The Latin American and the Spanish Stock Markets *

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Abstract

In this article I propose a model for the Spanish stock returns in an international setting. Using a simple Markov regime switching model I get a measure of the effect of the Latin American stock markets on the Spanish stock market. The evidence can be summarized as follows. First, for the excess return on the Spanish market portfolio, I find evidence supporting the hyphotesis that the Spanish stock market is positevely affected by the Latin American Stock markets. Second, when I develop a model for the excess return on size portfolios, I get that most of the effect accrues indirectly through common risk factors. Third, the small and the big portfolios seem to be the most affected, while the medium portfolios the less, and the relative effect of the Latin America to the effect of the world increases for the big portfolios at the end of the sample period. Fourth, at fitting the model for the excess return on individual Spanish stocks of the main firms operating in Latin America, I get no effect for ones and positive effect for others.

Keywords: Markov switching model, maximum likelihood estimation, stock returns.

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1 INTRODUCTION

The globalization of economic activity and the acceleration of international economic interdependence are certainly two of the main features of world economy during the 1980s and 1990s.[1] This fact, along with the opening up of so many emerging markets, has offered to the researchers a unique testing ground for the economic and financial implications of market integration as is pointed out by Kearney and Lucey (2004).

The structural changes undertaken by most of Latin American countries during the last decade have drastically increased the interest of international investors. Thus, most of the main countries in the region are nowadays characterized for its trade and financial market deregulation.

While this can be said to be a global process, the role of Spain should be highlighted. The historical cultural links between Latin America and Spain have taken an economic dimension. In fact, Spain is becoming one of the major foreign investors in Latin America and the trade relations are quickly increasing. Moreover, since December 1st 1999 a new market (called Latibex) to the main Latin American securities in euros is operating through the electronic Spanish trading system.[2] This new market allows Spanish (and European in general) investors to overcome the legal, fiscal, time, information and currency difficulties they should face investing directly in Latin American markets. Finally, after the consolidation of the European Monetary Union, Spain has played a key role as channel of the Europe-Latin America trade and financial relationships, as it has been pointed out by De Busturia (2000) and Levy and Sturzenegger (2000).

It is also widely known that the main Latin American countries have undergone financial and economic instability since the middle eighties and even now, some countries have still not overcome those problems performing relatively calm for some periods of time but with underlaying financial and economic pressures that in some case have led to a crises.[3] In this sense, the

[1] The advances in communications and information technology, deregulation of financial markets and the rising importance of institutional investors that are able and willing to invest internationally are some of the main forces driven this process. See The World Bank (1997).

[2] A report of the Federación Iberoamericana de Bolsas de Valores (1999) reflects the interest of the Latin American countries in this and others current processes of stock exchanges integration.

[3] See Kaminsky (1999) and reference therein for a literature review.

region is thought to be highly risky.

For all these reasons Spanish assets in Latin America are believed to be quite exposed to such a risk. Despite the belief and often suggested relation between Spanish and Latin American stock markets, there are no articles analyzing this fact in a formal way.

Considering that the stock indexes collect the risk of the economies, they are supposed to be the transmission channel of risk among financial markets, thereby, in this paper I analyze the Spanish stock market in an international setting by allowing stock returns to be affected not only by internal macroeconomic and financial variables but also by the returns of foreign indexes. In an ample sense, the aim of the article could be thought as measuring financial market integration.

My approach relies on a Markov switching model, but different from the one of Beckaert and Harvey (1995), who used a conditional CAPM in a Markov regimen switching model to show how market integration has performed in several emerging markets. I am specially interested on how the sensitivity of Spanish stock returns to Latin American stock returns (β-risk) has evolved over time, in order to shed light about the widespread intuition that Spanish stock market is more and more highly exposed to Latin American countries. In this way, my specification could be understood as a factor model with time-varying coefficients.

Several exercises are carried out. First, I use a simple model and show evidence of the effect of the excess return on the Latin American portfolio on the excess return on the Spanish market portfolio. Second, I develop a factor model for the excess return on Spanish size portfolios and show some striking evidences. Third, since most of the Spanish investments in Latin America have been undertaken by the largest Spanish firms, I show evidence on the effect of Latin America on the stock returns of those firms. The model aims to find a measure of how much Latin America is affecting Spanish stock markets.

The article is organized as follows. Section 2 presents some evidence of the trade and financial relations between Spain and Latin America. The econometric model is developed in section 3. Section 4 and 5 show the data used and the empirical results. Some concluding remarks are provided in section 6.

2 Trade and Financial flows between Latin America and Spain

Financial market openness is associated with the removal of barriers to portfolio investments. Thus, the evolution of net capital flows could be an indicator of the market integration.[4]

The favorable climate for foreign investments after the policy reformulation in the 1990s throughout Latin America has caused that the foreign direct investments (FDI) inflows into the region by transnational corporations[5] has increased four-fold in 2000 compared with the earlies 1990s.[6] The four largest economies of Latin America (Brazil, Argentina, Mexico and Chile) have been receiving over 70% of the total inward FDI in the region since the 1990s.

While the United States has been historically the largest foreign investor in the region, Spain has become very active since the mid-1990s. Table 1 makes clear this evolution. Since 1996 the Spanish investment in Latin America has been more than 40% of total Spanish foreign investment, being in 1999 especially high, 27.602 Millions Euros (63%). A very large proportion of it went to the services industry. The importance of the Spanish investment in the region is shown in Table 2. In the period 1996-2003, Spain was the first investor in Argentina, the second in Brazil Colombia, Chile, Dominic Republic, Peru and Venezuela, and the third in Mexico.

The increasing involvement of Spain in Latin American economies can be also remarked by the significant presence of some of the most important Spanish firms in the region as it can be seen in Table 3. According to the ECLAC Report (2004), TELEFÓNICA was the multinational enterprise with the largest consolidated sells in 2003 in the region (14.112 billion US dollars). Another Spanish transnational corporations were also in the first places of this ranking, REPSOL-YPF (7th), ENDESA (8h). In the banking industry, the presence of Spanish banks is also noteworthy: Banco Santander Central Hispano (BSCH) was in Jun 2004 the first in consolidated assets (73.039 billion US dollars), and Banco Bilbao Vizcaya Argentaria (BBVA) the second in this ranking.

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[4] See Bekaert and Harvey (1998, 2002) and the references therein.

[5] According to the World Investment Report (2000) a foreign direct investment is defined as an investment involving management control of a resident entity in one economy by an enterprise in another country.

[6] See the ECLAC Report 2000.

Regarding trade relations, Latin America has been in the 1990s the second recipient of Spanish exports (after the European Union). Table 4 shows that they reached in 1998 more than 6.4% of total Spanish exports (6.361 Million Euros), while in 1993 they were 5.2%. Argentina, Brazil and Mexico are the main importers of Spanish products. The Spanish imports from Latin American countries have also grown in recent years as shows table 4.

According to the statistics Spain and Latin America have strong economic links, thereby it could be expected that the Spanish Stock market be affected by the Latin American Stock Markets.

3 The Econometric Model

3.1 Basic Benchmark

Characterizing the dynamics of the stock returns has been a difficult task in empirical finance. While AR and GARCH models describe the conditional mean and variance as a linear function, Markov switching model allows us to model stock returns as a nonlinear stationary process rather than a linear one.[7] Ryden *et al.*(1998) showed that the Markov switching model is suited to explain the temporal and distributional properties of stock returns and Hamilton and Susmel (1994) suggest that stock returns are characterized by different ARCH process at different points in time with the changes between the process governed by an unobserved Markov process. The fact is that there exist events such as financial panics, political instability or changes in the government policies that seem to drive stock returns to undergo breaks, that is, stock returns can switch from one state to another when they are observed for a sufficiently long period.

The underlaying idea of the Markov switching model as a time series model is that once the process has changed in the past, it could change again in the future. However, the change in regime does not obey a deterministic rule, rather, the change in regime is a random variable.

Following Hamilton (1989), let the return on a stock i, r_t^i, be generated from a mixture of K Gaussian distributions at each time, each one with a positive probability, and let S_t be a stochastic unobservable state variable

[7] Although switching regression was introduced in econometrics in the latest fifties, it was not after the article of Hamilton (1989) when this approach starts being widely used in economics and finance.

indicating if the current regime is j, where $j = 1, 2, ..., K$. S_t is assumed to follow a first order Markov process, that is, only the information in $t-1$ matters. At each point in time there may be a probability of a regime switch that is governed by switching probabilities. The basic idea underlaying this model is that the conditional mean and variance of the stock return are allowed to take different values according to the K distributions and the latent regime indicator S_t. One of the main advantages of this model is that it allows variation not only in the parameters but also in the functional forms. Therefore a model for stock return can be given by

$$r_t^i = \sum_{i=1}^{K} p_{jt}^i \mu_{jt}^i + e_t^i \tag{1}$$

where μ_{jt}^i is the mean in state j, e_t^i is a normal disturbances and $p_{jt}^i = \Pr(S_t = j \backslash \Omega_{t-1}; \Theta)$ is the conditional probability of being in regime j at time t. Ω_{t-1} is the information set in $t-1$ and Θ is the set of parameters in the means and variances in each state and the transition matrix that are to be estimated. Notice that p_{jt}^i varies through time as new information arrives, hence Markov switching model is a special case of a general finite mixture distribution model with time-varying weights. Moreover, p_{jt}^i also varies with each stock.

Gray (1996), derives a recursive representation for the regimen probability when $K = 2$, that it can be generalized for K regimes

$$p_{jt}^i = \sum_{h=1}^{K} \left(\frac{\rho_{hj}^i f_{ht-1}^i p_{ht-1}^i}{\sum_{g=1}^{K} f_{gt-1}^i p_{gt-1}^i} \right) \qquad \text{for} \quad j = 1, 2, ..., K \tag{2}$$

where f_{gt}^i is normal density function at time t conditional on being in state h and time *t-1* information, Ω_{t-1}, and ρ_{hj}^i is the transition probability, that is

$$\rho_{hj}^i = Pr(S_t = j / S_{t-1} = h)$$

The log-likelihood function with normal disturbances to be maximized is,

$$Log\left(r_t^i, \Theta\right) = \sum_{t=1}^{T} Log\left\{\sum_{j=1}^{K} p_{jt}^i f_{jt}^i\right\} \tag{3}$$

subject to

$$\sum_{j=1}^{K} p_{jt}^i = 1$$

where

$$f_{jt}^i = \frac{1}{\sqrt{2\pi v_j^i}} \exp\left(-\frac{\left(e_{jt}^i\right)^2}{2v_j^i}\right)$$

and v_j^i is the conditional variance in each state for the i stock.

3.2 The model for the excess return on the market portfolio

Firstly I set a simple model for the excess return on the Spanish market portfolio, r_t^m. I assume a three-regime model, $K = 3$.

$$r_t^m = \sum_{j=1}^{3} p_{jt}^m \mu_{jt}^m + e_t^m \tag{4}$$

the conditional mean in state j is define as ,

$$\mu_{jt}^m = X_{jt}' \beta_j^m \qquad \text{for } j = 1, 2, 3$$

where X_{jt} is a $(k_j\text{x}1)$ vector of explanatory variables in each state and β_j^m is a vector of parameters.

With this specification I consider, r_t^m, in state 1, determined by Spanish financial and macroeconomics variables that are collected in X_{1t}. In state 2, r_t^m is determined by the excess return on the world portfolio, $X_{2t} =$

$(r_1^w, r_2^w, ...r_t^w)'$, and in state 3, r_t^m is determined by the excess return on the Latin American portfolio, $X_{3t} = \left(r_1^l, r_2^l, ...r_t^l\right)'$.

According to this specification, the conditional mean at time t of the excess return on the market portfolio is a weighed sum of the conditional means in each state, being the probabilities of the states, time-varying weights. Thus, the effect of X_{jt} on r_t^m is time varying and measured by $p_{jt}^m \beta_j^m$.

Note that in this specification the effect of the excess return on the world portfolio on the excess return on the Latin American portfolio is disregarded. One explanation could be the following. Until early 90's emerging markets, and especially Latin American markets, were considered segmented markets and after the reforms undergone by this countries leading stock markets to be more free to investors, the perception about their segmentation has changed. However, the evidence presented in Bekaert and Harvey (1995) show that contrary to that perception, stock markets of Mexico and Chile, which were the firsts carrying out liberation process and account for 60% on Latin American market capitalization, have become less integrated than before. Along the same lines, Garcia and Ghysels (1998) find evidence in favor of local CAPM against an International CAPM for the same Latin American countries. On the other hand, Barari (2004) shows that during late 1980s and first half of the 1990s most Latin American Markets move towards regional integration and away from global integration. The article also points out that although the pace of global to regional integration accelered around mid-1990s, the timing suggests cross region contagion effect resulting from Asian crisis.

3.3 The model for portfolios and individual stock returns

In this section I develop a model for the excess return on portfolios and individual stocks, r_t^i. The model is basically the same as the previous section with the difference that in state 1 I introduce in the mean equation internal common risk factors. By controlling for these factors, I will be able to eliminate from the observed returns that part corresponding to the effect of common risks affecting all stocks. Let me collect the common risk factors in a $(n\text{x}1)$ vector F_t and specify the model as

$$r_t^i = p_{1t}^i \left(\alpha_1^i + F_t'\pi^i + X_{1t}'\beta_1^i\right) + p_{2t}^i \left(\alpha_2^i + X_{2t}'\beta_2^i\right) + p_{3t}^i \left(\alpha_3^i + X_{3t}'\beta_3^i\right) + e_t^i \tag{5}$$

With this specification stock returns are allowed to be affected in regimen 1 by the internal common risk factors and the financial and macroeconomic variables, in regimen 2 by the excess return on the world portfolio and in regimen 3 by excess return on the Latin American portfolio.

However, as it was shown in the previous section, the vector X_{1t}, X_{2t} and, X_{3t}, can affect the return of the market portfolio, therefore I assume that in general, the common risk factors can be modeled as

$$F_t = \sum_{j=1}^{3} P_{jt} \odot (\Pi_j X_{jt}) + U_t \tag{6}$$

Where $\odot$ represents element-by-element Hadamard multiplication, P_{jt} is a $(n\text{x}1)$ vector of probabilities of being in regimen j, Π_j is a $(n\text{x}k_j)$ matrix of parameters and U_t is a $(n\text{x}1)$ vector of orthogonal disturbances.

Substituting (6) in (5), the stock return can be written as[8]

$$\begin{aligned} r_t^i &= p_{1t}^i \left(\alpha_1^i + \sum_{j=1}^{3} X_{jt}' \gamma_{jt}^i + U_t' \pi^i + X_{1t}' \beta_1^i \right) + \\ &\quad p_{2t}^i \left(\alpha_2^i + X_{2t}' \beta_2^i \right) + p_{3t}^i \left(\alpha_3^i + X_{3t}' \beta_3^i \right) + e_t^i \end{aligned} \tag{7}$$

where

$$\gamma_{jt}^i = \Pi_j' \left(\pi^i \odot P_{jt} \right) \qquad \text{for } j = 1, 2, 3$$

Let me define

$$\begin{aligned} \delta_{jt}^i &= p_{1t}^i \gamma_{jt}^i \\ \lambda_{jt}^i &= p_{jt}^i \beta_j^i \\ \phi_{jt}^i &= \delta_{jt}^i + \lambda_{jt}^i \end{aligned} \tag{8}$$

Note that when common risk factors are taken into account, different effects come up. Therefore, δ_{jt}^i and λ_{jt}^i can be interpreted as time varying indirect and direct effects of X_{jt} on r_t^i respectively, being ϕ_{jt}^i a total effect.

[8]See apendix 1.

It can be seen in equation (7) that in state 1, when only internal factors account for, the stock returns are affected indirectly by the macroeconomic and financial variables and the excess return on the foreign portfolios through the common risk factors. That is measured by δ^i_{jt}. Note that δ^i_{jt} is doubly time varying through γ^i_{jt} and p^i_{1t}, while λ^i_{jt} is time varying because of p^i_{jt}. Finally we can call ϕ^i_{jt} as a time-varying β-risk

In order to calculate those effects, the equation (7) can be transformed as follows[9]

$$\begin{aligned} r^i_t &= p^i_{1t}\left(\alpha^i_1 + \sum_{j=1}^{3} \mathbf{1}'_n \left(\Lambda^i_j \odot X^*_{jt}\right)\mathbf{1}_{k_j} + U'_t\pi^i + X'_{1t}\beta^i_1\right) + \\ & \quad p^i_{2t}\left(\alpha^i_2 + X'_{2t}\beta^i_2\right) + p^i_{3t}\left(\alpha^i_3 + X'_{3t}\beta^i_3\right) + e^i_t \end{aligned} \tag{9}$$

where,

$$\begin{aligned} \Lambda^i_j &= \left(\pi^i \mathbf{1}'_{k_j}\right) \odot \Pi_j \\ X^*_{jt} &= P_{jt}X'_{jt} \end{aligned}$$

And $\mathbf{1}_n$ and $\mathbf{1}_{k_j}$ are (nx1) and (k_jx1) vector of ones respectively.

The model is estimated in two stages. First, I estimate the equation (6) and get the vectors P_{1t}, P_{2t}, P_{3t} and U_t. Next, I construct the matrix of variables X^*_{jt} and estimate the parameters of the equation equation (9) and the probabilities in each state, p^i_{jt}, for each stock. Finally, as I am especially interested in the time varying effects, I calculate λ^i_{jt} directly as in (8) and $\delta^i_{jt} = p^i_{1t}\left(\Lambda^i_j\right)' P_{jt}$,[10] and taking into account that if and only if the parameters in Λ^i_j and β^i_j are significant at 10% level, they account for the construction of δ^i_{jt} and λ^i_{jt}, otherwise they are supposed to be zero.

Note that many parameters are to be estimated. According to Aray and Gardeazabal (2004) most of the effect of the unexpected component of the macroeconomic variables are stock specified, thus, in general, the restriction $\Lambda^i_1 = \mathbf{0}_{k_1 \text{x} n}$ is imposed. This is a very strong assumption, but allows to reduced the set of parameters in nk_1 parameters. Thus, the financial and macroeconomic variables affect stock returns only directly, that is, I suppose that there is not indirect effect, thereby $\phi^i_{1t} = \lambda^i_{1t}$.

[9] See apendix 2.

[10] See apendix 3.

4 Data

I use monthly data from January 1985 to December 2000. Data for Spain is in Spanish pesetas. I use the excess return on the Spanish market portfolio (IGBM) and a set of ten size portfolios, being portfolio 1 the smallest stock and portfolio 10 the biggest stock.[11] I further extend the analysis to search for evidence respect to individual stocks. I am specially interested in the stock returns of the main Spanish firms operating in Latin American: BBVA, BSCH, ENDESA, IBERDROLA, REPSOL-YPF and TELEFONICA.[12] These firms are the most important in the Spanish stock market and, as it was pointed out in section 2, they have an important participation in Latin America, thus their stock returns are supposed to be affected by events undergone for at least the Latin American countries where they have business.

The Spanish financial variables that are included in X_1 are the dividend yield, DY, the term structure of interest rate, $TEIR$ and the macroeconomic variables are the unexpected components of inflation rate, UIR and the unexpected rate of growth of the industrial production, UIP as estimated Aray and Gardeazabal (2004). For the variables included in X_2 and X_3, I use the monthly US dollar returns for the world markets from Morgan Stanley Capital International (MSCI)[13] and a global Latin American markets returns is from Standard and Poor Emerging Market Database (S&P EMDB),[14] both in excess of the 30-day Eurodollar rate. Since I consider stock returns in Spanish pesetas, US dollar returns for the world and Latin America are expressed in this currency.

When I fit the model for portfolios and individual stock returns, I consider F as the three-factor of Fama and French (1993,1996). According to this model, returns are fairly well explained by three factors, the excess return on the market portfolio, r^m, the return on a portfolio of small size firms minus the return on a portfolio of big size firms, SMB, where size is the market value of outstanding shares and the return on a portfolio of high book-to-

[11] Thank Miguel Angel Martínez for providing the Data on Spanish Stock Market.

[12] Data for ENDESA is available since January 1988 and for REPSOL-YPF since June 1989.

[13] The MSCI Developed Market Indexs is market capitalization weighted, covering 23 developed countries and more than 2,600 securities.

[14] The Latin American global index is the Latin America 40 Index, which includes highly liquid securities, representing 30% of the estimated total market capitalization for the region's largest countries as of August 31, 1999. Companies from Mexico, Brazil, Argentina, and Chile are represented in the index.

market firms minus the return on a portfolio of low book-to-market firms, HML, where book-to-market is the ratio of the book value to the market value of a firm. The return on the size and book-to-market portfolios are meant to capture risk factors related to size and book-to-market equity.

5 Estimation Issues

In the estimation the standard errors reported are robust to heteroskedasticity. On the other hand, in order to ensure that the probabilities in each state be positive and lower than one, I use the reparametrization of the transition probabilities given by Hamilton and Susmel (1994).

Table 5 shows the parameter estimates of equation (4). It can be seen that the coefficient for the excess return on the Latin America portfolio is significant as it would be expected from intuition. Figure 1 shows the estimation of conditional probabilities. I get that the average value of the probability of being in state 3 is about 0.24. I split the sample period into two sub-samples, one from January 1985 to December 1995 and the other from January 1996 to December 2000. I get in the former an average value of 0.22 and in the later of 0.28, which is almost a variation of 27%, so Spanish and Latin American capital markets are becoming more related. There are peaks in the regime probability, all them related to important events undergone by Latin American countries. As Bekaert and Harvey (1995) and Bekaert, Harvey and Lumsdaine (2002) I will intend to identify these dates with events in Latin America. In the period from February 1986 to June 1987 Argentina and Brazil announced changes in the exchange rate policy and especially Argentina underwent a strong exchange rate crisis. In the same period, bank debt restructuring agreements was carried out by Brazil and Venezuela. In the period June 1987 to September 1987 Argentina, Chile and Mexico agreed to restructure their debts. In the same period, foreign direct investment was limited through special conditions in Brazil. Mainly positive news, in the period June 1992 to September 1992, came from the Latin American countries. Argentina, Chile, Mexico were upgraded by the international classification agency like Moody´s and Standard&Poor reflecting the good investors expectations in those emerging markets. Moreover, new financial instruments, like warrants for example, were introduced in the main countries and a consensus on NAFTA was announced. At the end of 1996 and the beginning of 1997, the international investors, especially the

Spanish investors, play a very important role in the privatization process and acquisition of private firms in Latin America, mainly in the bank and telecommunication sectors. At the end of the sample, there is another peak related again with acquisition of Latin American banks by Spanish banks and more flexible rule for investors in some stock and derivate markets were announced.

According to the evidence, the excess return on the Spanish market portfolio does seem to be affected by the excess return on the Latin American market portfolio. Although the mean of this effect is not so large as it is commonly believed (0,1459), it has increased in some periods as it was described before and the mean in the latest years has been larger (0.1702) comparing to the one of total sample period.

Figure 2 shows the total effect of the excess return on Latin American portfolio on the excess return on size portfolios, ϕ_{3t}^{i}, along the sample period from equation (9). It can be seen that most coefficients are very time varying and positive along the sample. Let me call small portfolios the portfolios 1,2,3, medium portfolios, 4,5,6,7 and the big portfolios 8,9,10. In general the time varying effect does not follow the same pattern for all portfolios. The smallest, except the portfolio 3 and the biggest portfolios are the most variable and the medium portfolio except for portfolio 6, the least variable.

Figures 3 shows the mean of the total, direct and indirect effects of the excess return on the Latin American market portfolio on size portfolios . It can be noticed that they are positive and the indirect effect is most important than the direct effect, that is, most of the total effect accrues indirectly through the common risk factors. It is also striking that, in general, the medium portfolio seem to be the less affected, while the small portfolios, except for portfolio 2, along with the big portfolios are the most affected.

Table 6 shows the mean of the total effect for each portfolio in different sub-samples. The first column shows the mean of the effect of the excess return on the Latin American portfolio on the excess return on portfolios for the period going from January 1985 to December 1995 and in the second column from January 1996 to December 2000. Although I can say by no means that such effects follow a trend according to figure 2, it should be noticed that the mean of the total effect in the latest five years rises for some portfolios and diminishes for others. In fact, the big portfolios have a larger mean effect while the small portfolios, except for portfolio 2, have lower mean effect. Regarding medium portfolios, 5 and 7 have a larger mean and 4 and 6 a lower mean. The third column shows the percent variation. Regardless the sign, in most cases it is very important, showing that in the latest years of the sample period the portfolios have been impacted by the excess return on the Latin American market portfolio, perhaps mainly in line with the increasing in the Spanish direct investment outflows to Latin America. The fourth and fifth column show the mean of the total effect of the excess return on the world portfolio. These effects are also positive, as it was expected, and the percent variations have been much smaller especially in the case of big portfolios.

Note that, according to the percent variations, the effect of Latin America relative to the effect of the world has increased for the big portfolios and diminished for the rest of portfolios except for the portfolio 2.

When the model for individual stocks is fitted, I find no effect of the excess return on the Latin American portfolio excess return on TELEFONICA and IBERDROLA. Figure 4 shows the mean of the total effect of excess return on the Latin American portfolio for those stocks for which I do get effect. As the size portfolios, the total effect is highly time varying. In some periods the effects on BBVA and ENDESA are negative. However, Bank stocks (BBVA and BSCH) follow basically the same pattern, mainly because the indirect effect is most important as it can be seen in figure 5, while ENDESA and REPSOL-YPF show very different ones. Although the mean of the total effect is positive for ENDESA , the mean of the indirect effect is negative and very low in absolute value. On the other hand, REPSOL-YPF is affected only directly as it is show in figure 5. Unfortunately, the sample of stocks is very small, however, at fitting the model for many stocks it should be expected heterogenous results as it has been the case with this small sample.

6 Conclusions

This paper has developed a regime switching model in order to measure of the effect of Latin American stock markets on the Spanish stock market. Using market indexes, I have found evidence favoring the intuition that the excess return on the Latin American portfolio affects the excess return on the Spanish market portfolio. Despite the important presence of Spanish companies in the region the effect is not so large as it is commonly believed. The measure shows a low average value along the sample, although in the period 1996-2000 it undergoes a moderate increase. I have also presented evidence for size portfolios and the stock returns of the main Spanish firms operating in Latin American. I have found that the portfolios are mainly affected indirectly through the common risk factors and, in general, the medium portfolios seem to be the less affected, while the small and big portfolios are the most affected. On the other hand, the effect of Latin America relative to the effect of the world has increased for the big portfolios. Regarding the stocks, I do not get a similar effects, for example, those stocks belonging to bank activity behave in a similar way, while others behave very different.

Appendix 1.

Define

$$P_j = \begin{bmatrix} P_{jt}^1 \\ P_{jt}^2 \\ P_{jt}^3 \end{bmatrix}$$

P_{jt}^f, for $j = 1, 2, 3$ and $f = 1, 2, 3$ is the conditional probability of state j for the factor f.

$$X_j = \begin{bmatrix} x_{j1} \\ x_{j2} \\ . \\ . \\ x_{jk_j} \end{bmatrix}$$

x_{jl} for $l = 1, 2, ...k_j$ is the variable l of the state j.

$$\Pi_j = \begin{bmatrix} \pi_{j1}^1 & \pi_{j2}^1 .... & \pi_{jk_j}^1 \\ \pi_{j1}^2 & \pi_{j2}^2 .... & \pi_{jk_j}^2 \\ \pi_{j1}^3 & \pi_{j2}^3 .... & \pi_{jk_j}^3 \end{bmatrix}$$

π_{jl}^f is the sensitivity of the factor f to the variable l of the state j.

$$\pi^i = \begin{bmatrix} \pi_1^i \\ \pi_2^i \\ \pi_3^i \end{bmatrix}$$

π_f^i is the sensitivity of the return of the stock i to the factor f .
Note that trasposing the equation (6) gives

$$F_t' = \sum_{j=1}^{3} P_{jt}' \odot \left(X_{jt}' \Pi_j' \right) + U_t'$$

and substituting in (5)

$$
\begin{aligned}
r_t^i &= p_{1t}^i\left(\alpha_1^i+\left(\sum_{j=1}^{3}P'_{jt}\odot\left(X'_{jt}\Pi'_j\right)+U'_t\right)\pi^i+X'_{1t}\beta_1^i\right)\\
&\quad +p_{2t}^i\left(\alpha_2^i+X'_{2t}\beta_2^i\right)+p_{3t}^i\left(\alpha_3^i+X'_{3t}\beta_3^i\right)+e_t^i\\
&= p_{1t}^i\left(\alpha_1^i+\left(\sum_{j=1}^{3}P'_{jt}\odot\left(X'_{jt}\Pi'_j\right)\right)\pi^i+U'_t\pi^i+X'_{1t}\beta_1^i\right)\\
&\quad +p_{2t}^i\left(\alpha_2^i+X'_{2t}\beta_2^i\right)+p_{3t}^i\left(\alpha_3^i+X'_{3t}\beta_3^i\right)+e_t^i
\end{aligned}
$$

It can be shown that $\left(\sum_{j=1}^{3}P'_{jt}\odot\left(X'_{jt}\Pi'_j\right)\right)\pi^i=\sum_{j=1}^{3}X'_{jt}\Pi'_j\left(P_{jt}\odot\pi^i\right)$ for $j=1,2,3$ as follows

$$
\left[\begin{bmatrix}P_{jt}^1 & P_{jt}^2 & P_{jt}^3\end{bmatrix}\odot\left(\begin{bmatrix}x_{j1} & x_{j2}.... & x_{jk_j}\end{bmatrix}\begin{bmatrix}\pi_{j1}^1 & \pi_{j1}^2 & \pi_{j1}^3\\ \pi_{j2}^1 & \pi_{j2}^2 & \pi_{j2}^3\\ \vdots & \vdots & \vdots\\ \pi_{jk_j}^1 & \pi_{jk_j}^2 & \pi_{jk_j}^3\end{bmatrix}\right)\right]\begin{bmatrix}\pi_1^i\\ \pi_2^i\\ \pi_3^i\end{bmatrix}
$$

$$
=\left[\begin{bmatrix}P_{jt}^1 & P_{jt}^2 & P_{jt}^3\end{bmatrix}\odot\begin{bmatrix}\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^1 & \sum_{l=1}^{k_j}x_{jl}\pi_{jl}^2 & \sum_{l=1}^{k_j}x_{jl}\pi_{jl}^3\end{bmatrix}\right]\begin{bmatrix}\pi_1^i\\ \pi_2^i\\ \pi_3^i\end{bmatrix}
$$

$$
=P_{jt}^1\pi_1^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^1+P_{jt}^2\pi_2^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^2+P_{jt}^3\pi_3^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^3
$$

Note that this expression can be written as

$$
\begin{aligned}
&\begin{bmatrix}\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^1 & \sum_{l=1}^{k_j}x_{jl}\pi_{jl}^2 & \sum_{l=1}^{k_j}x_{jl}\pi_{jl}^3\end{bmatrix}\left[\begin{bmatrix}\pi_1^i\\ \pi_2^i\\ \pi_3^i\end{bmatrix}\odot\begin{bmatrix}P_{jt}^1\\ P_{jt}^2\\ P_{jt}^3\end{bmatrix}\right]\\
&= P_{jt}^1\pi_1^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^1+P_{jt}^2\pi_2^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^2+P_{jt}^3\pi_3^i\sum_{l=1}^{k_j}x_{jl}\pi_{jl}^3 \qquad \text{(A.1)}
\end{aligned}
$$

Appendix 2.

For $j = 1, 2, 3$ it is shown that

$$\begin{aligned}
\Lambda_j^i &= \left(\pi^i \mathbf{1}'_{k_j}\right) \odot \Pi_j \\
&= \left(\begin{bmatrix} \pi_1^i \\ \pi_2^i \\ \pi_3^i \end{bmatrix} \begin{bmatrix} 1 & 1.... & 1 \end{bmatrix} \right) \odot \begin{bmatrix} \pi_{j1}^1 & \pi_{j2}^1.... & \pi_{jk_j}^1 \\ \pi_{j1}^2 & \pi_{j2}^2.... & \pi_{jk_j}^2 \\ \pi_{j1}^3 & \pi_{j2}^3.... & \pi_{jk_j}^3 \end{bmatrix} \\
&= \begin{bmatrix} \pi_1^i & \pi_1^i.... & \pi_1^i \\ \pi_2^i & \pi_2^i.... & \pi_2^i \\ \pi_3^i & \pi_3^i.... & \pi_3^i \end{bmatrix} \odot \begin{bmatrix} \pi_{j1}^1 & \pi_{j2}^1.... & \pi_{jk_j}^1 \\ \pi_{j1}^2 & \pi_{j2}^2.... & \pi_{jk_j}^2 \\ \pi_{j1}^3 & \pi_{j2}^3.... & \pi_{jk_j}^3 \end{bmatrix} \\
&= \begin{bmatrix} \pi_1^i \pi_{j1}^1 & \pi_1^i \pi_{j2}^1.... & \pi_1^i \pi_{jk_j}^1 \\ \pi_2^i \pi_{j1}^2 & \pi_2^i \pi_{j2}^2.... & \pi_2^i \pi_{jk_j}^2 \\ \pi_3^i \pi_{j1}^3 & \pi_3^i \pi_{j2}^3.... & \pi_3^i \pi_{jk_j}^3 \end{bmatrix}
\end{aligned}$$

$$X_{jt}^* = \begin{bmatrix} P_j^1 x_{j1} & P_j^1 x_{j2}... & P_j^1 x_{jk_j} \\ P_j^2 x_{j1} & P_j^2 x_{j2}... & P_j^2 x_{jk_j} \\ P_j^3 x_{j1} & P_j^3 x_{j2} & P_j^3 x_{jk_j} \end{bmatrix}$$

$$\Lambda_j^i \odot X_{jt}^* = \begin{bmatrix} \pi_1^i \pi_{j1}^1 P_j^1 x_{j1} & \pi_1^i \pi_{j2}^1 P_j^1 x_{j2}.... & \pi_1^i \pi_{jk_j}^1 P_j^1 x_{jk_j} \\ \pi_2^i \pi_{j1}^2 P_j^2 x_{j1} & \pi_2^i \pi_{j2}^2 P_j^2 x_{j2}.... & \pi_2^i \pi_{jk_j}^2 P_j^2 x_{jk_j} \\ \pi_3^i \pi_{j1}^3 P_j^3 x_{j1} & \pi_3^i \pi_{j2}^3 P_j^3 x_{j1}.... & \pi_3^i \pi_{jk_j}^3 P_j^3 x_{jk_j} \end{bmatrix}$$

$$\mathbf{1}'_n \left(\Lambda_j^i \odot X_{jt}^*\right) = \begin{bmatrix} \pi_1^i \pi_{j1}^1 P_j^1 x_{j1} + & \pi_1^i \pi_{j2}^1 P_j^1 x_{j2} + & & \pi_1^i \pi_{jk_j}^1 P_j^1 x_{jk_j} + \\ \pi_2^i \pi_{j1}^2 P_j^2 x_{j1} + & \pi_2^i \pi_{j2}^2 P_j^2 x_{j2} + & .... & \pi_2^i \pi_{jk_j}^2 P_j^2 x_{jk_j} + \\ \pi_3^i \pi_{j1}^3 P_j^3 x_{j1} & \pi_3^i \pi_{j2}^3 P_j^3 x_{j1} & & \pi_3^i \pi_{jk_j}^3 P_j^3 x_{jk_j} \end{bmatrix}$$

$$\begin{aligned}
\mathbf{1}'_n \left(\Lambda_j^i \odot X_{jt}^*\right) \mathbf{1}_{k_j} &= P_{jt}^1 \pi_1^i \sum_{l=1}^{k_j} x_{jl} \pi_{jl}^1 + P_{jt}^2 \pi_2^i \sum_{l=1}^{k_j} x_{jl} \pi_{jl}^2 + P_{jt}^3 \pi_3^i \sum_{l=1}^{k_j} x_{jl} \pi_{jl}^3 \\
&= \sum_{j=1}^{3} X'_{jt} \Pi'_j \left(P_{jt} \odot \pi^i\right)
\end{aligned}$$

Note that this is exactly the equation (A.1).

Appendix 3.

There are two ways of writing δ^i_{jt} for $j = 1, 2, 3$.

$$\begin{aligned} \delta^i_{jt} &= p^i_{1t}\Pi'_j \left(\pi^i \odot P_{jt}\right) \\ \delta^i_{jt} &= p^i_{1t} \left(\Lambda^i_j\right)' P_{jt} \end{aligned}$$

According to these expressions it can be notice that $\Pi'_j \left(\pi^i \odot P_{jt}\right) = \left(\Lambda^i_j\right)' P_{jt}$.

$$\begin{aligned} \Pi'_j \left(\pi^i \odot P_{jt}\right) &= \begin{bmatrix} \pi^1_{j1} & \pi^2_{j1} & \pi^3_{j1} \\ \pi^1_{j2} & \pi^2_{j2} & \pi^3_{j2} \\ \vdots & \vdots & \vdots \\ \pi^1_{jk_j} & \pi^2_{jk_j} & \pi^3_{jk_j} \end{bmatrix} \left(\begin{bmatrix} \pi^i_1 \\ \pi^i_2 \\ \pi^i_3 \end{bmatrix} \odot \begin{bmatrix} P^1_{jt} \\ P^2_{jt} \\ P^3_{jt} \end{bmatrix} \right) \\ &= \begin{bmatrix} \pi^i_1\pi^1_{j1}P^1_{jt}+ & \pi^i_2\pi^2_{j1}P^2_{jt}+ & \pi^i_3\pi^3_{j1}P^3_{jt} \\ \pi^i_1\pi^1_{j2}P^1_{jt}+ & \pi^i_2\pi^2_{j2}P^2_{jt}+ & \pi^i_3\pi^3_{j2}P^3_{jt} \\ \vdots & \vdots & \vdots \\ \pi^i_1\pi^1_{jk_j}P^1_{jt}+ & \pi^i_2\pi^2_{jk_j}P^2_{jt}+ & \pi^i_3\pi^3_{jk_j}P^3_{jt} \end{bmatrix} \\ &= \begin{bmatrix} \pi^i_1\pi^1_{j1} & \pi^i_2\pi^2_{j1} & \pi^i_3\pi^3_{j1} \\ \pi^i_1\pi^1_{j2} & \pi^i_2\pi^2_{j2} & \pi^i_3\pi^3_{j2} \\ \vdots & \vdots & \vdots \\ \pi^i_1\pi^1_{jk_j} & \pi^i_2\pi^2_{jk_j} & \pi^i_3\pi^3_{jk_j} \end{bmatrix} \begin{bmatrix} P^1_{jt} \\ P^2_{jt} \\ P^3_{jt} \end{bmatrix} = \left(\Lambda^i_j\right)' P_{jt} \end{aligned}$$

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Table 1. Spanish Foreign Direct Investments in LatinAmerica
1993-2000

Year	Millions Euros	% Spanish FDI outflows
1993	58	8,18
1994	1.940	62,51
1995	267	9,73
1996	1.528	45,60
1997	5.233	56,50
1998	6.235	50,19
1999	27.702	63,93
2000	21.902	42,34

Source: Dirección General de Comercio e Inversiones. Secretaría de Estado de Turismo y Comercio. Ministerio de Industria, Turismo y Comercio.

Table 2. Rank of Spanish Investment in Latin America
1996-2003

Argentina	1
Brazil	2
Bolivia	5
Chile	2
Colombia	2
Ecuador	4
El Salvador	4
Mexico	3
Peru	2
Dominican Rep.	2
Venezuela	2

Source: ECLAC Report, 2004: The Foreign Investment in Latin America and the Caribbean. The Economic Commission for Latin America an the Caribbean (ECLAC), United Nation.

Table 3. Spanish Transnational Corporations in Latin America

Corporation	Industry	Rank	Sells 2003
			(Million US dollars)
TELEFÓNICA	Telecommunications	2	14.112
REPSOL-YPF	Petroleum	7	7.345
ENDESA	Electrical	8	7.257
			Consolidated Assets 2004 (Million US dollars)
BSCH	Banking	1	73.039
BBVA	Banking	2	66.260

Source: ECLAC Report, 2004: The Foreign Investment in Latin America and the Caribbean. The Economic Commission for Latin America an the Caribbean (ECLAC), United Nation.

Table 4. Spanish trade balance with Latin America, 1993-2000.
(Millions Euros)

Year	Exports	% over total Exports	Imports	% over total Imports
1993	2.648	5,68	2.685	4,41
1994	3.520	6,01	3.124	4,22
1995	3.661	5,16	3.480	3,99
1996	4.220	5,40	3.585	3.81
1997	5.643	6,04	4.343	3,97
1998	6.361	6,37	4.370	3,56
1999	6.078	5,80	4.834	3,48
2000	7.012	5,65	6.352	3,75

Source: Dirección General de Comercio e Inversiones. Secretaría de Estado de Turismo y Comercio. Ministerio de Industria, Turismo y Comercio.

Table 5. MSM Estimation for the excess return on the market portfolio

	Estimate	Standard Error
State 1		
DY_t	-0.0015	0.1065
$TEIR_t$	-2.9283	2.2766
UIR_t	-1.8566	1.9112
UIP_t	-0.3958	0.1610
v_1	0.0011	0.0003
State 2		
r_t^w	1.5090	0.1210
v_2	0.0014	0.0003
State 3		
r_t^l	0.6079	0.1192
v_3	0.0019	0.0005

Table 6. Mean of the total effect on portfolios

	Latin America			World		
	1985-1995	1996-2000	Variation	1985-1995	1996-2000	Variation
Portfolios						
Size 1	0.1939	0.1676	-13.56	0.6458	0.8175	26.59
Size 2	0.0763	0.0945	23.85	0.6290	0.6736	7.09
Size 3	0.2518	0.2472	-1.83	0.8269	0.8451	2.20
Size 4	0.1160	0.0983	-15.26	0.6749	0.6587	-2.40
Size 5	0.0141	0.0169	19.86	0	0	-
Size 6	0.1206	0.0815	-32.42	0.6314	0.4928	-21.95
Size 7	0.1246	0.1342	7.70	0.6543	0.7844	19.88
Size 8	0.1126	0.1371	21.76	0.8154	0.8696	6.65
Size 9	0.1911	0.2002	4.76	0.6075	0.5824	-4.13
Size 10	0.1309	0.1672	27.73	0.5006	0.5449	8.85

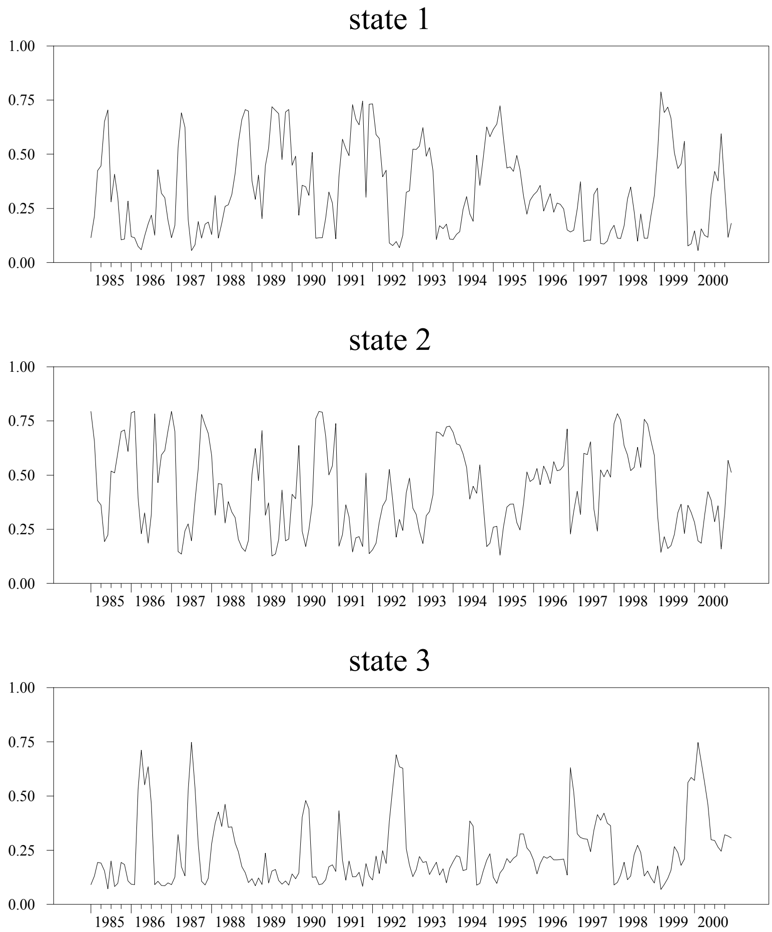

Figure 1: States probabilities for the excess return on the Spanish market portfolio.

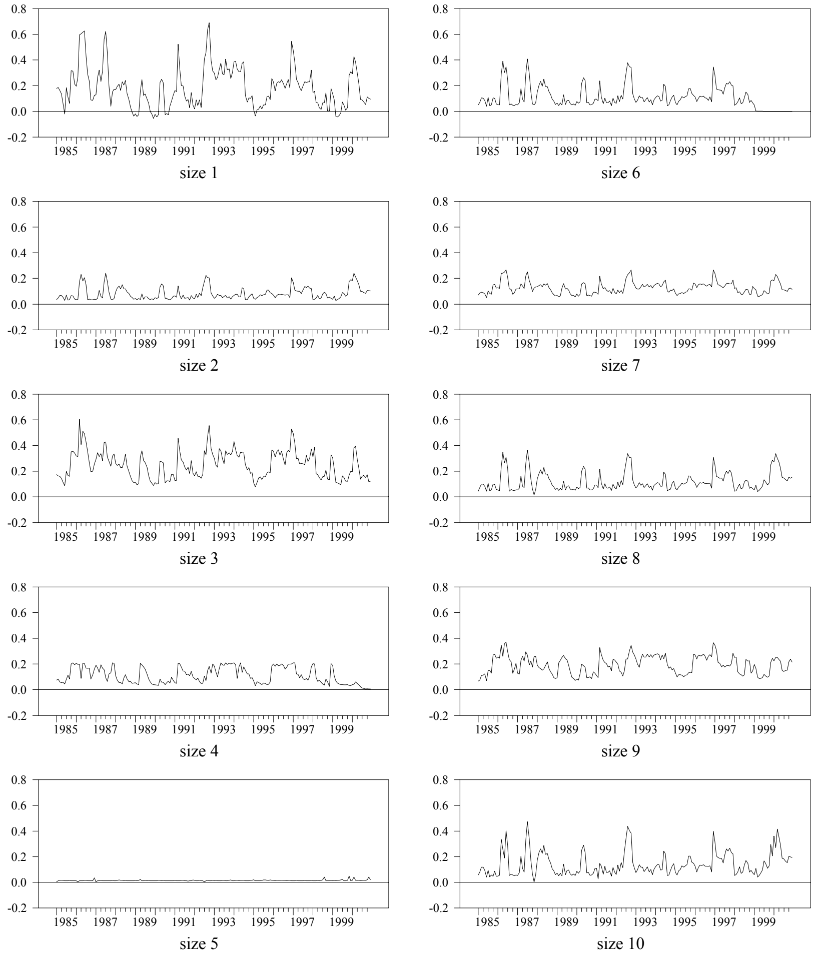

Figure 2: Time varying total effect of the excess return on the Latin American portfolio on the excess return on the Spanish size portfolios.

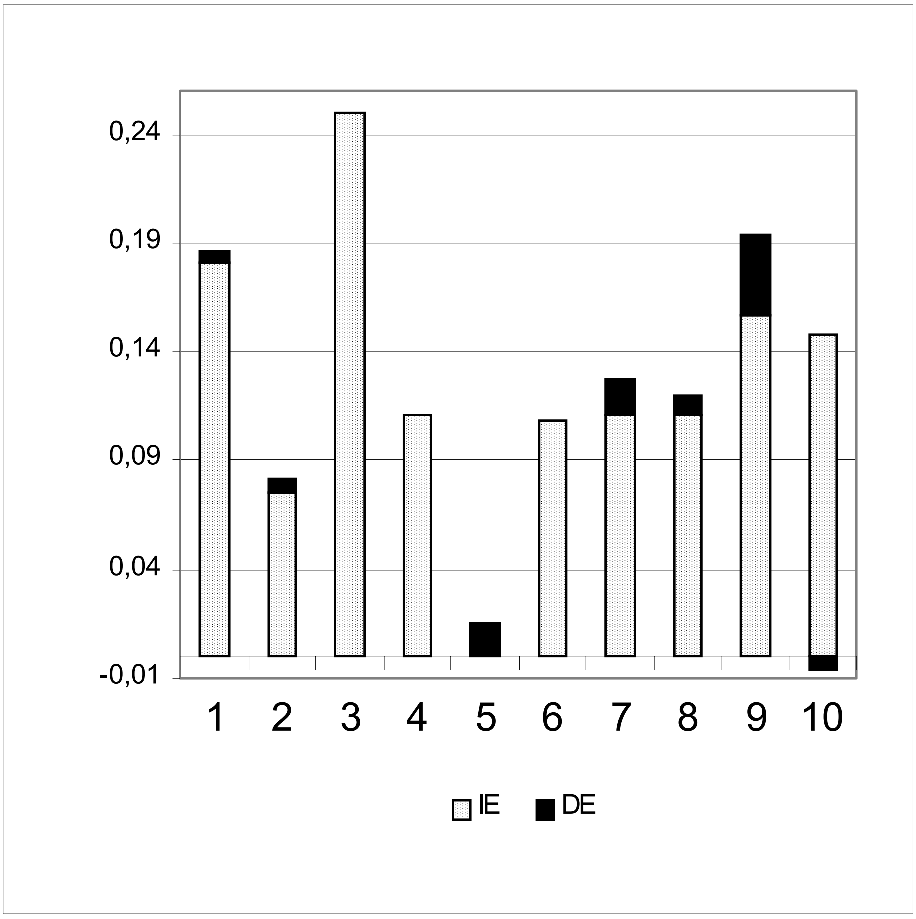

Figure 3: Indirect and direct average effect (IE and DE) of the excess return on the Latin American Portfolio on the excess return on the Spanish size portfolios.

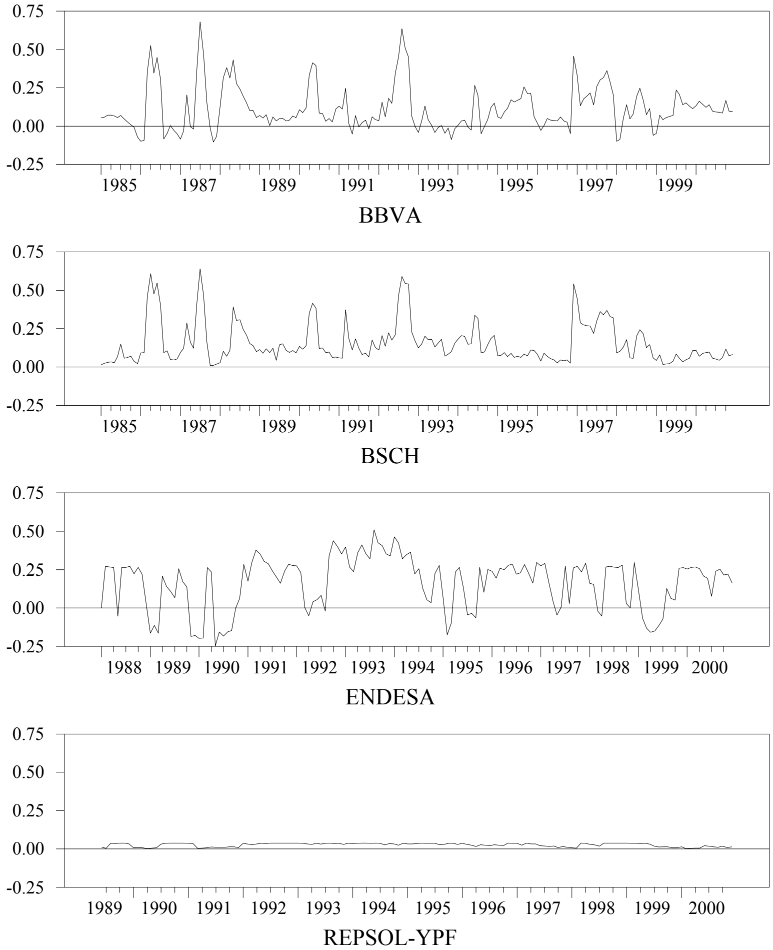

Figure 4: Time varying total effect of the excess return on the Latin American portfolio on the excess return on individual Spanish stocks.

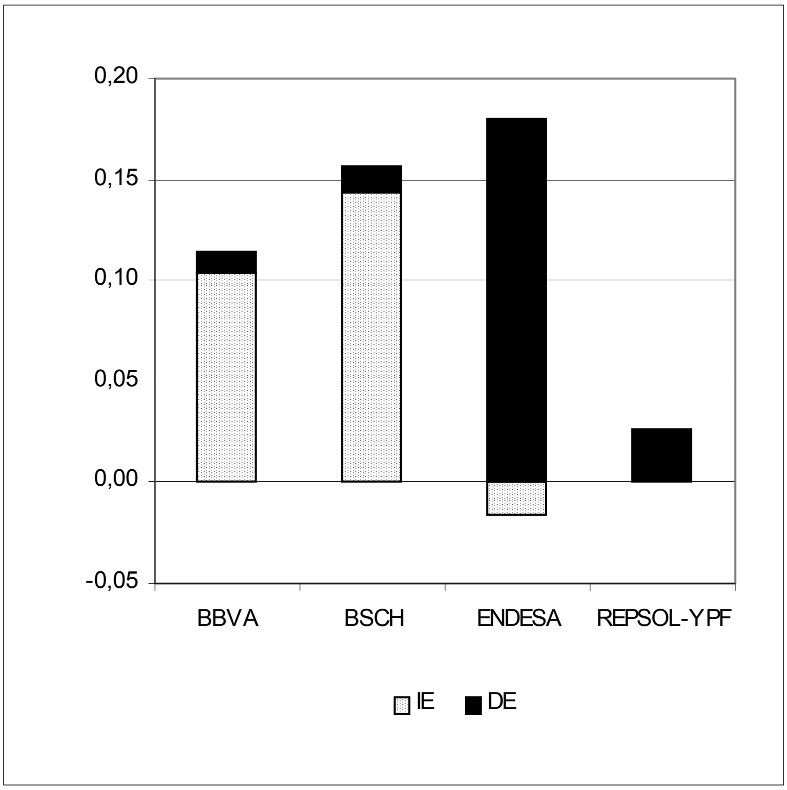

Figure 5: Indirect and direct average effect (IE and DE) of the excess return on the Latin American Portfolio on the excess return on the Individual Spanish stocks.