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Aaron Collett 20-April-2011

The Effect of Data Dissemination Agreements on Financial Volatility and Contagion

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Abstract

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The spillover of national financial crises between nations, or contagion, has risen in line with increased global economic and financial interconnectedness. However, the recent history of contagious crises show that patterns of contagion are often difficult to predict. Accordingly, this study addresses the puzzle of unpredictable trends in contagion. The study tackles this general puzzle by investigating how volatility can be spread between countries through an information channel of contagion. Information contagion occurs when market participants make investment decisions based on imperfect information. More specifically, the paper investigates if incidents of information contagion can be lessened if governments improve their data provision practices. In particular, the paper investigates the effect of subscription to the International Monetary Fund's (IMF) Special Data Dissemination Standard (SDDS) on contagion. I hypothesize that countries that provide better quality data and signal their commitment to this international standard by joining the institution experience less contagion of financial volatility. This relationship is tested in the paper in a multivariate regression of the effect of SDDS subscription on domestic volatility and contagion. The test sample consists of 25 countries and uses daily data from 1998 to 2009. The study offers the first empirical test of the relationship between the SDDS and contagion. The findings confirm the paper's hypotheses and show that SDDS accession both reduces domestic volatility and insulates nations from contagion of volatility, especially in times of crisis.

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I. Introduction

The spillover of national financial crises between nations has risen in line with increased global economic and financial interconnectedness. However, the spread of these crises is difficult to predict. In some instances nations with strong linkages to crisis countries and weak economic fundamentals experience less spillover, while nations with weaker linkages and seemingly stronger fundamentals experience more spillover. For example, the 1997 Thai economic crisis spread throughout Asia, but affected some nations with strong economic fundamentals more than their weaker peers. Prior to the crisis analysts showed concern for weak economic fundamentals in Vietnam and the Philippines, but crisis spread was limited in these nations (Hill 1998, 226). In contrast, Indonesia experienced significant spillovers even though "macroeconomic indicators [in] Indonesia … looked good [and] short-term foreign borrowing … was [not] unsustainable" (MacIntyre 2001, 95). Similarly, contagion in wake of the 1998 Russian crisis affected nations with limited links to Russia. The crisis led investors to reduce their exposure to seemingly uncorrelated financial instruments including "Brazilian stocks, U.S. mortgages, spreads between … government securities, and spreads between swaps and U.S. Treasuries" (Kyle and Xiong 2001, 1401). The unpredictability of crisis spread and the incidence of contagion in different nations are puzzles that this paper aims to address.

Given contagion's different forms, past research has defined the phenomenon in a variety of ways. In this study, I define the concept per Kodres and Pritsker's (2002, 772) interpretation of contagion as "a general price movement in one market resulting from a shock in another market." In particular this study investigates how shocks can increase

the spread of volatility. I define shocks broadly as events that are reflected in adverse price movements of national financial instruments or indices. I define volatility as market behavior that reduces the degree of predictability in price movement. In particular, I am interested in how volatility can be spread by beliefs-driven contagion, specifically information contagion. I adopt Kannan and Köhler-Geib's (2009, 4) definition of information contagion as a phenomenon where "crises in one country lead investors to doubt the accuracy of their information and lead them to rationally make decisions that increase the probability of a crisis in a second country." However, unlike Kannan and Köhler-Geib, I choose not to limit contagion to crisis scenarios, but instead look at contagion as any spillover of price volatility between countries. The significance of these distinctions will be discussed in greater depth in the paper's review of the literature.

In wake of incidences of contagion both researchers and policymakers have attempted to explain the channels of financial contagion and to understand how some factors mitigate nations' susceptibility to the phenomenon. In particular, research suggests that the availability of nations' economic and financial data affects crisis spread. Policy action in the wake of recent financial crises has also focused on information provision practices with the hope that greater transparency would increase investor confidence. As a result, many emerging markets have turned to the International Monetary Fund's (IMF) Special Data Dissemination Standard (SDDS) to signal their commitment to data transparency.

The effects of the SDDS on market accessibility and stability have been investigated, but the Standard's specific effect on contagion is not well documented. I argue that countries that provide better quality data and signal their commitment to this

international standard by joining the institution experience less contagion of financial volatility. To examine this relationship I conduct a multivariate analysis of the effect of SDDS subscription with a sample of 25 countries and daily data from 1998 to 2009. 20 of the 25 nations in the sample have subscribed to the SDDS. While advanced economies subscribe to the SDDS, the study's country sample includes only emerging market economies. Less developed nations are necessarily excluded since they cannot subscribe to the SDDS. To measure the SDDS's effect on contagion I investigate how SDDS subscription affects domestic volatility and the spread of volatility between nations. The model controls for national economic fundamentals, channels of contagion and fixed country- and time-specific effects. My findings confirm my hypotheses and show that SDDS accession both reduces domestic volatility and insulates nations from contagion of volatility, especially in times of crisis.

This study bridges the literature on the SDDS and contagion and thus makes a contribution to both. While previous research shows the SDDS's effect on crisis prevention, my results demonstrate the agreement's effect on the spread of crisis across borders. This addition is particularly significant since the SDDS was created in response to contagious crises. The study also contributes to the contagion literature by investigating the effect of information provision through an institutional lens. While previous research mainly addresses factors that explain contagion, this study investigates how international institutions can mitigate contagion. Consequently, my focus on the SDDS as an institution that coordinates domestic policy makes the results useful to policymakers and political economists alike.

II. Literature Review

a. Contagion

While the bulk of the literature on contagion has developed recently, various theoretical approaches to the topic have been proposed. Most importantly, the literature distinguishes between contagion caused by economic and financial fundamentals, and contagion caused by market beliefs. In this study I control for fundamentals-driven forms of contagion in order to solely investigate beliefs-driven contagion. Other contagion distinctions are based on authors' opinions of how contagion relates to crisis expectation and crisis magnitude. In the following section I will review the literature on each of these distinctions.

Beliefs v. Fundamentals

The distinction between beliefs- and fundamentals-driven contagions lies in whether price movements are caused by real weaknesses in a nation's economy or market participants' perceptions of weakness, respectively. In fundamentals-driven contagion market participants act rationally based on complete information whereas in beliefs-driven contagion market decisions are made based on imperfect information.

Information contagion, which this study is concerned with, is associated with the different forms of beliefs-driven contagion. These forms explain crisis transference as a result of incomplete information, investor reevaluation of fundamentals and investor herding behavior.

First, incomplete information models assert that investors with limited information about nations' fundamentals will tend to deleverage from those nations when regional or similar economies experience crises. Kannan and Köhler-Geib (2009) assert

that the onset of a crisis in one country undermines information that firms previously believed to be accurate, leading to uncertainty in information about nearby nations. Accordingly, the authors propose that an "uncertainty channel of contagion" leads to quick changes in market perceptions, leading to crisis (5). Gelos and Wei's (2005, 3010) research on emerging market funds supports this theory and concludes that when deciding investment allocations "[f]und managers tend … to avoid opaque countries to a larger extent during … crises." Since this investigation is primarily concerned with the effects of information provision, the incomplete information channel of contagion most strongly informs the study's hypotheses.

Nevertheless, other channels of contagion are affected by information provision and are thus relevant to the study. Another beliefs-driven contagion theory suggests that investors update their views on a nation in wake of crisis in another nation, recognize fundamentals that were overlooked earlier and reduce their investments accordingly. This theory was pioneered by Goldstein (1998, 18) in his analysis of the Asian financial crisis and was named the "wake-up call hypothesis." Unlike Kannan and Köhler-Geib, Goldstein believes that crisis leads to greater information analysis and a reconsideration of previous views of other economies. In addition, the theory suggests that initial crises could lead investors to change their views on appropriate levels of national economic risk for investment, as measured by economic and financial metrics. The change in investors' benchmarks for risk would negatively affect analysts' opinions of other nations' economic indicators and lead to a reduction in investment. For example, after a nation

experiences a debt crisis, investors' view on sustainable levels of debt may change and thus affect their analysis of other nations' debt sustainability.[1]

Lastly, literature on the third type of beliefs-driven contagion, investor herding, asserts that large banks make investment decisions based on the beliefs of their peers in order to secure stable investments. As Acharya and Yorulmazer (2008, 215) describe, "banks herd and undertake correlated investments so as to minimize the impact of such information contagion on the expected cost of borrowing." Borenzstein and Gelos (2003) also support the theory of herding through their study of the behavior of emerging market mutual funds.

In contrast to beliefs-driven contagion, fundamentals-driven contagion is dictated by real changes in economic and financial conditions. As Chang and Majnoni (2002, 802) note, fundamental-driven contagion occurs when "a crisis in one country leads investors to rationally and adversely update their beliefs about fundamentals in other countries." In these instances, crises in initial countries cause shocks that worsen fundamentals in other nations via economic ties. Since this study looks specifically at beliefs-driven contagion, these fundamental sources of contagion are especially important, since I must control for their effects.

Past research identifies a variety of key metrics of fundamental strength that determine pricing of country-level financial products.[2] Economic, financial and monetary

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[1] Forbes and Rigobon (2001) cite the crisis spillover from Russia to Brazil in 1998 as an example. After Russia devalued the ruble the Brazilian stock market fell by 50% in the following month. According to the authors, this contagion is best explained by investors' perceptions of IMF support after the crisis in Russia. The authors assert, "during the Russian crisis the market learned how the IMF would respond during the next … crisis and what … sort of rescue package it would implement. This learning process may have conveyed valuable information about potential rescue packages for the next countries that devalued their currencies" (1).

measures of fundamentals include GDP growth (Cady 2005; Grandes 2007; Kannan and Köhler-Geib 2009), inflation (Cady 2005), real exchange rate (Cady 2005; Min 1998; Min, et al. 2003; Grandes 2007), current account balance (Min, et al. 2003), terms of trade (Min, et al. 2003) and capital inflows (Grandes 2007). Authors also recognize alternative sources that cause fundamental deterioration, which in turn can spur price movements. For example, Mauro, et al. (2006, 3) note, "wars and episodes of politically-motivated violence" affect sovereign bond prices.

Deterioration of fundamentals in one nation can affect financial stability in another nation via channels of contagion. These channels are created by direct and third party linkages between nations. When an initial country experiences fundamentals deterioration, another nation may experience spillover effects due to these linkages. The literature primarily focuses on linkages via bilateral trade ties, common creditor exposure and shared economic characteristics.

One channel of contagion that is created by direct economic linkages is bilateral trade between nations. As crisis in an initial country shocks that nation's fundamentals, domestic export and import industries are adversely affected. Accordingly, crisis in one nation affects both the stability of their trade partners' import flows and lowers aggregate demand for trade partners' exports (Glick and Rose 1999). Similarly, strong capital flows between nations can pave a channel of contagion. In this case, nations in crisis would have reduced access to available investment capital, which would have knock-on effects in nations that depend on that foreign investment.

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[2] Referenced literature in this section specifically refers to movements in sovereign bond prices, which is consistent with my measurement of contagion, as outlined in the research design section.

Other channels of contagion are created when two nations are both exposed to a common financial or economic factor. One prominent theory on financial linkages suggests that the presence of a common creditor between two nations acts as a channel of contagion. Literature on contagion via a common creditor posits that a crisis in one country causes common creditors to reduce their investments in other nations (Kodres and Pritsker, 2002). In particular, common exposure to banks can transfer shocks through crises' effects on lending conditions. Van Rijckeghem and Weder (2001, 294) suggest that banks react to initial crises and make "adjustments to restore capital adequacy, meet margin calls, or adjust exposures [which] lead[s] to reduced credit lines to the second country." Other research investigates the role of mutual funds and suggests that these institutions adjust to crisis shocks by "reducing [their] weight in countries in which [they are] overexposed" (Broner, et al. 2006, 206). In both cases initial crises reduce creditors' ability to provide finance to nations, placing liquidity strains on those nations and adversely affecting their fundamentals.

Some studies also identify economic similarities as a primary cause of cross-border price movement spillovers. For example, Glick and Rose (1999, 609) identify "the degree to which [a nation] competes with other countries in foreign … export markets" as a channel of contagion. As global demand for products changes, the effects on nations with similar export portfolios are correlated. Common economic arrangements can also increase linkages between nations and thus have a spillover effect. For example, the recent contagion in the Eurozone primarily affected nations that are members of the European Monetary Union, which coordinates common economic policies, such as adoption of the euro. However, given this paper's definition of contagion, classifying

economic similarities as a channel of contagion would be misleading. In this case, the correlation of adverse effects between nations would be a function of an external shock as opposed to a spillover from one nation to another. This distinction, however, makes no functional difference in this study. Since I seek to investigate a factor that mitigates contagion, both common external shocks and channels of contagion act as controls in my model.

Other Distinctions

Aside from beliefs- and fundamentals-driven contagion differentiation, researchers also recognize other contagion distinctions. In particular, the literature differentiates contagion by the rate and magnitude of crisis transference as well as investors' level of crisis anticipation.

Studies often distinguish contagion by the rate and magnitude of crisis transference. For example, Kaminsky, et al. (2003, 55) limit their sample of contagion by specifying that "'excess comovement' in financial and economic variables" (2003, 55) must be observed in order to label crisis spread as contagion. Furthermore, the authors define contagion as crisis transference that is "fast and furious," as opposed to "spillovers" where transference is gradual and of a lesser magnitude. This definition of contagion caters to research centered on case study analysis of crisis events and is adopted by other authors such as Van Rijckeghem and Weder (2000), whose study specifically focuses on the Thai, Russian and Mexican crises.

Other studies, however, measure contagion as any amount of observed price movement transference from one nation to another. Kodres and Pritsker's (2002, 772) definition of contagion, which this study adopts, specifies that "general price

movements" in wake of an initial county shock constitutes contagion. This specification shows a clear division in authors' understanding of the concept. According to Kaminsky, et al.'s definition, contagion is limited to situations where both initial and target nations experience significant crises. In contrast, Kodres and Pritsker's definition suggests that contagion is a continuous phenomenon that is observed in large and small price movement spillovers alike.

Next, authors call attention to the difference between surprise and anticipated crises. Kannan and Köhler-Geib (2009, 2) recognize this distinction and note that some contagion analysis limits the scope of the concept to "surprise crises," where the event of crisis is not anticipated by market analysts. While most authors do not impose this restriction on their contagion definition, many include crisis anticipation in discussion of the topic and draw on specific metrics to measure this factor. For example, past research uses financial indicators such as sovereign bond ratings (Kaminsky, et al. 2003) or mutual fund investments (Borensztein and Gelos 2003) to determine whether financial markets anticipated a crisis. In these cases, sudden and significant price movements indicate that financial markets did not anticipate a crisis. Other studies have identified surprise crises by observing changes in the daily volume of news stories about countries' economic health (Rigobon and Wei 2003; Mondria and Quintana-Domeque 2007).

Specified Definition

As previously noted, my use of the term contagion in this paper will build on Kodres and Pritsker's definition and will investigate beliefs-driven contagion without limiting contagion to crisis scenarios. The investigation will measure contagion on a high-frequency basis by observing daily price changes and comovements between

countries. Since my independent variable is related to information provision, I will test how improved transparency affects the beliefs and decisions of investors.

From an institutional perspective an investigation of the SDDS's effects on beliefs-driven contagion is consistent with the goal of the study. The SDDS's purpose, to provide information, is better tested in beliefs-driven crises since they are often caused by incomplete information. Furthermore, previous research suggests that greater transparency reduces contagion in beliefs-driven crises. According to Kannan and Köhler-Geib (2009, 808), "more transparency … makes beliefs driven crises less contagious." Accordingly, the theoretical case for a relationship between data dissemination agreement subscription and contagion is strong in the context of beliefs-driven contagion.

With regard to the rate of transference, I choose not to limit my definition to crisis scenarios. There have been a limited number of contagious crises since the SDDS's creation so my crisis sample would be limited. Furthermore, this study's approach can also stratify the sample and observe the effects of contagion during daily episodes of high volatility. In addition, the SDDS's goal to realize "the improved functioning of financial markets" ("The IMF's DDI After 10 Years" 2008) is consistent with conducting continuous analysis to test the agreement's effect in times of both low and high volatility.

Finally, the distinction between surprise and anticipated crises will have limited implications on the study. The investigation's focus on volatility will mean that surprise crises will have particularly adverse effects on price movement predictability. Nonetheless, my model will also capture gradual spillovers from anticipated crises, so the scope of the study does not need to be limited by crisis anticipation distinctions.

b. Special Data Dissemination Standard (SDDS)

SDDS Overview

The contagious crises in the 1990s led the international community to realize the need for greater transparency. With reference to these crises, IMF analysis (2001, 7) asserts, "Inadequate economic data, hidden weaknesses in financial systems, and a lack of clarity about government policies … contributed to a loss of confidence that ultimately threatened to undermine global stability." These conclusions led the IMF to create the Data Dissemination Initiative (DDI) "to improve timely public release of economic and financial data and related information on compilation and release procedures" (Cady, et al. 2008, 92).

Under the umbrella of the DDI, the IMF created two standards for data dissemination in 1996: the General Data Dissemination Standard (GDDS) and the Special Data Dissemination Standard (SDDS). The former aims to develop nations' data provision capacity while the latter standardizes governments' data provision practices. Due to the SDDS's focus on emerging markets, the Standard was created "to guide countries seeking access to international capital markets" (Walter 2007, 35).

The SDDS requires nations to meet a variety of dissemination specifications and subdivides its data assessments by sector. The four dimensions of the SDDS are the data itself (specifically, coverage, periodicity and timeliness of data), public accessibility, integrity and quality. The SDDS investigates the transparency of 18 indicators spread over four categories of data, including real, fiscal, financial and external sector data (IMF 2007, 2).[3]

[3] See Appendix I for a summary table of SDDS dimensions and data categories

The SDDS indicators are intended to help inform market actors' decisions. As Mosley (2003, 332) asserts, "high quality information regarding government economic policies, central bank activities, and the condition of the domestic financial sector" results in "investment decisions [that] more accurately reflect investment risk." These three types of information are specifically targeted in the SDDS's data publication requirements, as summarized in Table 1 below.

Table 1 – Information Demands and SDDS Requirements

Information[4]	SDDS Data Category[5]	Publishing Requirements – Relevant Metrics[4]
"government economic policies"	Fiscal sector	- General and central government operations (including expenditure data) - Financing of public enterprises
	Real sector (indicators show policies' effectiveness)	- GDP - Production indices - Labor market - Price indices
"central bank activities"	Financial sector	- Central bank survey (including monetary base, domestic claims, foreign assets, foreign liabilities) - Interest rates (short-term, long-term, policy rates)
	External sector	- Official reserve assets - International investment position - Exchange rates
"domestic financial sector"	Financial sector	- Depository corporations survey (including broad money, domestic claims, foreign assets, foreign liabilities) - Stock market (including share price index)

Accession to the SDDS occurs in two stages. First, nations formally subscribe to the agreement and make a commitment to implement its parameters. Second, nations implement the specifications of the agreement, as determined by the IMF. Furthermore, SDDS nations are encouraged to engage in optional IMF Reports on Standards and Codes (ROSC) for Data Dissemination to signal the quality of their data practices.

[4] Mosley 2003, 332
[5] IMF 2007, 10-13

In order to subscribe to the agreement, a nation has to communicate their intention to subscribe to IMF SDDS staff and provide details of their data dissemination practices. Afterwards, the nation consults with IMF staff "to determine where its practices stand with respect to the SDDS as well as to identify any needed changes in practices" (IMF 2007, 4). Once this initial consultation has taken place nations can publicly announce their subscription and intention to implement the agreement.

In order to be in compliance with the SDDS, nations must fulfill a variety of tasks. The IMF recognizes that a nation has implemented the Standard when they have "met the SDDS specifications for the coverage, periodicity, and timeliness of the data and for dissemination of advance release calendars" (IMF "SDDS Subscription Information" 2011).

To remain in observance of the Standard a nation must continue to meet these specifications. Furthermore, nations must certify the accuracy of their metadata on a quarterly basis and consistently demonstrate adherence to the Standard's provisions. Additionally, each nation must appoint a SDDS country coordinator who receives monthly "monitoring reports" from IMF staff on the country's adherence to the Standard. Annual observance reports for all subscribing nations have been published since 2006 (IMF 2007, 66).

The creation of the Standard came at a time of financial turmoil when post-crisis governments sought out ways to stabilize their markets, causing some governments to quickly subscribe to the agreement. As reflected in Chart 1 below, a significant proportion of both advanced and emerging market nations subscribed to the Standard in its inaugural year. The chart also shows that nearly all advanced nations that have

subscribed to the SDDS did so in 1996. Early subscription among advanced economies is most likely due to developed nations' strong data dissemination practices that aligned with SDDS provisions and thus reduced barriers to accession.

Chart 1 – SDDS Subscription by Year (Cumulative)[6]

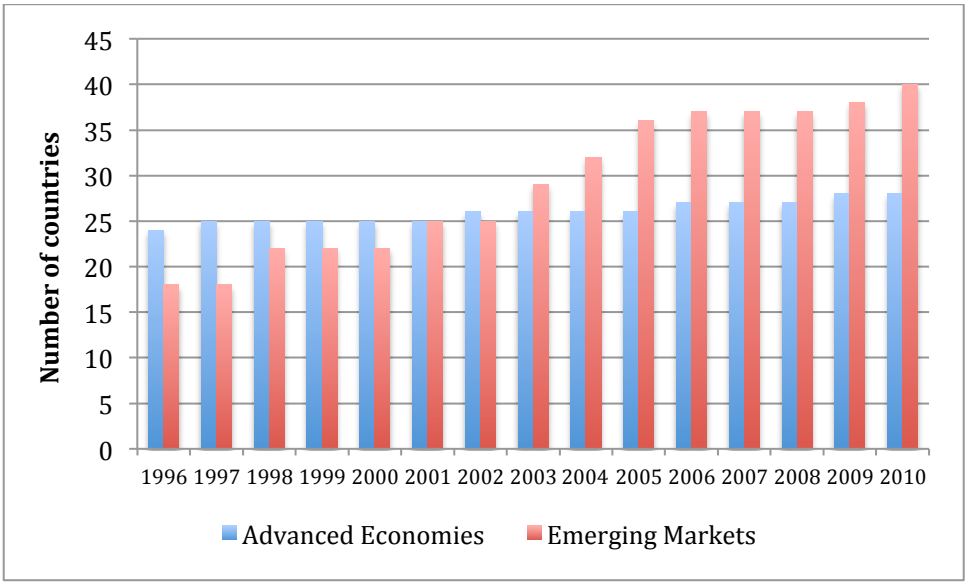
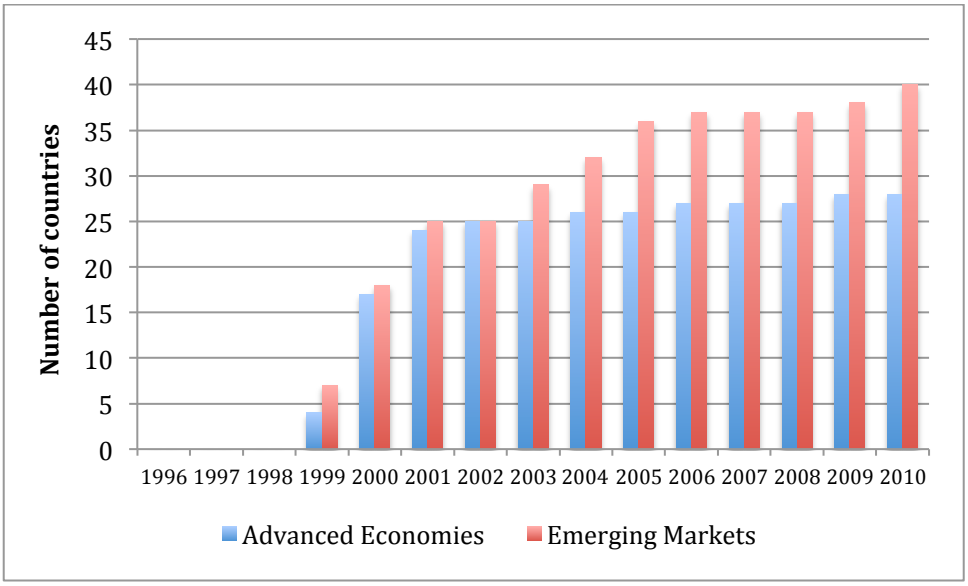


Chart 2 shows a similar result for Standard implementation, but has a wider distribution of implementation year observations. Comparing Chart 2 to Chart 1 shows a lag between the high volume of subscription in 1996 and the beginning of implementation three years later. The reason for the lag is that from the SDDS's creation in 1996 until the end of 1998, the Standard was in a "formal transition period." The purpose of the transition was to give "subscribers time to adjust their practices" and for the IMF to "review … the content and procedures of the SDDS with a view to making … adjustments" (IMF "SDDS Overview" 2011).

[6] Advanced economies and emerging market distinction drawn from IMF "WEO Groups" 2007.

Chart 2 – SDDS Implementation by Year (Cumulative)

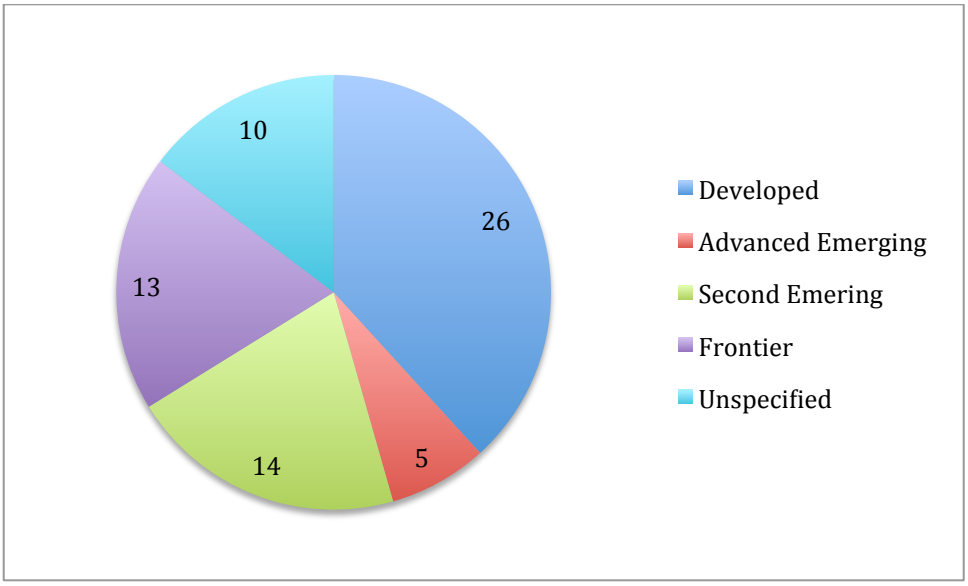


On average the lag between SDDS subscription and implementation is 2.7 years. Interestingly, the average lag for advanced economies (3.8 years) is twice that of emerging markets (1.9 years). This result could indicate that advanced nations are not compelled to implement transparency reforms quickly since existing dissemination mechanisms are trusted and speculation based on incomplete information is less likely where sources of market information are more abundant. The observation also provides preliminary evidence that emerging market nations look to benefit from the Standard's real effects on dissemination improvement, rather than being content with subscription's signaling effect.

To provide details on the economic conditions of SDDS nations I used international economy classifications to breakdown subscribers by market type. Chart 3 classifies country markets as frontier, secondary emerging, advanced emerging and developed. These distinctions are primarily drawn from the FTSE Global Equity Index Series Country Classification, but are supplemented by other country classifications for

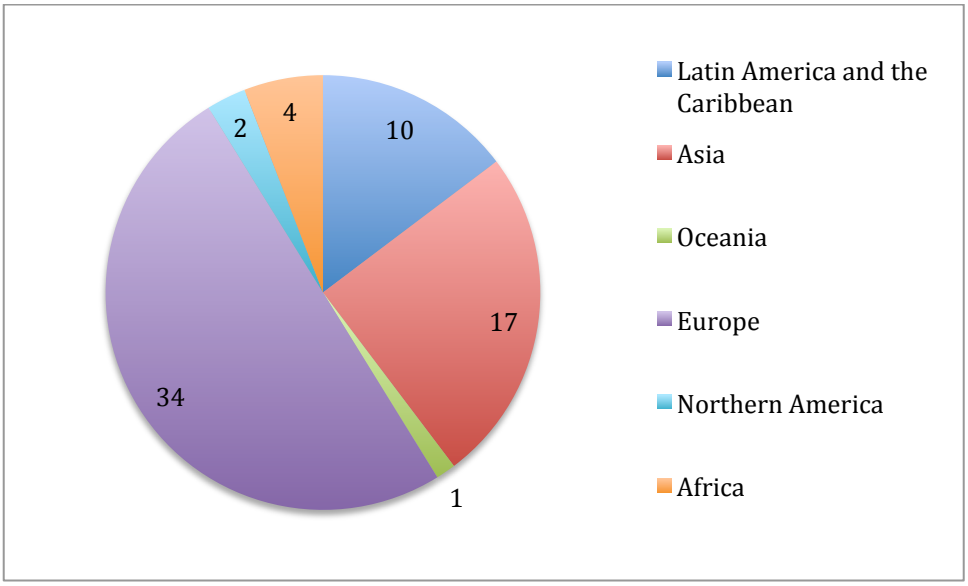
nations not covered by the FTSE classification (FTSE 2010; MSCI 2010). The results show a relatively even distribution of market sophistication.

Chart 3 – SDDS Participants by Market Classification



Finally, I classified SDDS nations by region using the UN Statistics region composition guidelines (UN 2011). SDDS nations' regional distribution is represented in Chart 4. The chart shows that 34 nations, or exactly half of total SDDS participants, are located in Europe. Other key regional groups include Asia and Latin America/the Caribbean with 17 and 10 participants, respectively. This finding makes sense intuitively since the SDDS was created during contagious crises that were concentrated in Asia and Latin America.

Chart 4 – Regional Distribution of SDDS Participants



SDDS Awareness

Literature on international investors' awareness of the SDDS arrives at contrasting conclusions. While some authors note that relatively few market participants factor SDDS accession into investment decisions, others suggest that SDDS accession is integrated into the risk models of various institutions.

Critics of the SDDS suggest that market participants' lack of awareness of the Standard blocks its effectiveness. In fact, Mosley's (2003, 344) investigation of mutual fund managers' SDDS awareness shows that 84% identified as either "vaguely aware" or "not aware at all" of the Standard. As a result Mosley asserts, "[b]ecause private economic agents have little awareness of the Standard, the SDDS does not offer concrete capital-market benefits to governments" (2003, 346).

However, this research was conducted quite early in the life of the institution and market awareness may have changed in subsequent years. Furthermore, other research contrasts with Mosley's findings and suggests that key market participants are aware of

the Standard. As a joint IMF-World Bank study suggests, the SDDS "seems to be becoming more integrated into the risk management practices of the private sector" and is included in factors considered by "a major credit rating agency[,]…two of the largest U.S.-based investment banks … and … one of the largest U.S. pension funds" (World Bank and IMF 2003, 13). The findings of a 2000 Financial Stability Forum survey also confirm international awareness of the SDDS. According to the report, investors considered the SDDS among "the best known [international standards] and viewed [the Standard] as particularly useful" (Alexander, et al. 2008, 42).

While the results of research on SDDS awareness contrast, a significant amount of studies suggest that market participants are aware of the SDDS. The conflicting results suggest that awareness varies between types of investors. Furthermore, the effects of awareness may be channeled to the market indirectly via intermediate market actors (i.e. credit rating agencies, financial news sources) who are aware of the SDDS and whose analysis affects the decisions of market participants.

The SDDS and Financial Stability

A significant amount of research has been conducted on the general effect of data dissemination agreements on financial markets and finds a positive correlation between data provision and financial stability. One study concluded, "various indicators of observance of standards are associated with lower spreads and higher credit ratings—both of which are measures of markets' expectations of the probability of crisis" (World Bank and IMF 2003, 14). Data dissemination has also been tied to reduced volatility when nations are particularly at risk of a speculative crisis. For example, Mosley (2003, 332) notes, "[b]etter information regarding sovereign and corporate borrowers may

reduce international investors' uncertainty and render speculative manias – and crashes – less likely."

The literature also speaks to government action specifically and how the decision to join agreements affects financial stability. The IMF asserts, "[m]arket scrutiny would discipline governments and lead to early detection of problems instead of late overreaction" (IMF "Signaling" 2004, 24). In line with the demonstrated benefits in the research, Simmons (2000, 821) suggests, "[g]overnments that are interested in efficiency gains from international transactions have good reasons to establish their credibility through such a commitment."

Research on the SDDS similarly shows that accession both increases financial stability and lowers borrowing costs. Alexander, et al. (2008, 93) conclude, "analysis provides strong and consistent econometric evidence of discounts for sovereign issuers … subscribing to the SDDS" (2008, 93).[7] SDDS implementation also reduces sovereign bond yields. Evidence from Glennester and Shin (2003, 5) shows a "4 to 12 percent [sovereign bond spread reduction] with SDDS compliance." In particular, previous studies have tested how these benefits are realized due to the SDDS's effect on the financial sector, credit rating agencies and the IMF itself.

First, the SDDS affects markets via the financial sector by increasing market analysts' confidence in the quality of national data. Gelos and Wei's (2005, 3006) study of SDDS implementation's effect on investment allocation shows that "countr[ies] adopting these transparency reforms experienced a sustained increase in country weight." Furthermore, as Eichengreen (1999, 27) asserts, "[SDDS] subscription status provides an

[7] See also Christofides, Mulder and Tiffin 2003

objective indicator of countries' creditworthiness, providing an alternative to the judgments of commercial credit agencies." In sum, accession to the agreement has been empirically shown to affect investment allocations and provides nations with an additional way to demonstrate creditworthiness.

Second, some believe that SDDS accession affects the financial sector indirectly by first affecting rating agencies' analysis of sovereign credit risk. World Bank and IMF research notes, "observance of the fiscal and data standards are explicit factors used by a major credit rating agency to determine countries' credit ratings" (World Bank and IMF 2003, 13). Since agencies must be attuned to arrangements and data that could affect nation's creditworthiness, the agencies are usually more aware of the Standard than other market participants. Thus, these agencies channel the positive effect of SDDS accession through favorable sovereign debt analyses that credit analysts provide to large financial firms.

Third, other authors assert that nations benefit from the SDDS because accession creates closer ties to the IMF itself, which sends positive international signals and also improves nations' access to IMF funds. As Walter (2007, 40) points out, "assessment of country compliance with standards and codes has been part of the IMF's Article IV policy surveillance role since May 1999." Furthermore, the author notes, "[t]he IMF executive board has … included observance of standards among factors taken into consideration in committing financing to a country under the Contingent Credit Line (CCL) facility[,] … particularly SDDS" (ibid).[8] Market participants' awareness of this

[8] The IMF's CCL facility was never tapped and expired in 2003. However, Walter's assertion still demonstrates a degree of SDDS consideration in IMF financing. Also, while the facility remained unused, the option of accessing the facility for the five years

advantage could in turn be integrated into those participants' presumed country credit risk, pushing down sovereign bond yields.

Information Provision

While past literature provides strong evidence for the benefits of SDDS accession, the reason why the benefits are realized remains unclear. More specifically, either the market signaling effect of SDDS subscription or actual improvements in data dissemination practices could explain SDDS accession's benefits. From a policy perspective this distinction is meaningful since the reasons behind SDDS accession's benefits should inform how policymakers engage the institution.

In order to delineate between these two channels I conduct tests of the SDDS's effect on data quality. In these tests I measure how nations' data dissemination performance varies based on whether or not they have acceded to the SDDS. To measure data dissemination performance I look to the IMF's ROSCs for Data Dissemination. These reports are conducted by IMF staff and employ the IMF's Data Quality Assessment Framework (DQAF) in order to "provide … a formal assessment of data quality" (IMF "Seventh Review" 2008, 15). Any IMF member can request an ROSC to be conducted in their nation.

The DQAF assesses six types of data by six quality criteria. The types of data are subdivided by sector into national accounts, consumer price index, producer price index, government finance statistics, monetary statistics and balance of payments statistics. These types of data are then analyzed based on the prerequisites of quality, assurances of integrity, methodological accuracy and reliability, serviceability and accessibility, each of

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that it was available may have reduced investor concerns about these nations access to liquidity in times of crisis.

which include three to five observable provisions. The IMF staff judge each type of data by each provision and determine whether the provision is observed, largely observed, largely not observed, not observed or not applicable.[9] In my analysis I assign numerical values to each observation.[10] Using these numerical values I create an average data quality score for each ROSC. Lower values indicate better data dissemination practices. I conduct this analysis for 52 ROSCs that use the most recent version of the DQAF, which was revised July 2003. This sample represents a vast majority of Data Dissemination ROSCs issued using the 2003 DQAF.

I then use the average ROSC scores to compare the data dissemination practices of nations that have and have not acceded to the SDDS. The average scores for SDDS subscribers and non-subscribers are provided in Tables 2-4. Table 2 places no restrictions on the sample and shows that SDDS subscribers exhibit better data dissemination practices than non-subscribers. Table 3 conducts the same test, but excludes nations that the IMF defines as advanced economies, in order to investigate emerging markets specifically. The results of Table 3 also show that subscribers demonstrate better data practices than non-subscribers. Table 4 again conducts the same test but excludes advanced economies and least developed nations. Even in this sample, which is limited exclusively to emerging markets, the results of the previous tests are supported.

Table 2 – Data Provision Quality, full sample

	SDDS Status when ROSC published	
	Subscribed	Not Subscribed
Sample	22	30
Average data score	1.342	1.678

[9] See Appendix II for a sample ROSC DQAF analysis

[10] I code the variables as follows: Observed = 1; Largely Observed = 2; Largely Not Observed = 3; Not Observed = 4; Not Applicable observations are excluded.

Table 3 – Data Provision Quality, excluding advanced economies

	SDDS Status when ROSC published	
	Subscribed	Not Subscribed
Sample	14	30
Average data score	1.417	1.678

Table 4 – Data Provision Quality, excluding advanced economies and LDCs

	SDDS Status when ROSC published	
	Subscribed	Not Subscribed
Sample	14	24
Average data score	1.417	1.618

These tests suggest that nations benefit from improved data practices after subscribing to the SDDS. However, the use of IMF ROSCs to measure the effects of the SDDS may pose endogeneity issues, since IMF data provision analyses are likely to be consistent with the practices mandated by the SDDS. Nevertheless, the results provide preliminary evidence that SDDS accession improves nations' data practices and does not act only as a market signal.

III. Theory

There is no precedent for the expected relationship between the SDDS and contagion since research on the topic is nearly nonexistent. The relationship is briefly mentioned in the IMF's ten-year review of the DDI. With reference to the market benefits of the SDDS, the authors of the report note, "[t]here is … some evidence that contagion among emerging market countries has been reduced [by SDDS accession] (there has been a secular reduction in the cross correlation among emerging market sovereign spreads)." However, the authors do not provide or cite these results and recognize, "it is not possible to attribute these phenomena directly to … the SDDS" based on the available evidence (Alexander, et al. 2008, 25).

Accordingly, I will construct the theoretical basis for this relationship via a common theme in the contagion and SDDS literatures: information. In the relationship between the SDDS and contagion, information acts as an intervening variable, as the SDDS affects information provision, while access to information affects beliefs-driven contagion. Since the SDDS and contagion's respective relationships to information are well developed in the literature, information can help explain the observed relationship between SDDS accession and contagion.

Causal Diagrams

Established Literature

SDDS Accession → Information Provision | Information Access → Reduced Beliefs Contagion

Theoretical Explanation

SDDS Accession → Information → Reduced Beliefs Contagion

Empirical Tests

SDDS Accession → Reduced Beliefs Contagion

Moreover, information plays a role in all three forms of beliefs-driven contagion. First, contagion caused by incomplete information is intuitively linked to market actors' information access, as previously described in the review of the literature. To recap, research on this form of contagion suggests that increased access to information should reduce investor uncertainty and volatility.

Second, the wake up call hypothesis is also driven by information since initial crisis shocks push investors to gather further information and update their beliefs accordingly. With greater access to information, investors' views of national

fundamentals should be regularly informed by reliable data and thus nations should not face sudden changes in investors' analysis.

The third theory of beliefs-driven contagion, herd behavior, is also linked to the availability of information. While herd behavior helps to explain contagion propagation, the herd's first mover's perception of national linkages and subsequent decision to reduce investment is determined by their imperfectly informed beliefs. Furthermore, access to information about a nation's fundamentals may prevent enough investors from herding before the trend snowballs. As Claessens and Forbes (2004, 8) assert, "herd behavior may not only be an outcome of optimal portfolio diversification, but may also become more common as the fixed cost of gathering and processing country-specific information increases." Accordingly, information access would help to prevent instances of herding.

The type of information that nations are required to release as SDDS subscribers is consistent with the information that helps prevent information contagion. As Kodres and Pritsker (2002, 795) observe, "one … protection against undesired, excessive price movements is a reduction in informational asymmetries through better transparency and more open access to information underlying the value of assets." The SDDS's goal of increased transparency and provision of economic and financial data (a key driver of asset values) parallel the authors' description of useful market information. Kodres and Pritsker also identify types of data that help market participants rationally determine investment positions. The authors suggest, "investors differential access to knowledge about government economic policy" leads to "asymmetric information," which can

contribute to contagion (2002, 794).[11]

Furthermore, the SDDS provides information in a structure that helps to reduce contagion. This distinction is particularly important since "the structure of information [during contagious crises] is crucial" (Chang and Majnoni 2002, 801). More specifically, Kannan and Köhler-Geib (2009, 5) assert, "[g]reater disclosure, insofar as it improves the precision of signals received by investors, has a beneficial effect … but noisier signals, can have harmful implications if [they] increase … the variation of beliefs regarding the true state of the economy." Accordingly, the SDDS's provisions that standardize data dissemination practices and establish consistent publication schedules structure information clearly for investors.

In sum, the SDDS's information provision matches the information required to reduce beliefs-driven contagion. Since theory suggests that all three forms of beliefs-driven contagion should be correlated to information access in the same direction, information provision should have a broad effect on beliefs-driven contagion. Simultaneously, the alignment of investor preferences for information structure, timing and content with the SDDS's information provision structure should deepen the effect.

Hypotheses

1. Subscription to the SDDS should reduce nations domestic volatility.

This hypothesis speaks to the general stabilizing effects of SDDS accession, as supported by past research of the SDDS's effect on other market risk indicators.[12] The hypothesis should hold true for two reasons. First, subscription to the Standard should act

[11] Refer back to Table 1 for details on how SDDS publishing requirements align with market participants' information demands.
[12] Refer to Literature Review section on "The SDDS and Financial Stability"

as a signal to investors and other actors in financial markets that the nation is committed to transparency. As a result, investor confidence in the credibility and integrity of the nation's data will increase and allow investors to make rational choices about their investments in that country. This effect could also be channeled to investors through third-party market actors whose analysis, which internalizes the positive signal of subscription, is used by investors. Second, subscription to the SDDS should increase data availability and thus provide market participants with the information necessary to rationally alter investments without need for sudden, volatile adjustments.

Whether volatility reduction is caused by signaling or improved data dissemination has been addressed in the previous analysis of ROSC scores. However, a more clear differentiation between signaled and real effects is difficult to determine in this test. This distinction, however, is of limited importance to this study's hypotheses. Since this paper aims to investigate the SDDS as an institution through which national policy can be shaped, the outcomes of subscription are more important than the channels through which those outcomes are achieved. Furthermore, the result is likely due to a combination of both factors and to differentiate the weight of each is beyond the scope of this study.

2. Subscription to the SDDS should reduce contagion of volatility and insulate nations from market shocks abroad.

Access to information should reduce the incidence of contagion and accordingly SDDS accession should mitigate contagion. The literature on beliefs-driven contagion centers on how market participants act in times when significant shocks lead investors to doubt the accuracy of their information. Times of crisis are when investors require good

quality information in order to rationally adjust their perceptions of how an event may affect other nations. Investors' ability to compare crisis economies to other economies without concerns of data credibility or accessibility, which are standardized under the SDDS, means that said investors would have less incentive to rely on beliefs.

In particular, some channels of contagion that have their greatest effect during crises should be significantly minimized by information provision. For example, the likelihood of herd behavior should be greatly reduced since common access to information would allow investors to individually analyze nations' risk and not rely on other panic-stricken investors. Similarly, the effect of the wake up call hypothesis should be mitigated since ease of access to and regular publication of data would allow for fundamentals reappraisals to happen more often, not just during times of crisis.

Conjecture: Implementation of the SDDS's provisions may further reduce a nation's susceptibility to contagion relative to the effect of subscription.

This statement is merely a conjecture since past research and theory does not provide enough evidence to suggest that SDDS subscription and implementation have independent effects. However, nations must implement significant reforms to improve their data dissemination practices in order to meet SDDS specifications. While SDDS subscription inevitably leads to implementation, the pace of a newly subscribed nation towards adopting the Standard is unclear. However, once implementation has occurred, remaining investor uncertainty about data quality should be reduced. Full compliance to the SDDS also increases the comparability of national data. Accordingly, investors can investigate the relationship between two nations more easily once nations have implemented the common data structure established by the SDDS.

The marginal benefit of implementation that is suggested by this conjecture also has an important policy implication. While SDDS subscription incurs minimal costs, implementation requires expenditure on institutional improvements. The null hypothesis is that implementation has no marginal benefit over subscription. If the null is confirmed, then policymakers' cost-benefit analysis of implementation vis-à-vis contagion would be affected.

IV. Research Design

In my model I compile a dataset that is composed of 25 emerging markets with data spanning from 1998 to 2009. Of these 25 nations, 20 have acceded to the SDDS. The five that have not subscribed include China, Dominican Republic, Pakistan, Venezuela and Trinidad and Tobago. Among the 20 SDDS nations only five nations subscribed to the SDDS during the sample period, including Brazil, Bulgaria, Russia, Ukraine and Uruguay. As a percent of total daily observations, nations that have not subscribed, subscribed but not implemented and both subscribed and implemented the SDDS represent 23%, 10% and 67%, respectively.

The unit of analysis for the test is country-days, of which there a total of 52,885 observations in the dataset. On average there are 2,114 daily observations for each nation, or 5.8 years' worth, though this varies depending on the country.[13]

Dependent Variable

The starting point of my dependent variable measurement is the definition of contagion that I have assumed. To recap, Kodres and Pritsker (2002, 772) define

[13] See Appendix III for the distribution of daily data by country and SDDS subscription status; see Appendix IV for descriptive information on each nation in the sample, including SDDS subscription details, geographical region and market type.

contagion as "a general price movement in one market resulting from a shock in another market." Given the authors' specification of price movement, my measurement of contagion must be based on the value of a financial instrument.

I have chosen government bonds as the study's financial stability indicator since bond returns are determined by investors' perception of investment risk. Government bonds have been issued and their returns quoted for a significant amount of time, so bond data is readily available. Furthermore, bonds are essential to government operations and are issued and traded regularly. Accordingly, the bond market is highly liquid and bond returns are generally accurate, especially in emerging economies where trading volumes are high.

Alternative measures of country risk that were considered were stock market indices and credit default swap (CDS) rates. These instruments would be legitimate measures of volatility, but this paper only uses bond data to keep the scope tractable.

The metric I have chosen to measure sovereign bond returns is JP Morgan's Emerging Market Bond Index (EMBI). The index is a bond return index, so lower values denote increased risk. The EMBI's "[w]ell-defined liquidity criteria ensure the index provides a fair and replicable benchmark," so there is no need to control for market illiquidity or trading volumes (JP Morgan). Finally, the EMBI has been widely employed in past research on contagion (Kaminsky and Schmukler 2002; Alexander, et al. 2008; Glennester and Shin 2003; Kaminsky, et al. 2003). A restriction of using the EMBI is that my sample is limited to a group of emerging markets that issue bonds and are quoted by the EMBI. However, these emerging markets are of the most interest in my theory and exhibit cross-country, cross-time variation on SDDS membership.

To arrive at the final analysis of my contagion variable there were a series of intermediate steps. First, I transformed the EMBI index into daily percent change values. Then I conducted a regression of these daily changes with a variety of explanatory variable. The regression equation used to test the correlation between nations' bond movements is:

$$\Delta Y_{i,t} = \beta_0 + \beta_1 \Delta Y_{i,t-1} + \beta_2 \Delta Y_{j,t-1} + \theta X_{i,t} + W_t + C_i + \varepsilon_{i,t}$$

The designations of the variables in the equation are as follows: $\Delta Y_{i,t}$ is the daily percentage change in the EMBI index (from day t-1 to day t) for country *i*; $\Delta Y_{i,t-1}$ is the previous day's percent change in the EMBI index (from day t-2 to t-1) for country *i*, to control for any degree of correlation in changes over time within that country; $\Delta Y_{j,t-1}$ is the previous day's (from day t-2 to t-1) percent change in the EMBI index for all other countries reported by JP Morgan in this category[14], averaged over all those countries, weighted by their level of bilateral trade with country *i* in the year of day *t*[15]; $X_{i,t}$ is a vector of control variables that measure country i's fundamentals and observable credit rating developments, and θ are those variables' coefficients; W_t is a week-specific fixed effect; $C_{i,j,k}$ is a country-specific fixed effect; and $\varepsilon_{i,j,t}$ is the error term.

I assume that $\varepsilon_{i,t}$ exhibits observation-specific variance, $\sigma^2_{i,t}$, where increased variance suggests higher levels of deviation between actual and predicted EMBI

[14] The sample includes daily EMBI data for 44 countries. Other than the 25 nations in the SDDS sample, these nations include Belarus, Belize, Cote d'Ivoire, Egypt, El Salvador, Gabon, Georgia, Ghana, Iraq, Jamaica, Kazakhstan, Lebanon, Lithuania, Panama, Peru, the Philippines, Serbia, Sri Lanka and Vietnam.

[15] I have chosen to focus only on the trade channel of contagion for my main analysis. Modeling all channels of contagion at once is not feasible due to issues of multicollinearity in this type of analysis. $\Delta Y_{j,t-1}$, calculated by averages weighted by trade, creditor or export portfolio similarity, are all correlated at 0.75 or higher. See Control Variables section for further discussion.

percentage movements in i. $\sigma^2_{i,j,t}$ thus represents observation-specific volatility, which is my measure of contagion in this study.

To investigate the effect of SDDS subscription and implementation on contagion, I use heteroskedastic regression to test how these independent variables affect the standard error variance of a nation's bond movements, or contagion. To test this relationship I use the following equation:

$$\sigma^2_{i,t} = \gamma_0 + \gamma_1\pi_{k,t-1} + \gamma_2 SDDSS_{i,t-1} + SDDSS_{i,t-1}*\pi_{k,t-1} + \gamma_3 SDDSI_{i,t-1} + SDDSI_{i,t-1}*\pi_{k,t-1} + \eta\delta_{i,t} + W_t + C_{i,k}$$

The designations of the variables in the equation are as follows: $\pi_{k,t-1}$ is the trade-weighted average of the absolute value of return movements for all partners with a one day lag; $SDDSS_{i,t-1}$ and $SDDSI_{i,t-1}$ are dummy variables that indicate whether i has subscribed to and implemented the SDDS, respectively; $SDDSS_{i,t-1}*\pi_{k,t-1}$ and $SDDSI_{i,t-1}*\pi_{k,t-1}$ are the interaction terms between the two SDDS variables and trade-weighted bond change variable; and $\delta_{i,t}$ is a vector of control variables that measures country i's fundamentals and η are those variables' coefficients.

Independent Variables

The two independent variables in my test are $SDDSS_{i,t-1}$ and $SDDSI_{i,t-1}$. The tables below summarize the values of the independent variables in the test sample.

Table 5
Subscribed v. Implemented (% by column)

	Implemented SDDS		
Subscribed to SDDS	0	1	Total
0	12,391 (70.69%)	0 (0.00%)	12,391 (23.44%)
1	5,138 (29.31%)	35,326 (100.00%)	40,464 (76.56%)
Total	17,529 (100.00%)	35,326 (100.00%)	52,855 (100.00%)

Table 6
Subscribed v. Implemented (% by row)

	Implemented SDDS		
Subscribed to SDDS	0	1	Total
0	12,391 (100.00%)	0 (0.00%)	12,391 (100.00%)
1	5,138 (12.70%)	35,326 (87.30%)	40,464 (100.00%)
Total	17,529 (33.16%)	35,326 (66.84%)	52,855 (100.00%)

Table 7
Subscribed v. Implemented (% of total observations)

	Implemented SDDS		
Subscribed to SDDS	0	1	Total
0	12,391 (23.44%)	0 (0.00%)	12,391 (23.44%)
1	5,138 (9.72%)	35,326 (66.84%)	40,464 (76.56%)
Total	17,529 (33.16%)	35,326 (66.84%)	52,855 (100.00%)

The cross-tabulation of the two independent variables yield informative results. First, the tables show that in 66.84% of country-day observations nations had both

subscribed to and implemented the SDDS. Nevertheless, the 17,529 instances where nations have not satisfied both conditions are sufficient to provide the necessary variation in the data for testing.

The tabulation also reveals that members had not implemented the Standard in only 12.70% of subscriber observations and 9.72% of total observations. These statistics point to nations' commitment to implement the SDDS once they have subscribed. Accordingly, investors can be quite sure that nations will move quickly to implementation of the Standard after subscribing.

Finally, the significant number of observations (23.44% of total observations) of both non-subscription and non-implementation is consistent with the composition of the sample. When the SDDS was announced, the majority of nations to first implement the Standard were advanced nations, presumably because their data provision institutions were already well developed. Since this model's sample exclusively draws from emerging market SDDS participants, the lag time between the SDDS's creation and subscription should be expected. Also, the five countries in the sample that are not SDDS subscribers significantly contribute to the amount of not subscribed observations.

Control Variables

Control variables in this study play a crucial role, as endogeneity issues are a significant concern. Since my investigation specifically addresses beliefs-driven contagion, many variables must be employed in order to control for fundamentals-driven channels of contagion. Furthermore, since my contagion variable is derived from bond indices, the many factors that can affect bond returns must be considered. Finally, general volatility trends in international bond markets and national economies must be addressed.

Accordingly, the study implements controls for national fundamentals, channels of contagion and fixed effects.

Fundamentals

In both the initial and heteroskedastic regressions a variety of controls for fundamentals are used. These variables are included to control for the effect that shifts in national fundamentals can have on bond returns, market volatility and fundamentals-driven contagion. In the initial regression I include controls for political, economic, monetary, fiscal and financial factors that are prominent in the contagion literature.

In order to control for the effects of political risk I include data from the Polity IVd database, which records when changes occur in nations' level of democracy. In the model, I include variables that identify whether a nation's polity score has changed in t-1 (d_pol1) and t-30 days (d_pol30).[16] [17]

On the economic and financial front, I control for changes in foreign currency reserves (d_respct)[18] and nations' real effective exchange rate index (d_REER)[19] on a monthly basis and GDP growth rate (growth)[20] on a yearly basis. Furthermore, I control for credit rating changes by the two most prominent rating agencies, Standard & Poor's and Moody's. For both rating agencies I include a variable that tests whether rating

[16] Center for Systemic Peace 2009
[17] Other political risk data was collected using the EIU's Overall Risk Ratings and the International Country Risk Guide's (ICRG) political risk ratings, but was ultimately not used in the analysis. Preliminary use of the data yielded a statistical significance to $\Delta Y_{i,t}$ of 0.609 and 0.189 for the EIU and ICRG scores, respectively.
[18] IMF IFS 2011
[19] IMF IFS 2011; EIU 2011
[20] IMF WEO 2011

changes have occurred in t-1 days (d_SP, d_M) and t-7 days (d_SPl7; d_Ml7). I also control for rating outlook changes for Standard & Poor's (SPlook).[21]

In the heteroskedastic regression I also control for metrics that have global market impacts, in addition to economic and financial variables. In terms of metrics that have a widespread effect on bond prices, I have included t-1 changes in the 3-month US Treasury bill rate (motbillrate)[22] and the price of oil (oilbrnp)[23] as controls. Furthermore, I control for nominal GDP (lngdp) and nominal per capita GDP (lnpc).[24] Finally, I control for the same growth variable as in the initial regression and also for Polity IVd scores (polity), but as actual scores as opposed to score changes.

Channels of Contagion

During preliminary testing I considered three different channels of contagion variables to include in the model: bilateral trade (TR), export similarity (XS) and exposure to common creditors (CR). However, preliminary analysis showed strong correlations between the three variables. Furthermore, when the initial regression was run with a combination of more than one of the variables, no more than one had a statistically significant effect on movements in national bond returns ($\Delta Y_{i,t}$ - Dbondpct). These results are shown in the two tables below.

Table 8 – XS-TR-CR Correlation

	XS	TR	CR
XS	1.0000	-	-
TR	0.7542	1.0000	-
CR	0.9831	0.7840	1.0000

[21] Standard & Poor's 2010; Moody's Investors Service 2010
[22] Financial Times 2011
[23] ibid
[24] IMF WEO 2011

Table 9 – Preliminary Regression Tests

Regression Including:	Regression Components	P>|t|
XS	XS	0.000
TR	TR	0.001
CR	CR	0.000
XS-TR	XS	0.831
	TR	0.001
XS-CR	XS	0.356
	CR	0.877
TR-CR	TR	0.723
	CR	0.000
XS-TR-CR	XS	0.369
	TR	0.868
	CR	0.928

As a result, only the bilateral trade variable was included in the final test. The variable was generated using one observation of bilateral trade data per month per ordered pair for all country pairings. This data was then used to create a trade-weighted average of bond return movements values in order to create the bilateral trade channel of contagion variable: $\Delta Y_{j,t-1}$ (AVGtr_Dbonpct).

Fixed Effects

Fixed effects that are week-specific (W_t) and country-specific ($C_{i,k}$) were also created for use in both the initial and heteroskedastic regressions. The purpose of these variables is to control for general market trends over time and at the national level.

The effects of these variables were then examined by performing Wald tests on the week and country parameters for the model. As the summarized findings in Table 10 show, both W_t and $C_{i,k}$ significantly affect the regression results.

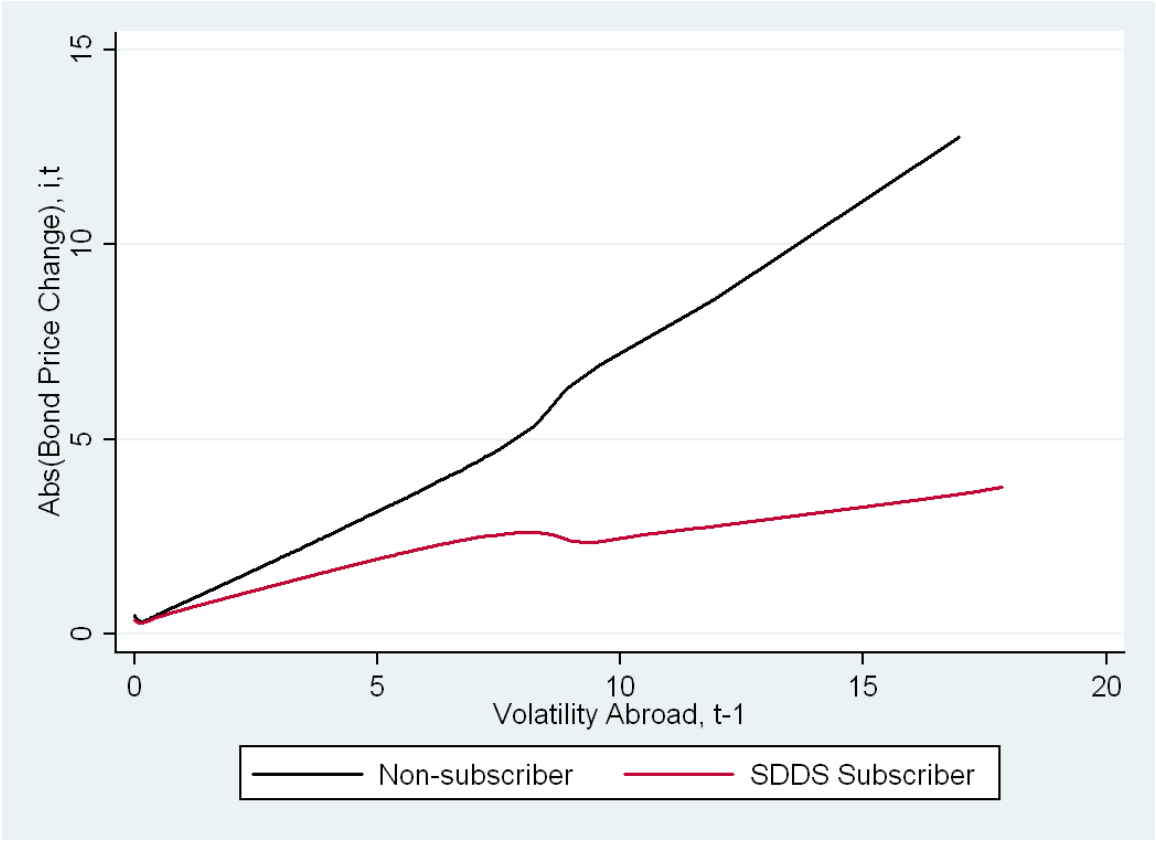
Table 10 – Fixed Effects Wald Tests

	Fixed Effects			
	Week Specific		Country Specific	
	Initial Regression Model	Standard Variance Model	Initial Regression Model	Standard Variance Model
Sample Size	300	300	26	26
Chi-squared	1275.96	3918.10	191.11	1908.64
Prob > chi-squared	0.0000	0.0000	0.0000	0.0000

V. Results

The results of the tests provide strong evidence in support of the paper's hypotheses. Chart 5 below offers a general illustration of the relationship found in the results. The chart shows the relationship between volatility abroad lagged by one day and domestic volatility. LOWESS fit lines are used to represent the relationship and are generated for both SDDS subscribers and non-subscribers. The positive relationship suggests that as volatility abroad increases domestic volatility also increases, which points to the influence of contagion. The fact that the SDDS subscriber LOWESS fit line is less steep than the line for non-subscribers suggests that contagion affects the former less than the latter. The greater distance between the lines at higher levels of foreign volatility suggests that SDDS subscribers are significantly insulated from contagion of volatility, which provides initial confirmation of my second hypothesis.

Chart 5 – LOWESS Fit Lines



The findings of the interval and heteroskedastic regressions reflect the results of the descriptive statistics in Chart 5 and confirm my two hypotheses and one conjecture. The results of the regression are presented in Table 11.

Table 11 – Regression Results[25]

Interval regression — Number of observations = 52855
Wald chi2(336) = 2057.59
Log pseudolikelihood = -39762.2 — Prob > chi2 = 0.0000

model	Coefficient	Robust Standard Error	z score	P >|z|	[95% Confidence	Interval]
Dbondpctl1	0.0149714	0.0137163	1.09	0.275	-0.0119121	0.0418548
AVGtr_Dbon~t	0.0654694	0.0068775	9.52	0.000	0.0519898	0.0789490
d_pol1	0.0650933	0.0327557	1.99	0.047	0.0008932	0.1292933
d_pol30	0.001639	0.0062633	0.26	0.794	-0.0106368	0.0139148
d_respct	-0.0050716	0.0021361	-2.37	0.018	-0.0092582	-0.0008849
d_REER	0.0038049	0.0008986	4.23	0.000	0.0020437	0.0055662
d_SP	-0.1474278	0.0376173	-3.92	0.000	-0.2211564	-0.0736992
d_SPl7	-0.0226291	0.0165669	-1.37	0.172	-0.0550995	0.0098414
d_SPlook	-0.1522609	0.0500003	-3.05	0.002	-0.2502596	-0.0542622
d_M	-0.2322224	0.058616	-3.96	0.000	-0.3471076	-0.1173372
d_Ml7	-0.014007	0.0228487	-0.61	0.540	-0.0587896	0.0307757
growth	-0.0007127	0.0006716	-1.06	0.289	-0.0020290	0.0006036
_cons	0.2780726	0.8464955	0.33	0.743	-1.3810280	1.9371730
lnsigma	Coefficient	Robust Standard Error	z score	P >|z|	[95% Confidence	Interval]
absDbond	0.2241122	0.0282061	7.95	0.000	0.1688293	0.2793951
SDDSsub	-0.1311975	0.053726	-2.44	0.015	-0.2364986	-0.0258965
x2	-0.1010091	0.0333807	-3.03	0.002	-0.1664340	-0.0355841
SDDSmet	-0.2431035	0.0416394	-5.84	0.000	-0.3247152	-0.1614919
x4	-0.0298531	0.0292322	-1.02	0.307	-0.0871471	0.0274409
lnpc	0.385704	0.285803	1.35	0.177	-0.1744595	0.9458675
lngdp	0.2474854	0.2876046	0.86	0.390	-0.3162093	0.8111801
polity	-0.0509459	0.0053471	-9.53	0.000	-0.0614260	-0.0404659
SPrating	0.0962421	0.0048217	19.96	0.000	0.0867917	0.1056926
motbillrate	-0.0212215	0.0070174	-3.02	0.002	-0.0349754	-0.0074676
oilbrnp	-0.0061433	0.0006549	-9.38	0.000	-0.0074270	-0.0048597
growth	-0.0517863	-0.0019005	27.25	0.000	-0.0555112	-0.0480614
_cons	-8.283554	4.278716	-1.94	0.053	-16.6696800	0.1025752

First, the results show that SDDS subscription has a statistically significant effect on the standard variance measurement of contagion, $\sigma^2_{i,t}$. The results show that SDDS subscription significantly reduces a nation's volatility and susceptibility to contagion.

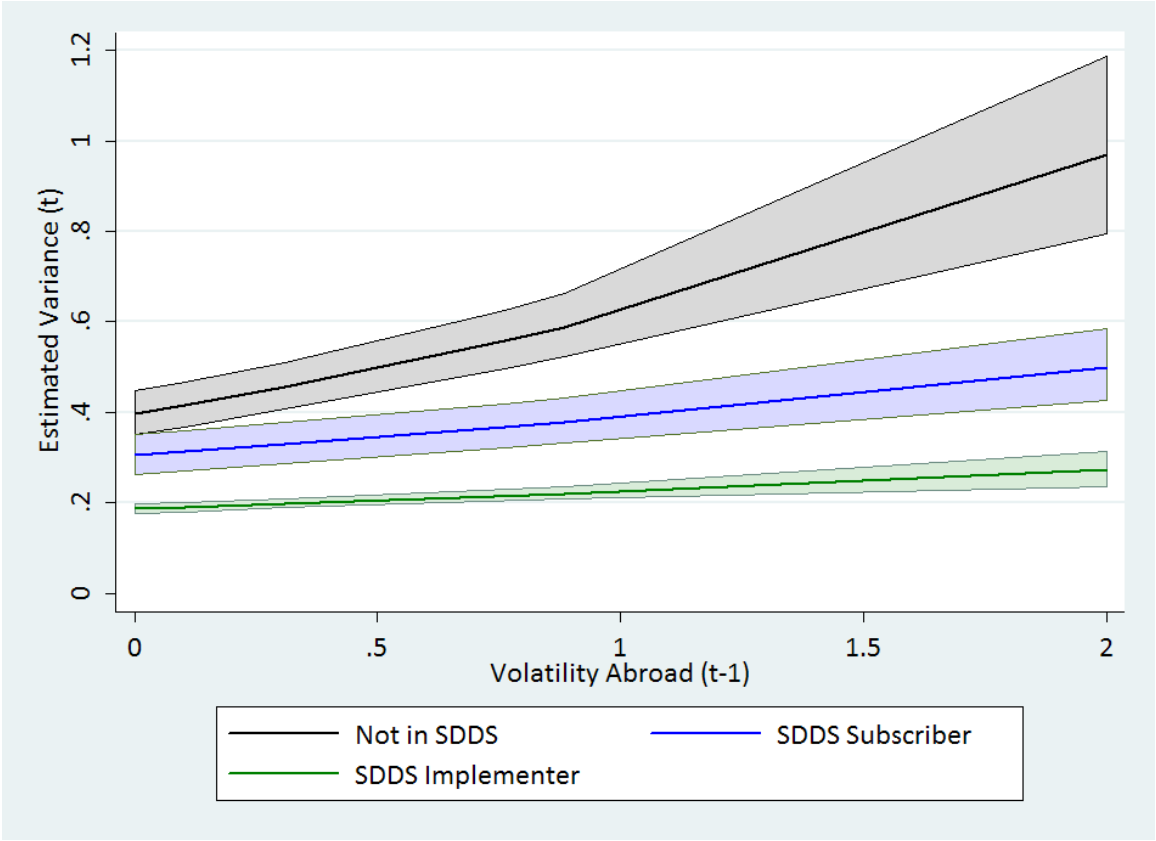
[25] Country- and week-specific fixed effects were also included as controls in the regression, but are omitted above due to space limitations

Furthermore, the tests show that the subscription interaction term, $SDDSS_{i,t-1}*\pi_{k,t-1}$ (x2), is statistically significant and leads to further reduction in contagion for subscribers as volatility abroad increases. Accordingly, the results suggest that SDDS subscription not only has an initial reduction effect on volatility but also insulates nations from contagion during times of high volatility abroad.

Second, the results demonstrate that SDDS implementation has a statistically significant effect on contagion, independent of subscription's effect. In fact, the effect of SDDS implementation reduces nations' volatility by nearly twice as much as SDDS subscription. Unlike SDDS subscription, however, the SDDS implementation interaction term, $SDDSI_{i,t-1}*\pi_{k,t-1}$ (x4) is not statistically significantly at a 0.05 interval and only insulates nations from contagion to a limited degree. Nevertheless, contagion reduction as a result of SDDS implementation is a strong result and confirms this paper's conjecture.

The results of the regression are represented graphically in Chart 6. The chart shows SDDS accession's effect on reduced volatility through a progressive downward shift in the line from SDDS non-subscribers to SDDS subscribers to SDDS implementers. Furthermore, the divergence of the SDDS non-subscribers line from the two SDDS lines demonstrates the insulating effects of accession.

Chart 6 – Contagion Trends by SDDS Status



Given the strong contagion insulation effects of SDDS accession in times of high volatility abroad, it is prudent to see if the results hold true when high levels of volatility are excluded from the test. Accordingly, the tests were rerun without values of $\pi_{k,t-1}$ above 5. The results of this test are shown in Table 12 and confirm that both the domestic volatility reduction and contagion insulation effects are retained even without the inclusion of volatility outliers.

Table 12 - Regression excluding $Y_{j,t-1} > 5$

Interval regression — Number of obs = 52737
Wald chi2(336) = 2049.18
Log pseudolikelihood = -39477.568 — Prob > chi2 = 0.0000

model	Coefficient	Robust Std. Err.	z score	P>|z|	[95% Conf.	Interval]
Dbondpctl1	0.0151362	0.0138141	1.10	0.273	-0.011939	0.0422113
AVGtr_Dbon	0.0677031	0.0070792	9.56	0.000	0.0538281	0.0815781
d_pol1	0.0643704	0.0332735	1.93	0.053	-0.0008444	0.1295853
d_pol30	0.0015593	0.0062937	0.25	0.804	-0.0107762	0.0138948
d_respct	-0.0050490	0.0021358	-2.36	0.018	-0.0092351	-0.000863
d_REER	0.0037944	0.0008984	4.22	0.000	0.0020336	0.0055553
d_SP	-0.1476061	0.0375747	-3.93	0.000	-0.2212511	-0.0739611
d_SPl7	-0.0225132	0.0165591	-1.36	0.174	-0.0549685	0.0099422
d_SPlook	-0.1523744	0.0499618	-3.05	0.002	-0.2502976	-0.0544511
d_M	-0.2327383	0.0585778	-3.97	0.000	-0.3475485	-0.117928
d_Ml7	-0.0137160	0.0228507	-0.60	0.548	-0.0585026	0.0310705
growth	-0.0007083	0.0006713	-1.06	0.291	-0.0020239	0.0006074
_cons	0.2948293	0.1827806	1.61	0.107	-0.0634141	0.6530728
lnsigma	Coefficient	Robust Std. Err.	zscore	P>|z|	[95% Conf.	Interval]
absDbond	0.2571922	0.0301559	8.53	0.000	0.1980877	0.3162967
SDDSsub	-0.1321285	0.0559297	-2.36	0.018	-0.2417486	-0.0225083
x2	-0.1020647	0.0403329	-2.53	0.011	-0.1811156	-0.0230138
SDDSmet	-0.2285686	0.0442065	-5.17	0.000	-0.3152116	-0.1419255
x4	-0.0531715	0.0365040	-1.46	0.145	-0.1247182	0.0183751
lnpc	0.3837640	0.2870451	1.34	0.181	-0.1788340	0.9463621
lngdp	0.2460614	0.2887671	0.85	0.394	-0.3199118	0.8120346
polity	-0.0504551	0.0054358	-9.28	0.000	-0.0611090	-0.0398011
SPrating	0.0963158	0.0048271	19.95	0.000	0.0868548	0.1057768
motbillrate	-0.0214827	0.0070287	-3.06	0.002	-0.0352587	-0.0077067
oilbrnp	-0.0060757	0.0006567	-9.25	0.000	-0.0073627	-0.0047886
growth	-0.0515705	0.0019019	-27.12	0.000	-0.0552982	-0.0478429
_cons	-10.7120800	6.1810230	-1.73	0.083	-22.8266600	1.4025030

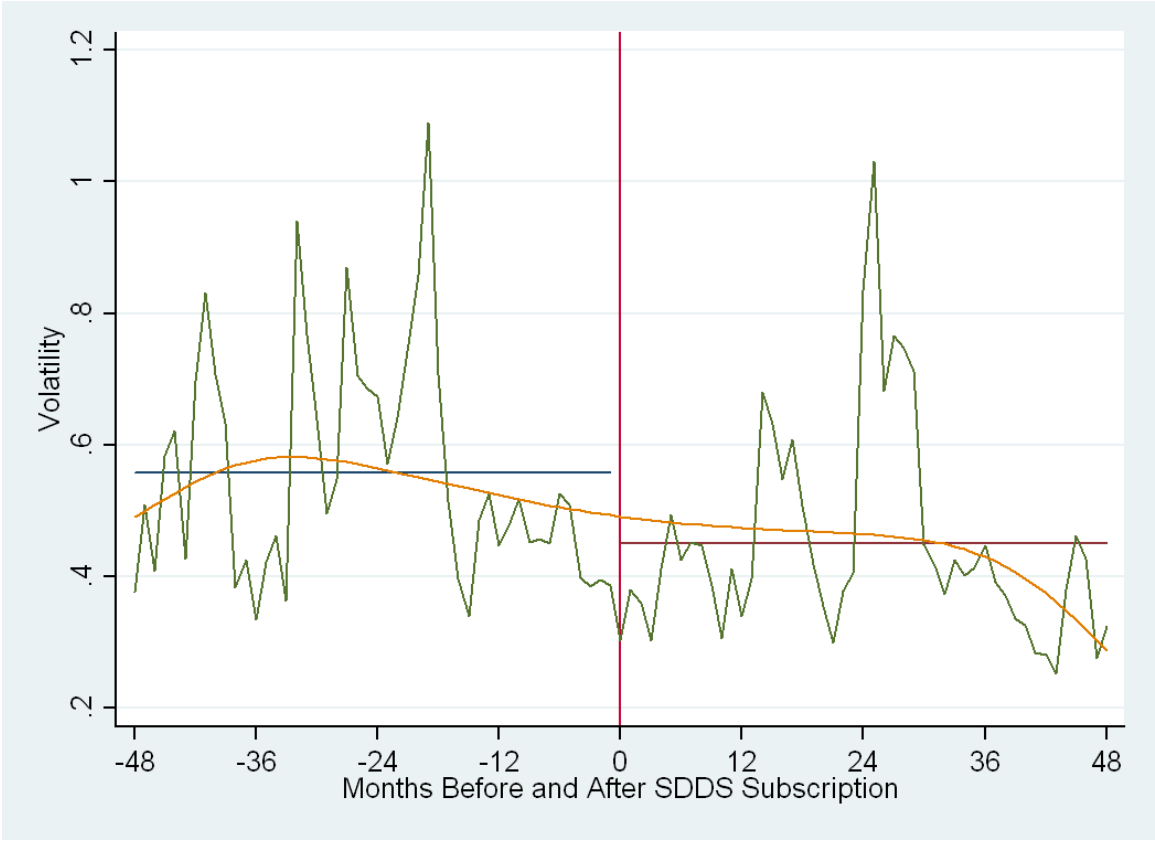
Finally, I conducted tests to reduce concerns about endogeneity bias in the study. Endogeneity would affect the study if nations made decisions about accession relative to trends in financial volatility. For example, if nations tended to implement reforms during periods of good financial performance and low volatility, then the relationship between

accession and contagion would be weakened. However, a variety of factors help allay endogeneity concerns.

Past research suggests that nations do not time SDDS accession with financial performance. Gelos and Wei (2005, 3006) "assess whether the decision to [subscribe] can be partly explained by a previous increase in investment in [a] country [and] find that this is not the case."

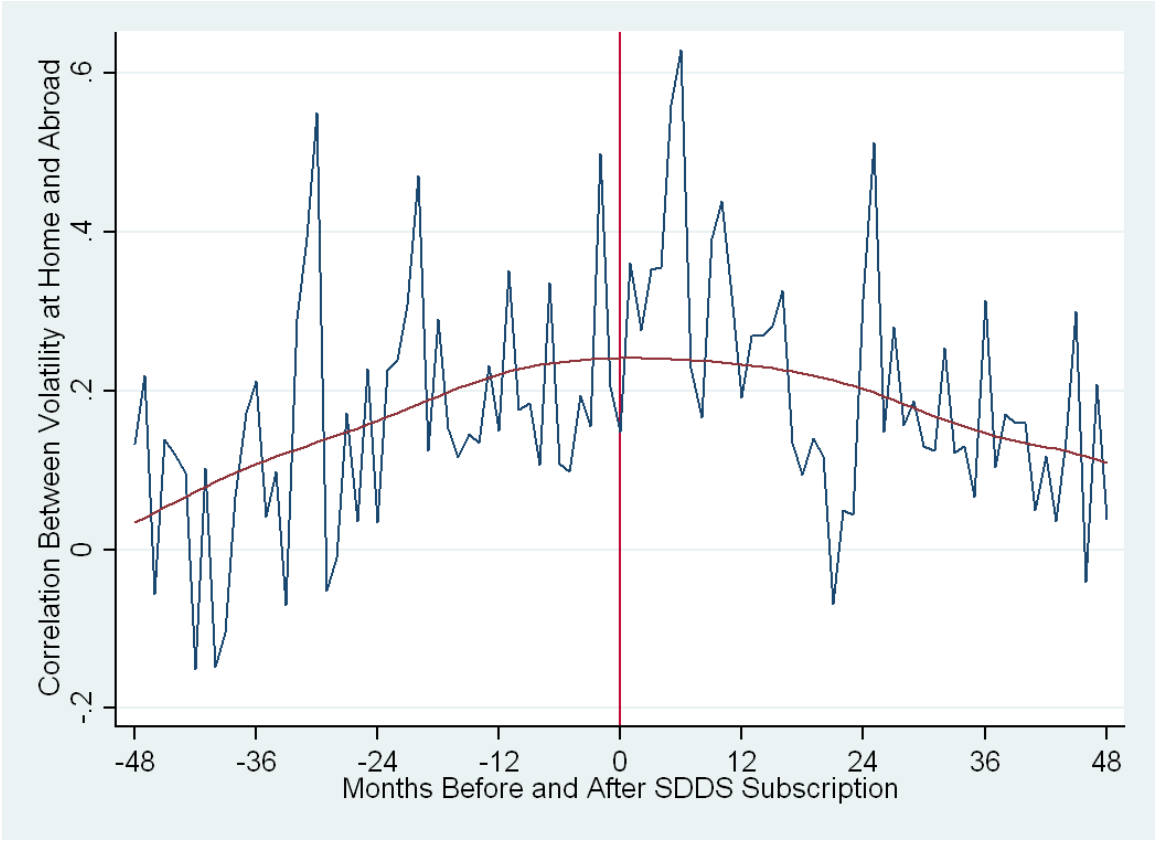
I find the same results when investigating accession timing relative to volatility using this paper's sample. In the first test I investigate the relationship between a nation's subscription date and domestic volatility. The volatility results are determined by taking the monthly average of each country's absolute bond price change and then averaging together the results from the 22 countries in the sample. The test has a 96 month, or eight year, sample period, four years before and after the subscription date. The results of this plot are shown in Chart 7. The results not only show a reduction in volatility after subscription but also show that subscription does not occur during a period of significantly high or low volatility.

Chart 7 – Domestic Volatility Relative to Accession



The second test of accession timing speaks more directly to endogeneity in this study. In this test I investigated the relationship between SDDS subscription and the correlation between domestic and foreign volatility, a measure of contagion. The correlations are calculated by correlating country i's volatility changes with the weighted average of country j's daily changes. The findings are presented in Chart 8 and draw from the same sample as in Chart 7. The results show that contagion levels are not low at the time of subscription, but in fact rise prior to the subscription date. The graph also strongly supports the results of the regression analysis since contagion of volatility clearly declines after SDDS accession.

Chart 8 – Contagion Relative to Subscription



These tests show limited endogeneity bias in the study and thus affirm both the relationship between SDDS accession and contagion, and the causal direction of the relationship.

VI. Conclusion

This study provides the first quantitative analysis of the effect of SDDS accession on contagion and thus offers a significant contribution to both the SDDS and contagion literatures. The robust results of the study's regression analyses confirm the hypotheses that were derived from analysis of past research on the role of information in contagion scenarios. The study's results speak to the SDDS's effect not only on sovereign bond return volatility but also on insulation to contagion from abroad. Furthermore, the results

confirm my conjecture on the marginal benefit of SDDS implementation relative to subscription.

From a policy perspective the paper's results demonstrate how governments' institutional engagement can mitigate contagion through standardized information provision. Accordingly, the study helps to bridge the gap between the extensive literature on information's effect on contagion and practical policy recommendations. This is particularly important since the study's sample selection targets emerging markets, which have been historically affected by high market volatility and contagion. Additionally, the study's focus on beliefs-driven contagion is particularly useful since domestic policy action has little effect on crises that are driven by imperfectly informed investors.

The results also have important implications for the IMF staff who work to strengthen the SDDS as an institution. The anecdotal connection between the SDDS and contagion that is alluded to in IMF analyses of the Standard can now be developed further and could be used to advocate accession. Since the SDDS was created in the wake of a spate of contagious crises, the Standard's effect on the phenomenon may prove particularly useful to IMF staff and national policymakers.

With that said, the results of the study only offer preliminary insight into the relationship between the SDDS and contagion. Consequently, further research on the topic would be beneficial. First, alternate tests of my hypotheses and replication of the results would add strength to the conclusions of this study. Testing my hypotheses on a different set of countries (e.g. advanced economies) would shed light on the generalizability of my results.

Second, more nuanced analysis of the broad theoretical assumptions of this paper could yield interesting results. In particular, research that distinguishes the SDDS's role as a signaling mechanism from its impact on improved data quality and accessibility could help inform the way that market participants and policymakers engage the institution. Additionally, such analysis may help IMF staff identify how the Standard could be improved. More specifically, further analysis of whether variation in Standard adherence affects contagion would be informative. A more detailed investigation of how Data Dissemination ROSCs affect contagion could be an avenue for potential research. Such research could build off of the preliminary analysis of ROSCs in this study to determine how consistent standard adherence affects markets. Alternatively, analysis of non-standardized data dissemination practices could provide insight into the SDDS's signaling benefits. Further research could isolate the signaling benefit of adopting international institution's data practices by comparing nations with similar data dissemination practices but different SDDS subscription statuses.

Third, research on the effect of the SDDS vis-à-vis fundamentals-driven contagion would significantly advance literature on the topic. This analysis would be useful since recent contagion literature suggests that information provision during fundamentals-driven crises could exacerbate the phenomenon.[26] Confirmation or denial of this conclusion with specific reference to the effect of the SDDS would allow policymakers to conduct a more complete cost-benefit analysis of accession.

Fourth, further research on the politics of the SDDS as an institution would help to contextualize this study. Investigation of this topic would yield additional insight into

[26] See Kannan and Köhler-Geib, 2009

why the SDDS was created and how the 1990s crises informed specific aspects of the SDDS. This analysis of the SDDS's purpose could also shed light on the institution's sustainability. A majority of SDDS subscription occurred early in the institution's life and further research could track if and, if so, how the role and effectiveness of the SDDS has changed over time.

Fifth, analysis of nations' motivations to join would provide insight into the factors that affect policymakers' view of the institution. Specifically, an investigation of how nations' domestic macroeconomic and political arrangements affect the decision to accede would be interesting. For example, investigating how different currency regimes affect nations' willingness to accede to international transparency agreements could yield informative results. Preliminary evidence suggests that nations with pegged currency regimes less readily accede to the SDDS. Using a compiled list of emerging market nations from various sources, I identified 14 emerging market nations who were not party to the SDDS. Among these nations, ten maintained pegged exchange rates and four maintained managed floats.[27] Testing this relationship further may provide valuable insights into how national arrangements affect cooperation with the institution.

Sixth, investigating domestic institutions' relation to the SDDS would provide insight into its effects on national economies. In particular, additional research could test whether SDDS subscription has spillover effects on national fundamentals. The findings of such an investigation could help to differentiate between the signaling effects of the SDDS and actual economic impacts. Furthermore, analysis of how standardized information provision affects firm behavior would be useful. Such effects may be

[27] Pegged: Bahrain, China, Iran, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, UAE and Vietnam; Managed float: Bangladesh, Mauritius, Nigeria, Sri Lanka

observed in real sector firms' approach to risk hedging activities. Theoretically, greater confidence in information and reduced volatility could decrease firms need to spend capital on hedging activities and allocate more capital to improving performance. This approach would be especially useful since previous literature on the SDDS rarely addresses the domestic effects of the institution.

Finally, this study's results point to the need for further research on how factors other than SDDS subscription affect contagion. Specifically, the regression results of this study show that the correlation between nations' Polity IVd scores and contagion is statistically significant.[28] The results seem to indicate that higher scores, which correspond to higher levels of democracy, reduce contagion of volatility. While these findings are not directly related to the topic at hand, further testing of these preliminary results would be an interesting political approach to contagion analysis.

Overall, the results of this paper confirm the benefits of SDDS accession in relation to contagion mitigation. Nevertheless, further research into the theoretical and empirical implications of this study would provide additional insight on the topic.

[28] Refer to results for control variable "polity" in Table 11

VII. Appendices

Appendix I – Sample SDDS Analysis

The following sample is taken from a Data Dissemination Report on Standards and Codes (ROSC) for Indonesia in July 2005 (IMF 2005). The sample shows the ROSC teams analysis measured against SDDS provisions.

Indonesia: Overview of Current Practices Regarding Coverage, Periodicity, and Timeliness of Macroeconomic Data Compared to the Special Data Dissemination Standard (SDDS)

D=daily; W=weekly; M=monthly; Q=quarterly; A=annual; NA= not applicable; NLT= no later than

SDDS Data Category	Coverage (Meets SDDS)	Periodicity		Timeliness		Comments
		SDDS	Indonesia	SDDS	Indonesia	
Real Sector						
National accounts	Yes	Q	Q	1Q	Q	
Production index	Yes	M	M	6W	6W	
Employment	Yes	Q	A	1Q	NLT 6M	See Footnote 1.
Unemployment	Yes	Q	A	1Q	NLT 6M	See Footnote 1.
Wages/Earnings	Yes	Q	Q	1Q	15W	See Footnote 2.
Price index: Consumer prices	Yes	M	M	1M	3D	
Price index: Producer prices	Yes	M	M	1M	1M	
Fiscal Sector						
General government or public sector operations	Yes	A	A	2Q	9M	See Footnote 3.
Central government operations	Yes	M	M	1M	1M	
Central government debt	Yes	Q	Q	1Q	NLT 1Q	
Financial Sector						
Analytical accounts of the banking sector	Yes	M	M	1M	NLT 4W	
Analytical accounts of the central bank	Yes	M	W	2W	2W	
Interest rates	Yes	D	D	NA	1W	
Stock market: Share price index	Yes	D	D	NA	D	
External Sector						
Balance of payments	Yes	Q	Q	1Q	3M	
International reserves and foreign currency liquidity (Foreign assets of Bank Indonesia)	Yes	M (W recomm ended)	W for official reserves. M for reserves template	1W for official reserves 1M for the reserves template	NLT 5WD for official reserves. NLT 1M for reserves template	
Merchandise trade	Yes	M	M	8W	NLT 1M	
International Investment Position	Yes	A	A	3Q	9M	See Footnote 4.
External debt	Yes	Q	Q	1Q	NLT 3M	
Exchange rates	Yes	D	D	NA	D	
Socio-demographic data						
Population	Yes	A	A	NA	NLT mid-year	

1/ Indonesia is taking flexibility options for the periodicity and timeliness of employment and unemployment data.
2/ Indonesia is taking a flexibility option for the timeliness of the wages and earnings data.
3/ A flexibility option is being taken for the timeliness of the data on general government operations.
4/ Indonesia makes use of the option to publish the IIP with a time lag of nine months while publishing external debt figures on a quarterly basis.

Appendix II – Sample ROSC DQAF Analysis

The following sample is taken from a Data Dissemination Report on Standards and Codes (ROSC) for Turkey in September 2009 (IMF 2009).

Table 1. Turkey: Data Quality Assessment Framework—Summary Results

Key to symbols: O = Practice Observed; LO = Practice Largely Observed; LNO =Practice Largely Not Observed; NO = Practice Not Observed; NA = Not Applicable

Dimensions/Elements / **Datasets**	National Accounts	Consumer Price Index	Producer Price Index	Government Finance Statistics	Balance of Payments	Monetary Statistics
0. Prerequisites of quality						
0.1 Legal and institutional environment	O	O	O	O	O	O
0.2 Resources	O	O	O	O	O	O
0.3 Relevance	O	O	O	O	O	O
0.4 Other quality management	O	O	O	O	O	O
1. Assurances of integrity						
1.1 Professionalism	O	O	O	O	O	O
1.2 Transparency	O	O	O	O	O	O
1.3 Ethical standards	O	O	O	O	O	O
2. Methodological soundness						
2.1 Concepts and definitions	O	O	LO	O	O	O
2.2 Scope	LO	LO	LO	LO	O	O
2.3 Classification/sectorization	O	O	O	O	O	LO
2.4 Basis for recording	O	LO	O	O	LO	O
3. Accuracy and reliability						
3.1 Source data	LO	O	O	O	O	O
3.2 Assessment of source data	O	O	O	O	O	O
3.3 Statistical techniques	LO	O	O	LO	O	O
3.4 Assessment and validation of intermediate data and statistical outputs	O	O	O	O	O	O
3.5 Revision studies	LO	O	O	LO	O	O
4. Serviceability						
4.1 Periodicity and timeliness	O	O	O	O	O	LO
4.2 Consistency	O	O	O	LO	LO	LO
4.3 Revision policy and practice	O	O	O	LO	O	O
5. Accessibility						
5.1 Data accessibility	LO	O	O	LO	O	O
5.2 Metadata accessibility	O	O	O	LO	O	O
5.3 Assistance to users	O	O	O	O	O	O

Practice observed: current practices generally in observance meet or achieve the objectives of DQAF internationally accepted statistical practices without any significant deficiencies. **Practice largely observed:** some departures, but these are not seen as sufficient to raise doubts about the authorities' ability to observe the DQAF practices. **Practice largely not observed:** significant departures and the authorities will need to take significant action to achieve observance. **Practice not observed:** most DQAF practices are not met. **Not applicable:** used only exceptionally when statistical practices do not apply to a country's circumstances.

Appendix III – Country-Day Observations

	SDDS Subscriber?		
Country name	No	Yes	Total
Argentina	0	2,487	2,487
Brazil	649	1,838	2,487
Bulgaria	1,048	1,271	2,319
Chile	0	2,211	2,211
China	2,487	0	2,487
Colombia	0	2,487	2,487
Croatia	0	2,487	2,487
Dominican Republic	1,687	0	1,687
Ecuador	0	1,967	1,967
Hungary	0	2,245	2,245
Indonesia	0	1,167	1,167
Malaysia	0	2,487	2,487
Mexico	0	2,487	2,487
Pakistan	1,461	0	1,461
Peru	0	2,487	2,487
Philippines	0	2,487	2,487
Poland	0	2,487	2,487
Russia	1,460	1,027	2,487
South Africa	0	2,087	2,087
Trinidad and Tobago	539	0	539
Tunisia	0	1,583	1,583
Turkey	0	2,487	2,487
Ukraine	220	1,456	1,676
Uruguay	562	1,229	1,791
Venezuela	2,278	0	2,278
Total	12,391	40,464	52,855

Appendix IV – Sample Description

Subscribers				
Country	**Subscription year**	**Implementation year**	**Geographical Region**	**Market Type**
South Africa	1996	2000	Africa	Advanced Emerging
Tunisia	2001	2001	Africa	Frontier
Turkey	1996	2001	Asia	Second Emerging
Indonesia	1996	2000	Asia	Second Emerging
Malaysia	1996	2000	Asia	Second Emerging
Philippines	1996	2001	Asia	Second Emerging
Hungary	1996	2000	Europe	Advanced Emerging
Poland	1996	2000	Europe	Advanced Emerging
Croatia	1996	2001	Europe	Frontier
Bulgaria	2003	2003	Europe	Frontier
Ukraine	2003	2003	Europe	Frontier
Russia	2005	2005	Europe	Second Emerging
Peru	1996	1999	Latin America and the Caribbean (LAC)	Second Emerging
Argentina	1996	1999	LAC	Frontier
Chile	1996	2000	LAC	Second Emerging
Colombia	1996	2000	LAC	Second Emerging
Ecuador	1998	2000	LAC	Unclassified
Brazil	2001	2001	LAC	Advanced Emerging
Uruguay	2004	2004	LAC	Unclassified
Mexico	1996	2000	LAC	Advanced Emerging

Non-Subscribers				
Country	**Subscription year**	**Implementation year**	**Geographical Region**	**Market Type**
China	-	-	Asia	Second Emerging
Pakistan	-	-	Asia	Second Emerging
Trinidad and Tobago	-	-	LAC	Frontier
Dominican Republic	-	-	LAC	Unclassified
Venezuela	-	-	LAC	Unclassified

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