The Costs of Sovereign Default: Evidence from Argentina*

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Abstract

We estimate the causal effect of sovereign default on the equity returns of Argentine firms. We identify this effect by exploiting changes in the probability of Argentine sovereign default induced by legal rulings in the case of *Republic of Argentina v. NML Capital*. Because the legal rulings affected the probability of Argentina defaulting on its debt, independent of underlying economic conditions, these rulings allow us to study the effect of default on firm performance. Using both standard event study methods and a Rigobon (2003) heteroskedasticity-based identification strategy, we find that an increase in the probability of sovereign default causes a significant decline in the Argentine equity market. A 1% increase in the risk-neutral probability of default causes a 0.55% fall in the US dollar value of index of Argentine American Depository Receipts (ADRs). Extrapolating from these estimates, we conclude that the recent Argentine sovereign default episode caused a cumulative 33% drop in the ADR index from 2011 to 2014. We find suggestive evidence that banks, exporters, and foreign-owned firms are particularly affected.

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1 Introduction

A fundamental question in international macroeconomics is why governments repay their debt to foreign creditors, given the limited recourse available to those creditors. The seminal paper of Eaton and Gersovitz (1981) argues that reputational concerns alone are sufficient to ensure that sovereigns repay their debt. Because a default leads to a loss of international reputation, defaulting countries are excluded from sovereign bond markets and can no longer share risk. Eaton and Gersovitz (1981) argue that countries repay their debt to maintain their international reputation and access to credit markets. In a famous critique, Bulow and Rogoff (1989b) demonstrate that reputational contracts alone cannot be sustained in equilibrium without some other type of default cost or punishment. Following this critique, hundreds of papers have been written trying to identify these costs of default. The fundamental identification challenge is that governments usually default in response to deteriorating economic conditions, which makes it hard to determine if the default itself caused further harm to the economy.

The case of *Republic of Argentina v. NML Capital* provides a natural experiment to disentangle the causal effect of sovereign default. Following Argentina's sovereign default in 2001, NML Capital, a subsidiary of Elliott Management Corporation, purchased defaulted bonds and refused to join other creditors in restructurings of the debt during 2005 and 2010. Instead, because the debt was issued under New York law, NML sued the Argentine state in US courts to receive full payment. To compel the Argentine government to repay the defaulted debt in full, the US courts blocked Argentina's ability to pay its restructured creditors until NML and the other holdout creditors were paid in full. The Argentine government resisted paying the holdouts in full, even though the required payments would not be particularly large relative to the Argentine economy. As a result, rulings in favor of NML raised the probability that Argentina would default on its restructured bonds, while rulings in favor of Argentina lowered this probability.

Because the court rulings were not responding to private information about the underlying economic circumstances in Argentina, we can use them to examine the effect of changing default probabilities on Argentine firms. We use credit default swaps (CDS) to measure the change in the risk neutral probability of default. Compiling rulings from the United States District Court for the Southern District of New York, the Second Court of Appeals, and United States Supreme Court, we identify sixteen rulings that potentially changed the probability of default. We find that, for every 1% increase in the 5-year cumulative default probability, the US dollar value of an index of Argentine American Depository Receipts (ADRs)

falls 0.55%.[1] Between January 3, 2011, when our data starts, and July 30, 2014, when Argentina defaulted, the risk-neutral 5-year default probability increased from roughly 40% to 100%. Our estimates imply that this episode reduced the value of the Argentine firms in our index by 33%.

We begin our analysis by studying these legal rulings in an event study framework. We find economically significant negative returns for the ADRs of Argentine firms in response to legal rulings in favor of NML, and positive returns in response to rulings in favor of Argentina. We find these effects when using two-day event windows, and when using narrower windows that vary in size depending on the announcement time of the rulings. We also find that a measure of the "blue rate," the unofficial exchange rate between Argentine pesos and US dollars, depreciates in response to rulings in favor of NML and appreciates in response to rulings in favor of Argentina.

The event study approach is subject to the concern that other factors may have changed during the relevant event windows. To alleviate this concern, following Rigobon (2003) and Rigobon and Sack (2004), we identify the effect of changes in the default probability on equity returns through heteroskedasticity. We assume that on days in which US courts rule on *Republic of Argentina v. NML Capital* and related court cases, the variance of shocks to the probability of default is higher than on other days. Using this identification strategy, we find results consistent with our event study approach. We interpret our results as providing evidence that sovereign default causes economically significant harm to corporations from the defaulting country.

To better understand how a sovereign default affects the economy, we examine which types of firms are harmed more or less by an increase in the probability of default. We sort firms along the dimensions suggested by the theoretical sovereign debt literature, as well as on some additional firm characteristics. We find suggestive evidence that banks, exporters, and foreign-owned firms are hurt more by increases in the probability of sovereign default than would be expected, given their "beta" to the Argentine market. Our results do not necessarily imply that these types of firms are hurt more in absolute terms by an increase in the probability of default than other firms, although this is indeed the case for banks. Instead, our results show that these firms are hurt more by an increase in the risk of a sovereign default than they would be by a "typical" shock that had the same impact on a broad index of Argentine stocks.[2]

[1] American Depository Receipts are shares in foreign firms that trade on US stock exchanges in US dollars.

[2] We calculate the effect of sovereign default conditional on the index because we do not want to imply that all high-beta firms are hurt more by sovereign default risk than other firms, simply because their value falls more than the broad index in response to an increase in sovereign risk. We find that exporters are more adversely affected by sovereign default than implied by their market beta, but they are not actually hurt more in absolute terms than non-exporters.

This paper contributes to a large literature examining the costs of sovereign default. The question of the cost of sovereign default is surveyed in Borensztein and Panizza (2008). Using quarterly data, Yeyati and Panizza (2011) find that output generally falls in anticipation of a sovereign default and the default itself tends to mark the beginning of the recovery. Bulow and Rogoff (1989a) argue that default is costly because foreign lenders can disrupt trade, a channel for which Rose (2006), Borensztein and Panizza (2010), and Zymek (2012) find empirical support. Gennaioli et al. (2014), Acharya et al. (2014), Bocola (2013) and Perez (2014) present models of the disruptive effect of default on the financial system and the consequent disruption of macroeconomic activity. Mendoza and Yue (2012) present a general equilibrium strategic default model, building on the framework of Aguiar and Gopinath (2006) and Arellano (2008), where default is costly because it reduces the ability of domestic firms to import intermediate goods, reducing their productivity. Cole and Kehoe (1998) argue that a sovereign default causes the government to lose its reputation not just in regards to the repayment debt, but also more generally. Arteta and Hale (2008) observe that during a sovereign default, external credit to the private sector is reduced. Schumacher et al. (2014) study sovereign debt litigation across a range of countries over the past 40 years. They find that creditor litigation is associated with a decline in international trade, sovereign exclusion from financial markets, and a longer time before the default is resolved. The Argentine case studied here differs from most of the cases studied in Schumacher et al. (2014) as this litigation also changed the probability of a new default, in addition to affecting the government's ability to resolve an ongoing default.

This paper is structured as follows: Section 2 discusses the case of *Republic of Argentina v. NML Capital*. Section 3 describes the data and presents summary statistics for the behavior of CDS and equity returns on event and non-event days. Section 4 presents our estimation framework, the identifying assumptions, and our results. Section 5 discusses industries and firm characteristics that are associated with larger responses to changes in the probability of sovereign default. Section 6 presents the interpretation of the results. Section 7 concludes.

2 Argentina's Sovereign Debt Saga

2.1 The Argentine Default of 2001 and the Restructurings of 2005 and 2010

Following decades of rampant inflation, in 1991 the Argentine government adopted the "convertibility plan," introducing a currency board in an attempt to irrevocably fix the peso-dollar exchange rate at one-to-one.

This meant that the government legally committed itself not to print any currency that was not backed one-to-one by a US dollar in reserves. While inflation fell following the convertibility plan, the government continued to run a deficit, largely financed through external dollar borrowing. In 2001, Argentina entered a deep recession, with unemployment reaching 14.7% in the fourth quarter.[3] In December 2001, after borrowing heavily from the IMF, Argentina defaulted on over $100 billion in external sovereign debt and devalued the exchange rate by 75%.[4]

The Argentine government then spent three years in failed negotiations with the IMF, the Paris Club, and its private creditors. In January 2005, Argentina presented a unilateral offer to its private creditors, which was accepted by the holders of $62.3 billion of the defaulted debt.[5] To strengthen its bargaining position, the Argentine legislature passed the "Lock Law," prohibiting the government from reopening the debt exchange or making any future offers on better terms.[6] After the first round of restructuring, holdout creditors were still owed $18.6 billion of principal, the Paris Club of creditors was owed $6.3 billion, and the IMF was owed $9.5 billion.[7] Despite the existence of the holdout creditors, S&P declared the end of the Argentine default in June 2005 and upgraded Argentina's long-term sovereign foreign currency credit rating to B-. In 2006, Argentina fully repaid the IMF, and Argentina reached an agreement with the Paris Club creditors in May 2014.[8]

In December 2010, Argentina offered another bond exchange to the holdout private creditors. Holdout private creditors who were owed $12.4 billion of principal agreed to the exchange. Following the exchange, on December 31, 2010, the remaining holdout creditors were owed an estimated $11.2 billion, split between $6.8 billion in principal and $4.4 billion in accumulated interest.[9] At this point, Argentina had restructured over 90% of its original debt.

2.2 Argentina vs. the "Vultures"

Following the 2010 debt exchange, the remaining holdout creditors, termed "vultures" by the Argentine government, continued their legal battle. One line of attack was on the Argentine government's reserve

[3] Data from Global Financial Data.

[4] Daseking et al. (2005).

[5] Hornbeck (2013).

[6] This Lock Law would feature prominently in Judge Griesa's interpretation of the *pari passu* clause, presenting evidence that holdouts were not on the same footing as the holdout creditors.

[7] Hornbeck (2013).

[8] http://www.reuters.com/article/2014/05/29/us-argentina-debt-parisclub-idUSKBN0E90JI20140529

[9] Hornbeck (2013).

assets, with the creditors arguing the country's reserves, held at the Federal Reserve Bank of New York, should be subject to attachment. While a district court initially agreed with the creditors, in 2011 the appellate court overturned the ruling.[10] The second line of attack, focused on the *pari passu* clause, was the one that eventually culminated in Argentina's recent default. The *pari passu* clause requires equal treatment of all bondholders. The creditors, led by NML Capital,[11] argued that the Argentine government breached this clause by paying the exchange bondholders and refusing to honor the claims of the holdouts. In addition, the holdouts asserted that the "Lock Law," by making explicit the government's policy of pledging not to re-open negotiations or pay any money, effectively subordinated them to the restructured bondholders.

The case took several years to work its way through the US courts, going from the United States District Court for the Southern District of New York ("Southern District"), to the United States Court of Appeals for the Second Circuit ("Second Circuit"), all the way to the United States Supreme Court. The numerous rulings that these three courts issued between December 2011, when Judge Thomas P. Griesa of the Southern District first ruled in favor of the holdouts on the *pari passu* issue,[12] until July 2014 when Argentina defaulted. For the purposes of this study, we view the various rulings as events that made it more or less likely that Argentina would be unable to pay the restructured bondholders, if it did not also repay the holdouts. Because of the Argentine government's unwillingness to pay the holdouts in full, rulings in favor of NML increased the probability of a default on the restructured bonds, while rulings in favor of Argentina reduced the probability of default.[13]

Following Griesa's initial ruling in December 2011, a year of legal wrangling ensued over what this ruling actually meant and how it would be enforced. Griesa clarified that Argentina was required to repay the holdouts as long as it was continuing to the pay the exchange bondholders (using a "ratable" payment formula). Argentina was not willing to comply with this ruling, and continued to pay the exchange bondholders without paying the holdouts. Griesa then ordered the financial intermediaries facilitating Argentina's payments to stop forwarding payments to the restructured bondholders until Argentina paid the holdouts. As a result, even if Argentina wanted to pay the restructured creditors, it could not do so without repaying the holdouts, as its trustee would not be allowed to disburse the funds delivered for the coupon payment. In

[10] Hornbeck (2013)

[11] Elliott Management Corporation, the parent company of NML, has a long history in litigating against defaulting countries. See Gulati and Klee (2001) for a discussion of Elliot's litigation against Peru and Panizza et al. (2009) for an excellent literature review on the law and economics of sovereign default.

[12] See the decision at http://blogs.reuters.com/felix-salmon/files/2012/04/2011-12-07-Equal-Treatment-Liability-Order.pdf

[13] We use the term default to refer to a "credit event," as defined in the credit default swap contracts we study. Defaults come in many varieties, from a temporary cessation in payments to complete repudiation.

late 2012, Griesa ordered Argentina to negotiate with the holdouts, but the holdouts and the courts rejected Argentina's offer of a deal comparable to the 2005 and 2010 bond exchanges. Argentina then twice appealed to the Supreme Court, with the Supreme Court declining to hear either appeal. Following the decline of the second appeal on June 16, 2014, Griesa's orders were implemented, and Argentina had only two weeks before a coupon to the restructured creditors was due. Against the court orders, Argentina actually sent this coupon payment to the bond trustee, Bank of New York Mellon (BNYM), but due the court order, BNYM did not forward to the payment to the restructured bond holders. Argentina legally missed the coupon payment on June 30, which began a 30-day grace period. After negotiations failed, Argentina entered default on July 30, 2014.

2.3 A Simple Interpretation

In the simplest interpretation of the unfolding court events, Argentina was forced to default by the US court system. This was the interpretation offered by a number of commentators in the financial press.[14] Under this interpretation, Argentina could not pay its debts because the US courts forbade financial intermediaries from facilitating the coupon payment. As a result, the court rulings did nothing but change the probability of a default.

We also argue that these legal rulings do not reveal information about the underlying state of the economy (or other unobserved fundamentals), except insofar as they change the probability of default. The key assumption is that Judge Griesa (and the second circuit and Supreme Court) have no information advantage over the market with respect to the state of the Argentine economy.[15]

Under this interpretation, we can use credit default swaps to measure the market-implied changes in the probability of default following the court rulings. Any effect these rulings have on other variables, such as equity returns, is caused by the change in the probability of default. By comparing these two quantities (the change in default probability and the stock return), we can estimate the effect of default on the value of the firm.

This interpretation motivates our empirical strategy. We look at the stock returns in windows around

[14]For instance, Matt O'Brien of the Washington Post wrote "Argentina was forced to default now, because it wouldn't pay the bonds it had defaulted on in 2001" (http://www.washingtonpost.com/blogs/wonkblog/wp/2014/08/03/everything-you-need-to-know-about-argentinas-weird-default/).

[15]In the event study literature that focuses on Federal Reserve monetary policy announcements, there is some concern that the Federal Reserve has more information than market participants about the state of the economy. These sorts of concerns are unlikely to apply in this paper.

each of these events, and estimate how changes in the risk of sovereign default are related to changes in the valuation of Argentine firms. We employ several different empirical methods, which are described in detail in the next two sections. After presenting our empirical results, we will discuss alternative interpretations of the legal rulings and our results. We will also discuss several important details about the Argentine debt situation that are relevant for the interpretation of our results.

3 Data and Summary Statistics

3.1 Stock Market and CDS Data

Our dataset consists of daily observations of financial variables from January 3, 2011 to July 29, 2014 (the day before Argentina most recently defaulted). We study the returns of US dollar-denominated ADRs issued by Argentine firms, which are traded in the United States, as well the Argentine peso-denominated equities traded in Argentina. The ADRs trade on the NYSE and NASDAQ, are relatively liquid, and can be traded by a wide range of market participants[16]. However, using only the ADRs limits the number of firms that can be included in our analysis. To study the cross-sectional patterns of Argentine firms, we also examine the returns of firms traded only in Argentina. In order to ensure sufficient data quality, we limit our study of local Argentine equities to firms with a 2011 market capitalization at least 200 million pesos, and for which the equity price changes on at least half of all trading days in our sample. The full list firms included in our analysis, along with select firm characteristics, can be seen in Table 1.

Our primary measure of the performance of the Argentine equity market comes from the MSCI Argentina index, an index of six Argentine ADRs. As of November 28, 2014, the companies included in the index (with their index weights in parentheses), are: YPF (30.56%); Telecom Argentina (22.11%); Banco Macro (18.64%); Grupo Financiero Galicia (16.11%); BBVA Banco Frances (7.50%); and Petrobras Argentina (5.09%). In addition, we construct our own indices of ADRs covering different sectors of the Argentine economy. We classify Argentine firms by whether they are a bank, a non-financial firm, or a real estate holding company . The industry classifications are based on the Fama-French 12 industry classification and are described in detail at the end of this section. We give equal weighting to each ADR included in our three indices. The financial index is composed of the ADRs of BBVA Banco Frances (ADR ticker BFR);

[16] Several market participants have told us that capital controls and related barriers are significant impediments to their participation in local Argentine equity markets.

Banco Macro (BMA); and Grupo Financiero Galicia (GGAL). The industrial index is composed of Cresud (CRESY); Empresa Distribuidora y Comercializadora Norte (EDN); Pampa Energia (PAM); Petrobras Argentina (PZE); Telecom Argentina (TEO); Transportador Gas Sur (TGS); and YPF (YPF). The real estate index is composed of Alto Palermo (APSA, local ticker SAM) and IRSA (IRS). Alto Palermo is the only firm included in the ADR-based analysis but excluded from the local equity analysis. It is excluded because the local price data does not meet the data quality requirements. The classification of the 35 firms included in the analysis of local equities can be found in Table 1. Because the MSCI Argentina Index is heavily tilted toward financial and energy firms, for our analysis of local returns, we construct an index equally weighting all of the returns of each of the 35 firms.

We use credit default swap (CDS) spreads to measure the market-implied risk-neutral probability of default. A CDS is a financial derivative where the seller of the swap agrees to insure the buyer against the possibility that the issuer defaults. Once a third party, generally the International Swaps and Derivatives Association (ISDA), declares a credit event, an auction occurs to determine the price of the defaulted debt. The CDS seller then pays the buyer the difference between the face and auction value of the debt. In appendix section §C, we provide details on how we impute risk-neutral default probabilities from the term structure of CDS spreads using the ISDA Standard Model. We focus on the 5-year cumulative default probability, the risk-neutral probability that Argentina defaults within 5 years of the CDS contract initiation.

Our CDS data is from Markit, a commercial data provider. We use a "sameday" CDS spread as of 9:30 am EST, which we refer to as the "open," and a composite end-of-day spread, which we refer to as the "close."[17] The composite end-of-day spread is gathered over a period of several hours from various market makers, and is the spread used by those market makers to value their own trading books. The composite end-of-day spread uses updated expectations about the recovery rate[18], whereas the sameday spread is built under the assumption that the expected recovery rate has not changed from the previous day's close. Markit uses a data cleaning process to ensure that both the sameday and composite end-of-day quotes are reasonable approximations of market prices.

Because we want to capture the abnormal variation in Argentine CDS and equity returns caused by changes in the probability of default, we need to account for other global factors that may affect both measures. To proxy for global risk aversion, we use the VIX index, the 30-day implied volatility on the S&P

[17] We have also run our results with a 3:30pm "sameday" quote, instead of the composite end-of-day. Our point estimates are similar, but the standard errors are larger.

[18] Markit surveys CDS dealers at the end of each day to gather expected recovery rates.

500.[19] We use the S&P 500 to measure global equity returns and we use the MSCI Emerging Markets Asia ETF to proxy for factors affecting emerging markets generally. We use the Asian index to ensure that movements in the index are not directly caused by fluctuations in Argentine markets. To control for aggregate credit market conditions, we use the Markit CDX High Yield and Investment Grade CDS indices.[20] These controls are included in all specifications reported in this paper, although our results are qualitatively similar when using a subset of these factors, or no controls at all.

In order to examine the channels through which a sovereign default can affect domestic firms, in section 5 we will sort firms along a number of dimensions. We begin by classifying firms according to their Fama-French industry classifications available on Kenneth French's website.[21] We sort firms into their corresponding Fama-French industries according the SIC code of their primary industry, available from Datastream. After this initial sort, we only have one firm, Boldt, classified as Business Equipment, and so we combine it with the telecommunications firms. The "Finance" Fama-French 12 industry classification is also too broad for our purposes, as it combines banks, holding companies, and real estate firms. We therefore split the nine firms initially classified as "Finance" according to their Fama-French 49 industry classification. This gives us six banks, two real estate firms, and one "Trading" firm, Sociedad Comercial del Plata. Because Sociedad Comercial del Plata is a diversified holding company, and is the only company in the Fama-French 49 industry classification of "Trading," we rename its industry "Diversified", and do not merge it with any other industry classification. After these modifications, we end up with six banks, two chemical firms, one diversified firm, three energy firms, four manufacturing firms, six non-durables firms, two real estate firms, three telecoms and eight utilities.

The next dimension along which we will sort firms is their exporter status. Bulow and Rogoff (1989a) posited that default was costly because foreign creditors have the ability to interfere with a country's trade. To test this channel, we examine if exporting firms are particularly hurt by an increase in the probability of default. Unfortunately, this task is complicated by the fact that publicly available data sources do not comprehensively report firm-level exports. We instead rely on industry-level measures. We use the OECD STAN Input-Output Tables for Argentina to calculate what share of each industry group's output is exported. The Input-Output Table covers 37 industries, each of which covers at least one two-digit ISIC industry, and

[19] See Longstaff et. al. (2011) for discussion of VIX and variation in sovereign CDS spreads.

[20] We use the continuous on the run series from from Thomson Reuters Datastream. More information on these indices can be found at https://www.markit.com/news/Credit%20Indices%20Primer.pdf.

[21] Classifications available here. We use the versions formatted by Dexin Zhou.

some of which, such as "Agriculture, hunting, forestry and fishing", cover up to five two-digit ISICs. After we calculate the share of exports for each of these 37 industries, we classify our 35 firms into one of these industries according to the SIC code of its primary output. Unfortunately, the most recent Input-Output Table for Argentina uses data from 1995, so our export analysis assumes that the relative tradability of different products has not changed too much over the past 20 years.[22] When we construct a zero-cost long-short portfolio, going long exporters and short non-exporters, we will classify firms as exporters if exports accounted for at least 10% of their primary industries' revenues in our Input-Output table, and non-exporters otherwise.

In order to examine the channel proposed by Mendoza and Yue (2012) that a sovereign default is costly because it reduces the ability of firms to import intermediate goods for production, we calculate the share of intermediate inputs imported for each industry. We again use the OECD STAN Input-Output Tables to calculate the reliance on imported intermediate goods for 37 industries, and then match each of our firms to these industries using their primary SIC code. As with exports, we rely on the 1995 Input-Output Table. For portfolio construction, we classify firms as non-importers if imported intermediates are less than 3% of total sales in their primary industry, and as importers otherwise.

The next cut of the data divides firms among those that are subsidiaries of foreign corporations and those that are not. We classify firms as foreign-owned if the headquarters of their ultimate parent is any country other than Argentina in Bloomberg (Field ULT_PARENT_CNTRY_DOMICILE). There are a number of reasons the effect of sovereign default might be different for foreign-owned and domestic firms. For instance, if a sovereign default has a large effect on the domestic banking system, perhaps foreign affiliates might have a relatively easier time accessing finance than domestically owned firms. A similar effect is documented for multinational and local firms following an exchange rate depreciation in Desai et al. (2008), with multinational firms cutting investment less than domestic firms, presumably because external financing helps multinational mitigate the balance sheet effect. On the other hand, if defaulting Argentine costs foreign firms its "general reputation" as inCole and Kehoe (1998), it may be more inclined to seize the assets of foreign firms. In this case, we would expect foreign-owned firms to underperform. We use the most recent ownership of this variable and cannot account for the possibility that an Argentine firm was only recently purchased by a foreign parent.

[22]For those firms that report data on revenue from exports, there is a strong correlation between reported exports as a share of sales and the imputed share of exports from the 1995 input-output table. These results are available upon request.

The final variable we use to classify our local equities is an indicator for whether or not the firms have an ADR. The reason for this is that ADRs are a potentially important way for residents to evade the government's capital controls. We might expect firms with ADRs to outperform firms without ADRs because the former is a valuable vehicle for acquiring foreign currency offshore. This feature of ADRs is addressed in detail by Auguste et al. (2006)

3.2 Definition of Events and Non-Events

We build a list of legal rulings issued by Judge Griesa, the Second Circuit, and the Supreme Court. We have created this list using articles in media (the Wall Street Journal, Bloomberg News, and the Financial Times), LexisNexis searches, and publicly available information from the website of a law firm (Shearman) that practices sovereign debt law.

In appendix section §F, we list all of these events and links to the relevant source material. Unfortunately, for many of the events, we are unable to determine precisely when the ruling was issued. We employ several methods to determine the timing of rulings. First, we examine news coverage of the rulings, using Bloomberg News, the Financial Times, and LexisNexis searches. Sometimes, contemporaneous news coverage specifically mentions when the ruling was released. Second, we use the date listed in the ruling (usually next to the judge's signature). Third, many of rulings are released in the PDF electronic format, and have a "creation time" and/or "modification time" listed in the meta-information of the PDF file. In appendix section §F, we list the information used to determine the approximate time of each ruling.

For most of our analysis, we use two-day event windows. Consider the Supreme Court ruling on Monday, June 16th, 2014. The two-day event window, applied to this event, would use the CDS spread change from the close on Friday, June 13th to the close on Tuesday, June 17th. It would use stock returns (for both ADRs and local stocks) from 4pm EDT on Friday, June 13th to 4pm EDT on Tuesday, June 17th[23].

For one section of our analysis, we use narrower window sizes, when possible. We classify events into several types based on when they occurred. We classify events as close-to-close, open-to-open, close-to-open, and open-to-close. For the Supreme Court ruling on June 16th, 2014, the event occurred in the morning of the 16th, after the stock market opened. In the appendix, we classify this ruling as "open-to-close" meaning that we will use the CDS spread change from 9:30am EDT on Monday the 16th to roughly

[23]For events occurring outside of daylight savings time in the eastern time zone, the local stocks close at 5pm ART (3pm EST), while the ADRs use 4pm EST. We make no attempt to correct for this.

4pm EST on Monday the 16th, and the ADR returns from 9:30am EDT on Monday the 16th to 4pm EDT on Monday the 16th. If we had instead classified the event as "close-to-close," we would compare the 4pm EDT close on Friday the 13th to the 4pm EDT close on Monday the 16th. The "close-to-open" and "open-to-open" windows are defined in a similar way.

We choose our sample of non-events to be a set of two-day default probability changes and stock returns (based on closes), non-overlapping, at least two days away from any event, and at least two days away from any of the "excluded events." "Excluded events" are legal rulings that we do not use, but also exclude from our sample of "non-events." For three of the legal rulings, we could not find any contemporaneous media coverage, and are therefore unable to determine when the event was known to market participants. For one legal ruling, we could not find the ruling itself, only references to it in media coverage. One of the legal rulings was issued on the Friday in October 2012 shortly before "Superstorm Sandy" hit New York, and another the night before Thanksgiving.[24] Finally, one of the legal rulings was issued at the beginning of an oral argument, in which Argentina's lawyers may have revealed information about Argentina's intentions. We exclude this day because it violates our identification assumptions. For the heteroskedasticity-based identification strategy we employ, removing these legal rulings increases the validity of our identifying assumption that the variance of shocks induced by legal rulings is higher on event days than non-event days. However, our results are robust to including these days in the set of non-events.

3.3 Summary of Events and Non-Events

In figure 1, we plot the two-day change in the 5-year default probability and the two-day return of MSCI Argentina index over our sample. Small data points in gray/light are non-events and the maroon/dark dots cover event windows in which a US court made a legal ruling regarding Argentina's debt. In most of our analysis, and in this plot, we use two-day return windows. As a result, there is some risk that other shocks occurred during the event window. In figure 1, the event labeled "1" is affected by this issue. In our analysis that uses small window sizes, this event is no longer an outlier. The details on each event can be found in Appendix A. In section §E, we present a similar figure for the different sectors of the Argentine economy, the exchange rate, and Mexican and Brazilian CDS changes and equity returns.

[Insert figure 1 here]

[24] The ruling issued the night before Thanksgiving is problematic in several ways (see the appendix for details).

3.4 Exchange Rates

Argentina has capital controls, and its official exchange rate has diverged from the "blue market" exchange rate. Argentina also imposes deposit requirements on foreigners who own local securities. One consequence of these capital controls is that is very unprofitable for foreigners to purchase local Argentine stocks. Instead, foreigners who wish to invest in Argentine companies purchase ADRs. Argentine citizens can also use ADRs, as a means of circumventing capital controls. By purchasing local shares, converting them to ADRs, and then selling them in dollars in the U.S., Argentine citizens can gain access to US dollar currency without government approval (Auguste et al. (2006)). The convertibility of ADRs effectively establishes a shadow exchange rate. We find (in unreported results) that the implied exchange rate computed using ADR and local stock market prices does not vary significantly across firms. In our results, we report an "ADR Blue Rate," which computes the implied exchange rate for each of the six firms in the MSCI Argentina index, and weighs them using the weights of that index, described previously.[25]

There is a second way to measure the "blue market" exchange rate, which is to poll currency dealers in Argentina. For Argentine households and firms who cannot purchase dollars from the government at the official rate, and cannot execute the ADR-based currency conversion, these dealers are one way to secure dollars. Datastream, a data provider, polls these dealers and computes a "blue rate" based on their responses.

In figure 2, we show the time series of the official exchange rate, the ADR-based blue rate, and the "Onshore" blue rate computed by Datastream.

[Insert figure 2 here].

The recent divergence between the ADR-based blue rate and the onshore blue rate coincides with the rise in the default probabilities experienced by Argentina. In our empirical results, we attempt to estimate whether increases in the default probability caused the blue rate to diverge from the official rate, and whether increases in the default probability caused the ADR blue rate to diverge from the onshore blue rate. We find statistically significant evidence that increases in the default probability cause the blue rate to diverge from the official rate, immediately after a legal ruling. We do not find statistically significant evidence that increases in default probability cause the ADR blue rate to diverge from the onshore blue rate.

[25] To compute the ADR blue rate, we need prices for both the ADRs and the corresponding locally traded Argentine stocks. As a result, the ADR blue rate is available only on days when both markets are open. This results in smaller sample in our regressions.

4 Framework

Our goal is to estimate the causal effect of sovereign default on equity returns. The key identification concerns are that stock returns might have an effect on default probabilities, and that unobserved common shocks might affect both the probability of default and stock returns. In our context, one example of the former issue is that poor earnings by large Argentine firms might harm the fiscal position of the Argentine government, and therefore alter the probability of default. An example of the latter issue is a shock to the market price of risk, which could cause both CDS spreads and stock returns to change.

We consider these issues through the lens of a simultaneous equation model (following Rigobon and Sack (2004)). While our actual implementation uses multiple assets and controls for various market factors, for exposition we discuss only a single asset, r_t, and the change in the risk-neutral probability of default, ΔD_t, and ignore constants.[26] For exposition, we will refer to this asset, r_t, as the equity market. The model we consider is

$$\Delta D_t = \gamma r_t + \kappa_D F_t + \varepsilon_t \tag{1}$$

$$r_t = \alpha \Delta D_t + \kappa F_t + \eta_t \tag{2}$$

where F_t is an unobserved factor that moves both the probability of default and equity returns, ε_t is a shock to the default probability, and η_t is a shock to the equity market return.[27] The goal is to estimate the parameter α, the impact of a change in the probability of default on equity market returns. If one were to simply run the regression in equation 2 using OLS, the coefficient estimate would be

$$\begin{aligned} \hat{\alpha} &= \frac{cov\left(\Delta D_t, r_t\right)}{var\left(\Delta D_t\right)} \\ &= \alpha + \left(1 - \alpha\gamma\right) \frac{\kappa\left(\kappa_D + \gamma\kappa\right)\sigma_F^2 + \gamma\sigma_\eta^2}{\left(\kappa_D + \gamma\kappa\right)^2 \sigma_F^2 + \gamma^2\sigma_\eta^2 + \sigma_\varepsilon^2} \end{aligned} \tag{3}$$

where σ_ε^2 is the variance of the default probability shock, σ_η^2 is the variance of equity return shock, and σ_F^2 is the variance of the common shock.[28] There are two sources of bias: simultaneity bias and omitted variable

[26] This is equivalent to treating abnormal returns and abnormal default probability changes as observed. Abnormal returns are the excess returns after projecting the return on to observable factors, and abnormal default probability changes are defined similarly. In our econometrics, we account for the estimator error associated with this projection when computing standard errors.

[27] We assume these shocks and unobserved factors are independent.

[28] This expression is the one presented in Rigobon and Sack (2004).

bias. The simultaneity bias exists if $\gamma \neq 0$ and $\sigma_\eta > 0$, and omitted variable bias exists if $\kappa \neq 0$, $\kappa_D \neq 0$, and $\sigma_F > 0$. In order for the OLS regression to be unbiased, equity market returns must have no effect on default probabilities and there must be no omitted common shocks. These assumptions are implausible in our context, but we present this OLS regression in section 4.1 for comparison purposes.

We can rely on more plausible assumptions by adopting an event study framework (see, for instance, Kuttner (2001) or Bernanke and Kuttner (2005)). We can make the identifying assumption that changes to Argentina's probability of default on during the event windows (time periods in which a US court makes a ruling in the case of the *Republic of Argentina v. NML Capital*) are driven exclusively by those legal rulings, or other idiosyncratic default probability shocks (ε_t).[29] Under this assumption, we can directly estimate equation (2) using OLS on these ruling days. We will pursue this strategy in section 4.3.

Finally, we will consider a heteroskedasticity-based identification strategy, following Rigobon (2003) and Rigobon and Sack (2004). This does not require the complete absence of common and idiosyncratic shocks during event windows. This strategy instead relies on the weaker identifying assumption that the variances of the common shocks F_t and equity return shocks η_t are the same on non-event days and event days, whereas the variance of the shock to the probability of default ε_t is higher on event days than non-event days. The variance of ε_t is assumed to be higher because of the impact of the legal rulings, which are modeled as ε_t shocks under the exclusion restriction. Under this assumption, we can identify the parameter α by comparing the covariance matrices of abnormal returns and default probability changes on event days and non-event days.

In order to see how we can use this strategy to identify our key parameter of interest, we first solve for the reduced from of equations 1 and 2:

$$\begin{aligned} r_t &= \frac{1}{1-\alpha\gamma}\left((\alpha\kappa_D+\kappa)F_t+\eta_t+\alpha\varepsilon_t\right) \\ \Delta D_t &= \frac{1}{1-\alpha\gamma}\left((\kappa_D+\gamma\kappa)F_t+\gamma\eta_t+\varepsilon_t\right) \end{aligned}$$

We can then divide all days in our sample into two types of days, event (E) and non-event (N) days. For

[29] Rigobon and Sack (2004) demonstrate that the event study makes the identification assumption that on event days, the ratio of the default shock variance σ_ε to both the equity return shock σ_η and the common shock σ_F is infinite. If this assumption holds, we can see from equation 3 that $\hat{\alpha}$ is an unbiased estimator of α.

each of the two types of days $j \in \{E,N\}$, we can estimate the covariance matrix of $[r_t, \Delta D_t]$, denoted Ω_j :

$$\Omega_j = \begin{bmatrix} var_j(r_t) & cov_j(r_t, \Delta D_t) \\ cov_j(r_t, \Delta D_t) & var_j(\Delta D_t) \end{bmatrix}$$

Calculating these moments using the reduced form equations, we can then write the covariance matrix on day type j as

$$\Omega_j = \left(\frac{1}{1-\alpha\gamma}\right)^2 \begin{bmatrix} \alpha^2\sigma^2_{\varepsilon,j} + \sigma^2_\eta + (\alpha\kappa_D + \kappa)^2 \sigma^2_F & \alpha\sigma^2_{\varepsilon,j} + \gamma\sigma^2_\eta + ((\alpha\kappa_D + \kappa)(\gamma\kappa + \kappa_D))\sigma^2_F \\ \alpha\sigma^2_{\varepsilon,j} + \gamma\sigma^2_\eta + ((\alpha\kappa_D + \kappa)(\gamma\kappa + \kappa_D))\sigma^2_F & \sigma^2_{\varepsilon,j} + \gamma^2\sigma^2_\eta + (\kappa_D + \gamma\kappa)^2\sigma^2_F \end{bmatrix}$$

We can then define the difference in the covariance matrices on event and non-event days as $\Delta\Omega = \Omega_E - \Omega_N$, which simplifies to

$$\Delta\Omega = \lambda \begin{bmatrix} \alpha^2 & \alpha \\ \alpha & 1 \end{bmatrix} \tag{4}$$

where $\lambda = \left(\frac{\sigma^2_{\varepsilon,E} - \sigma^2_{\varepsilon,N}}{(1-\alpha\gamma)^2}\right)$. This provides us with a number of ways to estimate the coefficient of interest α that we will examine in Section 4.5. Although we have described our framework where the only asset is the market, in Appendix D we demonstrate how an equivalent system can be derived in a multi-asset framework.

The heteroskedasticity-based approach is our preferred estimation procedure. If the identification assumptions required for the OLS or event study hold, the heteroskedasticity-based strategy will also be valid, but the converse is not true. However, the event study approach does have one advantage over the heteroskedasticity approach (as we have implemented it). For the heteroskedasticity approach, we use two-day event days, because those are the smallest uniformly-sized windows that all of our events can fit into. However, as discussed earlier, all of our events can in fact fit into smaller windows (open-close, open-open, close-open, or close-close), but those windows are not the same size for each event. Using the event study approach, we present results defined using these narrower windows. If the identification assumptions required for this event study hold, this approach may have more power than the heteroskedasticity-based approach.

We begin by presenting the OLS estimates, as point for comparison with our subsequent results.

4.1 OLS Estimates

In this section, we assume the OLS identifying assumption: $F_t = 0$ and $\gamma = 0$ in equations 1 and 2 above. The model can be written as

$$r_t = \alpha \Delta D_t + \eta_t$$

where α is the coefficient of interest, and $Cov(\Delta D_t, \eta_t) = 0$. We can estimate this equation with OLS.

In our actual implementation, we include a constant and the vector of controls X_t discussed in section 3.1. We estimate the OLS model for the returns of the MSCI Argentina Index, our three ADR industry groups, and our three measures of the exchange rate.

[Insert table 2 here]

The results in table 1 imply that a 1% increase in the probability of default is is associated with a 0.46% fall in the MSCI Argentina Index. In Appendix Table A3, we see increases in the probability of an Argentine default are associated with increases in Brazilian and Mexican CDS spreads and declines in the Brazilian and Mexican equity markets. This correlation points to the importance of omitted common factors. In our heteroskedasticity-based estimates presented below and in the appendix, we show that the legal rulings have no measurable impact on Brazilian and Mexican CDS or equity markets. The method we use to construct standard errors and confidence intervals is discussed below in section 4.4. For the OLS estimates, it is essentially equivalent to heteroskedasticity-robust standard errors and confidence intervals based on first-order approximations.

4.2 Case Study: Announcement

We begin our discussion of the event study approach with a single event. On June 16, 2014, the U.S. Supreme Court denied two appeals and a petition from the Republic of Argentina. This denial had several effects. First, it allowed the holdouts to pursue discovery against all of Argentina's foreign assets, not just those in the United States. Second, the court declined to review Judge Griesa's interpretation of the *pari passu* clause and his orders demanding equal treatment. The denial of Argentina's petition meant that Judge Griesa could prevent the Bank of New York, the payment agent on Argentina's restructured bonds, from paying the coupons on those bonds, unless Argentina also paid the holdouts. Because Argentina had

previously expressed its unwillingness to pay the holdouts, this news meant that Argentina was more likely to default.

This event is ideal for our purposes because we are able to precisely determine the time the news was released. The Supreme Court announces multiple orders in a single public session, and simultaneously provides copies of those orders to the press. Prior to releasing the official opinion, the court announces the order. SCOTUSBlog, a well-known legal website that provides news coverage and analysis of the Supreme Court, had a "live blog" of the announcements on that day. At 9:33am EST, SCOTUSBlog reported that "Both of the Argentine bond cases have been denied. Sotomayor took no part." [30] At 10:09am, the live blog stated that Argentina's petition had been denied. At 10:11am, the live blog provided a link to the ruling.

In figure 3, we plot the returns of the Argentine ADRs, underlying equities and the percentage change in the sovereign CDS spread. The ADRs begin trading in New York at 9:30am but trading of the underlying local stocks does not begin in Argentina until 10:30am EST. To compare the returns on the underlying local stocks with the ADRs, we weight the return of the underlying stocks according to their weight in the MSCI Argentina Index of ADRs. Finally, we include 1-minute interval data on the mid-price (halfway between the bid and ask) on 5-year Republic of Argentina Senior Credit Default Swaps, from Bloomberg.[31]

[Insert figure 3 here]

From 9:30am to 10:30am, the MSCI index of ADRs fell 6% and the sameday 5-year CDS spread (measured by Markit) increased by 693 basis points (bps), implying a 9.8% increase in the risk-neutral probability of default over the next 5 years. When the Argentine stock market opened, the index of equities opened 6.2% lower than it closed the previous night. Under the standard event study assumptions, this implies that a 1% increase in the probability of default causes a 0.63% fall in ADR prices, and virtually no change in the ADR-based blue rate.

4.3 Event Study

Following the discussion in section §4, we present the results of three event studies. Each event study uses the same identification assumptions, outlined above. The first event study uses two-day windows around

[30] See http://live.scotusblog.com/Event/Live_blog_of_orders_and_opinions__June_16_2014?Page=0

[31] We believe that the CDS data ultimately comes from the "screen" of an inter-dealer broker. It is not clear that these rates represent the actual market in the CDS. We use the Bloomberg data only for this figure, and rely on Markit data for our regressions. During the one-hour interval from 9:30am to 10:30am, the Markit sameday CDS spread increased by substantially more than the CDS spread reported by Bloomberg, although both changes are large relative to typical hourly movements.

events. We begin by presenting summary statistics for the returns of the MSCI Argentina Index and the changes in 5-year risk-neutral default probabilities, during event windows and non-event windows.

[Insert table 3 here]

Our event study methodology follows the one described in Campbell et al. (1997). Let N denote the set of non-event days, and let $L1 = |N|$. We first estimate the factor model on the non-event days,

$$r_{i,t} = \mu_i + \omega_i^T X_t + \nu_{i,t},$$

and generate a time series of abnormal returns, $\hat{r}_{i,t} = r_{i,t} - \hat{u}_i - \hat{\omega}_i^T X_t$, where X_t is the vector of controls discussed in section 3.1. We also estimate the variance of the abnormal returns associated with the factor model (assuming homoskedastic errors), $\hat{\sigma}_i^2 = \frac{1}{L1}\sum_{t\in N}\hat{\nu}_{i,t}^2$. We next estimate a factor model for the change in the probability of default, ΔD_t, and create a time series of abnormal default probability changes, $\hat{d}_t$. We then classify our event days into three categories, based on the abnormal default probability change during the event window. Let σ_d denote the standard deviation of the abnormal default probability changes. If the probability increases by at least σ_d, we label that day as an "higher default" event. If the probability decreases by at least σ_d, we label that event as a "lower default" event. If the default probability change is less, in absolute value, than σ_d, we label that as a "no news" event.

For each type of event, we report the cumulative abnormal return and cumulative abnormal default probability change over all events of that type (higher default, lower default, no news). We also report two statistics that are described in Campbell et al. (1997). In this event study (but not the next one we discuss), which does not aggregate returns across different ADRs, the two statistics are identical, up to a small sample size correction. Define $E_{\{h,l,n\}}$ as the set of event days of each type. The first statistic, $J1$, is computed, for event type j and ADR i, as

$$J1_{ij} = \frac{\sum_{t\in E_j}\hat{r}_{i,t}}{\sqrt{|E_j|\hat{\sigma}_i^2}}.$$

Under the null hypothesis that the events have no effect on the stock returns, $J1_{ij}$ is asymptotically distributed as a standard normal. However, because we have so few events in each category, asymptotic normality will be a poor approximation, if the abnormal returns are themselves far from normal. This is one reason we prefer the variance-based estimators discussed in the next section.

The second statistic, $J2$, is nearly identical to $J1$ for this event study (they will be different in the next event study we describe). For each event, we can define a standardized cumulative abnormal return,

$$z_{i,t} = \sqrt{\frac{|E_j|-4}{|E_j|-2}} \frac{\hat{r}_{i,t}}{\sqrt{\hat{\sigma}_i^2}},$$

where the first term represents a small-sample correction. The statistic $J2$ is defined as

$$J2_{ij} = \frac{\sum_{t \in E_j} z_{i,t}}{\sqrt{|E_j|}}.$$

This statistic is also asymptotically standard normal under the null hypothesis, subject to the same caveat about return normality. In the table 4, we present these two statistics for the MSCI Argentina Index.

[Insert table 4 here]

The results of this event study are broadly similar to the OLS estimates. In the 8 event days where the default probability significantly increased, the cumulative increase in the default probability was 44.21% and the stock market experienced a cumulative abnormal return of -18.12%. Assuming a linear relationship between default probabilities and equity returns, this implies that a 1% increase in the probability of default causes a 0.41% fall in the stock market. During the 5 days where the default probability significantly declined, the cumulative fall in the default probability was 29.48% with a cumulative abnormal return of 23.6%. This implies a 1% fall in the probability of default causes an 0.80% rise in the stock market. Treating the movements symmetrically and adding together the absolute value of the change in default probability and cumulative abnormal returns, we find that a 1% increase in the probability of default causes a 0.57% fall in the equity market. While the large window sizes used in this study raise concerns about the validity of the identification assumptions, we will see that this estimate is very close to the results we find from our heteroskedasticity-based estimates.

The next event study we present uses four different window sizes, discussed earlier. Our data set includes one additional event (17 instead of 16), because one of the two-day windows in fact contained two separate legal rulings on consecutive days. Conceptually, the event study is almost identical, except that we must study each type of event (higher default, lower default, no news) for each window size. That is, we separately estimate abnormal returns and abnormal default probability changes for each window size $s \in S$, the set of window sizes. We classify events based on the standard deviation of abnormal default probability changes

for the associated window size. Let E_{js} denote an event of type j (higher default, lower default, no news) with window size s (close-to-close, open-to-open, close-to-open, and open-to-close). The abnormal return $\hat{r}_{i,t,s}$ is the abnormal return for ADR i at time t with window size s, and $\hat{\sigma}_{is}^2$ is the variance of the abnormal returns for that window size. The $J1$ statistic is computed as

$$J1_{ij} = \frac{\sum_{s \in S} \sum_{t \in E_{js}} \hat{r}_{i,t,s}}{\sqrt{\sum_{s \in S} |E_{js}| \hat{\sigma}_{is}^2}}.$$

Asymptotically, subject to the same caveats mentioned previously, this statistic is distributed as a standard normal. The second statistic, $J2$, is constructed in a similar fashion. However, the standardized cumulative abnormal returns are now defined with respect to the event window size,

$$z_{i,t,s} = \sqrt{\frac{|E_{js}| - 4}{|E_{js}| - 2}} \frac{\hat{r}_{i,t,s}}{\sqrt{\hat{\sigma}_{is}^2}},$$

and the $J2$ statistic is

$$J2_{ij} = \frac{\sum_{s \in S} \sum_{t \in E_{js}} z_{i,t,s}}{\sqrt{\sum_{s \in S} |E_{js}|}}.$$

This statistic is also, subject to the same caveats, asymptotically standard normal. It is not the same as the $J1$ statistic, because of the heterogeneity in window size. If the cumulative abnormal returns occur mostly in shorter windows (which have smaller standard deviations), the $J2$ statistic will be larger in absolute value than the $J1$ statistic. If the reverse is true, the $J1$ statistic will be larger. The size of the window may depend in part on the court releasing the opinion, the urgency with which the opinion was required, and other endogenous factors. It is not obvious whether the $J1$ or $J2$ statistic should be preferred. Fortunately, the results presented in table 5 using the two statistics are similar.

[Insert table 5 here]

In the 5 event days where the default probability significantly increased, the cumulative probability of default rose 14.61% and the stock market had a cumulative abnormal return of -13.7%. This estimate implies that a 1% increase in the probability of default causes a 0.94% fall in equity returns. During the 5 days where the default probability significantly declined, the cumulative fall in the default probability was 32.58% with a cumulative abnormal equity return of 20.14%. This implies a 1% fall in the probability of default causes an 0.62% rise in the stock market. When we again treat up and down movements symmetrically, we find

that a 1% increase in the probability of default causes a 0.72% fall in the equity market.

Finally, we an present "IV-style" event study. This study uses the two-day events and non-events described previously. The second stage equation we wish to estimate is equation (2), discussed above. The instrument we use is $1(t \in E)\Delta D_t$ (and $1(t \in E)$), where E is the set of event days and $\mathbf{1}(\cdot)$ is the indicator function. The first-stage regression is

$$\Delta D_t = \chi 1(t \in E)\Delta D_t + \rho 1(t \in E) + \mu_D + \omega_D^T X_t + \tau_t,$$

where τ_t is a composite of the three unobserved shocks (ε_t, F_t, ν_t) on the non-event days. Under the event study assumptions, the unobserved shocks ε_t and F_t (in the second stage) are not correlated with the change in the default probability on event days.

The IV-style event study has the advantage that of offering an interpretable coefficient, $\hat{\alpha}$, that estimates the change in stock prices given a change in the default probability. It also takes into account the magnitude of the default probability changes on each event day, whereas the event studies discussed earlier treat each event in a category equally. However, it is not *a priori* clear that the impact of the default probability on stock returns should be linear, and therefore not obvious that this approach is superior to the two-day event study. The similarity of the two results suggests linearity is not a bad assumption. Because the IV-style event study uses two-day event windows, it requires stronger identification assumptions than the heterogenous-window event study. The standard errors and confidence intervals for this approach are described in section 4.4, below.

[Insert table 6 here]

Using this method, we find that a 1% increase in the probability of default causes a 0.55% fall in the MSCI Argentina Index, a 0.59% fall in financial stocks, a 0.33% fall in industrial stocks, and only a 3% fall in REIT-eligible stocks. While the coefficient differences are suggestive, we will defer a discussion of whether they are significantly different from one another until section 4.5. We also find that a 1% increase in the probability of default causes a 0.35% depreciation of the ADR blue rate, a 0.16% depreciation of the onshore blue rate, and has no effect on the official exchange rate.

4.4 Standard Errors and Confidence Intervals

To construct confidence intervals for our coefficient estimates, we employ the bootstrap procedure advocated by Horowitz (2001). The advantage of this procedure is that it offers "asymptotic refinements" for the coverage probabilities of tests, meaning that it is more likely to achieve the desired rejection probability under the null hypothesis. Our estimators (except for the OLS) are effectively based on a small number of the data points (the events), and therefore these refinements may provide significant improvements over first-order asymptotics. As a practical matter, our confidence intervals are in almost all cases substantially wider than those based on first-order asymptotics. Nevertheless, these "asymptotic refinements" are still based on asymptotic arguments, and there is no guarantee that they are accurate for our data. We also find (in unreported results) that our confidence intervals for our coefficient of interest, α, are similar to confidence intervals constructed under normal approximations, using a bootstrapped standard error.

We use 1000 repetitions of a stratified bootstrap, resampling with replacement from our set of events and non-events, separately, so that each bootstrap replication contains 16 events and 397 non-events.[32] In each bootstrap replication, we compute the (asymptotically pivotal) t-statistic $t_k = \frac{\hat{\alpha}_k - \hat{\alpha}}{\hat{\sigma}_k}$, where $\hat{\alpha}$ is the point estimate in our actual data sample, $\hat{\alpha}_k$ is the point estimate in bootstrap replication k, and $\hat{\sigma}_k$ is the heteroskedasticity-robust standard deviation estimate of $\hat{\alpha} - \alpha$ from bootstrap sample k. We then determine the 2.5th percentile and 97.5th percentile of t_k in the bootstrap replications, denoted $\hat{t}_{2.5}$ and $\hat{t}_{97.5}$, respectively. The reported 95% confidence interval for $\hat{\alpha}$ is $[\hat{t}_{2.5}\hat{\sigma} + \hat{\alpha}, \hat{t}_{97.5}\hat{\sigma} + \hat{\alpha}]$, where $\hat{\sigma}$ is the heteroskedasticity-robust standard deviation estimate of $\hat{\alpha} - \alpha$ from our original data sample. We construct 90% and 99% confidence intervals in a similar fashion, and use them to assign asterisks in our tables.[33] In the tables, we report the 95% confidence interval and the heteroskedasticity-robust standard error from our dataset ($\hat{\sigma}$).

4.5 Variance-based Analysis

Our final set of analysis is based on the difference between the covariance matrices in equation (4). There are several potential ways to estimate α based on $\Delta\Omega$. Two such estimators, which we call the CDS-IV and Returns-IV estimators, respectively, are defined as

[32] The number of events and non-events listed apply to the ADRs. The exchange rates have a slightly different number of events and non-events, due to holidays, missing data, and related issues.

[33] These asterisks represent an "equal-tailed" test that $\alpha \neq 0$.

$$\begin{aligned}\hat{\alpha}_{CIV} &= \frac{\Delta\Omega_{1,2}}{\Delta\Omega_{2,2}} = \frac{\mathrm{cov}_E(\Delta D_t, \Delta r_t) - \mathrm{cov}_N(\Delta D_t, \Delta r_t)}{\mathrm{var}_E(\Delta D_t) - \mathrm{var}_N(\Delta D_t)} \\ \hat{\alpha}_{RIV} &= \frac{\Delta\Omega_{1,1}}{\Delta\Omega_{1,2}} = \frac{\mathrm{var}_E(r_t) - \mathrm{var}_N(r_t)}{\mathrm{cov}_E(\Delta D_t, \Delta r_t) - \mathrm{cov}_N(\Delta D_t, \Delta r_t)}\end{aligned}$$

As shown in Rigobon and Sack (2004), these estimators can be implemented in an instrumental variables framework. More generally, equation (4) provides us with three moment conditions.

$$\Delta\Omega_{1,1} - \lambda\alpha^2 = 0, \tag{5}$$

$$\Delta\Omega_{1,2} - \lambda\alpha = 0, \tag{6}$$

$$\Delta\Omega_{2,2} - \lambda = 0. \tag{7}$$

The GMM estimator uses all three moment conditions.

The Returns-IV estimator uses an "irrelevant instrument" under the null hypothesis that $\alpha = 0$. The estimator $\hat{\alpha}_{RIV}$ is the ratio of the sample estimates of $\Delta\Omega_{1,1}$ and $\Delta\Omega_{1,2}$, both of which are zero in expectation under the null hypothesis. The denominator, $\Delta\Omega_{1,2}$, is the covariance between the default probability, which is the variable being instrumented for, and the instrument. Under the null hypothesis, this covariance is zero, meaning that the instrument is irrelevant. As a result, the behavior of the $\hat{\alpha}_{RIV}$ estimator under the null hypothesis is not characterized by the standard IV asymptotics, and our confidence intervals will not have the correct coverage probabilities.[34] The CDS-IV estimator does not suffer from this issue. The estimator $\hat{\alpha}_{CIV}$ is based on the ratio of the sample estimates of $\Delta\Omega_{1,2}$ and $\Delta\Omega_{2,2}$. Under the null hypothesis that $\alpha = 0$ and $\lambda > 0$, the CDS-IV instrument is still relevant, and the standard asymptotics for $\hat{\alpha}_{CIV}$ apply. The GMM estimator, $\hat{\alpha}_{GMM}$, which uses all three moments, can be thought of as a geometric average of the CDS-IV and Returns-IV estimators. When $\alpha \neq 0$, using all three moments is advantageous because it takes advantage of all available information and makes over-identifying tests possible. However, under the null hypothesis that $\alpha = 0$, using the Returns-IV estimator in any way is problematic. The two-step GMM procedure, implemented using standard asymptotics to estimate the optimal weighting matrix, would generally not correctly estimate the variances, because of the irrelevant instrument. As a result, the weight matrix might

[34] When α is near, but not equal, to zero, weak identification asymptotics may be a better characterization of the sample distribution of $\hat{\alpha}_{RIV}$.

effectively place excessive weight on the Returns-IV estimator, relative to the CDS-IV estimator, and end up providing problematic results. For these reasons, we use the CDS-IV estimator as our preferred estimation procedure. We report the results for the other two methods in the appendix.

The CDS-IV instrument is relevant under the assumption that $\lambda > 0$. We formally test this assumption using a one-sided F-test of the ratio of $(\Omega_E)_{22}$ to $(\Omega_N)_{22}$, which is the ratio of the variance of changes in the default probability on event days and non-event days. We test the alternate hypothesis that this ratio is greater than 1 (implying $\lambda > 0$) against the null hypothesis that it is equal to one. In our sample, this F-statistic is 11.78, well above the 99th percentile, one-sided, bootstrapped critical value of 1.98.[35] The relevance of the CDS-IV instrument is also suggested by the weak-identification F-test of Stock and Yogo (2005) (not to be confused with the F-test for $\lambda > 0$) shown in table 7. In table 7, we present the results of our CDS-IV estimation. The standard errors and confidence intervals use the bootstrap procedure described previously.

[Insert table 7 here]

We find that increases in the 5-year risk-neutral default probability cause statistically and economically significant declines in the MSCI Argentina Index, bank ADRs, and non-financial ADRs. In contrast, we do not find a statistically significant effect on the ADRs of Argentine real-estate holding companies, although we cannot rule out economically significant effects. The point estimates in table 7 are very close to those reported in table 6, with a 1% increase in the probability of default causing a 0.55% fall in the broad index, a 0.59% fall in bank stocks, a 0.30% fall in non-financial stocks, and 0.006% fall in real estate stocks. Increases in the probability of default also cause significant depreciation of the peso blue rate, measured with ADRs or by polling onshore currency dealers. However, there was no corresponding same-day change in the official exchange rate.[36] The increase in the risk-neutral default probability from 40% to 100%, which is roughly what Argentina experienced, would cause more than a 30% fall in the ADR index, by our estimates.

We formally test whether financial ADRs fall more than industrial ADRs, whether bank ADRs fall more than real estate ADRs, and whether industrial ADRs fall more than real estate ADRs. We construct these

[35] We use the bootstrapping procedure for pivotal statistics described by Horowitz (2001), and in our section on standard errors and confidence intervals.

[36] We cannot rule out the possibility that the official exchange responds subsequently. This non-result is consistent with our identifying assumption that actions by Argentina's government, unrelated to the legal rulings, are not more likely on event days than other days.

one-sided t-tests using the same bootstrap procedure for pivotal statistics discussed earlier. We find that both the bank ADRs and industrial ADRs fall more than the real estate ADRs (at the 95% confidence level), but cannot reject the hypothesis that bank and industrial ADRs respond equally to changes in the default probability.

We also test whether the blue rates depreciate relative to the official rate, in response to increases in the default probability. We find that the difference between the onshore blue rate and the official exchange rate is significant at the 95% level, while the difference between the ADR-based blue rate and the official rate is significant at the 90% level. We cannot rule out the hypothesis that the two blue rates respond equally to increases in the default probability.

Our results are consistent with the hypothesis that Argentina's default would cause significant harms to Argentina's economy. In the next section, we examine which sectors of the Argentine economy are more adversely affected.

5 Cross-Sectional Evidence

In this section, we examine which firm characteristics are associated with larger or smaller responses to the default shocks. The cross-sectional pattern of responses across firms can help shed light on the mechanism by which sovereign default affects the economy. First, we examine how different industries respond to default shocks. Second, we examine the heterogeneous firm responses to an increase in the probability of default, through the lens of different theories on the channel by which sovereign default affects the broader economy.

In their seminal contribution, Eaton and Gersovitz (1981) argue that the reason governments repay their debt is to maintain their reputation and ensure continued access to international bond markets. Because this access allows governments to smooth income fluctuations, it is valuable and is generally sufficient to guarantee repayment.[37] Because of the threat of attachment from outstanding creditors, Argentina had not issued a new international bond in thirteen years and was unlikely to do so soon. This suggests that the

[37] Tomz (2007) provides a historical account to argue in favor of the reputational model of sovereign debt. English (1996) argues that the experience of US states in the 1840s provides evidence in favor of the reputational model of sovereign default by arguing that no direct sanctions were available to creditors. The Eleventh Amendment prevents foreign creditors from suing US states to receive payments on defaulted debt, constitutionally guaranteed interstate free trade prevents foreign creditors from locking defaulters out of trade markets, and the US federal government prevents foreign creditors from using force to collect on the debt. English demonstrates that defaulting states are unable to borrow again for a number of years, concluding that the concern for maintaining a reputation for repayment is therefore the only explanation for continued repayment.

effect of default that we measure is different than the reputational mechanism posited in Eaton and Gersovitz (1981).[38] Instead, this points to the importance of alternative theories of sovereign default costs, examined in the literature following Bulow and Rogoff (1989b). We will attempt to examine the empirical relevance these hypothesized costs of sovereign default by examining whether four groups of firms are particularly affected by default: exporters, importers, banks, and foreign-owned companies.

First, motivated by Bulow and Rogoff (1989a), we will examine whether or not firms that are reliant on exports are particularly hurt. Bulow and Rogoff (1989a) argue that in the event of a sovereign default, foreign creditors can interfere with a country's exports. We would therefore expect exporters to underperform in response to increases in the probability of default. Using aggregate data, Rose (2006) and others have found support for this channel. Second, motivated by Mendoza and Yue (2012), we will examine whether or not firms that are reliant on imported intermediate goods are particularly hurt by default. Mendoza and Yue (2012) argue that a sovereign default reduces aggregate output because firms cannot secure financing to import goods needed for production, and so are forced to use domestic intermediate goods, which are imperfect substitutes. This would lead us to expect firms that are relatively more reliant on imported intermediate goods would underperform in response to a default shock. Third, motivated by Gennaioli et al. (2014), Acharya et al. (2014), Bolton and Jeanne (2011), Bocola (2013) and Perez (2014), we will examine whether financial firms are more adversely affected. While these papers are not explicitly about whether banks are hurt more than other firms, they posit that the aggregate decline in output following a sovereign default occurs because of the default's effect on bank balance sheets. This leads to a reduction in financial intermediation and a reduction in aggregate production. If this argument or something like it were correct, we would expect banks to be hurt disproportionately by an increase in the probability of default. Finally, motivated by Cole and Kehoe (1998), we examine whether foreign-owned firms underperform following an increase in the probability sovereign default. Cole and Kehoe (1998) argue that even if the loss of a reputation for repayment alone is not sufficient to motivate countries to repay their debt, if their "general reputation" is lost by defaulting on sovereign debt, foreigners would become less willing to trust the defaulting government. This theory would lead us to expect increases in the risk of sovereign default to cause foreign-owned firms to underperform, as foreigners perceive a higher risk that Argentina will act disreputably in other arenas, such as investment protection. Our empirical approach is similar to several papers in the literature studying

[38] We are not providing evidence against the importance of the the type of reputational concerns in Eaton and Gersovitz (1981), but rather arguing that this particular default is not likely to be affected by such concerns.

the cross-section of firms' responses to identified monetary policy shocks, using an event study for identification. Bernanke and Kuttner (2005) study U.S. stock market data and find that the response of various industry portfolios to a monetary policy shock is proportional to that industry's CAPM beta. Put differently, the ensemble of shocks that generate returns outside of the event windows have a similar cross-sectional pattern of returns to the monetary policy shock. Gorodnichenko and Weber (2013) find that a measure of the stickiness of firms' prices is correlated with the squared magnitude of firms' response to squared monetary policy shocks. We apply similar strategies to our context. First, we explore the abnormal returns for various industries in response to a default probability shock, controlling for the abnormal return of the Argentine market. Second, we form portfolios based on firm characteristics suggested by theory and then study the abnormal returns of those portfolios, again controlling for the abnormal return of the Argentine market.

Our procedures are motivated by a modified version of the model in equation (2) and equation (1). We derive both models from a single underlying system of equations, presented in the appendix, section §D. The modified version of the those equations has the return of the Argentine market index, $r_{m,t}$, on the right-hand side, in addition to the observable factors X_t and unobservable factors F_t. We denote the return of a particular stock or portfolio as $r_{i,t}$:

$$\Delta D_t = \mu_D + \omega_D X_t + \gamma r_{i,t} + \gamma_m r_{m,t} + \kappa_D F_t + \varepsilon_t \tag{8}$$

$$r_{i,t} = \mu_i + \omega_i X_t + (\alpha_i - \beta_i \alpha_m)\Delta D_t + \beta_i r_{m,t} + \kappa_i F_t + \eta_{i,t}. \tag{9}$$

The parameter α_m is the response of the Argentine market index, $r_{m,t}$, to the default shock. For the purposes of our study, this two equation system has exactly the same form as the system described in section §4. The Argentine market return, $r_{m,t}$, is an observable common factor, no different from the S&P 500 or other observable factors in X_t. The Rigobon (2003) procedure, applied to this system, identifies the coefficient $(\alpha_i - \beta_i \alpha_m)$, which can be interpreted as the excess sensitivity of the portfolio to the default shock, above and beyond what would be expected from the Argentine market's exposure to the default shock, and the sensitivity of the portfolio to the Argentine market. In this sense, our approach generalizes the CAPM-inspired analysis of Bernanke and Kuttner (2005) to a model with multiple exogenous shocks.

We begin by studying the response of industry portfolios to default shocks, controlling for the response of the Argentine market. To increase our sample size of firms, we use local Argentine stock returns, rather than ADRs. We convert the local stock returns, denominated in pesos, into dollars using the ADR-based

blue rate described previously. For stocks with ADRs, the converted return will be nearly identical to the ADR return.[39] The use of the ADR-based exchange rate requires that both the New York and Buenos Aires stock markets be open, which reduces the size of our sample. However, the events in our sample remain the same, with one exception.[40]

We group these firms into equal-weighted industry portfolios, using the industry definitions described in section 3.1. We also construct an equal-weighted index of all of the firms in our sample, which is restricted to firms passing a data quality test also described in section 3.1. We use this equal-weighted index as our measure of the Argentine market return. In Figure 4 and Table 8 below, we display estimates of the excess sensitivity of the industry portfolios to the default shock, using the CDS-IV estimator and the bootstrapped confidence intervals described in the previous sections.

[Insert figure 4 here]

[Insert table 8 here]

Three industries (banks, real estate, and utilities) stand out as over- or under-sensitive to default shocks. However, care must be taken when interpreting the results. First, the confidence intervals around these estimates are very wide. Our point estimates suggest that a 10% increase in the probability of default would cause bank stocks to fall by roughly 2% more than would be expected, given their beta to the Argentine index, and would cause real estate stocks and utilities to fall by 2% less than would be expected. However, the standard deviation of these estimates is almost 1%, and only the utilities' out-performance is significant at the 95% confidence interval. The uncertainty around our point estimates is driven by the small number of events we study, and the idiosyncratic variation in stocks' response to the different legal announcements. Second, our confidence intervals have not been adjusted for multiple testing; the fact that one industry has significant over- or under-performance at the 95% confidence level is not surprising, given the number of tests being performed.

That said, our point estimates are economically large. Taken at face value, our results suggest that as Argentina went from a 40% to 100% probability of defaulting, its banks' value fell by 11% more (in dollar terms) than would have been expected, given a 38% fall in the dollar value of the equal-weighted index.

[39] As mentioned previously, the implied exchange rate between various stock-ADR pairs does not vary substantially across firms.

[40] The treatment of the events around Monday, June 23, 2014 is different when using ADR and local stock data, as the result of an Argentine holiday on June 20th. The ADR data uses a two-day window from the close of June 20 to the close of June 24, whereas the local stock data uses the close of Jun 19 to June 23.

The excessive sensitivity of bank stocks to default risk is consistent with the theories of Gennaioli et al. (2013, 2014), Bocola (2013), and Bolton and Jeanne (2011). We interpret our data as providing suggestive evidence for these theories[41].

We next consider which characteristics of non-financial firms are associated with over- or under-performance in response to default shocks. As discussed in section 3.1, we form zero-cost, long-short portfolios of non-financial firms based on the export intensity of their primary industry, the import intensity of their primary industry, whether they are a listed subsidiary of a foreign firm, and whether they have an associated ADR. An import-intensive industry is not the opposite of an export-intensive one; some industries are classified as neither import nor export intensive, whereas others are both import and export intensive.[42] Finally, we compare firms with and without ADRs.

In these portfolios, we equally weight firms within the "long" and "short" groups. For example, we classify 12 of our 26 non-financial firms[43] as high export intensity, and 14 of 26 as low export intensity. We equally weight these firms, so that the "long" portfolio has a 1/12 weight on each high export intensity firm, and the short portfolio has a 1/14 weight on each low export intensity firm. We then form the long-short portfolio, and determine whether the portfolio over- or under-performs after a default shock, using the CDS-IV estimator and bootstrapped confidence intervals discussed previously.

[Insert figure 5 here]

[Insert table 9 here]

In Figure 5 and Table 9, we find that firms whose primary industry is export-intensive under-perform, while firms whose primary industry is import intensive over-perform expectations, given their exposure to the equal-weighted index and the index's response to the default probability shock. We find that our long-short exporter portfolio underperforms 0.18% more for each 1% increase in the risk-neutral probability of default than would be expected given the portfolio's loading on the market index. However, our results

[41] Regarding the outperformance of utilities, one market participant suggested to us that pressure on the Argentine government's foreign reserves, exacerbated by the default, might lead them to liberalize utility prices. In the status quo, underpriced electricity (for example) leads to over-consumption, which results in excessive importation of utilities' inputs. Excessive imports reduce the Argentine government's foreign reserves position, and their inability to borrow makes it difficult to replenish these reserves. This story is one possible explanation for why utility companies could indirectly benefit from a sovereign default, relative to other companies.

[42] The correlation is our sample of non-financial firms is 0.16.

[43] We in fact have 27 non-financial firms, but one is a technology firm. The technology firm's industry classification did not exist when the input/output table we use to construct the data was generated.

about import intensive firms are not robust to changes in the portfolio formation threshold. In unreported results, we find that using a 4% threshold for import intensity, instead of 3%, results in all of the utilities being reclassified from high import intensity to low import intensity. Because the utilities responded far less to default shocks than their beta would predict, their reclassification is sufficient to change the sign of the results. In contrast, we find that the results for exporters are qualitatively robust to variations in the threshold.

The over- or under-performance of the export and import portfolios is not an ideal test of the theories. In the context of the Bulow and Rogoff (1989a) theory, if we do not observe that exporting firms underperform, it may be because the firms we observe are not the ones whose exports would be seized, or because our export-intensive and non-export-intensive firms also differ on some other characteristic that predicts over- or under-performance[44]. The reverse is also true; a significant result does not necessarily validate the theory, but might instead be found because of a correlation across firms between exporting and some other firm characteristic.

We also find that non-financial foreign subsidiaries, of which there are seven, substantially underperform relative to non-financial firms that are not foreign subsidiaries. The long-short portfolio falls 0.25% more in response to a 1% increase in the risk-neutral probability of default than would be expected given the portfolio's loading on the index. This result is consistent with the general reputation theory of Cole and Kehoe (1998), implying that foreign investors become more reluctant to invest, although there are many other possible interpretations. We do not find that non-financial firms with an ADR substantially under- or out-perform non-financial firms without ADRs.

We interpret this cross-sectional analysis as lending modest support to several of the theories in the existing literature that try to understand the costs of sovereign default. The theories are not exclusive; sovereign default may harm the financial system, impede trade, and weaken a country's reputation in many areas. Our estimates are insufficiently precise to reject any of these theories, or speak to their quantitative importance. Nevertheless, our approach does have the advantage over the existing literature that we can pinpoint the direction of causality, from sovereign default to performance, in a way that would be very difficult using aggregate or annual data.

[44] Essentially, an omitted variables problem

6 Interpretation

We begin by describing an imaginary "ideal experiment" to identify the causal effect of default on economic activity. We will then discuss the ways in which our research design does and does not approach this ideal. We will offer alternative interpretations of the effect of the legal rulings, and discuss their implications for the interpretation of our results. We also discuss several additional aspects of Argentina's situation that are relevant.[45]

The ideal experiment would randomly induce one of two otherwise-identical groups of countries to default on their debt. These groups of countries would have characteristics similar to those of typical sovereign borrowers. The treatment (default) would be randomly assigned, so that it would be uncorrelated with the underlying state of the countries' economies. The treatment would induce a country to default, but would otherwise neither encourage nor impair other actions by that country's government, firms, or households. The null hypothesis in this experiment is that default does not affect economic activity. The alternative hypothesis is that default impairs economic activity, through some unspecified channel.

We emphasize the idea of "inducing" a country to default because we view default as a choice of the government. For the purposes of understanding why sovereign borrowers repay their debts, we would like to understand the consequences of them choosing not to repay. These consequences include the effects of whatever mitigating actions a country might take after having decided to default. These consequences also include the effects of firms, households, and other agents changing their behavior as a result of the default. The government's actions could include renegotiating with creditors, finding other means to borrow, balancing budgets via taxes or reduced spending, taking actions that affect the convertibility of the currency, among other actions. When we refer to the causal of effects of sovereign default, we include the anticipated effects of whatever policies the government is expected to employ as a result of having defaulted.

Our research design differs from this ideal experiment in a variety of ways. First, we study Argentina, a country whose experience with sovereign debt is very different from most other countries. Argentina is in some sense in default for the entirety of our sample, depending on the definition of "default." It has an unusual currency regime. Argentina defaulted for convoluted legal reasons. Additionally, the way in which Argentina acts to mitigate the consequences of its default might be different from the way other countries would respond in similar circumstances. Second, there is the issue of whether the default is exogenous to

[45] Alfaro (2014) examines the implications of the legal rulings on future sovereign debt restructurings.

Argentina's economic circumstances. Third, our outcome variables are not perfect measures of economic activity. Fourth, these legal rulings might have effects on firms' stock prices, through channels other than changes in the likelihood of default (the exclusion restriction may not hold). If the legal rulings compelled Argentina to repay a large amount of money, relative to its economy or foreign reserves, then firms' stock prices might fall due to the burdens of debt repayment and associated reduction in economic activity, rather than through any default-related effects.

In the reminder of this section, we will discuss each of these issues in more detail.

6.1 The Options Available to Argentina

It is not clear that Argentina was forced to default. Prior to these legal rulings, Argentina had several feasible courses of action with respect to its restructured debt and the holdouts. It could maintain the status quo, in which it was subject to attachment orders and other actions by the holdouts, while it continued to pay its restructured creditors. It could attempt to negotiate with the holdouts, and completely resolve its default. Finally, it could choose to default on its restructured creditors.

The cumulative effect of these legal rulings changed the menu of options available to Argentina. The status quo option, in which Argentina continued to pay its restructured bondholders without paying the holdouts, became infeasible.[46] Instead, Argentina could make payments on its debt, which would be divided between the restructured bondholders and the holdouts according to the "ratable payment" formula devised by Judge Griesa. Alternatively, it could attempt to negotiate with the holdouts, to avoid defaulting on its restructured bondholders. Finally, it could default on the restructured bondholders.

Argentina effectively chose the third option (default). It made a payment to the Bank of New York Mellon (BNYM), the trustee for its restructured bonds, that was sufficient to pay the restructured bondholders, without paying anything to the holdouts. Judge Griesa's order prohibited BNYM from forwarding this payment to the restructured bondholders, and Argentina missed a coupon payment. After the 30-day grace period, Argentina was declared in default by the rating agencies.

As of this writing, how the situation will be resolved is unclear. One recent proposal involves replacing BNYM with another, non-U.S. trustee, who would not be subject to the U.S. courts' orders, and could continue to pay the restructured bondholders. Another complication concerns the treatment of euro-denominated bondholders, whose coupon payments are included in the amount held by BNYM. These

[46] This infeasibility might be temporary or permanent– it is not clear as of this writing.

bondholders have argued that BNYM acted contrary to Belgian and U.K. law, and that they should continue to be paid.

The cumulative effect of the legal rulings raised the probability of default on the restructured bonds and/or payment of the holdouts, relative to the probability that the status quo would continue. If Argentine firms would be affected by payment of the holdouts, holding default or no default fixed, then the exclusion restriction of our experiment would not hold.

One possibility is that the legal rulings might change the probability or size of a settlement with the holdouts, and this could affect the firms. Under the null hypothesis, if the government somehow repaid the holdouts without fiscal consequences (say, using a gift from abroad), there would be no effect on firms. In reality, because the government would need to raise taxes, cut spending, or borrow to repay the holdouts, an increase in the probability or size of a settlement with the holdouts could harm firms.

To get a sense of whether this is reasonable, we consider the extent to which the bonds owned by the holdouts appreciated, on our event days. Based on preliminary findings, we believe that the increase in the expected value of the holdout bonds is dwarfed by the cumulative losses of the Argentine firms.[47] This suggests that if, in expectation, the entirety of the burden of repayment fell on these firms, that would only explain a small part of the stock market declines. A very large "multiplier" for the loss of equity value associated with the debt burden would be required for this argument to apply.

More generally, the legal rulings could have had other effects. However, Argentine corporations are legally independent from the Argentine government, and their assets cannot be attached by the holdouts.[48] The ruling affects them only to the extent that it changes the behavior of the Argentine government or other actors. This still leaves open several possible effects. The legal rulings could have provoked the government of Argentina into a sequence of actions unrelated to sovereign default. They could have influenced the probability that the current government of Argentina stays in power in the next election. The legal rulings could have changed the law regarding sovereign debt generally.

We can muster evidence against this last effect. In the appendix, section §B, we show that the stock markets and sovereign CDS spreads of Brazil and Mexico did not respond to these legal rulings (our estimates are close to zero, and relatively precise). This is in contrast to the OLS estimates, which show that those financial variables are correlated with the Argentine risk-neutral probability of default, presumably due to

[47] These calculations are available upon request.

[48] There was litigation regarding whether the Argentine central bank qualified as independent from a legal perspective, but no such litigation for any of the companies listed in the stock index.

common shocks affecting Latin America or emerging markets more generally. This evidence suggests that, whatever changes to sovereign debt law occurred as the result of these rulings, they did not materially impact other Latin American countries that issue debt in New York.

However, we cannot rule out every possible channel through which these rulings might have affected firms, other than via sovereign default. Ex-post, it appears that the primary response of the Argentine government to these rulings was default. We are unaware of any direct consequences for Argentine firms. Consistent with this interpretation, S&P did not downgrade any Argentine firms immediately upon the sovereign's default (Standard and Poor's 2014a). However, it subsequently downgraded a variety of firms, arguing that deteriorating economic conditions reduced those firms' credit quality (Standard and Poor's 2014b).

6.2 How Much Would Argentina Have to Repay?

To meet the precise demands of the courts, Argentina needed to pay its litigating creditors only $1.5 billion. However, the $1.5 billion owed to the litigating creditors was only around 10% of the estimated $15 billion holdout debt outstanding.[49] Presumably, if Argentina paid NML and its co-litigants in full, the other holdout creditors would demand repayment on similar terms. Even if we assume that Argentina would need to pay the full $15 billion, that represented only 3% of GDP,[50] and 45% of foreign currency reserves.[51]

However, it is possible that if Argentina did indeed pay the holdouts in full, it would then owe the restructured creditors a large payment as well. During its 2004-2005 debt restructuring, Argentina sought to convince its creditors that the unilateral offer it made was the best offer they would ever receive. Argentina included a "Rights Upon Future Offers" (RUFO) clause in the bond prospectus of the restructured debt.[52] The RUFO clause entitled restructuring creditors to terms at least as good as anything holdouts would receive in the future:

> Under the terms of the Pars, Discounts and Quasi-pars, if following the expiration of the Offer until December 31, 2014, Argentina voluntarily makes an offer to purchase or exchange or solicits consents to amend any Eligible Securities not tendered or accepted pursuant to the

[49] See Gelpern (2014a).

[50] The CIA World Factbook reports Argentina's 2013 GDP as $484.6 billion. However, this calculation uses the official exchange rate, which may overstate the size of Argentina's economy.

[51] The CIA World Factbook reports Argentina's foreign exchange and gold reserves at $33.65 billion as of December 31, 2013.

[52] Olivares-Caminal (2013) refers to this as the "most favored creditor clause."

> Offer, Argentina has agreed that it will take all steps necessary so that each holder of Pars, Discounts or Quasi-pars will have the right, for a period of at least 30 calendar days following the announcement of such offer, to exchange any of such holder's Pars, Discounts or Quasi-pars for the consideration in cash or in kind received in connection with such purchase or exchange offer or securities having terms substantially the same as those resulting from such amendment process, in each case in accordance with the terms and conditions of such purchases, exchange offer or amendment process.[53]

In other words, if Argentina made an offer to the holdouts that was better than what the restructured creditors received, the restructured creditors would be entitled to the better deal, provided the offer occurred before December 31, 2014. Argentina claimed that this RUFO clause meant that it could not pay NML the $1.5 billion owed without incurring hundreds of billions in additional liabilities. There is one crucial word in the RUFO that makes the whole matter more complicated: *voluntarily*. If Argentina offered the holdouts a better deal because US courts would otherwise have blocked its payments to the restructured bondholders, would that be voluntary or involuntary? Indeed, some observers noted that Argentina's counsel told the Second Circuit Court of Appeals that Argentina "would not voluntarily obey" court rulings to pay the holdouts in full.[54] In addition, other commenters noted that the RUFO appeared to have some loopholes, allowing Argentina to potentially settle with the holdouts without triggering the clause.[55] Finally, exchange bondholders could waive their right to exercise the RUFO, and because it takes 25% of exchange bondholders to trigger the clause, the whole issue could have been rendered moot if the exchange bondholders could be persuaded that this was preferable to having their coupon payments blocked.[56] Of course, this possibility assumes Argentina would have paid any amount to the holdouts, a questionable proposition given the domestic politics surrounding the holdouts.[57]

For the purposes of interpreting our results, the RUFO clause complicates matters in two ways. First, if the RUFO clause was binding and could not have been easily circumvented, negotiation with the holdouts may not have been feasible. In this case, it would be correct to say that the legal rulings forced Argentina

[53] Full bond prospectus available at http://www.sec.gov/Archives/edgar/data/914021/000095012305000302/y04567e424b5.htm

[54] http://ftalphaville.ft.com/2013/03/06/1411442/raising-the-rufo-in-argentine-bonds/

[55] See the comment's from Barclay's reported in FT Alphaville: http://ftalphaville.ft.com/2013/03/06/1411442/raising-the-rufo-in-argentine-bonds/

[56] See Gelpern (2014b).

[57] See Gelpern (2014b).

to default (the simple interpretation offered above). Second, if the RUFO clause was binding, but the legal rulings compelled Argentina to involuntarily pay the holdouts (and therefore circumvented the RUFO clause), they might have made renegotiation feasible when it was not previously feasible. Finally, if the RUFO clause was not binding, it does not alter the interpretation of the rulings discussed above.

The RUFO clause expired on December 31, 2014 but, as of the time of this draft, a settlement has not yet been reached.

6.3 Are the Legal Rulings Exogenous?

We argue that the rulings of the courts are not influenced by news about the Argentine economy. Formally, the interpretation of the laws in question does not depend on the state of the Argentine economy. Substantively, because the amount required to repay the holdouts in full was small relative to the Argentine economy, news about the Argentine economy's prospects would not materially change their ability to pay. Moreover, even if the judges were responding to economic fundamentals, under the null hypothesis that default does not affect fundamentals, the judges would have no information advantage over market participants. It follows that the effects of economic news on the judges' rulings would be anticipated by the market prior to those rulings, and any response by the market to the judges' rulings would not reflect news about fundamentals.

More subtle interactions between the state of the Argentine economy and the legal rulings might complicate the interpretation of our analysis. For example, if bad news about the Argentine economy causes the market response to the legal rulings to be larger than it otherwise would have been, our estimates will reflect some sort of average effect, where the averaging occurs over states of the economy. Relatedly, the underlying state of the economy might influence the Argentine government's decision about whether to negotiate with the holdouts or default, and therefore interact with the legal rulings to determine the extent to which the default probability and stock prices change. These issues emphasize that our estimates should be considered average treatment effects, relevant to Argentina.

It is important that our event study avoid announcements by the Argentine government, because such announcements might be responding to news about fundamentals, or affect corporations in ways other than through default. In the case of the Supreme Court decision discussed earlier, the Argentine government

did not respond immediately to the ruling.[58] More generally, we include as events only orders by a judge or judges. We exclude orders that were issued during oral arguments, because those events also include opportunities for lawyers representing Argentina to reveal information.

Our identifying assumption is that the variance of "legal shocks" is higher on days when a US court rules on the dispute between NML and Argentina while the variance of all other shocks remain the same. However, if in addition to shocks to economic fundamentals, and legal shocks, we imagine that there are "political shocks" which move the probability of Argentina defaulting on its debt, then it could be that the variance of these shocks are higher on event days because the government is more likely to make a pronouncement revealing how likely it is to default following a ruling by Judge Griesa.[59]

6.4 Interpreting Stock Returns

We view the response of stock prices to default shocks through the lens of the Campbell-Shiller decomposition. One reason ADR or local equity prices might decline is that default reduces the expected growth rate of corporate dividends, by harming the Argentine economy. Another reason that prices might decline is that higher default probabilities cause an increase in the required returns of Argentine firms. Because Argentina is small, relative to the world economy, and the ADRs are traded by investors in the U.S., there is no reason to expect that the legal rulings we identify alter the stochastic discount factor of the marginal investor. We also use controls for various risk factors known to predict financial market returns, to isolate the abnormal returns on Argentine ADRs that cannot be attributed to changes in the stochastic discount factor. Based on these arguments, we believe that the negative returns on Argentine ADRs associated with increases in default risk reflect reductions in expected dividend growth.[60]

Assume that the above arguments are correct, and adverse legal rulings cause reductions in expected ADR dividend growth by increasing the likelihood of default. The most straightforward interpretation of this result is that default will harm the Argentine economy, and this is what reduces expectations of dividend

[58] See the following Bloomberg story: Link.

[59] Based on news stories, we believe that such "political shocks" are no more likely on event days than non-event days. In the future, we hope to use news stories to determine a set of dates that correspond to political shocks, and test whether such events are more likely on event days than non-event days. Even if such political events are more likely one event days, our research design is valid. In this case, we would be identifying the causal effect of the rulings on default, inclusive of both the ruling's direct effect and the Argentine government's endogenous response. Alternatively, if the political events were more likely on event days but unrelated to the issue of default, or affected firms through some mechanism other than default, our identification would fail. However, there is no apparent reason for political events to be more likely on event days, unless they are related primarily to the legal rulings.

[60] Theoretically, the returns could also be caused by increases in the exposure of the ADRs to priced risk factors (an increase in "beta").

growth. However, there are other possible interpretations that we cannot rule out. Default may lead to changes in the corporate share of income in Argentina, without harming the overall economy.This story, and others like it, cannot be ruled out because our outcome variable is the price of a financial asset that may not be representative of the Argentine economy.

In order to examine the different responses of firms to increases in the probability of sovereign default, we also study the response of local equities. While we convert their prices to dollars using the ADR-implied blue rate, we cannot rule out that the returns may be affected by the risk of capital controls, particularly if only domestic residents own the securities. This would also affect the ADR-implied blue rate. Nevertheless, we do not find a significant difference in the response between how the local equity price of firms with and without ADRs response to increases in the probability of default. This makes us optimistic that the segmentation effects are relatively minor.

6.5 Was Argentina Already in Default?

Although the debt exchanges of 2005 and 2010 eventually achieved a participation rate of 91.3%, above the level generally needed by a sovereign to resolve a default and reenter capital markets,[61] Argentina remained unable to borrow internationally. This is because the ongoing creditor litigation had resulted in an attachment order, which would allow the holdouts to confiscate the proceeds from a new bond issuance.[62] However, ratings agencies took a different view, and on June 1, 2005, S&P declared the end of the Argentine default and gave them a sovereign foreign currency credit rating of B-.

There are several complications arising from Argentina's ambiguous international standing. If the costs of default for Argentina were lower than that of a typical sovereign debtor, because Argentina was already unable to borrow in international markets, then our estimates understate the costs for the typical sovereign. On the other hand, because Argentina chose to default despite an ability to pay, the costs might be higher than is typical. Complicating the story further is that the Argentine government was still able to borrow in local markets, and via inter-country loans. In the aggregate, the country of Argentina was able to run a current account deficit, because its households, firms, and even local governments were able to borrow internationally, despite the inability of its federal government to do so. Therefore, even if the federal government of Argentina was in default for our entire sample, it is not clear that (as a country) it was locked out

[61] Hornbeck (2013).
[62] Hornbeck (2013).

of international markets, before or after the latest default. These complications emphasize the uniqueness of Argentina's circumstances.

7 Conclusion

For several decades, one of the most important questions in international macroeconomics has been "why do governments repay their debts?" Using an identification strategy that exploits the timing of legal rulings in the case of *Republic of Argentina v. NML Capital, we* present evidence that a sovereign default significantly reduces the value of domestic firms. We provide suggestive evidence that exporters, banks, and foreign-owned firms are particularly hurt by sovereign default.

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Tables

Table 1: Firms Included in Analysis

Company	Ticker	Industry	Exports	Imports	Market Cap (2011)	ADR	ADR Sample	Foreign
Aluar	ALU	Manufacturing	19.4	13.1	9443.0			
Banco Santander Rio	BIO	Banks	1.5	0.4	12786.1	Y		Y
Boldt	BOL	Telecoms			1537.5			
Banco Patagonia	BPT	Banks	1.5	0.4	3488.4	Y		Y
Banco Macro Bansud	BSU	Banks	1.5	0.4	9379.2	Y	Y	
Carlos Casado	CAO	Real Estate	0.0	0.0	378.1	Y		
Endesa Costanera	CEC	Utilities	0.1	3.2	702.6			Y
Celulosa	CEL	Chemicals	11.2	19.2	760.3			
Central Puerto Rights	CEP	Utilities	0.1	3.2	1814.4			
Grupo Clarin	CLR	Telecoms	0.4	1.3	5633.4	Y		
Sociedad Comercial Del Plata	COM	Diverse	1.5	0.4	212.3			
Capex	CPX	Utilities	0.1	3.2	1087.8			
Cresud	CRE	Non-Durables	14.5	2.1	3495.9	Y	Y	
Edenor	EDC	Utilities	0.1	3.2	1894.5	Y	Y	
BBVA Banco Frances	FRA	Banks	1.5	0.4	7723.6	Y	Y	Y
Pampa Energia	FRG	Utilities	0.1	3.2	3417.2	Y	Y	
Gp Finance Galicia	GGA	Banks	1.5	0.4	7125.7	Y	Y	
Hipotecario Naci	HPD	Banks	1.5	0.4	3540.0	Y		
Solvay Indupa	IND	Chemicals	11.2	19.2	1218.0			Y
IRSA	IRS	Real Estate	0.0	0.0	3350.5	Y	Y	
Juan Minetti	JMI	Manufacturing	3.6	5.3	1633.5			Y
Ledesma	LED	Non-Durables	14.5	2.1	4004.0			
Metrogas	MET	Utilities	0.1	3.2	677.3	Y		
Mirgor	MIR	Manufacturing	10.1	11.2	512.0	Y		
Molinos Rio De La Plata	MOL	Non-Durables	19.5	2.8	8014.4			
Quickfood	PAY	Non-Durables	19.5	2.8	641.9			Y
Petrobras Energia	PER	Energy	25.5	2.1	8228.4	Y	Y	Y
IRSA Propiedades Commerciales	SAM	Real Estate	0.0	0.0	2960.1	Y	Y	
Moli Juan Semino	SEI	Non-Durables	19.5	2.8	325.5			
Siderar	SID	Manufacturing	19.4	13.1	10893.1			Y
Sa San Miguel	SMG	Non-Durables	19.5	2.8	491.1			
Telecom Argentina	TEC	Telecoms	2.7	8.1	21754.8	Y	Y	Y
Transportadora De Gas Del Sur	TGS	Energy	25.5	2.1	2558.3	Y	Y	
Transportadores De Gas Del Norte	TN4	Utilities	0.1	3.2	540.4			
Transener	TRA	Utilities	0.1	3.2	640.3			
YPF	YPF	Energy	14.2	8.4	74532.8	Y	Y	

Notes: This table lists the 35 firms used in the analysis of local equities, and one firm (ticker SAM) whose ADR is included in our ADR sample, but whose local stock returns do not pass our data quality requirement. Ticker indicates the company's ticker in Datastream. Exports denotes the percentage of exports of total output for the firm's primary industry. Imports denotes the percentage of intermediate imports divided by total output for the firm's primary industry. Both Exports and Imports are calculated by classifying the firm into one of the 37 industries in the OECD STAN Input-Output Table according the SIC code of the firm's primary industry. Market Cap (2011) is the firm's average end-of-quarter market capitalization in 2011 from Bloomberg, measured in Argentine pesos. ADR is an indicator for whether the firm currently has an American depository receipt, either exchange-traded or over-the-counter. ADR Sample indicates whether the ADR is included in our sample of ADRs. To be included, the ADR must be exchange-traded and have existed for our entire sample. Foreign is an indicator for whether the firm is owned by a non-Argentine parent company.

Table 2: OLS Results

	(1) Index	(2) Banks	(3) Non-Financial	(4) Real estate	(5) FX (ADR)	(6) FX (On.)	(7) FX (Official)
ΔD	-46.41***	-49.89***	-35.74***	-11.53	30.26***	11.55***	3.863
Robust SE	(6.318)	(8.111)	(6.077)	(8.023)	(4.573)	(4.019)	(1.740)
95% CI	[-61.8,-28.7]	[-66.0,-34.0]	[-51.7,-17.4]	[-27.9,6.1]	[18.1,43.3]	[3.4,19.4]	[-13.1,8.6]
Observations	413	413	413	413	368	413	413
R-squared	0.389	0.345	0.305	0.071	0.182	0.029	0.072

Notes: This table reports the results for the OLS regression of equity returns and foreign exchange (FX) rate on changes in the risk-neutral default probability (ΔD) and the covariates discussed in the text. The column headings denote the outcome variable. Index is the MSCI Argentina Index, Banks is our equally weighted index of Argentine bank ADRs, Non-Financial is our equally weighted index of Argentine non-financial ADRs, and Real Estate is our equally weighted index of Argentine real estate holding companies. FX (ADR) is the ARS/USD exchange rate derived from the ratio of ADR prices (in USD) to the price of the underlying equity (in ARS). FX (On.) is the ARS/USD exchange rate offered by onshore currency dealers. FX (Official) is the exchange rate set by the Argentine government. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Summary Statistics

Day Type	Mean ΔD (%)	SD ΔD (%)	Mean Equity (%)	Equity SD (%)	Cov$(\Delta D, Equity)$	# of Days
Event	0.88	6.13	0.26	4.50	-21.26	16
Non-Event	-0.01	1.79	0.01	3.17	-2.37	397

Notes: This table reports the mean default probability change, the standard deviation of default probability changes, the mean MSCI Argentina Index return, the standard deviation of that return, and the covariance of default probability changes and that return during events and non-events. The underlying data is based on the two-day event windows and non-events described in the text.

Table 4: Standard Event Study: Index

Shock Type	# Events	CAR (%)	ΔD (%)	J_1	$P-Val\,J_1$	J_2	$P-Val\,J_2$
Higher Default	8	-18.12	44.21	-2.46**	0.0139	-2.45**	0.0143
No News	3	-2.56	-0.03	-0.57	0.5687	-0.56	0.5755
Lower Default	5	23.59	-29.48	4.05***	0.0000	4.04***	0.0000

Notes: CAR indicates cumulative abnormal return over the event windows, ΔD is the change in the risk-neutral probability of default, and the test statistics J_1 and J_2 are described in the text and in Campbell et al. (1997), pp. 162. A shock type of higher default indicates that this event raised the default probability by more than one two-day standard deviation, a shock type of lower default indicates that this event lowered the default probability by more than one two-day standard deviation, and a shock type of no news indicates a day with a legal ruling in which the default probability did not move at least one two-day standard deviation in either direction. The underlying data is based on the two-day event windows and non-events described in the text. The p-values are the p-values for a two-sided hypothesis test assuming normality. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Heterogenous-Window Event Study: Index

Shock Type	# Events	CAR (%)	ΔD (%)	J_1	$P-Val\,J_1$	J_2	$P-Val\,J_2$
Higher Default	5	-13.70	14.61	-3.71***	0.0002	-3.34***	0.0008
No News	7	-5.26	4.91	-1.06	0.2891	-1.03	0.3030
Lower Default	5	20.14	-32.58	5.31***	0.0000	5.26***	0.0000

Notes: CAR indicates cumulative abnormal return over the event window, ΔD is the change in the risk-neutral probability of default, and the test statistics J_1 and J_2 are described in the text and in Campbell et al. (1997), pp. 162. This study pools events across different window sizes (open-open, open-close, close-open, close-close). A shock type of higher default indicates that this event raised the default probability by more than one standard deviation, where the standard deviation is defined for non-events with the same window size. A shock type of lower default indicates that this event lowered the default probability by more than one standard deviation, and a shock type of no news indicates a day with a legal ruling in which the default probability did not move at least one standard deviation in either direction. The underlying data is based on the event windows and non-events described in the text, and uses the narrowest windows possible with our data and uncertainty about event times. The p-values are the p-values for a two-sided hypothesis test assuming normality. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: IV-Style Event Study

	(1) Index	(2) Banks	(3) Non-Financial	(4) Real Estate	(5) FX (ADR)	(6) FX (On.)	(7) FX (Official)
ΔD	-55.18***	-59.14***	-31.61***	-3.124	35.07***	15.60***	-0.188
Robust SE	(10.84)	(13.92)	(10.41)	(13.76)	(7.577)	(6.896)	(3.000)
95% CI	413	413	413	413	368	413	413
Observations	[-78.6,-28.4]	[-82.5,-32.3]	[-56.6,-7.2]	[-27.0,23.3]	[12.0,59.5]	[4.7,27.0]	[-4.1,4.1]
1st Stage F-Stat	211.2	211.2	211.2	211.2	212.2	211.2	211.2

Notes: This table reports the results for the variance-based estimator estimated as the ratio of $\lambda\alpha$ to λ. This estimator is called the "CDS-IV" estimator because it depends on the excess variance of the CDS spread on event days. The column headings denote the outcome variable. Index is the MSCI Argentina Index, Banks is our equally weighted index of Argentine bank ADRs, Non-Financial is our equally weighted index of Argentine non-financial ADRs, and Real Estate is our equally weighted index of Argentine real estate holding companies. FX (ADR) is the ARS/USD exchange rate derived from the ratio of ADR prices (in USD) to the price of the underlying equity (in ARS). FX (On.) is the ARS/USD exchange rate offered by onshore currency dealers. FX (Official) is the exchange rate set by the Argentine government. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: CDS-IV

	(1) Index	(2) Banks	(3) Non-Financial	(4) Real Estate	(5) FX (ADR)	(6) FX (On.)	(7) FX (Official)
ΔD	-54.52***	-59.21***	-29.59**	-0.601	35.20**	16.17***	-0.579
Robust SE	(11.60)	(14.88)	(11.15)	(14.73)	(7.951)	(7.375)	(3.212)
95% CI	[-81.1,-25.3]	[-84.3,-31.0]	[-55.9,-2.9]	[-28.3,31.4]	[7.5,62.1]	[4.3,28.7]	[-2.6,4.9]
Observations	413	413	413	413	368	413	413
1st Stage F-Stat	171.9	171.9	171.9	171.9	178.7	171.9	171.9

Notes: This table reports the results for the variance-based estimator estimated as the ratio of $\lambda\alpha$ to λ. This estimator is called the "CDS-IV" estimator because it depends on the excess variance of the CDS spread on event days. The column headings denote the outcome variable. Index is the MSCI Argentina Index, Banks is our equally weighted index of Argentine bank ADRs, Non-Financial is our equally weighted index of Argentine non-financial ADRs, and Real Estate is our equally weighted index of Argentine real estate holding companies. FX (ADR) is the ARS/USD exchange rate derived from the ratio of ADR prices (in USD) to the price of the underlying equity (in ARS). FX (On.) is the ARS/USD exchange rate offered by onshore currency dealers. FX (Official) is the exchange rate set by the Argentine government. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Cross-Section: Industry Returns

	(1) Index	(2) Banks	(3) Chemicals	(4) Diverse	(5) Energy	(6) Manufacturing
ΔD	-63.91***	-18.86	5.006	10.94	-2.495	-7.965
	(8.173)	(8.277)	(13.95)	(19.06)	(9.932)	(7.299)
Index Beta		1.059	.927	.946	.912	.74
95% CI	[-81.29,-44.32]	[-42.03,6.353]	[-21,30.3]	[-19.12,36.24]	[-23.7,18.44]	[-21.4,3.382]
Observations	356	358	358	358	358	358
F_Stat	259.5	173.5	173.5	173.5	173.5	173.5

	(7) Non-Durables	(8) Non-Financial	(9) Real Estate	(10) Telecommunications	(11) Utilities
ΔD	-7.726	2.82	18.5	-10.67	21.61**
	(6.884)	(1.852)	(9.692)	(9.91)	(8.763)
Index Beta	.739	1.008	.712	.796	1.488
95% CI	[-25.16,6.812]	[-3.664,8.981]	[-6.741,43.04]	[-26.87,7.626]	[1.618,41.13]
Observations	358	358	358	358	358
F-Stat	173.5	173.5	173.5	173.5	173.5

Notes: This table reports the results for the "CDS-IV" estimator. The column headings denote the outcome variable. Index is the equal-weighted index of local equities in Table 1. The industry classifications are based on Fama-French with modifications described in Section 3.1. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Index beta is the coefficient on the equal-weighted index of Argentine local equities, as described in Section 5. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

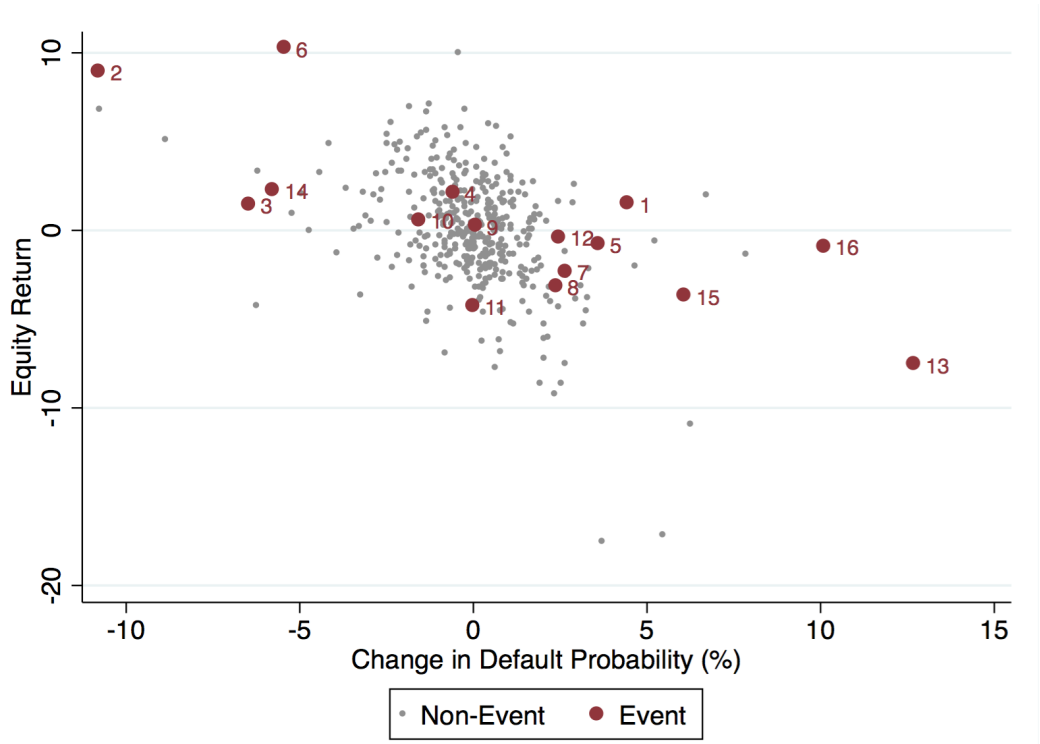
Table 9: Cross-Section: Long-Short Portfolios

	(1) Exporter	(2) Importer	(3) Financial	(4) Foreign-Owned	5) ADR
ΔD	-17.99**	16.79**	-22.1	-24.7***	7.216
	(9.297)	(7.937)	(9.908)	(7.824)	(7.399)
Index Beta	-.442	.349	.0469	-.29	.101
95% CI	[-33.07,-3.357]	[.798,32.81]	[-53.69,10.62]	[-39.51,-7.885]	[-8.009,21.84]
Observations	407	407	407	407	407
F-Stat	148	148	148	148	148

Notes: This table reports the results for the "CDS-IV" estimator. The column headings denote the outcome variable. Each column is a zero-cost long short portfolio. Exporter is a portfolio going long export-intensive non-financial firms and short non-export-intensive non-financial firms. Importer is defined equivalently for importers. Financial goes long banks and short non-financial firms. Foreign-owned firms goes long non-financial firms with a foreign parent and short domestically-owned non-financial firms. ADR goes long non-financial firms with an American Depository Receipt and short non-financial firms without one. The data sources are described in Section 3.1. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Index beta is the coefficient on the equal-weighted index of Argentine local equities, as described in Section 5. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

8 Figures

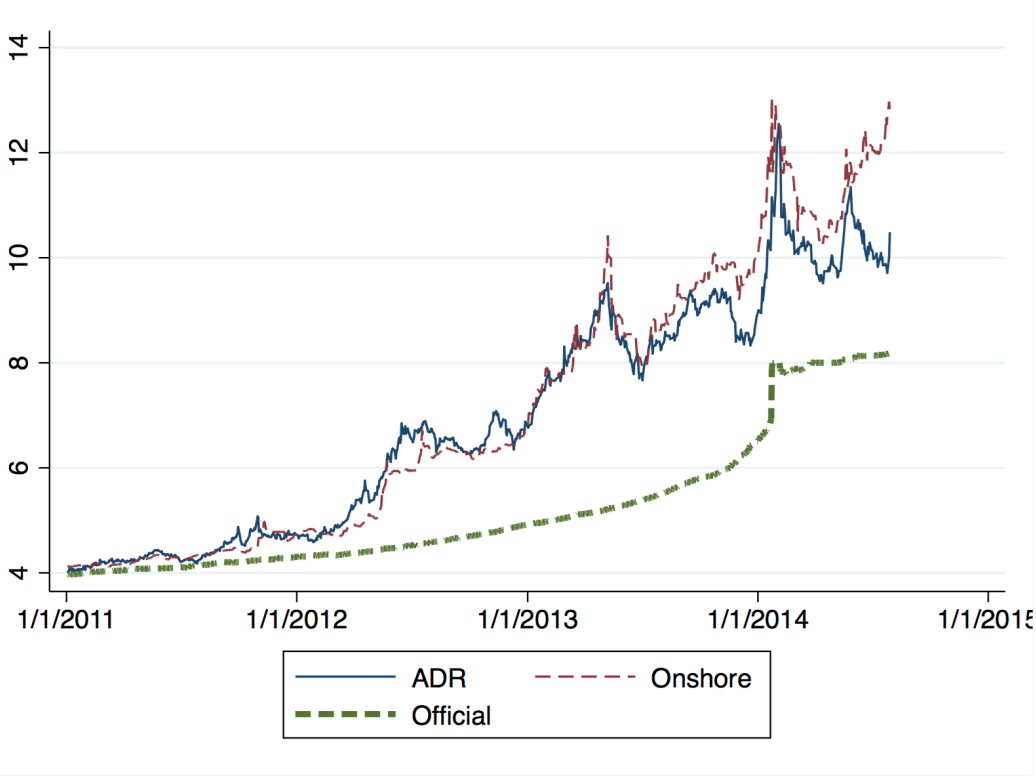
Figure 1: Default Probability Change and Equity Returns during Events and Non-Events



Event Number	Two-Day Window End Date	ΔD (%)	Equity Return (%)
1	November 27, 2012	4.47	1.49
2	November 29, 2012	-10.78	8.94
3	December 05, 2012	-6.44	1.45
4	December 07, 2012	-0.58	2.13
5	January 11, 2013	3.61	-0.78
6	March 04, 2013	-5.43	10.24
7	March 27, 2013	2.68	-2.32
8	August 26, 2013	2.39	-3.16
9	October 04, 2013	0.06	0.23
10	October 08, 2013	-1.55	0.58
11	November 19, 2013	0.01	-4.29
12	January 13, 2014	2.48	-0.39
13	June 17, 2014	12.70	-7.57
14	June 24, 2014	-5.75	2.24
15	June 27, 2014	6.10	-3.70
16	July 29, 2014	10.11	-0.91

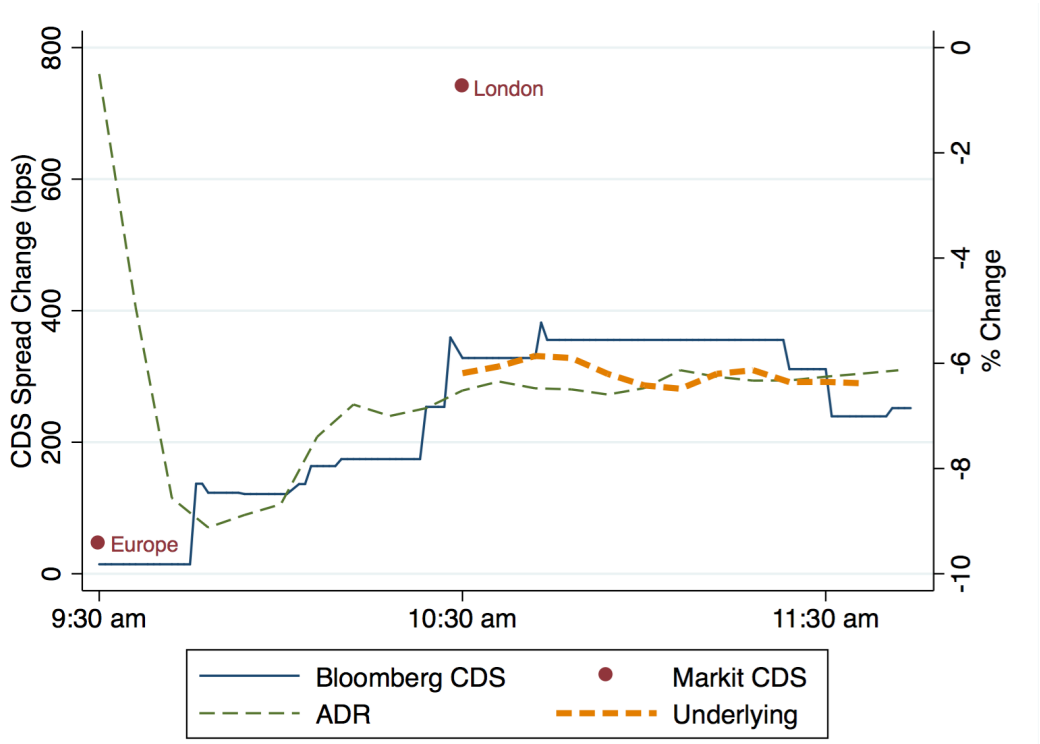
Notes: This figure plots the change in change in the risk-neutral probability of default and returns on the MSCI Argentina Index on event and non-event two-day windows. Each event and non-event day is a two-day event or non-event as described in the text. The numbers next to each maroon/dark dot references each event-day in the Table below the figure. The procedure for classifying events and non-events is described in the text.

Figure 2: Official, Onshore Blue, and ADR Exchange Rates (ARS/USD)



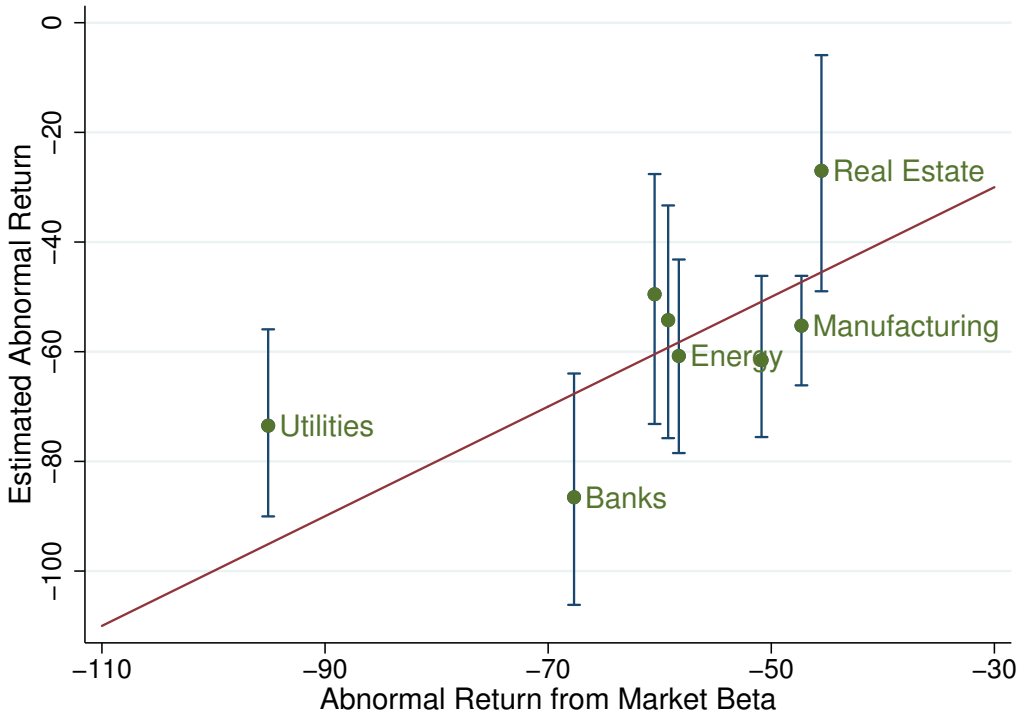
Notes: This figure plots the three versions of the ARS/USD exchange rate. ADR refers to the version of the "blue market" rate calculated by comparing the ADR share price in dollars with the underlying local stock price in pesos, Onshore is the exchange rate available through Argentine FX bureaus, and Official is the government's official exchange rate.

Figure 3: Event Data from June 16, 2014, 9:30-11:30am EST



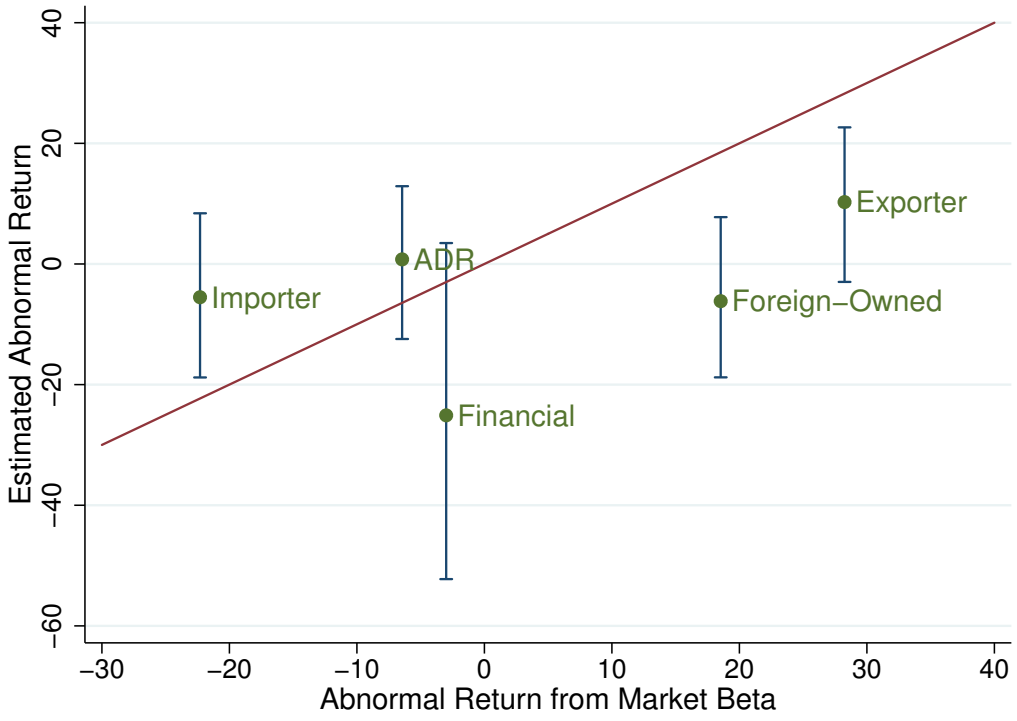
Notes: This figure plots the change in the CDS spread over the previous night's close ("CDS", left axis, basis points), the change in the price of the MSCI Argentina Index against the previous night's close ("ADR", right axis, %), and the change in the price of an index of Argentine stocks with the same weightings as in the ADR based MSCI Index over the previous night's close ("Underlying", right axis, %). The Markit CDS points are labeled with the name of the reporting market, with European markets reporting at 9:30am EST and London Markets reporting at 10:30am EST.

Figure 4: Estimated Response to Default Shocks: Industries



Notes: Industry classifications are based on the Fama-French 12 industry categories with the modifications described in Section 3.1. The labels for chemical firms, diverse firms, non-durables producers, and telecoms are suppressed. On the the x-axis, we plot the expected abnormal return for each portfolio, calculated as the beta of each long-short portfolio on the index times α_M, the effect of an increase in the probability of default in the abnormal return of the index. On the y-axis, we plot the sum of the expected abnormal return and $(\alpha_i - \beta_i \alpha_M)$, the additional sensitivity of each portfolio to an increase in the probability of default. Values above the line indicates that the portfolio over-performed following increases in the probability of default, relative to what would be implied by the portfolio's market beta. Values below the line indicate underperformance. The ranges indicate bootstrapped 90% confidence intervals.

Figure 5: Estimated Response to Default Shocks: Long-Short



Notes: Each label denotes a zero-cost long short portfolio. Exporter is a portfolio going long export-intensive non-financial firms and short non-export-intensive non-financial firms. Importer is defined equivalently for importers. Financial goes long banks and short non-financial firms. Foreign-owned firms goes long non-financial firms with a foreign parent and short domestically-owned non-financial firms. ADR goes long non-financial firms with an American Depository Receipt and short non-financial firms without one. The data sources are described in Section 3.1. On the the x-axis, we plot the expected abnormal return for each portfolio, calculated as the beta of each long-short portfolio on the index times α_M, the effect of an increase in the probability of default in the index. On the y-axis, we plot the sum of the expected abnormal return and $(\alpha_i - \beta_i \alpha_M)$, the additional sensitivity of each portfolio to an increase in the probability of default. Values above the line indicates that the portfolio over-performed following increases in the probability of default, relative to the abnormal return implied by the portfolio's market beta. Values below the line indicate underperformance. The ranges indicate bootstrapped 90% confidence intervals.

A GMM and Returns-IV

In this section, we present results for the GMM and Returns-IV estimators discussed in the text. Given the problematic behavior of these estimators under the null hypothesis that $\alpha = 0$, we cannot interpret our bootstrapped confidence intervals as providing correct coverage for the t-tests and J-tests conducted in this section. We therefore have removed all the of asterisks from the tables, although we list the standard errors and confidence intervals generated by our procedure.

For our GMM confidence intervals, we use the moment-recentering procedure discussed by Horowitz (2001). We also employ this bootstrap strategy to estimate the 95% confidence interval for the over-identification test (J statistic). The 95% confidence interval for the J-statistic is based on the 95th percentile of the sampling distribution, and the associated test is one-sided. Currently, we run our GMM procedure on abnormal returns/CDS changes, treating them as known. The GMM estimator is a two-step GMM estimator.

Table A1: Returns-IV

	(1) Index	(2) Banks	(3) Non-Financial	(4) Real Estate	(5) FX (ADR)	(6) FX (On.)	(7) FX (Official)
ΔD	-61.56***	-68.53***	-46.66*	176.7	55.59***	-9.886	499.5
Robust SE	(15.50)	(21.09)	(20.05)	(506.9)	(12.23)	(11.61)	(1,058)
95% CI	[-99.3,-13.5]	[-104.4,-29.5]	[-84.8,9.0]	[-3.5e+3,472.2]	[13.1,81.1]	[-43.8,34.9]	[-1.3e+5,721.9]
Observations	413	413	413	413	368	413	413
1st Stage F-Stat	81.99	71.37	41.32	0.237	64.21	59.45	0.216

Notes: This table reports the results for the variance-based estimator estimated as the ratio of $\lambda\alpha^2$ to $\lambda\alpha$. This estimator is called the "Returns-IV" estimator because it depends on the excess variance of the ADR return on event days. The column headings denote the outcome variable. Index is the MSCI Argentina Index, Banks is our equally weighted index of Argentine bank ADRs, Industrial is our equally weighted index of Argentine industrial ADRs, and REIT is our equally weighted index of Argentine real estate holding companies. FX (ADR) is the ARS/USD exchange rate derived from the ratio of ADR prices (in USD) to the price of the underlying equity (in ARS). FX (On.) is the ARS/USD exchange rate offered by onshore currency dealers. FX (Official) is the exchange rate set by the Argentine government. The coefficient on ΔD is the effect on the percentage returns of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text.

Table A2: GMM

	(1) Index	(2) Banks	(3) Non-Financial	(4) Real Estate	(5) FX (ADR)	(6) FX (On.)	(7) FX (Official)
α (ΔD)	-54.45**	-60.09***	-30.95	-0.466	40.82	17.87**	-0.166
Robust SE	(14.05)	(14.16)	(16.67)	(14.58)	(21.24)	(4.218)	(0.851)
95% CI	[-99.4,-15.5]	[-99.1,-28.6]	[-79.0,33.9]	[-64.5,37.7]	[-80.6,129.4]	[0.9,29.1]	[-2.3,1.5]
λ	30.04	30.55	26.42	33.05	21.39	50.85**	33.60
Robust SE	(13.21)	(13.64)	(12.54)	(13.02)	(10.44)	(11.66)	(14.17)
95% CI	[-143.8,57.4]	[-41.8,56.2]	[-264.1,56.7]	[-497.5,57.5]	[-166.3,52.2]	[3.2,69.3]	[-4.4e+03,48.9]
Observations	413	413	413	413	368	413	413
J-Stat	0.180	0.280	0.596	0.0207	1.160	5.521**	0.872
J-Stat-CI	[0,6.4]	[0,4.4]	[0,4.9]	[0,8.8]	[0,15.5]	[0,2.8]	[0,25.0]

Notes: The GMM estimates are based on a two-step estimator, run once for each outcome variable. The column headings denote the outcome variable. Index is the MSCI Argentina Index, Banks is our equally weighted index of Argentine bank ADRs, Non-Financial is our equally weighted index of Argentine non-financial ADRs, and Real Estate is our equally weighted index of Argentine real estate holding companies. FX (ADR) is the ARS/USD exchange rate derived from the ratio of ADR prices (in USD) to the price of the underlying equity (in ARS). FX (On.) is the ARS/USD exchange rate offered by onshore currency dealers. FX (Official) is the exchange rate set by the Argentine government. The parameter α is the effect on the percentage returns of an increase in the probability of default, from 0% to 100%. λ is proportional to the difference in the variance of the default probability shocks during event and non-event windows. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text, with moment recentering. J-Stat is an overidentification test of the validity of the assumptions described in Rigobon and Sack (2004). The underlying data is based on the two-day event windows and non-events described in the text.

B Mexico and Brazil

Table A3: Regressions for Brazil and Mexico

	(1) Brazil CDS	(2) Brazil Index	(3) Mexico CDS	(4) Mexico Index
OLS ΔD	53.08***	-12.21***	42.75***	-5.978**
Robust SE	(8.632)	(3.823)	(7.861)	(3.150)
95% CI	[30.53,76.38]	[-18.40,-6.50]	[20.43,67.46]	[-11.18,-0.98]
Event IVΔD	23.16**	-3.035	6.330	0.634
Robust SE	(15.22)	(6.592)	(13.98)	(5.426)
95% CI	[1.14,53.00]	[-15.04,9.30]	[-25.62,48.25]	[-4.14,7.93]
CDS-IVΔD	20.68	-1.098	1.728	1.669
Robust SE	(16.44)	(7.075)	(15.09)	(5.812)
95% CI	[-4.28,54.10]	[-9.84,10.18]	[-33.83,48.53]	[-3.22,8.73]

Notes: This table reports the results for the OLS, IV-style event study, and CDS-IV estimators of the effect of changes in the risk-neutral default probability (ΔD) on the 5-year CDS spreads and stock market indices of Brazil and Mexico. The coefficient on ΔD is the effect on the percentage returns (of stocks) and change in the 5-year CDS spread (in bps) of an increase in the 5-year risk-neutral default probability from 0% to 100%, implied by the Argentine CDS curve. Standard errors and confidence intervals are computed using the stratified bootstrap procedure described in the text. The underlying data is based on the two-day event windows and non-events described in the text. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

C Risk-Neutral Default Probabilities

We convert CDS spreads into risk-neutral default probabilities to provide a clearer sense of the magnitude of the estimated coefficients. We emphasize that we work with risk-neutral probabilities and do not attempt to convert them to physical probabilities. Pan and Singleton (2008) and Longstaff et al. (2011) impose additional structure to estimate the physical default probabilities.

We begin with data from Markit on CDS par spreads. The par spread is the coupon payment that a buyer of CDS protections pays to the seller of the contract such that the CDS contract has zero cost at initiation. Because the seller of a CDS insures the buyer of a CDS against credit losses throughout the duration of the contract, pricing the contract involves calculating the term structure of credit risk on the bond.

The market standard for pricing CDS is a reduced form model that models time-varying credit risk as a time-varying hazard rate of default.[63] The simplest version of such a model would be to assume that throughout the life of CDS contract there is a constant default hazard rate λ. In this simple case, we can convert the par spread S_T for a contract with maturity T to the hazard rate,

$$\lambda = \frac{S_T}{1 - Recov.} \tag{A10}$$

where *Recov.* is the recovery rate, which is assumed to be known and constant. Once this hazard rate λ is calculated, we can calculate the probability that a bond defaults before time $t = T$ as

$$Pr(Def < T) = 1 - \exp(-\lambda T).$$

For example, a 1-year CDS with zero recovery and a par spread of 100% would imply a hazard rate of 1. This means that half the time the bond would fully default and the seller would fully compensate the buyer, and half the time the underlying bond would not default and the seller would earn an annual interest rate of 100%, breaking even on average.

If there were only one tenor of CDS observed in the market, this constant hazard rate calculation would be all that is feasible. However, with the multiple tenors we do not need to restrict the hazard function λ to be constant throughout the duration of the CDS. Our dataset includes quotes at the 6 month, 1 year, 2 year, 3 year, 4 year, 5 year, 7 year, 10 year, 15 year, 20 year and 30 year tenors. We follow the ISDA standard and

[63] White (2013) provides a very thorough discussion of the ISDA standard model.

construct the risk-free yield curve using the Libor deposit rate for the 6 month tenor and interest rate swap rate for all longer maturities. This data can be downloaded from FRED, the online database of the Federal Reserve Bank of St. Louis.

We implement the standard market model in Matlab using *cdsbootstrap*. The assumption of the standard model is that the time varying hazard rate $\lambda(t)$ is constant between all of the nodes of the CDS curve. This mean that we begin by using A10 to calculate λ_{6m}, the hazard rate between the initiation of the contract and its expiration 6 months later. We use the recovery rate that Markit calculates by polling the reporting dealers as our assumed recovery upon default. This recovery rate is assumed to be the same for all tenors. Having calculated $\lambda_{6M,}$ we can calculate λ_{1Y}, the hazard rate between 6 months and 1 year of the contract consistent with the observed par spread, then λ_{2Y} between 1 and 2 years, and so on up the curve. Having calculated these hazard rates, we can then compute the probability of a default during the life of each contract as:

$$\begin{aligned}
Pr(D \leq 6M) &= 1 - \exp\left(-\lambda_{6M} \cdot \left(\frac{1}{2}\right)\right) \\
Pr(D \leq 1Y) &= 1 - \exp\left(-\lambda_{6M} \cdot \left(\frac{1}{2}\right) - \lambda_{1Y} \cdot \left(\frac{1}{2}\right)\right) \\
&\vdots \\
Pr(D \leq 5Y) &= 1 - \exp\left(-\lambda_{6M} \cdot \left(\frac{1}{2}\right) - \lambda_{1Y} \cdot \left(\frac{1}{2}\right) - \lambda_{2Y} - \lambda_{3Y} - \lambda_{4Y} - \lambda_{5Y}\right)
\end{aligned}$$

We perform this bootstrapping for our 11 tenors for the full sample period (January 3, 2011 to July 30, 2014).

D Econometric Model

The model we use is

$$\begin{aligned}
\Delta D_t &= \mu_d + \omega_D^T X_t + \gamma^T r_t + \beta_D F_t + \varepsilon_t \\
r_t &= \mu + \Omega X_t + \alpha \Delta D_t + \beta F_t + \eta_t,
\end{aligned}$$

where r_t is a vector of returns, ΔD_t is the change in the default probability, X_t is a set of global factors (S&P 500, etc...), F_t is an unobserved factor, and ε_t is the idiosyncratic default probability shock, and η_t is a vector

of return shocks that do not directly affect the probability of default. Through some algebra, we show that this is equivalent to the systems described in equations 1 and 2, used in most of our analysis, and equations 8 and 9 used in the cross-sectional analysis.

We begin by separating the equation governing the vector of returns r_t into the return of asset i, $r_{i,t}$, which is the asset of interest, and the returns of some other assets, denoted $r_{-i,t}$. We separate the various coefficient vectors and matrices, $\mu, \Omega, \alpha, \beta, \gamma$, and shocks η_t, into versions for asset i, μ_i, ω_i^T, etc..., and versions for the other assets, μ_{-i}, Ω_{-i}, etc... This system can be written as

$$\begin{aligned}
\Delta D_t &= \mu_d + \omega_D^T X_t + \gamma_i^T r_{i,t} + \gamma_{-i}^T r_{-i,t} + \beta_D F_t + \varepsilon_t \\
r_{i,t} &= \mu_i + \omega_i^T X_t + \alpha_i \Delta D_t + \beta_i F_t + \eta_{i,t} \\
r_{-i,t} &= \mu_{-i} + \Omega_{-i} X_t + \alpha_{-i} \Delta D_t + \beta_{-i} F_t + \eta_{-i,t}.
\end{aligned}$$

Most of our analysis considers only a single asset, $r_{i,t}$, and the default probably change ΔD_t. Substituting the returns $r_{-i,t}$ into the ΔD_t equation,

$$\begin{aligned}
\Delta D_t &= \frac{\mu_d + \gamma_{-i}^T \mu_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} + \frac{\omega_D^T + \beta_{-i}^T \Omega_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} X_t + \frac{\gamma_i^T r_{i,t}}{1 - \gamma_{-i}^T \alpha_{-i}} + \\
&\quad \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} F_t + \frac{1}{1 - \gamma_{-i}^T \alpha_{-i}} (\gamma_{-i}^T \eta_{-i,t} + \varepsilon_t) \\
r_{i,t} &= \mu_i + \omega_i^T X_t + \alpha_i \Delta D_t + \beta_i F_t + \eta_{i,t}.
\end{aligned}$$

This system, for the two assets, is equivalent to the one in equations 1 and 2, except that is has two shocks, $\gamma_{-i}^T \eta_{-i,t}$ and ε_t, that directly affect ΔD_t without affecting $r_{i,t}$, and includes constants and observable controls X_t. Neither of these differences substantially alter the identification assumptions or analysis. The event study and Rigobon (2003) approach both identify the coefficient α_i, under their identifying assumptions, which is the coefficient of interest.

Next, we discuss a version of this system with the market return. Let the market return be a weighted

version of the return vector, $r_{m,t} = w^T r_t$. Separating the vectorized version of the system into four equations,

$$\begin{aligned}
\Delta D_t &= \mu_d + \omega_D^T X_t + \gamma_i^T r_{i,t} + \gamma_{-i}^T r_{-i,t} + \beta_D F_t + \varepsilon_t \\
r_{i,t} &= \mu_i + \omega_i^T X_t + \alpha_i \Delta D_t + \beta_i F_t + \eta_{i,t} \\
r_{-i,t} &= \mu_{-i} + \Omega_{-i} X_t + \alpha_{-i} \Delta D_t + \beta_{-i} F_t + \eta_{-i,t} \\
r_{m,t} &= \mu_m + \omega_m^T X_t + \alpha_m \Delta D_t + F_t + w^T \eta_t,
\end{aligned}$$

where $\mu_m = w^T \mu$, $\omega_m^T = w^T \Omega$, and so on. We have assumed that $w^T \beta = 1$, which is a normalization. Substituting out $r_{-i,t}$,

$$\begin{aligned}
\Delta D_t &= \frac{\mu_d + \gamma_{-i}^T \mu_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} + \frac{\omega_D^T + \beta_{-i}^T \Omega_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} X_t + \frac{\gamma_i^T r_{i,t}}{1 - \gamma_{-i}^T \alpha_{-i}} + \\
&\quad \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} F_t + \frac{1}{1 - \gamma_{-i}^T \alpha_{-i}} (\gamma_{-i}^T \eta_{-i,t} + \varepsilon_t) \\
r_{i,t} &= \mu_i + \omega_i^T X_t + \alpha_i \Delta D_t + \beta_i F_t + \eta_{i,t} \\
r_{m,t} &= \mu_m + \omega_m^T X_t + \alpha_m \Delta D_t + F_t + w^T \eta_t,
\end{aligned}$$

as above. Next, we solve for F_t using the market return equation:

$$F_t = r_{m,t} - \mu_m - \omega_m^T X_t - \alpha_m \Delta D_t - w^T \eta_t.$$

Plugging this into our system of equations,

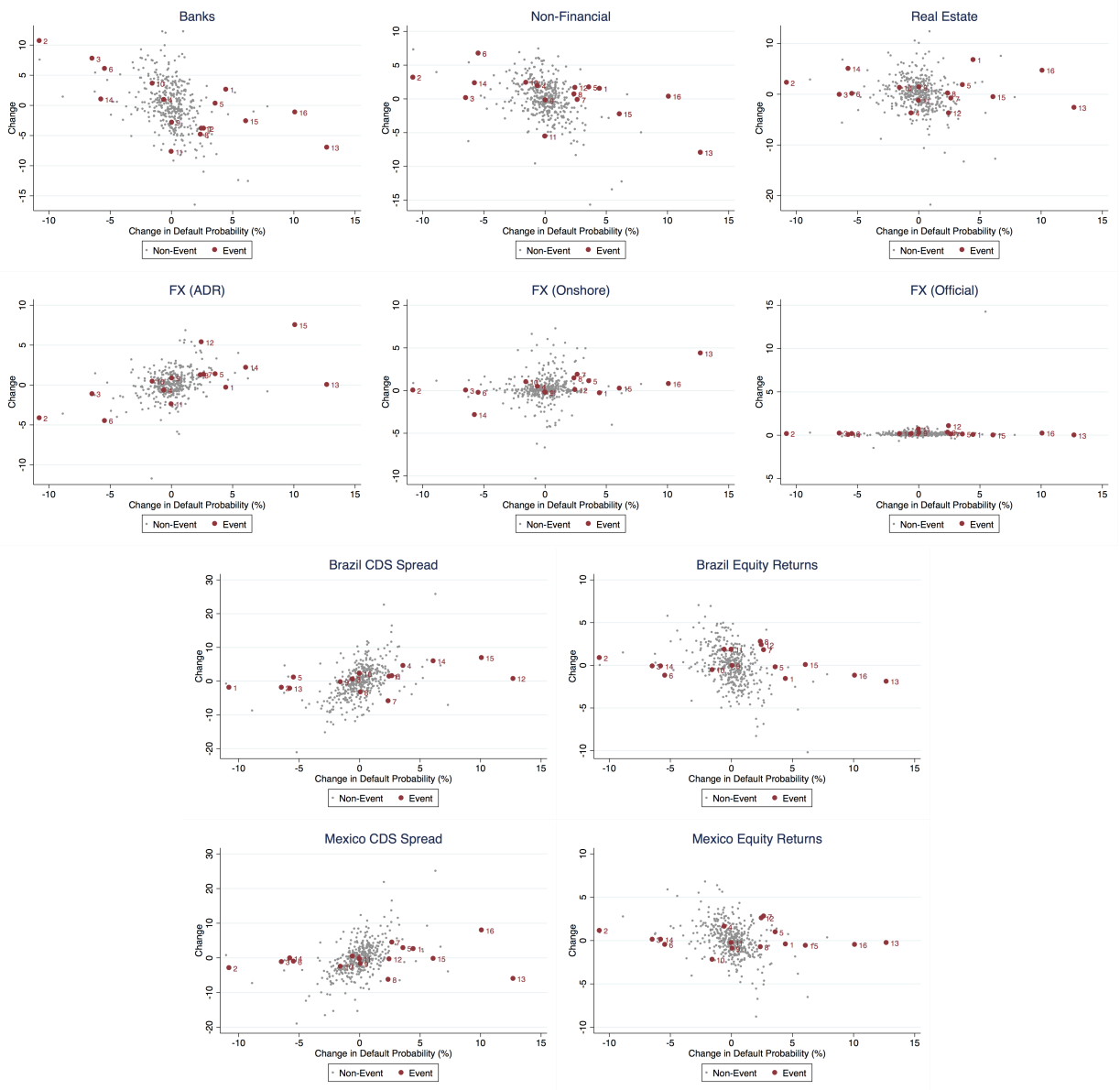
$$\begin{aligned}
(1 + \alpha_m \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}}) \Delta D_t &= (\frac{\mu_d + \gamma_{-i}^T \mu_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} - \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} \mu_m) + (\frac{\omega_D^T + \beta_{-i}^T \Omega_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} - \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} \omega_m^T) X_t + \\
&\quad \frac{\gamma_i^T r_{i,t}}{1 - \gamma_{-i}^T \alpha_{-i}} + \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} r_{m,t} + (\frac{\gamma_{-i}^T}{1 - \gamma_{-i}^T \alpha_{-i}} - \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} w_{-i}^T) \eta_{-i,t} + \\
&\quad \frac{\beta_D + \gamma_{-i}^T \beta_{-i}}{1 - \gamma_{-i}^T \alpha_{-i}} w_i \eta_{i,t} + \frac{1}{1 - \gamma_{-i}^T \alpha_{-i}} \varepsilon_t \\
r_{i,t} &= (\mu_i - \beta_i \mu_m) + (\omega_i^T - \beta_i \omega_m^T) X_t + (\alpha_i - \beta_i \alpha_m) \Delta D_t + \beta_i r_{m,t} + (1 - w_i \beta_i) \eta_{i,t} + w_{-i}^T \eta_{-i,t}.
\end{aligned}$$

This system is equivalent to the one presented in equations 8 and 9, except that there are multiple common

factors ($\eta_{i,t}$ and $\eta_{-i,t}$) and no idiosyncratic return shocks. The event study and Rigobon (2003) approach both identify the coefficient $(\alpha_i - \beta_i \alpha_m)$, under their identifying assumptions, which is the coefficient of interest.

E Figures

Figure A1: Change in Default Probability and other Financial Variables on Event and Non-Event Days



Notes: This figure plots the change in the risk-neutral probability of default and returns on all indices and exchange rates, as well as Mexican and Brazilian equities and CDS, on event and non-event days. Each event and non-event day is a two-day event or non-event as described in the text. The numbers next to each maroon dot references each event-day in the table below Figure 1. The procedure for classifying events and non-events is described in the text.

F Event and Excluded Dates

Two-Day Window End	Event Type	Description	PDF Time (EST)	Decision Link	News Time (EST)	News Link	Comments
7Dec11	Excluded	Original ruling by Judge Griesa with regards to Pari Passu clause.	7Dec11, 12:55pm	Decision	Missing	Missing	There was very little contemporaneous news coverage, and we are unable to determine when the ruling became public. The first story we found about the ruling is based on an article in "La Nacion" published on 5Mar12.
23Feb12	Excluded	Order by Judge Griesa requiring "ratable payment."	Missing	Order	Missing	Missing	See above.
05Mar12	Excluded	Stay granted by Judge Griesa, pending appeal.	Missing	Stay	05Mar12, 7:11am	Bloomberg	See above.
26Oct12	Excluded	Appeals court upholds Judge Griesa's ruling that the Pari Passu clause requires equal treatment of restructured bondholders and holdouts.	25Oct12, 12:43pm	Decision	26Oct12, 2:14pm	Bloomberg	The appeals court releases opinions during the middle of the day. Unfortunately, the closing marks on this day are questionable, given the impending impact of "Superstorm Sandy."
23Nov12	Excluded	Judge Griesa removes the stay on his order that Argentina immediately pay the holdouts, if they also pay the exchange bondholders.	Missing	Order	22Nov12, 5:33am.	Business News Americas	Nov 22 was Thanksgiving in the United States, and all CDS marks on that date and the morning of the 23rd appear to be the same as on the 21st. The opinion was filed by Judge Griesa on the night of the 21st, but was embargoed until the 23rd. On the 22nd, the Argentine market fell a lot, but bounced back on the 23rd. We cannot observe this in the ADR data, so we exclude this event.

Two-Day Window End	Event Type	Description	PDF Time (EST)	Decision Link	News Time (EST)	News Link	Comments
27Nov12	Open-to-Open, 26Nov12 to 27Nov12	Judge Griesa denies the exchange bondholders request for a stay. The bondholders immediately appealed.	26Nov12, 3:43pm	Denial	27Nov12, 5:00am.	New York Post	The denial occurred on the 26th, and both the government of Argentina and the exchange bondholders immediately appealed. We compare the open on the 27th to the open on the 26th. The 26th is an Argentine holiday, so the ADR Blue Rate is missing (for the open-to-open, but not the two day window).
29Nov12	Close-to-Open, 28Nov12 to 29Nov12	Appeals court grants emergency stay of Judge Griesa's order.	28Nov12, 5:04pm[64]	Stay	29Nov12, 8:24am.	Bloomberg	
05Dec12	Open-to-Close, 04Dec12	Appeals court denies request of holdouts to force Argentina to post security against the payments owed.	04Dec12, 1:15pm.[65]	Denial	04Dec12, 1:46pm.	Bloomberg	
07Dec12	Close-to-Close, 05Dec12 to 06Dec12	Appeals court allows the Bank of New York (custodian of the exchange bonds) and the Euro bondholders to appear as interested parties.	05Dec12, 10:13pm.	Order	06Dec12, 11:47am	Bloomberg	
11Jan13	Close-to-Open, 10Jan13 to 11Jan13	Appeals court denies certification for exchange bondholders to appeal to NY state court for interpretation on Pari Passu clause.	10Jan13, 4:10pm	Order	11Jan13, 12:01am	Bloomberg	The ruling was written immediately after the closes on the 10th.

[64]This order has a 9pm "creation time" and a 5pm "modification time."

[65]This "creation time" of this PDF is actually at 4pm, 3 hours after the "modification time".

Two-Day Window End	Event Type	Description	PDF Time (EST)	Decision Link	News Time (EST)	News Link	Comments
28Feb13	Excluded	Appeals court denies request for en-banc hearing of appeal.	28Feb13, 3:27pm.	Decision	Missing	Shearman	The denial occurred at the beginning of a hearing, during which lawyers for both sides argued various issues. Lawyers from Argentina may have changed their arguments in response to expectations about the Argentine economy, violating the exclusion restriction.
04Mar13	Open-to-Open, 01Mar13 to 04Mar13	Appeals court asked Argentina for a payment formula.	01Mar13, 11:49am.	Order	01Mar13, 4:46pm	Financial Times	The FT story is the earliest we could find. Most other coverage is from the following day (a Saturday).
27Mar13	Open-to-Open, 27Mar13 to 26Mar13	Appeals court denies Argentina's request for en-banc rehearing.	26Mar13, 11:58am	Order	26Mar13, 2:35pm	Bloomberg	The Bloomberg story specifically mentions a 374bp increase in the 5yr CDS spread, which does not appear in our data until after the NY close at 3:30pm. We use the one day window to ensure we are capturing the event.
01Apr13	Non-Event (neither event or excluded)	Argentina files payment plan. Offer roughly 1/6 of Judge Griesa ordered.	N/A	N/A	30Mar13, 12:05pm	Bloomberg	Argentina filed just before midnight on 28Mar13. Actions by Argentina are endogenous. This neither an event nor excluded.
22Apr13	Non-Event (neither event or excluded)	Holdouts reject Argentina's payment plan.	19Apr13, 5:20pm	Reply	20Apr13, 12:01am	Bloomberg	Holdouts reject Argentina's payment plan. Also conceivably endogenous. The rejection was filed after business hours on Friday, 19Apr13. This is also neither an event nor excluded.
26Aug13	Close-to-Close, 22Aug13 to 23Aug13	Appeals court upholds Griesa's decision.	22Aug13, 4:21pm	Decision	23Aug13, 4:02pm	Bloomberg	The appeals court announces decisions during the business day. The modification date of the PDF is 10:17am. However, because the

Two-Day Window End	Event Type	Description	PDF Time (EST)	Decision Link	News Time (EST)	News Link	Comments
11Sep13	Non-Event	Supreme court schedules hearing to consider Argentina's appeal.	Missing	Docket Info.	11Sep13, 2:35pm.	Bloomberg	The supreme court distributed case materials related to Argentina's petition. We were advised that this is routine and not "news," so we do not count is as a ruling.
26Sep13	Excluded	Holdouts had petitioned Griesa to consider the Argentine central bank liable for the defaulted debt. Argentina motioned to dismiss, and Griesa rejected Argentina's motion.	Missing	Missing	25Sep13, 5:40pm.	Bloomberg	We were not able to find Griesa's ruling, so we exclude this event.
04Oct13	Open-to-Open, 03Oct12 to 04Oct13	Griesa bars Argentina from swapping the exchange bonds into Argentine-law bonds.	03Oct13, 2:43pm.	Order	03Oct13, 6:27pm.	Bloomberg	
08Oct13	Open-to-Close, 07Oct13	Supreme court denies Argentina's first petition.	N/A	Order	07Oct13, 11:45am	SCOTUS Blog	The stock market opens (9:30am EST) before the Supreme court issues decisions (9:30am or 10:00am EST).
19Nov13	Open-to-Open, 18Nov13 to 19Nov13	Appeals court denies Argentina's request for an en-banc hearing.	18Nov13, 11:04am	Denial	19Nov13, 12:01am	Bloomberg	The modification time of the orders is 4:53pm.
13Jan14	Open-to-Close, 10Jan14	Supreme court agrees to hear Argentina case.	10Jan14, 2:42pm	Order	10Jan14, 2:48pm	SCOTUS Blog	The supreme court usually announces orders at 10am. The document was likely posted afterwards.
17Jun14	Open-to-Close, 16Jun14	Supreme court denies Argentina's second petition.	See Text.	Denial	See Text.	SCOTUS Blog	The text discusses this event in detail.
23Jun14	Open-to-Open, 20Jun14 to 23Jun14	Griesa prohibits debt swap of exchange bonds to Argentine law bonds.	20Jun14, 2:17pm	Order			20Jun14 is an Argentine holiday, so the local stocks are missing. This event is excluded from our ADR analysis because of the two-day windows (it overlaps with the event below).

Two-Day Window End	Event Type	Description	PDF Time (EST)	Decision Link	News Time (EST)	News Link	Comments
24Jun14	Open-to-Open, 23Jun14 to 24Jun14	Griesa appoints special master to oversee negotiations.	23Jun14, 12:36pm	Order	23Jun14, 7:35pm	Bloomberg	The modification date for the order is 1:05pm. This event is excluded from our local stock analysis because of the two-day event windows (see the event above).
27Jun14	Open-to-Close, 26Jun14	Griesa rejects Argentina's application for a stay, pending negotiations.	26Jun14, 11:40am	Order	26Jun14, 2:05pm	Bloomberg	
30Jun14	Non-Event	Argentina misses a coupon payment					
29Jul14	Open-to-Open, 28Jul14 to 29Jul14	Griesa allows Citi to pay Repsol bonds for one month.	28Jul14, 3:51pm	Order	28Jul14, 12:01am	Bloomberg	The modification time on the order is 5:07. This event almost certainly occurred post-close, but we use the one day window to be safe.
30Jul14		The 30-day grace period for the missed payment expires.				Bloomberg	We end our dataset on 29Jul14.