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Contagion Effects from the 1994 Mexican Peso Crisis: Evidence from Chilean Stocks

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Abstract

The contagion, or informational spillover, effects of the 1994 peso crisis from the Mexican market to the Chilean market, and to the Chilean American Depository Receipts (ADRs) trading in the U.S., are examined. Significant excess returns are observed for Chilean stocks for the event dates of the Mexican Peso crisis, providing evidence of contagion effects. Significant excess returns on these Chilean ADRs are also observed for each of the five event dates associated with the Peso crisis, suggesting that the contagion effects spilled over to the ADRs. A multiple regression model shows that the spillover contagion effects were very efficiently transmitted from the Mexican market to the Chilean market to the Chilean ADRs. Multifactor

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regressions show that the most significant influence on the pricing of Chilean ADRs is the raw Chilean Index, rather than the Chilean Index expressed in U.S. dollars.

Keywords: contagion, Mexican Peso crisis, transmission of volatility

JEL classifications: F23/F34/G15

1. Introduction

In late 1994, Mexico started to feel the effects of a major financial crisis that resulted in the Mexican government devaluing the Mexican Peso (the Peso crisis). Along with the devaluation of the Mexican Peso, the Mexican stock market collapsed in anticipation of a harsher economic climate in Mexico (see Agenor and Masson, 1999, Buttimer and Swidler, 1998; Espinosa and Russell, 1996; Kamin, 1999; Kildegaard, 1996 for additional details on the Peso crisis).

Previous evidence suggests that significant events associated with a firm (see, e.g., Dickenson, 1991) or a country (see, e.g., Saunders, 1986, Karolyi and Stulz, 1996) have an informational spillover effect on other firms or countries. This "contagion" effect of news regarding a firm or a country has been well documented in areas such as bank failures and sovereign debt moratoriums.

The severity of the Peso crisis had significant implications for the regional economies in Latin America, suggesting that the contagion effect of the crisis should have been observable in other regional economies. While the Peso crisis has been examined from a variety of economic perspectives (see, e.g., Kilic (1998, 1999)), its cross-border contagion effects for common stock prices, in general, have not been studied. This paper seeks to fill this void in the literature.

Chile is of particular interest in examining the contagion effects of the Mexican Peso crisis. First, Chile and Mexico are significant trading partners. They have signed a bilateral trade agreement and from 1991 to 1994 total trade between Chile and Mexico increased by 150% (SECOFI, 1999). Second, Chile was one of the earliest economies in Latin America to adopt market liberalization reforms. By late 1994, Chile was widely viewed as an economic model for the rest of Latin America. It had a stable economy, prudent macroeconomic management policies, a high domestic savings rate, and a high quality banking system (IMF, 1996). Its economic growth rate averaged 5.5%, with a stable inflation rate of 9% and an unemployment rate below 7% (Gallardo, 1994). In fact, Chile, dubbed the "Tiger of the Andes" with its stable government, investment-grade bond ratings, and mature capital markets, was widely recognized throughout the Peso crisis as a "model of efficiency and innovation" (Escobar, 1995). In December 1994, President Bill Clinton announced his intent to make Chile the first South American member of NAFTA. Third, Chile's international reserves in 1994 were large enough to provide support for its currency against speculative attacks. By late 1994, Chile had international reserves of $12 billion and a trade surplus of $600 million. Fourth, during the Peso crisis, there were no economically significant events in Chile that would be

expected to influence either the Chilean currency or its stock markets. During the crisis, Chilean Finance Minister Aninat stated publicly that the Mexican crisis would not affect Chile, due to of their differential economic fundamentals, and analysts argued against "putting all Latin and South American countries in the same bag" (Handleman, 1995). Fifth, Five weeks into the crisis, Chile extended to beleaguered Mexico a one year, $200 million line of credit as part of a $1-billion offer from four Latin American neighbors, indicating a commitment on behalf of the Chilean administration to see the crisis resolved before the contagion spread (Washington Post, 1995). These factors make Chile an ideal candidate for examining the contagion effects of the Peso crisis.[1]

While the above factors were particularly relevant in using Chile to study the contagion effects of the Peso crisis, additional factors make Chile even more appealing for this study. In 1994, the stocks of fifteen of the largest Chilean firms were trading in the U.S. in the form of American Depository Receipts (ADRs).[2] These ADRs allow us to model the contagion effects through the transmission of information to three capital markets and two foreign exchange rates.

The purposes of this paper are to examine the contagion effects of the Mexican Peso crisis on Chilean stocks, and to examine the spillover contagion effects from the Chilean market to the Chilean ADRs trading in the U.S. If, in fact, investors expected the Chilean economy to be adversely affected by the Mexican crisis, then these expectations would not only affect Chilean stocks, but also they would be transmitted to the Chilean ADRs in the U.S. due to arbitrage-related factors. In addition to the Chilean stock index, we also utilize data on fifteen Chilean ADRs trading on the New York Stock Exchange (NYSE) to test both the contagion effects for the Chilean stocks and the spillover contagion effects for the Chilean ADRs related to the 1994 debt crisis in Mexico.

Five different issues are examined in this paper. First, we examine the contagion effects of the 1994 Mexican Peso crisis on the Chilean stock market. In the absence of any contagion effects, we would not observe significant price reactions for Chilean stocks on important dates associated with the Mexican Peso crisis. Second, we seek to identify the spillover contagion effects from the Chilean market to the Chilean ADRs trading in the U.S. during the Mexican Peso crisis. If no spillover contagion effects are present, then the Chilean ADRs should not show market-model adjusted excess returns in response to the Peso crisis. Third, we analyze all Peso crisis event dates simultaneously, while allowing for a shift in the

[1] As suggested by a referee, it is possible that interest rates in Mexico, Chile, and the U.S. may have served as conduits for the transmission of news. An examination of the 90 day government debt rates shows that while the Mexican and the U.S. interest rates tended to move in tandem during the Peso crisis, such was not the case for the Chilean rate. Thus, any Peso-related reactions in the Chilean stock market or Chilean ADRs cannot be attributed to interest rate parity based adjustments.

[2] In 1994, the U.S. was a significant trading partner for Chile, accounting for approximately 25 percent of its international trade.

systematic risk of the ADRs during the event period. Fourth, we examine the relationship between ADR returns and the returns on the NYSE, Chilean, and Mexican indices to gain insights into the pricing of ADRs. Finally, we investigate how new information in one market was transmitted to other markets during the Peso crisis.

The paper is organized as follows. Section 2 provides a discussion of the Mexican Peso crisis and the contagion hypothesis. The data and methodology are presented in Section 3. The results are discussed in Section 4, followed by conclusions in Section 5.

2. The 1994 peso crisis and contagion

2.1. The 1994 Mexican Peso crisis

In early 1994, as evidenced by a budget surplus, a respectable privatization policy, increasing capital inflows, and a declining government deficit, economic prospects for Mexico looked optimistic. However, in reality, Mexico was headed into a severe financial crisis that ultimately resulted in the devaluation of the Mexican Peso by the end of 1994 (the Peso crisis). Several important factors contributed to the Peso crisis. The assassination of a Mexican presidential candidate and political unrest in the impoverished state of Chiapas negatively affected investors' confidence in the stability of the Mexican government. There were serious regarding about the stability of the Mexican government and its ability to constructively engage in conducting domestic policy, thereby leading to capital flight. Furthermore, investors considered the replacement of a significant amount of short-term debt with "Tesebonos"—securities convertible to U.S. dollars at maturity— as a troubling sign regarding confidence in the Peso, By December 1994, investors fearing hyperinflation, default, and capital controls, fled the Peso, resulting in the decline in Mexico's foreign exchange reserves from $30 billion in 1993 to $5 billion by December 1994. The Mexican government did not recognize that the depletion of reserves constituted a long-term decline in the demand for Mexican assets by foreign investors. Thus, it appears that the government did not anticipate the extent of the Mexican stock market's reaction to the depreciation of the Peso.[3]

On assuming office on December 1, 1994, Mexican president Zedillo provided strong assurances to investors that the Peso would be maintained around an exchange rate of 3.4 Pesos to the dollar. However, when investors sold Pesos and exerted pressure of the exchange rates, Mexican finance minister Mr. Jaime Serra y Puche announced that the upper limit of the exchange rate would be increased by 13%. The Peso immediately devalued to this level. Mexico let the Peso float on December 22, 1994, resulting in a depreciation of 36%.

The U.S. government feared that a major economic recession in Mexico held the potential for spreading to other Latin American countries. Thus, on January 12,

[3] These investments held the potential for providing investors with an opportunity to examine and adjust their Latin American portfolio holdings.

1995, it began to consider a support package to stabilize the Peso. Political infighting kept the package from receiving swift approval. It was not until January 31, 1995, that a support package of $20 billion was made available through the U.S. Treasury's Exchange Stabilization Fund. The significant dates and events associated with the 1994 Peso crisis are summarized as follows: on December 20, 1994, the Mexican government announced an official devaluation of the Peso; on December 22, 1994, the Peso was allowed to float; on December 27, 1994, the auction of dollar denominated Mexican government bonds fails to attract capital; on January 12, 1995, the U.S. government pledge support for the Peso stabilization plan; on January 31, 1995 funds for U.S. support package become available.

2.2. Contagion

Contagion is considered analogous to the "domino effect" where news for one firm, or related to one country, spills over to other firms in the industry, or to other countries (Karolyi and Stulz, 1996). Much of the literature examining the existence of contagion is related to the banking industry and to sovereign debt. Information based contagion models (Jacklin and Bhattacharya, 1988) argues that depositors' private information about risky investments leads to contagions, while pure panic models (see, e.g., Diamond and Dybvig, 1983) propose that uninformed investors substitute psychological panic for information.

The information-based contagion hypothesis has been supported by the literature. For example, Aharony and Swary (1996) examine the characteristics of bank failure contagion in the Southwest United States and find that distance from the failed bank and capital adequacy are negatively related to the size of the contagion impact. They conclude that information is conveyed through similarity to the failed bank, which is perceived by depositors and investors to be proxied by these variables. Evidence for the pure panic phenomenon is limited. Jayanti, Whyte, and Do (1996) find that even in the presence of deposit insurance, contagion still took place in a sample of Canadian banks following bank failures in the Canadian banking industry, indicating that uninformed responses may drive bank runs.

International events may also precipitate shifts in investor perceptions that lead to contagion. Harvey and Huang (1991) show that informational spillovers from one market affect price formation in other markets. Several studies have investigated the contagion effects of international debt crises. Saunders (1986) suggests that the 1982 Mexican-Brazilian debt crisis may have affected interest rate spreads and loan volumes in the international loan market. Karafiath, Mynatt, and Smith (1991) extend the evidence on international default by showing that investors continued to adjust their expectations following the 1987 Brazilian debt moratorium.

2.3. Contagion and chilean stocks

Due to the reasons mentioned previously, it can be logically expected that investors in Chilean stocks would react to news related to the Peso crisis. We would expect Chilean stock prices to react when news is disseminated about the Peso crisis.

For example, if investors had viewed Chile as prone to a near-term currency crisis similar to the one in Mexico, then the Mexican crisis would have produced a negative stock reaction in Chile ("putting all Latin and South American countries in the same bag"). In addition, investors may have formed expectations regarding reactive monetary and exchange rate policy interventions by the Chilean government. If investors believed that the Chilean government would be able to restrict the negative impact of the Mexican crisis through a prudent policy of intervention in monetary and currency markets, they may have been willing to hold on to or may in fact have increased their holdings in Chilean assets, thereby actually positively influencing Chilean stocks. Further, the Chilean-Mexican exchange rate realignment driven by the Mexico Peso crisis could have influenced Chilean corporate profits and their stocks, especially of those corporations that were involved in Chile-Mexico cross-border trade and investment. Thus, there are multiple reasons for the existence of a Peso crisis contagion effect on Chilean stocks.

Of even greater interest is the potential for spillover contagion effects from the Chilean stocks to their ADRs trading in the U.S. Information and/or panic driven Chilean Peso-U.S. Dollar exchange rate realignments would have impacted the Chilean ADR trading in the U.S. In addition, a possible negative impact of the Mexican crisis on corporate fundamentals of Chilean firms trading as ADRs would have impacted the ADR prices in NYSE. Thus, we would expect a spillover contagion of the Mexican Peso crisis on Chilean ADRs trading in the U.S.

Fortunately, a significant number of Chilean stocks had ADRs trading in the U.S. during 1994–5. Furthermore, these ADRs generally represented a substantial cross-section of economic activity in the Chilean economy. These dynamics provide a unique opportunity to study the information spillover contagion effects associated with the 1994 Mexican Peso crisis.

A primary issue of ADRs is made by a U.S. bank in lieu of the foreign shares that are physically deposited in trust with the bank's foreign affiliate (see, e.g., Kim et al. 2000). Subsequent to the primary issue, the ADRs trade in the same manner as ordinary shares of U.S. firms. In theory, the price of an ADR reflects both the changes in the value of its underlying home country security and its home currency shifts against the U.S. dollar. U.S. market conditions may also affect the price of an ADR because it is traded in the U.S. ADR owners can convert ADRs into the underlying home country currency shares, and investors holding the home currency shares can convert their holdings into ADRs. Thus, any arbitrage opportunity between the prices of ADRs and their underlying securities quickly forces parity between the two categories of securities. If exchange rates are constant, then any changes in the underlying securities should be contemporaneously reflected in ADR prices. Similarly, foreign exchange changes should be contemporaneously reflected in security prices.

3. Data and methodology

All returns time series include adjustments for dividends paid. Four different methodologies are used to examine the five issues identified in this paper.

3.1. Data

Data for the Santiago stock index IGPA were obtained from the Research Department at the Chilean Stock Exchange. IGPA represents the Chilean stock market on average. Data for the Mexican stock index IPC were obtained from the *Wall Street Journal*. The U.S. stock market is proxied by the Center for Research on Security Prices (CRSP) at the University of Chicago CRSP equally-weighted index and the NYSE Index. Daily foreign exchange data were obtained from various issues of the *Wall Street Journal*. We use for our analysis the universe of fifteen Chilean ADRs trading in the U.S. at the time of the Peso crisis: Admin Fondos Pensions, Banco O' Higgins, Banco Osorno y La Union, Chilgener SA, Compania Cerveceria, Compania Telecom Chile, Cristalerias de Chile, Embotelladora Andina, Empresa Nacional Electric Chile, Enersis SA, Laboratorio Chile, Madeco SA, Maderas y Sinteticos, Sociedad Quimica Minera, and Vina Concha y Toro are the Chilean ADRs used in the study. We form a portfolio of returns for these ADRs for the period November 1, 1994, to June 1, 1995. Returns data for the Chilean ADRs are obtained from CRSP.

3.2. Event study

Standard event study methodology (Brown and Warner 1985) is used to identify cumulative average excess returns (CAERs) for the event day (0), the day prior to the event (–1) and days –1 and 0 (–1, 0) for the Chilean stocks and the Chilean ADRs. For the Chilean stocks we use the Mexican IPC index as the market index. For the Chilean ADRs, the results are invariant to the use of either the equally-weighted CRSP index or the value-weighted CRSP index. The market model specifies the return generating process. The CAERs are estimated by using Scholes-Williams (1977) betas to adjust for possible non-synchronous trading. The significance tests are adjusted for cross-sectional dependence in the regression residuals. The event study results are reported in Table 1.

3.3. Regression analysis

Event day clustering and an industry, or in the present case country, induced correlation of returns can be addressed through the use of the multivariate regression model (MRM) based on Zellner's (1962) SUR framework (Binder 1985), which has been utilized, for example, by Sundaram, Rangan, and Davidson (1992). The event period begins on December 20, 1994 and ends on January 31, 1995 (the resolution date), when the U.S. support package became available. The estimated model specifically recognizes the possibility of shifts in risk parameters during the event period and the post-event period. The following MRM is estimated:

$$r_t = a + a' D_s + b r_{mt} + b' D_o r_{mt} + b'' D_s r_{mt} + \sum_{i=I}^{n} C_i D_i + e_t \qquad (1)$$

where: r_t = the rate of return on the portfolio of Chilean ADRs for day t; r_{mt} = the

Table 1

Cumulative average excess returns: Chilean stock market

Event Date	(–1, 0)	(–1)	(0)
Panel A: Chilean Stock Market			
12/20/1994	–1.47	–0.41	–1.06
Negative	(–2.32)**	(–0.84)	(–1.79)*
12/22/1994	–1.96	–1.06	–0.43
Negative	(–2.78)***	(–1.69)*	(–0.73)
12/27/1994	1.36	1.79	–0.43
Negative	(1.81)*	(2.55)**	(–0.97)
01/12/1995	5.28	1.91	3.37
Positive	(3.98)***	(2.43)**	(4.17)***
01/31/1995	–0.55	–1.81	1.26
Positive	(–0.91)	(–3.81)***	(2.12)**
Panel B: Chilean ADRs			
12/20/1994	–1.76	–0.13	–1.63
Negative	(–3.20)***	(–0.44)	(–6.42)***
12/22/1994	–6.40	–2.87	–3.54
Negative	(–10.59)***	(–6.32)***	(–4.53)***
12/27/1994	0.23	1.54	–1.30
Negative	(0.29)	(2.41)**	(–1.30)
01/12/1995	6.34	1.90	4.45
Positive	(4.40)***	(1.61)	(5.25)***
01/31/1995	–0.25	–2.97	2.72
Positive	(–0.25)	(–7.82)***	(4.73)***

*** Indicates statistical significance at the 0.01 level.
** Indicates statistical significance at the 0.05 level.
* Indicates statistical significance at the 0.10 level.

[a] Negative [positive] means that the Peso crisis news on this date was negative [positive].
[b] CAERs—cumulative average excess returns–indicate the average market-model adjusted change over the event window in the market values of the stock index. The Mexican index is used as the market index. t statistics are given in parentheses.

rate of return on the market index; $a =$ the regression constant up to the agreement date; $a' =$ shift in the regression constant in the post-event period $b =$ systematic risk coefficient for the portfolio; $b' =$ shift in the systematic risk during the event period; $b'' =$ shift in the systematic risk during the post-event period; D_s (shift dummy variable) $= 1$ after the resolution date and $= 0$ up to the resolution date; D_o (shift dummy variable) $= 1$ during the event period and $= 0$ otherwise; D_i (information dummy variable i, for the ith event) $= 1$ if the announcement or the prior date and $= 0$ otherwise;[4] $C_i =$ coefficient of information dummy variable i for the

[4] The dummy variable takes the value one on the day prior to the event and on the event day to alleviate the problem of identifying the day of information release.

Table 2

Multiple regression results[1]

$$r_t = a + a' D_s + b r_{mt} + b' D_o r_{mt} + b'' D_s r_{mt} + \sum_{i=1}^{n} C_i D_i + e_t$$

Panel A: U.S. NYSE Index

Constant		Beta			Information Dummy Variables[4]				
Overall	Post[3]	Overall	Event[2]	Post[3]	D1	D2	D3	D4	D5
–0.57	0.65	–0.22	2.85	2.07	–0.30	–2.39	1.79	3.87	0.42
(–1.47)	(1.44)	(–0.29)	(2.04)**	(2.32)**	(–0.20)	(–1.59)	(1.19)	(2.58)***	(0.28)
$n = 122$									

Panel B: Chilean IGPA Index

Constant		Beta			Information Dummy Variables[4]				
Overall	Post[3]	Overall	Event[2]	Post[3]	D1	D2	D3	D4	D5
–0.10	0.22	0.57	1.05	0.88	0.10	–0.95	0.28	–0.86	0.41
(–0.54)	(1.02)	(1.39)	(2.40)**	(2.09)**	(0.15)	(–1.35)	(0.39)	(–1.05)	(0.59)
$N = 122$									

*** Indicates statistical significance at the 0.01 level.
** Indicates statistical significance at the 0.05 level.
* Indicates statistical significance at the 0.10 level.

[1] t statistics are reported in parentheses.
[2] Reports the change from overall during the event period from 12/19/1994 to 1/31/1995.
[3] Reports the change from overall during the postevent period from 2/1/1995 to 6/1/1995.
[4] The event dates are D1, 12/20/1994; D2, 12/22/1994; D3, 12/27/1994; D4, 1/12/1995; and D5, 1/31/1995.

portfolio; n = number of event dates analyzed; e_t = stochastic error term for the portfolio. The White (1982) correction procedure is used to correct for heteroskedasticity.

A shift in the market risk and return equilibrium may be evident following the resolution of the Mexican peso crisis. Given the ambiguity of the period of shift, it is appropriate to consider the day when the U.S. support package became available (January 31, 1995) as the resolution point because much uncertainty regarding the Peso support was eliminated on this day. Thus, D_s takes on the value of 1 for dates after January 31, 1995.

The dummy variable D_o is included in the model to isolate the shift in systematic risk during the event period. This allows for separate estimation of the systematic risk coefficient for the pre and post-event periods. The significance of the changes in the model parameters and information effects are measured by the t-statistics of the model coefficients. The results from this model are presented in Table 2.

3.4. Multi-factor regression model

Event study methodology provides an indication of the excess returns for the event dates associated with the Peso crisis. The MRM captures the dynamics between

the Chilean ADR portfolio returns and either the NYSE or the IGPA Index. However, these methodologies do not provide any indication of the extent to which Chilean ADRs in the U.S. respond to an index in the presence of other indices. Thus, we use a multi-factor asset-pricing model, as shown below, that allows us to model this issue (see Jorion and Schwartz, 1986):

$$r_t = a_o + a_1 NYSE_t + a_z IGPA_t + a_3 CRANCY_t + a_4 MXIPC_t + e_t \qquad (2)$$

where r_t is the return on the portfolio of Chilean ADRs, NYSE, IGPA, and MXIPC are the returns on the U.S., Chilean, and Mexican stock market indices, respectively, and CRNCY is the U.S.-Chilean foreign exchange rate. A second model is also estimated in which CRNCY is removed from the model, and IGPA and MXIPC are replaced by IGPAD and MXIPCD, respectively, which are the U.S. dollar returns on the Chilean and Mexican indices. Both models are designed to identify the influence of fluctuations in both the underlying indices and the exchange rates. The multifactor regression results are presented in Table 3.

3.5. Variance decompositions

To further investigate the dynamic interactions among the variables, a five-variable vector autoregression (VAR) is fitted for NYSE, MXIPC, CYNCY, IGPA, and ARCHL, the rate of return on the portfolio of the Chilean ADRs. Based on multivariate versions of the Akaike Information Criterion and the Schwarz Bayesian Criterion, we estimate the VAR with six lags. We perform a variance decomposition analysis for the five-variable VAR using a Choleski decomposition. We use forecasting horizons of 1, 3, 5, 10 and 15 days. The construction of the VAR system is such that the error terms are serially uncorrelated. However, without adjusting for contemporaneous correlations, the possibility exists that an innovation in one variable may also work through the contemporaneous correlations of innovations of other series. This issue is resolved by using an orthogonal transformation so that the orthogonalized innovations form an identity covariance matrix. They are uncorrelated both serially and contemporaneously.

4. Results

4.1. Event study results, chilean stocks and ADRs

The event study results for the Chilean market are summarized in Table 1, Panel A. For the first event date, when Mexico announced a devaluation of the Peso, the CAERs are significantly negative for day 0, the event date.The CAERs are also significantly negative for the (–1, 0) window. These results indicate that the Chilean stock market reacted negatively to the Mexican Peso devaluation news, and constitutes evidence of contagion. The results suggest that irrespective of the economic

Table 3

Multifactor regression results

Results from regressing the returns on the portfolio of the Chilean ADRs trading in the United States (r) on the returns on the New York Stock Exchange (NYSE), the returns on the Chilean Stock Market Index (IGPA), the returns on the Chilean Index expressed in U.S. dollars (IGPAD), percentage changes in the U.S.–Chilean foreign exchange rate (CRNCY), the returns on the Mexican Stock Market Index (MXIPC), and the returns on the Mexican Index in U.S. dollars (MXIPCD). t statistics are in parentheses.

$$r_t = a_0 + a_1 NYSE_t + a_2 IGPA_t + a_3 CRNCY_t + a_4 MXIPC_t + e_t$$

IGPA and MXIPC are replaced by IGPAD and MXIPCD, respectively, in the model with CRNCY removed from the model.

Independent	Regression Number							
Variable	1	2	3	4	5	6	7	8
a_1	0.00	0.05	0.05	0.01	0.03	0.05	–0.02	0.13
	(0.00)	(0.55)	(0.56)	(0.16)	(0.31)	(0.33)	(–0.11)	(0.85)
NYSE	1.36			0.37	0.36		0.70	0.32
	(3.35)***			(1.96)*	(1.76)*		(2.12)**	(0.98)
IGPA		1.47	1.47	1.44	1.46			
		(22.95)***	(22.78)***	(21.95)***	(19.49)**			
CRNCY			0.00	–0.00	–0.02			
			(0.01)	(–0.17)	(–0.30)			
MXIPC					0.08			
					(2.32)**			
IGPAD						0.68	0.64	0.53
						(9.13)***	(8.52)***	(6.98)***
MXIPCD								0.15
								(4.70)***
R^2, %	7.80	81.30	81.14	81.59	80.33	40.54	42.22	49.21

*** Indicates statistical significance at the 0.01 level.
** Indicates statistical significance at the 0.05 level.
* Indicates statistical significance at the 0.10 level.

environment in Chile, Chilean investors felt that the Mexican Peso crisis would have carryover effects to the Chilean economy.

Negative information regarding the Peso was imparted to the market on the second and third event dates. On these dates, significantly negative CAERs are observed for the Chilean market, again indicating contagion effects.

Investors received positive news regarding the Peso crisis on January 12, 1995 and January 31, 1995. If contagion effects were present, then they would manifest themselves positively in the Chilean market on these two days. The results in Table 1, Panel A show significantly positive CAERs for day 0 on these two dates. Incidentally, Table 1 shows significantly negative CAERs for day –1 for the last event in the Peso crisis. The reason is that on January 30, 1995, there was increased uncertainty regarding the approval and availability of support funds from the U.S. government,

and the negative CAERs simply reflect this increased uncertainty. In summary, the results in Table 1 provide clear-cut evidence of contagion effects with the Chilean market going down [up] in reaction to negative [positive] news regarding the Mexican Peso crisis.

Of even greater interest is whether the contagion effects from Mexico to Chile were in fact extended to the Chilean ADRs trading in the U.S. The event study results for the Chilean ADRs for the five key dates associated with the Peso crisis are summarized in Table 1, Panel B. For the first event date on December 20, 1994, the results in Panel B show significant negative CAERs for the (–1, 0) window. This result suggests that if the Chilean ADRs are priced relative to the NYSE Index, then the market reacted negatively to the official announcement of the Mexican Peso devaluation. These results indicate the presence of spillover contagion effects from the Mexican market, via the Chilean market, to the Chilean ADRs. However, the results are not surprising. Given the arbitrage possibilities mentioned previously, it is logical to expect that when Chilean stocks decline in prices, their ADRs in the U.S. market would decline also.

The CAERs for the (–1, 0) window for December 22, 1994 are –6.40 percent, significant at the one percent level. Investors, as expected, perceived the floating of the peso very negatively. Investors did not react significantly on December 27, 1994 to the failure of the auction of dollar denominated Mexican bonds.

A resolution to the Peso crisis was apparent on January 12, 1995 when the U.S. government pledged to support a stabilization plan for the Peso. The (–1, 0) window CAERs for this event date reflects this positive news as they are significantly positive.

The CAERs surrounding the last event date are similar to what was observed for the Chilean stocks for this event date. The CAERs for day 0 are significantly negative and the CAERs for day –1 are significantly positive, for the reason articulated previously. In summary, these results provide strong evidence of spillover contagion effects.

4.2. Multiple regression results

The return on the Chilean ADR portfolio is the dependent variable in the MRM. For the results reported in Table 2, Panel A, the U.S. NYSE Index is used as the market index. The shifts in the beta during the event period and the post event are positive and significantly different from the overall portfolio beta. This result shows that the systematic risk of the Chilean ADRs increased significantly when the Mexican Peso crisis started to unfold.

Panel A also shows that the coefficient for D4, January 12, 1995, is significantly positive. This is the day on which the U.S. government pledged support for the Peso stabilization plan. The coefficients for the other event days are not significantly different from zero.

It is interesting to compare the results in Tables 1 and 2. The (–1, 0) window CAERs in Table 1, Panel B for D1 (12/20/1994) and D2 (12/22/94) are significantly

negative. However, such is not the case in Panel A, Table 2. The reason is that the negative CAERs in Table 1 are based on expected returns estimated from pre-event a and b, whereas in Table 2, shifts in a and b are captured prior to calculating the excess returns. The results show that the negative excess returns for D1 and D2 were primarily due to an increase in the systematic risk for the Chilean ADRs. The differences in excess returns in Table 1, Panel B and Table 2 for D3, D4, D5 are similarly accounted for by the shift in b during the event period.

Panel B, Table 2, reports the results for the MRM with the Chilean IGPA Index as the market index. As is the case for the MRM results for the NYSE Index, the event and the post event betas are statistically higher than the overall beta. However, the magnitude of the changes is not as large as with the NYSE Index. The coefficients for the five event dates are not significantly different from zero.

The combined results from Panels A and B in Table 2 indicate that during the event period, the pricing of the ADRs was driven by changes in the Chilean Peso IGPA Index since the information dummy variables are not different from zero. The results in Table 2 also show that, subsequent to the Peso crisis, based on both the NYSE Index and the Chilean IGPA Index, investors started to view Chilean ADRs as being significantly more risky.

4.3. Multifactor regression results

The results for the multi factor regressions for the ADRs are reported in Table 3. For all regressions the dependent variable is the return on the portfolio of Chilean ADRs trading in the U.S. In regression 1, the NYSE coefficient is significantly positive, with the returns in the index explaining 7.80% of the variation in the returns on the Chilean ADR portfolio.[5] In contrast, in regression 2, the coefficient for IGPA (the Chilean index unadjusted for exchange rate changes) is highly significant and explains 81.30 percent of the variation in the returns on the Chilean ADR portfolio.

Regression 3 includes both IGPA and CRNCY, changes in the U.S.-Chilean exchange rate, as the predictor variables. The IGPA coefficient is highly significant, while the CRNCY coefficient is not. This result is surprising in the sense that it indicates that during the Peso crisis the Chilean ADRs were priced *vis á vis* the IGPA Index in Pesos. Changes in the exchange rate as it reacted to the emerging Peso crisis did not influence returns on the Chilean ADRs.

Regression 4 includes the variables NYSE, IGPA and CRNCY. Both NYSE and IGPA have significant coefficients. However, the t statistic and the coefficient for IGPA are higher than for NYSE. This regression indicates that although the NYSE Index had some influence on the pricing of the Chilean ADRs during the Peso crisis,

[5] The regression models were also estimated by including one and two lags in model. Inclusion of the lagged variables did not affect the regression results.

the primary pricing of the ADRs was dependent on the average risky asset returns in the Chilean market, as proxied by IGPA.

Regression 5 adds the Mexican index, MXIPC, to regression 4. NYSE, IGPA and MXIPC all exert an influence on the Chilean ADR returns, with IGPA being most influential in explaining returns on the Chilean ADRs.

Regression 6 is with the dollar returns on the IGPA Index–IGPAD. The coefficient is significant but the R^2 is substantially lower than for regression 2 that has IGPA returns in Chilean Pesos. Regression 7 adds the NYSE Index to regression 6. Both variables are significant, and the result is similar to regression 4.

The last regression adds the dollar returns on the Mexican Index to regression 7. For this regression, IGPAD and MXIPCD have significant coefficients, while NYSE does not.

Collectively, and surprisingly, the regression results indicate that the Chilean Peso returns on IGPA were the primary determinant of returns on the Chilean ADR portfolio during the Peso crisis. The U.S.-Chilean exchange rate did not significantly influence the Chilean ADR portfolio returns.

4.4. Variance decompositions

We next estimate the variance decompositions for the five different forecasting horizons for the five-variable VAR using a Choleski decomposition. The order of the variables is NYSE → MXIPC → CRNCY → IGPA → ARCHL. This ordering may be justified on a semi-structural interpretation of interactions among the variables: U.S. and Mexican stock returns may be deemed "exogenous" for the Chilean stock market and ADR returns.[6] Innovations in the returns on U.S. shares explain a sizable proportion of their own forecast error variance. 68% of the forecast error variance for the Mexican Index returns is explained by their own innovations. U.S. returns explain just over 14% of the returns on the Mexican Index. Exchange rate returns are primarily explained by their own innovations, with the Chilean Index returns explaining another 15%, and the Chilean ADR portfolio returns explaining a further 7.4%.

Forecast error variance in the Chilean Index returns is primarily explained by their own innovations. Returns on the Mexican Index, the U.S. Index, and the Chilean ADR portfolio also influence Chilean Index returns. Almost 21% of the forecast error variance for the returns on the Chilean ADR portfolio is explained by their own innovations. However, the significant factor is the Chilean Index returns, which explains almost half of the variance in the ADR portfolio returns. The NYSE and the Mexican Index returns also explain 15% and 11% of the variance in the portfolio returns. It is interesting to note that exchange rate innovations do not significantly contribute to the pricing of Chilean ADRs.

[6] The results in tabular form are available from the corresponding author.

There are two further interesting aspects to note with these results. First, the Chilean Index has strong spillover effects since it has a significant influence on the NYSE Index, on the U.S.-Chilean foreign exchange rate, and on the Chilean ADR portfolio. The second interesting aspect is the spillover effect of the developments in the Mexican stock market. At a 15-day forecasting horizon, innovations in Mexican shares explain 12.9% of the forecast error in Chilean shares and 15.4% of the forecast error in the Chilean ADR portfolio. These results corroborate the evidence presented in Tables 1–3.

5. Conclusions

This paper examines the contagion effects of the 1994 Mexican peso crisis on both Chilean stocks trading in Chile and Chilean ADRs trading in the U.S. Our results show that the Chilean stock market and the Chilean ADRs reacted significantly to the five important news events associated with the Peso crisis. Significant excess returns are observed for the various event dates associated with the Peso crisis. Multiple regression models designed to estimate shifts in the regression parameters show that the systematic risk of Chilean ADRs increased substantially during both the event and the post-event periods.

Results from a multifactor regression model show that while the U.S. index was an influencing factor in the pricing of Chilean ADRs, the major influence on these ADRs is from the Chilean Index that had not been adjusted for exchange rate changes. Surprisingly, changes in the exchange rate did not influence the Chilean ADRs. Similarly, the dollar Chilean Index, which captures exchange rate dynamics, influences Chilean ADRs, but the influence is small when compared to the influence of the raw Chilean Index. These results suggest that during the Mexican peso crisis, investors priced Chilean ADRs *vis á vis* the Chilean Index, and did not consider exchange rate changes in the market. The raw or Peso-based measure of the Chilean Index was the major determinant of pricing Chilean ADRs during the Peso crisis.

The above results are confirmed when the variance decomposition results are considered. The Chilean Index influences not only the Chilean ADRs, but also the NYSE Index and the U.S.-Chilean exchange rate.

Overall, the results of this study suggest that the effects of the Peso crisis spilled over into the Chilean economy, thus providing support for the contagion hypothesis. Furthermore, during this period of uncertainty, investors did not pay attention to exchange rate based asset pricing. Rather, they simply applied the home country Chilean Index, unadjusted for exchange rate fluctuations, to price U.S. dollar denominated Chilean ADRs.

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