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# Financial crisis and market risk premium: Identifying multiple structural changes

*Juan J. García-Machado*
Professor of Finance, Department of Financial Economics, Accounting and Operations Management, University of Huelva (Spain).
E-mail: machado@uhu.es

*Emilio Congregado*
Senior Lecturer of Economics, Department of Economics and Statistics, University of Huelva (Spain).
E-mail: congregado@uhu.es

*Antonio A. Golpe*
Assistant Professor in Economics, Department of Economics and Statistics, University of Huelva (Spain).
E-mail: antonio.golpe@dehie.uhu.es

*Juan J. de-la-Vega*
Senior Lecturer of Finance, Department of Financial Economics, Accounting and Operations Management, University of Huelva (Spain).
E-mail: vega@uhu.es

**CRISIS FINANCIERA Y PRIMA DE RIESGO DE MERCADO: IDENTIFICANDO CAMBIOS ESTRUCTURALES MÚLTIPLES**

**RESUMEN:** La relación entre variables macroeconómicas y los rendimientos del mercado bursátil está bien documentado en la literatura. Sin embargo, en este artículo examinamos la relación a largo plazo entre los rendimientos de los mercados de bonos durante el periodo 1991:11 - 2009:11, utilizando la metodología de cambios estructurales propuesta por Bai y Perron. Nuestros hallazgos indican que, mientras que la prima de riesgo es comúnmente positiva, aparecen tres períodos en los que ésta toma signo negativo (1991:1-1993:2, 1998:3-2002:2 and from 2007:1-2009:11) adelantando cambios en la evolución del PIB. De esta forma, el estudio muestra la existencia de cambios estructurales en la prima de riesgo española y la relación de ésta con el ciclo económico. Estos resultados contribuyen a una mejor comprensión de las estrechas relaciones entre los mercados financieros y el entorno macroeconómico. El trabajo también analiza las implicaciones del estudio así como sugerencias para la investigación futura.

**PALABRAS CLAVE:** crisis financiera, prima de riesgo, tipo sin riesgo, mercados financieros, bonos del Estado, España, cambio estructural.

**CRISE FINANCIÈRE ET PRIME DE MARCHÉ: IDENTIFICATION DE CHANGEMENTS STRUCTURELS MULTIPLES**

**RÉSUMÉ :** La relation entre les variables macroéconomiques et les rendements du marché boursier a bien été documentée dans les publications antérieures. Cependant, cet article examine la relation à long terme entre les rendements des marchés de bonus durant la période de 1991/11 à 2009/11, par la méthodologie des changements structurels proposée par Bai et Perron. Les résultats indiquent que, bien que la prime de risque soit généralement positive, elle est négative durant trois périodes (de 1991/1 à 1993/2, de 1998/3 à 2002/2 et de 2007/1 à 2009/11), entraînant des changements dans l'evolution du PIB. L'etude effectuée démontre l'existence de changements structurels concernant la prime de risque espagnole et son rapport avec le cycle économique. Ces résultats contribuent à une meilleure compréhension des relations étroites entre les marchés financiers et le cardre macroéconommique. L'article analyse également les implications de l'étude et fournit des propositions pour la recherche future.

**MOTS-CLEFS:** crise financière, prime de risque, type sans risque, marchés financiers, bonus de l'Etat, changement structurel.

**CRISE FINANCEIRA E PRIMA DE RISCO DE MERCADO: IDENTIFICANDO MÚLTIPLAS MUDANÇAS ESTRUTURAIS**

**RESUMO:** A relação entre variáveis macroeconômicas e os rendimentos da bolsa de valores está bem documentado na literatura. Sem embargo, neste artigo examinamos a relação a longo prazo entre os rendimentos dos mercados de bônus durante o período 1991:11 - 2009:11, utilizando a metodologia de múltiplas mudanças estruturais proposta por Bai e Perron. Nossas descobertas indicam que, enquanto que a prima de risco é comumente positiva, aparecem três períodos nos que esta se torna negativa (1991:1-1993:2, 1998:3-2002:2 e 2007:1-2009:11) adiantando mudanças na evolução do PIB. Desta forma, o estudo mostra a existência de mudanças estruturais na prima de risco espanhola e a relação desta com o ciclo econômico. Estes resultados contribuem a uma melhor compreensão das estreitas relações entre os mercados financeiros e o entorno macroeconômico. O trabalho também analisa as implicações do estudo assim como apresenta sugestões para a pesquisa futura.

**PALAVRAS CHAVE:** crise financeira, prima de risco, tipo sem risco, mercados financeiros, bônus do Estado, Espanha, mudança estrutural.

**CLASIFICACIÓN JEL:** G11, G12, C32, E44.

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**CORRESPONDENCIA:** Juan J. García-Machado. Depto. de Economía Financiera, Contabilidad y Dirección de Operaciones. Facultad de Ciencias Empresariales. Plaza de la Merced, 11, E-21001, Huelva, España.

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**ABSTRACT:** The relationship between macroeconomic variables and stock market returns is, by now, well-documented in the literature. However, in this article we examine the long-run relationship between stock and bond markets returns over the period from 1991:11 to 2009:11, using Bai and Perron's multiple structural change approach. Findings indicate that while the market risk premium is usually positive, periods with negative values appear only in three periods (1991:1-1993:2, 1998:3-2002:2 and from 2007:1-2009:11) leading to changes in the GDP evolution. Thereby, the study shows the presence of structural breaks in the Spanish market risk premium and its relationship with business cycle. These findings contribute to a better understanding of close linkages between the financial markets and the macroeconomic variables such as GDP. Implications of the study and suggestions for future research are provided.

**KEYWORDS:** Financial crisis, market risk premium, risk free rate, Spanish financial markets, Spanish government bonds, structural change.

## INTRODUCTION[1]

In an article entitled Europeans start to worry that U.S. fever could be contagious, the *Financial Times* warned that: "This was the week when the financial crisis and its ripple effects finally spread out of the banking sector and reverberated through the rest of corporate Europe" (Milne & Guerrera, 2008, p. 16). By May 2008, the European Central Bank indicated that "Demand for eurozone bank loans has tumbled and credit standards have tightened

[1] This procedure has a number of advantages over previous approaches (for details, see Bai and Perron, 2006).

further, according to a European Central Bank survey that could dent confidence in the region's resilience" (Atkins, 2008, p. 2).

For at least two decades, the European Union (EU) had lagged behind the United States in regard to economic growth and productivity improvements. Meanwhile, the European financial markets were still not integrated, and each nation still had its own regulatory standards.

Some academics remained pessimistic about the future growth in Europe, suggesting that the traditional forces of government regulation and ownership, expensive social security systems, and high taxes would place a growing burden on all European countries, thereby constricting financial oportunities. An important reality was that U.S. GDP was nearly 25% of global GDP, so a change in U.S. economic activity would inevitably have ripple effects throughout the world. The 2007-2008 financial crisis has demonstrated the close linkages between the financial system and the economy as a whole (Conklin and Cadieux, 2008, p. 12).

With regard to market risk premium, this is one of the most important numbers in finance. Unfortunately, estimating and understanding its value has proved to be difficult. Although a substantial body of research shows that expected returns vary over time, the static approach of estimating the risk premium as the simple average of historical excess stock returns remains the most commonly employed method in practice (Mayfield, 2004, pp. 465-466).

In Spain, market risk premium has experienced a remarkable turnaround in the last three years. In particular, positive market risk premium values during the most part of the 1990's and 2000's have turned into negative ones after 2007:1.

This situation was expected as prior to the current financial crisis, with the booming stock market and promising return from stock market, people were inclined to invest in this market with the expectation to achieve a quick benefit within a short period.

It is a well-known fact that the relationship between stock and bond markets –among different types of assets– plays an important role in asset allocation strategies and portfolio diversification process. Given that, the stock and the bond market are interdependent, dynamic allocation of funds from one market to another is possible, which in turn will result in balanced price increase in the bond market and in declining price in the stock market.

In particular, the strategic allocations of capital resources between stocks and bonds and the degree of correlation between them is one of the most important elements that determine portfolio performance, given that stock and bond market are closed substitute for balancing of portfolio of assets.

The dynamic nature of this asset allocation has been studied from different perspectives. Recent works have explored the long-run relationship between these two classes of asset using co-integration analysis (Ahmed, 2009; Clare et al., 1994; Mills, 1991). However, we will try to analyze this relationship from a different perspective: testing the existence of structural changes in the risk market premium and showing that this allocation pattern changed during 2007 anticipating the current credit crunch.

Therefore, the objective of this study is two folds: Firstly, this study aims to examine the strategic (long-term) relationship between stock and bond markets returns identifying structural changes using the approach developed by Bai and Perron (1998, 2003a). This procedure will allow us to test endogenously for the presence of multiple structural changes in this relationship.[2] Secondly, given close interdependence of these two markets and the macroeconomic performance we will try to show in an informal way if these structural changes have acted as leading indicators to business cycles.

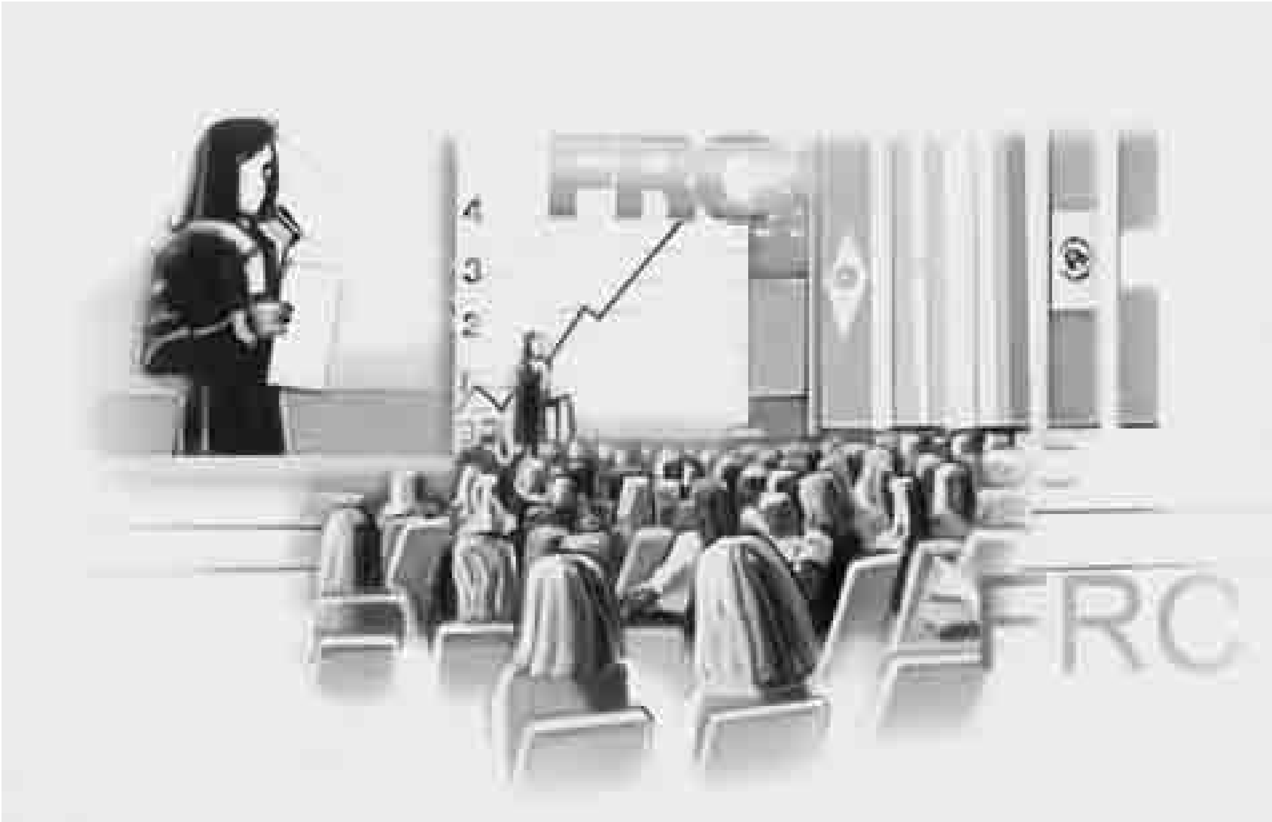
The rest of the article is organized as follows: Section 2 represents a selective review of the premium risk concept and some previous related empirical literature on the relationship between stock and bond markets. Section 3 briefly describes the data and methodology, whereas Section 4 shows our main results. Finally, conclusions and implications are presented in Section 5.

## THEORETICAL BACKGROUND

Many of available studies show the relationship between the financial markets and the macroeconomic variables. For example, Cooper et al. (2004) examine the cointegration between macroeconomic variables and stock market indices from Singapore Stock Exchange. Hördahl (2008) uses a dynamic term structure model based on an explicit structural macroeconomic framework to estimate inflation risk premium in the United States and the euro area.

Moreover, a lot of researches show that expected returns vary over time. For example, Fama and Schwert (1977), Shiller (1984), Campbell and Shiller(1988), Fama and French (1988, 1989), Campbel (1991), Hodrick (1992) and

[2] This procedure has a number of advantages over previous approaches (for details, see Bai and Perron, 2006).




Lamont (1998). Brunner et al. (1998) survey a sample of 27 "highly regarded corporations" and find that the estimates of risk premium are generally based on either the arithmetic or geometric average of historical excess market returns.

Recent studies provide historical evidence of a structural shift in the market risk premium. Siegel (1992) documents that the market premium has not been constant over the past century and the excess stock returns during the mid-1900s are abnormally large. Pastor and Stambaugh (2001) use a Bayesian analysis to test for structural breaks in the distribution of historical returns and to relate those breaks to changes in the market risk premium. Fama and French (2002) provide evidence of a structural shift in the market risk premium by comparing the ex-ante risk premium from a Gordon growth model with the ex-post risk premium based on the historical average of excess market returns. Evidence of a structural shift in the volatility of market returns is also provided in earlier studies. Officer (1973) and Schwert (1989) argue that market returns during the Great Depression era were unusually volatile, and Pagan and Schwert (1990) show that the volatility of market returns during the Great Depression was inconsistent with stationary models of heteroskedastic returns. Mayfield (2004) provides a model with a structural basis for estimating the impact of such a structural shift on the market risk premium. Consistent with Pagan and Schwert (1990) and Pastor and Stambaugh (2001), Mayfield found evidence of a statistically significant shift in the underlying volatility process that governs the evolution of volatility states following the 1930s. Because of the structural shift in the Markov transition probabilities, the likelihood of entering into the high-volatility state falls from about 39% before 1940 to less than 5% after 1940. Given the lower likelihood of entering the high-volatility state, the risk premium falls from about 20.1% before 1940 to 7.1% after 1940 (Mayfield, 2004, p. 468).

Further, given the assumed market efficiency in stock and bond market, no arbitrage relationship is expected from these two markets. The formation of such relation can be explained as:

$$E(S/\vartheta) = E(B/\vartheta) + market\ risk\ \ premium \qquad (1)$$

where $\theta$ is the set of information. Therefore the expected return on stock depends on expected return on bond plus additional risk premium in relation to the bond. It is assumed that, over the years, information set is likely to be changed given the dynamic economics environment which could lead to changes in risk premium rather than being held constant. Therefore the marginal investor may like to take in and out money from these two markets until we have equilibrium relationship of stock and bond markets. In sum, stock market uncertainty could be important for cross-market pricing influences and should be taken into consideration when setting optimal portfolio allocations (Connolly et al., 2005).

This relationship has been extensively explored. For instance, Lo and MacKinlay (1988) or Fama and French (1996) show that stock and bond returns do not follow a random walk process. Further support to this finding can be founded in Fleming and Remolona (1997), Clare and Thomas (1992), Campbell and Hamao (1989), and Keim and Stambaugh (1986). A second class of empirical works are focused on the co-movement and causality between stocks and bonds (Chordia et al., 2005; Fleming et al., 1998; Hotchikiss and Ronen, 2002; Li, 2002; Li and Zou, 2008 Wainscott, 1990) whereas the most recent research has looked for co-integration between stock and bond indexes (Ahmed, 2009; Clare et al., 1994; Mills, 1991).

In general, evidence suggests that correlation between stock and bond return may play a crucial role in allocation decisions leading to movements in some key macroeconomic variables. Chan et al. (1997) studied whether stock and bond prices were collinear in the long run. The results of the unit root tests suggested that the bond and the stock markets were integrated of the first order. Therefore, a nonstationary component was driving these stock and bond prices. They found that this nonstationary component was not shared by the two prices, indicating that the two prices could move apart over time.

## DATA AND METHODOLOGY

The empirical analysis data uses monthly data on stock and bond Spanish markets taken from the Spanish Central Bank.[3] To operationalize the concept of market risk premium, we decided to use the concept of historical risk premium,[4] defining it as the historical differential return of the stock market over treasury bonds. Therefore, the market risk premium is calculated as the difference between the stock return (*Rmsi*) and the risk free return or treasury bond return (*Rsb*):

$$market\ risk\ premium = Rmsi_t - Rsb_t \qquad (2)$$

To calculate Rmsi, we take natural logarithm on the monthy Madrid Stock Market index in first-difference, multiplying it by 12 to transform our original data in annual rates. Rsb is the risk free return expressed as annual rates.

As we mentioned, an alternative though indirect way of analyzing the relationship between stock and bond market returns is by means of the market risk premium evolution, testing the presence of structural changes in the Spanish market risk over the period 1991:1-2009:11.

As suggested above, we examine the possibility of instabilities in this relationship to address the question of whether the long-run relationship estimated between stock and bond market returns is stable over time or it exhibits some structural break allowing the instability to occur at a unknown date. To carry out this task we use the tests of multiple structural breaks proposed by Bai and Perron (1998, 2003).

Bai-Perron's approach allows to test for multiple breaks at unknown dates, so that it successively estimates each break point by using a specific-to-general strategy to determine the number of breaks. Bai and Perron (1998) suggest several statistics to indentify the break points: i) The $SupF_t(k)$ test, i.e. a sup F-type test of the null hypothesis of non structural break vs the alternative of a fixed (arbitrary) number of breaks estimating the long-run relationship with multiple structural breaks k; ii) Two maximum test of the null hyothesis of no structural break vs the alternative of a unknown number of breaks given some upper bound, i.e. $UD_{max}$ test, an equal weighted version, and $WD_{max}$ test, with weights that depend on the number of regressors and the significance level of the test; and iii) The $SupF_t(\ell+1/\ell)$ test, i.e. a sequential test of the null hypothesis of $\ell$ breaks vs the alternative $\ell+1$ of breaks.

## RESULTS

We begin our analysis by examining the time-series properties of the series. We use a modified version of the Dickey and Fuller (1979, 1981) test (DF) and a modified version of the Phillips and Perron (1988) tests (PP) proposed by

[3] Asset Markets Time Series. In particular the two time series considered are the treasury bond (10 years) average return and the Madrid General Stock Index (IGBB, Bolsa de Madrid). Data were downloaded from the BIEST (Spanish Central Bank Time series search engine) collected by Spanish Central Bank on December, 2009. Available at: http://app.bde.es/tsi_www/paginaBienvenida.do?idioma=es [04/12/09]. Data on Spanish real GDP are taken from the Quarterly National Accounts database Available at: http://www.ine.es/jaxiBD/tabla.do?per=03&type=db&divi=CNTR&idtab=9 [04/12/09].

[4] The concept of market risk premium can be considered from alternative perspectives. For instance, as the incremental return of the market over the return of treasury bonds required by an investor–required market risk premium–or alternatively as the expected differential return of the stock market over treasury bonds –expected market risk premium–. See Fernández (2009) for a detailed discussion.

Ng and Perron (2001) for the null hypothesis of a unit root to solve the traditional problems associated to conventional unit root tests. Ng and Perron (2001) propose a class of modified tests, $\overline{M}$, with GLS detrending of the data and using the modified Akaike information criteria to select the autoregressive truncation lag.

Table A1 reports test statistics of Ng-Perron tests, $\overline{M}Z_{\alpha}^{GLS}$, $\overline{M}Z_{t}^{GLS}$, $\overline{M}SB^{GLS}$, $\overline{M}PT^{GLS}$. All test statistics formally examine the unit root null hypothesis against the alternative of stationarity. At the 5% level, the null hypothesis of non-stationarity for the series in levels for *Rmsi* and *Rsb* cannot be rejected by using Ng-Perron tests. By contrast, however both ADF and KPSS tests suggest that the two series are stationary.

The results of applying the Bai-Perron tests to the relationship between stock and bond market are shown in Table 2. To estimate the partial structural change model we consider a particular specification with serially uncorrelated errors, different distributions for the data across segments and the same distribution for the errors across segments. We allowed up to eight breaks and used a trimming of $\varepsilon$ = 0.10, so that each regime has at least 22 observations. We apply the procedure with a constant and account for potential serial correlation via non-parametric adjustments. The statistics $UD_{max}$ and $WD_{max}$ are highly significant which implies that at least one break in the model exists. As we can see, all the $SupF_t(k)$ tests are significant with k running between one and eight so that at least one break could be present in this relationship. In turn, $SupF_t(\ell+1/\ell)$ the test is not significant for any $\ell \geq 7$, so the sequential procedure selects six breaks. Hence, the results of the Bai-Perron tests would suggest a model of seven regimes, with the dates of the breaks estimated at July 1993, October 1996, July 1998, August 2002, October 2004 and December 2006 (their confidence intervals are shown in Table 1).

Finally, we proceed to estimate the market risk premium for the seven sub-samples and the results are shown in the columns of Table 3. As it can be seen, in the first, fourth and last regime the market risk premium is negative. Comparing these regimes with the evolution of the GDP we can observe the similar pattern followed by these markets and

**TABLE 1. Unit root tests**

| Variable | *ADF* | *Lags* | *KPSS* | $\overline{M}Z_{\alpha}^{GLS}$ | $\overline{M}Z_{t}^{GLS}$ | $\overline{M}SB^{GLS}$ | $\overline{M}PT^{GLS}$ | *Lags* |
|---|---|---|---|---|---|---|---|---|
| Stock market | -3,880* | 9 | 0,131 | -2,483 | -1,105 | 0,445 | 9,818 | 8 |
| Treasure bond | -2,577*** | 10 | 0,345 | -0,313 | -0,202 | 0,647 | 25,663 | 3 |

*Denotes hull hypothesis rejection. Remember that the null hypothesis in the KPSS test is stationarity whereas the null in the rest of the test is the existence of a unit root.

**TABLE 2. Bai-Perron tests of multiple structural changes in the long-run relationship**

| Specifications | | | | | | | |
|---|---|---|---|---|---|---|---|
| $y_t$={Rmsi$_t$} | | $z_t$={1,Rsb$_t$} | | q=2 | p=0 | h=22 | M=8 |
| **Tests** | | | | | | | |
| $UD_{max}$ | | $WD_{max}$ | | | | | |
| 1032,164* | | 1196,133* | | | | | |
| $SupF_t(1)$ | $SupF_t(2)$ | $SupF_t(3)$ | $SupF_t(4)$ | $SupF_t(5)$ | $SupF_t(6)$ | $SupF_t(7)$ | $SupF_t(8)$ |
| 1032,164* | 777,572* | 907,715* | 707,018* | 569,277* | 506,238* | 455,373* | 387,510* |
| | | | | | | | |
| $SupF_t(2/1)$ | $SupF_t(3/2)$ | $SupF_t(4/3)$ | $SupF_t(5/4)$ | $SupF_t(6/5)$ | $SupF_t(7/6)$ | $SupF_t(8/7)$ | |
| 194,546* | 34,129* | 28,594* | 24,328* | 24,328* | 20,935 | 0,000 | |
| **Break dates estimates** | | | | | | | |
| $T_1$ | 1993:07 | [1993:01-1993:09] | | | | | |
| $T_2$ | 1996:10 | [1996:09-1996:11] | | | | | |
| $T_3$ | 1998:07 | [1998:05-1998:11] | | | | | |
| $T_4$ | 2002:08 | [2002:07-2002:11] | | | | | |
| $T_5$ | 2004:10 | [2004:08-2004:11] | | | | | |
| $T_6$ | 2006:12 | [2006:10-2007:02] | | | | | |

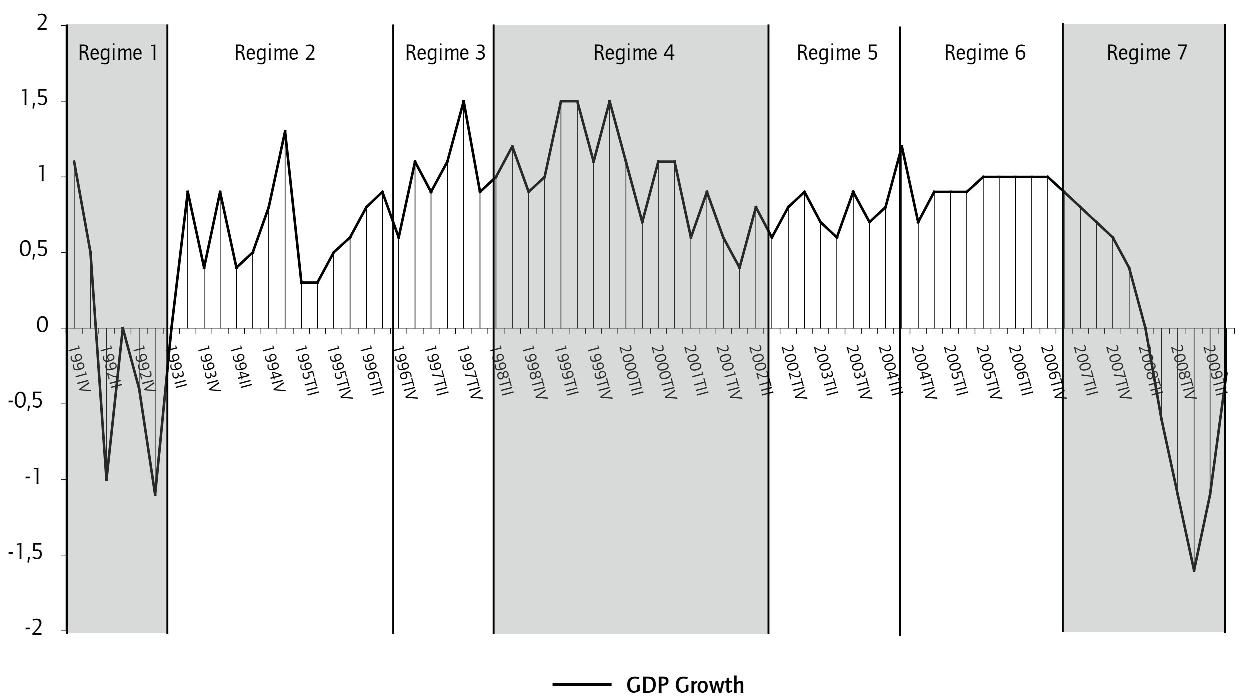
*Notes*: $y_t$,$z_t$,q,p,h, and M denote the dependent variable, the explanatory variables allowed to change, the number of regressors, the number of corrections included in the variance-covariance matrix, the minimum number of observations in each segment, and the maximum number of breaks, respectively.
***,**,and * denote significance at the 10%,5% and 1% levels, respectively. The critical values are taken from Bai and Perron (1998), Tables 1 and 2; and from Bai & Perron (2001), Tables 1 and 2.
The number of breaks (in our case, seven) has been determined according to the sequential procedure of Bai and Perron (1998), at the 1% size for the sequential test $SupF_t(\ell+1/\ell)$.
95% confidence intervals for $T_i$ in brackets.

**TABLE 3. Risk premium across different regimes (annual).**

| | Full sample | First regime | Second regime | Thrid regime | Fourth regime | Fifth regime | Sixth regime | Seventh regime |
|---|---|---|---|---|---|---|---|---|
| | 1991:11-2009:10 | 1991:11-1993:05 | 1993:06-1996:09 | 1996:10-1998:06 | 1998:07-2002:07 | 2002:08-2004:09 | 2004:10-2006:11 | 2006:12-2009:11 |
| Average Risk premium | 2,124 | -12,467 | 0,672 | 43,816 | -12,368 | 7,793 | 23,219 | -12,528 |
| Volatility | 68,924 | 63,133 | 58,479 | 73,429 | 77,918 | 64,675 | 36,509 | 77,952 |
| Skewness | -0.536 | -0.422 | 0.156 | -0.811 | -0.383 | -0.849 | -0.435 | -0.567 |
| Kurtosis | 4.035 | 1.996 | 2.525 | 3.625 | 4.149 | 4.678 | 2.875 | 3.726 |
| Jarque Bera test | 0.000 | 0.489 | 0.769 | 0.266 | 0.142 | 0.046 | 0.658 | 0.267 |
| Test for equality of means between regimes Anova F- test df(6,209) P-value in brackets | | | | 2,604 | [0,019] | | | |
| Barlett test for equality of variances between regimes Barlett test df(6) P-value in brackets | | | | 18,477 | [0,005] | | | |

Note: In cursive regimes with negative market risk premium.

**FIGURE 1. The evolution of GDP in Market Risk Premium regimes.**




the recent macroeconomic evolution (see, Figure 1). Table 3 also includes both the Anova F test and the Barlett test for testing the equality of means and variances between regimes. In both cases, results reject the null hypothesis of equality of means and variances, respectively between the regimes.

In the figure 1, shadow areas corresponds to regimes with negative market risk premium (regimes 1, 4 and 7). As we can observe these regimes corresponds to a deaccelaration or crises episodies. In this sense, structural changes in the evolution of the market risk premium lead to changes in the business cycle.

## CONCLUSIONS

This paper tested the presence of structural breaks in the Spanish risk market premium and its relationship with business cycle. Defining market risk premium in terms of the difference between the stock return and the risk free return or treasury bond return, the results provide robust evidence of structural changes leading to business cycles changes. In particular, our findings indicate that while the market risk premium is usually positive, periods with negative values appear only in three periods (1991:1-1993:2, 1998:3-2002:2 and from 2007:1-2009:11) leading to changes in the GDP evolution. Therefore, the strategic allocations of capital resources between stocks and bonds as two close substitutes for balancing of portfolio of assets must be considered a way to anticipate changes in business cycles' phases, given that stock market uncertainty has important cross-market pricing influences and should be taken into consideration when setting optimal portfolio allocations.

This result also suggests that forecasting of financial return series are subject to breaks and advises us on the presence of certain correlation between these breaks in the movement among stock and bond indices and macroeconomic variables. In view of evidence that these structural changes and regime shifts seem to lead business cycle turningpoints, the use of the link between stock and bonds returns and its structural breaks as a predictor of economic crises would be present in the future research agenda, to test the potential to increase the out-of-sample predictability of GDP.

However, we cannot rule out the possibility that it might simply reflect data limitations given that our analysis focuses on a singular country.[5] Therefore, future work might fruitfully apply the methodology used in this article to a broader range of countries and should also seek to extend the length of the data series which are utilized.

## REFERENCES


Ahmed, H.J.A. (2009). The equilibrium relation between Stock Index and Bond Index: Evidence from Bursa Malaisya. *International Research Journal of Finance and Economics*, *30*, 1-15.

Atkins, R. (2008, 10/11 May). Eurozone loan demand plunges. *Financial Times*, p. 2.

Bai, J. & Perron, P. (1998). Estimating and testing linear models with multiple structural changes. *Econometrica*, *66*, 47-78.

Bai, J. & Perron, P. (2003a). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, *18*, 1-22.

Bai, J. & Perron, P. (2003b). Critical values for multiple structural change tests. *Econometrics Journal*, *6*, 72-78.

Bai, J. & Perron, P. (2006). Multiple structural change models: A simulation analysis. In D. Corbae, S.N. Durlauf & B.E. Hansen (Eds.), *Econometric theory and practice: Frontiers of analysis and applied research* (pp. 212-238). Cambridge: Cambridge University Press.

Bajo, O., Díaz, C. & Esteve, V. (2008). US deficit sustainability revisited: A multiple structural change approach. *Applied Economics*, *40*, 1609-1613.

Brunner, R. F., Eades, K. M., Harris, R. S. & Higgins, R. C. (1998). Best practices in estimating the cost of capital, survey and synthesis. *Financial Practice and Education*, 13-28.

Campbell, J. Y. (1991). A variance decomposition for stock returns. *Economic Journal*, *101*, 157-179.


[5] Using G7 data, Kim and In (2007) found the correlation between changes in stock prices and bond yields can differ from country to country and can also depend on the time scale.


Campbell, J. Y. & Hamao, Y. (1989). Predictable bond and stock returns in the United States and Japan: A study of long-term capital market integration. *Journal of Finance*, *47*(1), 43-70.

Campbell, J. Y. & Shiller, R. J. (1988). The dividend-price ratio and expectations of future dividends and discount factors. *Review of Financial Studies*, *1*, 195-227.

Chan, K. C., Norrbin, S. C. & Lai, P. (1997). Are stock and bond prices collinear in the long run? *International Review of Economics and Finance*, *6*(2), 193-201.

Chordia, T., Sarkar, A. & Subrahmanyam, A. (2005). An empirical analysis of stock and bond liquidity. *Review of Financial Studies*, *18*, 85-129.

Clare, A. D. & Thomas, S. H. (1992). International evidence for the predictability of bond and stock returns. *Economic Letters*, *40*, 105-112.

Clare, A. D., Thomas S. H. & Wickens M. R. (1994). Is the Gilt-Equity Yield Ratio useful for predicting UK stock returns? *The Economic Journal*, *104*(2), 303-315.

Conklin, D. & Cadieux, D. (2008, 30th June). The 2007-2008 financial crisis: Causes, impacts, and the need for new regulations. *Ivey Publising*. The University of Western Ontario. Available at: http://cases.ivey.uwo.ca/Cases/Pages/home

Connolly, R., Stivers, C. & Sun, L. (2005). Stock market uncertainty and the stock-bond return relation. *Journal of Financial and Quantitative Analysis*, *40*, 161-194.

Cooper, R., Chuin, L. & Atkin, M. (2004). Relationship between macroeconomic variables and stock market indices: Cointegration evidence from stock exchange of Singapore's All-S sector indices. *Journal Pengurusan*, *24*, 47-77.

Fama, E. F. & French, K. R. (1988). Dividend yields and expected stock returns. *Journal of Financial Economics*, *22*, 3-27.

Fama, E. F. & French, K. R. (1989). Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics*, *25*, 23-49.

Fama, E. F. & French K. R. (1996). Multifactor explanations of asset pricing anomalies. *Journal of Finance*, *51*, 55-84.

Fama, E. F. & French, K. R. (2002). The equity premium. *Journal of Finance*, *57*, 637-659.

Fama, E. F. & Schwert, G. W. (1977). Asset returns and inflation. *Journal of Financial Economics*, *5*, 115-146.

Fernández, P. (2009). Equity risk premium: Historic, expected, required and implied. MPRA Paper 14221, March.

Fleming, M. J. & Remolona, E. M. (1997). What moves the bond market? *Economic Policy Review*, *3*(4), 31-50.

Fleming, M. J., C. Kirby C. & Ostdiek, B. (1998). Informational and volatility linkage in the stock-bond and money market. *Journal of Financial Economics*, *49*, 111-137.

Hartmann, D., Kempa, B. & Pierdzioch C. (2008). Economic and financial crises and the predictability of U.S. stock returns. *Journal of Empirical Finance*, *15*(3), 468-480.

Hodrick, R. (1992). Dividend yields and expected stock returns: Alternative procedures for inference and measurement. *Review of Financial Studies*, *5*, 357-386.

Hördahl, P. (2008). The inflation risk premium in the term structure of interest rates. *BIS Quarterly Review*, September, 23-38.

Keim, D. B. & Stambaugh, R. F. (1986). Predicting returns in the stock and bond markets. *Journal of Financial Economics*, *17*, 357-390.

Kim, S. & In, F. (2007). On the relationship between changes in stock prices and bond yields in the G7 countries: Wavelet analysis. *Journal of International Financial Markets, Institutions and Money*, *17*(2), 167-179.

Lamont, O. (1998). Earnings and expected returns. *Journal of Finance*, *53*, 1563-1587.

Li, L. (2002). Macroeconomic factors and the correlation of stock and bond returns.*Yale TCF Working paper*, November, No. 02-46.

Li, L. & Zou, L. P. (2008). How do policy and information shocks impact co-movements of China's T-bond and stock markets? *Journal of Banking & Finance*, *32*(3), 347-359.

Lo, A. & MacKinlay, A. (1988). Stock prices do not follow random walk. *Review of Financial Studies*, *1*, 41-66.

Mayfield, E. S. (2004). Estimating the market risk premium. *Journal of Financial Economics*, *73*, 465-496.

Mills, T. C. (1991). Equity Prices, Dividends and Gilt Yields in the U.K: Cointegration, Error Correction and 'Confidence'. *Scottish Journal of Political Economy*, 38(3), 242-255.

Milne, R. & Guerrera, F. (2008, 2nd May). Europeans start to worry that U.S. fever could be contagious. *Financial Times*, 16.

Ng, S. & Perron, P. (2001). Lag length selection and the construction of unit root tests with good size and power. *Econometrica*, *69*, 1529-1554.

Officer, R. R. (1973). The variability of the market factor of the New York Stock Exchange. *Journal of Business*, *46*, 434-453.

Pagan, A. R. & Schwert, G. W. (1990). Alternative models for conditional stock volatility. *Journal of Econometrics*, *45*, 267-290.

Pastor, L. & Stambaugh, R. F. (2001). The equity premium and structural breaks. *Journal of Finance*, *56*, 1207-1239.

Perron, P. & Ng, S. (1996). Useful modifications to sorne unit root tests with dependent errors and their local asymptotic properties. *Review of Economic Studies*, *63*, 435-463.

Shiller, R. J. (1984). Stock prices and social dynamics. *Brookings Papers on Economic Activity*, *2*, 457-498.

Schwert, G. W. (1989). Why does stock market volatility change over time? *Journal of Finance*, *44*, 1115-1153.

Siegel, J. J. (1992). The equity premium: Stock and bond returns since 1802. *Financial Analysts Journal*, *48*, 28-38.

Wainscott, C. B. (July-August 1990). The stock-bond correlation and its implications for asset allocation. *Financial Analysts Journal*, 55-60.