoc. We will discuss six models that are used by practitioners.

The international capital asset pricing model

The international CAPM model assumes complete market integration, so that there is one global price of risk. If currency risk is diversifiable, the cost of equity for company j can be expressed as:

$$k_j = r_f + \beta_{jw} \times ERP_w$$

where r_f is the expected return on the risk- free security, β_{sw} represents the beta coefficient for the company (with respect to the world market portfolio), and ERP_w is the global price of non- diversifiable risk; see for example Solnik and McLeavey (2003).[8] The basic problem with this formulation is that it assumes perfect integration of capital markets, an assumption that proves to be unrealistic in emerging markets. For instance, Harvey (1995) reports no relationship between average return and beta for emerging markets, a result that is confirmed with a broader sample of countries by Erb, Harvey and Viskanta (1996). For this reason, the above model tends to underestimate the ERP in emerging markets.

The globally nested capital asset pricing model

Building on a previous work by Solnik (1991), Clare and Kaplan (1998) developed a model, which they use to compute the cost of capital of four Latin American capital markets. The model is based upon the CAPM, but it incorporates two sources of risk, regional and country specific risks, in addition to the standard global risk of the international CAPM. The model encompasses the previous international CAPM, in the sense that when a country and its associated world region become fully integrated into world capital markets, the model collapses to the more familiar single- factor version the CAPM where only global risk is priced.

[8] If currency risk is systematic, the equation has also sensitivities that measure the currency exposures of the asset times the currency risk premiums, see Solnik and Mc Leavey (op. cit., page 153). The empirical evidence suggests that currency risk is mostly diversifiable.

To implement the model, the authors need to know the world ERP. They use the MSCI world index as a proxy, but the histories series is to short to provide a good estimate of the unconditional mean. So the authors use the Ibbotson data on the US ERP to infer a world ERP. In order to do this, they estimate a market model, having the US equity returns as the dependent variable, and the MSCI world returns as the independent variable. The world ERP is obtained as the US ERP divided by the beta coefficient estimated in the previous step.

In order to test the integration of a particular region to world markets, a second regression is run, with the excess return on region k (k=1,2,…K) as the dependent variable, and the world excess return as the independent variable. The authors consider a statistically and economically significant constant coefficient as evidence of lack of financial integration to the world capital markets for that particular region. Moreover, the annualized value of the constant represents the residual regional risk premium, the second risk premium in the multi- factor equation of the Globally nested CAPM.

The next stage involves the regression of the excess return on a given country on the residual regional risk (estimated in the previous step) and the world equity excess return. The residual country risk is defined as the difference between the country risk premium and the part of the country risk premium explained by regional and world factors. If this residual country risk premium is significant (both statistically and economically), then there is at least some portion of the country's equity market return that is not integrated with either the world equity market or the regional equity market to which the country belongs. The authors test the model for Argentina, Chile, Brazil and Mexico, using the MSCI Latin American index as a proxy for the regional factor. In the particular case of Chile, they conclude that country and regional factors are also significant.

<u>The country- spread model.</u>

This model adds a country- specific spread to a cost of equity determined using U.S. data. Specifically:

$$\text{Cost of equity} = \text{risk- free rate}_{US} + \text{beta} \times (\text{US risk premium}) + \text{default spread}$$

Where the risk- free rate is the U.S. rate, beta is computed with respect to the local market portfolio, and the default spread measures the difference between dollar- denominated bonds issued by the country and the US Treasury bond rate. The intuition behind this model is that many of the factors that affect default risk in bond markets (stability of the country's currency, budget and trade balances, political stability, etc.) also influence equity risk.

Damodaran (2002) suggests a slightly different way to implement this model. He argues that since bond spreads are extremely volatile, and can shift significantly on a daily basis, it may be preferable to compute the average the default spreads of all countries in the world with the specified rating over and above the appropriate risk less rate (the average is less volatile and more reliable for long- term analysis). Also, as an alternative to credit ratings (which tend to lag markets when a revision is due), it is possible to much more comprehensive measures of risk, credit scores, developed by some services (like The Economist).

As Damodaran recognizes, this approach has the shortcoming that, since equities are likely to be more risky than bonds, default spreads likely understate equity risk premiums. But in our opinion, there is a more fundamental problem with this model: it implicitly assumes that the ERP of an emerging market equals the ERP of the U.S., an assumption that the author itself finds questionable. In order to see this, suppose we are interested in computing the cost of equity for the local market. In that case, the beta coefficient is 1 by definition, and since the local risk free rate equals the US risk- free rate plus the default spread, the local ERP equals the US ERP.[9] For this reason, we also disregard this approach.

<u>The relative standard deviation model</u>

This model compares an investment in the equity markets (emerging versus the US), and apply a premium to the US ERP; formally define:

$$\text{Relative SD of country X} = (\text{SD of country X}) / (\text{SD of the US})$$

This relative standard deviation is then multiplied by the premium for US stocks to obtain a measure of total risk premium for the particular market:

$$\text{ERP of country X} = \text{ERP of the US} \times \text{Relative SD of country X}$$

In order to avoid biases caused by different measurement units, the two portfolios should be expressed in a common currency, say the dollar. Damodaran (2002) recognizes that this approach may underestimate the ERP in a risky but illiquid emerging market, where because of the lack of liquidity their estimated volatility is low. On the other hand, since it focuses on variance risk, it may be overemphasize the segmentation of the market, tending to overestimate the ERP of a highly volatile but partially integrated emerging market.

<u>The default spreads and relative standard deviations model.</u>

This model, presented by Damodaran (2002), compares an investment in bonds versus stocks in the same emerging market, and requires a premium in order to invest in stocks. Arguing that the country ERP should be larger than the country default risk spread, Damodaran proposes the following approach to estimate the country risk premium:

[9] The presentation of the author does not make entirely clear how the beta coefficient is computed. If instead it were computed with respect to a proxy for the US market portfolio, the result would be even more unreasonable. Since the beta of an emerging market portfolio with respect to the US market is typically less than 1, the emerging market ERP would be smaller than the U.S. ERP.

$$\text{Country risk premium} = \text{Country default spread} \times \frac{\sigma_{country\ \ equity}}{\sigma_{country\ \ bond}}$$

Where

Country risk premium = (ERP for the less developed economy) – (ERP for a mature market)

The ratio of volatilities can be computed for each country, or using the global average (reported by Damodaran in his web page).

<u>The country risk rating model</u>

Erb, Harvey and Viskanta (1995, 1996) developed a model based on country credit ratings, which has the obvious advantage that it can be applied to economies without the necessary data to compute a CAPM cost of equity. The model uses country risk ratings published twice a year by the Institutional Investor. The simplest model that they consider is the linear model, where the semiannual return in US dollar for country j at time t, is regress unto a the country credit rating at time (t-1). The slope coefficient is interpreted as the "reward for risk", not specific to a particular country but worldwide.
The authors express concerns that the relation between credit risk and return may not be linear, since if a credit rating falls quite low expected returns may go up faster than the linear model suggests; in the limit, at very low credit ratings it may be that multinationals do not consider any hurdle rate as appropriate for investing. In order to capture this potential non- linearity, they propose a log- linear model, were the semiannual returns are related to the natural logarithm of the country risk rating of each country, also lagged one semester. In both cases the slope coefficient should be negative, meaning that a higher credit rating is associated with a lower expected return.

Finally, with the intention to capture differences in the reward for risk across different markets, the authors consider an augmented version of the log model. In this specification, they regress the stock returns of different countries against the log country risk rating of developed and emerging markets.

Erb et al (op. cit.) report that (in contrast with developed markets, and consistent with previous studies), there is no evidence of a relationship between beta and expected returns for the emerging markets. The authors find evidence of non- linearity, which appears to be appropriately captured in the log model (the main differences appear in the low credit risk region). On the other hand, the difference between the slope coefficients for emerging and developed markets is insignificant, and the R squared coefficient, adjusted for the number of regressions, is only slightly higher with the augmented model. This suggests that the log linear model, with a single reward for credit risk, is the model that best fits the data.

Since many of the approaches summarized above are based on an estimate of the ERP for a mature market, in the next section we review the literature on this topic to come out with an estimate of the ERP in a mature market.

4. The ERP of a mature market: Literature review

Ibbotson & Associates reports yearly the historic averages of the ERP for the U.S.; in the period 1926-2001 the average ERP over Treasury bills was 8,8%, with an standard deviation of the mean of 2,38%. Since the null hypothesis of normality of the ERP is not rejected by the data, we can say that a 95% confidence interval for the ERP in short horizons is (approximately) given by 4,14%-13,46%. This huge interval, even with 75 years of data, tells us that the estimates are very imprecise, and highlights the difficulty faced in estimating the ex-ante ERP. Also, Dimson, Marsh and Staunton (2002) published a book entitled "Triumph of the optimists", where they present 101 years (1900-2001) of investment returns of sixteen countries (including the U.S.); the arithmetic mean of the ERP relative to treasury bills was reported to be 6.2%, ranging from a low 3.4% (Denmark) to a high 11.0% (Italy).[10]

Contributing to the difficulty of the task, the historical data could have two problems that may question the validity of the average ERP as an estimate of the ex- ante ERP: non-stationarity and survival bias. If the ERP is non- stationary, there is no reason to expect that the future will be like the past; and if the US economy is a rare case of a successful economy, its ex post performance is not an indication of what the future may bring about.

The recursive coefficient test applied to the historical series of the US ERP fail to reject the null hypothesis of stability. On the other hand, there are variables correlated with the expost ERP which vary over time. For example, Fama and French (1988) found that the dividend yield explains the ex- post ERP over treasury bills, measured in horizons of 1, 2 and 5 years after the date in which the dividend yield is observed.[11] Also, Fama and French (1989) presented evidence that the market returns are negatively correlated with the business cycle.[12] Despite this evidence, it is very likely that they have no predictive power for the future long- run ex- ante ERP. If the dividend yield is mean- reverting (as it appears to be), long- run estimates of the ERP should still be similar to the historical mean. The same argument applies to business cycle.

Brown, Goetzmann, and Ross (1995) is the first academic study to focus on the survival bias in the ERP . In their model there is a critical level of stock prices, below which the market collapses and trading stops[13]. As expected, the ERP conditional on the fact that the market has never reached the critical level is significantly higher than the unconditional ERP. In order to estimate the magnitude of the survival bias, they set parameters similar to

[10] They also report an ERP over 10 year bonds, with a global average of 5.1% (arithmetic) and a standard deviation of 4.7%. This "ten year risk premium" ranged from 1.5% (Denmark) to 8.3% (Germany).

[11] This indirect evidence is consistent with a non- stable ERP, but the implied variation in the ERP is rather small: movements of dividend yields between the historical high and lows imply only a 1% change per year in the ERP.

[12] They argue that this is because the marginal utility of another dollar of consumption is higher in recessions, so individuals need higher expected returns in order to be induced to forego consumption.

[13] Russia, China, Germany and Japan have had one or more major interruptions (associated with major internal revolutions, being invaded, or major battles lost) that prevent their inclusion in long term studies. This contrasts with the U.S., that after 1926 (the starting point in the Ibbotson data base) has mostly prospered.

the U.S.: they fix the conditional ERP at 8%, and they find that it is consistent with an unconditional ERP of 4%. The survival bias also underestimates the volatility of the market, since the really bad outcomes are not present in the sample.

The empirical evidence presented by Brown et al (1995), based on their theoretical model, is rather inconclusive, but overall it suggests that the survivorship bias may be less of a problem that originally thought. Siegel (1998) estimated common stock returns for the United Kingdom, Germany, and Japan over the period 1926-1997. He found that the geometric average of real returns of U.S. stocks was higher than the average for German stocks by 0.6%, for British stocks by 1%, and for Japanese stocks by 3.8%;[14] considering that both Japanese and German data are conditional on a collapse of the market, this would suggest that that survival was not as important a problem as it appeared in Brown et al (1995). And although in a similar study Goetzmann and Jorion (1997) found that the real rates of appreciation (they lacked information on dividends) in the U.S. were 3.5% higher than the median rate of the other countries, the more recent work of Dimson et al (op. cit.) contradict their finding, showing a different picture in their study of returns (including dividends) of 15 countries in the longer period 1900-2001. The countries included accounted for over 87% of today's world market capitalization, and were also dominant at the start of the past century. Their results show that the stock market in the US does not necessarily outperform the stock market in the other 15 countries in the sample[15]; also suggesting that concerns about success and survivorship bias may have been overstated.[16]

Another avenue that has been explored to estimate the ERP is to produce direct estimates of the premium, that is, estimates that are not based on the historical record, but on the current prices; this requires a model of stock prices. According to the Dividend Discount Model (DDM), the stock price equals the present value of the future expected dividend payments. The expected return corresponds to the value of k in the following equation:

$$p = \sum_{t=1}^{\infty} \frac{E(d_t)}{(1+k)^t} \qquad (1)$$

where p is the price of the market portfolio, d_t represents the value of dividend E(.) is the expected value operator. Knowing the expected cash flow of dividends it is possible to solve for the value of k. The Gordon model makes a very simple assumption to project the expected value of dividend, which is that dividends grow at a constant rate g until infinite.[17] Under this assumption the above equation can be written as:

[14] The collapse of the Japanese market during and after World War II was far more extensive than was the case in Germany.

[15] In the period 1900-2000, 7 of the 15 countries exhibit ERP relative to bills (and relative to bonds) higher than the U.S.: Australia, France, Germany (99 years ex- 1922/3), Italy, Japan, Sweden and United Kingdom.

[16] Also in the sample starting from 1900, the ERP is lower than the Ibbotson data (which starts in 1926). Brealey and Myers (2003) comment that it is difficult to say which period is more representative of the investors' future expectations, since the First World War and its consequences were atypical in many senses.

[17] The model with a constant growth rate at infinitum could be derived from the firm valuation model in Miller Modigliani (1961). This model establishes that the value of a firm that is financed 100 per cent with equity is equal to the present value of its actual assets plus the present values of its future investment opportunities.

$$p = \frac{d_1}{k - g} \qquad (2)$$

So that the expected return of the stock equals the current dividend yield plus the expected dividend growth rate:

$$k = \frac{d_1}{p} + g \qquad (3)$$

Note that the Gordon's model provides an expected cost of capital rather than the ERP. To obtain the ERP we have to subtract the risk free rate, parameter that is not obtained from the model.

$$ERP = k - r_f \qquad (4)$$

In this sense, the direct estimation of ERP provides estimation of the expected market return and not of the ERP itself. This difference is important since empirically it seems that the expected market return is more stable than the ERP (see Grinblatt y Titman, 2002; Brennan, 1997).

Two key assumptions are necessary to derive Gordon's model: (a) The rate of return of new projects is constant, and (b) that each period the firm allocates a constant fraction of its operational income to finance new investment. Moreover equation (2) requires that $k>g$, or else the value of the firm will be negative ($k<g$) or infinity ($k=g$). Because of this, in practice this model is not used in the case of firms that are in a growth stage, but in the case of consolidated firms, that are paying significant dividends, related to the firm's profitability.[18] The classical example is a mature utility firm.

Thus, the above formula is applicable to a specific firm, with certain characteristics. To apply this model to the economy as a whole requires even stronger assumptions (see Appendix 1). Cornell (1999) applies the DDM to the U.S. market (S&P500), using the median of 2,000 analysts' forecasts for an explicit forecast period of 5 years. From year 6 to 19, he assumes that the growth rate converges linearly to the long- run growth rate, which is equal to the average forecast of the (nominal) growth rate of the economy, provided by two forecast firms. This long run growth rate is assumed to prevail from year 20 onward. Using this approach, Cornell estimates a value- weighted average cost of capital of 11.26%, which implies a premium of 5.77% over bills and 4.53% over bonds, significantly less (economically) than the historical averages (although not statistically different, at a 5% significance level). Finally, there are even additional problems to apply this model to an emerging economy, which we discuss in the next section.

In order to avoid the dividend forecasting altogether, Kaplan and Ruback (1995) estimated the equity premiums based on information provided by the buyers of 51 highly leveraged transactions completed in the period 1983-1989. The authors had access to the price paid in each case, and also to the cash- flow forecasts developed by the buyers. Kaplan and

[18] Otherwise analysts tend to favor the free cash flow model (which does not require to project dividend initiation dates to price a stock).

Ruback (op. cit.) used the CAPM to infer the market risk premium from the cost of equity for each deal; the average ERP was estimated in 7.78%. Of course, this estimate may be affected by a tendency to inflate the cash flows (perhaps due to optimistic views, or for the strategic incentive to secure debt financing); or the higher ERP used may also reflect liquidity premiums. But still it is interesting that their cash- flow based estimate of the ERP is remarkably similar to the historical ERP over bonds (7.4% in the Ibbotson data).

Another direct estimation of the ERP, provided by Siegel (1998), focuses on earning yields (instead of dividend yields), defined as earnings per share divided by share price is an estimate of the long- run real return on stocks. In 1998, after the longest bull market in U.S. history, this ratio dropped below 4% for the first time in postwar history; which implies (if his argument holds) estimates of the ERP of 5.5% over treasury bills and 3.75% over long- run treasury bonds.

From a theoretical perspective, the historical equity risk premium presents a puzzle, in the sense that it is of an order of magnitude greater than what the standard neoclassical paradigm of financial economics can explain (see Mehra and Prescott, 1985). Basically, in neoclassical theory assets are priced such that the loss in marginal utility incurred by sacrificing current consumption and buying a certain asset equals the expected gain in marginal utility that results from an increase in consumption when the asset pays off in the future. Using standard theory Mehra and Prescott (op.cit.) showed that, since stocks and bonds pay off in approximately the same states of nature, they should have a similar rate of return, and hence the equity premium should be small (about 1 percent per year). In fact, with some simplifying assumptions (not made in the original paper), Mehra (2003), shows that the log equity risk premium can be written as:

$$\ln E[R_e] - \ln R_f = \alpha \sigma_C^2 \qquad (5)$$

where R_e is the return on equity, R_f is the risk-free rate of interest, α is the coefficient of relative risk aversion, and $\sigma_C^2 = \text{var}(\ln C)$ is the variance of the continuously compounded growth rate of per capita consumption. Basically, since the growth rate of consumption is quite stable ($\sigma_C^2 = 0.00125$), and the coefficient of risk aversion is less than 10 (as various studies quoted in Mehra (op.cit.) show, the maximum equity risk premium over Treasury bills consistent with the model is of the order of magnitude of 1%, far less than the historical average of 100 years, hence the "equity risk premium puzzle".

There are excellent surveys on the extensive literature related to the equity risk premium puzzle, see for example Campbell (1999), Constantinides (2002), and Mehra (2003); our purpose here is to highlight the main developments. The research to explain the above puzzle has followed two different channels. modifications of the price kernel, represented by the single parameter of risk aversion α in the simplified above equation,[19] and

[19] Other dimensions of the price kernel include liquidity premium and taxes. For example, Bansal and Coleman argue that Treasury bills (and monetary- like assets) may include a transaction- service component in their return, so the equity premium could in part be a liquidity premium (not only a risk premium). Similarly, if households have a liquidity motive for holding debt, bond returns would be low and the resulting

(admittedly fewer) efforts to improve the measurement of the the risk of the securities, represented by the variance of log per capita consumption in the previous equation, σ_C^2.

An important example of the research on the pricing of risk is Epstein and Zin (1991), which point out that an implicit assumption in Mehra and Prescott (op. cit.) is that the coefficient of risk aversion is restricted to be the reciprocal of the elasticity of intertemporal substitution, which implies that if an agent is averse to variation in consumption in different states of nature, so it will over time (and there is no reason why this must be so). The practical implication of this feature of the utility function assumed in Mehra- Prescott is that, since consumption growth over time (in the historic series), individuals have little incentive to save, implying a low demand for bonds, and hence a high risk- free rate (contrary to the historical evidence). To solve this problem, Epstein and Zin (op. cit.) suggest a more general class of utility functions, which they call "generalized expected utility", which allows for independent parameterization of the risk aversion coefficient and the elasticity of intertemporal substitution. With this more general model, a high coefficient of risk aversion does not imply that agents smooth consumption over time. Thismodel is able to reproduce higher equity premiums, without making implausible assumption about the risk aversion parameters, and thus ameliorating the ERP puzzle.
On a similar line of work, Constantinides (1990) incorporates habit persistence into the utility function. This sensible feature of preferences models utility as dependent not only on current consumption (as in the traditional model) but also on past consumption, reflecting the idea that people become accustomed to a standard of living. Formally, the utility function is defined as:

$$U(c) = E\left[\sum_{s=0}^{\infty} \beta^s \frac{\left(c_{t+s} - \lambda c_{t+s-1}\right)^{1-\alpha}}{1-\alpha}\right], \quad \lambda > 0 \qquad (6)$$

where λ is a parameter that captures the effect of past consumption. With these preferences, the agent becomes extremely risk averse to consumption risk even when his or her risk aversion is small. For small changes in consumptions, changes in marginal utility can be large. This induced aversion to consumption risk increases the demand for bonds, thereby reducing the risk- free rate; and therefore increasing the equity premium. Mathematically, the mean equity premium is equal to the covariance of consumption growth with equity returns, divided by the intertemporal elasticity of substitution in consumption. Given risk aversion, habit persistence lowers this elasticity and hence raises the equity premium. A variant of this approach is to define utility of consumption relative to average per capita consumption (keeping up with the Joneses), as in Abel (1990). Another is to incorporate the possibility of a recession, that is, a mayor economic downturn, as a state variable. Campbell and Cochrane (1999) develop this argument, showing in a model with external habit persistence, that the risk aversion of investors rises dramatically when the probability of a recession increases; thus the model can generate a high risk premium. Specifically, they model the utility function by:

$$U(C_t) = \left[C_t - X\right]^{1-h} \qquad (7)$$

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equity premium would be large. McGrattan and Prescott suggest that the large reduction in individual income tax rates and the increased opportunity to shelter income from taxation in the post- Second World War period led to a doubling of equity prices between 1960 and 2000 in the U.S., and this increase in equity prices led to much higher *ex post* returns on equity than on debt.

where X represents the accustomed standard of living, which depends on past consumption. In their model, the effective risk aversion depends on how far current consumption is from the habitual level:

$$\alpha = \frac{h \times C_t}{C_t - X} \qquad (8)$$

Since risk aversion increases when consumption is low (in recessions), it generate a precautionary demand for bonds that help lower the risk- free rate.[20] These models have been successful in explaining the low interest rates (the interest rate puzzle), and have had some success in explaining the equity premium puzzle.

Two examples of the second line of research, that seeks to better measure the risk of the securities are the work of Constantinides, Donaldson and Mehra (2002) and Longstaff and Piazzesi (2003). While the original work of Mehra- Prescott constrained aggregate dividends to be equal to aggregate consumption, modeling cash flows separately is crucial, since historically corporate cash flows have been far more volatile (and sensitive to the economy) than has aggregate consumption.
The work of Constantinides, Donaldson and Mehra (2002) makes this important distinction, decomposing consumption into the sum of wages and equity income. Also they propose an overlapping- generations model, with heterogeneous investors due to age, as opposed to the early work on the equity risk premium that assumed homogeneous investors.[21]. Consumers live for three periods: a period of human capital acquisition, where the consumer receives a low endowment income; an employment period where the consumer receives labor income subject to large uncertainty; and a retirement period, where the agent retires and consumes the assets accumulated in the second period. The key feature is that the future income of the young consumers is derived from their wages forthcoming in the middle age, while the future income of the middle- aged consumers is derived from their savings in equity and bonds. This implies that the risk of holding equity and bonds is concentrated in the hands of the middle- aged saving consumers. The young who should be holding equity (since for them equity is les risky) are prevented from doing so, because of borrowing constraints, as human capital does not collateralize major loans in modern economies (for reasons of moral hazard and adverse selection). Thus, equity is priced solely by middle- aged investors (for whom equity is more risky), and hence the equity premium is high.

[20] Reitz (1988) has proposed as a solution to the puzzle a very small probability (1%) of a very large drop in consumption (25%) to reconcile the equity premium with a risk aversion parameter of 10. Unfortunately, interest rates have not moved reflecting a reasonable probability of a disaster historically (a nuclear war, for example)

[21] Probably to relax the assumption of homogeneous investors seemed unpromising, since unique, idiosyncratic risks are not priced in the market. Not all specific risks are diversifiable, however. For example, human capital is risky, and it may be difficult to diversify it. Heaton and Lucas (1996) assume that human capital risk cannot be insured by workers, and they show that the risks associated with labor income can explain up to half of the observed equity risk premium. Unfortunately, their model also predicts that interest rates are as volatile as stock returns, which is inconsistent with the data. Similarly, Constantinides and Duffie (1996) point out that assuming that the variance of the idiosyncratic risk (for example, associated with human capital) is correlated with the market, people become reluctant to hold stocks, requiring a larger risk premium to be induced to hold stocks.

Longstaff and Piazzesi (2003) also explore the implications of allowing aggregate cash flows to differ from aggregate consumption; this permits aggregate dividends to differ from aggregate consumption. Empirically, the fraction of labor income in output is counter cyclical, as labor contracts provide insurance against business cycle risk; hence the fraction of corporate earnings in output (and consumption) is strongly procyclical. Longstaff et al (op. cit.) incorporate this evidence modeling aggregate dividends as a small but highly volatile and procyclical component of aggregate consumption. Aggregate dividends and consumption follow distinct exponential- affine jump- diffusion processes, which capture not only the (usual) small economic shocks, but also the possibility of rare, catastrophic large economic shocks. From the first order conditions of the representative agent, the authors derive a simple expression for the equity risk premium, that is a generalization of the Mehra- Prescott equation (5):

$$ERP = \alpha\sigma_C^2 - \lambda J_{\wedge} J_P + \alpha H \rho \sigma_C \sigma_F \quad (9)$$

where (as before) α = parameter of risk aversion; and λ = the probability of a jump (large, catastrophic shock); σ_C, σ_F = the instantaneous volatility of percentage changes in consumption and the corporate fraction respectively, $J_{\wedge}$ = the percentage jump in marginal utility, J_P = the percentage jump in the stock price, and H = the elasticity of the stock price with respect to F. This equation means that the equity premium implied by the model has three components. The first term, $\alpha\sigma_C^2$, corresponds to the equity premium implied by the original Mehra- Prescott research (see equation 5), which may be considered the consumption risk premium component. The second component reflects the effect of a jump on the equilibrium price of the stock. The sign of the $J_{\wedge}, J_P$ terms are opposite: a negative shock to dividends lowers the price, but reduces consumption, hence rises the marginal utility of consumption (given risk aversion); hence $-\lambda J_{\wedge} J_P > 0$. The second term can be interpreted as an event- risk premium, or jump component in the equity premium; note that the separate modeling of corporate cash flows and consumption lets the jump in consumption to differ in size from the jump in dividends.[22] The third term in the above equation reflects the covariance between consumption growth and percentage changes in the corporate fraction. If we assume (as in Mehra- Prescott, op. cit.) that dividends are a constant fraction of consumption, $\sigma_F = 0$. This third term represents the corporate- risk premium, and Longstaff and Piazzesi (2003) suggest that it is by far the most important part of the equity risk premium. Using the historical U.S. volatilities of consumption and corporate fraction of 3% and 30% respectively, this component can be of the order of 4.5%. Adding up the three components, the estimated equity premium would be of 0.45+0.52+4.50% = 5.47%, clearly on the expected order of magnitude.

[22] The authors propose an interesting example. Suppose that a catastrophe like the great depression occurs once every 100 years on average (λ=0.01), resulting (as it did in the U.S.) in a 10 percent drop in consumption, and a 75% decline in the stock market. This is consistent with an event risk- premium of 0.52%; higher than the consumption- risk premium obtained of 0.45%, with a risk aversion of 5 and a consumption volatility of 3%.

5. Estimates of the ERP in the Chilean market and concluding remarks

As the previous section documented, there has been much discussion regarding the ex ante ERP for mature markets. The historical average ERP for the US, reported by Ibbotson&Associates, using the S&P500 as a proxy for the market portfolio, and Treasury bonds with 20 years of maturity (long horizon) was 7.42% in the period 1926-2001, (Ibbotson&Associates, 2002). Extending back the series, the average drops to 7.0%; as can be seen in the following table, that reports the historical equity risk premiums for 16 countries in the period 1900-2001, (Dimson et al 2002). Although the authors recognize that the quality of the data is not homogeneous in the sample, and they expect to improve the quality of their computations in future editions,[23] it is probably the most comprehensive study available on the historical returns obtained by world financial markets. The average historical ERP over long- term bonds, for the mostly developed economies was 5.6%.

Country	Arithmetic mean (%) (relative to long- term bonds)
Australia	8.0
Belgium	4.8
Canada	6.0
Denmark	3.3
France	7.0
Germany (excluding 1922-23)	9.9
Ireland	4.6
Italy	8.4
Japan	10.3
The Netherlands	6.7
South Africa	7.1
Spain	4.2
Sweden	7.4
Switzerland (from 1911)	4.2
United Kingdom	5.6
United States	7.0
World	5.6

Source: Dimson et al (op. cit.), page 173

Regarding the important aspect of the expected (in contrast with the historical) ERP, there has been a wide variety of opinions, both in academia and professional practice. Welch (1998) published the results of a survey of 112 professors of financial economics, regarding their estimates of the long- term forward- looking risk premium. The average ERP estimate was 6%, which Welch argues was too high; actually in a subsequent version of the survey (2001, unpublished), the average was lower. In order to show the variety of opinions about

[23] There are some problems in the estimates reported by Dimson et al, problems that are not shared by the Ibbotson data.

the ERP in the Finance profession, we reproduce part of Table 2 of Welch (2001), which summarizes the answers of 476 professors of finance and economics. The range of answers goes from 0% (there is no equity premium) to 25% per year! The arithmetic average is 5.5%, less than the U.S. average (7%), but almost the same as the world equity average (5.6%) over the last 101 years. It is possible to see some of this dispersion of opinions concerning this, "the most important parameter in finance", in the finance literature. For example, Dimson et al suggest a range between 4-5% for the forward looking (arithmetic) ERP, situating themselves below the average of the Welch survey. Brealey and Myers (2002) suggest an average ERP between 6-8.5% for the U.S., showing that they are more optimistic than the average professor in the survey; and so do most of the leading textbooks in finance, including Bodie, Kane and Marcus (1999).

Consensus forecasts of finance and economics professors as of august 2001, in percent

Forecasts	Arithmetic Mean	Standard Deviation	Percentiles				
			Min	Q1	Median	Q3	Max
30-year equity premium forecast	5.5	2.7	0	4	5	7	25%

As we mentioned in Section 3, there are a number of ad- hoc models used in practice to estimate the ERP in emerging markets. We disregard the international asset pricing model, given its strong assumption of perfect market integration, and the empirical evidence presented that the coefficient of systematic risk beta has no explanatory power to explain the average returns of stocks in emerging markets (in contrast with mature markets). For the same reason, we do not consider the country- spread model, that assumes that the equity risk premium of developed and emerging markets are the same.

Estimates for various countries of the Globally Nested Capital Asset Pricing Model, and the Credit Risk Country Model are provided yearly by *Ibbotson & Associates*, and we quote their latest estimation (2002) for Chile .[24] Their models report the expected return of the market for each country in dollars, so that in order to obtain an estimate of the ERP we need to subtract the rate of interest in dollars. In our case, the longest government bond issued by Chile in dollars was the sovereign bond with maturity in 2012, which average yield during 2002 was 6.33%. Of course, this rate is lower today, but we use the 2002 average in order to be consistent with the period of estimation used by *Ibbotson&Associates*.

In addition, we provide estimates of the Chilean ERP based on the relative standard deviation model, and the default spread and relative standard deviation model. In the case of the standard deviation model, we use the IPSA as a proxy for the Chilean market, even if it is not as well diversified as the more general IGPA. Our motivation for this election is the same general concern expressed by Damodaran (2002) when discussing this model, that

[24] However, it is important to keep in mind that Ibbotson&Associates may base its estimate of the equity premium of a mature market on its own data for the US (7.4%), higher than the estimate we are using (5.5%).

due to thin trading the historical volatility of the return on the Chilean market may be under estimated. This concern is particularly important in the case of Chile, which is known to be one of the less liquid markets of the world.[25] We face a similar choice in the case of the default spread and relative standard deviation model. The average default spread was estimated over Treasury securities was 1.37% (estimated using daily data over Jan 8th 2003 to Dec 16th 2003 period). But the volatility of the country bond is very small in Chile (5.2%), implying a ratio of volatility of country equity to volatility of country bond of 4.42. It is very likely that the low volatility also reflects a very thin market for the sovereign bond. For this reason, we estimate instead the ratio of volatilities by their world average, as reported by Damodaran in his Web page (1.5). The following table reports our estimates for the Chilean ERP over long term bonds, assuming an ERP for a mature market of 7.4% (to make them comparable with the estimates provided by Ibbotson&Associates); we also compute them for the interval values suggested by Brealey and Myers (6% and 8.5%).

Model	Implicit U.S. ERP	Chilean ERP
Country credit rating (Log model) (*)	N/A	8.9%
Country credit rating (Linear model) (*)	N/A	10.1%
Globally nested CAPM (*)		9.0%
Relative Standard Deviation	7.40%	10.5%
Default Spread + Relative standard deviation	7.40%	9.5%
Relative Standard Deviation	6.00%	8.5%
Default Spread + Relative standard deviation	6.00%	8.1%
Relative Standard Deviation	8.50%	12.1%
Default Spread + Relative standard deviation	8.50%	10.6%

Source: Our computations, except (*), which come from Ibbotson&Associates (2002b), assuming a risk-free rate of interest for the Chilean economy of 6.33% in U.S. dollars.

As it can be seen from the previous Table, The estimates of the Chilean ERP over long-term bonds range from a low 8.9% (using the country credit rating model in log form) and a high 12.1%, if we assume an ERP of 8.50% for the U.S. economy, and use the relative standard deviation model.

As a final remark, we would like to point out that many of the reasons given for a low estimate of the ERP in mature economies do not apply to an emerging market. For example, scholars that argue for a low estimate of the ERP in the US economy generally tend to rely on direct estimates of the ERP, based on the dividend discount model, which

[25] The manager of a mutual fund told as recently that the IGPA is not an available portfolio for investment, precisely due to this lack of liquidity. When calculating beta coefficients, there are methodologies available to account for the bias that the lack of synchronous data induces (for example, Dimson), but not in the case of standard deviations.

either from the start, or at a non- to- distant future date, assumes constant growth rate of dividends (the Gordon model). This assumption may be reasonable for a mature economy, but certainly it is not appropriate for a developing economy. The literature of economic growth suggests a convergence to the (lower) rates of growth of developed economies, once the economy converges to the steady state, that is, once it becomes developed. This implies that a developing economy like Chile should have a (perhaps long, see for example the experience of the so- called Asian tigers) period of super normal growth, aided by technology transfer from developed countries, before it converges to a constant growth rate in the long run. As a second example, one of the reasons advanced for a 0% ERP in the US is that the presence of inflation risk[26], and the argument that stocks provide a better shelter against inflation than long term bonds; clearly this argument does not hold in Chile, since our local bond market is fully indexed.

[26] The collapse of the gold standard resulted in the (then new) inflation risk in monetary economies, which was accompanied by a reduction of the risk of recession (where bonds generally perform better than stocks); both effects decrease the attractiveness of nominal fixed income securities.

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Appendix: Application of the DDM to the economy as a whole

As explained before, the model of Gordon was developed for a specific firm, with specific characteristics. To use it for estimating the ERP requires stronger assumptions. One of the conditions that the model should satisfy is consistency with a model based on first principles. Let us assume that the representative agent maximizes the expected utility given by:

$$maxE_0 \sum_0^{\infty} \beta^t u(c_t)$$

where $0<\beta<1$ represents the subjective discount factor, *u(.)* is the utility function with $u'>0$, $u''<0$, c_t is consumption in period t, and E_t represents the conditional expectation to the information available at time t. This agent faces the following budget constraint:

$$y_t + (p_t + d_t)n_{t-1} = c_t + p_t n_t$$

where y_t represents income in t, p_t is the price of the risky asset in t, d_t is the dividend payments by this asset at time t, and n_t is the number of stocks held at time t for the next period. The first order condition for this problem is given by:

$$p_t = E_t\left[\beta \frac{u'(c_{t+1})}{u'(c_t)}(p_{t+1} + d_{t+1})\right] \qquad (5)$$

Substituting recursively and using the law of iterated expectations, we derive the standard formula that the price of an asset is equal to the present value of the expected dividends, using an appropriated rate of discount. Imposing the non-bubble condition, $\lim_{j\to\infty} E_t \beta^j \{u'(c_{t+j})/u'(c_t)\} d_{t+j} = 0,$ we can write (5) as:

$$p_t = E_t \sum_{j=1}^{\infty} \beta^j \frac{u'(c_{t+j})}{u'(c_t)} d_{t+j} = Cov\left[\beta^j \frac{u'(c_{t+j})}{u'(c_t)} d_{t+j}\right] + E_t\left(\beta^j \frac{u'(c_{t+j})}{u'(c_t)}\right) E_t\left(d_{t+j}\right) \qquad (6)$$

Therefore the Gordon's formula requires that the dividend flows be orthogonal to the stochastic discount factor. This assumption may be valid for an specific asset, which pays a dividend flows that has a correlation near zero with the growth rate of the marginal utility of consumption for the representative agent. But it turns to be a strong assumption in a general equilibrium context (taking *n* in the budget constraint as the number of shares of the market portfolio held by the agent).

Nevertheless, making further assumptions we can derive (2) from (6). In a context of an endowment economy with a deterministic constant growth rate of consumption the stochastic discounted factor becomes deterministic and it will be equal to the inverse of *(1+*

k) in equation (2). Thus, we eliminate expectation in (6) and given that the growth rate is deterministic we can write $d_{t+j} = d_t(1+g)^j$. Plugging these conditions in (6) and solving the sum we obtain equation (2).