THE ARGENTINE CRISIS AND ITS CONTAGION EFFECTS ON LATIN AMERICAN MARKETS[1]

Pablo Morán V.[2]

Abstract. Financial and exchange rate crises in emerging countries during the last decade have generated increasing interest in the subject of contagion. In this paper we present evidence of spillover effects during the incubation of the Argentine crisis on two Latin American countries. As expected, our results indicate that informational shocks affected mainly Argentina. Even though we find evidence of contagion effects on Chile and Brazil during argentine-related announcements, the general evidence indicates that foreign investors did not rebalance their portfolios away from non-Argentine Latin American markets during the pre-crisis period. It indicates that foreign investors do not perceive Latin American countries as one fully integrated market.

Key words: spillover effects, herding behavior, information shocks.

1. Introduction

The Mexican crisis in 1994-95, the Asian crisis in 1997, the Russian default in 1998 and the Brazilian devaluation in 1999 have motivated a great deal of empirical and theoretical research in the subject of contagion. Financial contagion characterizes the increase in volatility and comovements in international financial markets occurring principally during financial and/or exchange rate crisis in one region or country. Although it is reasonable to expect increase in volatility and share price drops in countries with financial difficulties, it is not equally clear why and how other markets become infected with this virus. Two main approaches have been proposed as explanations for this phenomenon. On the one hand, the fundamental-based approach proposes that contagion is produced when the infected country is linked to other countries via trade or finance. On the other hand, the self-fulfilling approach states that contagion arises as a consequence of herding behavior, not necessarily irrational, by investors as the main channels of interconnection are not clearly present./P>

Even though theoretical models in the subject are abundant, the empirical evidence is still limited. This fact is perhaps due to the nature of the phenomenon itself, generally considered as one of the side effects of the globalization of international financial markets. As pointed out by Kim and Singal (2000), recent currency and financial crises have incited many academics and politicians to reassess the goodness of free flow of capitals for emerging countries. Bekaert and Harvey (2000) highlight the fact that excess volatility induced by foreign investors has often been an argument against the liberalization process of these countries.

The purpose of this paper is to uncover potential spillover effects generated during the incubation of the Argentine crisis on two Latin American countries: Brazil and Chile. The rich set of political and economic events prior to the Argentine default in December 2001 make it an interesting case of study. Most existing empirical evidence on contagion examines the behavior of equity markets during the crisis itself; therefore, the main contribution of this paper to the existing empirical literature is the consideration of the pre-crisis period as a way to study expectation formation prior to the actual crisis. This paper is organized as follows. Section two is devoted to a brief review of the contagion literature. In section three, I describe and discuss the methodology and the sample selection. Empirical findings are presented in section four and the conclusion is given in section five.

2. Crises and Contagion

Although macroeconomic theory predicts contagion effects among countries with close links in fundamentals, it has been found that variations in fundamentals are not enough to explain the pattern of contagion among countries (Berg and Patillo, 1999) Under the fundamentals approach, monetary and financial weaknesses are the leading forces behind the spreading of contagion across countries, as they would make a country more vulnerable to the "infection". The observation that emerging markets appear to be the more vulnerable while developed markets tend to remain relatively isolated from external crises is consistent with this fundamental-based approach. An alternative explanation is that global financial markets respond to the same public information due to correlations in the information channels or correlations in the liquidity shock channels. In the first case, price changes in one market could be perceived as having implications for the asset values in other markets. In the second case, liquidity needs by investors would induce them to liquidate assets in different markets spreading the shock generated in one market.

The low explanatory power of macroeconomic and financial fundamentals in predicting the spreading of crises has lead researchers to open new theoretical venues. The new literature on contagion is based mainly on information asymmetries and information frictions. King and Wadhwani (1990) highlight the fact that even though news announcement are public information, not all information, or the ability to process it, is publicly available. Thus, market prices contain valuable information about the private information of the investors willing to pay these prices when the structure of information is relatively simple. They point out, however, that mistakes in one market can be transmitted to other markets if the information structure is more complex, particularly when the dimension of the signal space exceeds the dimension of the price space. In this case, the equilibrium prices would not be fully revealing as the mapping from signals to market prices is not invertible.

Calvo and Mendoza (2000) argue that as the number of available markets increases with the globalization, the share of individual countries in an investor's portfolio decreases, reducing the incentives to gather country-specific information. Rigobon (1998) states that investors facing signal extracting costs at the moment of assessing investment choices might get confused about the true fundamentals, generating speculative attacks or bubbles even when the fundamentals remain the same. Thus, information frictions as well as information asymmetries would help explain herding behavior and, therefore, would be potential sources of contagion in financial markets.

Kyle and Xiong (2001) develop a theoretical model in which the contagion is a consequence of a wealth effect that changes the risk aversion of financial intermediaries. In their model, when convergence traders (intermediaries) suffer losses, they have a reduced capacity to bear risks, proceeding to liquidate positions reducing thus the market liquidity, and increasing price volatility and correlations across markets. Kodres and Pritsker (2002) present a model in which the channel of propagation of contagion is the cross-market hedging by informed investors. In this model, investors respond optimally to shocks in one country by rebalancing their exposures to macroeconomic risks in different countries, transmitting the shocks to other markets even if these markets are weakly linked by fundamentals. Information asymmetries in this model make a country more vulnerable to contagion since uninformed investors can misinterpret this rebalancing as being related to private information about asset values within the country.

Fleming, Kirby and Ostdiek (1998) investigate the nature of volatility linkages in the stock, bond and money markets in the US for the period 1983-1995. They find strong linkages between these markets as measured by the estimated correlation for volatilities. They reject the hypothesis that the correlations are perfect, concluding that the information spillover caused by cross-market hedging is incomplete. Kaminsky and Reinhart (2000) examine empirically the importance of trade and financial links in the pattern of propagation of crises. They conclude that contagion is more regional than global, but they warn about direct extrapolations since trade in assets has grown much faster than trade in goods generating more links in international markets. Caramazza, Ricci and Salgado (2004) examine the role of financial linkages as the channel of propagation for the Mexican, Asian and Russian crises. For a sample of 41 emerging countries, they find that, after controlling for other fundamentals, financial linkages and weaknesses affect significantly not only the probability of crisis but also the extent of regional contagion. Similar evidence, although using a

different methodology, is reported by Fratzscher (2003) for Latin American (1994-95) and Asian (1997) crises. His findings indicate that the main reason for the spreading of these crises across emerging markets is not weaknesses of fundamentals, but the high degree of financial interdependence among affected economies.

Kaminsky and Schmukler (1999) study the behavior of Asian financial markets during the crisis in this region. They analyze the 20 one-day largest changes in prices (downturns and upturns) in each market, and relate these swings with reports in the international financial press, news releases about monetary and fiscal policies, and news releases about agreements with the IMF. They find that some of the largest one-day movements cannot be explained by news releases and that rumors or concerns related to the release of relevant information affect foreign markets as strongly as they affect domestic financial markets. Finally they find that even though news releases about monetary and fiscal policies are important, news releases about agreements with the international community and credit rating agencies are at the heart of the price swings. Bailey, Chan and Chung (2000) analyze the impact of intra day exchange rate movements and the related news on a set of ADRs and close-end funds listed on NYSE of several emerging countries during the Mexican currency crisis. They find that Mexican and non-Mexican Latin American equity returns are significantly affected (in different degrees) by the intra day changes in the Mexican exchange rate, although Asian equities are not significantly affected. Their evidence based on trading volumes indicates that even though investors revise their holdings, they do not panic and sell off non-Mexican equities at times of the Mexican currency depreciation or during the arrival of new information. Finally, their findings suggest that the close-end fund market dominated by small investors is more sensitive to Mexican news than the ADR markets dominated by institutional investors. Consistent with this evidence, Chung (2004) finds that even though the depreciation of the Thai Baht triggered a sell-off of Asian country funds, non-Asian ADRs and country funds did not suffer significant sell-offs.

3. Methodology and Sample Selection

1. Methodology

As discussed earlier, spillover effects can be reflected in the returns as well as in the variance of returns. Given the role attributed in the literature to foreign investors during crises, we use the American Depositary Receipts (ADRs) of Argentina, Chile and Brazil as representative of the corresponding local stock markets. The use of ADRs has several advantages over the use of the local stock markets. First, the receipts are issued by an US depositary bank and are treated as US securities for clearance, settlement, transfer and ownership purposes, which allow us to overcome the potential effects of market segmentation. Second, ADRs can be canceled by the depositary and converted back into the underlying share easily. Thus, after considering transaction costs and the exchange rate, we would expect a very close relationship between the ADR traded on the US and the underlying share traded on the local stock market.[3] Third, we would expect more transparency or better information quality to foreign investors from firms with ADRs, as they have normally (level II and III) to comply with US GAAPs and US disclosure requirements. Finally, ADRs are traded and pay dividends in US dollars, and therefore, prices already incorporate forward-looking exchange rate expectations. This is relevant since Argentina, Chile and Brazil have different exchange rate regimes.

In contrast to previous empirical research, which normally applies tests based on correlations, Granger causality or vector autoregression (VAR), we follow a somewhat more direct approach. Resting on the semi strong form of market efficiency, we expect that any market rebalancing (contagion) due to information arrival during the incubation of the Argentine crisis be captured through as an abnormal return for ADRs of Chilean and Brazilian.[4] This test is to some extent direct since it allows us to know whether or not foreign investors perceive Brazil, Argentina and Chile as one integrated region. Table I summarizes the 22 events we identify as relevant for the present study.

Table I: Main events identified for argentina in the period under study.

IMF-related announcements were taken from IMF press releases (available at: http://www.imf.org). News related to internal events in Argentina were taken from local press and Yahoo News Argentina (available at: http://www.yahoo.com.ar). Finally, news about international reactions were taken from Lexis/Nexis (Wall Street Journal and other sources)

Event	Date	Description
1	September 15, 2000	IMF completes first Argentina review under the stand-by credit.
2	December 18, 2000	After an agreement on a strengthened economic program, Horst Köhler is prepared to recommend an increase of Argentina's access to IMF financing.
3	January 12, 2001	IMF completes second review and approves augmentation of Argentina's stand-by credit.
4	February 19, 2001	Explode the financial crisis in Turkey.
5	March 16, 2001	The argentine government presents a new economic plan, which has some political objections.
6	March 21, 2001	Lopez Murphy resigns and Domingo Cavallo became the new minister of finance.
7	April 2, 2001	Country's budget gap for first quarter 2001 was US$1 billion above the target set with IMF.
8	May 21, 2001	IMF completes the third argentine review under the stand-by credit.
9	June 3, 2001	Successful completion of the debt exchange offer for US$29.477 million.
10	June 30, 2001	The argentine senate approves a law of fiscal responsibility.
11	August 9, 2001	Argentina's economic team travel to Washington to seek new loans from IMF.
12	August 21, 2001	Horst Köhler is prepared to recommend an augmentation of Argentina's current stand-by credit by approximately US$8 billion to about US$22 billion from the present US$14 billion.
13	September 7, 2001	The IMF's execute board completed the fourth review and approved an augmentation to about US$21,57 billion of Argentina's stand-by credit.
14	October 16-17, 2001	S&P and Moody's warn that Argentina could enter into a technical default.
15	October 30, 2001	Domingo Cavallo presses IMF for a new strategy that does not involve debt restructuring.

16	November 1, 2001	After IMF refused to accelerate the loan schedule, Argentine starts the restructuring of public debt through the exchange of domestic and international bonds.
17	December 1, 2001	IMF announces that it will not release US$1.3 billion loan as scheduled later this month.
18	December 20, 2001	The president Fernando de la Rua resigns in the middle of political and social objections.
19	December 24, 2001	The interim president, Adolfo Rodriguez Saa, declares the argentine default.
20	January 4, 2002	Presentation of a new economic plan and devaluation 1.4 pesos for 1 US dollar.
21	January 16, 2002	IMF today approves a request from Argentina to extend by one year the repayment of about US$933 million, which is due on January 17, 2002.
22	February 3, 2002	Conversion of domestic deposits and credits to peso and adoption of a floating exchange rate.

Our approach has some limitations though. First, it is difficult to establish the precise moment when the news is incorporated into the information set of investors. Thus, imprecise event dates ends up with lower statistical power to detect the abnormal returns. Second, event studies are only able to detect the unexpected portion of the announcement. Thus, we would underestimate the economic value of the announcement when investors have assigned a nonzero probability to the event. Nonetheless, we are not interested per se in the economic value of a particular event, but in its sign. Finally, all events described in table I affect simultaneously the ADR performance of the three countries, generating the clustering in calendar date, which implies a loss of efficiency in our estimates. To overcome this clustering problem, each country will be analyzed as a portfolio, incorporating thus the contemporaneous covariance among returns into the portfolio variance[5].

For the estimation of the average daily abnormal returns, we use the dummy variable approach. As discussed by Karafiath (1988), this approach yields the same estimates as the forecasting error approach normally used in event studies. The return generating process for each portfolio of ADRs is assumed to be as follows:

$$R_{it} = \alpha + \beta R_{mt} + \lambda D_{sept} + \theta D_{sept} R_{mt} + \sum_{E=1}^{22} \phi_E D_E + \varepsilon \quad (1)$$

Where:

R_{it} : Daily return of each ADR country-portfolio,

R_{mt} : Daily return for the market proxy. The market proxies used are the S&P 500 and the MSCI World index,

D_{sept} : Dummy variable that takes the value 1 from the first trading day after September 11th 2001 to the last trading day in the estimation period, and 0 otherwise,

D_{E} : Dummy variable that takes the value 1 for the three days surrounding the announcement date of the event E and 0 otherwise.

Parameters α and β are assumed constant with a shift after September 11th 2001. These shifts are captures by λ and θ for α and β respectively. In few words, this specification allows for a potential structural change in the return generating process after this event. Coefficients ϕ_{E} capture any potential jump in the mean return due to the events. Thus, these coefficients will capture the contagion effects of argentine-related announcements on our three country portfolios.

The error term is assumed serially uncorrelated and uncorrelated with the exogenous variables. As spillover effects can also be reflected in the variance of returns, we consider explicitly their effects in the model by assuming that the variance of the error follows an EGARCH (1,1) process:

$$Ln(h_t) = w + \kappa Ln(h_{t-1}) + \varphi g(\varepsilon_{t-1}) \quad (2)$$

Where:

$$g(\varepsilon_{t-1}) = \gamma\varepsilon_{t-1} + \left(\left|\varepsilon_{t-1}\right| - E\left|\varepsilon_{t-1}\right|\right) \text{ and } \varepsilon_t = e\sqrt{h_t} \quad e \approx IN(0,1)$$

We must remark that this specification assumes potential volatility linkages as exogenous, but it takes into account their effects in the estimation process. Thus, this specification should have more power in detecting the abnormal returns than the OLS estimation (more efficient estimates) as the heteroskedasticity of the residuals is modeled explicitly.

2. Sample selection

The list of firms with ADRs for Argentina, Chile and Brazil was taken from the Bank of New York's web site (www.adrbny.com). The initial sample includes: 25, 28 and 50 ADRs for Chile, Argentina and Brazil respectively. ADR price data in US dollars were taken from DataStream Advance. For inclusion in our sample, firms ADRs must comply with two selection criteria. First, the ADR price must be available (identifiable) in DataStream from September 1st 2000 to February 28th 2002. A total of 20, 21 and 30 ADRs for Argentina, Chile and Brazil respectively fulfill this criterion. Second, the ADR must have transaction at least 75% of the trading days during the period of interest. A total of 9, 6 and 10 ADRs for Argentina, Chile and Brazil respectively fulfill this criterion.

The first selection criterion was imposed due to the findings (discussed earlier) in Melvin (2004). The second selection criterion was imposed mainly because several ADRs were not traded at all, especially after the September 11th attack. As the principal interest in this paper is to study the informational content of the announcements

related to the Argentine crisis, the thin trading problem would bias our estimates toward zero obscuring the final results. Table II presents the main characteristics of the final sample.

In table II we see that ADRs for the three countries are relatively homogeneous in terms of exchange and ADR level, although industry composition varies across countries. To some extent this variation in the industry composition of our portfolios might bias our findings if the argentine crisis had asymmetrical industry effects. As ADRs can be investment vehicles for global investors as well as US investors, two stock indexes were used as market proxies: the S&P 500 Composite and the MSCI World index.

During the period of study, there are 390 trading days. Days of no transactions were deleted from the database, which include 15 holidays and 4 days after the September 11th attack. Thus, the final database includes 371 observations for the two indexes and the three country portfolios.

Table II: Portfolio composition by country.

9, 6 and 10 ADRs compose the portfolio for Argentina, Chile and Brazil respectively. The total number of ADRs by country is: Argentina 25 ADRs, Chile 28 and Brazil 50. Source: Bank of New York.

	Argentina	**Chile**	**Brazil**
Industry			
Banking	1	1	1
Utility, Gas & Electric	1	0	2
Fin. Services and invest.	1	1	0
Real estate	1	0	0
Telecommunications	3	0	2
Food-Agribus-Tabacco	1	0	0
Oil-gas service	1	0	0
Beverage	0	3	1
Airlines	0	1	0
Paper & forest	0	0	1
Mining & Minerals	0	0	1
Aerospace	0	0	1
Retailing	0	0	1

Exchange			
NYSE	8	6	8
OTC	0	0	2
Nasdaq	1	0	0
Level			
Level I	0	0	2
Level II	3	3	6
Level III	6	3	2
No. of firms	**9**	**6**	**10**

4. Empirical Findings

Even though the main purpose of this study is to document the spillover effects in returns of Argentine-related events on the other two Latin American countries, these results are presented later on. Given that an important event occurred within the estimation period (September 11th attack), the next sub section is dedicated to analyze the assumed structural model of return.

1. Structural coefficients

Table III presents the structural coefficients of the estimated models of return assuming an EGARCH (1,1) model. After considering the heteroskedasticity of returns in the Argentine case, we see that the intercept is significantly negative (daily average of -0.32% and –0.28% for S&P 500 and MSCI respectively). In contrast to the Chilean and Brazilian securities, it seems that investors started liquidating Argentine assets even before September 11th. This is consistent with evidence presented by Melvin (2004). The event September 11th seems to have no significant effect on Argentina as measured with the two indexes. For Brazil we observe a shift in Beta (β) after September 11th when the S&P 500 is considered, but the shift in the intercept is not statistically significant at conventional levels of significance for both indexes. In the case of Chile, we observe a significantly negative shift in the intercept of –0.54% and -0.3% for S&P 500 and MSCI respectively and an increase in Beta (β) under the specification with the S&P 500 index.

Table III: Structural coefficients of the return process under the EGARCH specification for the residuals.

The parameters were estimated using as a proxy for the market the S&P 500 composite and the MSCI World index. The variable Dsept is a dummy variable, which is 1 after September 11th and 0 otherwise. The return generating process was assumed to follow:

$$R_{it} = \alpha + \beta R_{mt} + \lambda D_{sept} + \theta D_{sept} R_{mt} + \sum_{E=1}^{22} \phi_E D_E + \varepsilon$$

Where R_{it} is the return of the country portfolio. The variance of the error term is assumed to follow an EGARCH (1,1) process as follows:

$$Ln(h_t) = w + \kappa Ln(h_{t-1}) + \varphi g(\varepsilon_{t-1})$$

$$g(\varepsilon_{t-1}) = \gamma\varepsilon_{t-1} + \left(\left|\varepsilon_{t-1}\right| - E\left|\varepsilon_{t-1}\right|\right) \quad \varepsilon_t = e\sqrt{h_t} \quad e \approx IN(0,1)$$

The estimation period is from September 1st, 2000 to February 28th, 2002. The values in parenthesis correspond to the t-statistics. The returns for each country correspond to an equally weighted portfolio of the final sample of ADRs from each country.

	Argentina		**Chile**		**Brazil**	
	S&P 500	***MSCI***	***S&P 500***	***MSCI***	***S&P 500***	***MSCI***
	Panel A: Coefficients of the Mean Return Process					
Intercept (α)	-0.0032 *** (–4.46)	-0.0028 *** (–102.43)	0.00044 (0.82)	0.00031 (0.55)	-0.00029 (–0.25)	0.00004 (0.03)
Beta (β)	0.53 *** (9.21)	0.81 *** (3077.95)	0.13 *** (3.17)	0.27 *** (4.95)	0.66 *** (9.17)	0.89 *** (8.43)
Δ Intercept (λ)	-0.0022 (–1.25)	-0.0026 (–1.43)	-0.0054 *** (–4.51)	-0.003 *** (–2.87)	0.0023 (1.12)	0.0025 (1.18)
Δ Beta (θ)	0.039 (0.32)	-0.086 (–0.43)	0.33 *** (3.87)	-0.025 (–0.25)	0.40 *** (2.53)	0.21 (1.05)
	Panel B: Coefficients of the Error Process					
Intercept (w)	-1.13 *** (–3.03)	-1.02 *** (–3.12)	-12.14 *** (–8.15)	-12.61 *** (–9.38)	-1.90 *** (–2.97)	-2.11 *** (–2.74)
EGarch 1 (κ)	0.85 *** (18.28)	0.87 *** (21.18)	-0.30 * (–1.91)	-0.35 ** (–2.47)	0.76 *** (9.67)	0.74 *** (7.76)

EArch 1 (φ)	0.56 *** (5.96)	0.63 *** (6.41)	0.57 *** (4.27)	0.67 *** (5.03)	0.27 *** (2.98)	0.29 *** (3.00)
Leverage (γ)	-0.39 *** (–3.69)	-0.32 *** (–3.16)	0.13 (0.94)	0.026 (0.20)	-0.74 ** (–2.19)	-0.69 ** (–2.36)

*, ** and *** represents 10, 5 and 1% of significance respectively.

Panel B of table III presents the estimated coefficients for the error process. Confirming our presumptions, all coefficients for Argentina and Brazil are significant at conventional levels of significance. For both countries, the parameter κ is close to one indicating a high persistence in the variance of returns. Chile seems to be a particular case since the persistence, although significant, is lower. In summary shocks in variance are long lasting for Argentina and Brazil, indicating perhaps a closer relationship between these two countries. On the other hand the conditional variance for Chile seems to be of shorter memory.

2. **Abnormal returns during the events**

For completeness, we present the abnormal returns when the error term is assumed white noise in the appendix (Table A-I). Table IV presents the abnormal returns under the EGARCH (1,1) specification for the error term. As expected, there is a great deal of consistency between abnormal returns under the two specifications for the error term. Furthermore, by incorporating the heteroskedasticity of residuals into the model, the efficiency of the estimates increases and, therefore, more events are significant, especially in the beginning of the period. Another interesting feature that enhances the robustness of the results is the consistency in sign and magnitude for most of the abnormal returns for the three countries independently of the index used as the market proxy. In general, the contrast between the sign of the abnormal returns and the news announced that day show a very consistent picture across countries and events.

We see that most of the events are significant for Argentina. Although some events are only significant when measured in relation to the S&P 500, the sign and magnitude are similar for both indexes. Chile and Brazil show fewer significant events than Argentina, but these two countries also share the same feature about the consistency in sign and magnitude under the two stock indexes. The evidence indicates the existence of contagion effects for the region even during the incubation of the Argentine crisis. However, and consistent with findings by Bailey et al. (2000) for the Mexican crisis, we find that even though investors rebalance their Latin American holdings during some announcements, they seem to differentiate the other Latin American markets from the Argentine one. This is also consistent with evidence presented by Chung (2004) for the Asian crisis.

A simple view of the number of significant abnormal returns suggests that contagion is more severe for Chile than it is for Brazil. Given the closer commercial links between Argentina and Brazil, it appears surprising the low number of observed abnormal returns for Brazil. It could be argued that difference in the nature of the firms composing the portfolios (diversity of industries) is the reason of these results. Another potential explanation is that Brazilian firms might be less exposed to *unexpected* shocks due to a more developed capital market (availability of financial hedging instruments) Nonetheless, we leave this explanation as a conjecture only. The approval of the responsibility law in Argentina (event 10) has a negative abnormal return for Argentina and Brazil, but Brazil seems more affected by the announcement than Argentina. It might be the case that, as part of this responsibility law, some restrictions had been placed on trade with Brazil.

Table IV: Abnormal returns for each portfolio for each event.

The parameters were estimated using as a proxy for the market, the S&P 500 composite and the MSCI World index. The results below correspond to the 22 dummy-event variables in the function:

$$R_{it} = \alpha_i + \beta R_{mt} + \lambda D_{sept} + \theta D_{sept} R_{mt} + \sum_{i=1}^{22} \phi_i D_i + \varepsilon$$

Where R_{it} is the return of the country portfolio. The variance of the error term is assumed to follow an exponential Garch (1,1) process as follows:

$$Ln(h_t) = w + \kappa Ln(h_{t-1}) + \varphi g(\varepsilon_{t-1})$$

$$g(\varepsilon_{t-1}) = \gamma \varepsilon_{t-1} + \left(|\varepsilon_{t-1}| - E|\varepsilon_{t-1}| \right) \varepsilon_t = e\sqrt{h_t} \quad e \approx IN(0,1)$$

The estimation period is from September 1st, 2000 to February 28th, 2002. The values in parenthesis correspond to the t-statistics. The returns for each country correspond to an equally weighted portfolio of the final sample of ADRs from each country. Dates are detailed in table I and the events are detailed in appendix 1.

	Argentina		**Chile**		**Brazil**	
Event	***SP500***	***MSCI***	***SP500***	***MSCI***	***SP500***	***MSCI***
1. September 15, 2000	0.31 (0.46)	0.36 (0.68)	0.3 (0.69)	0.37 (0.91)	-1.29 (–1.34)	**-1.35** [c] (–1.85)
2. December 18, 2000	**1.10** [b] (2.01)	**1.21** [c] (1.9)	0.16 (0.33)	0.23 (0.56)	0.87 (1.01)	0.89 (1.05)
3. January 12, 2001.	**1.16** [a] (16.04)	**0.99** [d] (1.5)	**0.55** [c] (1.77)	**0.4** [d] (1.47)	-0.19 (–0.21)	-0.33 (–0.35)
4. February 19, 2001	**-0.73** [d] (–1.47)	-0.58 (–1.08)	-0.22 (–0.54)	-0.094 (–0.25)	-0.58 (–0.62)	-0.51 (–0.52)
5. March 16, 2001	**-1.05** [d] (–1.52)	-1.09 (–1.2)	0.008 (0.02)	-0.024 (–0.06)	-0.51 (–0.64)	-0.57 (–0.70)
6. March 21, 2001	**-1.27** [c] (–1.7)	-0.75 (–0.90)	-0.26 (–0.69)	**-0.53** [c] (–1.66)	**-1.65** [c] (–1.75)	-1.34 (–1.36)
7. April 2, 2001	0.09 (0.18)	0.017 (0.03)	-0.31 (–1.03)	-0.27 (–0.83)	-0.17 (–0.64)	**-0.24** [c] (–1.85)

8. May 21, 2001	**0.76** [c] (1.68)	**0.72** [d] (1.4)	**0.33** [b] (2.11)	**0.35** [a] (5.99)	-1.02 (–1.16)	-1.08 (–1.15)
9. June 3, 2001	**0.89** [d] (1.52)	**0.91** [c] (1.67)	-0.75 (–1.22)	-0.68 (–1.12)	0.26 (0.33)	0.15 (0.17)
10. June 30, 2001	**-1.59** [c] (–1.78)	**-1.52** [d] (–1.47)	0.22 (0.57)	0.3 (0.93)	**-2.37** [a] (–2.48)	**-2.28** [b] (–2.36)
11. August 9, 2001	**2.23** [a] (2.59)	**2.56** [a] (3.3)	**1.21** [a] (3.13)	**1.4** [a] (4.05)	0.19 (0.24)	0.42 (0.51)
12. August 21, 2001	**1.64** [b] (2.33)	**1.63** [b] (2.41)	0.26 (0.89)	**0.21** [a] (3.6)	**-1.21** [d] (–1.43)	**-1.48** [c] (–1.84)
13. September 7, 2001	0.085 (0.11)	0.99 (1.19)	**0.99** [c] (1.76)	**1.36** [a] (3.65)	-0.51 (–0.60)	**1.6** [d] (1.59)
14. October 16-17, 2001	**2.07** [a] (2.79)	**1.98** [a] (2.6)	**1.81** [a] (3.11)	**0.81** [d] (1.4)	0.07 (0.08)	-0.51 (–0.54)
15. October 30, 2001	-1.12 (–1.33)	-0.92 (–0.75)	0.53 (0.94)	-0.11 (–0.21)	0 (0)	-0.16 (–0.18)
16. November 1, 2001	0.38 (0.52)	0.36 (0.5)	**-0.72** [c] (–1.92)	**-1.13** [c] (–1.78)	**2.07** [b] (2.34)	**2.38** [a] (2.52)
17. December 1, 2001	**-1.64** [c] (–1.65)	-1.57 (–1.38)	-0.089 (–0.21)	**-0.51** [d] (–1.41)	-0.99 (–1.07)	-0.99 (–1.09)
18. December 20, 2001	**2.2** [a] (2.6)	**2.21** [a] (3.34)	0.55 (1.17)	0.12 (0.27)	-0.84 (–0.89)	-1.17 (–1.25)

19. December 24, 2001	**0.64** [a] (3.39)	0.5 (0.67)	**1.3** [a] (3.13)	**1.04** [a] (2.92)	0.044 (0.05)	**-0.28** [d] (–1.43)
20. January 4, 2002	**-3.48** [a] (–7.46)	**-3.46** [a] (–5.94)	-0.14 (–0.33)	-0.11 (–0.17)	-0.21 (–0.33)	-0.36 (–0.52)
21. January 16, 2002	**5.18** [a] (3.75)	**5.16** [a] (4.45)	0.51 (1.23)	0.15 (0.46)	-0.026 (–0.03)	-0.2 (–0.25)
22. February 3, 2002	**-0.66** [a] (–2.48)	-0.57 (–0.52)	0.022 (0.04)	**-1.5** [a] (–2.46)	0.34 (0.35)	0.42 (0.42)

a, b, c, d represent 1, 5, 10 and 15% of significance respectively.

Events 3, 8, 11 and 14 are significant for Chile and Argentina, but not significant for Brazil. Locking at table I, we see that most of these events are related to news generated outside Argentina (mainly IMF-related). This suggests that the nature of the news would be important in the contagion effects for Chile, which is consistent with the evidence reported by Kaminsky and Schmukler (1999). Consistent with Bailey, Chan and Chung (2000), we also observe that the abnormal return for the Chilean ADRs are lower than those observed in Argentine ADRs during these events. Thus, it suggests that investors do not perceive Chile and Argentina as one integrated market. In general, we observe that Chile benefits from positive shocks, but remains with no abnormal return during negative shocks, which suggests an asymmetry in the spillover effects for Chile. This last finding question in some sense the ability of test based on (linear) Granger causality to uncover spillover effects in returns. Additionally, we cannot discard that given the closeness of events 18 and 19, the significant abnormal return observed for Chile during the event 19 be a late reaction to event 18; result that is fully consistent with the findings described above.

Events 2, 9, 18, 20 and 21 are only significant for Argentina. In table I, we can see that these events are mainly related to internal decisions/events occurring/announced in Argentina. This confirms the previous conclusion that the nature of the news, and specifically the source, is an important determinant of the magnitude of the spillover effects. The resignation of the former president, Fernando de la Rua, (event 18) seems to have been good news for Argentine ADRs (significant 2.2%). One the other hand during the formal announcement of devaluation (event 20), we observe a significantly negative abnormal return of -3.5% for the Argentine portfolio. The highest abnormal return (5.2%) corresponds to the extension of one year given by IMF for the first payment of the stand-by credit (event 21). The magnitude of these abnormal returns, in particular the three just described, and the insignificance of these events for the Chilean and Brazilian portfolios confirm the previous conclusion that ADR investors would not see the region as one unique market. A surprising finding is that the explosion of the crisis in turkey (event 4) seems to have only weak effects on Argentina and no significant effects on Chile and Brazil.

5. Conclusion

Financial and exchange rate crises in emerging countries during the last decade have generated increasing interest in the subject of contagion. Links in fundamentals as well as asymmetries of information are in the center of the theories explaining this interesting phenomenon.

In this paper, we study the spillover effects of the Argentine pre crisis period on two Latin American countries. In particular, we study the performance of Argentine, Brazilian and Chilean ADRs during important announcements related to the incubation of this crisis. Consistent with previous empirical research, we find that Argentine-related news affect principally the country in crisis, Argentina. Even though we find evidence of contagion (abnormal returns) for Chile and Brazil during important Argentine-related events, investors appear not to be rebalancing their portfolios away from non-Argentine Latin American stocks.

Also consistent with previous empirical research, we find that the nature of the news is important in the consequent stock price reactions. International news seems to be more important for the surrounding countries than news generated in Argentina. In addition, the returns of Chilean stocks seem to be more affected than Brazilian stocks during the news releases, especially during "good news" events. We argue that this effect might due to the greater availability of financial hedging instruments in Brazil.

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Appendix

Table A-I: Abnormal returns for each portfolio for each event.

The parameters were estimated using as a proxy for the market, the S&P 500 composite and the MSCI World index. The results below correspond to the 22 dummy-event variables in the function:

$$R_{it} = \alpha_i + \beta R_{mt} + \lambda D_{sept} + \theta D_{sept} R_{mt} + \sum_{i=1}^{22} \phi_i D_i + \varepsilon$$

Where R_{it} is the return of the country portfolio. The error term is assumed to be IID Normal with zero mean. The estimation period is from September 1st, 2000 to February 28th, 2002. The values in parenthesis correspond to the t-statistics for the null that the average three-days abnormal return is zero. The returns for each country correspond to an equally weighted portfolio of the final sample of ADRs from each country.

	Argentina		**Chile**		**Brazil**	
Event	*SP500*	*MSCI*	*SP500*	*MSCI*	*SP500*	*MSCI*
1. September 15, 2000	0.45 (0.35)	0.36 (0.28)	0.23 (0.39)	0.23 (0.40)	-0.98 (–0.92)	-1.084 (–1.01)
2. December 18, 2000	1.21 (0.95)	1.24 (0.98)	0.19 (0.33)	0.25 (0.42)	0.77 (0.71)	0.831 (0.77)
3. January 12, 2001.	1.14 (1.04)	0.98 (0.89)	**1.38** [a] (2.73)	**1.31** [a] (2.59)	0.088 (0.09)	-0.12 (–0.13)
4. February 19, 2001	-0.74 (–0.67)	-0.72 (–0.65)	-0.36 (–0.7)	-0.29 (–0.58)	-0.36 (–0.38)	-0.31 (–0.33)
5. March 16, 2001	-1.083 (–0.86)	-1.124 (–0.89)	0.12 (0.21)	0.14 (0.24)	-0.17 (–0.15)	-0.20 (–0.19)
6. March 21, 2001	0.84 (0.76)	0.72 (0.65)	-0.31 (–0.62)	-0.41 (–0.80)	-0.62 (–0.66)	-0.80 (–0.85)
7. April 2, 2001	0.24	0.17	-0.38	-0.399	-0.078	-0.17

	(0.22)	(0.15)	(–0.75)	(–0.79)	(–0.08)	(–0.18)
8. May 21, 2001	0.72 (0.57)	0.66 (0.52)	0.33 (0.57)	0.31 (0.53)	-0.82 (–0.76)	-0.89 (–0.84)
9. June 3, 2001	0.68 (0.53)	0.59 (0.46)	**-0.98** [c] (–1.69)	**-1.02** [c] (–1.75)	0.402 (0.37)	0.28 (0.27)
10. June 30, 2001	-1.46 (–1.16)	-1.44 (–1.14)	0.50 (0.86)	0.51 (0.88)	**-2.15** [b] (–2.01)	**-2.11** [b] (–1.98)
11. August 9, 2001	**2.24** [c] (1.77)	**2.54** [b] (2)	**1.15** [b] (1.97)	**1.25** [b] (2.15)	0.19 (0.17)	0.572 (0.53)
12. August 21, 2001	1.57 (1.24)	1.43 (1.13)	0.35 (0.61)	0.32 (0.54)	-0.99 (–0.93)	-1.12 (–1.09)
13. September 7, 2001	-0.92 (–0.73)	-0.62 (–0.49)	-0.501 (–0.86)	-0.36 (–0.62)	-0.86 (–0.80)	-0.47 (–0.43)
14. October 16-17, 2001	**2.83** [b] (2.2)	**2.56** [b] (2)	**1.29** [b] (2.18)	**1.072** [c] (1.82)	0.012 (0.01)	-0.42 (–0.39)
15. October 30, 2001	0.19 (0.14)	0.19 (0.15)	0.42 (0.69)	0.42 (0.70)	0.086 (0.08)	0.17 (0.15)
16. November 1, 2001	0.93 (0.72)	1.09 (0.84)	-0.77 (–1.3)	-0.65 (–1.10)	**2.19** [b] (1.99)	**2.4** [b] (2.2)
17. December 1, 2001	-1.09 (–0.98)	-1.06 (–0.95)	-0.27 (–0.52)	-0.24 (–0.47)	-0.48 (–0.5)	-0.4 (–0.42)
18. December 20, 2001	**2.68** [b]	**2.57** [b]	0.52	0.44	-0.45	-0.62

	(2.10)	(2.01)	(0.89)	(0.75)	(–0.41)	(–0.57)
19. December 24, 2001	1.09 (0.86)	1.01 (0.76)	**0.885** [d] (1.51)	**0.81** [d] (1.38)	-0.067 (–0.06)	-0.23 (–0.21)
20. January 4, 2002	**-3.05** [a] (–2.74)	**-3.01** [a] (–2.69)	-0.046 (–0.09)	-0.007 (–0.01)	-0.77 (–0.82)	-0.68 (–0.71)
21. January 16, 2002	**4.14** [a] (3.7)	**4.01** [a] (3.59)	0.33 (0.63)	0.23 (0.44)	0.345 (0.36)	0.16 (0.17)
22. February 3, 2002	-0.25 (–0.19)	-0.22 (–0.17)	-0.27 (–0.46)	-0.24 (–0.40)	0.65 (0.59)	0.78 (0.70)

a, b, c and d represents 1, 5, 10, 15% of significance respectively.

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2 Ingeniero Comercial (Universidad de Talca), Master of Science in Finance (Concordia University, Canada). Profesor Escuela de Contador Público y Auditor, Facultad de Ciencias Empresariales, Universidad de Talca, Chile. Dos Norte 685, Casilla 721, Talca, Chile. E-mail: pmoran@utalca.cl

3 Melvin (2003) finds that, for a short period during the Argentine crises, ADRs and the underlying shares deviated from this parity. He argues that this deviation does not reflect failure of arbitrage pressures, but the premium due to capital controls imposed by the Argentine government by the end of 2001. These findings will impose a restriction on our empirical approach later.

4 Bin et al. (2004) also use ADRs and, as we do here, event study methods to test for contagion during the major currency crises in the 1990s.

5 Note that we do not eliminate completely this clustering problem as each country portfolio will still be considered as independent in our estimation.