

Effects of Macroeconomic Announcements on Stock Returns across Volatility Regimes*

Henry Aray[†]
University of Granada

Abstract

Based on a simple Markov regime switching model, this article presents evidence on the effects of macroeconomic announcements on individual stocks returns. The model specification allows two regimes to be distinguished: one with high volatility and the other with low volatility. Considering the level of significance at 5%, the response of stock returns to macroeconomic announcements is much stronger in the low volatility regime. However, the effects of the Fama-French factors on individual stock returns is unambiguously significant in both regimes.

Keywords: Markov Switching Model, Macroeconomic announcements, Stock Returns.

JEL Classification: E44,G14

*Financial support from the Spanish Ministry of Education and Science, through Project SEJ2007-62081/ECON is gratefully acknowledged.

[†]Corresponding author: Universidad de Granada, Campus de la Cartuja S/N, Facultad de Ciencias Económicas y Empresariales, Departamento de Teoría e Historia Económica, 18011, Granada, Spain. E-mails: haray@ugr.es. Tel.: +34 958 241000 Ext: 20140; Fax: +34 958 249995.

1 Introduction

Stock returns are believed to move in response to macroeconomic news which may indicate the general pulse of the economy. Hence, market participants closely follow releases of macroeconomic data and the media often suggest a strong association between movements in stock prices and macroeconomic announcements. Since the publication of the article by McQueen and Roley (1993), researchers have controlled for the state of the economy when estimating the effect of macroeconomic announcements on stock returns.

We could also expect macroeconomic news to have different effects depending on the state of the financial market volatility. However, this topic has not been explored by researchers. This article therefore aims to provide evidence that stock market returns response differently to macroeconomic announcements depending on the volatility regime. As far as we know, this is the first attempt to explain this. We consider two volatility regimes, high and low, which are endogenously determined through a Markov regimen switching model *à la* Hamilton (1989). The macroeconomic variables included are the Consumer Price Index (*CPI*), Index of Industrial Production (*IIP*) and Unemployment Rate (*UR*).

As a whole, clustering information and special events are responsible for the financial market volatility. News, such as financial results of factories, dividend announcements, public information in general regarding the public sector, changes in economic policy, political instability, terrorist attacks, and even catastrophes are supposed to create the conditions for the behavior of financial markets. Since macroeconomic announcements are, on the one hand, scheduled news exogenously released regularly on preannounced dates and, on the other hand, they are typically not clustered in time, their influence on stock returns could be conditioned on the state of market volatility.

We use data on individual Spanish stock returns and our findings suggest that macroeconomic announcements mainly affect stock returns in the low volatility regime.

The rest of the article is organized as follows. Section 2 presents the econometric model, Section 3 shows the data and the main results and Section 4 concludes.

2 The Econometric Model

Following Hamilton (1989), let the return on stock i in period t , r_{it} , follows a mixture of two normal distribution

$$r_{it} \sim N(\mu_{it}^j, \sigma_i^j) \quad \text{with probability } \phi_{it-1}^j \quad \text{for } j = h, l. \quad (1)$$

Where μ_{it}^j, σ_i^j are the conditional mean and variance in regime j , with h (l) being the high (low) volatility regime. ϕ_{it-1}^j is the econometrician's time varying assessment of the likelihood that the stock returns being in regime j conditioned to the information in $t - 1$, specified as in Gray (1996).

The conditional mean in regime j is written as follows

$$\mu_{it}^j = \alpha_i^j + X_t' \beta_i^j + Z_t' \gamma_i^j, \quad \text{for } j = h, l \quad (2)$$

Where X_t is a (3×1) vector that brings together the three common risk factors proposed in Fama and French (1993), $EXMR_t$, SMB_t and HML_t . The (4×1) vector Z_t contains an announcement day indicator dummy variable D_t that takes the value one whenever there is an announcement of the macroeconomic variables considered here and the macroeconomic surprises: the unexpected inflation rate, UIR_t , the unexpected growth rate in the index of industrial production, UIP_t , and the unexpected changes in the unemployment rate, UUR_t .

It may be argued that macroeconomic news may also influence stock returns through the Fama-French factors (FFF), as the excess return on the market portfolio (and also the other factors) may respond to macroeconomic announcements. In order to take into account this indirect effect of macroeconomic news on individual stock returns through the FFF we specify

$$X_t = \Pi Z_t + V_t \quad (3)$$

where Π is a (3×3) matrix of coefficients that measure the effect of macroeconomic news on the FFF and V_t is a zero mean vector of random disturbances, common to all stocks and orthogonal to the unexpected portion of the macroeconomic announcements. In other words, V_t is that part of X_t which is purged of the effect of macroeconomic news.

Substituting (3) in (2) we get

$$\mu_{it}^j = \alpha_i^j + V_t' \beta_i^j + Z_t' \theta_i^j, \quad \text{for } j = h, l \quad (4)$$

where $\theta_i^j = (\Pi' \beta_i^j + \gamma_i^j)$ is a vector of parameters that measure the total effect of macroeconomic news on the return on stock i in regime j . The total effect is the sum of a direct effect measured by γ_i^j and an indirect effect through the FFF measured by $\Pi' \beta_i^j$.

3 Data and Empirical Issues

The data on stock return used in this article correspond to a sample of Spanish stocks traded on the Madrid market from the first trading day of 1998 to the last trading day of 2000. The sample comprises data on 81 stocks and 748 days used in Gardeazabal and Regúlez (2004).¹ The Spanish Institute of Statistics, INE, provides series on CPI , IIP and UR and announcement days.² Since our sample period is too short we do not control for the state of the economy.³

The unexpected component of macroeconomic news is unobservable and this poses a problem for estimation. In order to overcome that problem, we took the simplest route. We fitted ARIMA models to the time series of CPI , IIP and UR . The use of ARIMA-based forecasts simplifies the treatment of expectations and can be justified because they are typically fairly accurate, and are used by many forecasting agencies. Details of these estimations are given in the Appendix.

Notice that we use daily data on excess returns of individual stocks and FFF while series on CPI and IIP are provided at monthly frequency and UR at quarterly frequency. To handle these mixed-frequency irregularly-spaced data we constructed daily time series of UIR_t , UIP_t , and UUR_t that took values equal to the unexpected component on the day of the announcements and zero on the remaining days. There is a natural explanation for combining these frequencies in this manner: in an efficient market, participants continuously adjust their information set as news arrives. In particular they update the expected value of macroeconomic variables. However, only when the data is released, once a month for CPI

¹Thanks are due to Javier Gardeazabal for providing data on individual stock excess returns and Fama-French factors.

²Macroeconomic data are typically subject to revision in the years following their release. However, in Spain, the CPI and unemployment rate are not subject to revision. The data used for the IIP are revised.

³In fact, Spanish economy was in expansion in that period.

and IIP and once every quarter for UR , do participants find out what the unexpected portion of the news is.

Figure 1 shows the estimates of individual coefficients and t-statistics (in absolute value) for macroeconomic announcements. Estimations are controlled for heteroskedasticity. The first column of graphs of Figure 1 corresponds to estimates of coefficients under a high variance regime and the second column to estimates of coefficients under a low variance regime. Each pair of estimated coefficients and t-statistics (in absolute value) is represented by a small square. The horizontal line in each panel of Figure 1 is a 95% confidence interval yardstick. Therefore, if a square falls above the horizontal line it means that the corresponding coefficient is significant. We would expect to see no more than 5% of all coefficients falling above the horizontal line (in a sample of 81 stocks, approximately 4) when all coefficients are jointly zero.

A glance at Figure 1 reveals that macroeconomic announcements affect stock returns across the regimes differently. In fact, the magnitude of macroeconomic announcement effects is much larger in the high volatility regime, which was expected. However, a detailed inspection shows that in the high variance regime there is no evidence of response of stock returns to macroeconomic announcements, except for UIP_t , which is on the edge of significance with four squares falling above the horizontal line. Conversely, in the low variance regime, stock returns unambiguously respond to macroeconomic announcements. For all the variables there are many more than four squares above the horizontal line. According to the empirical results, much stronger evidence is found in the low volatility regime.

This finding has a logical explanation. The arrival and clustering of non-scheduled news with a great impact on investors' information set which increase the market volatility could focus the attention of market participants on that information, dampening the effect of the arrival of scheduled news such as macroeconomic announcements. By contrast, in the low variance regime, the little or no clustering of news means that when macroeconomic data is released, market participants take the announcements into account, leading to portfolio recomposition because of macroeconomic information.

To provide evidence that our finding is not a general result for any explanatory variable included in equation (4), Figure 2 shows the individual coefficient and t-statistics (in absolute value) for the constant and the FFF . Notice that in both high and low variance regimes more squares fall outside the confidence intervals than would be expected if the FFF had no effect

on stock returns. Therefore, unlike macroeconomic announcement effects, the results show that the effects of the *FFF* are significant regardless of the regime.

4 Conclusion

In this article we present evidence on the effects of macroeconomic announcements on individual Spanish stock returns across volatility regimes which are endogenously determined using a Markov Switching model. We concentrate our research on three macroeconomic variables: inflation rate, growth rate in the index of industrial production and unemployment rate. Estimations are controlled for the three Fama-French factors.

Our findings can be summarized as follows. Macroeconomic announcements mainly affect stock returns in the low volatility regime. In the high volatility regime, the effect of clustering of information or other non-scheduled news dampen the effect of the macroeconomic announcements. Conversely, in the low variance regime, macroeconomic data release is more likely to affect stock returns since there is little relevant non-scheduled news. However, the response of individual stock returns to the Fama-French factors is significant regardless of the volatility regime.

References

- [1] Fama, E.F. and F.R. French. 1993. Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics* 33, 3-56.
- [2] Gardeazabal, J. and M. Regúlez. 2004. A Factor Model of Seasonality in Stock Returns. *Quarterly Review of Economics and Finance* 44, 224-236.
- [3] Gray, S. 1996. Modelling the Conditional Distribution of Interest Rate as a Regime-switching Process. *Journal of Financial Economics* 42, 26-62.
- [4] Hamilton, J. 1989. A new Approach of the Economic Analysis of Nonstationary Time Series and the Business Cycle. *Econometrica* 57, 357-384.
- [5] McQueen,G. and V. Roley. 1993. Stock Prices, News, and Business Conditions. *The Review of Financial Studies*, 683-707.

Appendix: Construction of forecasts

We collected monthly data on the Spanish *CPI* from January 1976 to November 1997 and on *IIP* from January 1975 to October 1997, and quarterly data on the unemployment rate from the second quarter of 1987 to the third quarter of 1997. In order to determine the underlying ARIMA structure we first performed Dickey-Fuller (*DF*), Augmented Dickey-Fuller (*ADF*) and Phillips-Perron (*PP*) tests. Accordingly, *CPI* and *UUR* are $I(1)$ and *IIP* is $I(0)$, except for the *ADF* test. According to the Hasza-Fuller test statistics, for *UUR* it is necessary to take regular and seasonal differences to make the series stationary, while for *CPI* and *IIP* it is not. The *IIP* has a seasonal unit root according to the Dickey-Hasza-Fuller test. We also carried out the *KPSS* test of $I(0)$ versus $I(1)$, and rejected the null hypothesis of stationarity for all three series. Hence, we have taken regular differences on *CPI*, seasonal differences on *IIP* and regular and seasonal differences on *UUR*. Following the traditional Box-Jenkins identification-estimation procedure we estimated ARIMA models. Using these models, we computed one-step-ahead forecasts. The data released in January 1998 correspond to the December 1997 value of the *CPI* and the November 1997 value of the *IIP*, and the data released in the first quarter of 1998 correspond to the fourth quarter of 1997 for *UUR*. Using the actual values and the forecasts for the first announcement in our sample we computed the unexpected values of macroeconomic variables. Then we added the data point to our data set, reestimated the model and computed a one-step-ahead forecast once again. This procedure was repeated until the end of the sample was reached. Once we had computed the unexpected components of the macroeconomic figures, we constructed daily unexpected series for each variable. These daily series are zero whenever there is no announcement and equal to our estimate of the unexpected rate whenever there is an announcement.

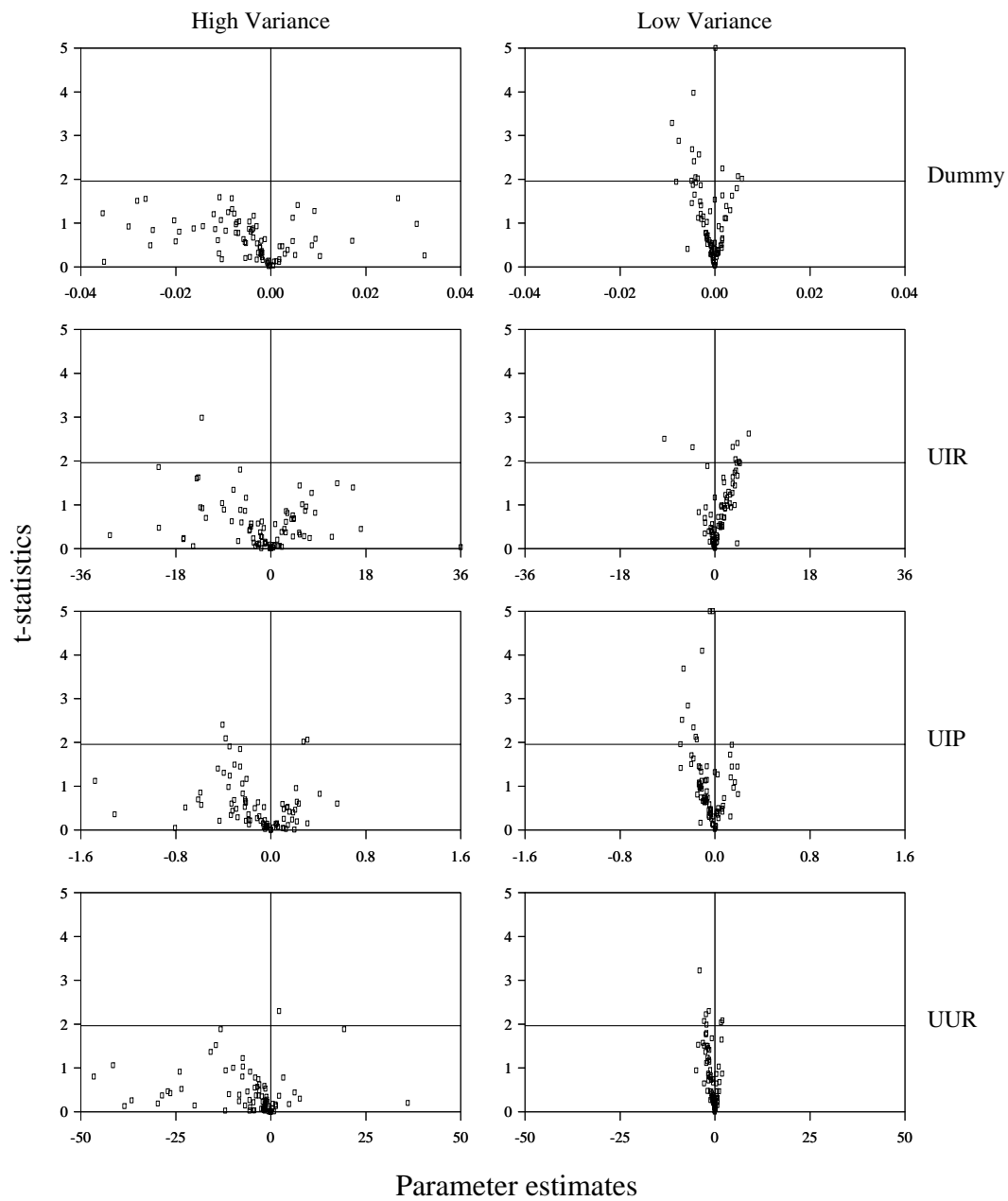


Figure 1: Macroeconomic Announcements

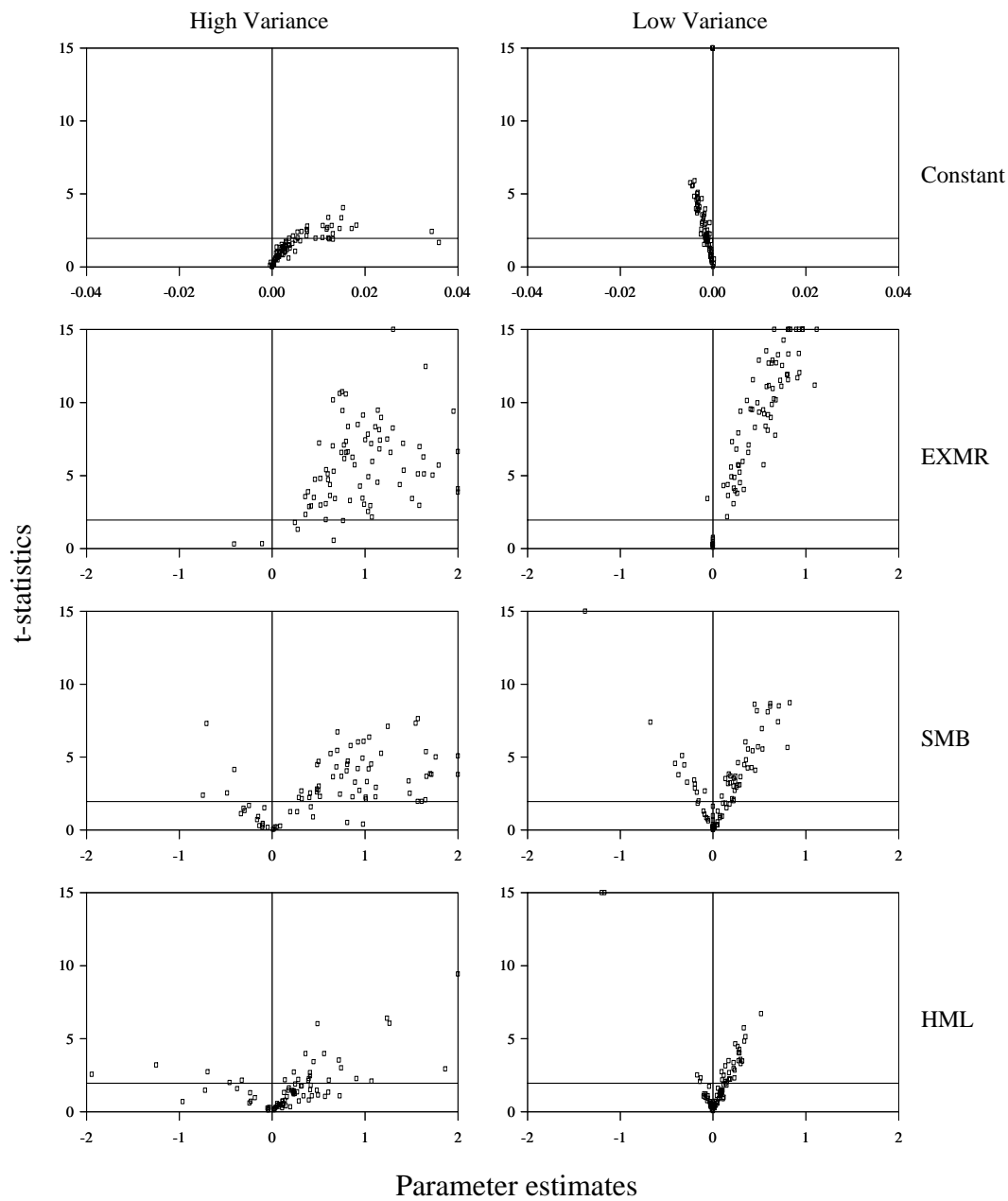


Figure 2: Fama-French Common risk factors