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Measuring Time-Varying Equity Risk Premium in Context of Financial Crisis: Do Developed and Emerging Market Differ?

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Abstract

This paper aims at measuring equity risk premium over the period May 2000 - May 2011 for calm and turbulent periods. Unlike previous studies, our paper focuses on both developed stock markets (The USA, UK, France, India and Mexico). To do this, we propose a multivariate dynamic version of CAPM-GARCH-M (Capital Asset Pricing – Generalized Autoregressive Conditional Heteroscedasticity in Mean) model that enables Beta-market and therefore equity premium to be time-varying. Our results show different interesting findings and have important implications. First, our modelling captures the most important risk premium variations induced by economic stylized facts or exogenous shocks. Second, the time-variation hypothesis for risk premium is not rejected for both developed and emerging markets. Third,... We show that Risk Premium is highest during volatile market and lowest during recoveries.

Keywords: Equity Risk Premium, Developed and Emerging market, CAPM-GARCH-M
JEL Classification: G15, C32.

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1. Introduction

The equity risk premium constitutes an interesting topic in modern finance as not only it enables to evaluate investor's behaviours and aversion *vis-à-vis* risk but also to derive benchmark price for financial assets and to help to make optimal investment and portfolio choices (Graham and Harvey, 2003). Indeed, the expected or *ex-ante* risk premium is required to specify asset allocation model as it constitutes a key input for well-known financial models such as the Capital Asset Pricing Model (CAPM). Thus, the risk premium plays a crucial role in wealth allocation decision among different financial assets and also in specifying portfolio management strategies and evaluating the risk level in a given economy.

Therefore, the specification of risk premium dynamics would be great issue for financial economists, investors, traders and policymakers. Interestingly, the highest losses of stock markets after the recent global financial crisis (2008-2009) implied important transaction trading declines[1], and might suggest significant changes in risk premium. The measure of risk premium is therefore more than required to improve investor's decisions and forecast future equity market dynamics. That is, the estimation of equity premium does not have suggest a unanimous method as not it depends on the sample period and the methodology used (Pastor and Stambaugh, 2001) but also because of uncertainty.

In the literature, the estimation of equity premium was the object of several previous studies (Cochrane 1997, Siegel and Thaler, 1997; Pastor and Stambaugh, 2001; Abou and Prat, 2010; Arouri and Jawadi, 2012, Prat 2013). Overall, the authors point to time-variation in risk premium dynamics but previous studies do not unanimously specify its determinants and factors. This divergence can be explained by the fact that the estimation of risk premium is not entirely based on observed values, but it is rather measured under uncertainty conditions, expectation hypothesis and with respect to the risk-free rate. Accordingly, different methods have been implemented to estimate risk premium. Abou and Prat (2010) identify two important measure methods for *ex-ante* risk premium: *Backward Approach* and *Forward Approach*. While the first requires expectation assumption and expresses the expected return in function of the historical values of returns or other variables (dividends, earnings, interest rate, wealth, etc.); the *Forward Approach* consists in relying on stock price forecast survey data and does not require any expectation hypothesis[2]. Consequently, previous studies do not provide unanimous conclusions regarding risk premium specification and determinants and no robust estimate are developed yet. Also, it seems that previous works often focus on the risk premium for Developed markets and in particular the US stock market, while less consideration is attributed for emerging markets.

Unlike previous works, this study aims at investigating the evolution of risk premium for both main key developed and emerging countries (The US, the UK, France, India and Mexico). Furthermore, in order to apprehend further changes in risk premium induced by the recent crisis, we contribute while proposing time-variation estimation for risk premium that is also robust to further volatility change[3]. This is particularly crucial to capture uncertainty effect that may allow implying frequently disproportionate responses of financial market and investors in times of stress in response to shocks (Shafer, 1986). Also, while the investigation of US risk premium enables to compare our results to those of previous results, the extension to other developed and emerging markets provides an international comparison.

[1] In 2008, both German, French and British stock markets lost more than 50% of their capitalization.
[2] For a literature survey on Backward and Forward risk premium modelling, see Abou and Prat (2010).
[3] Abou and Prat (2012) show that the US risk premium is both time-varying and horizon dependent.

From a theoretical view, the risk premium is expected to be time-varying and cyclical according to the phases of business cycle. Indeed, during exuberance periods, the premium may rather decrease whereas it tends to increase and to be volatile in turbulent times. For example, after the recent global financial crisis, the risk premium reaches very high historical levels never reached previously. Our findings have confirmed these intuitions while pointing to significant increase in risk premium after 2008 and several structural breaks in risk premium dynamics.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature. The econometric methodology is presented in Section 3. Next, empirical results are discussed in section 4. Finally, the last section concludes.

2. Time-Variation in Risk Premium: A Brief Literature Survey

This section does not aim to discuss the numerous studies of risk premium, but rather to focus on those that have showed the time-variation character in risk premium. That is, after explaining the potential time-variation causes for risk premium, we briefly analyse the main results of the selected studies.

First, it is obvious to consider time-variation and term-structure for risk premium -at least for *ex-ante* premium- as its measure requires forecasts made by market investors who can continuously revise them over time and according to business cycle, which may affect risk premium estimates. Behavioural heterogeneity should also imply different estimates. Abou and Prat (2007) suggest obvious significant difference between individual risk premia and market risk premium due to the inefficient market character and to heterogeneous expectation hypotheses.

Second, microeconomic and macroeconomic factors that drive investor's choices, equity markets and therefore risk premium are not unstable and their effects also should be adjusted according to economic cycles. This can suggest short-term versus long term views and challenges regarding risk premium (Abou and Prat, 2012) and implies significant changes and difference in risk premium estimates over the time. For example, according to Siegel (2005), the US historical premium was around 3.17% during 1802-1870 and about 3.99% over the period 1871-1925, while from Ibbotson Associates (2006), it reaches 7.1% during the period 1926-2005. Dimson *et al.* (2003) also suggest highest premium after 1950. Using another approach based on the Dividend Discount Model (DDM), Fama and French (2002) found over the period 1951-2000, a US mean premium (S&P500) around 2.5%.

Third, the risk premium horizon seems implying significant difference between short and long-term risk premium. In such context, French *et al.* (1987) show that ARCH effects drive monthly US risk premium. The use of conditional multivariate CAPM by De Santis and Gerard (1997) and recently Arouri and Jawadi (2012) also help to capture short-movement in US risk premium. Also, conditional arbitrage modelling is also relevant to account for time-variation and fluctuations in Canadian risk premium (Kryzanowski *et al.* (1997).

In a recent study by Jawadi and Arouri (2012), the authors check the effect of subprime crisis on the evolution of US risk premium. Also, using a conditional CAPM, they point to a significant increase of the US risk premium after the recent financial crisis due to an increase in the world risk and the US systematic risk. They do no reject the time-varying hypothesis of the price of world market risk, which they associate to lack of confidence in the future of financial markets and to a high instability of financial markets.

As for emerging stock markets, it is important to note that recent and frequent changes have occurred on these markets and have affected their structures, implying their exposure to both domestic and global risk factors. Accordingly, these markets are being neither fully integrating nor strongly segmented, which implies that their equity premia may depend also on both domestic and global factors. The literature review about emerging market is however scare and existing studies suggest several factors for emerging equity risk premium: exchange rates, global and regional risk factors. The analysis of equity risk premium for emerging countries is therefore interesting to better understand the return-risk relationship and the investment opportunities in these countries.

3. Econometric Methodology

Equity risk premium was estimated using several techniques: a CAPM-GARCH model (Engle *et al.*, 1987, French *et al.*, 1987), a CAPM with time-varying covariance (Bollerslev *et al.*, 1988) to cite only few references. Using also the CAPM of Sharpe (1964) and Lintner (1965) and under its well-known hypotheses, we can specify the equity risk premium as follows:

$$E(R_{i,t}) - rf_t = \beta_i \left(E(R_{M,t}) - rf_t\right) \quad (1)$$

Where: rf_t and $R_{i,t}$ denote the one period returns of riskless asset and a risky share *i* respectively. R_M measures the one period market portfolio return, β_i refers to market beta and corresponds to $\beta_i = \frac{\text{cov}\left(R_{i,t}, R_{M,t}\right)}{V\left(R_{M,t}\right)}$.

However, according to Harvey (1991) and Fama and French (2004), the above standard CAPM model is not adequate to apprehend time-variation in risk premium and price of risk. Such variability is more revealed for emerging markets due do unstable macroeconomic factors, market structure and political conditions and strategies. Accordingly, we extend the model (1) to account for the variability of the beta coefficient, β_i and the market price of risk. In particular, to estimate the time-varying risk premium, we use the following conditional CAPM model (Bollerslev *et al.*, 1988) for which all moments are conditional to the information available at time *t* that is represented by the information set I_t:

$$E(R_{i,t}|I_t) - rf_t = \beta_i \left(E(R_{M,i}|I_t) - rf_t\right) \quad (2)$$

where rf_t denotes the one period return of the riskless asset, $R_{i,t}|I_t$ and $R_{M,t}|I_t$ are the one period return of portfolio *i* and the one period market return portfolio conditional to the available information I_t, while $\beta_{i,t} = \frac{\text{cov}\left(R_{i,t}, R_{M,t}|I_t\right)}{V\left(R_{M,t}|I_t\right)}$ denotes the time-varying conditional market beta.

In order to estimate the conditional CAPM (model (2), we retain a multivariate AR(1)-GARCH(1,1)-M model (Bollerslev *et al.*, 1988) that we define as follows:

$$R_{i,t} = \theta_1 R_{i,t-1} + \theta_2 h_{i,t} + \varepsilon_{i,t}$$
$$\varepsilon_{i,t} = z_{i,t}\sqrt{h_{i,t}}, \quad with \;\; h_{i,t} = \phi_0 + \phi_1 \varepsilon_{i,t-1}^2 + \phi_2 h_{i,t-1} + \nu_{i,t} \quad (3)$$

where $R_{i,t}$ denotes the stock return of share *i*, $\varepsilon_t | I_t \to N(0, h_t)$, $h_{i,t}$ is the conditional variance, $z_{i,t} \to N(0,1)$, and $\theta_1, \theta_2, \phi_0, \phi_1, and\ \phi_2$ are coefficients to be estimated, with $\phi_1 > 0,\ \phi_2 > 0$ according to the positivity condition.

This econometric specification is suitable with financial theory as the conditional mean (return) is explicitly dependent on the conditional variance of the process (risk). While estimating this model by the quasi-maximum likelihood method as in Bollerslev and Wooldridge (1992), it can be possible to reproduce the time-varying dynamics of risk premium. These models have been applied in the next section for different developed and emerging stock indexes.

4. Data and Empirical Results

4.1 The Data and Preliminary Analysis

The empirical investigation covers three developed stock markets: France (CAC40), The USA (S&P500), the UK (FTSE100) using monthly data over the period January 1989 to May 2011 and two key emerging markets: Mexico and India over the period January 2000 to May 2011. As a benchmark, we used the MSCI World index for developed markets and the MSCI Emerging index for emerging markets. For each country, the risk-free asset corresponds to its interbank rate for one month. Interestingly, the sample under consideration several crises and stylized facts associated with the Internet bubble, the Gulf War, the subprime crisis, the recent financial global financial crisis suggesting further evidence of time-variation in stock markets, investor's behavior and risk aversion and risk premium. All data are obtained from the database Morgan Stanley Capital International.

First, we apply unit root tests and show that all series are integrated of one order (I(1))[4]. We focus that on stock returns that we define as the first logarithm difference of closing stock prices.

4.2 Time-Varying Risk Premium Estimate

Second, we check the ARCH effect through the application of ARCH test. Our finding point to significant hetereoscedasticity in MSCI stock returns suggesting further evidence of volatility excess in the data. To apprehend this volatility, we estimate several ARCH specifications and a GARCH (1, 1)-M seems to be the most appropriate specification to reproduce conditional volatility for benchmark markets, whereas an AR(1)-GARCH(1,1) is retained to estimate the stock return dynamics for the benchmark market[5].

Next, we estimate the covariance terms using (the popular rolling window estimator. The covariance at time t depends of information available at time $t-1$. The covariance is estimated on the period $t-k,\ldots t-1$, where k is predetermined, a common value for monthly data is k=24. and we estimate for each market the Beta-market. This enables us to estimate risk-premium using the conditional CAPM (model (2)).

Accordingly, we generate time-varying risk premium estimate that we report in Figure 1 for developed markets and in Figure 2 for emerging markets. Our findings imply several interesting results. First, our modelling captures the most important risk premium variations induced by economic stylized facts or exogenous shocks (i.e. first

[4] We do not report unit root test results to save space but results are available upon request.
[5] Results are not reported to save space but are available upon request.

and second Gulf war (1990, 2003), Internet bubble (2000), shock of September 11 2001, subprime crisis (2007), global financial crisis (2008-2009)). Indeed, as in line with the financial theory, risk premia vary with the business cycle as they reach highest levels during volatile market and lowest during recoveries. Second, the time-variation hypothesis for risk premium is not rejected for both developed and emerging markets, even though variability is significantly more marked for developed markets. Interestingly, we show that the risk premiums increased significantly during periods of crisis. In particular, they reached very high levels after the recent crisis never reached before, which reflects the uncertainty and investors' risk aversion after the crisis. For example, over the period 2000-2008, risk premium in mean is about 6.5% for the USA, 6.6% for France, 5.7% for the UK, 4.6% for Mexico, and 5.3% for India. They are higher for developed countries but the highest value is for the French case. As for the period 2009-2010, highest values are being for emerging markets (13% ù for Mexico and 13.4%ùù for India), while we note 10.9%, 9.6% and 8.5% for the USA, France and the UK respectively. Finally, While premium decreased by the end of the period for emerging markets, they recently knew a new episode of increase due to the effect of debt crisis and economic recession in Europe and the USA.

Figure 1: Risk premium Estimate for Developed Market

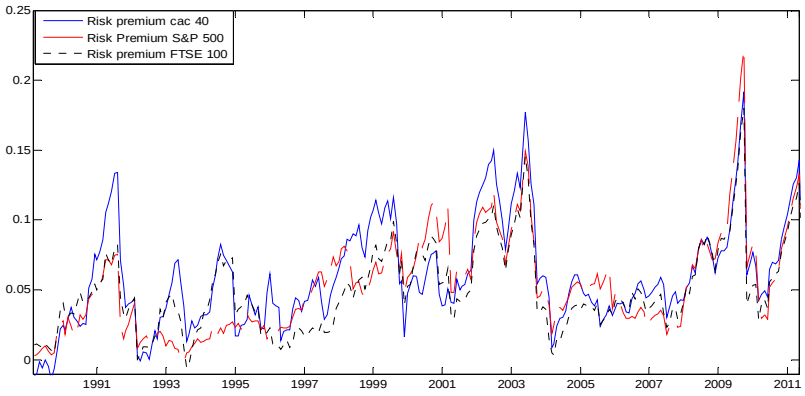
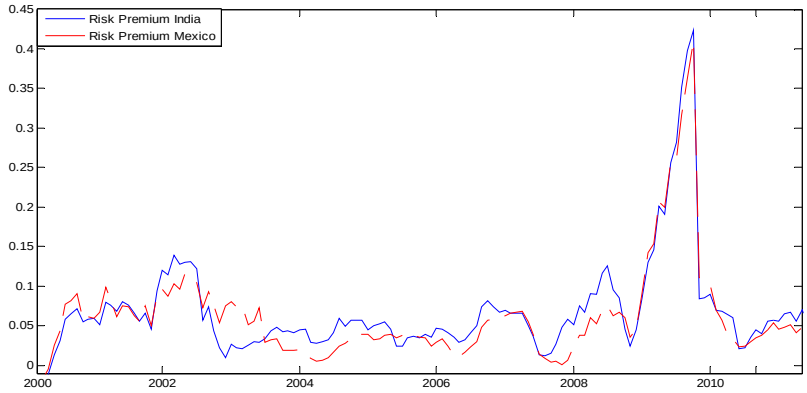
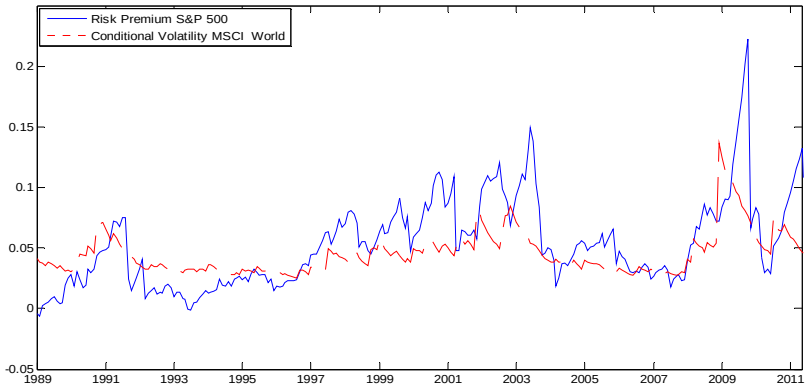


Figure 2: Risk premium Estimate or the Emerging Markets



Finally, in order explain the reason for this time-variation in risk premium, we looked its correlation with conditional variance while considering the US case and we plot in Figure 3 the US estimated risk premium and the world conditional variance. Our analysis points to a positive correlation suggesting higher is the market volatility important is time-variation in risk premium. This result is in line with the conclusion of French *et al.* (1986).

Figure 3: Risk premium and conditional volatility



5. Conclusion

This paper studies the risk premium dynamics for main key developed and emerging stock markets over the last decade. To do this, we propose a conditional CAPM-GARCH-M specification that enables to capture changes in risk premium. Accordingly, we show significant time-variation in risk premium for both markets. We note that the recent crisis is source of volatility excess which implies an increase in risk premium. This result suggests that a better control and risk management should enable to control risk premium variations. At least, two extensions are possible. First, the sample can be augmented by other developed and emerging countries making the comparison more

interesting. Second, our econometric approach can be extend while taking into account nonlinearity and/or dynamic correlations.

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