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Cross-border trading as a mechanism for implicit capital flight: ADRs and the Argentine crisis ☆

Sebastian Auguste[a], Kathryn M.E. Dominguez[b,c,d,*], Herman Kamil[e], Linda L. Tesar[c,d]

[a]*FIEL, Buenos Aires C1054 AAF, Argentina*
[b]*Gerald R. Ford School of Public Policy, University of Michigan, Ann Arbor, MI 48109, USA*
[c]*Department of Economics, University of Michigan, Ann Arbor, MI 48109, USA*
[d]*NBER, USA*
[e]*International Monetary Fund, Washington, DC 20431, USA*

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Abstract

Cross-listed shares may confound government efforts to control capital outflows by providing a legal means through which investors can transfer their wealth outside the country. We study the recent experience of investors who while subject to capital controls, were able to purchase cross-listed shares using local currency, convert them into dollar-denominated shares, re-sell them abroad, and deposit the dollar proceeds in foreign bank accounts. Capital controls drive a wedge between the

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*Corresponding author. Gerald R. Ford School of Public Policy, Department of Economics, University of Michigan, Ann Arbor, MI 48109, USA. Tel.: +17347649498; fax: +17347639181.
E-mail address: kathrynd@umich.edu (K.M.E. Dominguez).

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price of local shares and their corresponding cross-listed shares. This wedge provides an implicit devaluation forecast and the market's valuation of capital control circumvention.

JEL classification: F32; F36; G12; G15

Keywords: ADRs; Argentina; Capital controls; Capital flight; Venezuela

1. Introduction

The role and consequences of capital controls continues to be a subject of controversy for many developing countries. Governments that under normal circumstances advocate financial integration with global markets are often tempted to resort to capital controls in the face of economic crisis. Argentina and Venezuela are two recent cases in point. In December 2001, after a decade of open capital markets, the Argentine government imposed a series of financial market controls in an ultimately unsuccessful bid to forestall economic crisis. In early 2003, Venezuela established capital controls in the wake of a 20% devaluation. These experiences with capital controls afford an opportunity to examine the reactions of investors within and outside of the country to a drastic change in financial market conditions.

The same economic conditions that encourage governments to impose capital controls also give residents and investors in these countries incentives to remove their wealth. Capital flight can be accomplished through various channels. In this paper, we examine one potential channel for capital flight that is made possible by the existence of cross-listed shares. By converting locally purchased shares into their corresponding shares listed abroad, investors can effectively move their wealth out of the country, thereby confounding government efforts to control capital outflows.

There is an extensive literature on cross-listed shares and their role in the global integration of financial markets (see, for example, the survey by Karolyi (1998)). Cross listing of shares on the U.S. stock market allows firms to enjoy the advantages of greater liquidity, transparency and access to the U.S. capital market.[1] From the perspective of U.S. investors, cross-listed shares are a convenient way of obtaining global diversification.[2] This paper describes a new, and largely unstudied, role for cross-listed shares as a mechanism for capital flight.[3]

In the absence of capital controls, the law of one price should hold for cross-listed shares in the home and foreign market after controlling for the exchange rate and transaction costs. When capital controls are in place, however, the factors that determine demand for cross-listed shares in the home market may diverge from those in the foreign market resulting in a wedge between the two prices. In Section 2 below, we show how controls on

[1]See, for example, Alexander et al. (1987), Foerster and Karolyi (1999), Miller (1999), Ahearne et al. (2004), Melvin and Valerno-Tonone (2003), and Doidge et al. (2001).

[2]See, for example, Officer and Hoffmeister (1987), Wahab and Khandala (1993), and Jiang (1998). Domowitz et al. (1997), Errunza et al. (1999), and Karolyi and Stulz (2003) examine the broader influences of cross-listed shares on the development and integration of markets.

[3]Melvin (2003) and Kadiyala and Kadiyala (2004) also examine the role of cross-listed shares during the recent Argentine capital control regime.

capital inflows into the firm's home market will result in a premium on the firm's cross-listed shares in the foreign market relative to the corresponding shares in the local market, while controls on capital outflow will lead to a premium on shares in the local market relative to their corresponding cross-listed shares in the foreign market. We test this relationship in a cross-section of countries and find limited evidence of a systematic link between capital controls and the difference between the local price of shares and their corresponding (exchange rate adjusted) price in the foreign market. Lack of information about the specifics of the capital controls and their impact on the relative prices of cross-listed shares in the home and foreign markets, however, makes it difficult to draw strong conclusions about the relationship between violations of the law of one price for cross-listed shares and capital controls in general. Therefore, we turn to two specific cases of countries with capital controls and cross-listed shares, Argentina and Venezuela, in which we can precisely track changes in government policy and the consequent impact of these policies on share prices.

The financial regulations put in place during the crises in Argentina and Venezuela allow us to study how cross-listed shares can provide investors with a means of circumventing capital controls. In Section 3, we discuss the particular controls faced by investors in Argentina and calculate American Depositary Receipt (ADR)[4] discounts[5] based on the transactions costs that U.S. and Argentine investors faced during the December 2001–May 2002 period. We find evidence that local investors were willing to pay a substantial price to move their deposits out of the domestic market through the conversion of local shares to ADR shares in the U.S. At their peak, some ADRs in Argentina and Venezuela were trading at a discount (relative to their corresponding local price converted to dollars) of more than 50 cents on the dollar.

In the presence of capital controls, ADR discounts include the value of circumventing capital controls as well as the value of converting one's assets into dollars. We use ADR discounts in Argentina to estimate the market's expectation of the peso devaluation in January 2002 and to price capital control circumvention. We find that ADR discounts just before the actual devaluation indicate an expected 40–45% fall in the value of the peso relative to the dollar, similar to reports in a number of financial newspapers during this period. Our estimates of capital control circumvention value (CCCV) using the most liquid ADR, Perez Companc, average 3% over the full period, and rise to just under 6% before the devaluation.

In Section 4, we test whether the imposition of capital controls leads to changes in the underlying pricing structure of cross-listed stocks in Buenos Aires and New York. We find evidence that local market factors became more important for pricing cross-listed shares in Argentina, and less important for pricing the same cross-listed shares in New York during the period when capital controls were in place. Section 5 concludes.

[4]Although Depositary Receipts (DRs) can be issued in a number of markets, all of the cross-listed firms from Argentina and Venezuela issued DRs in the U.S.; consequently, we will refer to Argentine and Venezuelan cross-listed shares as ADRs. ADRs are classified by the U.S. SEC as Rule 144a, OTC, Level II or Level III. Level II and III ADRs require basic to full compliance with U.S. GAAP and SEC disclosure rules. Level III ADRs are capital raising.

[5]ADR discounts are measured as the difference between the local price in U.S. dollars and the ADR price, as a fraction of the local price in dollars (where the local price is adjusted for the ADR conversion ratio). See Eq. (6).

2. Cross-listed returns and capital controls

In order to understand how capital controls influence the relative price of cross-listed securities in the local and foreign markets, it is useful to define the pay-offs of holding these stocks in the two markets. Consider a security i that is traded on the local market but is also cross-listed in the U.S. We will use the following definitions:

p_{it}^{L} is the price of a share in firm i on the local market, in local currency; p_{it}^{ADR} the price of the associated ADRs for firm i in the U.S., in dollars; S_t the spot exchange rate, U.S. dollars per local currency; ξ_i the conversion ratio between local share i and its corresponding ADR.[6]

Each period t, the local share i pays out a dividend in local currency, denoted d_{it}^{L}. The ex-dividend market valuation of the share, in local currency, is equal to the expected stream of dividends, discounted by the period rate of time discount, β, and adjusted by the local consumer price index, CPI_{t+j}^{L}:

$$p_{it}^{\mathrm{L}} = \sum_{j=1}^{\infty} \beta^j E_t \frac{d_{it+j}^{L}}{CPI_{t+j}^{\mathrm{L}}}. \tag{1}$$

Assuming that the foreign investors have the same rate of time discount β, the market valuation of the corresponding ADR, in dollars, is

$$p_{it}^{\mathrm{ADR}} = \sum_{j=1}^{\infty} \beta^j E_t \frac{S_{t+j} d_{it+j}^{L}}{CPI_{t+j}^{\mathrm{US}}}. \tag{2}$$

Note that ADRs represent claims against the same stream of risky cash flows in pesos as their corresponding local shares. Dividends on the ADRs, however, are paid in dollars, and the appropriate deflator is the U.S. consumer price index, CPI_{t+j}^{US}. If firms fail (or are expected to fail) to pay dividends to shareholders of ADRs (possibly because of government restrictions in the issuing country) this will drive a wedge between the local share price and the currency-adjusted ADR price.

2.1. The law of one price for ADRs

In the absence of capital controls and foreign exchange controls (and abstracting for now from transactions costs and time delays in ADR conversion), the law of one price should prevail for ADRs and their corresponding local shares. Eq. (3) shows the return in local currency from round-trip arbitrage between the local market and the U.S.via ADRs:

$$p_{it}^{\mathrm{L}} \xi_i \left(\frac{1}{p_{it}^{\mathrm{ADR}}} \right) S_t = 1. \tag{3}$$

Investors purchase a local share at price $p_{it}{}^{\mathrm{L}}$. The share is then converted into $(1/\xi_i)$ units of an ADR and the ADR is sold for dollars. Finally, the dollars are converted back into local currency at the prevailing market exchange rate.

[6]Local shares are often bundled into groups of shares per ADR. Gompers and Metrick (2001) find that low-priced shares have higher transaction costs suggesting that bundling is likely done for cost reasons. Another reason for bundling is that the NYSE has minimum price requirements. Bundling can help companies avoid their stock being delisted (which occurs when share prices fall below the NYSE minimum). The conversion ratio is fixed at the time of the initial listing.

To see the impact of capital controls on the return from conversion of local shares into ADRs, consider the return, R_{it}^{L}, on round-trip arbitrage from the perspective of a local investor currently holding a domestic share:

$$R_{it}^{L} = \frac{((p_{it}^{ADR}/S_t\xi_i)) - p_{it}^{L}}{p_{it}^{L}}. \tag{4}$$

We assume that investors can conduct this arbitrage instantaneously. Note that if the transaction were to take time, the expected change in the exchange rate over the transaction interval would also affect the investor's return.

Now suppose the government of the country in which the investor resides imposes controls on capital outflows and/or restricts access to foreign exchange. We denote this tax on capital outflows as τ_{KO}. Also suppose that investors in the local market can freely convert a local share of security i into its ADR and sell the ADR on the U.S. stock market for U.S. dollars (thereby avoiding τ_{KO}).[7] All other cross-border investments must include the tax on capital outflows, τ_{KO}. However, because investment in ADRs legally circumvents this tax, demand for local shares with corresponding ADRs will increase, driving up the local price. In equilibrium, local investors will pay a premium on local shares (or a discount on ADRs) for the right to convert local shares into foreign-currency denominated ADRs. The wedge between the ADR price and the price on the corresponding local share reveals the extent to which controls on capital outflows are binding.

Conversely, consider the impact of controls on capital inflows. Eq. (5) shows the return, R_{it}^{US}, to round-trip arbitrage from the perspective of a U.S. investor currently holding an ADR:

$$R_{it}^{US} = \frac{S_t\xi_i p_{it}^{L} - p_{it}^{ADR}}{p_{it}^{ADR}}. \tag{5}$$

A tax on capital inflows, τ_{KI}, into the local market reduces the return U.S. investors receive on alternative investments in the local market. If the ADR channel remains open, arbitrage through ADRs will result in a premium on ADRs relative to local shares. In this case, U.S. investors are willing to pay a premium for the privilege of bringing capital into the local market (and avoiding τ_{KI}).

The discussion above implies a strict dichotomy between the impact of controls on capital inflows and outflows on the sign of ADR discounts. In practice, however, this dichotomy may not be so clear. Controls on capital outflows could cause U.S. investors to worry about their ability to repatriate profits, and thereby effectively reduce capital *inflows*. In the empirical section below, we will see that it is difficult to separately identify the effects of controls on capital inflows and capital outflows.

Note also that in both cases arbitrage implies that the wedge between the local and exchange rate adjusted U.S. price should reflect the cost of avoiding the capital control through an alternative mechanism. Therefore, the price gap reflects not only the de jure control, but also the ability of investors to circumvent that control. If the alternatives are relatively cheap, capital controls would not bind and we would expect the wedge between

[7]We will discuss in detail the controls on investors in Argentina in Section 3. In both Venezuela and Argentina local investors faced prohibitive controls on capital outflows and on foreign exchange but were able to convert local shares to ADRs, thereby legally circumventing the capital control.

the local price and the corresponding ADR price to be small. In Section 3 below we provide a measure of the CCCV for Argentina during the period when capital controls were in place.

2.2. Cross-sectional evidence on ADR discounts and capital controls

The previous discussion suggests that, in principle, the discount on ADRs should be positively related to controls on capital outflow, and negatively related to controls on capital inflow. To test this relationship we collected country-level data on capital control indices[8] and firm-level data on ADRs and their underlying local shares. We select a representative cross-listed firm for each of 42 countries,[9] and calculate the ADR discount, defined as[10]

$$D_{it} = 1 - \frac{p_{it}^{\mathrm{ADR}}}{S_t \xi_i p_{it}^{\mathrm{L}}}. \tag{6}$$

We selected the year 1999 for our cross-sectional analysis because it was a year for which we had the largest overlap of information on ADR discounts and on capital controls, and because it was a year of relative calm for most financial markets in the wake of the Asian crisis.[11]

We study the relationship between ADR discounts and four different indices of capital controls: (i) the IMF index;[12] (ii) the capital account openness index (CAOI) index;[13] (iii) the Chinn–Ito index;[14] and (iv) the Edison and Warnock index.[15] Each capital control

[8]We first compute daily ADR discounts on days when there were transactions in both markets (to avoid non-synchronous trading biases) and take a weekly average. We then compute the average for the calendar year 1999 as the average of the weekly averages. Results based on daily data are qualitatively similar and are available upon request.

[9]We selected one representative level II or level III ADR from each country on the basis of liquidity. Unfortunately many countries that have capital controls do not have ADRs or their ADRs are only traded infrequently. The countries (firms) included in our analysis are: Argentina (Banco Frances), Australia (News Corp Ltd), Austria (Evn Ag), Belgium (Solvay SA), Brazil (Embratel Participacoes SA), Chile (Enersis SA), China (Sinopec Shanghai Petrochemical Co Ltd), Colombia (Bancolombia), Czech Republic (Komercni Banka As), Denmark (Novo-Nordisk A/S), Finland (Nokia), France (Total SA), Germany (Pfeiffer Vacuum Technology Ag), Greece (Hellenic Telecommunications Organization SA), Hungary (Matav Rt), India (Infosys), Indonesia (Indonesian Satellite Corp Tbk Pt), Ireland (Eln), Israel (Matav-Cable Systems Media Ltd), Italy (Benetton Group Spa), Japan (Sony), Korea (Sk Telecom Co Ltd), Luxembourg (Espirito Santo Financial Group SA), Mexico (Grupo Televisa SA), Netherlands (Koninklijke Philips Electronics NV), New Zealand (Fletcher Challenge Forests Ltd), Norway (Norsk Hydro Asa), Peru (Cia De Minas Buenaventura SA), Philippines (San Miguel Corp), Portugal (Portugal Telecom Sgps SA), Russia (Vimpel-Communications), Singapore (Keppel Corp Ltd), South Africa (Durban Roodepoort Deep Ltd), Sweden (Volvo Ab), Switzerland (Logitech International SA), Taiwan (Macronix International), Thailand (Advance), Turkey (Turkcell Iletisim Hizmet As), United Kingdom (Barclays Plc), Venezuela (Cia Anonima Nacional Telefonos De Venezuela–CANTV).

[10]Note that this definition of the ADR discount is equivalent to Eq. (4) except that the terms in the numerator are reversed (making the discount positive when the price of local shares exceeds the price of the corresponding ADR). We use this definition of the ADR discount in all the empirical work to follow.

[11]There were no capital controls in place in Argentina in 1999 so this analysis will not capture the significant deviations between the prices of local shares and their corresponding ADRs that occurred in 2001 and 2002.

[12]See Alesina et al. (1993).

[13]See Brune et al. (2001).

[14]See Chinn and Ito (2002).

[15]See Edison and Warnock (2003).

series has some advantages and some disadvantages. Each series covers a different sample of countries. Although we have 42 countries with data on ADR discounts and some measure of capital controls, the largest sample we were able to use in a regression contained 37 country observations. The IMF index is probably the most widely used in studies of the impact of capital controls on financial market development and growth. The index is essentially a dummy variable indicating whether or not a country has capital controls in place in a given calendar year based on the information provided in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The advantage of this measure is that it covers a large sample of countries. The drawback is that the index contains no information about whether the controls restrict capital inflow or outflow, the particular type of transaction that is restricted, or the intensity of the control. The CAOI measure is similar to the IMF index in that a dummy variable is created for each category of capital flow. The dummies are then added up so that the more controls that are in place, the bigger the index number. This provides a rough gauge of capital control intensity, but does not give a clear indication of how tightly each type of capital flow is restricted. The Chinn–Ito measure is based on the same underlying information, but attempts to aggregate the information in a way so as to better capture the intensity of the restrictions. The Edison–Warnock index takes a completely different approach by computing the ratios of the market capitalization of "investable" stocks (i.e. those available to foreign investors) to the full set of stocks in a given market. In effect, the Edison–Warnock index provides a measure of the extent to which a market is closed to foreign investors. It does not, however, provide information about the intensity of controls on capital outflow from a given market. Edison and Warnock provide two measures of their index: the basic index (labeled "unsmooth" in Table 1) and an index that corrects for shifts due to changes in sectoral market capitalizations and not due to shifts in capital controls (the "smooth" index in Table 1).

Table 1 shows the results of the regression of the ADR discount on the various capital control indices:

$$D_i = \beta_0 + \beta_1 cc_i + \mu_i, \tag{7}$$

where D_i is the average ADR discount for a representative firm in country i in 1999, cc_i is the value of the capital control index for country i in 1999, and μ_i is the error term. Each index is adjusted so that the higher the index, the more intense the capital control. As shown in the top panel of Table 1, we find some evidence of a positive relationship between ADR discounts and the various measures of capital controls. The coefficients on the IMF, CAOI and Chinn–Ito indices are statistically significantly different from zero at the 5 percent level, while the smooth Edison–Warnock index is significant at the 10 percent level.[16] Because the indices provide only de jure classifications and little information about whether the controls are on capital inflows or outflows, it is difficult to know how to interpret the results. It could be that most of the controls are on capital outflows, and the positive coefficient can be taken as evidence that controls on outflows result in an increase in the ADR discount. If this were the correct interpretation, however, we would have expected the coefficient on the Edison–Warnock indices, which reflect only restrictions on

[16]If we exclude China, as suggested in Edison and Warnock (2003), and include developed countries with zero restrictions, as was done in Ahearne et al. (2004), the smooth Edison–Warnock index is significant at the 1 percent level.

Table 1
Testing for the relationship between ADR discounts and capital controls in a cross section of countries, 1999

	Alternative indices of capital controls:				
	IMF	CAOI	Chinn–Ito	Edison–Warnock	
				Smooth	Unsmooth
A. Dependent variable: ADR discount					
β	0.106	0.019	0.059	0.436	0.250
Std error	0.048	0.008	0.018	0.214	0.179
P-value	0.036	0.028	0.002	0.058	0.173
Number of Obs	37	36	33	19	19
R^2	0.12	0.13	0.27	0.2	0.11
B. Dependent variable: Absolute value of ADR discount					
β	0.100	0.018	0.060	0.436	0.260
Std error	0.048	0.008	0.017	0.212	0.177
P-value	0.045	0.032	0.003	0.056	0.159
Number of Obs	37	36	33	19	19
R^2	0.11	0.13	0.25	0.15	0.06

Sources: Bloomberg; Alesina et al. (1993) for the IMF index; Brune et al. (2001) for the CAOI (Capital Account Openness Index); Chinn and Ito (2002); Edison and Warnock (2003).
Note: The dependent variable is the average ADR discount (measured as the difference between the local price in US dollars and the ADR price, as a fraction of the local price in dollars) for a representative cross-listed firm (based on liquidity) in selected countries in 1999. Local prices are adjusted for the ADR conversion ratio. β is the coefficient on the capital control index (where the higher the index, the more intense the capital control).

capital *inflows*, to be negative. Alternatively, it may be that, in practice, controls on inflows ultimately serve to control outflows.

Given the ambiguities in the capital controls series, we repeat the regression using the absolute value of the ADR discount as the dependent variable. The hypothesis tested here is whether capital controls, regardless of whether they affect inflows or outflows, drive a wedge between local share prices and their corresponding ADRs. The results in the second panel provide some support for this hypothesis. The estimated coefficients are again all positive and four of the five are significant at the five percent level. Fig. 1 provides a plot of the ADR discounts (expressed in percent) and the Chinn–Ito measure of capital control intensity. The figure suggests that in most countries, the ADR discount is very close to zero and that the positive relationship between controls and discounts is driven by two countries, Colombia and India.[17] When those two countries are dropped from the regression, none of the coefficients are statistically different from zero.

[17]Colombia's capital controls involved a tax on short-term investment repatriation which provided incentives for investors to purchase ADRs (which are not subject to the tax) rather than local shares. In India (before 2002) there was only one-way fungibility for ADR conversions. ADRs could be converted back into local shares, but not vice versa. Over time the reduction in ADR liquidity (due to the fall in supply) resulted in high premiums on ADRs relative to the underlying stocks. Taiwan and South Korea are also special cases. The Taiwanese and South Korean governments restrict foreign ownership of companies making it very difficult to purchase stocks in the local market. Taiwan also restricts the size of the ADR program. The case of one Taiwanese firm, Taiwan Semi Conductor, has been widely cited in the press because its ADR price so greatly exceeded its local price.

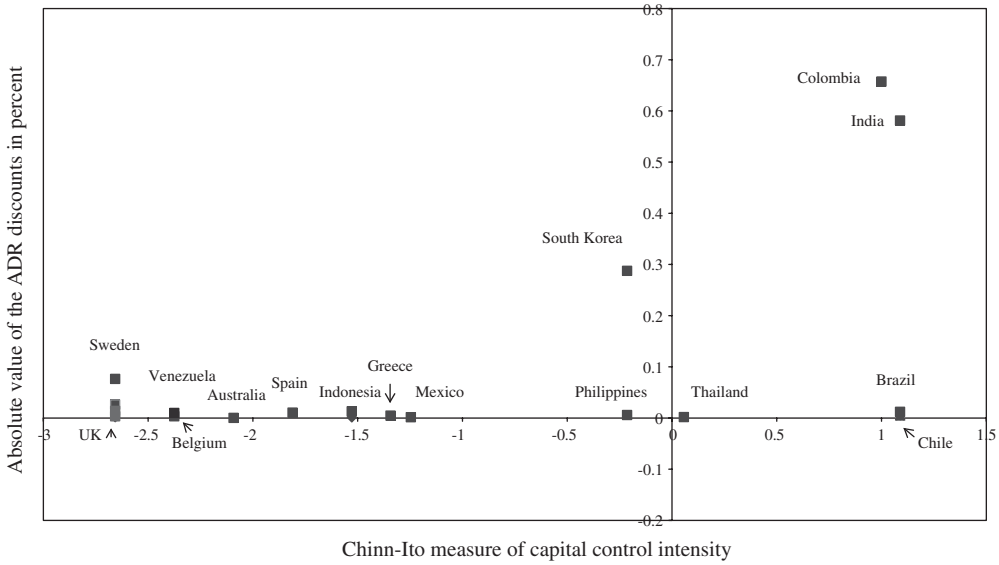

Fig. 1. Capital Control Intensity and ADR discounts. *Sources:* Bloomberg, Chinn–Ito (2002), *Note:* Scatter plot summarizes the relationship between capital control intensity (as measured by Chinn and Ito) and average ADR discount for a representative firm (based on liquidity) in selected countries in 1999.

The cross-sectional analysis suggests that there is a tenuous relationship between available measures of capital controls and ADR discounts. As shown in Fig. 1, there is a great deal of cross-country heterogeneity in the capital control indices, but in most countries those controls have no impact on ADR discounts. There are a number of factors that could account for this weak relationship in the cross-section. First, the dependent variable in the regression is the average ADR discount over the calendar year. Even a cursory glance at ADR discounts reveals that discounts can swing dramatically over time, particularly during periods of volatility in financial markets. These are precisely the periods when capital controls tend to be imposed, but such information is lost in taking annual averages (which we do in order to match these data with the annual capital control indices). Thus, the particular window chosen for the analysis can have a large impact on the results. Second, and more importantly, the capital control measures are only crude indicators of the particular restrictions that could affect transactions in ADRs. Controls on some types of capital flow may be largely irrelevant for stock market participants, whereas other types of legal restrictions–seemingly unrelated to capital flow–could have a large effect on ADR discounts. For example, restrictions on withdrawals from bank accounts in Argentina (which are neither controls on capital inflow or outflow) contributed to a run up in local stock prices and on ADR discounts. Third, the cross-sectional analysis ignores transactions costs and other taxes (e.g. brokerage fees, local sales taxes, etc.) and short sales restrictions,[18] which could distort ADR discounts. Finally, we have calculated ADR returns assuming instantaneous arbitrage. If investors know that there is a significant time delay in ADR conversions, the wedge between the prices of local shares

[18]Bris et al. (2003) examine whether short-sales restrictions in different countries affect market efficiency.

and their corresponding ADRs will also reflect the risk premium associated with holding the asset over the conversion interval.

For these reasons, we think that the cross-sectional analysis yields at best an imprecise measure of the relationship between restrictions on capital markets and the wedge between the prices of local shares and their corresponding ADRs. To probe this relationship more deeply, we next turn to the role played by ADRs in the unfolding of two recent events, the financial crises in Argentina and Venezuela.

3. Case study: Argentine capital controls and ADRs

Although the exact timing and causes of Argentina's economic fall from grace are contentious, there is little disagreement that by the last quarter of 2001 Argentina was on the brink of a full-scale collapse.[19] Between July and November 2001, Argentines withdrew over $15 billion from banks–on 30 November 2001 alone, banks saw withdrawals of $1.3 billion. On 3rd December, in a desperate effort to prevent further massive capital outflows, financial market controls were established (these are known as the "Corralito"), which among other restrictions, imposed a ceiling of $1000 a month on bank withdrawals.[20] In January the Argentine peso was officially devalued and all bank deposits and some (small denomination) debts were "pesofied."[21]

3.1. The Corralito

Under the *Corralito*, depositors were limited to withdrawals of 250 pesos per week per account[22] but could access their accounts to transfer funds within the banking system. Wire transfers required Central Bank approval, foreign currency futures transactions were prohibited, and in effect, all investors, foreign and domestic, were prohibited from transferring funds abroad. The restrictions were announced as temporary measures that would remain in place until the danger of the speculative attack had passed.[23]

The *Corralito*, did not, however, restrict investors from trading Argentine securities including those that were cross-listed on another market. Indeed, to do so would have seriously destabilized the local market as it would have prevented investors from trading in some of the largest and most liquid stocks on the market. The Argentine ADR "loophole" worked as follows: Argentine residents were allowed to use bank deposits to purchase

[19]Mussa (2002) makes the case that the persistent inability of the Argentine government to run responsible fiscal policy was the primary cause of the economic collapse. Others point to the deleterious effects of an over-valued currency on exports (see, for example, Feldstein (2002)) and the sudden stop in foreign capital inflows (Calvo et al. (2003)). Also, see Dominguez and Tesar (2005) for a detailed description of the factors that let to Argentina's collapse.

[20]A literal translation of "Corralito" is little corral. It is also the word for "playpen."

[21]On 3 February 2002, an asymmetric pesofication (based on type of borrower) of debts was announced. See Appendix 1 for more details.

[22]Perhaps unsurprisingly there was a sudden increase in the number of new bank accounts in early December. The government promptly changed the regulations so that the deposit limits applied per person rather than per account. According to the press, some 500,000 accounts were opened in the 2 days following the imposition of bank restrictions.

[23]Some of the original withdrawal limits were eventually modified, though the main restrictions on capital outflow remained in place until 2 December 2002 (exactly 1 year after they were first introduced). See Appendix A for a detailed timeline of the changes in financial market regulations in Argentina beginning in October 2001.

Argentine stocks. If a stock happened to be cross-listed in the U.S. those shares could be legally converted from Argentine shares into ADRs. The ADRs could then be sold in the U.S. and the dollar proceeds deposited in a U.S. account. Under normal circumstances the dollar proceeds would appear in the Argentine Balance of Payments as a capital inflow, as foreign residents have acquired claims on Argentine firms. Under the *Corralito,* however, the capital inflows did not occur, and the dollars and/or shares remained outside of Argentina. In effect, the ADR "loophole" allowed Argentines to transfer monies abroad, but the transactions did not result directly in a fall in Argentina's international reserves (or a fall in Argentine bank deposits). ADR conversions, however, did reduce the number of (underlying) shares available on the local stock exchange in Buenos Aires, La Bolsa.

3.2. Decomposition of the Argentine ADR discount under the Corralito

To see the impact of the *Corralito* on the ADR discounts, we modify Eq. (3) to take into account the restrictions on bank deposits:

$$\left(\frac{1}{p_t^{\mathrm{D}}}\right) p_{it}^{\mathrm{L}}\, \xi_i \left(\frac{1}{p_{it}^{\mathrm{ADR}}}\right) S_t = 1, \tag{3'}$$

where p_t^{D} is the price of local-currency denominated bank deposits in terms of local stock (or cash). During the *Corralito,* p_t^{D} was less than one because investors were willing to pay for the opportunity to cash out their bank deposits (which had limited convertibility). In the absence of controls on bank deposits, we would expect p_t^{D} to be equal to one. Arbitrage now involves cashing out one's bank deposits at a discount, purchasing local shares, converting those shares into ADRs and then selling the ADRs for dollars in the U.S. Consider the return from ADR conversion on the day the capital controls are imposed, denoted $t+1$, relative to the day before. Taking the log difference of Eq. (3′) yields

$$\begin{aligned}&(\ln p_{it+1}^{\mathrm{L}} - \ln p_{it}^{\mathrm{L}}) - (\ln p_{t+1}^{\mathrm{D}} - \ln p_t^{\mathrm{D}}) + (\ln \xi_i - \ln \xi_i)\\ &- (\ln p_{it+1}^{\mathrm{ADR}} - \ln p_{it}^{\mathrm{ADR}}) + (\ln S_{t+1} - \ln S_t).\end{aligned} \tag{8}$$

The first effect, $(\ln p_{it+1}^{\mathrm{L}} - \ln p_{it}^{\mathrm{L}}) - (\ln p_{t+1}^{\mathrm{D}} - \ln p_t^{\mathrm{D}})$, we term the *liquidity value* of shares. This reflects the impact of the banking restrictions on the relative price of local shares to bank deposits. This effect will only exist if controls restrict access to bank deposits but at the same time allow investors to transform frozen bank deposits—which could potentially be expropriated by the government or lost in a full-scale bank run—into stocks. In the absence of controls liquidity value is zero. Note that the prices of all local market stocks will reflect this liquidity value, not just those that are cross listed. The premium associated with asset transformation should remain until all depositors in the local market have re-optimized their portfolios or the deposit restrictions are removed.

The second effect is the CCCV of cross-listed shares. ADRs provide a legal means of acquiring foreign assets in capital outflow control regimes. Note that in Eq. (8) the rate of conversion of local stock i into its ADR equivalent, ξ_i, is a constant. Therefore, holding changes in ADR prices and the exchange rate constant, the increase in the local price of cross-listed shares relative to the (fixed) rate of conversion, ξ_i, reflects the value of being able to circumvent the capital controls. In the absence of capital controls this effect is clearly zero. During a capital control regime, ADRs carry an additional premium over other non-cross-listed shares and the premium should last until all local investors are

Table 2
Pre-Corralito ADR information (January–November 2001)

Name	Ratio ADR:local	Industry	Market cap as % of total market	Trading volume as % market	Mean return (%)	Standard deviation (%)
			Nov 2001	Nov 2001	(daily)	(daily)
BBVA Banco Frances	1:3	Banking	0.26	1.92	−0.40	4.76
Cresud S.A.C.I.F. Y A.	1:10	Food-agribus-tobacco	0.04	0.39	−0.06	1.64
Financiero Galicia	1:10	Fin serv-investment	0.22	7.09	−0.54	4.24
Irsa Inversiones	1:10	Real estate	0.06	0.60	−0.44	2.79
Metrogas S.A.	1:10	Oil and gas-service	0.15	0.06	−0.13	2.39
Perez Companc (PC)	1:10	Util-gas, elec and water	1.03	9.82	−0.18	3.17
Siderca S.A.I.C	1:10	Steel	0.61	2.75	−0.16	2.62
Telecom Arg Stet-France	1:5	Telecom-DatNtwk	0.61	3.43	−0.35	3.82
Telefonica	1:10	Telecom-DatNtwk	1.42	0.03	−0.31	3.41
TGS	1:5	Oil & Gas-Service	0.39	0.84	−0.11	2.88
YPF S.A.	1:1	Oil & Gas-Service	3.11	0.09	−0.21	1.74
All ADRs			7.91	27.03	−0.26	1.83

Sources: JP Morgan.
Note: The "All ADRs" row corresponds to an equal-weighted ADR portfolio. The "Ratio ADR:local" is the number of local shares bundled into one ADR share.

indifferent between holding their assets at home or abroad. This could be achieved either when all of the available funds have left the country, the cost of moving funds becomes prohibitively high, the emergence of alternative mechanisms to channel funds abroad reduces the demand for local shares with a corresponding ADR, or the capital controls are removed.

The third effect is the *currency value* of ADRs. This effect has two parts. The first part, reflected in the change in p_{it}^{ADR}, is due to the fact that holders of ADRs own claims to dollar-denominated dividends, paid out at the official exchange rate (recall Eq. (2)). Depending on the impact of the capital controls on the expected path of the official exchange rate, this would alter the market valuation of the ADR relative to its local share equivalent. The second part of the currency effect is the change in the exchange rate itself. Because investors receive dollars, rather than local currency, for the sale of the asset, this will affect the expected profit from ADR conversion.

3.3. Trading volume in Argentine ADRs

Table 2 provides a list of the 11 ADRs listed in Argentina as of 1 December 2001 and traded on either the NYSE or Nasdaq.[24] In November 2001 trade in these 11 ADRs

[24]Our list of Argentine ADRs is drawn from JP Morgan's ADR Universe Directory. Our focus is on 11 of the 13 exchange-listed shares, referred to as Level II and Level III (capital-raising) programs. The two shares we do not include, Nortel and APSA, had very few transactions over the period of study. APSA ADRs only traded on 1 day during the *Corralito* while Nortel (a preferred stock) had very few transactions over this period. There are also 11 (Rule 144a and OTC) ADR shares that we do not include in our analysis because there was virtually no trading of these stocks over the period we study.

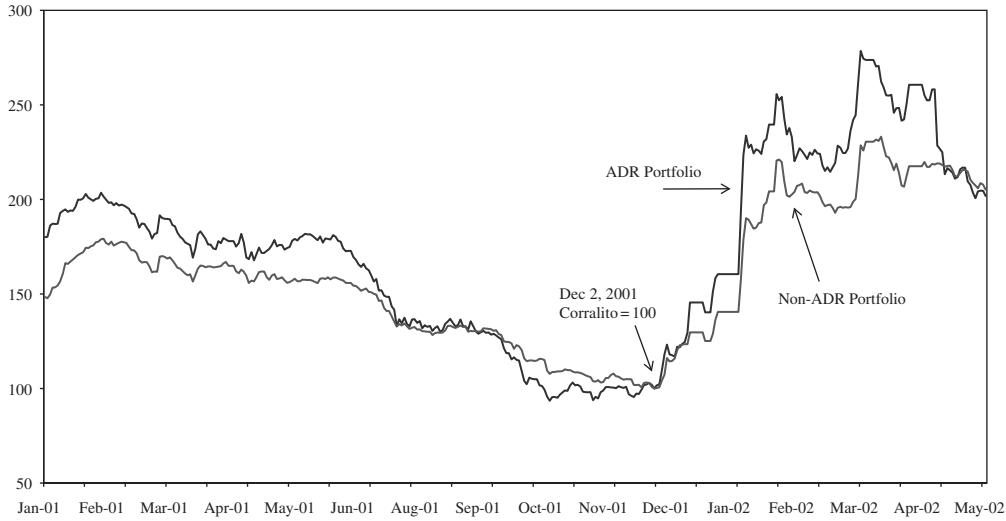

Fig. 2. Price indices of ADR and non-ADR portfolios, value weighted. (Value at the time of the imposition of *Corralito*, 30 November 2001 = 100). *Source:* Bloomberg, *Note:* The non-ADR portfolio includes all non-cross-listed local shares.

accounted for 36 percent of the Merval Index and 27 percent of total market volume. Table 2 also provides pre-*Corralito* information on each ADR's market capitalization and trading volume as a percent of the market, as well as the mean and standard deviation of returns (over the period January–November 2001).

Fig. 2 shows price indices for value-weighted portfolios of ADRs[25] and all other Argentine stocks from 1 January 2001 to 31 May 2002. Both portfolios reverse their downward trend in the pre-*Corralito* period, increasing immediately following the freezing of bank accounts and the imposition of capital controls. As our discussion above predicted, the ADR portfolio price index experiences a bigger increase than the non-ADR portfolio price index, reflecting the additional capital circumvention and currency values of cross-listed stocks.[26] We formally test for differences in ADR and non-ADR portfolio returns just after the imposition of the *Corralito* in Section 3.4 below.

We also observe a dramatic change in the trading volume in cross-listed shares in Argentina over this period. Although the aggregate trading volume on La Bolsa steadily declines, Fig. 3 shows that the fraction of ADRs in the total volume traded jumps dramatically at the time of the *Corralito* from roughly 40 percent of the total volume to over 80 percent. Perez Companc alone accounted for nearly 50 percent of the total volume of trading in December 2001. In late February 2002, volume in the ADR market leveled off.[27] Although the *Corralito* continued to be in effect, several regulatory changes, starting

[25]The figure using price indices for equal-weighted portfolios of ADRs and non-ADRs is qualitatively similar.

[26]Levy-Yeyati et al. (2003) argue that it was the most liquid stocks (not ADRs) that had the largest increase in price after the *Corralito*. We find that while liquidity played a role, in regressions explaining Argentine stock returns, a dummy variable for ADR shares is significant and positive even after controlling for liquidity.

[27]ADR volume also declined in New York falling from its peak in December 2001. Volume in February 2002 was 18 percent lower than the previous December, and by May 2002, volume was a mere 23 percent of what it had been in December 2001.

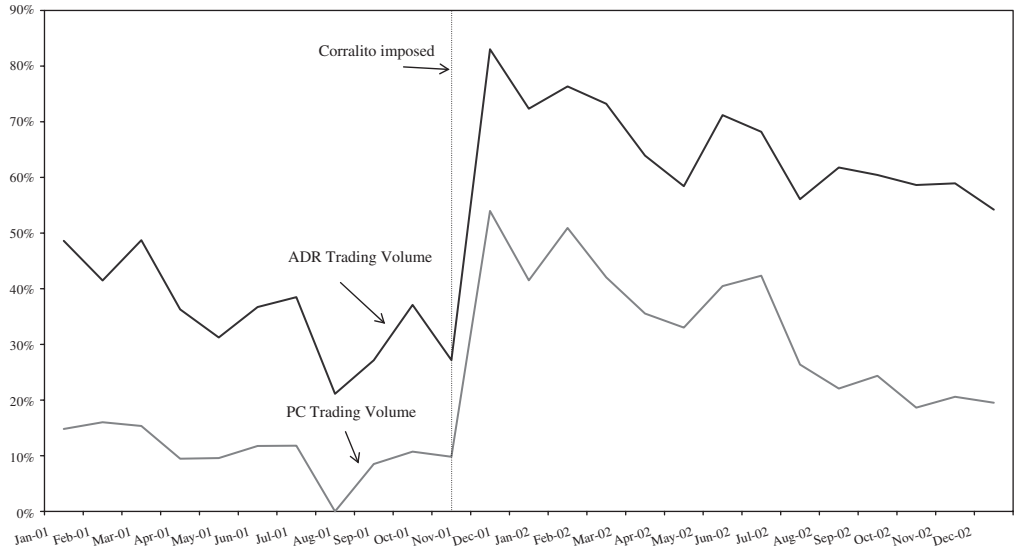

Fig. 3. Volume traded in local shares with ADRs and Perez Companc (PC) as a fraction of total volume traded (in all shares) in Buenos Aires (monthly, in percent). *Source:* Bolsar.

in February 2002, may have diminished investor's incentives to use the stock market as a means to gain access to frozen assets[28].

3.4. Changes in prices of Argentine ADRs

Table 3 presents the results of tests for whether the differences in the ADR and non-ADR portfolios seen visually in Fig. 2, at the time of the *Corralito*, are statistically significant. The table presents changes in ADR and non-ADR portfolio prices in Argentina and New York following the imposition of the *Corralito*. (All prices are measured in U.S. dollars). On the day following the imposition of the *Corralito* (see the first column of the table), the equal-weighted ADR portfolio price in Argentina jumped 2.93 percent while the equal-weighted portfolio of non-ADRs increased by 0.7 percent. If we measure the change in ADR and non-ADR portfolio prices 1 week after the imposition of the *Corralito* the ADR portfolio price change is even more dramatic, increasing by 13.92 percent, while the non-ADR portfolio rise is 9.43 percent. Similar results hold for the value-weighted portfolios. These changes are statistically significantly different from the price movements one would have anticipated based on the pre-*Corralito* distribution and are consistent with the view that there was an increase in the liquidity value of all Argentine stocks.

We also examine differences in the prices of the equally weighted ADR and non-ADR portfolios (after the imposition of the *Corralito*) and find that the wedge between the two portfolios is 2.23 percent 1 day after (and 4.5 percent 1 week after) the capital controls were

[28]In February 2002, investors were allowed to withdraw (once and for all) 7000 U.S. dollars from any of their bank accounts. In March 2002, investors were given the option to convert deposits into bonds (in pesos or dollars) and they were allowed to use their deposits to purchase properties and subsequently cars.

Table 3
Price impact of corralito on ADRs in Argentina and New York

	Day before to day after	*t*-stat	Day before to week after	*t*-stat
I. Percent change in Argentine prices (IN $US)				
Equal weighted portfolis				
ADRs (ARG)	2.93	41.78	13.92	44.50
Non-ADRs	0.70	22.32	9.43	42.75
Difference in wedge between ADRs (ARG) and non-ADRs (ARG)	2.23	43.80	4.50	19.95
Value-weighted portfolis				
ADRs (ARG)	1.68	25.99	21.47	63.22
Non-ADRs	0.29	8.13	16.22	54.14
Difference in wedge between ADRs (ARG) and non-ADRs (ARG)	1.39	25.91	5.25	19.31
II. Percent change in New York price (IN $US)				
Equal-weighted portfolis				
ADRs (NY)	1.21	19.57	−1.27	−0.82
Difference in wedge between ADRs (NY) and non-ADRs (ARG)	0.51	10.56	−10.70	−38.41
Value-weighted portfolis				
ADRs (NY)	0.39	8.33	1.15	5.14
Difference in wedge between ADRs (NY) and non-ADRs (ARG)	0.10	2.68	−14.59	−44.40

Source: Economatica.
Note: T-stats are tests that the return on ADR and non-ADR portfolios on the day after and the week after the imposition of the *Corralito* differ significantly from the mean daily and weekly ADR and non-ADR porfolio returns in the pre-*Corralito* period. "Day before to day after" is the return between 12/3/2001 and 11/30/2001; "Day before to week after" is the return between 12/7/2001 and 11/30/2001. Tests assume that the distribution of returns in the ADR and non-ADR portfolios did not change after the imposition of the *Corralito*.

put in place. The *t*-statistics indicate that one would not have been able to forecast the wedge between ADR and non-ADR portfolio returns that arose during the *Corralito*, based on the distributions of returns for the two portfolios in the pre-*Corralito* period.[29] The impact of the *Corralito* on share prices is consistent with the predictions of Eq. (8). The liquidity of shares relative to bank deposits drives up the prices of all shares in Argentina. However, ADR prices increase by more due to the other benefits of ADR convertibility. The results in Table 3 are suggestive that there was an additional premium associated with ADRs relative to non-ADRs during the *Corralito*.

In the lower panel of Table 3 we examine the same ADR and non-ADR portfolio price changes, now using the ADR portfolio price in New York. The ADR portfolio price in New York increases too, but by a fraction of the price changes of the same portfolio in Argentina. We also find that the difference between the (equally weighted) ADR portfolio

[29]It is worth noting, however, that the distribution of ADR and non-ADR portfolio prices may well have changed after the imposition of the *Corralito.* If the distribution of prices changed, *t*-stats based on the pre-*Corralito* period will not be appropriate. It is, however, unclear in this case what assumption one should make about the distribution of prices in the immediate aftermath of the *Corralito*.

price in New York and the non-ADR portfolio price (in Buenos Aires) one day after the *Corralito* is only 0.5 percent. The difference in the New York ADR portfolio price and non-ADR portfolio price the week after the imposition of the *Corralito* is actually negative (and statistically significant) suggesting that the New York price on the ADR portfolio fell below the non-ADR portfolio price during this period. Taken together, the data suggest that New York ADR prices changed little following the *Corralito*, while prices on the corresponding shares in Argentina rose dramatically. This is consistent with the argument made in Section 2 that controls on capital outflows would increase demand for local shares with corresponding ADRs relative to demand for non-cross listed local shares.

3.5. Argentine ADR discounts

It is clear from Table 3 that Argentine share prices increased following the imposition of the *Corralito,* consistent with our prediction that share prices reflect the liquidity value of stocks relative to bank deposits. One of the difficulties in studying share price movements, however, is that it is difficult if not impossible to control for changes in fundamentals that could have affected firms around the time of the *Corralito*. The advantage of studying ADRs is that one can use the price of ADRs in New York as a benchmark for gauging the impact of changes in policies that were specific to investors in Argentina. We therefore turn to the discounts on ADR shares in New York relative to their corresponding price in Buenos Aires.

Figs. 4 and 5 show prices of local and ADR shares (both in dollars) and the ADR discounts for two (Perez Companc and Siderca) of the 11 companies in our sample of ADRs over the 1 January 2001–31 May 2002 period.[30] The figures also show the arbitrage bounds based on our estimates of transactions costs (described in Appendix B and detailed in Table B1).[31] Table 4 summarizes the maximum and average discounts during pre-*Corralito*, *Corralito* pre-devaluation and *Corralito* post-devaluation periods for each company and the averages across the 11 companies. The top panel of the table calculates the discounts excluding transactions costs and the bottom panel includes transactions costs.[32]

The information in Table 4 and the plots indicate that the average pre-*Corralito* discount for all companies was close to zero, suggesting that arbitrage between Argentina and the U.S. kept prices of local shares and their corresponding ADRs in close alignment. During the C*orralito*, the average ADR discount (the local price less the ADR price) jumped to 17.93 percent (excluding transaction costs). And, even after the devaluation in January the average ADR discount remained at 4.71% (or 10.94% including transactions costs). Unfortunately many of the ADRs traded only sporadically in the December 2001–January 2002 period, so that it is not possible to do a full-fledged event study analysis of the impact of the *Corralito* and the devaluation on the ADR discounts. To get a sense of whether the

[30]Similar figures for the rest of the ADRs are available upon request.

[31]The transactions costs we use in the calculations include the Argentine brokerage fees in both Buenos Aires and New York ($\tau_1 = .3025$, $\tau_3 = .3025$), the Buenos Aires stock exchange fee ($\tau_2 = .1025$), the ADR conversion fee ($\tau_4 = .15$) and the fees to open a NY bank account and wire transfer ADR proceeds ($\tau_5 = 1.0$). These costs are explained in detail in Appendix Table B1. We ignore the time delay in our calculations of premia/discounts. The difference between the lower and upper arbitrage bound in our estimations is around 500 basis points. Rabinovitch et al. (2003), using data for 6 Argentinean stocks with ADRs for the period 1993–2000 estimate arbitrage bands of around 270 basis points, suggesting that transactions costs increased during the *Corralito.*

[32]We use the same transactions costs for the pre-*Corralito* and post-*Corralito* periods for consistency, even though it is likely that these costs increased substantially after the imposition of the *Corralito* (so that we are biasing our results against finding differences in the two periods).

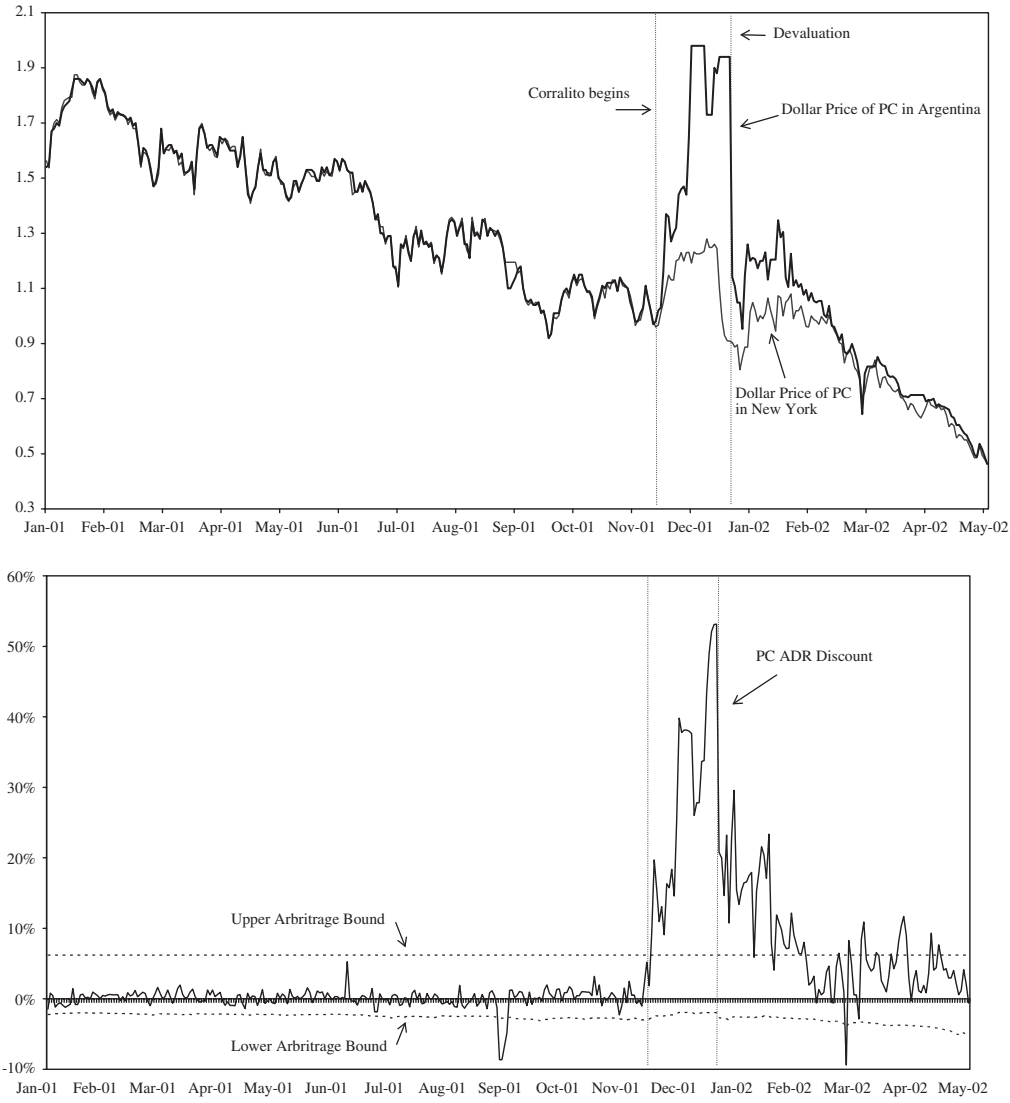

Fig. 4. Daily PC (Perez Companc) prices in NY and Argentina and PC's ADR discount before and during the *Corralito*. *Source*: Bloomberg, *Note*: Arbitrage bounds are calculated based on the derivations described in Appendix B.

changes in discounts over this period are statistically significant we provide *t*-statistics that suggest that the discounts observed in the *Corralito* period are far outside the range that we would have expected based on the distribution of pre-*Corralito* discounts.[33]

[33]Non-parametric kernel density estimates (available upon request) suggest that along with differences in the first moment of the ADR discount, there were statistically significant changes in the shape, dispersion and skewness of the distribution of ADR discounts during the *Corralito* relative to the pre-*Corralito* distribution.

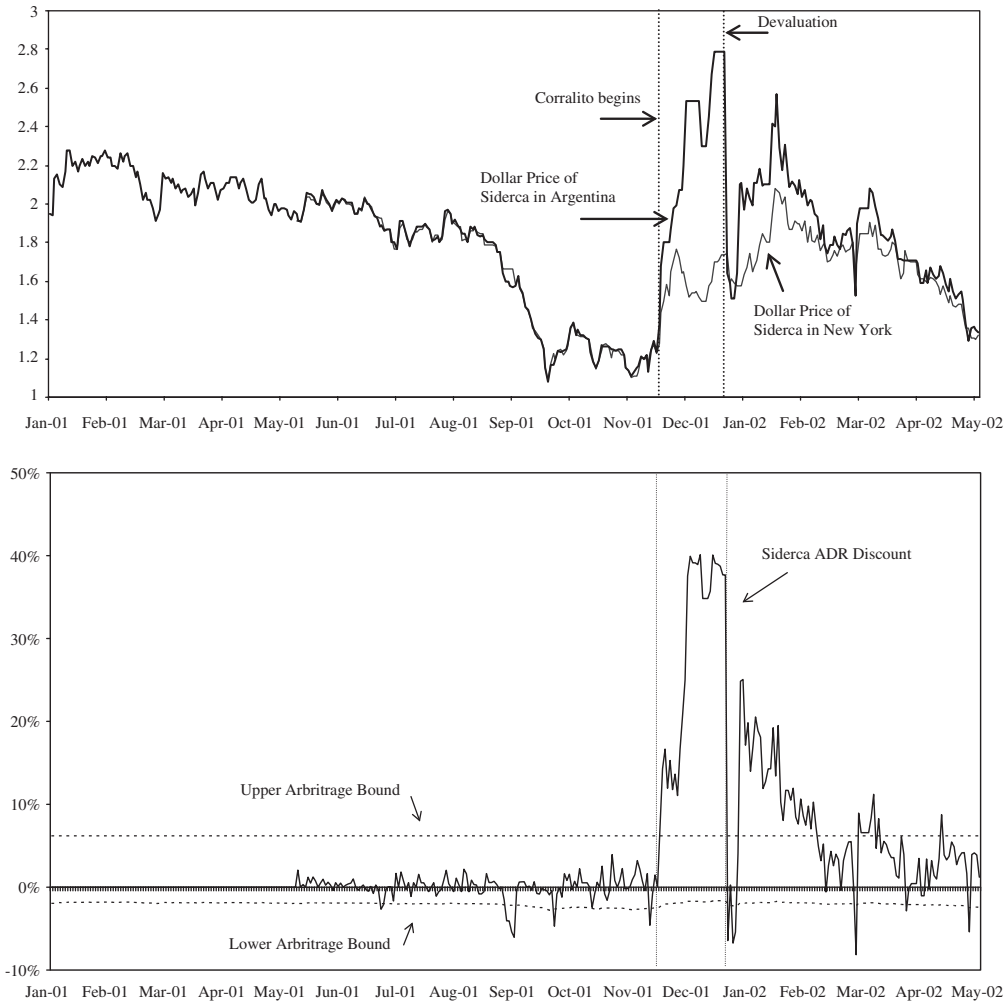

Fig. 5. Daily Siderca prices in NY and Argentina and Siderca's ADR discount before and during the *Corralito*. *Source:* Bloomberg, *Note:* Arbitrage bounds are calculated based on the derivations described in Appendix B.

Figs. 4 and 5 suggest that the ADR discounts were relatively small at the beginning of the *Corralito* and peaked just prior to the devaluation. One interpretation of this evidence is that the value of converting to dollar-denominated assets increased as the devaluation became more likely in early January 2002. At their peak, the discount exceeded 50 cents on the dollar for Banco Frances and Perez Companc.[34]

[34]According to brokers and the financial press, the most demanded ADRs for capital outflow purposes in this period were (in order of importance): Perez Companc (PC), Grupo Financiero Galicia, Siderca and Telecom. In December 2001, the number of shares of PC traded on the NYSE increased 170%.

Table 4
Average ADR discounts before and during the *Corralito*

	Pre-corralito	Corralito pre-devaluation			Corralito post-devaluation		
	1 Jan 2000–30 Nov 2001	3 Dec 2001–10 Jan 2002			11 Jan 2002–31 May 2002		
A. Excluding transactions costs	Mean	Max	Mean	*t*-stat	Max	Mean	*t*-stat
BBVA Banco Frances	−0.02	52.09	20.43	7.96	21.89	7.00	9.73
Cresud S.A.C.I.F. Y A.	0.01	32.35	21.47	2.91	22.61	3.27	2.28
Financiero galicia	0.35	43.89	20.04	6.90	18.42	3.66	3.69
Irsa Inversiones	0.08	38.27	15.74	11.56	14.11	2.01	1.47
Metrogas S.A.	−0.81	27.03	10.94	1.65	19.63	−1.05	−0.12
Perez Companc (PC)	0.08	53.14	19.56	7.00	23.36	6.36	9.53
Siderca S.A.I.C	0.13	40.12	20.35	5.63	24.85	6.77	9.52
Telecom Arg Stet-France	0.13	39.71	19.23	8.00	23.56	5.64	7.05
Telefonica	−0.59	23.52	13.95	8.09	17.39	−14.25	−3.68
TGS	0.22	45.45	20.14	8.68	19.94	4.36	4.13
YPF S.A.	−0.08	31.79	15.96	4.87	24.72	8.14	7.30
Portfolios							
Equal-weighted	0.02	38.85	17.93	8.63	19.88	4.71	6.48
Value-weighted	−0.02	37.30	17.27	9.84	20.49	5.91	22.18
B. Including transactions costs							
BBVA Banco Frances	2.48	54.35	23.50	8.48	27.55	14.13	18.51
Cresud S.A.C.I.F. Y A.	3.43	35.26	24.70	3.00	26.38	7.20	2.75
Financiero galicia	3.37	47.83	24.70	7.71	30.09	15.86	17.73
Irsa inversiones	2.67	41.16	19.37	12.90	19.06	6.57	3.10
Metrogas S.A.	2.92	30.28	14.57	1.66	24.50	5.69	1.49
Perez Companc (PC)	2.79	54.71	21.97	7.14	26.45	9.78	11.38
Siderca S.A.I.C	2.78	41.73	22.49	5.66	27.48	9.17	9.44
Telecom Arg Stet-France	2.75	42.19	22.58	8.73	27.44	12.88	14.86
Telefonica	1.67	26.01	16.72	8.49	20.41	−10.48	−3.41
TGS	4.01	48.32	24.13	9.27	26.17	13.62	12.89
YPF S.A.	2.13	33.47	18.08	4.97	27.31	10.64	7.66
Portfolios							
Equal-weighted	2.78	41.39	21.15	9.20	24.61	10.94	13.11
Value-weighted	2.51	39.28	19.87	10.71	23.62	9.61	24.44

Sources: Bloomberg and Economatica.
Note: Mean ADR discounts (measured as the difference between the local price in US dollars and the ADR price, as a fraction of the local price in dollars) are calculated only on days when the security was traded in both markets. Local prices are adjusted for the ADR conversion ratio. *T*-stats are tests that the mean ADR discount during the *Corallito* differs significantly from the mean ADR discount in the pre-*Corralito* period. The test corrects for differences in sample size and unequal variances across the sub-periods. Transaction costs are assumed to be the same in the pre- and post-*Corralito* periods.

3.6. ADR discounts prior to the devaluation

By late December 2001, it was clear that a devaluation of the Argentine peso was imminent.[35] On 21st December, the Argentine foreign exchange market was closed,

[35]Although President Dualde initially promised that he would not devalue the peso before March, financial press reports in this period suggest that the market expected a devaluation to come much sooner. On 4th January

although the official exchange rate remained at 1 peso per dollar. Reports in the press suggest that there was an active parallel market for dollars on the streets of Buenos Aires during this period, and there were trades in the 1-week ahead non-delivery forward (NDF) peso-dollar market in New York. It is in this context that the Argentine ADR market was also able to serve as a shadow foreign exchange market, allowing us to back out the market's implicit forecast of the size of the devaluation. Recall from Eq. (8) that the ADR discount can be decomposed into 3 components: the liquidity premium (for which we have data)[36], the CCCV, and the currency value. We use two different identification schemes to disentangle the CCCV from the currency value. First, we use data from financial press reports as well as non-delivery forward (NDF) prices[37] to measure currency expectations. The CCCV in this approach is then the residual, after subtracting off the liquidity premium and the expected devaluation from the ADR discount. Alternatively, going back to Eq. (8), we make the assumption that the CCCV and the liquidity premium did not change in the interval of 1-day-before to the day of the devaluation, allowing us to directly back out devaluation expectations from the 1-day change in the ADR discount on the eve of the actual devaluation.

In the week before the announcement of the devaluation (and on the days between the announcement and the actual devaluation) the range of forecasts for the size of the devaluation varied widely. Uncertainty about the magnitude of the devaluation was further complicated by the fact that when the Government announced that a devaluation would take place (on 7th January)–they also announced that a new dual-exchange rate system would be established—in effect indicating that there would be two simultaneous devaluations. Clarin, the leading newspaper in Argentina, reported on 3rd January that a devaluation was imminent and that it was expected to be 30%. On 4th January, Clarin revised its forecast of the devaluation to a range of between 35% and 40%. In contrast, the 1-week ahead NDF market was predicting a devaluation of just 25% on 9th and 10th January (down from 30% in the previous week). Reuters, which collected data on the peso–U.S.D black market rate in this period, did not track the rate in the week prior to the devaluation apparently because of the wide dispersion of quotes in the broker market. In our decomposition calculations we use the (high-end) 40% devaluation forecast reported in the financial press starting on 4–10 January. For the rest of the days in our sample we use the NDF market forecasts.

In Fig. 6, we provide a visual picture of our first method of decomposing the ADR discount for Perez Companc (PC) into its 3 components. We focus on PC because it was the

(*footnote continued*)

reports in the press (apparently based on official leaks) indicated that the Government was likely to devalue before mid-January. The Argentine Congress voted to establish the Law of Economic Emergency and abolish the Convertibility Law on (Sunday) 6th January. The decision to devalue the peso and establish a dual exchange rate regime was officially announced on (Monday) 7th January. The actual devaluation occurred on (Friday) 11th January when the peso–U.S.D exchange rate was officially changed from 1 to 1.4. The free float of the peso started on 11th February. See Appendix C for more information regarding exchange rate developments over this period.

[36]The sources for this data are Nosis S.A. and Broda Consultores. The liquidity premium is calculated as the daily average market discount on checks relative to cash. These data are available for January–November 2002. In keeping with anecdotal evidence from Argentine brokers we assume that the liquidity premium rises gradually (linearly) from 0% to 9% (the average premium in January) by 20th December the day that President de la Rua resigned and it became more likely that a devaluation would be necessary (and the *Corralito* would remain in place for the indefinite future).

[37]The NDF data are a composite index of 1-week forward peso–dollar contracts available on Bloomberg.

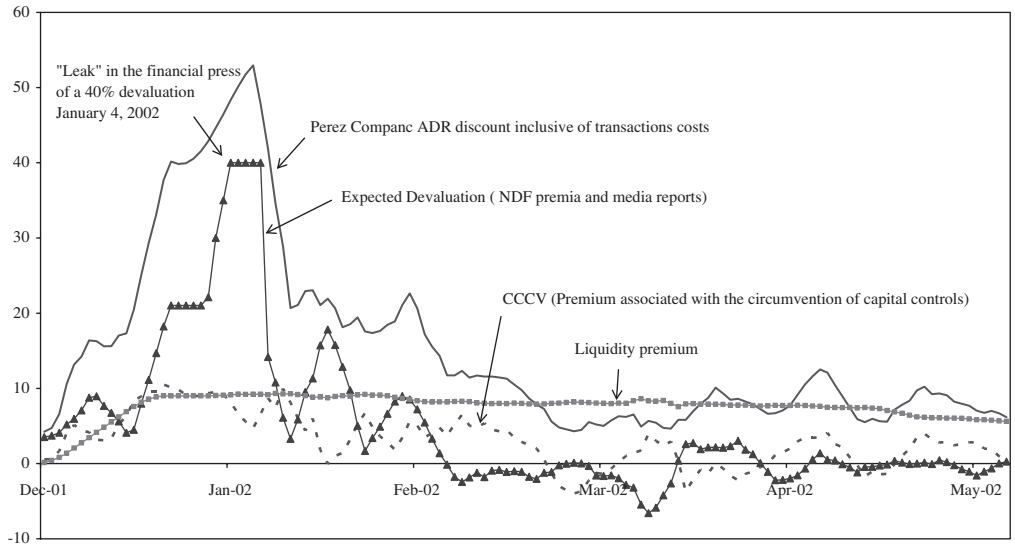

Fig. 6. Decomposition of Perez Companc's ADR discount. *Sources:* Bloomberg, Nosis S.A., Broda Consultores and Clarin, *Note:* Observations are based on weekly moving averages.

stock with the highest trading volume in the U.S. and Argentina during the days surrounding the devaluation, and information from brokers suggests that PC was the stock primarily used to conduct ADR conversions. The liquidity premium (the price of deposits) ranged from 0 to 9 percent, declining very gradually from mid-January through May 2002. The expected devaluation—based on the NDF series and media reports as described above—shows three sharp spikes on 6 December, 20 December and 4 January. The CCCV—which is the residual—averages 5 percent in the week before the announcement of the devaluation. It then falls back down to around 3 percent in the post-devaluation period.

In Table 5 we calculate the CCCV for each of the eleven ADRs over the week before the devaluation assuming a liquidity premium of 9 percent and an expected devaluation of 40 percent. The Argentine Merval was closed in the days surrounding the devaluation, so changes in the ADR discount reflect movements of the stock price in New York. It is interesting to note that only two of the ADRs, Banco Frances and Perez Companc, have positive CCCVs in this period. If actual devaluation expectations were lower than 40 percent (as suggested by the NDF prices) a number of the CCCV estimates would turn positive.[38] It is also the case that in the period just prior to the devaluation liquidity in some of the ADRs was extremely low (as reflected in the trading volume numbers shown in Table 5). This is especially true for those ADRs with relatively low rates of discount (Irsa, Metrogas, and YPF).[39]

[38]If we calculate the CCCV on 4th January, when both the Argentine and New York markets were open, and use the NDF estimate of expected devaluation of 30 percent and a liquidity of premium of 9.2 percent, the CCCVs for Financiero Galicia, Siderca and TGS all become positive at 5.1, 1.4 and 0.4 percent, respectively.

[39]Amihud (2002) provides an alternative measure of liquidity (designed to capture the daily price impact of order flow) that takes the average ratio of the daily absolute return on share *i* to the daily value of trading volume for share *i*. Using this measure of liquidity, the five most liquid shares in Argentina during the *Corralito* are PC, Financiero Galicia, Siderca, Telecom and Banco Frances. Further, using this measure of liquidity, PC is at least 4 times as liquid as any of the other cross-listed shares.

Table 5
Estimated CCCV and expected devaluation After January 4, 2002

Individual ADRS	Decomposition of ADR discount in week before the devaluation				Difference in ADR discounts discounts around devaluation	
	4–10 Jan 2002					
	Max ADR discount (%)	CCCV (%)	Volume in Arg	Volume in NY	4th–11th Jan (%)	10th–11th Jan (%)
BBVA Banco Frances	54.4	5.4	886	1872	19.29	35.52
Cresud S.A.C.I.F. Y A.	35.3	−13.7	8026	40	58.82	62.35
Financiero Galicia	47.8	−1.2	5887	3678	33.29	36.89
Irsa Inversiones	41.2	−7.8	807	619	28.64	43.21
Metrogas S.A.	30.3	−18.7	372	200	23.72	45.34
Perez Companc (PC)	54.7	5.7	16757	16429	22.62	32.36
Siderca S.A.I.C	41.7	−7.3	4470	817	45.52	44.12
Telecom Arg Stet-France	42.2	−6.8	4251	25674	76.00	69.67
Telefonica	na	na	0	878	na	na
TGS	48.3	−0.7	410	284	38.97	37.96
YPF S.A.	33.5	−15.5	219	795	48.72	45.61
Average	42.92	−6.08	3826	4662	39.56	45.30

Sources: Bloomberg, Economatica, Nosis S.Z. and Broda Consultores, and Clarin.
Note: ADR discounts are measured as the difference between the local price in US dollars and the ADR price, as a fraction of the local price in dollars. Local prices are adjusted for the ADR conversion ratio. The Argentine Stock Market was closed 5–17 Jan so that the reported ADR discounts are based on Argentine trading on 4th. January. The CCCV column is calculated as the "max ADR discount" minus a liquidity premia of 9%, and an expected devaluation of 40%. Volume is in thousands of dollars. Telefonica is excluded as its shares did not trade in Argentina on 4th. January. Using Amihud's (2002) measure of liquidity, PC is at least 4 times more liquid than all the other ADRs, and the five most liquid shares in Argentina during the Corralito are PC, Financiero Galicia, Siderca, Telecom and Banco Frances.

One way to think about the CCCV in this context is as a measure of the degree to which the Argentine capital controls were binding. If there were other less costly means of circumventing the *Corralito* we should see the CCCV embedded in the ADR discount decline. Indeed, the Argentine government eased some of the more draconian restrictions on capital outflows in the months following the devaluation, which likely lowered the ADR CCCV. Also, a number of other cross-listed financial instruments, including CEDEARs (U.S. firms cross-listed on the Argentine stock market), became more liquid in early 2002 which provided additional vehicles for capital outflow,[40] further lowering the CCCV for ADRs. Finally, it should be noted that a negative CCCV for a particular stock does not necessarily mean that there are costless profits available to investors through ADR conversions. The calculation of the CCCV assumes that the trade can occur instantaneously. If the stock is held for any period of time, and this period will be longer for more illiquid stocks—investors will also take into account any additional covariance

[40]See Auguste et al. (2002) for a further discussion of the role of CEDEARs.

risks that they would incur in holding the stock. These additional risk factors are not included in our calculations.

Our second method of disentangling the CCCV from the currency value contained in the ADR discount is presented in the last two columns of Table 5. We make the assumption that the CCCV value (and the liquidity premium) did not change on the eve of the devaluation. If we take the difference in ADR discounts just before and just after the devaluation on 11th January we find an average expected devaluation of between 40 and 45 percent, depending on whether we use the ADR discounts on 10th January (when only the New York market was open) or on 4th January (the last trading day on the Argentine Stock Market before the devaluation) in our calculations.[41] These changes in discounts are significantly larger than the typical daily or weekly discount changes in the pre-*Corralito* period and they suggest that, on average, the ADR market did a good job predicting the magnitude of the official devaluation (which was 40 percent). However, it is interesting to note that the devaluation forecasts implicit in the ADR discounts were generally far from predicting the 70 percent devaluation that took place for the floating component of the dual-exchange rate system that was also established on 11th January.

3.7. Venezuela's CANTV ADR discount

Just 2 months after Argentina's *Corralito* was finally abolished, Venezuela found itself in the midst of an economic crisis that resulted in a 20 percent devaluation of the Bolivar against the dollar and the establishment of capital controls on 6 February 2003. The Venezuelan controls were less severe than those in Argentina in that they did not involve the freezing of bank deposits, but all conversions of Venezuelan Bolivars into U.S. dollars (including the purchase of dollars to pay dividends to ADR holders) became subject to government approval. In the period immediately following the imposition of the capital controls ADR conversions were suspended, although trading in CANTV shares (the most liquid Venezuelan ADR) continued both in Venezuela and New York.[42] Starting in May 2003 the Bank of New York announced that it would resume CANTV ADR conversions and the CANTV discounts (the difference between the ADR price in New York and the corresponding local price in U.S. dollars) increased dramatically from below 10 percent to between 30 and 45 percent, peaking at 50 percent in January 2004.[43]

[41]Over this period there are days when only the U.S. market is open (although there exist local prices in Argentina based on the previous trading day) as well as days when particular ADRs did not trade in one or both markets. If we calculate changes in the ADR discounts on 17th January (when the Argentine stock market reopened), rather than 11th January, the average change in the ADR discount ranged between 32 and 33 percent.

[42]The other Venezuelan firm that was cross-listed on the NYSE in 2003 was Corimon. It was de-listed in June 2003 after it failed to pay dividends to ADR holders and its ADR price in NY dropped so steeply that its market capitalization fell below the NYSE minimum value. The other 11 Venezuelan ADRs were OTC and extremely illiquid during 2003.

[43]As of February 2004, the Institutional Investor Relations Department of CANTV indicated that 92 percent of all possible ordinary shares of CANTV which can be transformed into ADRs (class-D shares), have been converted and are outstanding in New York.

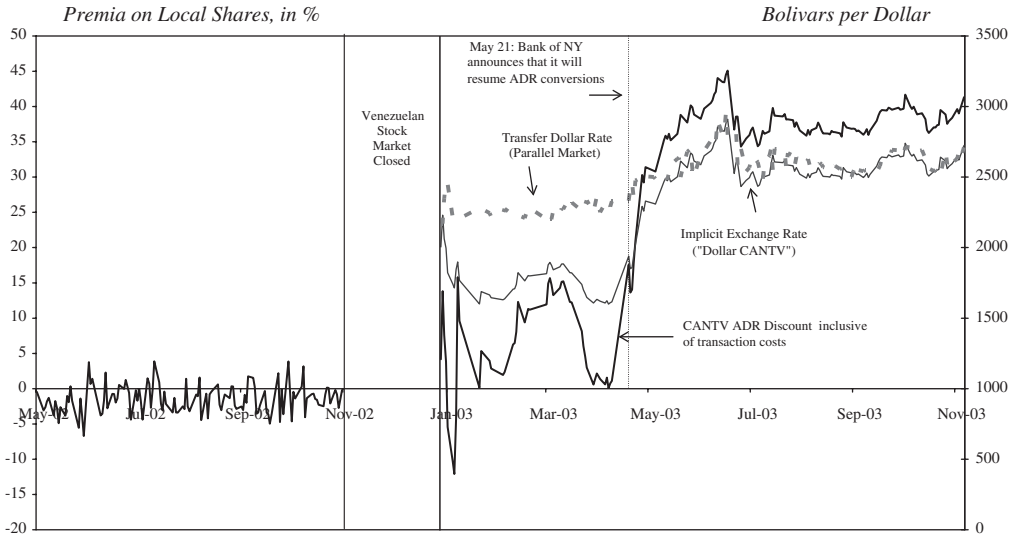

Fig. 7. CANTV's ADR discount and the "Dollar CANTV" rate. *Sources:* Bloomberg and Activalores.

Fig. 7 shows the CANTV ADR discount together with the "dollar-transfer" rate[44] and the "dollar–CANTV" rate[45] over the period May 2002–February 2004 (the capital controls are still in place at the time of this writing). During the period when CANTV ADR conversions were suspended (6th February–20th May 2003) and arbitrage was not possible, the "dollar–CANTV" is much lower than the "dollar-transfer" rate. Once ADR conversions resumed, and arbitrage could again take place, the "dollar–CANTV" rate closely tracks the "dollar-transfer" rate. In June 2003, the *Economist* reported that "shares in CANTV, the telephone company, which is also quoted in New York, rose by 68 percent in May, as investors realized that they could swap them for a dollar-denominated ADR, and thus for dollars".[46] Unfortunately, there does not exist an alternative measure of currency value in Venezuela that will allow us to disentangle the CCCV from the expected devaluation.[47] If we assume that the CCCV was in the 3–5 percent range that we found for Argentina, this would imply an ADR market expectation of a 55–62 percent devaluation of the Bolivar relative to the dollar in early December 2003.

[44]The dollar transfer market (also described as "money tables" or "mesas de dinero") provides the price in bolivars of buying dollars and transferring them to a foreign bank, so that this price will include the CCCV. These data are available from Venanacham (the Venezuelan–US Chamber of Commerce in Caracas) and are for "large transactions" in an informal broker market. The transaction fee for these transfers is typically fixed at $25 per operation.

[45]The dollar CANTV is the effective cost of buying dollars using CANTV ADR conversions inclusive of transactions costs. Our estimates of transactions costs for this market were provided by Activalores.

[46]The *Economist*, 12 June 2003. It is interesting to note that CANTV posted negative earnings in the same quarter that its share price rose by 68 percent. Venezuela's Caracas General Index also rose 63 percent as a direct consequence of CANTV's price boom, even as Venezuelan GDP was contracting 25 percent.

[47]The official Venezuelan exchange rate was fixed over this period at 1598 Bolivars to the dollar. It is not possible to use Bolivar NDF prices to decompose the ADR discount because the market was extremely illiquid over this period. The dollar transfer rate is also not useful because it includes both transaction costs and a CCCV component.

The Venezuelan ADR market, and particularly the CANTV ADR discount, continues to provide market participants with a timely indicator of the effective exchange rate in an organized, legal, and transparent asset market. Indeed, it is interesting to note that in November 2003 Morgan Stanley Capital International (MSCI) announced that it would use CANTV's ADR discount to proxy for the Bolivar–usd exchange rate in their calculation of the MSCI Venezuela Index.[48]

4. Market factors and the pricing of ADRs

In Section 3 of this paper, we analyze the time series of Argentine ADR and local prices in isolation. We now turn to the pricing of ADR stocks in the context of overall market movements in Argentina and New York.

In theory, in a fully liberalized and integrated financial environment, we would expect ADRs to be priced based on global market factors. Investors with access to global assets should expect returns to be based on covariances of individual stocks and the global market portfolio. That said, in practice, Karolyi and Stulz (2003) and Gagnon and Karolyi (2004) find that home bias tends to increase local influences on asset prices. They find that local market portfolios often better explain the cross-sectional variation in expected returns for local stocks, though they also find that equity flows and cross-country correlations increase global influences on asset prices.[49] The pricing of Argentine ADRs provides an interesting natural experiment in the context of this literature. Prior to the imposition of the *Corralito*, Argentina's financial markets were considered fully liberalized. The *Corralito*, although allowing ADR transactions to continue, was intended to control capital outflows and therefore presumably led to a less globally integrated Argentine capital market.[50] In terms of the market model, we might therefore expect to find that the influence of local and global market factors in pricing Argentine cross-listed stocks changed during the period in which capital controls were in force.

We test whether the imposition of the *Corralito* led to changes in the pricing of Argentine stocks with associated ADRs using a multi-factor market model; where R_{it} is the return on asset i at time t, R_{mt}^{G} is the return on the global market portfolio at time t, R_{mt}^{L} is the return on the local market portfolio at time t, and ΔS_t is the change in the exchange rate at time t:

$$R_{it} = \beta_0 + \beta_1 R_{mt}^{G} + \beta_2 R_{mt}^{L} + \beta_3 \Delta S_t + \varepsilon_{it}. \tag{9}$$

Table 6 presents daily time series results[51] from regressions of returns from the value-weighted ADR portfolio (in Argentina and the U.S.) on the MSCI world index, an

[48]On 26 November 2003, MSCI announced its decision to change its standard spot rate for the Venezuelan Bolivar to a notional exchange rate based on the relationship between the price of CANTV in the local market in bolivars and the price of its ADR in US dollars.

[49]Also see Errunza and Losq (1985), Eun and Janakiramanan (1986) and Alexander et al. (1987) who examine the pricing of ADR portfolios in the context of the market model and generally find evidence that global market factors dominate local factors in explaining ADR returns. In a large cross-country study, Gagnon and Karolyi (2004) find evidence of significant differences in the prices of local shares and their corresponding ADR shares, though they also find that these differences rarely persist for more than 1 day.

[50]Schmukler and Kaminsky (2000), however, find little evidence that capital controls (in six emerging market economies during the 1990s) effectively segmented domestic markets especially over longer horizons.

[51]Daily returns correspond to close-to-close prices including dividends and excluding weekends and holidays.

Table 6
Explaining ADR portfolio returns in Argentina and the U.S. using a global market portfolio and an argentine (non-ADR) local market portfolio over the Pre-*Corralito* and *Corralito* periods

Independent variable	Pre-*Corralito*		*Corralito*	
	Local shares	ADRs	Local shares	ADRs
Local market portfolio	0.834**	0.736**	1.011**	0.157**
	(0.053)	(0.050)	(0.094)	(0.046)
Global market portfolio	0.961**	0.992**	0.668*	0.651**
	(0.057)	(0.053)	(0.256)	(0.174)
Exchange rate change			0.069	−0.011
			(0.097)	(0.029)
Constant	0.000	0.000	−0.002	−0.004*
	(0.001)	(0.001)	(0.002)	(0.002)
Number of Obs	477	483	104	124
R^2	0.45	0.47	0.81	0.2
F-statistic	190.7	208.9	58.2	5.5
DW statistic	2.11	1.89	1.89	1.88
Partial R^2 (local MP)	0.42	0.43	0.76	0.16
Partial R^2 (global MP)	0.16	0.23	0.01	0.09

Sources: Economatica and Bloomberg.
Note: Standard errors are in parenthesis. The global market portfolio is the MSCI world index and the local market portfolio is an orthgonalized value-weighted portfolio (in dollars) of all the stocks traded in Buenos Aires except those with an associated ADR. The dependent variable is the return in Argentina or the U.S. on a value-weighted portfolio of the 11 stocks with associated ADRs. The pre-*Corralito* period is 1/1/2000 to 11/30/2001 and the *Corralito* period is 12/3/2001 to 5/31/2002. ** denotes significance at the 1% level, and * denotes significance at the 5% level. The regressions over the *Corralito* period include dummy variables for days when the Argentinean market was closed. Partial R^2 (market x) corresponds to the R^2 when we exclude the other market index in the regression (in the pre-*Corralito* sample the Exchange Rate Change variable is also excluded).

orthogonalized[52] local Argentine value-weighted portfolio index (excluding the stocks with associated ADRs), and the change in the peso–dollar exchange rate. Regression results are presented both for the period prior to the imposition of the *Corralito* (specifically January 2000–November 2001) and for the *Corralito* period (December 2001–May 2002).

The results in Table 6 suggest that both local (Argentine) market factors and global market factors were important in pricing Argentine stocks with associated ADRs even before the imposition of the *Corralito*. Our estimates of the betas on the global market portfolio are close to one while the β on the local market factor are 0.8 for the portfolio returns in Argentina and 0.7 for the corresponding ADR portfolio returns in the U.S. Focusing first on the results for the regression using the portfolio price in Argentina we find that in the *Corralito* period the local market portfolio β rises (both in absolute magnitude and in relation to the β on the global market portfolio) following the imposition of the *Corralito*. If we examine what proportion of the variance of portfolio returns in Argentina is explained by the local market portfolio (using the partial R^2), we find that

[52]We orthogonalize the non-ADR Argentine portfolio by regressing it on the MSCI (separately over the pre- and post-*Corralito* subperiods) and use the residuals from these first stage regressions for R^{L}_{mt} in the estimation of Eq. (8).

prior to the *Corralito* this was 42 percent, whereas during the *Corralito* this rises to 76 percent.[53] The opposite is true of the global market factor; the proportion of the variance of portfolio returns in Argentina explained by the global market factor falls from 16 percent prior to the *Corralito* to just 1 percent during the *Corralito*. These results suggest local market factors in Argentina became more important in pricing stocks with associated ADRs (and presumably all Argentine stocks), and global factors became less important, during the period in which capital controls were in force.

The discussion in Sections 2 and 3 of this paper suggests that the pricing of cross-listed shares in Argentina and New York may have diverged during the *Corralito* period. And, in particular, we might expect that while local factors influenced prices in Argentina, they may not have been as important for prices of the same stocks sold in New York (given that investors in New York were not subject to the restrictions of the *Corralito*). Indeed, we find that estimates of Eq. (9) using ADR portfolio returns in New York indicate that the β on the local market portfolio falls dramatically from .73 in the pre-*Corralito* subperiod to .16 in the *Corralito* period. The β on the global market portfolio in this regression also falls in the *Corralito* period (from 0.99 to 0.65), as does the regression goodness of fit which falls from 0.47 in the pre-*Corralito* period to 0.2 during the *Corralito*.[54] Further, the percentage of variation in the return of the ADR portfolio in New York explained by the local market portfolio (based on the partial R^2) falls from 43 percent before the *Corralito* to 16 percent during the *Corralito*, while the explanatory power of the global market index falls from 23 to 9 percent.

In order to more formally test the hypothesis that the influence of local and global market factors for pricing Argentine cross-listed shares changed after the imposition of the *Corralito*, we use a Chow breakpoint test for structural change. Table 7 presents the results of four such Chow tests for no structural change in the local and global market betas in the two markets (over the full sample period January 2000–May 2002). The results indicate strong rejections of the hypothesis of no structural change in both the local and global market betas after the imposition of the *Corralito* for the ADR portfolios in both markets. These results together with the results presented in Table 6 indicate that Argentine ADRs in New York became less like other Argentine stocks (including those with associated ADRs) with the advent of capital controls.

[53]This result is based on a market model which includes dummies to control for the many market closures that occurred during the *Corralito*. In order to determine whether non-frequent trading introduces bias in our regression results, we re-estimated Eq. (8) using the Scholes and Williams (1977) non-synchronous trading correction. Specifically, we estimate Eq. (8) allowing for up to 10 lags and leads of the local and global market portfolios. We compute $\beta_n^{SW} = (\sum_{i=-n}^{n}\beta_i/1 + \sum_{i=1}^{n}2\rho^i)$, where ρ is the autocorrelation coefficient. We find that the local market portfolio beta is robust to the choice of leads and lags, whereas the global market portfolio β is sensitive to the lag specification in the *Corralito* period, though the main qualitative results remain robust. These lead and lag estimates of the β are available upon request.

[54]We analyze beta stability in the post-*Corralito* period by running recursive least squares regressions. These estimates (available upon request) suggest that in the first 2 months following the imposition of the *Corralito* (and when the volume in the ADR market was at its peak) neither the global market index nor the Argentine market index explain ADR portfolio returns in New York (whereas in Argentina local market factors become more important in explaining the pricing of stocks with associated ADRs over this period). In the subsequent 2-month rolling subsamples the global market index β regains statistical significance and rises in magnitude for the ADR portfolio returns in New York.

Table 7
Chow breakpoint test for local and global market portfolio beta stability after the imposition of the *Corralito*

Local shares	Local market portfolio β	Global market portfolio β	Both market β
F-statistic	12.931	3.440	3.796
P-value	0.000	0.017	0.005
ADRs			
F-statistic	6.719	3.230	30.050
P-value	0.001	0.040	0.000

Note: The dependent variable is the return (in dollars) in Argentina (Local Shares) or in the U.S. (ADRs) on a value-weighted portfolio of the 11 stocks with associated ADRs. The global market portfolio is the MSCI world index and the local market portfolio is an orthogonalized value-weighted portfolio (in dollars) of all the stocks traded in Buenos Aires except those with an associated ADR. The full sample is 1/1/2000 to 5/30/2002 and the breakpoint is 11/30/2001.

5. Conclusions

Argentina in late 2001 and early 2002 and Venezuela in 2003 provide an unusual opportunity to analyze the reactions of investors to capital controls. The Argentine *Corralito*, originally put in place to stave off a devaluation of the peso, effectively served to provide incentives for Argentines to invest in the Argentine stock market, and provided a new role for cross-listed shares as a (legal) mechanism for capital flight. Venezuelan investors also learned to use CANTV ADRs to evade similar capital controls. Investors in both countries were able to purchase cross-listed stocks for local currency, convert them into ADRs, re-sell them in New York for dollars and deposit the dollar proceeds in U.S. bank accounts.

In the paper, we show that Argentine and Venezuelan ADR discounts went as high as 55 percent, indicating that investors were willing to pay significant amounts in order to move their funds abroad and to hedge the dollar value of their assets. In effect, ADR discounts serve as a shadow exchange rate in the presence of capital controls. In Venezuela, the implicit value of the dollar in CANTV ADR discounts serves as timely indicator of the effective exchange rate in an organized, legal, and transparent asset market. On the eve of the Argentine devaluation, the ADR market anticipated a fall in the value of the peso relative to the dollar in the range of 40–45 percent. We also estimate that the CCCV for Argentine ADRs averaged 3 percent during the *Corralito*.

We find that the imposition of the *Corralito* led to changes in the underlying pricing structure of ADR stocks in Argentina and New York. The *Corralito*, although allowing ADR transactions to continue, was intended to control capital outflows and therefore should have led to a less globally integrated Argentine capital market. We find evidence of an increase in Argentine market segmentation after the imposition of the *Corralito*. Local market factors in Argentina became more important in pricing peso-denominated stocks with associated ADRs, while the reverse was true (local factors became less important) for the same ADRs in New York.

In the paper, we have focused on the recent Argentine experience with capital controls and the role that cross-listed securities can play in such an environment. But there are general lessons to be learned. Our analysis suggests that once having established ADRs and other kinds of contractual arrangements across markets, it is difficult if not impossible

to reverse the process of capital market integration. Indeed Venezuela tried to halt ADR conversions by restricting firms from paying out dollar dividends, but the government ultimately succumbed to pressures and allowed ADR conversions to resume. ADRs also give insights into the extent to which capital controls are binding by providing a market measure of the effectiveness of those controls.

Appendix A. Argentina's financial market event time line

28 October 2001	Minister Cavallo starts negotiations with the IMF and the U.S. Treasury to purchase collateral for new Argentine bonds to be issued in an exchange for the nearly $100 billion of local and external debt.
29 October 2001	Mr. Cavallo defines the debt exchange operation as voluntary. The old debt would exchange for bonds paying 7 percent per year and be guaranteed by tax revenues. The IMF and U.S. Treasury require compliance with a zero deficit and an agreement with the provinces on tax revenue sharing before any kind of financial support is given.
19 November 2001	The IMF announces it will not make any new disbursements without being satisfied that Argentina has secured the goals previously designated.
30 November 2001	End of a debt swap with local banks and pension funds for more that 55 billion (over a total public debt of 160 billions).
2 December 2001	The government announces temporary capital control regime (termed *Corralito*) involving bank withdrawal limits and limits on dollar transfers abroad as a last-ditch effort to fend off a devaluation and prevent a major banking crisis. Withdrawals are limited to 250 pesos (dollars) per week per account. Depositors, however, may still access funds for larger purchases through checks or debit cards and transfer their money among banks. Holders of deposits may also exchange them for federal bonds (BODENs) maturing in 2005, 2007 or 2012 in a Canje exchange. No limits are placed on domestic payments made with checks, credits, debit cards and electronic MEP (*Metodo Electronico de Pagos*) payments.
3 December 2001	The capital control measures announced on 2nd December come into full effect through Decree 1570–01 on 3rd December: (a) Wire transfers suspended except with prior Central Bank approval. (b) Cash withdrawals from the Banking System limited to US$ 1000 per month. (c) Financial Argentine institutions prohibited from foreign currency futures transactions. (d) Financial Argentine institutions prohibited from issuing new bank loans denominated in Argentine Pesos. All new loans must be issued in U.S. dollars and existing peso loans must be converted to U.S. dollar loans at a one to one rate.

(e) Foreign investors trading in the Argentine Securities Market subject to repatriation restrictions. Funds related to securities transactions must remain in the country until government approval is obtained or the measure is officially revoked.

19 December 2001 Mr. Cavallo and all other ministers resign.

20 December 2001 President Dela Rua resigns and Mr. Ramon Puerta becomes interim president. Country Risk reaches 4618 points. Global (sovereign) bond yields reach their historical maximum of 49 percent annual return in dollars.

21 December 2001 The official Foreign Exchange Rate market is closed.

23 December 2001 Mr. Rodriguez Saa becomes the new interim president for 60 days. He declares the suspension of external debt payments for at least 60 days, totaling $166 bn in federal and provincial debt.

24 December 2001 The government announces that a new fiat currency (i.e., without foreign-currency backing) will be created (the *argentino*).

30 December 2001 Interim president Mr. Rodriguez Saa resigns and the legislative assembly elects Mr. Eduardo Duhalde as new president.

2 January 2002 Mr. Duhalde assumes power.

4 January 2002 "Leak" reported in the financial press suggests that a 40 percent devaluation is imminent.

5 January 2002 The Argentine stock market is closed.

6 January 2002 The Argentine Congress votes to establish the Law of Economic Emergency and abolish the Convertibility Law.

7 January 2002 The new Minister of Finance, Mr. Lenicov, announces the devaluation of the peso and the establishment of a new dual foreign exchange rate regime, to be implemented on the 9th of January 2002.

11 January 2002 After several delays, the exchange rate market re-opens and the new dual exchange rate system is put in place:

(a) 1 Argentinean peso = 1 U.S. dollar parity (Convertibility Plan) is abolished.
(b) All debts (capital and interests) agreed in ARG currency with financial entities—converted into U.S. dollars according to the Decree 1570/2001- will be reconverted into the original currency agreed (pesos).
(c) The official, fixed conversion rate of 1 U.S Dollar = 1.4 pesos is relevant for foreign trade operations. The free or floating rate is relevant for all other transactions and freely determined by the market.

17 January 2002 Argentine stock market re-opens.

21 January 2002 The government announces the easing of bank withdrawal restrictions:

(a) Up to 7000 pesos can be withdrawn from term deposits in pesos (transferring that money to a checking account).

(b) Up to 5000 dollars can be withdrawn from term deposits in dollars (transferring that money to a checking account at the official exchange rate, 1.40).
(c) Up to 5000 dollars in a saving account can be *pesofied* at the official exchange rate.

3 February 2002 — Mr. Lenicov announces an asymmetric *pesofication* and the end of the dual exchange rate regime:

(a) *Pesofication* of all dollar deposits at 1.4 pesos per dollar.
(b) Corporate and consumer debts are also *pesofied*, but at the exchange rate prevailing during the Convertibility period. Both deposits and credit will be indexed to inflation.
(c) The end of the dual exchange rate regime and a unified floating exchange rate determined by market forces.
(d) The right to withdraw wage and pension income from the *corralito* without any amount restrictions (before workers could only extract up to 1.500 pesos).

Corralon starts which freezes bank term deposits (holders of term deposits had the option to convert them into CEDROs or BODENs maturing in 2007 or 2012 in a Canje exchange).

4 February 2002 — The official foreign exchange market is closed.

11 February 2002 — The BCRA establishes a new unified free foreign exchange market, which replaces the two markets—official and free—implemented in January. The exchange rate market re-opens and the floating dollar exchange rate reaches 2.1 pesos, well below the devaluation expectations built-into asset prices.

26 March 2002 — The Central Bank announces new measures related to foreign exchange transactions and ADR/CEDEAR conversions aimed at improving the functioning of the foreign currency market and regulating the buying and selling of foreign currency by order and for the account of the Central Bank. The press communication also mentions that there will be coordination between the *Comision Nacional de Valores* (CNV) and the *Bolsa de Comercio de Buenos Aires* (BCBA) in order to adopt new measures to regulate capital outflows via ADR and CEDEAR transactions.

September 2002 — The central bank passes very restrictive regulation (circular #3723) that mandates that every stock be traded in its underlying currency. After intense opposition from the financial community, the central bank rescinds #3723 and instead passes a resolution (circular #3727) that forbids "contra cable" operations. These operations allowed brokers to sell stocks purchased in Buenos Aires instantaneously in New York (or any foreign market) using the Mercado de Valores as a clearinghouse. Under #3727 it was still possible for investors in Argentina to convert CEDEARs and sell them in New York, but

	this new restriction significantly increased the transactions costs to do so.
2 December 2002	Corralito rescinded.

Sources: Ambito Financiero, La Nacion and Clarin (various issues) and Pictet.

Appendix B. Transactions costs and computation of arbitrage bounds

Appendix Table B1 shows transaction cost ranges that reflect amounts that were charged to both small and large Argentine investors during the *Corralito*. The standard length of time required for an ADR conversion was nine days.[55] Large investors, institutional investors, and bankers faced substantially lower costs than smaller investors, and could also complete the ADR conversion in a shorter period of time.[56]

Taking into account these various transactions costs and defining n_0 as the minimum time required to sell an ADR in New York, the expected return (at period t) in U.S. dollars of converting local share i into its corresponding ADR is[57]

$$\frac{E_t[p_{it+n}^{\mathrm{ADR}}(1-\tau_3)(1-\tau_5)]-\tau_4-[\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t]}{[\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t]}, \tag{B.1}$$

where $n \geqslant n_0$, $\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)$ is the local currency the investor needs to buy ξ_i local shares to obtain one ADR corresponding to stock i, and $E_t[p_{it+n}^{\mathrm{ADR}}(1-\tau_3)(1-\tau_5)]$ is the dollar amount that the local investor expects to obtain after selling the ADR in the U.S. at time $t+n$ after taxes and expenses. Local investors typically face a broker's fee, τ_1, and a transactions fee, τ_2. A second broker's fee, τ_3, is incurred when the asset is sold in the U.S. We also include a fixed fee in dollars, τ_4, that the investor must pay to transform the local shares into an ADR. Finally, the cost of opening a bank account in the U.S. is τ_5. Note that the investor does not have to physically obtain dollars to carry out this operation (the return is simply expressed in dollar units) so the investor does not pay a fee for obtaining foreign exchange.

If the local investor were instead to use the dollar amount $[\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t]$ to buy local share i and sell it in the local market in period $t+n$ for the expected (net of taxes) price, her expected return at time t will be:

$$\frac{E_t \xi_i p_{it+n}^{\mathrm{L}}(1-\tau_1-\tau_2)S_{t+n}-\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t}{\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t}, \tag{B.2}$$

[55]Information from brokers in Buenos Aires suggests that the time to conversion varied considerably across type of investor and across time. We use contemporaneous prices and exchange rates as a benchmark in computing arbitrage returns, which can be interpreted as the minimum cost investors would incur for ADR conversion.

[56]The costs reported in the table are based on phone interviews with portfolio managers and investors in Buenos Aires and on information published on the websites of various Argentine brokerages advertising the ADR-conversion process.

[57]Here we are assuming the conversion fee is paid in dollars in the U.S. once the operation is complete, and the amount is withdrawn from the investor's banking account.

Table B1
Transaction cost ranges for ADR settlement cycle

Location of trade or activity	Parameter	Description	Estimated range of values (percent of total value of stock market transaction, except where noted)
Buenos Aires stock market	τ_1	The brokerage fee is not regulated in Argentina, but for market operations larger than 10,000 pesos, the fee is in the range [0.25 percent, 1 percent] of total settlement, before value-added tax. During December most of the capital control- evading transactions were settled for amounts larger than 10,000 pesos.	[0.3025, 1.21]
	τ_2	Fee that the Buenos Aires stock exchange market charges for every transaction.	0.1025
American depositary bank	τ_4	ADR issuance (conversion) fee charged by the broker. During this period, brokers charged big markups over the typical US$ 0.04–0.05 conversion fees charged by depositary banks.	[0.10 dollar, 0.20 dollars]
NYSE stock market	τ_3	Argentinean brokerage fee for selling the ADR in the U.S.	[0.3025, 1.21]
	τ_5	Approximate cost of opening a banking account in the U.S. and wire transferring the ADR proceeds to a U.S. bank.	1
Argentinean bank	τ_6	Approximate cost of transferring money from Argentina to the U.S. During the capital controls period these transactions were not allowed.	1

Note: The transaction costs ranges account for the wide dispersion of brokerage and conversion fees across size and institutional affiliation of investors, and across time. Large investors faced substantially lower costs than smaller ones, and could also complete the ADR conversion in a shorter period of time.
Sources: All transaction cost information, in particular ADR conversion fees, were obtained from personal interviews in Buenos Aires and/or direct communication with brokers at *InvertirOnline, ElAccionista, CapitalMarkets Argentina and ArgentineReserach* and web-adversitements at portfoliopersonal.com.

where $\xi_i p_{it}^{\mathrm{L}}(1+\tau_1+\tau_2)S_t$ is the amount, expressed in dollars, the investor needs in order to buy enough shares of the local stock i to reach the equivalent of one ADR, and $E_t\xi_i p_{it+n}^{\mathrm{L}}(1-\tau_1-\tau_2)S_{t+n}$ is the amount of money she receives for selling the shares after n periods. The returns are calculated net of the broker's fee and the local transactions fee.

For the investor to be willing to convert shares to ADRs, it must be the case that:

$$E_t[p_{it+n}^{\mathrm{ADR}}(1-\tau_3)(1-\tau_5)]-\tau_4-E_t[\xi_i p_{it+n}^{\mathrm{L}}(1-\tau_1-\tau_2)S_{t+n}]\geqslant 0 \tag{B.3}$$

U.S. investor

The trade-off facing a US investor is different from that of an Argentine investor because of the asymmetries in fees, taxes and institutional regulations in the two markets.

The expected return to holding ADR i for n periods is

$$\frac{E_t p_{it+n}^{\mathrm{ADR}} - p_{it}^{\mathrm{ADR}}}{p_{it}^{\mathrm{ADR}}}. \tag{B.4}$$

U.S. investors do not face a broker's fee or a stock market transactions fee.[58]

The return to converting the ADR to local shares, and repatriating the earnings is given by

$$\frac{E_t \xi_i p_{it+n}^{\mathrm{L}}(1-\tau_1-\tau_2)(1-\tau_6)S_{t+n} - p_{it}^{\mathrm{ADR}}}{p_{it}^{\mathrm{ADR}}}. \tag{B.5}$$

When selling the shares in the local market, we assume that the U.S. investor incurs charges in using a local broker and must pay the stock market transactions fee. Since we assume that he would like to return the profits from the sale back to the U.S., he incurs an additional tax (τ_6) for transferring the funds.

A risk-neutral investor will cancel an ADR when

$$E_t \xi_i p_{it+n}^{\mathrm{L}}(1-\tau_1-\tau_2)(1-\tau_6)S_{t+n} - p_{it}^{\mathrm{ADR}} \geqslant 0. \tag{B.6}$$

This suggests that if local prices (expressed in dollars) exceed the ADR price investors should buy ADRs, convert them back to local shares and sell them in the local market.

Arbitrage bounds

The trade-offs faced by local and U.S. investors yield arbitrage bounds for capital inflow into and outflow from the local market. Eq. (B.6) can be re-written to show the bound facing a local investor who is contemplating converting his local stocks i into their corresponding ADR:

$$\frac{(1-\tau_1-\tau_2)}{(1-\tau_3)(1-\tau_5)} + \frac{\tau_4}{(1-\tau_3)(1-\tau_5)E_t \xi_i p_{it+n}^{\mathrm{L}} S_{t+n}} - 1 \geqslant \frac{E_t p_{it+n}^{\mathrm{ADR}} - E_t \xi_i p_{it+n}^{\mathrm{L}} S_{t+n}}{E_t \xi_i p_{it+n}^{\mathrm{L}} S_{t+n}}. \tag{B.7}$$

Capital outflows to the U.S. will not occur if the transaction costs on the left-hand side of (B.7) (which are a function of the local price and the exchange rate) exceed the returns to the conversion. The Argentine data show that local prices moved well outside of the arbitrage bands because of the value investors attached to being able to convert their frozen bank deposits into dollars in overseas accounts.

Eq. (B.8) shows the corresponding arbitrage bound for capital inflows into the local market. Transactions costs faced by a U.S. investor that exceed the returns of selling ADRs for local shares will choke off capital inflows into the local market.

$$(1-\tau_1-\tau_2)(1-\tau_6) - 1 \geqslant \frac{E_t \xi_i p_{it+n}^{\mathrm{L}} S_{t+n} - E_t p_{it+n}^{\mathrm{ADR}}}{E_t \xi_i p_{it+n}^{\mathrm{L}} S_{t+n}}. \tag{B.8}$$

If the ADR premium/discount lies between the bounds in (B.7) and (B.8) neither investor would engage in arbitrage between the markets. Premia outside of the bounds should, in the absence of capital controls, be arbitraged away.

[58]It is not strictly true that U.S. investors face zero transactions costs. However, our empirical analysis focuses on the arbitrage conducted by Argentine investors during the *Corralito*, so we abstract from the relatively small U.S. transaction costs for simplicity.

Appendix C. Argentine exchange rate market developments

The Argentine foreign exchange rate market was closed (*feriado cambiario*) from the 21st of December until the 10th of January (inclusive). During this period the shadow (or parallel) market exchange rate quoted at around 1.5–1.6 pesos per dollar, well above the official parity of 1 peso per dollar prevailing before markets were closed.

On 4th January, the Minister of Finance announced the discontinuation of the Currency Board and on 7th January, the Minister of Finance announced the devaluation of the peso and a new exchange rate regime. The new exchange rate regime was a dual one, featuring an official, fixed non-convertible rate of 1.4 pesos per dollar (relevant for exporters and financial institutions) and a free or floating dollar, for all other operations and determined by supply and demand. This new dual regime *came into full effect* on Friday the 11th of January when the markets were re-opened.

On the11th January, there were two different values for the free exchange rate: dollars purchased with cash at 1.7–1.8 "free pesos" per dollar, and a higher exchange rate for dollars purchased with checks from funds in the C*orralito* (1.9–2 "trapped pesos" per dollar).

Exchange rate market operations were again suspended from the 4th to 8th of February, inclusive. On Sunday, 3rd February, the new Minister of Finance announced the end of the dual exchange rate regime and a unified floating exchange rate was put in place on Monday, 11th February. On the 11th, the floating exchange rate opened at 2.10 pesos per dollar (Fig. 8).

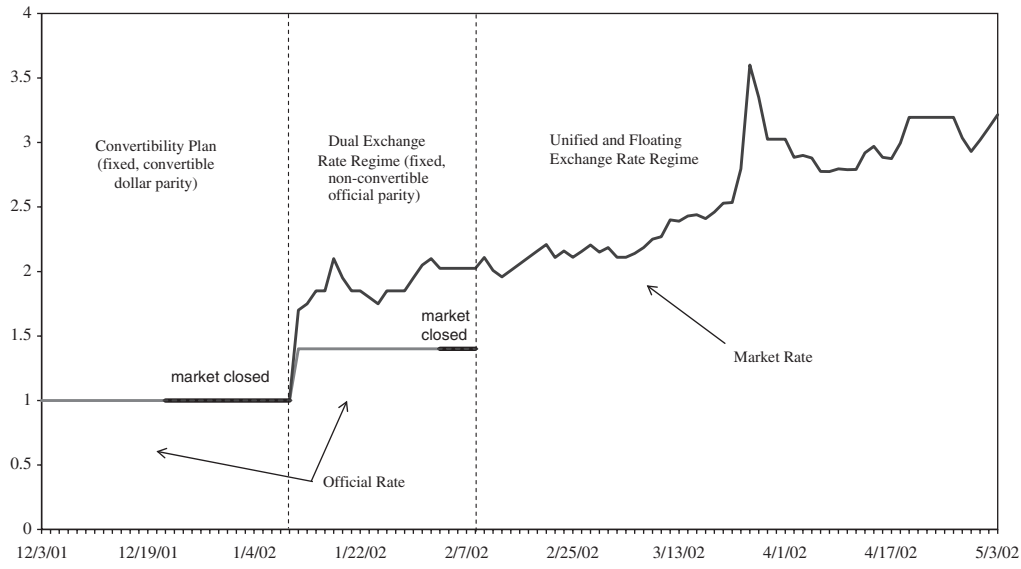

Fig. 8. Foreign exchange rate regimes in Argentina, (daily exchange rate in pesos per dollar: 3 December 2001–31 May 2002). *Source:* Bloomberg, *Note:* Solid black lines denote periods when the official foreign exchange market was closed.

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