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The dual listing puzzle: evidence from the ADR market

1. Introduction

During the 1990s the number of firms and the amount of capital risen by companies in foreign markets increased significantly[1]. International listing, the fact of being listed simultaneously on a home and foreign market, should help firms to extend their capability to raise capital and be a signalling tool about the firm's prospects in their international business. Furthermore, dual listing enhances liquidity and improves trading of shares by foreign investors. American Depository Receipts (ADRs) are the most used means for foreign firms to be listed on US stock markets. By listing their shares through ADRs, US investors can buy foreign shares as domestic ones, thereby reducing the cost of investing in foreign securities.

This study analyses the benefits of dual listing for firms and investors from the perspective of integration-segmentation of capital markets and signalling theories. We consider the effects of dual listing on stock returns and systematic risk on the issuing market. Previous empirical research on dual listing has only studied dual listing for firms from developed capital markets that have listed their shares on other developed markets. These studies have obtained weak positive evidence about the benefits of dual listing. We have chosen emerging market firms (Mexican and Chilean) which listed their shares in the US through ADRs.[2] If dual listing is advantageous, the benefits would be larger for firms from emerging markets than for firms from developed capital markets. Firms in emerging markets could face some restrictions to raise capital due to the size of the local markets or the lack of a solid institutional investor base. If US investors are able to invest in foreign shares abroad, foreign emerging market firms could benefit by raising capital more efficiently.

Throughout this paper we analyse and answer the following questions: i) Is it beneficial for an emerging market firm to raise capital in the US through ADRs? ii) Are the benefits the same if the firm lists its shares on an organised stock exchange, such as the NYSE, or on an over-the-counter market? iii) Is the effect the same whether the firm's market is "integrated" or "segmented"

* Based on the master's thesis: "The dual listing puzzle: evidence from the ADR market". MSc in Banking & Finance, Université de Lausanne, November 1996. I am very grateful to Prof. Nils Tuchschmid of the Université de Lausanne and Prof. Michel Dubois of the Université de Neuchâtel, who guided me while writing my master's thesis. I am also grateful to Dori A. Flanagan, Vice-President of the Bank of New York who provided me with their database on ADRs. Finally, I would like to thank Professor Walter Wasserfallen and Prof. Andreas Grünbichler, referees of this journal, for their comments on an earlier draft of this paper. Julio Alberto Giró, UBS Asset Management Switzerland Ltd., Gessnerallee 3, P.O. Box, CH-8021 Zürich, Tel.: ++41 - 1 - 234 2989, Fax: ++41 - 1 - 235 7736, E-Mail: julio-alberto.giro@ubs.com.

relative to the US market? iv) What are the effects of dual listing on systematic risk ?
The effect of seasoned equity offerings (SEOs) on stock returns cannot be isolated from that of dual listing. Unfortunately, we are not able to distinguish both effects, creating thus a "joint test". Thus, we only focus our research on the effects of dual listing ignoring those of SEOs.
The structure of the paper is as follows: Section 2 reviews the dual listing literature. Section 3 introduces the ADR market. Section 4 presents and describes the data used in our study. Section 5 and 6 describe the hypotheses tested, explain the methodology and comment results both on stock price returns and systematic risk. Our conclusions are finally showed in section 7.

2. Literature Review

We can distinguish various approaches to dual listing. A group of authors has investigated the motives for dual listing. MITOO (1992) noted that firms dual list their shares overseas to obtain financial advantages to raise capital and to increase visibility. SAUDARAGAN'S (1988) found that the probability of listing abroad is linked to the firm size relative to its domestic capital market, and to the amount of revenue earned abroad. Other research has focused attention on the price and risk effects of firms already listed on domestic markets which list their shares on a foreign stock exchange. We can distinguish between US companies listing abroad and foreign companies listing in the US. Research examining the impact of US companies listing overseas showed average negative market response to dual listing in the short-term, resulting in a decrease in shareholder's wealth after the event. In other words, US firms face costs associated with overseas listing requirements that are higher than the benefits, as noted by HOWE and KELM (1987). Conversely, LEE (1991) suggests that US companies seeking internationalisation should not be discouraged to list overseas. Managers should be selective by choosing foreign exchanges as the impact of international listing is dependant on the exchange where shares are listed.
Various authors have treated dual listing theoretically and empirically in light of theories about *segmentation* and *integration* of capital markets. JORION and SCHWARTZ (1986) define *integration* as "a situation where investors earn the same risk-adjusted expected return on similar financial instruments in different national markets". If the required rate of return for a security on a local market differs from that on comparable securities on international markets, these markets are referred to as *segmented.* JORION and SCHWARTZ (1986) noted that only systematic risk relative to the *world market* should be priced with capital markets integration. Conversely, complete segmentation implies that only *national factors* should be captured by pricing models. Total or partial segmentation of markets is largely due to *barriers to investments.* Barriers to international capital flow hinder investment professionals to buy foreign stocks in their local markets. In this sense, the barriers cause total or partial segmentation of capital markets.[3] HOWE and MADURA (1990) examined the impact of dual listing on systematic risk for 34 foreign firms (French, German, Japanese and Swiss) which listed their shares in the US through ADRs from 1970 to 1984. The authors noted that if capital markets are segmented and dual listing is an effective mechanism for reducing segmentation, dual listing would have an effect on the stock systematic risk. Their research concluded that dual listing does not appear to cause significant shifts in risk regardless of the risk measure examined (domestic and international systematic risk.) Similarly, FOESTER and KAROLYI (1993) examined the degree of segmentation of Canadian and US stock markets. They found that changes in both total and systematic risk after international listing are not significant. Nevertheless, industry effects tend to explain different effects of interlisting mainly due to tax reasons for the resource industry as far as stock returns are concerned.

ALEXANDER, EUN and JANAKIRAMANAN (1988) tested the hypothesis that if capital markets are either completely or "mildly" segmented, international listing should lead to a reduction of expected price return. Their hypothesis is based on ERRUNZA and LOSQ's model (1985) for "mildly" segmented capital markets[4]. The risk premium of the security from the completely or mildly segmented country is expected to decline after the security becomes listed internationally as foreign investors will be able to purchase the security directly in their home market without restrictions. The magnitude of the reduction in expected returns will depend on the nationality of the firm, i.e. on the degree of segmentation of the local market with respect to the international market. Alexander EUN and JANAKIRAMANAN (1988) tested for dual listing of Canadian and non-Canadian firms on the US market. Results confirm the hypothesis by ERRUNZA and LOSQ (1985) that international listing brings in a change in equilibrium prices for firms from "mildly" segmented markets as confirmed with the non-Canadian subsample. Yet the decline in the "super risk premium" should lead to an increase in prices of securities from mildly segmented markets after dual listing, while the opposite was observed empirically. To summarise, the benefits of dual listing are not the same for firms in every country. Benefits of dual listing depend on the level of integration or segmentation between the firm's domestic and foreign target market.

3.The ADR Market

Depository receipts are the most effective instrument for firms seeking international listing. These instruments were established to facilitate foreign investment by large US and foreign investors. A Depository receipt is a negotiable certificate representing a company's publicly traded foreign security. Depository receipts are created when a broker purchases the company's shares on the home stock market and delivers them to the depository's local custodian bank who issues depository receipts. There are different types of Depository Receipt facilities. *Unsponsored Depository Receipts* are issued by one or more depositories in response to market demand, but without a formal agreement with the firm. There are few unsponsored programmes at the moment. *Sponsored Depository Receipts*, in contrast, are issued by one depository appointed by the company under a Depository Agreement or service contract. There are three levels of Sponsored Depository Receipts. Level-I Depository Receipts are the simplest method for companies to access foreign markets. Most of level-I depository receipts are sold to qualified institutional investors through private placements under rule 144A of the Securities and Exchange Commission (SEC). Companies issuing Level-I Depository Receipts are not required to comply with either Generally Accepted Accounting Principles (GAAP) or full disclosure with the SEC. Level-II and III ADRs enable firms to list their securities on organised exchange markets. The difference between Level-II and III facilities is that by issuing Level III Sponsored Depository receipts, firms are able to raise capital on the listing exchange in the future. Level II and III issues require full registration and reporting with the SEC and adherence to US GAAP. As a result, firms issuing level II or III

Table 1: Total Capital Raised in Public Depository Receipt Offerings – in USD million

1990	1991	1992	1993	1994	1995
1,742	4,612	5,258	9,538	11,030	8,461

Source: The Bank of New York – The complete Depository Receipt Listing – Data as of December 1995.

Table 2: Trading volume for Depository Receipts by country listed on exchanges in 1995

Country	Depository Receipt Dollar Trading Volume by Country	Depository Receipt Share Trading Volume by Country
UK	24.5%	24.4%
Mexico	**19.7%**	**28.8%**
Netherlands	13.4%	5.7%
Sweden	7.0%	7.1%
Argentina	5.7%	7.2%
Finland	5.3%	2.6%
Chile	**4.2%**	**3.4%**
Spain	3.3%	2.6%
Australia	2.3%	3.5%
Other	14.6%	14.8%
Total	100.0%	100.0%

Source: The Bank of New York – The complete Depository Receipt Listing – Data as of December 1995.

ADRs convey more information to the market than that issuing level I ADRs. Throughout our work we refer to Level I ADRs as "144A" issues and Level II and II ADRs as "NYSE" issues (as the majority of the issues in our sample are listed on the NYSE.)

The history of ADRs dates back to 1927, when J.P. Morgan created the first ADR for Seldfridge's stores, the UK retail firm. During the 1950s several large multinational corporations started to list in the US market through ADRs. During the 1990s firms from emerging markets joined the US market through those instruments. Depository receipts trade freely either on organised exchanges such as the NYSE or AMEX or on the over-the-counter market. Settlement practices for ADRs are identical to those of US securities. At present there are approximately 1,450 Depository Receipt programmes for companies from nearly 50 countries.

The amount of capital that firms raised through Depository Receipts offerings has gained momentum over the last years as shown in table 1. The devaluation of the Mexican Peso hurt capital rising activity in emerging markets during the first half of 1995. The market for new issues of Depository receipts has been dominated by Latin American and Asian firms from 1993 to 1994. Although the hot market for Emerging Market corporations slowed its activity after the Mexican Peso devaluation, it has regained momentum since 1996.

Table 2 shows ADR volume by country. The Mexican market represented 19.7% of total dollar trading dollar volume by country traded on Depository Receipts during 1995. Mexico was the second country in terms of dollar volume in ADRs in 1995 after the UK, one of the most developed capital markets in the world and a very close

Table 3: Depository Receipt Share volume by Exchange – in USD billion

Year	NYSE	NASDAQ	AMEX
1993	169.2	29.3	2.2
1994	212.7	33.3	2.0
1995	225.5	49.4	1.1

Source: The Bank of New York – The complete Depository Receipt Listing – Data as of December 1995.

market to US investors. Furthermore, Mexican Depository Receipts were those with higher turnover measured by number of shares exchanged during 1995. We also highlighted Chile, whose dollar trading volume represented 4.2% of the ADR market volume measured in USD in 1995.
The NYSE is the market with the largest trading volume of Depository Receipts as we can see from table 3. Only sponsored Level-II or III Depository Receipts are allowed to trade on the NYSE, requiring a high level of information disclosure by corporations.
The cost of issuing ADRs is related to that associated with the target stock exchange. The New York Stock Exchange requires certain standards, policies and procedures for listing of non-US corporations. Typical listing costs amount to $ 100,000 on NYSE, to $ 25,000 on the NASDAQ and to $ 10,000 on the AMEX.

4. Sample selection and Description

We have chosen a sub-sample of Chilean and Mexican firms that performed seasoned equity offerings through American Depository Receipts (ADRs) during the period 1990–1995. In addition to reporting our results separately by ADR type or targeted market, we also split our sample by country. We label the Chilean market as "segmented" as there are certain investment restrictions for foreigners who buy Chilean stocks in that country. A foreign investor who buys Chilean stocks locally should maintain a reserve equivalent to 30% of its investment for at least one year and pay a 35% withholding tax on capital gains and dividends, thereby constituting a barrier for foreign investment. The reasons for assuming that Mexico and the US are "integrated" markets are the economic and financial ties between both countries. In addition to economic integration through NAFTA, US investors have been active in the Mexican market for many years. Mexican firms were among the first emerging market firms to issue ADRs.
The Mexican Stock Exchange was founded in 1894 and is the only stock exchange in Mexico. At present it is the second largest exchange in terms of market capitalisation in Latin America with a market capitalisation of USD 141 bn as of June 30, 1997. It is conducted exclusively by the 33 brokerage firms that are stockholders of the exchange. As of year-end 1996, there were 193 companies listed on the Mexican Stock Exchange, excluding mutual funds. Among the companies listed, 43 firms had ADR programmes outstanding. The Santiago Stock Exchange, established in 1893, is a private company owned by 46 shareholders. As of December 1996, 326 companies had listed shares on the Santiago Stock Exchange, which account for approximately 72% of all amounts traded in Chile (the remainder is traded on an electronic market). The market capitalisation of the Santiago Stock Exchange totalled USD 85 bn as of June 30, 1997. There are 22 Chilean firms with outstanding ADR programmes at present.
We were constrained to reduce our sample because of the lack of quantity or quality of data about offerings. From a total of 88 Mexican De-

Table 4: Average size of ADR issues (1990–1995) – Size in USD million

Country	Mexico					Chile				
Issue	Mean	Median	Max.	Min	Issues	Mean	Median	Max.	Min	Issues
NYSE	363.8	151.4	1243.3	55.2	11	72.2	66.5	127.4	26.5	16
144A	133.4	71.4	461.0	30.4	9	N/A	N/A	N/A	N/A	N/A

Table 5: Timing of ADR issues (1990–1995) – Size in USD million

Year of Issue	Mexico				Chile			
	Total	Mean	Median	Issues	Total	Mean	Median	Issues
1990	N/A	N/A	N/A	N/A	98.3	98.3	98.3	1
1991	1,634.0	272.3	126.2	6	N/A	N/A	N/A	N/A
1992	2,220.2	246.7	75.7	9	56.5	56.5	56.5	1
1993	395.0	98.7	79.0	4	267.5	66.9	64.1	5
1994	816.8	90.8	55.4	8	531.0	75.9	68.4	7
1995	67.3	33.7	33.7	2	113.8	56.9	56.9	2
Total Issues	5,133.3			29	968.8			15

pository receipts we have chosen only 20 seasoned equity offerings. The selection process was similar for Chilean firms, resulting in keeping 16 out of 20 firms with outstanding ADR facilities. The small number of observations in our sample could cause a selection bias. The information about ADR issues was provided by The Bank of New York, a major Depository Agent; stock data were collected from Datastream. We selected only ADRs that had performed seasoned equity offerings. Many firms issuing ADRs do so simultaneously with their IPOs. We have explicitly excluded IPOs and right offerings which are not subject of our study, and those offerings for which we do not have enough data prior to the listing week to calculate a return benchmark.

Table 4 contains information relative to the sample firms. It shows the average size of issues, measured by the mean and median amount of capital issued. We also include maximum and minimum issue size by class. As few stock issues represent a large portion of total market capitalisation, the median, instead of the mean statistic, seems to be a more realistic measure of the offering size. Among firms that marketed issues internationally, the larger the volume the more likely the firm lists the issue on the NYSE. The Chilean sample shows less dispersion among issue size than the Mexican one. Not surprisingly, Chilean firms only issued level-II or III ADRs. This decision was taken in order to overcome the relatively segmented nature of their market.

Table 5 presents the number of issues chronologically. Timing is an important factor as firms tend to benefit from "hot markets" issuing shares when their firm is highly valued by the market. We see clearly that Mexican firms issues were large in the early 1990s, while most of Chilean largest issues took place in 1994 and 1995. Due to the large ties with the US, it seems logic that the Mexican market led the process of dual listing among other developed stock markets.

The event of dual listing is not largely clustered in a specific calendar time. This is good news for our testing procedure, as we will find that security returns do not cross correlate to the security forecast error in the event period. We have chosen weekly frequencies of returns instead of daily or monthly frequencies. This choice can be considered as a trade-off between "normality and availability" as monthly returns are more likely to be normally distributed, and we only counted with a small sample due to the reduced time-span.

We do not know with precision the *announcement date* of dual listings. In other words, our event date is unknown to us. However, we counted with the *first listing date*. We set week $t = 0$ as the effective first listing date. We consider the week in which the effective dual listing took place as week $t = 0$. We have considered an *observation period*

or *event window* which elapses ten weeks before and after the event date. Its purpose is to see whether stocks perform abnormally during the selected window, which includs the announcement date.

5. Effects of dual listing on stock price returns

5.1 Hypothesis tested

Hypothesis 1:
We assume that NYSE issues convey a larger degree of information than 144A issues due to the characteristics of the registration process.
H_o: If the improvement of information disclosure is not material, post-listing returns will be similar regardless of the market to which issues were targeted.
H_1: If the dual listing process is associated with a larger degree of information disclosure, NYSE issues would be a *signalling* device for firms, causing stock returns to increase after dual listing. If dual listing is a signalling mechanism, the effects will be lower for 144A issues.

Hypothesis 2:
If markets are partially or completely segmented, the stock mean expected return should be lower after dual listing, as the segmentation cost disappears. After dual listing, international investors no longer face investment restrictions as they can trade foreign stocks in their home market. The risk premium associated with the "cost" of segmentation is expected to vanish. As a result, stock prices should increase in the post-dual listing period. If markets are not segmented, mean returns should not change significantly after dual listing.
H_o: If markets are not segmented, no significant change in stock prices will be recorded after dual listing.
H_1: If markets are partially or totally segmented (before dual listing), stock prices should increase after dual listing.

5.2 Methodology

Our study follows the traditional methodology for event studies developed by Brown and Warner (1980, 1985). We aim at testing the impact of dual listing on stock price returns. As noted by Brown and Warner (1980), event studies provide a direct test of market efficiency since the persistency of nonzero abnormal returns is inconsistent with the Efficient Market Hypothesis. We expect, therefore, to find an abnormal performance of stock prices only during a short period of time. We want to see if actual returns containing the information set y_i at time i, are higher than expected returns calculated with a pricing model which does not incorporate the information set. Formally,

$$\begin{aligned} &H_0: R_j - E(R_j) = AR_t = 0 \quad \text{vs} \\ &H_1: R_j - E(R_j) = AR_t \neq 0 \end{aligned} \tag{1}$$

Where,
$E(R_j)$ is the expected return of stock j and
R_j is the actual return of stock j.
AR_t stands for abnormal return of stock j.

A stock performance can only be considered abnormal relative to a particular *benchmark*. In order to specify the benchmark, we use a pricing model to generate *normal* returns. The market model appears to be the most appropriate model to calculate our benchmark. It takes into account systematic risk of stock i measured by beta in the pricing of normal returns. $AR_{i,t}$ is calculated with the market model.[5] Stock returns are regressed against market returns as follows:

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t} R_{m,t} + \varepsilon_{i,t} \tag{2}$$

Where, $R_{i,t}$ is the market return for stock i at time t, $R_{m,t}$, is the domestic market return at time t. Market returns were calculated in local currency. The market model is calculated only during the estimation period (t: weeks –30 to +30) excluding the observation period (t: weeks –10 to +10) with OLS regressions.

By subtracting actual returns from expected returns, we calculate abnormal returns for every security each week during the observation period. We test the significance of cumulative residuals. In order to do so, we denote $CAR_{i,t}$ as cumulative abnormal returns. Where d_{1i} and d_{2i} are the first and the last days, respectively, of a particular period for firm i. The abnormal price return for firm i over a particular period is given by the cumulative abnormal return:

$$CAR_{i,t} = \sum_{t=d_{1i}}^{t=d_{2i}} AR_t \qquad (4)$$

Under the null hypothesis of no abnormal performance, cumulative abnormal returns are expected to be zero. It is necessary to aggregate the returns of the portfolio of securities of n firms over a particular period to perform a cross-sectional analysis. Its abnormal price performance is given by the mean cumulative abnormal return MCAR:

$$MCAR = \frac{1}{N} \sum_{i=n}^{N} CAR_i \qquad (5)$$

To test the statistical significance of MCAR we employ t-stats on our samples. To do so, we standardise the abnormal returns for each firm:

$$SAR_{i,t} = \frac{AR_{i,t}}{s_{j,t}} \qquad (6)$$

where $s_{i,t}$ is estimated with the standard deviation of the sample.

We cumulate all the standardised abnormal returns for all securities. In order to perform a cross-sectional test, we give the same weight to each security in the cumulative standard abnormal return:

$$MSAR_{i,t} = \frac{1}{N} \sum_{i=1}^{N} SAR_{i,t} \qquad (7)$$

where $MSAR_t$ is the mean standardised abnormal return.

After cumulating standard abnormal returns, our null hypothesis becomes:

$$H_0: MSAR_t = 0 \quad \text{vs} \quad H_1: MSAR_t \neq 0$$

Having set the hypothesis that standardised abnormal returns are normally distributed: $SAR_{i,t} \sim N(0, \sigma^2)$, then mean average returns are a linear combination of normal distributions. Therefore, $MSAR_t$ follows the normal distribution:

$$MSAR_{i,t} \sim N\left(0, \frac{\sigma^2}{T}\right)$$

Mean standardised abnormal returns at date t ($MSAR_t$) will be distributed according to a z-statistic. They follow a Student distribution with n–1 degrees of freedom, which is tested bilaterally.

$$z = \frac{MSAR_t - 0}{(\sigma / \sqrt{N})} \sim T_{N-1} \qquad (8)$$

Where σ is estimated from $s_{j,t}$, the sample variance.

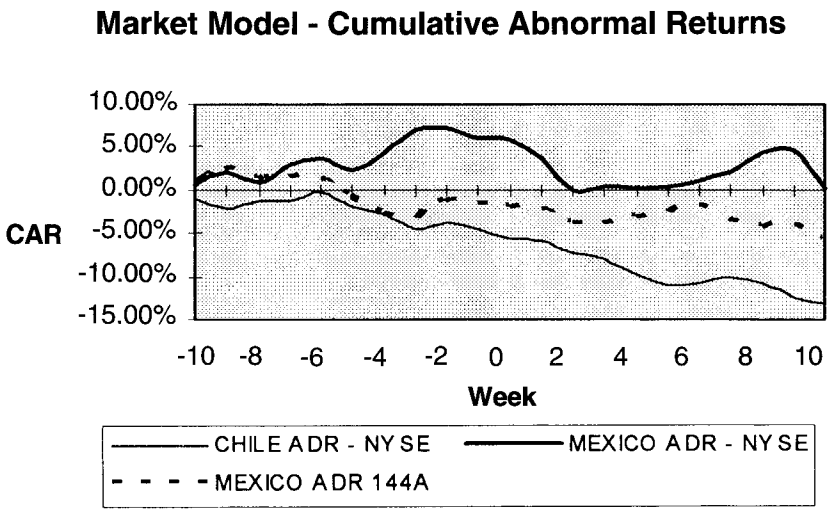
The z-test imposes us strong restrictions. In order for the z-statistics to be distributed Student-t, stock price returns must be normally distributed. The small size of our sample casts serious doubts about the possibility of accepting the normal distribution of abnormal returns and hence the above tests lack of power by construction. Furthermore, few outliers (observations that take extreme values) can bias the distribution. As a result we proceeded to bootstrap our samples to correct for this test bias, and tested for their significance with parametric tests.[6]

5.3 Results

The graph below shows weekly abnormal cumulative returns calculated with the market model.[7] The local performance of Mexican ADRs depends on the market to which the issue was targeted.

During the fourth week of the application process, the NYSE usually announces new firm issues. As from the fourth week prior to the issue, the aver age return of NYSE issues increased. The market

Figure 1: Market Model – Cumulative abnormal performance



reaction for NYSE firms seems logical as eligibility for listing on the NYSE is interpreted as good news by market participants (a signalling mechanism.) Unfortunately the passage of time erodes the positive effects of dual listing. Shareholders' wealth remained unchanged at the end of the observation period (10 weeks) for firms issuing ADRs on the NYSE. As we can see in table 6, cumulative abnormal returns lack of statistical significance. This trend in results is in line with the majority of event studies testing dual listings, such as those of ALEXANDER, EUN and JANAKIRAMAN (1988) or FOERESTER and KAROLYI (1993). Results for those firms with private placements in the US under rule 144A differ from issues targeted to the NYSE. The share price of 144A issues starts to decline even before the announcement week (between the second and first weeks). However, none of the abnormal returns are statistically significant. The information content of an international issue under rule 144A is not as good as for NYSE issues. In this way, results are likely to confirm the signalling hypothesis, validating hypothesis 1.[8]

Chilean ADRs (which we suppose belong to a partially segmented market) strongly depreciate after being listed on the NYSE. This effect begins four weeks prior to the effective listing date, in line with the announcement date of the offerings. Once again results lack of statistical significance. Our results contrast what would predict the model by ERRUNZA and LOSQ. It remains as an open question why Chilean ADRs behaved in this way after international listing. After dual listing more foreign investors would be able to buy Chilean equities through ADRs due to the decline in the risk premium associated to the level of segmentation. A possible explanation for the underpricing of Chilean issues is the fact that local shares could remain even more segmented after dual listing of blue chips. As a result, investors could perceive the potential risk of a market downward price correction which would impact the future price of the dual listing stocks through its systematic risk. Bootstrapped returns (right columns in table 6), show a higher level of significance of returns for Mexican domestic issues across the whole observation window as well as for post-listing returns for Chilean ADR issues. The significance of abnormal returns increases when using bootstrapping specially for Chilean NYSE issues as seen in table 6.

Table 6: Mexican Stocks – abnormal weekly cumulative returns – parametric tests

Abnormal cumulative returns, percentage of positive returns and z-statistics (cumulative returns) – Mean and z-stats (bootstrapped cumulative returns)

	Chile ADR – NYSE (n=16)					Mexico ADR – NYSE (n=11)					Mexico ADR 144A (n=9)				
	Cumulative abnormal returns			Bootstraped returns		Cumulative abnormal returns			Bootstraped returns		Cumulative abnormal returns			Bootstraped returns	
Date	Mean	%>0	z-stat	Mean	z-stat	Mean	%>0	z-stat	Mean	z-stat	Mean	%>0	z–stat	mean	z–stat
–10	–0.97%	38%	–0.76	–0.66%	***–2.21***	0.55%	73%	0.38	0.34%	0.79	0.42%	67%	0.35	0.83%	***2.25***
–9	–2.19%	44%	–1.05	–1.53%	***–2.73***	2.00%	64%	1.38	1.40%	**1.96**	2.44%	67%	1.66	2.53%	***3.89***
–8	–1.45%	38%	–0.72	–0.94%	–1.23	0.79%	45%	0.32	–0.37%	–0.32	1.43%	67%	0.88	1.54%	1.78
–7	–1.46%	31%	–0.69	–0.82%	–0.80	3.10%	45%	1.14	2.25%	1.48	1.63%	67%	0.85	1.54%	1.35
–6	–0.73%	38%	–0.32	–0.16%	–0.13	3.65%	73%	**1.86**	3.22%	1.60	1.27%	56%	0.45	1.25%	0.82
–5	–2.32%	31%	–0.83	–1.23%	–0.82	2.36%	55%	0.96	2.13%	0.90	–0.60%	44%	–0.22	–0.66%	–0.34
–4	–3.28%	31%	–0.88	–2.29%	–1.17	4.43%	64%	1.32	4.11%	1.53	–2.67%	33%	–0.76	–2.66%	–1.06
–3	–5.13%	38%	–0.88	–4.20%	–1.63	6.87%	64%	**2.13**	6.55%	**2.16**	–3.21%	33%	–0.76	–3.37%	–1.11
–2	–4.43%	38%	–0.75	–3.51%	–1.24	7.30%	64%	**2.05**	7.15%	**2.15**	–1.26%	56%	–0.29	–1.58%	–0.45
–1	–5.12%	44%	–0.84	–4.34%	–1.45	6.03%	64%	1.57	6.17%	1.68	–1.40%	56%	–0.34	–1.89%	–0.52
0	–6.49%	38%	–0.82	–5.08%	–1.45	5.82%	55%	1.42	6.09%	1.51	–1.98%	44%	–0.46	–2.24%	–0.54
1	–6.64%	38%	–0.79	–5.10%	–1.34	3.80%	55%	0.90	4.01%	0.89	–2.05%	44%	–0.53	–2.39%	–0.54
2	–8.30%	38%	–1.00	–6.70%	–1.68	–0.04%	45%	–0.01	0.27%	0.05	–3.86%	33%	–0.99	–3.90%	–0.82
3	–9.04%	38%	–1.06	–7.40%	–1.73	0.49%	64%	0.11	0.27%	0.05	–3.73%	56%	–0.98	–3.69%	–0.72
4	–10.93%	31%	–1.27	–9.25%	**–2.01**	0.25%	55%	0.05	0.18%	0.03	–3.19%	56%	–0.74	–2.97%	–0.53
5	–12.18%	31%	–1.45	–10.53%	***–2.20***	0.53%	64%	0.11	0.01%	0.00	–2.54%	44%	–0.58	–2.31%	–0.38
6	–11.91%	38%	–1.35	–10.55%	**–2.08**	1.02%	64%	0.20	0.68%	0.10	–1.76%	44%	–0.38	–1.52%	–0.23
7	–11.23%	38%	–1.38	–9.75%	**–1.84**	1.94%	64%	0.35	1.59%	0.23	–3.31%	44%	–0.71	–3.15%	–0.46
8	–12.19%	38%	–1.42	–10.67%	**–1.90**	4.28%	82%	0.77	3.75%	0.51	–4.34%	33%	–0.97	–4.03%	–0.57
9	–13.70%	0%	–1.62	–12.14%	**–2.04**	4.60%	73%	0.83	4.09%	0.54	–3.98%	22%	–0.95	–3.58%	–0.48
10	–14.47%	0%	–1.58	–12.69%	**–2.01**	0.27%	73%	0.04	–0.11%	–0.01	–5.71%	33%	–1.16	–5.36%	–0.68

Note: z-statistics in **bold** are significant at 10% level while those in ***bold italics*** are significant at 5%.

Table 7: Mexican NYSE vs. 144A – Difference in cumulative abnormal performance

Date	Market model NYSE–OTC		Market Model with dummy NYSE–OTC	
	Mean	t-stat (mean)	Mean	t-stat (mean)
–10	–0.18%	–0.15	0.14%	0.11
–9	–0.75%	–0.53	–0.43%	–0.29
–8	–1.14%	–0.73	–0.63%	–0.39
–7	0.76%	0.42	1.47%	0.77
–6	1.62%	0.61	2.37%	0.84
–5	2.20%	0.85	2.96%	1.07
–4	6.20%	1.84	7.09%	**2.03**
–3	9.15%	**2.20**	10.08%	***2.38***
–2	7.78%	**1.89**	8.56%	**2.00**
–1	6.44%	1.62	7.42%	1.79
0	6.44%	1.62	7.80%	1.81
1	4.54%	1.25	5.85%	1.52
2	2.50%	0.67	3.82%	0.98
3	2.90%	0.81	4.23%	1.11
4	1.86%	0.53	3.43%	0.80
5	1.78%	0.49	3.07%	0.69
6	1.59%	0.38	2.78%	0.60
7	3.77%	0.88	5.26%	1.12
8	7.15%	1.83	8.62%	1.92
9	7.13%	**2.05**	8.58%	**2.05**
10	4.60%	1.15	5.99%	1.22

Table 7 compares the increase in shareholder's wealth between NYSE and 144A issues. The difference in cumulative mean of abnormal returns is only statistically significant for the third week before listing. Firms convey a better signal to the market by listing ADRs on the NYSE rather than issuing ADRs on OTC markets. This difference is statistically significant around the announcement week which takes place four weeks prior to the effective listing date of a NYSE issue. This wealth difference seems to offset the high information cost required by the SEC and the NYSE. Yet the significance of these results is concentrated in a short time interval and benefits decline over time.

6. Effects of dual listing on systematic risk

6.1 Hypothesis tested

Hypothesis 3:
When capital markets are segmented, the pricing of a security only depends on domestic factors measured by the domestic beta. In such a context, international risk factors are not priced. As a result of the reduction in market segmentation, the pricing of securities of stocks from segmented markets is expected to change after dual listing.
H_o: If capital markets are not segmented, domestic betas and international betas will not be modified after dual listing.

H_1: If capital markets are segmented, domestic betas will decline and international betas will increase after dual listing.

6.2 Methodology

Following HOWE and MADURA (1990) we test for whether dual listing causes changes in systematic risk. Systematic risk is captured by the beta of the stock, which measures the covariance of the individual stock returns with the domestic market returns. In order to calculate betas we regress domestic stock returns on local market index returns using a single index market model as follows:

$$R_{jt} = \alpha_{it} + \beta_{j,t} R_{m,t} + \varepsilon_j$$

The first test consists of measuring whether domestic betas change after dual listing. To do so we test if there is a structural change in betas comparing pre- and post-listing betas. The null and alternative hypothesis are given by:

$$H_0: \beta_1 = \beta_2 \quad \text{vs} \quad H_1: \beta_1 \neq \beta_2$$

Where, β_1 is the beta of firm i during the pre-listing estimation period and β_2 s the beta of firm i during the post-listing estimation period. For each firm, we calculate an F-test following the methodology proposed by Chow (Chow Test.)

$$F(J, n-k) \sim \frac{\left(e'_{60}e - e'_{-30}e - e'_{-30}e\right)}{\left(e'_{-30}e + e'_{-30}e\right)/(n-k)} \qquad (16)$$

Where e_i'e are sum of squared residuals for the constrained and unconstrained[9] , n is the number of observations, J the number of restrictions and K the number of parameters. We cannot use the Chow test for cross-sectional betas. So to test for changes in betas in cross-section we present the percentage of times the null hypothesis of no change in betas is rejected with the Chow test for individual securities. Alternatively we calculate in cross-section the difference of average pre- and post-listing betas. The significance of the null hypothesis is tested with the following z-statistic:

$$\frac{\bar{\beta}_2 - \bar{\beta}_1}{S_2\sqrt{\frac{1}{n_1} + \frac{1}{n_{21}}}} \sim t[n_1 + n_2 - 2] \qquad (17)$$

Another procedure consists of comparing pre- and post-listing betas using a two index model. This model explains domestic stock returns with the domestic market index and the international index returns (S&P 500 in our case since firms are listed on the US). Returns on S&P 500 are translated into local currency in order to eliminate the effect of foreign exchange on returns. The pricing model is as follows:

$$R_j = \alpha_j + \beta_{loc} R_{loc} + \beta_{for} R_{for} + \nu_j \qquad (18)$$

The average correlation between the domestic index and the US index converted into local currency was 54% for our sample data. We proceeded to take out the influence of collinearity between two explanatory variables by extracting the part of the performance of the S&P index explained by the local index. More precisely, we regressed the returns of the index S&P 500 index on the domestic market index and pluged the residuals into the two factor model. We calculated the new parameters with the new series, so that two kinds of systematic risks can be identified: one associated with the domestic market (Dβ), or local, and the other with the US market (USβ), or foreign. We applied the same statistic tests for the two index model as for the one index model: Chow test and z-stats on cross-sectional average of coefficients.

In addition to the previous regressions, we calculated betas with the methodology developed by SCHOLES and WILLIAMS (1977). The latter aims at eliminating the errors arising from the lack of synchrony between returns of the market index

and security prices. We followed this procedure in order to obtain a less biased estimate of beta. SCHOLES and WILLIAMS propose the following consistent estimate of beta:

$$p\lim\hat{\beta}_i = \left(\beta_i^{-1} + \beta_i^{0} + \beta_i^{+1}\right) / \left(1 + 2\rho_1\right) \qquad (19)$$

where,

β_i^{-1} is the parameter estimate obtained from the simple OLS regression of R_t against I_{t-1}.

β_i^{0} is obtained from the synchronous OLS regression.

β_i^{+1} is the parameter estimate obtained from the simple OLS regression of R_t against I_{t+1}

ρ_1 is the first order serial correlation coefficient for the market index.

After having calculated adjusted betas, the null hypothesis of no changes in betas is tested with cross-sectional z-tests.

6.3 Results

Table 8 shows cross-sectional tests on betas calculated according to equation (2). The value of beta, below unity before dual listing, moves up after the event week. An increase in trading volume due to dual listing could be a major reason explaining an increase in systematic risk.[10] Despite the increase in the value of systematic risk measured by a higher beta, none of them is statistically significant. Our results differ in opposite direction from those of HOWE and MADURA (1990), even though their results lack of statistical significance at current confidence levels.

The lower panel of table 8 displays the change of betas as calculated with the methodology proposed by SCHOLES and WILLIAMS. Betas are higher than those estimated with synchronous observations. Pre-listing betas are higher than unity except for the Chilean sub-sample in contrast to betas calculated with synchronous observations. The sign of the magnitude of changes in betas for Mexican NYSE and local sub-groups is negative. Even though results are not statistically significant, dual listing appears to be associated with an increase in domestic systematic risk.

Table 8: Change in domestic betas after dual listing

	Average all ADRs	Average NYSE	Average NYSE Chile	Average NYSE Mexico	Average OTC Mexico	Average Local Mexico
	(n=36)	(n=27)	(n=16)	(n=11)	(n=9)	(n=9)
Change in betas using synchronised data						
β pre-listing	0.88	0.87	1.00	0.67	0.91	0.64
β post-listing	1.03	1.04	1.16	0.87	1.06	0.82
Δ β	0.15	0.18	0.16	0.20	0.26	0.19
z-stat	0.64	0.67	0.56	0.88	1.37	0.79
Change in betas using Scholes and Williams' methodology						
β pre-listing	1.11	1.02	0.87	1.24	1.39	1.15
β post-listing	1.57	1.61	1.91	1.18	1.44	1.02
Δ β	0.46	0.59	1.04	–0.06	0.05	–0.13
z-stat	0.42	0.51	0.78	–0.07	0.05	–0.16

Table 9: One factor market model
Chow Stability test – Rate of rejection of the null hypothesis of constant parameters

Rejection level	All ADRs	NYSE	NYSE Chile	NYSE Mex	144A Mex
	(n=37)	(n=27)	(n=16)	(n=11)	(n=9)
@10%	49%	52%	44%	64%	33%
@5%	35%	33%	19%	55%	33%

Table 9 displays the results of the Chow tests for synchronous regressions. It provides us with further information about the stability of the market model. In 64% of the observed Mexican firms, the change in beta is statistically significant at a 10% level. Chilean NYSE listings show a lower rate of rejection, which is even lower for Mexican 144A ADRs and Mexican domestic issues. The equal impact on systematic risk of 144A and local issues implies that by issuing 144A ADRs a firm would not obtain the benefits of international cross listing.

We are not able to reject the null hypothesis that systematic risk has changed for stocks from segmented markets after dual listing using a *single (domestic) index* market model. There is no evi-

Table 10: Change in domestic and international (US) betas after dual listing

	ADRs ALL (n=36)	ADRs NYSE ALL (n=27)	ADRs NYSE Chile (n=16)	ADRs NYSE Mexico (n=11)	ADRs 144A Mexico (n=9)
Change in betas using synchronised data					
Dβ pre-listing	0.96	0.98	1.11	0.78	0.91
Dβ post-listing	1.07	1.10	1.18	0.99	0.98
Δ Dβ	0.11	0.13	0.07	0.21	0.07
z-stat	0.48	0.50	0.25	0.93	0.40
USβ pre-listing	–0.03	–0.03	0.02	–0.10	–0.02
USβ post-listing	0.03	0.03	0.03	0.03	0.03
Δ USβ	0.06	0.06	0.01	0.13	0.05
z-stat	0.29	0.30	0.30	0.30	0.27
Change in betas using Scholes and Williams' methodology					
Dβ pre-listing	1.52	1.62	2.10	0.94	1.22
Dβ post-listing	1.94	2.23	3.06	1.03	1.05
Δ Dβ	0.41	0.61	0.96	0.09	–0.17
z-stat	0.34	0.45	0.53	0.13	0.24
USβ pre-listing	–0.17	–0.13	–0.02	–0.28	–0.29
USβ post-listing	0.50	0.60	–0.01	1.48	0.23
Δ USβ	0.67	0.72	0.01	1.76	0.52
z-stat	0.42	0.42	***0.01***	0.97	0.44

Table 11: Two factor market model
Chow Stability test – Rate of rejection of the null hypothesis of constant parameters

	ADRs	ADRs NYSE	ADRs NYSE	ADRs NYSE	ADRs OTC
Rejection	ALL	ALL	Chile	Mexico	Mexico
Level	(n=36)	(n=27)	(n=16)	(n=11)	(n=9)
@10%	64%	73%	65%	89%	33%
@5%	41%	46%	41%	56%	25%

dence of a reduction of systematic risk after investment barriers are lifted. Our results show an increase in systematic risk regardless of the firm type and market. The Chow test shows strong evidence that domestic and 144A issues differ from the rest of the sub-sample. Results confirm that 144A issues cannot obtain the same benefits from dual listing as NYSE issues: the effects on pricing are similar for 144A ADRs.

Table 10 displays changes in coefficients for the *two factor* model. Both sources of systematic risk, one associated with the domestic market ($D\beta$) and the other with the US market ($US\beta$), increase after dual listing for all the cases except for Chilean ADRs listed on the NYSE. The explanatory value of the regressions also improved and alphas declined. We have a similar interpretation for the decline in alphas, from positive values to negative ones, as for the one index market model. The foreign market index seems to explain a larger extent returns after dual listing. The domestic betas (country of listing) have also increased after dual listing. This can be due to a higher volume or better synchrony of returns between stocks and market indexes after dual listing. In contrast to our null hypothesis, we found that there is no reduction of domestic systematic risk for Chilean firms (supposedly segmented.) The Mexican market should not increase its domestic beta if it had a large degree of integration with the US market. The sign of alphas became negative, showing that the market predicts negative abnormal returns on average. Results calculated with the SCHOLES and WILLIAMS' methodology differ from those obtained with synchronous observations. Chilean domestic betas appear to be substantially larger using the SCHOLES and WILLIAMS' methodology due to four extreme observations (one fourth of our sample). This is inherent to the methodology by SCHOLES and WILLIAMS. Adjusting for negative correlations creates large values for betas, obtaining estimates of beta that are not consistent with reality. US betas increase after dual listing in four out of the five sub-samples. The sign of international betas after dual listing becomes positive for all issues except Chilean NYSE ADRs in contrast to what we should have expected. Mexican firms became more sensitive to the US market as Chilean ones. The magnitude of the change is stronger with betas estimated with the SCHOLES and WILLIAMS' methodology, but still lacks of statistical significance.

A test on the stability of the synchronous regression parameters calculated with two factor model is shown in table 11. The level of rejection of the null hypothesis of the same parameters after the event is stronger than for the one factor market model. The Mexican 144A sub-sample presents a clear different pattern: dual listing does not seem to affect the risk of the firm. Although we cannot reject hypothesis 3, we obtain a partial result: systematic risk changes after dual listing for all samples but not for 144A issues.

In short, our results depend on the methodology and are in neither case statistically significant. Hence we are not able to reject unanimously null hypothesis 3.

7. Conclusion

We have analysed the effects of dual listing on stock returns and systematic risk. The effect on stock returns for ADR issues listed on the NYSE is opposite for Mexican and Chilean firms. While Mexican issues experience positive returns around the announcement week, a negative trend in returns is observed for Chilean issues. Such a difference in results could be explained by the different nature of the Chilean and Mexican stock markets. The benefits of listing rule 144A ADR issues on the NYSE vanished gradually for Mexican issues. We find that investors do not perceive ADR issues as thoroughly positive as ADR issues listed on organised exchanges. Our empirical results tend to confirm that in order to obtain full advantage of dual listing investors should be able to trade foreign shares in organised exchanges and not on over-the-counter markets. The high cost of Level II and III ADR issues seems to be justified in terms of the benefits from dual listing. This is not verified for issues only targeted to qualified institutional investors under rule 144A.

On average, systematic risk increases after dual listing. This change is not verified for Mexican straight local issues. The increase in betas is partially due to the fact that trading volume increases following the event, increasing the covariance of stock returns and the market index. Nevertheless, tested with two alternative methodologies, this increase in betas is not statistically significant. Results regarding the higher dependence of stock prices on international factors after dual listing seem not to be strong enough. In short, there is not strong evidence for pricing purposes that international factors lead domestic factors for firms that list their shares in a foreign market besides their home market.

Firms are not penalised by the cost of dual listing when listing their shares on the NYSE. The same is not observed for 144A issues due to a lower signalling content of such issues. Although there is a transformation in the underlying factors which influence pricing, changes are not chiefly significant. In contrast to what we had expected, the effect of dual listing on emerging market stocks is not strongly significant. This is not bad news; it seems to show evidence that stocks in emerging markets are priced correctly and dual listing does not alter the existing equilibrium. Furthermore, the level of segmentation between Mexican and Chilean markets and the US market does not appear to be significant. Another important conclusion of our study is that 144A issues are a poor means for obtaining the benefits of dual listing as reported by MITOO (1992). A treasurer looking for financial and marketing advantages from dual listing should clearly prefer listing the firm shares on an organised stock exchange.

The main criticism to which our study would be subject is the small size of the sample. This imposes restrictions on statistical estimation of results and the test of our hypothesis. If we had aggregated several markets, we would not be able to analyse our results in light of theories of integration and segmentation of markets.

Footnotes

[1] Total capital raised through ADRs in 1994 amounted to USD 11.0 bn versus USD 1.7 bn in 1990.

[2] Urias M. (1994), Working Paper Standford University, has analysed the impact of securities cross listing on the cost of capital in emerging markets (Venezuela and Chile.)

[3] Barriers are either explicit or implicit. *Explicit barriers* consists mainly on legal barriers (fraction of foreign investment allowed to mutual and pension funds, government-imposed controls on foreign exchange, taxation, etc.) *Implicit barriers* have to do with information barriers and market mechanisms.

[4] Mild segmentation is the fact that investors in one country can buy securities in other country and not otherwise.

[5] A second alternative is a market model with a dummy variable. It takes the value 1 in the listing week and 0 otherwise:

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t} R_{m,t} + \gamma_{i,t} D^{\tau} + \varepsilon_{i,t} \qquad (3)$$

Where D^{τ} is the dummy variable and $\gamma_{i,t}$ is the associated coefficient. We will further refer to this model as "market model with dummy variable". To calculate the regression parameters (OLS) we estimate our benchmark across both the estimation and observation periods. In other words, we do not exclude the observation period (*t*: weeks *–30 to +30.)*

[6] The *bootstrap* is a data-based simulation method for statistical inference consisting of obtaining randomly, with replacement, *n* samples from an existing *x* population. We also performed nonparametric tests (sign and rang tests) following Corrado and Zivney (1992). Those tests are performed on noncumulative abnormal returns. Results were not different from those obtained with parametric tests.

[7] A similar trend is obtained when calculating cumulative abnormal returns with the market model with a dummy.

[8] We also tested for 9 Mexican local issues listed only on the domestic market. The highly positive reaction of straight local issues is surprising. The performance of local issues has a very distinctive upwards trend in contrast to what we would expect according to the information release hypothesis. Local returns of shares listed on the Mexican Exchange react positively at the announcement week. There is a large positive impact nine weeks before the listing date which continuously persists over time. It is hard to find a clear explanation about the reaction of share prices to local SEOs in light of the financial literature although Eckbo and Masulis (1995) showed either SEOs underpricing or overpricing according to the country studied.

[9] The constrained model is the model subject to restrictions, i.e. estimating the parameters only during the pre- or post-listing period.

[10] We have found that trading volume increases after dual listing. This change is statistically significant at usual confidence levels.

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