Can we beat the market with beta? An intuitive test of the CAPM *

¿Podemos batir al Mercado con beta? Un contraste intuitivo del CAPM

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ABSTRACT Based on a strict and intuitive methodology, the article proposes an empirical test of the CAPM for the main Spanish market stocks. The idea is to replicate the behaviour of an investor purchasing undervalued shares according to the CAPM in order to beat the market during the following period. Where the investor does not meet his objective, the results are consistent with market efficiency and with the CAPM, as the stocks would quickly adapt to their rational value, according to the model. Otherwise, a strategy to beat the market would have been found, obtaining returns above those expected for a given level of systematic risk. Our results are consistent with market efficiency and with the CAPM. This conclusion is reached in different ways, indicating the robustness of the procedure.

KEYWORDS CAPM; Market efficiency; Performance measures.

RESUMEN El artículo plantea, con base en una metodología intuitiva y rigurosa, una contrastación empírica sobre el CAPM para las principales acciones del mercado español. La idea es replicar la actuación de un inversor que compra acciones infravaloradas según el CAPM, con el objetivo de batir al mercado el periodo siguiente. Si el inversor no logra su objetivo, los resultados serían coherentes con la eficiencia del mercado y con el CAPM, pues las acciones se ajustarían rápidamente a su valor racional según el modelo. En caso contrario habríamos encontrado una estrategia para batir al mercado, obteniendo rentabilidades superiores a las esperadas para un riesgo sistemático dado. Nuestros resultados son coherentes con la eficiencia del mercado y el CAPM. Y a esta conclusión se llega por diferentes caminos, lo que habla de la robustez del procedimiento.

PALABRAS CLAVE CAPM; Eficiencia de mercado; Medidas de rendimiento.

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1. INTRODUCTION

This paper aims to test whether an investor can beat the market using the Capital Asset Pricing Model (CAPM). This objective intrinsically appraises the CAPM, because the use of the model should not provide extraordinary returns if it exactly reflects the behaviour of the market, in which case the returns on the securities would be a function of the systematic risk that securities bring to the investor, being the relationship between average returns and risk accurate and known.

The objective also involves an evaluation of market efficiency. Assuming the model provides a sound explanation of reality but the results of the test do not bear out predictions, we must then conclude that the market is not efficient and fails to provide an adequate reflection of relevant information. However, we could also ascribe these differences to problems with the model and maintain the market efficiency hypothesis, as explained in the previous paragraph.

Studies performed to date do not provide any definitive conclusions, due to problems inherent in the test itself and in market behaviour. It is in view of this lack of clarity that we have decided to perform this CAPM-based market efficiency test.

Efficiency has been tested at great length in financial literature; good summaries on the topic can be found in Fama (1970, 1991, 1998), Malkiel (2003) or Gómez-Bezares (2010), where several works applying different methodologies and studying different markets and time periods are referenced. Evidence is yet a shady deal, and, for this reason, different tests are still being carried out.

We seek to establish whether an investor can systematically beat the market applying the CAPM, obtaining higher returns than the (risk-adjusted) market return by basing decisions on the CAPM. If he can, we must conclude that the expected returns on securities are not fully explained by betas (the relevant risk measure). This would not, however, automatically entail the rejection of the model, because the investor may benefit from mismatches in the market, which would eventually be absorbed into the prevailing logic. This is the paradox of the efficient market hypothesis: for a market to be efficient, which of course means that extraordinary returns cannot be obtained on the basis of historical, public or private information, it is necessary for many investors not to believe in such efficiency, then security prices are to pick up such information.

Our objective, then, is to seek securities that are out of the Securities Market Line (SML). Thus, a security that is above the SML will outperform the level indicated by systematic risk, because it is undervalued. When the security is below the SML, the opposite occurs. The rational investor will, then, pick undervalued securities.

Having identified undervalued securities, our aim will be to test whether such a portfolio would or would not beat the market. We use Jensen's (1968, 1969) measure to analyse performance. Though a classic measure of performance, Jensen's alpha remains popular with academics, as may be observed in the work of Silva *et al.* (2003), or Nielsen and Vassalou (2004).

In this paper, we have applied an intuitive test methodology, which is conceptually straightforward and deliberately seeks to avoid intricate procedures and an unwieldy econometric set-up. However, it will throw light on the utility of the CAPM as an investment-decision tool or, to put it another way, whether the model can generate extraordinary returns.

Various papers have sought to evaluate the operation of the CAPM, although the majority apply classic test methodologies based on a complex statistical and econometric analysis, which hinders understanding of the procedure. We will comment some of these works later, but among the most known we can find the following: Black *et al.* (1972), Fama and MacBeth (1973), Fama and French (1992), Jagannathan and Wang (1996) or Lewellen and Nagel (2006); the works by Subrahmanyam (2010) and Levy (2010) are also interesting.

Nevertheless, some scholars, such as Gómez-Bezares *et al.* (1996), have avoided complex methodologies, preferring an analysis similar to the one presented here, which is intended to expand on their findings by adding a further procedure to establish thresholds for the level at which the investor will include undervalued securities in the portfolio. These thresholds are determined in two ways. In an initial analysis we employ Jensen's alpha and, in a second analysis we use Treynor's (1965) ratio, another classic measure that still provides a paradigm for performance measurement today, as may be seen in Casarin *et al.* (2005) and Hubner (2005a, 2005b).

As we have just commented, this work is based on Gómez-Bezares *et al.* (1996), but now we go further by making several changes and improvements: we employ a better sample based in the IBEX 35, which enables to reproduce the work; our study is focused on a different time period (in the abovementioned paper the authors used data prior to the Continuous Market beginning); we improve the statistic processing by using the Z-test; the previous paper included all the undervalued assets, whereas, in this work, as commented before, we also consider a certain undervaluation level (the 25% less undervalued stocks are removed from the study); the preceding paper does not apply the Treynor-ratio to measure undervaluation, however in this work it is used as an alternative measure, as well as Jensen's alpha, in order to determine the most undervalued stocks; in the previous work data on the five previous years are used to compute betas, whereas we use only data on the three prior years in order to make more adequate the betas computation…, these are only some of the multiple differences between both studies. We believe, in short, that this work makes notable contributions to that from Gómez-Bezares *et al.* (1996), and also maintains the essential points of its robust methodology.

However, the tests and arguments surrounding the CAPM go back a long way. In general, criticism has been voiced on two levels. In the first place, the CAPM is too theoretical for financial professionals and in the second, the model does not adequately reflect a much more complex reality for academics.

The first tests carried out favoured the CAPM. Thus, Black *et al.* (1972) and Fama and MacBeth (1973) obtained consistent results with a linear model using beta as the only

measure of risk. It was some time later that Fama and French (1992) opened up the main source of argument about the CAPM by demonstrating the scant capacity of beta to explain average returns, while showing that other variables did so.

Fama and French (1992) do confirm a number of problems in CAPM which had been already appointed, as indicated by Roll and Ross (1994). The problem is that we don't know the true Market portfolio, so we seek approaches for it, as expressed Roll (1977). On the other hand, the small relation between betas and mean returns had also been appointed by prior literature as, for example, Reinganum (1981). It was also know the relationship between mean returns and several fundamental variables as size (Banz, 1981), PER (Basu, 1983) or ratio book-to-market (Chan, Hamao and Lakonishok, 1991). An analysis of these problems, focused on the Spanish Market, is addressed in Gómez-Bezares, Madariaga and Santibáñez (1994).

These problems are still nowadays analysed by literature, as for example in Subrahmanyam (2010). On the other hand, several authors have tried to overcome Roll's criticism by completing the Market portfolio (i.e. Jagannathan and Wang, 1996). Brav, Lehavy and Michaely (2005) make other contributions using ex-ante data.

Other critiques of the CAPM refer to the unvarying nature of betas over time (see Jagannathan and Wang, 1996), which resulted in proposals for a conditional version of the model, although this approach was not universally accepted in the academic community (see Lewellen and Nagel, 2006).

Other scholars have criticised the simplicity of the CAPM, arguing for more sophisticated models. These include Jegadeesh and Titman (2001), who support the use of behaviourist models, and Liu (2006), who stresses the importance of including liquidity in the model.

During the last forty years, the econometric instruments and, in general, the methodology has become more difficult, as can be checked in the referred literature. In spite of that, the problem is still unsolved; in fact whereas prestigious academics as Fama and French (2004) complain of the poor empirical results found with the CAPM, other relevant authors as Levy (2010) argument in favour of it.

This is just a small sample of the innumerable criticisms made of the CAPM, which nonetheless remains the most widely used model among both financial professionals and academics, in spite of the difficulty of empirical testing. While it is true that the CAPM is incomplete and oversimplifies reality, more complex alternative models do not provide better results.

Moreover, the utility of the CAPM for companies and markets has been proved beyond doubt. It is in this context that we undertake an evaluation of the model's functioning.

Our test has several methodological advantages as it allows betas and risk premium to be time-varying; additionally, we focus on the most liquid stocks in the Spanish Market which minimizes the problem of illiquidity; and also we use portfolios, which reduces the measurement errors. However, the most important advantage of it is

that poses a trading strategy which can be easily simulated: if our strategy beats the Market, we will get an abnormal return; in other case the efficiency and the CAPM will be confirmed.

Our test is not involved in the Market portfolio problem (the Roll's criticism), as it computes betas as the investors usually do. Finally, our methodology does not consider the two classical methods to test the CAPM (temporal series and cross-section), so it becomes innovative.

The interest in recent works analysing the Spanish Market, and related with beta, the CAPM or the possible inefficiencies, can be found, for example, in works by Rojo and García (2006), Font and Grau (2007), or Miralles *et al.* (2007, 2009).

The rest of this paper is organised as follows: section two describes the methodology applied and section three the data base analysed, while sections four and five present the results obtained and our main conclusions.

2. METHODOLOGY

As explained above, our aim is to test whether it is possible to obtain extraordinary returns using the CAPM, which is to say whether the returns generated using the model are greater than would be expected in view of the systematic risk borne.

To this end, we examine the period between December 1989 and March 2007. The study focuses on the 35 stocks included in the IBEX 35 index at any time within the proposed period.

Figure 1 (see Appendix) shows the classification (by sector of activity) of all of the stocks forming part of the IBEX 35 index at some time or other until March 2007. In the figure three different arrows (see the caption) indicate a change in the company's name (the old name is given before the arrow and the new name after it); mergers (the companies merged appear before the arrow and the group resulting from the merger after it); or takeovers (the name of the target is given before the arrow and that of the parent company after it).

We propose two analyses. The first assumes that the investor adjusts his positions at the end of each month (i.e. investments are sold at the end of each month and undervalued stocks per the CAPM are purchased). The second is similar, but in this case the investor demands a threshold level for the inclusion of undervalued stocks in the portfolio, discarding the first quartile and purchasing only the 75% that are furthest from the SML.

The second analysis has two variants. In the first, the quartiles are constructed on the basis of differences arising each month between the average return on a given stock and the return it should have provided according to the CAPM. In the second, Treynor's ratio is used. This variant is designed to meet the criticism of Jensen's alpha voiced by Modigliani (1997), who argued that differences in returns are not comparable when risks are unlike. In fact, a certain Jensen's alpha will be more

significant for low risk levels than for high risk levels where it might be due by chance.

The period analysed (December 1989 to March 2007) is split into two sub-periods. The first sub-period begins in 1989 and ends in November 1992. The first sub-period provides the data necessary to compute the betas for the model at the beginning of the second (i.e. the calculation is performed using the preceding 36 months). The second sub-period begins in December 1992 (1) and ends in 2007. This second sub-period is used for the test itself.

The methodology for both types of behaviour can also be broken down into two parts.

The first concerns the construction of the stock portfolios, and the second allows an assessment of whether the portfolios constructed outperform the market.

2.1. Construction of the stock portfolios

At the end of each month, the investor will examine the IBEX 35 stocks (2) and will pick those that are undervalued (in a second analysis, the investor will pick only the 75% of stocks that are most undervalued).

Under- and overvalued stocks were identified by comparing the monthly return actually obtained on the security with the monthly return it should have obtained according to the CAPM.

This expected return was obtained by calculating the monthly betas for each stock (β_i) over the test period (December 1992 to March 2007). Thus, the beta for any given stock in a given month was calculated by means of a regression adjustment between the monthly returns on the stock (3) and the market portfolio (4) in the prior 36 months.

Later, we calculated the average monthly returns obtained on stock i ($\overline{R}_i$), on the market portfolio ($\overline{R_M}$) and on the risk-free asset ($\overline{R_F}$) in the 36-month period as the simple average of the 36 monthly returns in each case.

(1) Initially, we had intended the second sub-period to commence at the same time as the launch of the IBEX 35 (January 1992). Given that we had decided on a prior period of 36 months to establish the model betas, however, we were obliged to shift the starting point to December. Likewise, we had intended the beginning of the first sub-period to coincide with the creation of the Continuous Market (April 1989), but the majority of the stocks included in the sample were first listed on this market after December 1989, when data become available.

(2) Stocks must have a minimum of 36 data prior to the month analysed in order to determine beta. In the case of mergers, the beta for the resulting company was calculated based on the weighted average of the monthly returns of the companies merged. Weightings were proportional to the size of each of the merged companies.

(3) We looked at the returns generated for the investor in respect of capital gains, dividends and the sale of subscription rights. The return was adjusted for splits.

(4) The return on the market portfolio was constructed as a mean of the returns actually generated by the stocks forming part of the IBEX 35 each month. We opted to construct this return rather than using a stock market index, such as the IBEX 35 itself, because we were interested in obtaining an index corrected for gains, dividends, splits and preferential subscription rights. Also, an equally weighted portfolio is theoretically superior.

Based on these results, we determined the average monthly returns ($\overline{R_i}$) the security should have generated in the 36-month period according to the CAPM:

$$\overline{R_i} = \overline{R_F} + [\overline{R_M} - \overline{R_F}]\ \beta_i \qquad (1)$$

The next step was to compare the average monthly return actually obtained ($\overline{R_i}$) on each stock with the return it should have generated according to the CAPM ($\overline{R_i}$). If the actual return is higher than the expected return, then the stock is undervalued. If the actual return is lower, the stock is overvalued.

At this point, we may distinguish between the two analyses performed. In the first, the investor will pick all undervalued stocks [(5)] in any given month (based on the data for the prior 36 months). In the second analysis, meanwhile, the investor will split the undervalued stocks into quartiles and will discard the first, acquiring only 75% of the undervalued stocks in each month. These are the stocks that are furthest from the SML and, accordingly, are the most undervalued.

This second analysis was, in turn, split into two procedures. In the first, the quartiles were constructed based on Jensen's alphas and in the second based on the Treynor ratio [(6)].

2.2. Assessment of the functioning of the CAPM: did we beat the market?

If stocks are persistently undervalued, it would be reasonable to expect that portfolios constructed using undervalued stocks would beat the market in the relevant month, but this would not be the case if the CAPM held perfectly.

We applied the Jensen index, a widely-used performance measure, to test whether the portfolios did or did not beat the market:

$$\alpha_p = (R_p - R_F) - \beta_p\ (R_M - R_F) \qquad (2)$$

If the Jensen index throws up a positive result, we have beaten the market.

This performance measure is calculated by first establishing the portfolio beta (β_p) for each month as a simple average of the individual betas [(7)] for the stocks included, which may be either all of the undervalued stocks or the most undervalued 75%. The return on the portfolio (R_p) was obtained in the same way as a simple average of the individual returns actually obtained each month on all of the stock included.

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(5) Overvalued stocks were not included in the analysis because we did not take the possibility of short selling into consideration.

(6) In this second variant, Jensen's measure is still used to establish whether or not a stock is undervalued, although the quartiles are constructed based on the Treynor ratio. This is because we encountered certain difficulties in determining undervalued stocks based on the Treynor ratio. These problems were related with return premiums and negative betas present in some cases in our data base. Naturally, we accept that the use of the Treynor ratio to construct the quartiles is not problem-free, since certain stocks could have positive alphas and low Treynor ratios, which would exclude them from the analysis. This is because the Treynor ratio takes the form of a quotient.

(7) Individual betas are calculated with data of the previous 36 months.

R_M and R_F are the monthly returns on the market portfolio and the risk-free asset, respectively, for the month under consideration, and α_p is the Jensen alpha for portfolio *p*.

Finally, we applied the Z-test, which approximately follows a normal distribution (0,1) to determine whether the number of months in which we beat the market was due to chance:

$$Z = (Y - np) / \sqrt{np\,(1 - p)} \qquad (3)$$

Y indicates the number of periods in which the portfolio formed by undervalued stocks beats the market; n represents the number of months analysed; and *p* is assigned a value of 0.5, since this is the probability of beating the market if the CAPM and the efficiency hypothesis hold [8], and we wish to test whether the difference *(Y – np)* is due to chance.

A value of $|Z| > 1.96$ would reject the null hypothesis of difference due to chance at a significance level of 5%.

3. DATA BASE

As explained above, our analysis focuses on the 35 stocks included in the IBEX 35 [9] from the inception of the Spanish Continuous Market until March 2007. Thus, for each month, the investor considers the IBEX stocks that have at least historical data for 36 months.

The data for returns on all of the stocks was obtained from *Bloomberg*, and we encountered problems obtaining data for only two out of 88 stocks [10]. These were Agromán (AGR) and Energías e Industrias Aragonesas (ARA). These stocks were excluded from the analysis. The impact of these exclusions is not significant, since AGR formed part of the IBEX 35 for only two years (January 1991 to January 1993) and ARA was included for just six months (July 1992 to January 1993).

Returns data are available for all of the other stocks from the moment they were first listed on the Continuous Market.

(8) If the CAPM and the efficiency hypothesis hold perfectly, the results on any portfolio (adjusted for risk) will be the same on average as the results for the market as a whole. We have here assumed that results may by chance be 50% of the times above or below the market for a given month.

(9) Although the composition of the IBEX 35 is revised on a six-monthly basis, sometimes, between two revisions, significant financial transactions affecting the components of the index take place which forces to implement an extraordinary revision. As our analysis is conducted on a monthly basis, we consider the stocks included in the index each month taking into account the corresponding revisions.

(10) Please note that the index is always composed of 35 stocks, however the 35 stocks group is not constant in the time, in fact a company can be included in the index during only a number of months. In total, 88 stocks (considering also the changes in the stock denomination) have been included in the index (at least one month) in the time period analyzed here.

TABLE I

ANNUAL DESCRIPTIVE STATISTICS OF MONTHLY STOCK RETURNS *

Panel A: Prior period					
Year	*Mean*	*Median*	*Maximum*	*Minimum*	*Std.Dev.*
dec 1989/nov 1990	0.187118	-0.002995	11.170000	-0.359280	1.195000
dec 1990/nov 1991	0.010761	0.000000	0.470758	-0.288640	0.095169
dec 1991/nov 1992	-0.013669	-0.011575	0.448602	-0.375127	0.113660
dec 1989/nov 1992	**0.054038**	**-0.004545**	**11.17000**	**-0.375127**	**0.661538**
Panel B: Contrast Period					
Year	*Mean*	*Median*	*Maximum*	*Minimum*	*Std.Dev.*
dec 1992/nov 1993	0.035059	0.028576	0.343220	-0.237244	0.083789
dec 1993/nov 1994	0.009628	-0.000857	0.510076	-0.604553	0.101984
dec 1994/nov 1995	0.006480	0.002051	0.554368	-0.220966	0.077322
dec 1995/nov 1996	0.022723	0.022042	0.204344	-0.164185	0.062786
dec 1996/nov 1997	0.038109	0.034819	0.429381	-0.308638	0.097809
dec 1997/nov 1998	0.027631	0.028225	0.432660	-0.331141	0.120737
dec 1998/nov 1999	-0.001611	-0.003229	0.351075	-0.223282	0.080742
dec 1999/nov 2000	0.002103	-0.005529	0.556553	-0.357094	0.110788
dec 2000/nov 2001	0.003081	0.000000	0.468603	-0.282024	0.098028
dec 2001/nov 2002	-0.005393	-0.002908	0.369085	-0.403408	0.104471
dec 2002/nov 2003	0.013977	0.016353	0.551835	-0.347280	0.083299
dec 2003/nov 2004	0.018440	0.015852	0.297322	-0.147819	0.050610
dec 2004/nov 2005	0.023066	0.014685	0.257841	-0.110474	0.057863
dec 2005/nov 2006	0.029634	0.022335	0.372409	-0.169830	0.062640
dec 2006/mch 2007	0.021989	0.013010	0.264933	-0.285306	0.068472
dec 1992/mch 2007	**0.016678**	**0.012686**	**0.556553**	**-0.604553**	**0.087537**

* Note: The returns have been computed on a monthly basis, and they are not expressed in percentage. The historical price data used to compute the returns is adjusted for splits, dividends and distributions

Table I has two panels. Panel A shows the descriptive statistics for monthly returns registered during the prior period and panel B the descriptive statistics for monthly returns registered during the test period. Since the IBEX 35 did not yet exist as such for the period reflected in Panel A, to construct this panel we considered those stocks that formed part of the index at the beginning of the test period and for which prior month's data were available. Hence, the stocks considered in December 1989 are those that were already listed on the Continuous Market at that time and came to form part of the IBEX 35 in December 1992. In the following months, the number of stocks included increases in line with new listings. Meanwhile Panel B, as focuses on a post IBEX 35 period, considers the returns on the IBEX 35 securities included in the study, comprising all those for which at least 36 prior data were available.

Please note that for the purpose of the paper we have built a market portfolio [(11)]. The excess returns are net of the monthly return of investing in a Treasury bill with maturity equal to one month.

(11) The market portfolio was constructed as a simple average of returns, adjusted for the effects of dividends, splits, etc. affecting the IBEX 35 stocks each month. Naturally, a minimum 36 months' history is not required for inclusion in the

The IBEX 35 index was created out of the FIEX 35 and MEFF 30 on 14 January 1992. This index is characterized by its high liquidity, capitalization and trade volumes.

Figure 2 (see Appendix) shows the historical composition of the IBEX 35 from the creation of the Continuous Market (the IBEX 35 index did not yet exist as such at that time, although the conjunction of the two aforementioned indices did) until March 2007.

The index has ordinary and extraordinary revisions. As shown in figure 2, extraordinary reviews of the composition of the index are frequent (rows shaded in grey), as well as changes in stock codes (boxes in bold). As may also be seen from figure 2, in certain periods when a six-monthly review was called for, it was not actually carried out as no events had occurred to make it necessary (rows indicating "NO REVISION").

4. RESULTS

4.1. Investor picks all undervalued stocks

As explained above, the investor is assumed to observe the historical performance of all of the stocks forming the IBEX 35 in any given moment [(12)] (i.e. he observes performance over the preceding 36 months), in order to establish which are undervalued and which overvalued. The investor picks the undervalued stocks.

The investor then goes on to check whether his portfolio of undervalued stock beats the market. Table II shows the results of this strategy. Specifically, the table shows the number (and percentage) of months in which the portfolio beat the market for each of the fourteen years analysed and for the remaining-four month period. It also shows the result for the whole period, as well as the *Z* value for the full period.

Based on Table II, we may conclude that the CAPM does not provide a significantly better strategy than investment in the market portfolio. The strategy beats the market in only 92 of the 172 months analysed, representing 53.49%[(13)]. This result is confirmed by the Z value, which scores less than 1.96, implying that the investor's successes (in the months where he did beat the market) may be due to chance.

Taking each year on its own, we may observe that in two of the 14 years analysed (specifically between December 2004 and November 2006), the CAPM appears as a useful tool to help investors beat the market (in these two years the model beat the market in 75% and 83.33% of months respectively). The poor functioning of the model or non-efficiency of the market is confirmed in these months.

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market portfolio in this case.

(12) Stocks are required to have a track-record of at least 36 months. Where a stock that does not have 36 months of prior data forms part of the IBEX 35, it is included in the analysis for the month in which 36 historical data are available, unless the stock has already been excluded form the IBEX 35.

(13) Furthermore, we have not taken transaction costs into account, which would undoubtedly be higher in the portfolio managed, and would therefore further detract from the strategy.

TABLE II

RESULTS OF THE FIRST STRATEGY (ACQUISITION OF ALL OF THE UNDERVALUED STOCKS)

Year	*number of successful months*	*% of success*	*Z*
dec 1992/nov 1993	4	33.33%	
dec 1993/nov 1994	4	33.33%	
dec 1994/nov 1995	5	41.67%	
dec 1995/nov 1996	7	58.33%	
dec 1996/nov 1997	7	58.33%	
dec 1997/nov 1998	6	50.00%	
dec 1998/nov 1999	7	58.33%	
dec 1999/nov 2000	6	50.00%	
dec 2000/nov 2001	6	50.00%	
dec 2001/nov 2002	5	41.67%	
dec 2002/nov 2003	7	58.33%	
dec 2003/nov 2004	7	58.33%	
dec 2004/nov 2005	9	75.00%	
dec 2005/nov 2006	10	83.33%	
dec 2006/mch 2007	2	50.00%	
dec 1992/mch 2007	**92**	**53.49%**	0.91

In the first two years (from December 1992 until November 1994) the opposite occurred, when the model rarely succeeded in beating the market (just 33.33% of months). In these months, it would therefore seem that the opposite strategy could be used to beat the market.

4.2. INVESTOR PICKS THE THREE QUARTILES OF MOST UNDERVALUED STOCKS

As in the previous analysis, the difference between the average return actually achieved by the stock in a single month (based on the 36 previous months) and the return it should have obtained according to the CAPM will allow us to determine whether or not a stock is undervalued.

However, in this analysis the investor ignores the first quartile of undervalued stocks and picks the remaining 75%, which are the most undervalued.

The stocks were classified (for each month) by quartiles using Jensen's measure as a first variant of the analysis and based on the Treynor ratio in the second.

4.2.1. *Quartiles constructed on the basis of Jensen's measure*

Table III shows the results of this strategy for quartiles formed on the basis of the Jensen measure.

TABLE III

RESULTS OF THE SECOND STRATEGY (ACQUISITION OF THE THREE QUARTILES OF MOST UNDERVALUED STOCKS, CONSTRUCTED ON THE BASIS OF THE JENSEN MEASURE)

Year	*number of successfu months*	*% of success*	*Z*
dec 1992/nov 1993	3	25.00%	
dec 1993/nov 1994	4	33.33%	
dec 1994/nov 1995	5	41.67%	
dec 1995/nov 1996	8	66.67%	
dec 996/nov 1997	6	50.00%	
dec 1997/nov 1998	7	58.33%	
dec 1998/nov 1999	8	66.67%	
dec 1999/nov 2000	6	50.00%	
dec 2000/nov 2001	5	41.67%	
dec 2001/nov 2002	5	41.67%	
dec 2002/nov 2003	9	75.00%	
dec 2003/nov 2004	6	50.00%	
dec 2004/nov 2005	10	83.33%	
dec 2005/nov 2006	10	83.33%	
dec 2006/mch 2007	2	50.00%	
dec 1992/mch 2007	**94**	**54.65%**	**1.22**

The results in this case are very similar to those observed for the previous strategy. Once again, then, the CAPM does not provide a useful strategy to beat the market, since it succeeded in only 94 of the 172 months (54.65%). The Z test again supports this result.

By periods, we may observe that the CAPM proved a useful tool to beat the market in five years (December 1995-November 1996, December 1998-November 1999, December 2002-November 2003, December 2004-November 2005, and December 2005-November 2006), implying either that the model functions poorly or that the market was not efficient, since it was possible to beat it most months.

However, the opposite results were obtained in the first two years (December 1992 until November 1994), when the percentage success rate was lower (25% and 33.33%, respectively).

4.2.2. Quartiles constructed on the basis of the Treynor ratio

Table IV shows the results of this strategy for quartiles formed on the basis of the Treynor ratio.

TABLE IV

RESULTS OF THE THIRD STRATEGY (ACQUISITION OF THE THREE QUARTILES OF MOST UNDERVALUED STOCKS, CONSTRUCTED ON THE BASIS OF THE TREYNOR RATIO)

Year	*number of successful months*	*% of success*	*Z*
dec 1992/nov 1993	3	25.00%	
dec 1993/nov 1994	4	33.33%	
dec 1994/nov 1995	7	58.33%	
dec 1995/nov 1996	7	58.33%	
dec 1996/nov 1997	6	50.00%	
dec 1997/nov 1998	7	58.33%	
dec 1998/nov 1999	7	58.33%	
dec 1999/nov 2000	7	58.33%	
dec 2000/nov 2001	4	33.33%	
dec 2001/nov 2002	5	41.67%	
dec 2002/nov 2003	8	66.67%	
dec 2003/nov 2004	6	50.00%	
dec 2004/nov 2005	10	83.33%	
dec 2005/nov 2006	10	83.33%	
dec 2006/mch 2007	2	50.00%	
dec 1992/mch 2007	**93**	**54.07%**	**1.07**

The results of this strategy are in line with those obtained for the preceding two. Once again, the success rate of the strategy for the period as a whole was low and the Z-test shows that we may accept the hypothesis that any possible success or failure is due to chance.

The CAPM appears as a useful tool to beat the market in three years, from December 2002 to November 2003 and from December 2004 to November 2006. In these years, we may assert either that the market was not efficient or that the model functions poorly.

The lowest success rates were obtained in the first two years analysed, and in the ninth. However, we cannot assert that the market was efficient in these years as it could be beaten using the contrary strategy.

5. SUMMARY AND FINDINGS

The objective of this paper is to determine whether strategies based on the CAPM help investors gain extraordinary returns, while deliberately avoiding a complex methodology and opting for a more intuitive, though no less scientific, test approach.

If it is confirmed that CAPM-based strategies do help beat the market easily, this may be interpreted as revealing market inefficiency or as a sign that the model does not function correctly, since the only way to achieve higher returns if the CAPM holds is to accept a higher level of systematic risk. In any event, the CAPM would be a useful

decision making tool for investors, allowing them to earn higher returns than the market at a given level of systematic risk.

If the CAPM does not help beat the market, then we may accept that the market is efficient and the model functions well (unless we systematically lose money by applying it).

In light of our results, we may conclude that the utility of the model as a decision making instrument is shown to be low for a short run strategy. Assuming that the investor adjusts positions at the end of each month, we find that the model beats the market a little over 50% of the times. This is a very small advantage and it would be further whittled away if we were to consider transaction costs.

The results obtained are very similar whether the investor picks all undervalued stocks or opts only for the 75% of most undervalued stocks. Likewise, the results are similar when the undervaluation thresholds are determined based both on Jensen's alpha and on the Treynor ratio. It thus appears that undervalued stocks quickly realign with the SML.

One important feature of our study is that the hypothetical behaviour of the investor is perfectly replicable, because he always acts on the basis of available information in the relevant month. Meanwhile, investment is in IBEX 35 stocks for which 36 months of historical data are available, and conclusions are therefore applicable to the most representative and soundest stocks in the Spanish market.

Finally, we would mention that we have implicitly accepted the logic of the CAPM throughout the study, measuring performance via the Jensen index (which means basing measurement on the CAPM). For this reason, our results would be consistent with the fact that it is market efficiency that prevents the generation of extraordinary returns over the market return, and that the CAPM holds reasonably well therefore does not allow us to beat the market.

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APPENDIX

FIGURE 1

IBEX 35 STOCKS CLASSIFIED BY SECTORS OF ACTIVITY

TELECOMMUNICATIONS & TECHNOLOGY
ANTENA 3 TV (A3TV)
AMPER (AMP)
AMADEUS GLOBAL TRAVEL DISTRIBUTION (AMS)
GAMESA CORPORACIÓN TECNOLÓGICA (GAM)
GRUPO PICKING PACK (GPP) → SERVICE POINT SOLUTIONS (SPS)
INDRA SISTEMAS (IDR)
RADIOTRÓNICA (RAD) → AVÁNZIT (AVZ)
TELEFÓNICA (TEF)
TELEFÓNICA MÓVILES (TEM)
GESTEVISIÓN TELECINCO (TL5)
TERRA NETWORKS (TRR) ⇨ (TEF)
INFRASTRUCTURE & TRANSPORT
ABERTIS INFRAESTRUCTURAS (ABE)
ACESA INFRAESTRUCTURAS (ACE) → (ABE)
AUREA CONCESIONES DE INFRAESTRUCTURAS (AUM) ⇨ (ABE)
CINTRA CONCESIONES DE INFRAESTRUCTURAS (CIN)
GRUPO FERROVIAL (FER)
IBERIA LÍNEAS AÉREAS DE ESPAÑA (IBLA)
IRON, STEEL & METAL
ACERALIA CORPORACIÓN SIDERÚRGICA (ACR) ⇨ ARCELOR (LOR)
ACERINOX (ACX)
ASTURIANA DE ZINC (AZC)
ARCELOR (LOR)
TUBACEX (TUB)
BUILDING
ACTIVIDADES DE CONSTRUCCIÓN Y SERVICIOS (ACS)
ACCIONA (ANA)
ASLAND (ASL)
CUBIERTAS (CUB) → (ANA)
DRAGADOS Y CONSTRUCCIONES (DRC) ⇨ (ACS)
FOMENTO DE CONSTRUCCIONES Y CONTRATAS (FCC)
FOMENTO DE OBRAS Y CONSTRUCCIONES (FOC) ⇨ (FCC)
HUARTE (HHU)
URALITA (URA)
PORTLAND VALDERRIVAS (VDR) ⇨ (FCC)
BANKING
BANCO ARGENTARIA (ARG)
BANCO BILBAO VIZCAYA (BBV)
(ARG) + (BBV) ⇢ BANCO BILBAO VIZCAYA ARGENTARIA (BBVA)
BANCO CENTRAL HISPANOAMERICANO (BCH)
BANKINTER (BKT)
BANCO ESPAÑOL DE CRÉDITO (BTO)
BANCO EXTERIOR DE ESPAÑA (EXT) ⇨ (BBVA)
BANCO POPULAR ESPAÑOL (POP)
BANCO DE SABADELL (SABD)
BANCO SANTANDER (SAN)
(BCH) + (SAN) ⇢ BANCO SANTANDER CENTRAL HISPANO (SCH) (SAN)
TEXTILE
CORTEFIEL (CTF)
INDUSTRIAS DE DISEÑO TEXTIL (ITX)

(Continue in next page)

FIGURE 1 (CONT.)
IBEX 35 STOCKS CLASSIFIED BY SECTORS OF ACTIVITY

ENERGY
HIDROELÉCTRICA DEL CANTÁBRICO (CAN)
COMPAÑÍA ESPAÑOLA DE PETRÓLEOS (CEP)
CATALANA DE GAS (CTG) → GAS NATURAL (GAS)
EMPRESA NACIONAL DE ELECTRICIDAD (ELE)
EMPRESA NACIONAL DEL GAS (ENG)
FUERZAS ELÉCTRICAS DE CATALUÑA (FEC) ⇨ (ELE)
GAS NATURAL (GAS)
GAS Y ELECTRICIDAD (GES) ⇨ (ELE)
IBERDROLA (IBE)
RED ELÉCTRICA DE ESPAÑA (REE)
REPSOL YPF (REP)
COMPAÑÍA SEVILLANA DE ELECTRICIDAD (SEV) ⇨ (ELE)
UNIÓN FENOSA (UNF)
PROPERTIES
INMOBILIARIA COLONIAL (CAR)
FADESA INMOBILIARIA (FAD)
METROVACESA (MVC)
SACYR VALLEHERMOSO (SYV)
INMOBILIARIA URBIS (URB)
INMOBILIARIA VALLEHERMOSO (VAL) → (SYV)
FOOD
EBRO AGRÍCOLAS (EBA)
PULEVA (PUL)
TELEPIZZA (TPZ)
PULEVA UNIÓN INDUSTRIAL Y AGROGANADERA (UNI) → (PUL)
SHOPPING
CENTROS COMERCIALES CARREFOUR (CRF)
CENTROS COMERCIALES CONTINENTE (CTE) ⇨ (CRF)
CENTROS COMERCIALES PRYCA (PRY) ⇨ (CRF)
CELLULOSE
EMPRESA NACIONAL DE CELULOSA (ENC)
VISCOFÁN (VIS)
HOTELS
NH HOTELES (NHH)
SOL MELIÁ (SOL)
COMMUNICATION & INFORMATION
PROMOTORA DE INFORMACIONES (PRS)
SOGECABLE (SGC)
TELEFÓNICA PUBLICIDAD E INFORMACIÓN (TPI)
OTHERS
AGUAS DE BARCELONA (AGS) (drinking water supplying)
CORPORACIÓN FINANCIERA ALBA (ALB) (asset management)
ALTADIS (ALT) (tobacco)
MAPFRE (MAP) (insurances)
SARRIÓ (SAR) (paper industry)
TABACALERA (TAB) (tobacco) → (ALT)
ZELTIA (ZEL) (pharmacist)
ZARDOYA OTIS (ZOT) (mechanical stairs, elevators)

→	*Change in company's name.*
⇨	*Takeovers.*
⇢	*Mergers.*

FIGURE 2
HISTORICAL COMPOSITION OF THE IBEX 35 *

INITIAL COMPOSITION

ACE	*ACX*	*ALB*	*ASL*	*AZU*	*BBV*	*BKT*	*BTO*	*CEN*	*CEP*	*CRI*	*CTG*
DRC	*ECR*	*ELE*	*FEC*	*FOC*	*HID*	*HIS*	*IBE*	*MAP*	*PMD*	*POP*	*PSG*
REP	*SAN*	*SEV*	*TAB*	*TEF*	*UNF*	*URA*	*URB*	*VAL*	*VDR*	*VIS*	

REVISION		***INCLUSIONS***					***EXCLUSIONS***				
Nº	***Date***										
1	*1991-01-02*	AGR	CUB	HHU			AZU	PSG	PMD		
2	*1991-07-01*	MVC	CAN	PMD			ALB	CRI	ACX		
3	*1991-10-01*	ALB	CRI				HID	PMD			
4	*1992-01-02*	SAR	EXT	AGS	BCH	ACX	CEN	HIS	ECR	ALB	CRI
5	*1992-03-10*	FCC					FOC				
6	*1992-07-01*	PRY	ARA	ALB	AUM		EXT	HHU	AGS	CEP	
7	*1993-01-04*	CEP	HHU	AGS	ZOT		AGR	ARA	URB	SAR	
8	*1993-07-01*	ARG					CEP				
9	*1994-01-03*	EBA	GES				ASL	ZOT			
10	*1994-07-01*	CTE					EBA				
11	*1995-01-02*	ENC	CTF				HHU	AGS			
12	*1995-07-02*	AGS	AMP	AZC			CTF	GES	VDR		
13	*1996-01-02*	GES					AZC				
14	*1996-07-01*	NO REVISION					NO REVISION				
15	*1997-01-02*	SOL	UNI				ENC	VIS			
16	*1997-06-02*	**ANA**					**CUB**				
17	*1997-07-01*	AZC	TUB	VIS			ANA	GES	MVC		
18	*1997-10-01*	**PUL**					**UNI**				
19	*1998-01-02*	NO REVISION					NO REVISION				
20	*1998-04-02*	ACS					BTO				
21	*1998-07-01*	ACR	TPZ				ALB	FEC			
22	*1999-01-04*	ALB	ANA	NHH			AZC	SEV	TUB		
23	*1999-04-19*	SCH	RAD				BCH	SAN			
24	*1999-07-01*	FER	IDR				AMP	RAD			
25	*2000-01-03*	AMS	SGC	TPI	**ALT**		PUL	URA	VIS	**TAB**	
26	*2000-01-31*	BBVA	TRR				ARG	BBV			
27	*2000-07-03*	REE	ZEL				AUM	MAP			
28	*2000-10-02*	CRF	PRS				CTE	PRY			
29	*2001-01-02*	TEM	GPP				AGS	VAL			
30	*2001-04-10*						CAN				
31	*2001-04-24*	GAM									
32	*2001-05-01*	**GAS**					**CTG**				
33	*2001-07-02*	ITX					GPP				
34	*2001-11-01*	**SAN**					**SCH**				
35	*2002-01-02*	NO REVISION					NO REVISION				
36	*2002-02-09*						ACR				
37	*2002-02-19*	LOR									
38	*2002-07-01*	IBLA					TPZ				
39	*2002-12-30*						CRF				
40	*2003-01-02*	MVC	VAL				ALB	SOL			
41	*2003-01-10*	ENG									

(Continue in next page)

FIGURE 2 (CONT.)
HISTORICAL COMPOSITION OF THE IBEX 35 *

42	*2003-06-02*	**ABE**	**SYV**				**ACE**	**VAL**				
43	*2003-07-01*	*MAP*					*PRS*					
44	*2003-07-24*						*TRR*					
45	*2003-08-04*	*TRR*										
46	*2003-12-15*						*DRC*					
47	*2004-01-02*	*BTO*	*PRS*				*TRR*					
48	*2004-07-01*	*SABD*					*SYV*					
49	*2005-01-03*	*SYV*	*TL5*				*REE*	*ZEL*				
50	*2005-06-28*						*AMS*					
51	*2005-07-01*	*REE*	*CIN*				*BTO*	*NHH*				
52	*2005-07-08*	*A3TV*										
53	*2006-01-02*	*NHH*					*MAP*					
54	*2006-07-03*	*FAD*					*NHH*					
55	*2006-07-06*						*LOR*					
56	*2006-07-25*	*MAP*					*TEM*	*TPI*				
57	*2006-08-01*	*BTO*										
58	*2006-08-17*	*NHH*										
59	*2007-01-02*	*AGS*					*PRS*					
60	*2007-03-09*						*FAD*					
61	*2007-03-21*	*CAR*										

* Note: Rows shaded in grey indicate extraordinary revisions of index composition; boxes with bold letters indicate changes in stock codes.