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The Impact of Foreign Cross-Listings on Asymmetric Spillovers in Brussels Stock Exchange[1]

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Abstract

This paper develops the approach suggested by Howe, Madura and Tucker (1993) to examine the impact of cross-listings on stock price volatility in Brussels. In general, bad news on and around Friday listings appears to be the most prevalent for laxer shareholder protection rules of regulatory environments.

Key words: GARCH, cross-listings, day of the week effects, regulatory differences.
JEL Classification: G15

1. Introduction

This paper develops the approach suggested by Howe, Madura and Tucker (1993) to examine the transmission of information for cross-listed equities between markets in Brussels. A central focus of this study is to examine the asymmetric information spillover effects resulting from a foreign cross-listing.

This paper uses La Porta et al.'s (1998) broad capital regulatory classification to analyze the magnitude and persistence of volatility spillovers (asymmetry) from the foreign listing to the home equity of cross-listed companies in the Brussels market. The goal here is to examine asymmetric information spillover effects from the foreign to the home equities of cross-listed companies quoted on stock exchanges with broadly different regulatory structures.

After identifying differences in regulatory features associated with the cross-listing (using La Porta et al.'s (1998) classification) we then model the information transmission process from the foreign portfolio of cross-listed equities to the respective home listings. The analysis seeks to examine whether asymmetric volatility spillovers from the foreign to home cross-listings varies according to different regulatory environments across markets and listing dates.

In their seminal study Howe, Madura and Tucker (1993) examine changes in stock price volatility in association with the listing of US firms' stocks on overseas exchanges, and document significant increases in anticipated volatility following the overseas exchange listing. Also, in an earlier study, Howe and Madura (1990) examine the impact of international listing on common-stock volatility, finding no significant shifts in volatility resulting from the international listing. The above findings by Howe and Madura (1990) suggest that markets are already reasonably well integrated and also listing cannot reduce segmentation. As far as we are aware these are the only studies that examine the impact of cross-listings on volatility spillovers. Given the inconclusive findings of these two studies we extend the, albeit limited, literature by developing a GARCH modelling process to analyse whether different barriers influence the asymmetric information transmission mechanism for European cross-listings.

The starting point for this paper is to develop the above-mentioned approach of Howe, Madura (1990) and Howe, Madura and Tucker (1993) for our analysis of cross-listed Brussels securities using a modified GARCH modeling approach as suggested by Li and Engle (1998)[2]. In particular, the GARCH model introduced by Li and Engle (1998) is modified to take account of asymmetric information effects and the influence of different regulatory barriers across markets.

Traditionally, univariate GARCH models have been used to investigate stock price volatility changes as a function of information arrival. This literature (see Engle (1982), and Engle and Bollerslev (1986)) supports the finding that news arrives in clusters and stock price volatility is

[1] We would like to thank two anonymous referees for their valuable comments.
[2] Li and Engle (1998) present a GARCH modelling framework incorporating dummy variables to take account of macro-economic announcement on the volatility of US treasury futures.

significantly autocorrelated over time. However, more recent studies (e.g. Nelson, 1991) have suggested that asymmetric GARCH models offer greater flexibility (compared with the standard univariate GARCH approach) for estimating the impact of bad and good news on stock price volatility. Nelson (1991) was the first to identify that the GARCH modelling framework should take account of asymmetry in the process of stock price volatility changes as bad and good news may influence stock price volatility changes differently[1]. The approach developed in this paper, therefore, presents a methodology, which allows us to model the impact of bad, and good news information on the magnitude and persistence of stock price volatility for portfolios of cross-listed European equities in Brussels market.

Overall, there is little evidence to suggest that good news has much of an influence on volatility spillovers resulting from foreign cross listings. In general, bad news on and around Friday listings appears to be the most prevalent for laxer shareholder protection rules of regulatory environments.

This paper is structured as follows. Section 2 provides a literature review. Section 3 outlines the research design and the sample used in this study, and Section 4 provides the empirical results. Finally, Section 5 summarizes the main findings of the study.

2. Literature review

A number of studies bring to light empirical evidence on 'volatility clustering' with regard to the impact of the news on stock price volatility. Among others, evidence about 'volatility clustering' are provided by Engle (1982), Pindyck (1986), and Bollerslev (1986). All of these studies support the view that news tends to be clustered together and this has an influence on stock price volatility. In particular, Engle (1982) introduces a new class of stochastic models referred to as autoregressive conditional heteroscedastic (ARCH) processes. In general, ARCH modelling approaches infer that past information can forecast next period's stock price volatility (Typically the ARCH process incorporates a one-period lag structure).

Pindyck (1986) finds that changes in stock price variance do not typically persist for very long, although he finds that the previous period volatility does appear to explain the next period's volatility more than other variables (such as changes in corporate profits and real interest rates), and the influence depends mainly on the magnitude of the respective shocks. Pindyck reports that about one-third of the 1974 stock market decline in the US may be attributed to stock price volatility changes. Bollerslev (1986) extends the ARCH modeling framework introduced by Engle (1982) to a GARCH (General ARCH) process. The GARCH model allows the past conditional variances in the current conditional variance estimation to capture volatility clustering. As such the GARCH framework is preferred to the ARCH modeling approach for investigating volatility spillovers between markets as it allows us to examine both the magnitude and persistence of spillover effects (Whereas, the ARCH approach only provides estimates of magnitude).

Black (1976) notes that stock price volatility tends to grow in reaction to bad news and falls in response to good news. The economic explanation given by Black is that negative returns make the equity value of a firm relatively more risky than other firms and this increases the firm's stock price volatility. In another study, Black (1986) notes that noise can also increase stock price volatility. Black finds that noise may be permanent or temporary, and thus stock price volatility may be influenced by both temporary and permanent noise and also by bad and good news.

Lo and McKinlay (1988) and Lehman (1990) look at the impact of temporary noise on stock price volatility, and find that noise trading leads to an increase in stock price volatility over the short-term but a decline over the long-term (with negative autocorrelation). Likewise, Poterba and Summers (1988) suggest that stock price returns show positive serial correlation over short periods and negative correlation over longer intervals. In their study using NYSE returns over the 1926-1985

[1] Nelson (1991) proposed the EGARCH model that investigates the impact of information asymmetry on stock price volatility. We, however, use a modified GARCH model that allows to examine the impact of information asymmetry on stock price volatility following Li and Engle's (1998) suggestion. We do this, because the GARCH model allows us to examine asymmetry on both permanent and temporary noise under a similar modelling framework compared with the EGARCH framework.

period they find that transitory price components account for a substantial part of the variance in equity returns. In general, the aforementioned studies suggest that noise may influence stock price volatility, and this may be temporary or permanent in nature. In addition, asymmetric information (good or bad news) also appears to influence stock price volatility in a differential manner.

The aim of this paper at the time of foreign listing, therefore, is to examine volatility spillovers for cross-listed Brussels equities. We examine permanent and temporary noise effects and the influence of good and bad news (information asymmetries) on the respective volatility from the foreign to home listing. Prior to this analysis, we do not know what the impact of trading noise on stock price volatility for cross-listed equities will be, because, as far as we are aware, this has not been examined in the established literature.

3. Data and Methodology

3.1. Data sample

We identify the sample by writing to the stock exchange in *Brussels*. We request data on the 'cross-listing' dates and the foreign stock exchanges where 'cross-listings' have occurred. The exchanges provided information on 8 'cross-listings' for 4 companies; these listings involve the issue of ordinary shares[1] and A and B ordinary shares with restricted voting rights between the years 1987 to 2000.

Cross-listings are also identified from the FT-Extel database in order to identify mergers/de-listings and capital investment changes (such as change of name) through the life of a quoted company. Daily share price information is obtained for all the home and foreign equities in the sample. Table 1 shows the name, nationality and timing of the foreign cross-listings on respective exchanges.

Table 1

Sample of European Equity Cross-Listings: Name of Company, Date of Listing and Stock Exchanges

Home Listings	Foreign Listings			
	LON	ZUR	AMS	GER
The Brussels Home Equities				
Electrabel	X(3/3/92)		X(29/9/95)	
Generale Bank	X(13/3/92)		X(10/6/88)	
Petrofina	X(30/9/91)	X(8/10/87)		X(5/10/87)
Solvay	X(3/3/92)			

Note: (i) The symbol 'X' shows the interlistings of each company on the stock exchanges.
(ii) Price information on the cross-listed equities are obtained from Datastream over the sample period.

The return prices for our sample of home cross-listed equities are calculated at time t as the difference of Ln (P_t/P_{t-1}), where Ln is a logarithmic difference of stock prices at their closed value at the end of the trading day. We exclude non-weekend periods for which the returns cannot be calculated due to the absence of frequent quotes. These days are identified by writing to stock exchanges and based on their answers we exclude the data sample for those holiday-days for which no quotes are observed. Also, Datastream records provide additional information on holiday-schedules for those years that stock exchanges are not able to provide such data. In addition, we exclude observations around the October 1987 stock market crash October 16th , 19th , 20th , and 21st as the inclusion of such information may bias the summary statistics[2].

[1] These are the commonest form of shares, and comprise most of company's share capital.
[2] Karolyi (1995) excludes data around these dates in his study of a multivariate GARCH model of international transmission of stock returns and volatility: The case of the United States and Canada.

3.2. Regulatory Classification

To examine the spillover effects across markets around the time of the foreign listing we also use La Porta et al.'s (1998) regulatory classification to see if these transmission effects vary across stock markets with different regulatory features. In particular, we use the La Porta et al.'s (1998) classification that distinguishes between stock market regulations covering investor protection rules. Table 2 shows this classification according to our sample. For example, a listed Brussels company that obtains a foreign listing in London+, Amsterdam, Frankfurt, and Zurich is obtaining cross-listing on four exchanges that (according to La Porta et al.) have laxer investor protection rules compared to Brussels. For ease of exposition we use this categorization of stock market rules as a proxy for the regulatory environment. So in our analysis, this enables us to examine the influence of a foreign cross-listing in a tougher, laxer or similar regulatory environment on volatility spillovers to the home market portfolio.

Table 2

Public information that 'spills over' from foreign markets to home markets with 'high' or 'low' or 'similar' shareholder protection rules

	Foreign Markets			
Home Market	London+	Amsterdam	Frankfurt+	Zurich
Belgium	LOW	LOW	LOW	LOW

Source: Authors' own construction defined from La Porta et al. (1998).

Note: (i) NA means not available.

(ii) La Porta et al. (1998) use ownership concentration in 10 largest private firms as an index of investor protection: The index is constructed using the average percentage of common shares owned by the three largest shareholders in the 10 largest non-financial, privately owned domestic firms in a given country. A firm is considered privately owned if the state is not a known shareholder. It is often efficient to have some ownership concentration in companies since large shareholders might monitor managers and thus increase the value of a firm. Concentration of ownership is an adaptation to poor legal protection. Countries that for some reason have heavily concentrated ownership and small stock markets might have little use for good accounting standards, and so fail to develop them. Good accounting standards and shareholder protection measures are associated with a lower concentration of ownership, indicating that concentration is indeed a response to poor investor protection (La Porta et al., 1998).

3.3. Modelling Approach

As in Howe, Madura and Tucker (1993) we examine volatility spillovers from the foreign cross-listed equity (around the listing data) to the home equity. To do this we use a GARCH approach, similar to Li and Engle (1998) but we modify their model to take account of day of the week effects, and asymmetric information (good and bad news). The modeling framework takes into account both permanent and transitory volatility components. The aim is to see whether asymmetric temporary spillover effects from the foreign to the home market, around the time of foreign listing, (and controlling for day of the week effects) influences cross-listed companies share price volatility. For each of the firms in the sample that had an international listing and had multiple shares available, asymmetric volatility is estimated from day –10 to +10 surrounding the foreign listing day (day 0) (similar to Howe, Madura and Tucker (1993), and Dharan and Ikenberry (1995)).

This provides us with the following modified GARCH model:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \varepsilon_t, \text{ where } \varepsilon_t | \Omega_{t-1} \sim N(0, h_t). \quad (1.1a)$$

The model employed for the first moments of errors, ε_t, is a martingale process, as we show:

$$E(\varepsilon_t) = E(r_t - \mu_t), \quad (1.2b)$$

where, μ_t is the long-term drift coefficient

and

$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 \varepsilon_{t-1}^2 + \beta_3 \varepsilon_{t-1}^2 + \delta_1 K_{1t} + \delta_2 K_{2t} + \delta_3 F_{1t-1} + \delta_4 F_{2t-1} + \delta_5 W_{1t+1} + \delta_6 W_{2t+1}, \quad (1.2)$$

where Ω_{t-1} represents the information set available at the end of day t-1. β_1 ($\varepsilon_{t-1} < 0$) and β_2($\varepsilon_{t-1} > 0$) are the coefficients for bad and good permanent component variables of the variance equation, respectively. The dummy variables for K, F, and W variables represent day-of-the-week-cross-listing effects on Monday[1], day-of-the-week-pre-cross-listing-drift effects on Monday[2], and day-of-the-week-post-cross-listing-drift effects on Monday[3]. Thus, K_{1t}, F_{1t-1}, and W_{1t+1} = 1 if ε_{t-1}<0; K_{1t}, F_{1t-1}, and W_{1t+1} = 0, otherwise. Also, K_{2t}, F_{2t-1}, and W_{2t+1} = 1 if ε_{t-1}>0; K_{2t}, F_{2t-1}, and W_{2t+1} = 0, otherwise.

The dummy variables on day-of-the-week-effect dates, day-of-the-week-pre-listing drift effect period and day-of-the-week-post-listing drift effect period with bad and good news produce an alternative framework to examine the dynamic nature of good vs. bad news for transitory noise in the return variance equation. The advantage of the current GARCH methodology is that it controls not only for day-of-the-week-effects, but also for positive and negative shocks on Monday, Tuesday, Wednesday, Thursday or Friday. Thus, positive and negative shocks might control for different volatility effects.

The model enables us to examine the influence of bad and good news on home equity portfolio volatility around the date of a foreign cross-listing. This approach enables us to compare asymmetric pre- and post-listing volatility of our home equity portfolio around the listing date of the foreign equity. For instance, we can examine if a foreign listing on a Tuesday influenced by bad news transmits greater volatility to the home equity portfolio compared with a similar foreign listing characterized by good news.

Finally, the methodology allows us to investigate volatility spillovers around the time of the foreign listing taking into account different stock market regulatory environments. As mentioned earlier, we use La Porta et al.'s (1998) investor protection rules classification for Brussels exchange to identify companies that foreign list on exchanges with tougher, more lax or similar investor protection rules than the Brussels market. We can then compare day of the week asymmetric volatility transmission effects for foreign listing in markets with different investor protection rules. This methodology allows us to investigate asymmetric volatility spillovers around the time of the foreign listing taking into account different stock market regulatory environments.

4. Empirical Results

4.1. Spillovers, Home Equity cross-listings and the Regulatory Environment

This section reports the findings of our analysis that examines the influence of the foreign listings on the portfolios of home cross-listed equities. In particular, we focus on home cross-listed equities in the Brussels market. Recalling the methodology outlined above, we identify the influence of the foreign listing on portfolios of home cross-listed equities taking into account day-of-the-week-effects, asymmetric information and differences in regulations (shareholder protection) across stock markets.

4.2. Asymmetric temporary spillover effects from foreign listings to the Brussels home portfolios of cross-listed equities

Table 3 presents the asymmetric temporary spillover effects for home cross-listed firms' equities on the Brussels stock exchange with respect to lower investor protection environments with respect to Brussels stock exchange[4].

[1] or Tuesday, Wednesday, Thursday or Friday.
[2] or Tuesday, Wednesday, Thursday or Friday.
[3] or Tuesday, Wednesday, Thursday or Friday.
[4] The estimates did not converge for all the days around foreign listings (e.g., Tuesday, Wednesday, and Thursday), except for Monday.

Table 3

Asymmetric temporary spillover effects from foreign listings to the Brussels home portfolios of cross-listed equities in association with different regulatory regimes

Lax Shareholder Protection Rules	
The Brussels stock market	
Panel A: Monday weekday-Bad versus Good news	
Past Volatility of one lag	0.84* (0.01)
Permanent noise	
Bad News	0.08* (0.01)
Good News	0.11* (0.01)
Temporary noise	
Monday-Bad News	-0.46 (0.53)
Pre-Monday-Bad News	-0.36 (0.39)
Post-Monday-Bad News	0.85* (0.36)
Monday-Good News	0.36 (0.40)
Pre-Monday-Good News	-0.17 (0.30)
Post-Monday-Good News	-0.18 (0.26)
Log-Likelihood	13247.56
Panel B: Friday weekday-Bad versus Good news	
Past Volatility of one lag	0.83* (0.01)
Permanent noise	
Bad News	0.11* (0.01)
Good News	0.09* (0.008)
Temporary noise	
Friday-Bad News	0.76* (0.08)
Pre-Friday-Bad News	-0.27* (0.09)
Post-Friday-Bad News	-0.46* (0.05)
Friday-Good News	0.06 (0.09)
Pre-Friday-Good News	0.03 (0.09)
Post-Friday-Good News	0.08 (0.14)
Log-Likelihood	13254.12

Note: * statistically significant at the 5 percent level.

As previously mentioned investment barriers that arise from shareholder protection rules can influence asymmetric volatility spillovers of bad and good news from foreign listings to the home cross-listed equity portfolio.

Panels A and B of Table 3 show the results for the Brussels portfolios of home equities. In general, we can see that bad and good news (both permanent and temporary), as well as previous period's volatility impact in the future period volatility for the home cross-listed equities. In particular, Panel A specifies the asymmetric temporary spillovers from foreign markets with laxer shareholder protection rules to Brussels home market on Monday. We find that the post-listing effect for bad news on Monday is significant and equal to 0.85. This means that bad temporary news is more important on Monday than good temporary news.

Panel B presents the results of asymmetric temporary spillovers on Friday. Bad news for Friday listing period found to be significant at the 5% level and equal to 0.76. A similar significant result found in the pre-listing period of Friday for bad news which is equal to 0.27 and has got a negative persistence. The results also show that there is a significant result in the Friday post-listing period of bad news being equal to 0.46 with negative persistence. In general, we found that bad news, from pre-listing to listing period on Friday, was increased by 0.49 and then in the post-listing period, bad news, was decreased by 0.30. Again, this means that bad news was more important on Friday than good news.

Looking at the results together in Brussels market, one can see that both the impact of regulatory environments and days of listings have significant influence on asymmetric spillovers of bad and good news. In particular, we find that the persistence of news changes from the pre-listing periods to the listing periods and from the listing periods to the post-listing periods around different days of listings. Also, we find the magnitude of information transfers (both good and bad news) to differ according to the various days of listings. Overall, both these factors indicate evidence of market segmentation across the Brussels stock exchange.

5. Conclusions and Summary of the results

5.1. Summary of the findings

This paper examines the impact of cross-listings on stock price volatility in Brussels. The analysis also takes into account the influence of different regulatory structures across the markets where firms are cross-listed. In particular, we use La Porta et al.'s (1998) broad stock market regulatory classification to analyse the magnitude and persistence of asymmetric volatility spillovers from the foreign listings to the home equity of cross-listed companies in Brussels market. The temporary spillover effects seek to examine whether the day of listings have an impact on the magnitude and persistence of asymmetric volatility spillovers. We also seek to examine whether the pre and/or post-listings periods have an impact on asymmetric volatility spillovers from the foreign to the home equity portfolios.

If one considers all the results it can be seen that there is little evidence to suggest that good news have much of an influence on volatility spillovers resulting from foreign cross listings. From a general perspective results also clearly indicate that volatility transmission can vary across various listing dates. In addition, bad news on and around Friday listings appears to be the most prevalent for laxer shareholder protection rules of regulatory environments.

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