Idiosyncratic Risk and Asset Pricing Anomalies

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ABSTRACT - The aim of this paper is two-fold. Firstly, we follow the theoretical model of Merton (1987) and provide a new perspective of study about the role of idiosyncratic risk in the asset pricing process analyzing whether the idiosyncratic risk premium depends on the idiosyncratic risk level of an asset as well as the variations in the market-wide measure of idiosyncratic risk. Secondly, we evaluate the informative content of this kind of risk in asset pricing analyzing whether it can help explain those anomalies related to the specific characteristics of an asset such as size, value, liquidity and past returns. Our findings contribute to provide an answer for the main unsolved questions about the idiosyncratic risk puzzle: whether there exists a premium associated to this kind of risk, the sign of this risk premium and its informative content.

KEY-WORDS - Idiosyncratic risk, asset pricing, anomalies, individual securities, Spanish market

JEL CLASSIFICATION - G10, G12

1. INTRODUCTION

The seminal papers that established the fundamentals of modern finance (Markowitz, 1952; Sharpe, 1964; Lintner, 1965) also introduced the notion of decomposing total risk into systematic or un-diversifiable risk and idiosyncratic or diversifiable risk. These initial studies argue that, in a frictionless market and within the framework of the CAPM, idiosyncratic risk should be irrelevant in price formation.

However, in recent years idiosyncratic risk has been the subject of a great deal of research. Firstly, Campbell et al. (2001) documented the increase and time trend of idiosyncratic risk in the US market. Secondly, Goyal and Santa-Clara (2003) presented evidence of the relationship between average idiosyncratic volatility and future market returns. More recently, Ang et al. (2006) analyzed the relation between idiosyncratic risk and cross-sectional stock returns.

Following Ang et al. (2006), numerous papers have documented the relationship of idiosyncratic risk with some well-known asset pricing anomalies such as size, value, liquidity and momentum effects. However, none of this previous research has directly analyzed whether those anomalies persist after introducing this kind of risk into the asset pricing process.

The aim of this study is to analyze the role over the last two decades of idiosyncratic risk in the Spanish stock market, a medium-sized market that plays a relevant role in the shaping of...
the stock market map in Europe.1 Previous to our work, Miralles-Marcelo et al. (2012) propose two alternative ways to introduce idiosyncratic risk into the asset pricing process for the Spanish case based on an individual and an aggregated setting: as a non-desirable firm-specific characteristic and as a source of another kind of systematic risk un-captured by the beta coefficient. Their results provide different signs for the idiosyncratic risk premium depending on the alternative model employed to introduce it in asset pricing.

In this context, our study contributes to the existing body of financial literature in two ways. The first one is related to the theoretical and methodological proposal for analyzing the role of idiosyncratic risk in asset pricing. Based on the theoretical model of Merton (1987), we provide a unified model that includes a unique risk premium which depends on the idiosyncratic risk level of an asset as well as the variations in the market-wide measure of idiosyncratic risk. As expected, we obtain a net positive premium related to idiosyncratic risk. Our results show a positive relation between returns and individual idiosyncratic risk levels and a negative but lower relation with the aggregate measure of idiosyncratic risk. These results are robust when controlling for various firm characteristics (size, value, liquidity and past returns) and market conditions (high and low volatility periods).

Secondly, we directly evaluate the informative content of idiosyncratic risk in asset pricing and whether it can help explain those anomalies related to the specific characteristics of an asset. To that end, we employ the empirical methodology proposed by Brennan et al. (1998) which presents several advantages over the classical Fama and MacBeth (1973) cross-sectional regression. Firstly, in contrast to the Fama and MacBeth cross-sectional regression, the Brennan et al. (1998) approach does not suffer from the errors-in-variables problem because the estimated factor loadings or market betas are not used as independent variables. Secondly, the Brennan et al. (1998) methodology is implemented using single securities, thus avoiding the data-snooping biases which are inherent in portfolio-based approaches, as noted by Lo and MacKinlay (1990). Finally, we observe that when we introduce idiosyncratic risk in the asset pricing process the liquidity and momentum effects attenuate while the size and book-to-market anomalies persists. Our results have important implications for portfolio and risk management and contribute to provide a unified and coherent answer for the main and still unsolved questions about the idiosyncratic risk puzzle: whether or not there exists a premium associated to this kind of risk, the sign for this risk premium and its informative content.

The remainder of the article is organized as follows. Section 2 presents an in-depth statement regarding the role of idiosyncratic risk in the asset pricing process and its relationship with some well-known asset pricing anomalies. Furthermore, Section 2 describes the theory and econometric methodology employed for analyzing the role of idiosyncratic risk in asset pricing. Section 3 describes the data base employed. Section 4 contains the empirical analysis for the Spanish stock market. Finally, Section 5 has concluding remarks.

2. ASSET PRICING MODELS AND ASSET PRICING ANOMALIES

2.1. Idiosyncratic Risk and Asset Pricing

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1 It is important to report empirical results from other data sets in order to check the robustness of the available results and to support the conviction that it is not due to a data-snooping problem (Lo and MacKinlay, 1990).
Modern portfolio theory predicts that idiosyncratic risk is eliminated in equilibrium through diversification and therefore does not affect the cross-section of expected returns. However, since the seminal work of Fama and MacBeth (1973), there exists evidence about the role of idiosyncratic risk in the CAPM context as a non-desirable firm-specific characteristic. In fact, this has been the most extended procedure employed to analyze the cross-section of idiosyncratic risk and expected returns. Although the existing empirical results documented for the US market include a null relation (Fama and MacBeth, 1973; Bali and Cakici, 2008), a negative relation (Ang et al., 2006), and a positive relation (Malkiel and Xu, 2006; Brockman and Yan, 2006; Fu, 2009). Controversy also exists in an international context. While Ang et al. (2009) confirm their US findings for 23 developed markets around the world, Brockman et al. (2006) and Pukthuanthong-Le and Visaltanachoti (2009) find that idiosyncratic risk is priced on a significantly positive risk premium for stock returns across 44 countries and 36 countries respectively.

Besides this confusing evidence, another disadvantage of this model specification is that it does not take into account more recent evidence about aggregated idiosyncratic risk. Firstly, Campbell et al. (2001) documented that aggregated idiosyncratic risk followed an upward trend. Secondly, Goyal and Santa-Clara (2003) found that aggregate measures of idiosyncratic volatility could predict one-month-ahead excess market returns. Both are important reasons to consider idiosyncratic risk as a source of systematic risk.

In consequence, some researchers focus on the role of aggregate idiosyncratic risk in the asset pricing process. More precisely, they adopt the risk factor construction methodology proposed by Fama and French (1993) to include idiosyncratic risk in the asset pricing process in an aggregate setting. In fact, this is the most extended procedure recently employed to include idiosyncratic risk into the asset pricing process as followed by Drew et al. (2004) for the Shanghai stock market; Koch (2009) for the German market; Guo and Savickas (2010) for the US market; Cotter et al. (2014) for the UK market; and Huang et al. (2013) for several emerging markets. In particular, they compute a systematic risk factor as the difference between returns on stocks with low idiosyncratic volatility and returns on stocks with high idiosyncratic volatility and document that it is a significantly priced factor in the cross-section of stock returns in different markets.

For the Spanish stock market, Miralles-Marcelo et al. (2012) propose two alternative ways to introduce idiosyncratic risk into the asset pricing process based on an individual and an aggregated setting. Firstly, they introduce idiosyncratic risk in the CAPM context as a non-desirable firm-specific characteristic, following the seminal work of Fama and MacBeth (1973). In a second group of analysis they propose idiosyncratic risk as a source of another kind of systematic risk un-captured by the beta coefficient. Within this framework they propose three alternative extensions of the traditional CAPM: a factor model, adopting the risk factor construction methodology proposed by Fama and French (1993); an Intertemporal CAPM; and a Conditional CAPM. Their results confirm that the sign of this risk premium depends on the alternative model employed to introduce it in asset pricing.

Taking into account the results of Miralles-Marcelo et al. (2012), we employ the theoretical model of Merton (1987) and provide a unified specification that includes a unique risk premium which depends on the idiosyncratic risk level of an asset as well as the variations in the
market-wide measure of idiosyncratic risk.

More precisely, Merton (1987) develops a theoretical capital market equilibrium model in an information-segmented market, where the measure of the disinformation cost, commonly referred to as shadow cost, depends on three different variables: the shareholder base, the relative market size and the idiosyncratic risk level of an asset. The resulting equation of Merton’s (1987) model is:

\[
E(R_j) - R_f = \beta_j \left[ E(R_m) - R_f \right] + \lambda_j - \beta_j \lambda_m
\]  

where, \( E(R_j) \) is the expected return on security \( j \), \( R_f \) is the risk-free interest rate, and \( \beta_j \) is the systematic risk premium. In addition to this premium, there is a disinformation risk premium that not only depends on the relationship between the cost of incomplete information of the firms, \( \lambda_j \), but also on the whole disinformation cost in the market, \( \beta_j \lambda_m \). This is because not all investors have information about all assets, although they do have homogeneous expectations. Consequently, Merton (1987) presumes the existence of a lack of information about the market as a whole. Moreover, this additional risk premium should be positive or negative, depending on the magnitude of \( \lambda_j \) and \( \beta_j \lambda_m \) respectively.

We have to point out that, although we follow this theoretical framework to analyze the role of idiosyncratic risk in asset pricing, our empirical work doesn’t represent a direct analysis of Merton’s (1987) model. For that reason, we follow one strand of the literature which tests Merton’s (1987) model controlling for size and shareholders base, and then analyze the relationship with idiosyncratic risk.

2.2. Idiosyncratic risk and asset pricing anomalies

In addition to previous research, several articles try to find an economic explanation for the role of idiosyncratic risk in asset pricing. With this aim, most of them demonstrate that this kind of risk is highly related to asset specific characteristics such as size, value, liquidity and past returns.

It is highly documented that small stocks have substantially higher idiosyncratic risk than do large stocks (Pastor and Veronesi, 2003; Malkiel and Xu, 2006; Bali and Cakici, 2008).

Furthermore, Spiegel and Wang (2005) document that stock idiosyncratic risk and liquidity are negatively correlated while George and Hwang (2010) obtain similar results employing variables based on trading volume instead of liquidity. Their results confirm that stock returns increase with the level of idiosyncratic risk and decrease in stock liquidity or trading volume and that the impact of idiosyncratic risk is much stronger and often eliminates the liquidity and volume explanatory power.

On the other hand, Guo and Savickas (2010) propose an explanation for the cross-
sectional idiosyncratic factor effect that relates to that proposed by Campbell and Vuolteenaho (2004) for the book-to-market effect. They argue that stocks with high book-to-market (value stocks) have higher expected returns than stocks with low book-to-market (growth stocks) because the latter are more sensitive to discount-rate shocks.

Moreover, Huang et al. (2010) and Arena et al. (2010) relate idiosyncratic risk to the return reversal anomaly. They argue that stocks with higher idiosyncratic risk and hence greater firm-specific information may experience larger short-horizon return reversals to the extent that stock prices may overreact to firm-specific information.

In this context, the second aim of this paper is to shed light on the idiosyncratic risk puzzle by evaluating the informative content of this kind of risk in asset pricing and analyzing whether it can help explain those anomalies related to the specific characteristics of assets such as size, value, liquidity and past returns.

To that end, we employ the econometric methodology proposed by Brennan et al. (1998) and followed by Chordia et al. (2001), Lewellen et al. (2006) and Chou et al. (2010), among others. In this sense, we suggest that the expected return of an asset can be explained by model (2):

$$E(R_j) - R_f = \beta_j [E(R_m) - R_f] + \lambda_j - \beta_j \lambda_m + \sum_{n=1}^{N} c_{nj} Z_{nj}$$

(2)

where, in addition to Merton’s (1987) theoretical model, we include a set of non-risk characteristics in which $Z_{njt}$ \( (n = 1, ..., N) \) is the value of non-risk characteristic \( n \) for security \( j \) in month \( t \), and \( c_{nt} \) is the premium per unit of characteristic \( n \) in month \( t \).

The null hypothesis behind model (2) is that the expected returns of stocks depend only on Merton’s (1987) specification and the security characteristics considered have no incremental explanatory power over this model.

Following Brennan et al. (1998), firstly, we estimate the idiosyncratic risk measure and factor loadings for all securities. Then, we calculate the risk-adjusted return on each of the securities, $R_{jt}^*$, for each month of the following year as in equation (3) for all $j$:

$$R_{jt}^* = R_{jt} - R_f - \beta_j [E(R_m) - R_f] - \lambda_j + \beta_j \lambda_m$$

(3)

The risk-adjusted returns from (3) are then used to test whether non-risk characteristics can describe the cross-sectional variation in expected returns. The estimation equation now becomes (4) for all $j$:

$$\bar{R}_{jt}^* = c_0 + \sum_{n=1}^{N} c_{njt} Z_{njt} + \bar{e}_{jt}$$

(4)

Under the null hypothesis that expected returns depend only on the systematic and idiosyncratic risk premiums, the coefficients $c_{njt}$'s \( (n = 0, 1, ..., N) \) of security characteristics will be
equal to zero.

Brennan et al. (1998) show that the standard Fama and MacBeth (1973) two-step approach suffers from the errors-in-variables problem because the estimations of factor loadings are measured with errors. However, with this alternative methodology the measurement error is now transferred to the dependent variable. Thus the estimates of $c_{nt}$'s ($n = 0,1,...,N$) from the least squared regression are unbiased.

3. DATA BASE

We collect firm-level data for all stocks listed on the Spanish stock market over the period 1990-2010 from Thomson DataStream. The basic data consist of monthly returns, idiosyncratic risk and other specific characteristics for a sample of 203 companies that are calculated as follow.

3.1. Idiosyncratic risk

Although models such as Merton (1987) have a precise definition of idiosyncratic risk, they do not offer a way to estimate it. This study follows Campbell et al. (2001) to decompose the return of a typical stock into a systematic and an idiosyncratic component without having to estimate co-variances or betas for individual stocks.

Based on the market-adjusted return model, the excess return of a stock $j$ is decomposed into a market-wide excess return and a firm specific residual:

$$ r_{jt} = r_{mt} + \eta_{jt} $$

(5)

where $\eta_{jt}$ is the difference between the individual stock excess return $r_{jt}$ and the market excess return $r_{mt}$.

To obtain a measure of average firm-level volatility first we add the daily squares of the firm-specific residual in equation (5) for each firm $j$ and each month $t$ in the sample:

$$ \sigma_{\etajt}^2 = \sum_{s \in t} \eta_{js}^2 $$

(6)

where $s$ denotes the trading days in a particular month.

Next, we compute the weighted average of the firm-specific volatilities over the market to estimate the aggregated measure of firm-specific risk:

$$ \sigma_{\etajt}^2 = \sum_j \sigma_{\etajt}^2 $$

(7)

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3 Although the observation period began in 1990, we present results from 1995 to 2010 because we require enough lag time to allow loadings to be estimated reliably.

4 The total number of stocks increased from 99 in July 1990 to 203 in July 2010.
3.2. Non-risk specific characteristics

As we mentioned above, there are four main non-risk specific characteristics of a security that are related in previous empirical research to changes in idiosyncratic risk. With the aim of finding evidence for the Spanish stock market, we calculate for each stock and each month the following variables:

SIZE: The natural logarithm of the market value of the equity of the firm.
BM: The natural logarithm of the book value of the equity to the market value of the equity, using the end of the previous year market and book values.
TURN: The natural logarithm of the turnover of the firm, measured as trading volume divided by the total number of shares outstanding.
MOM: The natural logarithm of the cumulative return over the three previous months.5

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTIVE STATISTICS</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Return (%)</td>
</tr>
<tr>
<td>Idiosyncratic Risk</td>
</tr>
<tr>
<td>Firm Size (in millions of euros)</td>
</tr>
<tr>
<td>Book-to-market ratio</td>
</tr>
<tr>
<td>Turnover trading volume</td>
</tr>
<tr>
<td>Three months cumulative return</td>
</tr>
</tbody>
</table>

This table presents the summary statistics of the time-series averages of cross-sectional means over 180 months from August 1995 through July 2010 for the following variables: firm return in excess from the risk free rate, expressed in percentages; idiosyncratic risk levels calculated as in Campbell et al. (2001); firm size, expressed in millions of euros; the book-to-market ration; turnover; and the cumulative return over the three previous months, expressed in percentages.

Table 1 reports the time-series averages of the cross-sectional means, medians and standard deviations of the raw or unlogged characteristics of the securities quoted on the Spanish stock market over the sample period. These are: firm return in excess from the risk free rate, expressed in percentages; idiosyncratic risk levels calculated as in Campbell et al. (2001); firm size, expressed in millions of euros; the book-to-market ratio; turnover; and the cumulative return over the three previous months.

Moreover, Table 2 reports the averages of the month-by-month cross-sectional correlations of the transformed variables that we use in our analysis. As we can observe, idiosyncratic risk is highly and negatively correlated to excess returns, size and cumulative returns, but in contrast to previous evidence, it is not correlated to the book-to-market ratio. On the other hand,

5 Although we could include more momentum variables, they are excluded because of their high correlation between each other.
Table 2 shows that size and turnover are the asset specific characteristics which are most closely correlated.

### TABLE 2
CORRELATION COEFFICIENTS

<table>
<thead>
<tr>
<th></th>
<th>Return</th>
<th>IR</th>
<th>Size</th>
<th>Btm</th>
<th>Turn</th>
<th>Mom2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR</td>
<td>-0.42</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>0.11</td>
<td>-0.38</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Btm</td>
<td>-0.05</td>
<td>0.00</td>
<td>-0.42</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn</td>
<td>-0.05</td>
<td>-0.13</td>
<td>0.64</td>
<td>-0.27</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Mom</td>
<td>0.59</td>
<td>-0.45</td>
<td>0.10</td>
<td>-0.03</td>
<td>-0.06</td>
<td>1.00</td>
</tr>
</tbody>
</table>

This table presents the correlation coefficients of the transformed variables: excess return, idiosyncratic risk, and the natural logarithm of size, book-to-market, turnover and cumulative returns. Results from August 1995 through July 2010.

4. EMPIRICAL ANALYSIS

This section is divided into two main areas. Firstly, we present the cross-sectional analysis for the standard CAPM and Merton’s (1987) model which incorporates idiosyncratic risk as a non-desirable characteristic as well as an aggregated risk factor. Secondly, we analyze the informative content of Merton’s (1987) model in some well-known asset pricing anomalies following the methodology of Brennan et al. (1998).

4.1. Results from Merton’s (1987) model

As we expound in the theoretical section, we propose a unified alternative model to analyze the role of idiosyncratic risk in asset pricing. More precisely, we analyze the role of idiosyncratic risk as a firm-specific characteristic as well as the market-wide idiosyncratic risk variations in the asset pricing process.

The model that we propose is as follows:

$$ r_j = \gamma_0 + \gamma_1 \beta_{jm} + \gamma_2 \sigma_{\epsilon_j} + \gamma_3 \beta_{jm} \sigma_{\epsilon_j} + \epsilon_j $$

(8)

where $r_j$ is the excess return of security $j$ at month $t$, $\beta_{jm}$ is the market beta coefficient for each security $j$, $\sigma_{\epsilon_j}$ is the average idiosyncratic risk of security $j$ at month $t$, and $\beta_{jm} \sigma_{\epsilon_j}$ denotes a security’s sensitivity to variations in market-wide idiosyncratic volatility. In a CAPM context, we expect $\gamma_2$ and $\gamma_3$ to be non-significant coefficients. In contracts, within the context of Merton’s (1987) model, we expect a positive and significant $\gamma_2$ coefficient and a negative and signif-
icant $\gamma_{2m}$ coefficient.

We estimate the monthly factor loadings for all securities which had at least 24 return observations over the previous 60 months. Given these explanatory variables, we perform the Fama and MacBeth (1973) regression. Moreover, the R2 statistic and the adjusted R2 of the cross-sectional regression are calculated as an intuitive measure which expresses the fraction of the cross-sectional variation of average excess returns captured by the model. We report results in Table 3 using the standard CAPM as a benchmark model.

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>COMPETING ASSET PRICING MODELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma_0$</td>
<td>$\gamma_1$</td>
</tr>
<tr>
<td>Standard CAPM</td>
<td>0.008***</td>
</tr>
<tr>
<td>Merton (1987) model</td>
<td>0.004</td>
</tr>
</tbody>
</table>

This table contains the time series averages of the monthly coefficients in cross-sectional asset pricing tests using Fama-MacBeth methodology over 180 months from August 1995 through July 2010. In the first row we present the results from the standard CAPM, employed as a benchmark model. In the second row we present the results from a model that incorporates individual idiosyncratic risk level effect and the market-wide idiosyncratic risk effect, following Merton (1987). The resulting model is:

$$r_{jt} = \gamma_0 + \gamma_1 \beta_{jt}^m + \gamma_{2j} \sigma_{jt} + \gamma_{2m} \beta_{jt}^\sigma + u_{jt}$$

(9)

Where the explanatory variables are the betas, estimated with the 60 previous monthly returns for each cross-sectional test, and the idiosyncratic risk levels lagged one period. The gamma coefficients represent the risk premiums associated with the systematic risk, $\gamma_1$, and the idiosyncratic risk, $\gamma_2$. We report the Fama-MacBeth t-statistics in parenthesis.

Note: ***, ** and * denote 1%, 5% and 10% significance level respectively.

As expected, our results show a positive relation between returns and individual idiosyncratic risk levels. This means that investors require an extra-premium to hold assets with high idiosyncratic risk levels in their portfolios. This might also indicate that investors require a positive risk premium because they are unable to avoid idiosyncratic risk through diversification or it requires a high cost. Moreover, we observe a negative relation between returns and the aggregate measure of idiosyncratic risk. However, the magnitude of this additional term is lower than the previous one. In consequence, we obtain a net positive premium associated to idio-

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6 This approach is implemented using individual securities following the latest evidence related to the idiosyncratic risk puzzle (Vozlyublennaia, 2011). However, it also avoids the portfolio formation process problems that are commonly encountered in the Fama-MacBeth cross-sectional regression: the under-rejection bias argued by Roll (1977) and the data-snooping bias suggested by Lo and MacKinlay (1990).
synchronous risk.

In relation to the systematic risk premium, and in contrast to standard financial theory, we obtain a significant negative risk premium for all models considered. Although we did not expect it, these results do not differ from those previously obtained by Rubio (1988, 1991), Gallego, Gómez and Marhuenda (1992) and Nieto (2004) for the Spanish stock market which document a non-significant market premium and even a risk premium with a negative sign. Overall, when we focus on R2 and adjusted-R2 statistics, Merton’s (1987) specification model performs better than the standard CAPM.

Before drawing some overall conclusions regarding the asset pricing role of systematic and idiosyncratic risks, it is instructive to conduct a robustness check which we do using some control variables and sub-periods of analysis.

**TABLE 4**

**MERTON’S (1987) MODEL WITH CONTROL VARIABLES**

<table>
<thead>
<tr>
<th>$\gamma_0$</th>
<th>$\gamma_1$</th>
<th>$\gamma_{2j}$</th>
<th>$\gamma_{2m}$</th>
<th>Size</th>
<th>Btm</th>
<th>Turn</th>
<th>Mom</th>
<th>Adj. R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.007</td>
<td>-0.010***</td>
<td>1.229***</td>
<td>-0.001**</td>
<td>0.002**</td>
<td></td>
<td></td>
<td></td>
<td>24.39</td>
</tr>
<tr>
<td>(-1.56)</td>
<td>(-3.95)</td>
<td>(7.05)</td>
<td>(-1.97)</td>
<td>(2.55)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.010**</td>
<td>-0.010***</td>
<td>1.312***</td>
<td>0.000</td>
<td>0.002***</td>
<td>0.006***</td>
<td></td>
<td></td>
<td>24.42</td>
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<td>(-2.23)</td>
<td>(-3.89)</td>
<td>(7.34)</td>
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<td>(3.98)</td>
<td>(5.14)</td>
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<tr>
<td>-0.013***</td>
<td>-0.013***</td>
<td>1.608***</td>
<td>0.000</td>
<td>0.003***</td>
<td>0.005***</td>
<td>0.001</td>
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<td>23.70</td>
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<td>(-3.08)</td>
<td>(-5.78)</td>
<td>(8.58)</td>
<td>(-0.44)</td>
<td>(3.69)</td>
<td>(4.76)</td>
<td>(0.94)</td>
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<td>-0.013***</td>
<td>-0.012***</td>
<td>1.704***</td>
<td>0.000</td>
<td>0.002***</td>
<td>0.006***</td>
<td>0.001</td>
<td>0.024***</td>
<td>26.07</td>
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<tr>
<td>(-2.98)</td>
<td>(-5.57)</td>
<td>(9.16)</td>
<td>(0.11)</td>
<td>(3.07)</td>
<td>(5.56)</td>
<td>(0.95)</td>
<td>(4.10)</td>
<td></td>
</tr>
</tbody>
</table>

This table contains the time series averages of the monthly coefficients in cross-sectional asset pricing tests using Fama-MacBeth methodology over 180 months from August 1995 through July 2010. We present the results from the unified model which incorporates individual idiosyncratic risk levels effect and the market-wide idiosyncratic risk effect, following Merton (1987) controlling for some specific non-risk characteristics of a firm: size, book-to-market, turnover and momentum. The resulting model is:

$$r_{jt} = \gamma_0 + \gamma_1 \beta_{jt}^m + \gamma_{2j} \sigma_{\eta_{jt}} + \gamma_{2m} \sigma_{\eta_{jt}} + \beta_j \sum_{m=1}^{M} c_m Z_{mj} + u_{jt}$$

(10)

where the explanatory variables are the betas, estimated with the 60 previous monthly returns for each cross-sectional test, and the specific characteristics lagged one period. We present estimated coefficients and Fama-MacBeth t-statistics in parenthesis.

Note: ***, ** and * denote 1%, 5% and 10% significance level respectively.
In Table 4 we present the results from Merton’s (1987) model controlling for the well-known asset pricing anomalies associated with the specific characteristics of a firm: size, book-to-market, turnover and momentum. As we observe, the premium associated to individual idiosyncratic risk levels persists after controlling for all these variables, although the significance of the premium associated to the aggregated idiosyncratic risk attenuates in almost all cases. Finally, this robustness check confirms our previous results from Table 3 which indicate that there exists a net positive idiosyncratic risk premium in the Spanish stock market over the sample period.

| TABLE 5 | MERTON’S (1987) MODEL BY SUB- Periods |
|………………|………………………………………|………………………………………|………………|………………………………………|………………………………………|………………|………………………………………|………………|………………………………………|………………|
| $\gamma_0$ | $\gamma_1$ | $\gamma_{2j}$ | $\gamma_{2m}$ | Size | Btm | Turn | Mom | Adj R2 |
|………………|………………|………………|………………|………………|………………|………………|………………|………………|………………|
| Panel A: High Volatility periods |
| 0.002 | -0.014* | 0.739** | 0.001 | 29.37 |
| (0.21) | (-1.68) | (2.02) | (0.78) | |
| -0.002 | - | 1.357*** | 0.002 | 0.006** | -0.002 | 0.026 | 34.63 |
| (-0.13) | (-2.58) | (2.69) | (1.61) | (2.28) | (-0.98) | (1.66) | |
| Panel B: Medium Volatility periods |
| 0.005** | -0.010*** | 1.181*** | 0.001*** | 22.02 |
| (2.03) | (-3.13) | (4.90) | (-2.66) | |
| - | - | 1.719*** | 0.000 | 0.002*** | 0.007*** | 0.001*** | 0.021*** | 25.67 |
| (-2.76) | (-4.21) | (7.21) | (-0.32) | (2.78) | (5.22) | (1.96) | (3.01) | |
| Panel C: Low Volatility periods |
| 0.001 | 0.009*** | 1.283*** | -0.001 | 17.34 |
| (0.38) | (-2.70) | (4.67) | (-1.62) | |
| - | - | 2.008*** | -0.001 | 0.002** | 0.002 | 0.001* | 0.031** | 18.70 |
| (-2.62) | (-2.73) | (6.23) | (-0.72) | (2.33) | (1.01) | (1.81) | (2.32) | |

This table contains the time series averages of the monthly coefficients in cross-sectional asset pricing tests using Fama-MacBeth methodology over 180 months from August 1995 through July 2010. We present the results from the unified model which incorporates individual idiosyncratic risk level effect and the market-wide idiosyncratic risk effect, following Merton (1987) controlling for some specific non-risk characteristics of a firm: size, book-to-market, turnover and momentum. These results are presented by sub-periods of high, medium and low market volatility as in Ang et al. (2006). The resulting model is:
\[ r_{jt} = \gamma_0 + \gamma_1 \beta_{jt} + \gamma_2 \sigma_{\eta_{jt}} + \gamma_3 \beta_{jt}^\sigma + \sum_{n=1}^{N} c_n Z_{n_{jt}} + u_{jt} \]  

(11)

where the explanatory variables are the betas, estimated with the 60 previous monthly returns for each cross-sectional test, and the specific characteristics lagged one period. We present estimated coefficients and Fama-MacBeth t-statistics in parenthesis.

Note: ***, ** and * denote 1%, 5% and 10% significance level respectively.

These results persist when we divide our sample period into high, medium and low volatile periods following Ang et al. (2006). Results are reported in Table 5. Ang et al. (2006) suggest that the idiosyncratic volatility effect would be concentrated during the most volatile periods in the market. This hypothesis is supported by the results of Frieder and Jiang (2007) for the US market which confirm that “upside” volatility mainly drives the idiosyncratic volatility and return relation. To test for this possibility in the Spanish stock market, we analyze our model dividing the sample into periods: the stable one with the lowest 20% of absolute moves of the market return; the volatile one with the highest 20%; and the third one with the remaining 60%.

As we observe in Table 5, during stable and volatile periods there exists a positive risk premium associated to the individual idiosyncratic risk level while the risk premium associated to the aggregated measure attenuates. However, when we introduce control variables in the analysis by sub-periods the significance of those control variables attenuates. More precisely, in volatile periods (Panel A) only the book-to-market variable is significant, while in stable periods (Panel C) only the significance of size and momentum variables persists. This indicates that, while the idiosyncratic risk premium is not affected by the sub-sample periods, the significance of control variables are conditioned by the period of analysis.

4.2. Brennan et al. (1998) methodology

Finally, we employ the Brennan et al. (1998) approach in order to analyze the informative content of idiosyncratic risk in the asset pricing process. More precisely, we regress asset returns, adjusted from the systematic and idiosyncratic risks, over the non-risk specific characteristics to evaluate whether the significance of these control variables persists or attenuates, as described in Section 2.
TABLE 6
BRENNAN ET AL. (1998) METHODOLOGY

<table>
<thead>
<tr>
<th></th>
<th>$c_0$</th>
<th>Size</th>
<th>Btm</th>
<th>Turn</th>
<th>Mom</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sample</td>
<td>-0.038***</td>
<td>0.006***</td>
<td>0.011***</td>
<td>-0.001*</td>
<td>0.012***</td>
</tr>
<tr>
<td></td>
<td>(-6.30)</td>
<td>(5.84)</td>
<td>(6.72)</td>
<td>(-1.79)</td>
<td>(2.50)</td>
</tr>
<tr>
<td>High Volatile periods</td>
<td>-0.017</td>
<td>0.005*</td>
<td>0.013***</td>
<td>-0.003**</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(-1.10)</td>
<td>(1.85)</td>
<td>(4.89)</td>
<td>(-2.35)</td>
<td>(0.29)</td>
</tr>
<tr>
<td>Medium Volatility periods</td>
<td>-0.044***</td>
<td>0.007***</td>
<td>0.011***</td>
<td>-0.001</td>
<td>0.020*</td>
</tr>
<tr>
<td></td>
<td>(-6.01)</td>
<td>(5.05)</td>
<td>(5.12)</td>
<td>(-1.63)</td>
<td>(1.83)</td>
</tr>
<tr>
<td>Low Volatility periods</td>
<td>-0.040***</td>
<td>0.004***</td>
<td>0.009**</td>
<td>0.001</td>
<td>0.029*</td>
</tr>
<tr>
<td></td>
<td>(-3.04)</td>
<td>(2.60)</td>
<td>(2.01)</td>
<td>(1.45)</td>
<td>(1.94)</td>
</tr>
</tbody>
</table>

This table contains the time series averages of the monthly coefficients in cross-sectional asset pricing tests using the Brennan et al. (1998) approach over 180 months from August 1995 through July 2010. The resulting model is:

$$
\bar{R}_{jt}^* = c_0 + \sum_{n=1}^{N} c_n Z_{njt} + \bar{\varepsilon}_{jt}
$$

where $\bar{R}_{jt}^*$ is the excess return of security $j$ adjusted by systematic and idiosyncratic risks following Merton (1987) and $Z_n$ are some well-known firm specific characteristics associated to the idiosyncratic risk: size, book-to-market, turnover and momentum. We present $t$-statistics in parenthesis.

Note: ***, ** and * denote 1%, 5% and 10% significance level respectively.

Results are reported in Table 6 for all samples and are also divided into periods of high, medium and low market volatility. As we observe, we find that non-risk firm characteristics retain significant explanatory power after adjusting returns to the measures of risk considered. In particular, we find that the size and book-to-market effects persist while the turnover and momentum effects attenuate. These findings indicate that idiosyncratic risk can help explain turnover and momentum anomalies.

5. CONCLUSIONS

The idiosyncratic risk puzzle has been largely documented for the US market and nowadays empirical evidence has been extended to an international setting. In this context, the aim of this paper is to two-fold. First, we propose a unified methodology of study for evaluating the informative content of idiosyncratic risk in asset pricing based on the theoretical capital market equilibrium model of Merton (1987). We propose a model in which the idiosyncratic risk premium depends on the idiosyncratic risk level of an asset as well as the variations in the market-wide measure of idiosyncratic risk that could be positive or negative, depending on the magnitude of the estimated coefficients.
Secondly, we directly analyze whether, when we introduce the firm-specific risk in the asset pricing process, it helps to explain those anomalies related to the specific characteristics of assets such as size, value, liquidity and past returns. To that end, we employ the empirical methodology proposed by Brennan et al. (1998) which presents several advantages over the classical Fama and MacBeth (1973) cross-sectional regression.

Both estimates have been implemented for the Spanish stock market over the last two decades using single securities. This avoids the data-snooping biases that are inherent in portfolio-based approaches and checks the robustness of the available results obtained from other data sets.

Overall, our results show the existence of a net positive idiosyncratic risk premium for the whole sample as well as over volatile and stable periods and controlling for some specific non-risk characteristics. However, when we analyze the informative content of this kind of risk we observe that it cannot help explain size and book-to-market anomalies but it can help attenuate the turnover and momentum asset pricing anomalies.

These findings have important implications for portfolio and risk management and highlight the need for additional research into the underlying causes and consequences of these empirical results.

REFERENCES