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Equity risk premium and time horizon: What do the U.S. secular data say?

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ABSTRACT

We consider a representative investor whose wealth is made up of the equity market portfolio and the risk-less asset, and who maximizes the expected utility of his/her future wealth for a given horizon. The solution of this program shows that the equilibrium value of the equity risk premium – the latter being measured by the difference between the expected equity portfolio return and the risk-free interest rate – is given by the product of the price of risk by the expected variance of stock returns. When returns are predictable, these two magnitudes are both time-varying and horizon-dependent. In accordance with this theoretical framework, our paper presents an econometric model of the equity risk premia for two traditional horizons: the one-period-ahead horizon (i.e. the 'short-term' premium) and the infinite-time horizon (i.e. the 'long-term' premium). Using annual US secular data from 1871 to 2008, and representing the expected returns by mixing the three traditional adaptive, extrapolative and regressive processes, large disparities in the dynamics of the two premia are evidenced. Concerning the determination of the equilibrium values of the two premia, the expected variances depend on the past values of the centered squared returns while the prices of risk (unobservable variables) are estimated according to the Kalman filter methodology, which enables us to capture the influence of hidden variables and of non-directly measurable psychological effects. A spread of interest rates adds to this determination. Possibly due to risky arbitrage and transaction costs, the results show that observed premia gradually converge towards their equilibrium values, this process being described by an error correction model. Overall, our model provides a rather satisfactory representation of 'short-term' and 'long-term' premia.

1. Introduction

A thorough understanding of the market equity risk premium is a major challenge for both theoretical and empirical reasons.[1] At theoretical level, a key input in asset allocation models is the value of the market equity risk premium (e.g. the CAPM); in fact, these models are pretty much inoperative without a valid estimate of this premium. At empirical level, stock market capitalization is highly sensitive to the value of the risk premium since a 1% shift in the latter can add or subtract a trillion dollars to the US stock market value.[2] However, a multitude of premia has to be taken into consideration. Indeed, investors in equity markets intervene according to different decision-making time horizons: e.g., intra-day or daily traders, individual non-professional portfolio managers, long-term institutional investors such as pension funds, etc. The point is that when returns are unpredictable, there is a single risk premium, but when stock returns are predictable, risk premia are horizon-dependent. In this last context, equities are exchanged between agents requiring different risk premia, although the market clearing condition gives a single market price.[3] Anufriev and Bottazzi (2004) discussed the conditions of existence of a market equilibrium price in a multiple horizon framework and showed that, using suitable parameterization, the no-arbitrage market condition leads to a stable fixed point.[4] Over the last 15 years, heterogeneity models have been developed while distinguishing fundamentalists and chartists.[5] While the fundamentalists are often viewed as reflecting the behaviour of long-term investors and the chartists the behaviour of short-term investors, the investment's time horizon was rarely explicitly taken into account for measuring and modelling equity risk premia. The little attention given to this important source of heterogeneity in the stock market is somewhat astonishing

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[1] The author thanks David Le Bris for relevant comments on a first version of this paper.

[2] See Graham and Harvey (2003).

[3] Let P_τ^* be the virtual price related to investors with horizon τ and n_τ the number of equities held by this class of investors. With a number h of independent horizons, the market clearing condition for an equity priced P may be written as $\sum_{\tau=1}^{h} n_\tau (P - P_\tau^*) = 0$ with $\sum_{\tau=1}^{h} n_\tau = N$, where N refers to the total number of equities. This leads to $P = \sum_{\tau=1}^{h} a_\tau P_\tau^*$ with $a_\tau = \frac{n_\tau}{N}$ and $\sum_{\tau=1}^{h} a_\tau = 1$. As a result, le market price appears as a weighted average of the virtual prices corresponding to the different horizons.

[4] Subbotin (2009) gives a survey of the rare literature on this point.

[5] Among others, see Brock and Hommes (1998), Boswijk et al. (2007).

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insofar as the literature on interest term structure shows that time horizon matter considerably in the value of the required risk (or term) premium: why should it not be the same for the stock market? Our paper aims to shed some additional light on this question.

The rest of the paper is organized as follows. Part 2 gives a brief survey of the literature on equity risk premiums and indicates the novel features of our study with respect to the literature. Part 3 presents our theoretical framework which allows us to express the equilibrium value of an equity risk premium for a given horizon as the product of the expected variance of returns and the price of risk associated with the horizon. Part 4 presents assumptions for the determination of expectations (returns and variances) and for the prices of risk. Using US secular data from 1871 to 2008, Part 5 presents the estimation of the equilibrium premia given by the Kalman filter methodology for the one-period-ahead and the infinite time horizons, and shows that, possibly due to risky arbitrage and transaction costs, an error correction model represents the gradual adjustment of premia towards their equilibrium values. Part 6 concludes.

2. Brief survey of the literature on equity risk premium and novel aspects of this study

A common way of measuring the equity risk premium is to consider over a long time period the average of the difference between the observed stock market return and the risk-free interest rate, in other words, the excess return, also known as the "ex-post risk premium." At theoretical level, the well-known debate about the "equity premium puzzle" refers to empirical results based on this approach: with reasonable values of preference parameters (i.e. the risk aversion coefficient and the subjective discount rate), the theoretical risk premium inferred from the consumption asset-based general equilibrium model is far too low (about 1–2% a year) compared to the observed arithmetic average of *ex-post* premium, which stands at about 6–7% per year for US secular data (Mehra and Prescott (1985)).[6,7] The debate needs to be supplemented by the three main properties of equity risk premia, which will be considered in the model proposed hereafter: premia are ex-ante, time-varying and horizon-dependant magnitudes.

2.1. The time-varying character of equity risk premia

Long-term averages hide in fact hide large variations in excess returns. Dimson et al. (2003) report that premiums were generally higher during the second half of the 20th century, while Siegel (2005) shows that the average premium was substantially lower during the periods 1802–1870 (3.2%) and 1871–1925 (4.00%). On the other hand, Ibbotson Associates (2006) find the value of 7.1% for the period 1926–2005. Overall, we can see that these equity premium values vary significantly depending on the period, and this led Shiller (2000) to point out that "the future will not necessarily be like the past," while Fernandez (2006, p.12) concludes that "… equity premium change over time and it is not clear why capital market data from the 19th century or from the first half of the 20th century may be useful in estimating expected returns in the 21st century…" Further evidence of the time-varying character of equity risk premium is of course given by the many conditional variance models. As early as 1987, French et al. showed that monthly risk premia fluctuations on the US stock market are partly driven by the conditional variance of returns (ARCH effects), while the paper by Koutmos et al. (2008) gives a recent illustration of this approach using daily stock returns for European countries. Adopting another approach, De Santis and Gerard (1997) analysed the dynamics of premia by using a conditional multivariate CAPM, while the study by Kryzanowski et al. (1997), based on the conditional Arbitrage Pricing Theory, focuses on the macroeconomic factors of the time-varying equity premia for a set of 130 mutual funds equities on the Canadian market.[8]

2.2. Ex-post versus ex-ante risk premia

An equity premium is defined by the difference between the expected return of the risky asset at time t for a given time horizon and an equivalent horizon risk-free rate: a risk premium is clearly an ex-ante concept. However, the empirical studies quoted above refer to the ex-post risk premium as an excess return based on the return observed over a given future time span, and this gives rise to two main difficulties. First, since investors make their financial choices on the basis of their required ex-ante premium, the ex-post premium is not a straightforward decision-making concept, unless the perfect foresight hypothesis holds. However, under this last condition, it is clear that there is no risk premium. Second, the excess return equals the underlying risk premium plus the forecasting error and this is likely to generate severe econometric biases when the error is not a white noise, i.e. when returns are not expected rationally.[9] In fact, survey data show that there are large and systematic forecasting errors imbedded in experts' expected returns for various short horizons (i.e. inferior or equal to 12 months),[10] and this report suggests that the excess return is not a good proxy of risk premium. Following another approach, Fama and French (2002) measure long-term ex-ante risk premium on the US stock market (S&P index) using the dividends (or earnings) discount model (DDM). According to the Gordon formula, this premium equals

[6] Papers by Kocherlakota (1996), Cochrane (1997) and Siegel and Thaler (1997) provide comprehensive surveys of the literature related to the equity premium puzzle and attempts to solve this puzzle (see also Prat, 2007). Note that a statistical source of this puzzle is given by the "survival bias" according to which the performance over a number of past years of a group of equities existing today is biased upwards because only those that survived for these years are considered. One should include both the current equities and those that has been dropped out of the sample. Previous authors (Brown and Ross, 1995) have suggested that there could exist serious survival bias in the observed U.S. equity premium. However, Li and Xu (2002) argue interestingly that the survival bias in the U.S. stock price data is unlikely to be significant. This conclusion is based on a general framework for modeling survival which leads to a mathematical relationship between the *ex-ante* survival probability and the average survival bias. This relationship put into evidence the difficulty facing the survival argument since high survival bias requires an *ex-ante* probability of market failure which seems unrealistically high given the history of financial market.

[7] Bancel and Ceddaha (1999) confirm the empirical evidence of the ERP puzzle for countries other than US. However, recent studies on other stock markets find that the equity risk premium averages significantly lower than the US one. For instance, Annaert et al. (2011) calculate a market-weighted return index for the 20 largest stocks listed on the Brussels Stock Exchange (blue ships) over the period 1833–2005 and show that the geometric average of risk premium related to this return index compared to the short term rate is 2.79%. Similarly, Le Bris and Tobelem (2012) show with secular data that the French equity risk premium is about half of the US one. Of course, these results do not solve the US puzzle. Moreover, although they significantly reduce the importance of the puzzle for these other countries compared to US, the observed premia remain still too high to completely remove the puzzle.

[8] According to these studies, there is an implicit assimilation between the frequency of observation in returns and the time horizon of the investment, which is a simplifying assumption. For instance, Benartzi and Thaler (1995) suggested that long-term investors can adopt myopic behaviour since they observe returns over periods shorter than the horizon. Conversely, studies modelling high frequency data using GARCH specifications suggest that the one-period-ahead expected variance depends on the squared returns from many lagged returns.

[9] This is probably why the values of ex-post premia are as often negative as positive (among others, see Mpacko-Priso (2001)). This may also explain why studies using lagged predictors to forecast excess equity returns (dividend yield, earnings price ratio, short-term interest rate, payout ratio, term and default spreads of interest rates, inflation rate, book-to-market ratio, consumption, wealth,…) can find no robust predictors (see Goyal and Welch, 2003, 2007), hence confirming that the ex-post premium is probably more of a countable observation than an operational concept.

[10] See Cowles (1933), Lakonishok (1980), Brown and Maital (1981), Pearce (1984), Taylor (1988), Dokko and Edelstein (1989), Mpacko-Priso (2001), MacDonald and Marsh (1992), Fraser and MacDonald (1993), Prat (1994), and Abou and Prat (1997). More recently, using semi-annual S&P industrial expectations 6 and 12 months ahead, carried out by J. Livingston's surveys on a panel of experts, Abou and Prat (2010) calculated risk premia over the period 1952 to 1993 using these data, and showed that these premia are time-varying with an average of 2.3% per year, hence approaching the value predicted by the consumption-based asset-pricing model.