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DISPERSED INFORMATION AND SOVEREIGN RISK PREMIA*

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Abstract

In this paper, we examine empirically the link between sovereign bond spreads and the dispersion in economic forecasters' forecasts about a country's macroeconomic fundamentals. We conjecture that forecast dispersion is a proxy for dispersed information among investors. First, we show that economies with more dispersed forecasts about their macroeconomic fundamentals bear a higher cost of debt. Second, we propose an index of "informational interdependence" that reflects the extent to which countries are linked, if any, through dispersed information. Third, we demonstrate that countries are linked through dispersed information. Finally, by applying results from the spatial econometrics literature, we quantify the role that informational interdependence plays in the transmission of shocks across sovereign bond markets.

Resumen

En este trabajo examinamos de forma empírica la relación que existe entre los diferenciales de precios de los bonos soberanos y la dispersión de las proyecciones de los fundamentales macroeconómicos de los países, realizadas por los analistas macro. Partimos con el supuesto que la dispersión de las proyecciones macroeconómicas es una proxy de la dispersión de información entre los inversoresinversionistas. En primer lugar, mostramos que las economías con mayor dispersión de proyecciones sobre sus fundamentales macroeconómicos enfrentan un costo de endeudamiento más alto. En segundo lugar, proponemos un índice de interdependencia informacional que refleja el grado en el que los países están vinculados a través de la dispersión de la información. Tercero, demostramos que los países sí están vinculados mediante la dispersión de la información. Finalmente, aplicando resultados de la econometría espacial, cuantificamos el rol que la interdependencia informacional juega en la transmisión de shocks a través del mercado de bonos soberanos.

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1 Introduction

The behavior of sovereign debt markets is still challenging to understand, specially because sovereign bond yields tend to co−move strongly. In this paper, we examine empirically a novel relation, which is the link between sovereign bond spreads and the dispersion in economic forecasters' forecasts about a country's macroeconomic fundamentals. We conjecture that forecast dispersion is a proxy for dispersed information among investors. First, we show that countries with more dispersed forecasts about their macroeconomic fundamentals bear a higher cost of debt. Second, we propose an index of "informational interdependence" that reflects the extent to which countries are linked, if any, through dispersed information. Third, we demonstrate that countries are linked through dispersed information. Finally, we quantify the role that informational interdependence plays in the transmission of shocks across sovereign bond markets.

There is an abundant literature studying the determinants of sovereign risk premia and default. Among them, Aguiar *et al.* (2016) document that, in addition to country−specific fundamentals, common latent factors (common across sovereign bond markets) are important drivers of sovereign spreads globally. However, they find that only a modest share of these factors can be accounted for by standard measures of risk pricing, uncertainty or the risk−free rate. These large and largely unexplained common factors thus suggest some form of contagion across sovereign markets (Cole *et al.*, 2016).

Several papers try to explain contagion, by focusing on different sources of linkages between countries. First, there are those papers that focus on real linkages; for example, due to trading relationships (in goods or financial assets) between countries.[1] Second, there is the belief linkage: Because of imperfect information and correlation of fundamentals in different countries, bad news about one country result in investors becoming more pessimistic about other countries.[2] Third, there are the explanations relying on self−fulfilling crises, either through feedback effects or rollover problems.[3] Finally, Cole *et al.* (2016) propose a linkage stemming from investment and information: With global investors exposed to several countries' sovereign bond risks, changes in one country's fundamentals induce a portfolio reallocation that can spread across countries.[4]

[1] To cite some references, Kaminsky and Reinhart (2000); Hernández and Valdés (2001); Van Rijckeghem and Weder (2001) and Caramazza *et al.* (2000).

[2] The belief linkage requires correlation in fundamentals across countries or the existence of common unobservable factors linking countries; global investors investing in different countries or sequentiality in the arrival of information. It then operates through learning and herding. Among them, Kyle and Xiong (2001); Goldstein and Pauzner (2004); Yuan (2005) and Broner *et al.* (2006).

[3] Lorenzoni and Werning (2013); Cole and Kehoe (1996); Aguiar *et al.* (2015) and Bocola and Dovis (2015) are some examples.

[4] According to this explanation, the flow of capital across countries can generate contagion in sovereign spreads, even in the absence of real linkages, correlation of fundamentals or belief updating about one country due to equilibrium outcomes in another country. Also, they show that a reinforcing factor is the change in information acquisition: An investor may have more incentives to obtain information about the country experiencing changes in fundamentals, making its bond prices more volatile.

In this context, the motivation of our paper is to provide empirical evidence for the belief linkage and, in particular, for the extent that dispersed information about countries' macroeconomic fundamentals creates linkages between countries and influences, if any, sovereign bond spreads. Theoretically, dispersed information; correlation of fundamentals across countries; global investors (or sequentiality in the arrival of information) and non−linear sovereign bond payoffs (due to the default risk) can, as a result of changes in beliefs about one country's fundamentals influence how markets price sovereign risks and induce a portfolio reallocation that may spill over to sovereign spreads in other countries.

We proceed in steps. First, in a reduced form model of sovereign bond spreads, including macroeconomic control variables, international portfolio funds and global factors, we examine the relation between our proxy for dispersed information and sovereign spreads.[5] Second, relying on the methodology of Bailey *et al.* (2016), we propose a matrix of "informational interdependence" that reflects the extent to which countries are linked, if any, through dispersed information. Finally, by applying results from the spatial econometrics literature, we modify the model specification of step 1 to quantify the importance of this informational interdependence on sovereign bond spreads.

To proxy dispersed information, we take advantage of a large database that contains cross−sectional information of economic forecasters' gross domestic product (GDP) forecasts. For each of the 24 emerging and advanced economies in our sample, over the period $2006-2015$, the database contains monthly data on the economic forecasters' one year ahead GDP growth forecasts. We then consider the standard deviation of their forecasts and, for robustness, the difference between the 75^{th} and the 25^{th} percentile of the same forecasts. To measure the cost of debt, we use sovereign Credit Default Swap (CDS) contracts on the external debt. In particular, we use the five−year sovereign CDS spread, at a monthly basis.

In addition to the macroeconomic control variables and the stock of international portfolio funds to each country,[6] we include the Chicago Board Options Exchange Market Volatility Index (VIX) and the US Dollar LIBOR interest rate. The reason for including these global factors is to disentangle the effect of global uncertainty (second moment shocks) from the impact of global first moment shocks, respectively,[7] and to distinguish both of them from the influence of dispersed forecasts at the country level, which is sometimes interpreted as a measure of domestic economic uncertainty.[8]

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[5] Our reduced form model specification is in line with the interpretation of the macro/international finance literature, according to which macroeconomic control variables and global factors drive sovereign risk premia.

[6] To avoid endogeneity due to simultaneity bias, we lag the macroeconomic control variables and the stock of international portfolio funds.

[7] There is a recent and fast growing literature, stressing that fluctuations in uncertainty can drive economic outcomes, by augmenting the real option value of delaying (difficult to reverse) investment and hiring decisions; by increasing the precautionary saving motive among consumers; by affecting collateral values and rising credit spreads, limiting the supply of credit; among other mechanisms. Within this literature, Christiano *et. al* 2014; Di Maggio *et. al* 2016 and Leduc and Liu, 2016.

[8] As discussed in Baetje and Friedrici (2016), the linkage between survey−based dispersion and economic uncer-

Our first key result is that sovereign spreads are greater, the more dispersed economic forecasters' GDP growth forecasts are. In other words, sovereign bond markets are pricing dispersed information, when evaluating the cost of sovereign debt. One way to read it is that when investors (proxied by economic forecasters) disagree more strongly about the future evolution of the economy, for instance, because it becomes more difficult to predict, they may perceive this country as riskier and charge an extra premium to insure against this risk. Importantly, this finding is robust to alternative forecast horizons, covariates and lead and lag structures; distinct manners to proxy dispersed information; as well as various model specifications and estimation techniques.

Second, we show that our proxy for dispersed information creates (statistically) significant linkages between countries. We say that two countries are (statistically) linked if the sample−estimates of the pairwise correlation of their forecast dispersion is above a certain threshold. We then build the matrix of informational interdependence, with each element in the matrix indicating whether there is a (statistically) significant country−pair linkage or not.

We find that significant country−pair linkages account for 17% of the total number of possible entries in the matrix of informational interdependence and, interestingly, we do not observe distinct patterns between advanced−advanced, advanced−emerging or emerging−emerging economies. Furthermore, we conclude that the pattern of significant linkages that informational interdependence generates is different from the ones that we obtain when considering other macroeconomic variables, such as GDP growth or trade. Therefore, with our methodology, we are measuring a distinct type of linkage between countries, relative to the ones already stressed in the literature.

Finally, we show that the matrix of informational interdependence contains useful information to explain sovereign bond spreads and that the coefficient estimates to measure the strength to which sovereign bond spreads in different countries are linked through dispersed information are significant, positive and of considerable size. In addition, our results indicate that changes in a country's characteristic significantly impact sovereign bond spreads in the country experiencing the changes (direct effect), as well as spreads in other countries (indirect effect). In fact, we find that in three out of the four explanatory variables for which we compute the impacts, the indirect effects more than double the direct ones, thus implying that informational spillovers are important.

Policy implications of our results are twofold. First, they indicate that dispersed information is priced by sovereign bond markets, more dispersed forecasts about a country's macroeconomic fundamentals being associated with a larger cost of debt. Indeed, we estimate that a 1 standard deviation increase in the economic forecasters' one year ahead GDP growth forecast dispersion implies a +20 basis point expansion of CDS spreads.

Second, while a country's sovereign bond spreads are likely to be influenced by those of other countries through a variety of channels, our results suggest that informational interdependence

tainty relies on the assumption that forecasters disagree more strongly during more volatile (uncertain) times, when the outcome gets harder to forecast.

could be considered as an additional channel. Therefore, this is interesting for governments and policy makers, concerned about the determinants of the cost of sovereign debt.

The remainder of the paper is organized as follows. Section 2 reviews the related literature, whereas section 3 presents the data and some descriptive statistics. Section 4, in turn, describes the methodology, while section 5 presents the empirical results and discusses the main findings of the paper. Finally, section 6 concludes. The appendix contains additional descriptive statistics, absent in the main text.

2 Literature review

This paper is related to two strands of literature.

First, there is the abundant empirical literature on the driving forces behind sovereign risk premia, both for emerging and advanced economies. Typically, these studies distinguish between global factors (supply side); country−specific macroeconomic variables (demand side) and global market uncertainty.[9]Overall, they show that while improved country−specific fundamentals and better global conditions, for instance, in the form of more available international funds to be invested in sovereign markets, reduce sovereign bond spreads; higher global market uncertainty worsen sovereign bond spreads.

Focusing on emerging markets, it is possible to cite Uribe and Yue (2006), González−Rozada and Levy Yeyati (2008), Hilscher and Nosbusch (2010), Kennedy and Palerm (2014) and Aguiar *et al.* (2016). Examining advanced or emerging and advanced economies, we can mention Codogno *et al.* 2003; Remolona *et al.* (2008); Longstaff *et al.* (2011); Favero and Missale (2012) and Amstad *et al.* (2016). While we rely on the same set of determinants of sovereign risk premia that this literature has identified, we contribute to it by showing that dispersed forecasts about future macroeconomic fundamentals is another key driver.

Second, this paper relates to the literature, both theoretical and empirical, that investigates the effect of dispersed information on credit spreads. Within them, Güntay and Hackbarth (2010), Buraschi *et al* (2013), Albagli *et al.* (2014) and Margaretic (2016).[10] Mainly focused on corporate bonds or stocks, this strand concludes that dispersed information matters and some of them agree that greater dispersion leads to higher credit risk.[11] We share with this literature the conclusion

[9]More specifically, the global factors include international investors' behavior, proxied by international capital flows and risk appetite; international interest rates and terms of trades, among others. The country−specific macroeconomic variables, in turn, relate to business cycle fluctuations, inflation and monetary policy stance, measured by variables, such as GDP growth, international reserves, export growth, fiscal and current account balance, public investment and inflation. Finally, researchers usually use exchange market, stock market or US government bond volatility indexes to proxy global market uncertainty

[10]Güntay and Hackbarth (2010) and Buraschi *et al.* (2013) proxy dispersed information with dispersion in analysts' earnings forecasts.

[11]For instance, assuming non−linear bond payoffs, dispersed information and limits to arbitrage, Albagli *et al.*

that it matters. We add to it, since we provide evidence in favor of a positive relation between dispersed information and sovereign risk premia.

The papers closest to ours are Benzoni *et al.* (2015) and Margaretic (2016). Benzoni and coauthors propose an equilibrium model for defaultable bonds that are subject to contagion risk. They then test their predictions, relying on sovereign European CDS data. While they examine whether fragile beliefs (investors are uncertain about their ability to accurately estimate the underlying fundamental economic state variable and its probability) explain credit spreads, we focus on the influence of dispersed information on sovereign bond spread fluctuations.

Relying on a noisy rational expectation model for defaultable bonds, with imperfect information, Margaretic (2016) also shows that sovereign bond spreads depend on country−specific macroeconomic fundamentals, international capital flows and dispersed information about future macroeconomic fundamentals. Considering a larger and longer dataset, we extend her work by proposing a matrix of "informational interdependence" and quantifying the role it plays to transmit shocks across sovereign bond markets.

3 Data

3.1 CDS data

We use a dataset of sovereign CDS contracts on the external debt of 24 advanced and emerging economies, over 2006 – 2015. Sovereign CDS contracts function as insurance contracts that allow investors to buy protection against the event that a sovereign defaults on or restructures its debt. We consider the five−year sovereign CDS spread, at a monthly basis, which we denote hereafter as *CDS Spread*, with data source Bloomberg system.The advanced economies are Australia, Germany, Spain, France, Great Britain, Italy, Netherlands, Sweden and USA. The emerging economies, in turn, are Bulgaria, Brazil, Chile, China, Croatia, Hungary, Indonesia, Mexico, Malaysia, Romania, Russia, Slovakia, Thailand, Turkey and Venezuela.

3.2 Dispersed information about macroeconomic fundamentals

To proxy dispersed information among investors, we rely on cross−sectional information of economic forecasters' GDP forecasts. More specifically, we consider the standard deviation of economic forecasters' one year ahead GDP growth forecasts (end of period), at a monthly basis, which source is Consensus Forecast. We refer to it as *GDPY1SD*. As a robustness check, we use the difference between the 75^{th} and the 25^{th} percentile of the one year ahead GDP growth forecast, relative to the

(2014) show that greater dispersion leads to higher credit risk, due to the endogenous overweighting of tail events that the informational frictions generate.

50^{th} percentile, which we denote as $GDPY1SD_{75-25}$.[12] Finally, to allow for sufficient variability, we require at least seven economic forecasters per month for an observation to be included.

3.3 Country−specific macroeconomic fundamentals

Following the macro/international finance literature, we include as country−specific macroeconomic variables, a measure of economic activity, that is, the quarterly (seasonally adjusted) industrial production growth, which we name hereafter as *IP*, and the external debt to GDP ratio, hereafter *Ext Debt over GDP*, lagged one year.[13] In addition, we use the (quarterly) consumer price inflation, hereafter *Inflation*, to proxy monetary policy. Lastly, although not included in the final model specification, for robustness, we consider other macroeconomic variables, such as, the government fiscal balance, the foreign exchange reserves to GDP ratio and the exports to GDP ratio, all lagged.

3.4 International portfolio funds and global factors

To capture the behavior of international investors, we consider the information on international portfolio funds to each country. More specifically, we use a dataset on international portfolio flows and holdings at the fund level, compiled by Emerging Portfolio Fund Research (EPFR). It contains information on daily, weekly and monthly flows for more than 16000 equity funds and more than 8000 bond funds, as well as data on funds' total assets under management in each country, at the end of each month.[14]

Relying on the monthly EPFR data, we annualize the international portfolio flows, in order to have a measure of the monthly evolution of the stock of international portfolio funds to each country. To avoid endogeneity due to simultaneity bias, we annualize each country series with an 11 month−moving average, not including the current month. We name this covariate as *Inter Port Funds over GDP*.

For robustness, we also use balance of payment data. More specifically, we consider the (annu-

[12] Although the standard deviation of economic forecasters' current year GDP growth forecast (end of period) is also available in the dataset, we prefer *GDPY1SD*. This is because the former is more sensitive to the effect of seasonality, that is, the fact that as the year goes by, economic forecasters have more information (because more information is released) to produce their (end of period) current year GDP growth forecast, resulting in a diminishing cross−sectional dispersion of GDP growth forecasts. While *GDPY1SD* is less exposed to this effect, we explicitly control for seasonality in the estimations.

[13] Relying on a sample of 20 emerging economies Aguiar *et al.* (2016) show that, on average, real GDP growth and debt−to−GDP ratio explain around 24% of the total variability of sovereign bond spreads.

[14] As pointed out in Forbes *et al.* (2016), one disadvantage of the EPFR dataset is that it only includes information on mutual funds and does not include flows through banks, hedge funds, foreign direct investment or non−mutual fund investors. According to the authors, the data capture about 5% to 20% of total market capitalization for most countries in the EPFR dataset. Despite the shortcomings, this information is believed to be a fairly representative sample of international portfolio flows and it is the most comprehensive dataset currently available at a high frequency, with detailed geographic coverage.

alized) Foreign Direct Investment and the Portfolio Investment, both as a proportion of GDP and lagged one year. We denote these variables as *FDI over GDP* and *Port Inv over GDP*, respectively. Also, we distinguish between inflows and outflows.

Regarding the global factors, we include the Chicago Board Options Exchange Market Volatility Index, hereafter *VIX*, and the 3 month US Dollar LIBOR interest rate (*Libor3M*). Being standard measures for foreign financial market uncertainty (over the next 30−day period) and for international borrowing costs, respectively, we incorporate these variables in order to distinguish the effect of global uncertainty (second moment shocks) from the impact of global first moment shocks, respectively. Finally, for estimation, we standardize all variables.

3.5 Some descriptive statistics: CDS spreads and GDP forecast dispersion over time

We now present some descriptive statistics of the variables of interest. In particular, we are interested in the relation between *CDS Spread* and the standard deviation of economic forecasters' one year ahead GDP growth forecasts, *GDPY1SD*.

To begin with, table 1 reports the descriptive statistics (mean, standard deviation, minimum and maximum values) of the control variables we use in this paper, whereas tables A1 and A2, in Appendix A, present the mean of the control variables by country and the data availability, respectively. Second, figures 1 to 4 depict some box plots of the CDS data and the standard deviation of economic forecasters' one year ahead GDP growth forecasts.

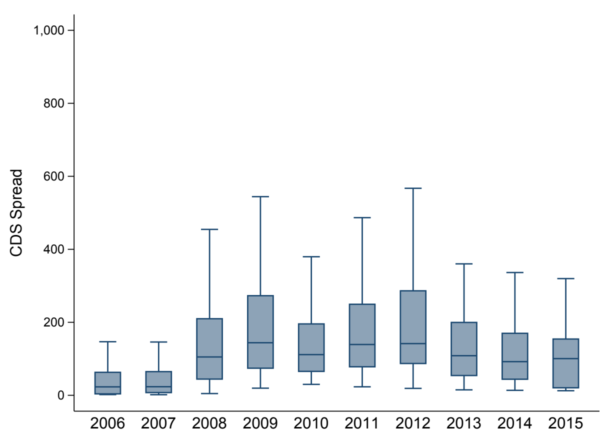
More specifically, while figure 1 depicts the box plot of *CDS Spread*, at each year, figure 2 distinguishes between advanced and emerging economies, as classified in the World Economic Outlook (WEO), International Monetary Fund (IMF). In turn, figure 3 presents the box plot of *GDPY1SD*, at each year, whereas figure 4 differentiates between advanced and emerging economies.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
CDS Spread	184.13	396.41	1.63	6145.31
GDPY1SD	0.57	0.48	0.05	7.32
$GDPY1_{75-25}$	0.67	0.52	0.01	5.50
IP	0.33	3.84	-30.13	36.45
Ext Debt over GDP	96.52	93.50	7.37	539.24
Inflation	1.19	2.49	-3.03	34.93
Inter Port Funds over GDP	0.02	0.04	-0.15	0.19
Port Inv Inward over GDP	2.43	3.95	-8.84	19.26
Port Inv Outward over GDP	1.55	2.99	-8.02	13.96
FDI Invward over GDP	3.29	3.86	-1.59	42.08
FDI Outward over GDP	1.94	4.02	-6.91	47.50
VIX	20.84	9.00	10.42	59.89
Libor3M	1.34	1.82	0.22	5.62

Notes. Std. Dev.: Standard deviation. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP forecast. $GDPY1_{75-25}$: Difference between the 75^{th} and the 25^{th} percentile of the one year ahead GDP forecast, relative to the 50^{th} percentile. *IP*: Industrial production quarter on quarter growth. *Ext Debt over GDP*: External Debt, as a proportion of GDP. *Inflation*: Quarter on quarter inflation, measured by the consumer price index. *Inter Port Funds over GDP*: International Portfolio Funds over GDP. *Port Inv Inward over GDP*: Portfolio Investment Inward, as a proportion of GDP. *Port Inv Outward over GDP*: Portfolio Investment Outward, as a proportion of GDP. *FDI Inward over GDP*: Foreign Direct Investment Inward, as a proportion of GDP. *FDI Outward over GDP*: Foreign Direct Investment Outward, as a proportion of GDP. *VIX*: Chicago Board Options Exchange Market Volatility Index. *Libor3M*: 3 month US Dollar LIBOR interest rate. Source: Central Bank of Chile.

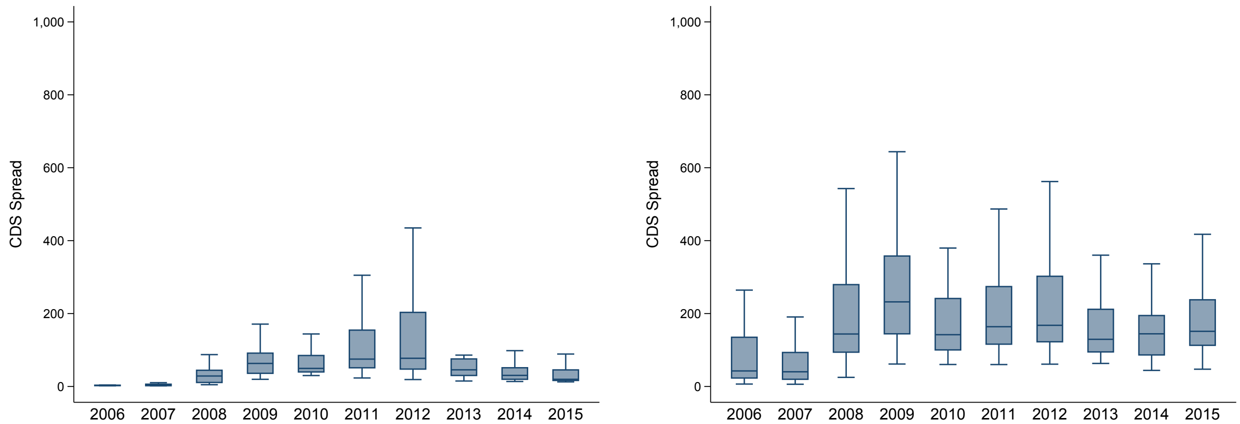
Figure 1: Box plot of *CDS Spread*



Notes: Boxes show the p10, p25, p50, p75 and p90 of the annual empirical distributions. *CDS Spread*: CDS spread.

Source: Central Bank of Chile.

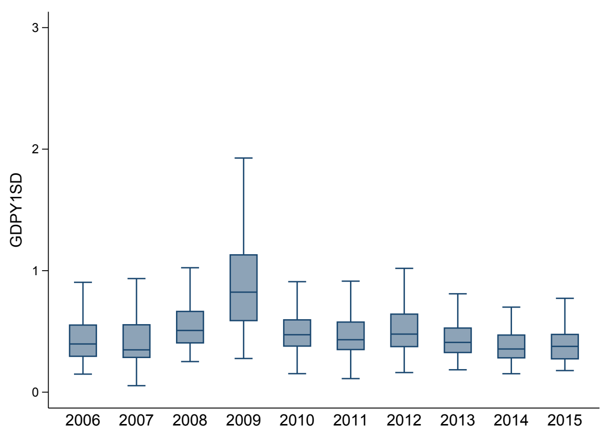
Figure 2: Box plots of *CDS Spread* - Advanced Economies (left) and *CDS Spread* - Emerging Economies (right), by year



Notes: Boxes show the p10, p25, p50, p75 and p90 of the annual empirical distributions. *CDS Spread*: CDS spread. Source: Central Bank of Chile.

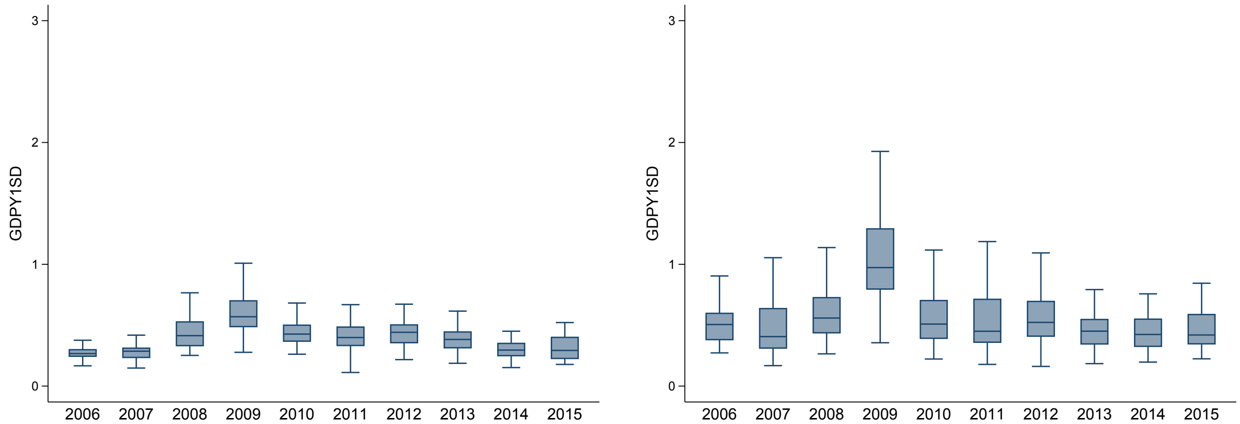
From figures 1 and 2, it is worth to highlight the increase in the sovereign *CDS Spread* starting with the $2007-2009$ subprime mortgage crisis and specially within emerging economies. The $2010-2012$ European sovereign debt crisis and the resulting more heterogeneous sovereign *CDS Spreads* the advanced economies face during the period also becomes evident from the previous figures.

Figure 3: Box plot of *GDPY1SD*, by year



Notes: Boxes show the p10, p25, p50, p75 and p90 of the annual empirical distributions. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP growth forecast. Source: Central Bank of Chile.

Figure 4: Box plot of *GDPY1SD* - Advanced Economies (left) and *GDPY1SD* - Emerging Economies (right), by year



Notes: Boxes show the p10, p25, p50, p75 and p90 of the annual empirical distributions. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP growth forecast. Source: Central Bank of Chile.

Figures 3 and 4 show that the standard deviation in economic forecasters' one year ahead GDP growth forecasts seems larger within emerging economies and, in particular, during the $2007 - 2009$ subprime mortgage crises. From the existing literature, there are several possible explanations we can come up with regarding the fact that economic forecasters tend to disagree more strongly in emerging economies, relative to the advanced ones.

For instance, it might be indicating that the quality of information is relatively lower in emerging economies (Harkness, 2004); that the future path of government measures is more difficult to predict in these economies (Flaubert, 2017); that they are more vulnerable to the effect of global factors (Amstad *et al.*, 2016), which again makes the future GDP growth more difficult to forecast. All in all, our objective is not to determine the most plausible explanation among them, but to identify the salient features of *GDPY1SD*.

We now dig into the bi−variate relation between sovereign bond spreads and the dispersion of economic forecasters' one year ahead GDP growth forecasts: We first look at this relation at the aggregate level and then, examine it at the country level.

To do so, we first construct quintiles, based on the empirical distribution of the standard deviation of economic forecasters' one year ahead GDP growth forecasts. Table 2 tabulates the mean and standard deviation of *CDS Spread*, for each quintile of *GDPY1SD*. In addition, it distinguishes between emerging and advanced economies. For robustness, table A3, in appendix, tabulates the mean and standard deviation of *CDS Spread*, this time for each quintile constructed with the coefficient of variation, that is, the ratio of *GDPY1SD* and the mean of economic forecasters' one year ahead GDP growth forecasts, hereafter $GDPY1M$.

Table 2: Mean and standard deviation of *CDS Spread*, for each quintile constructed with *GDPY1SD*.

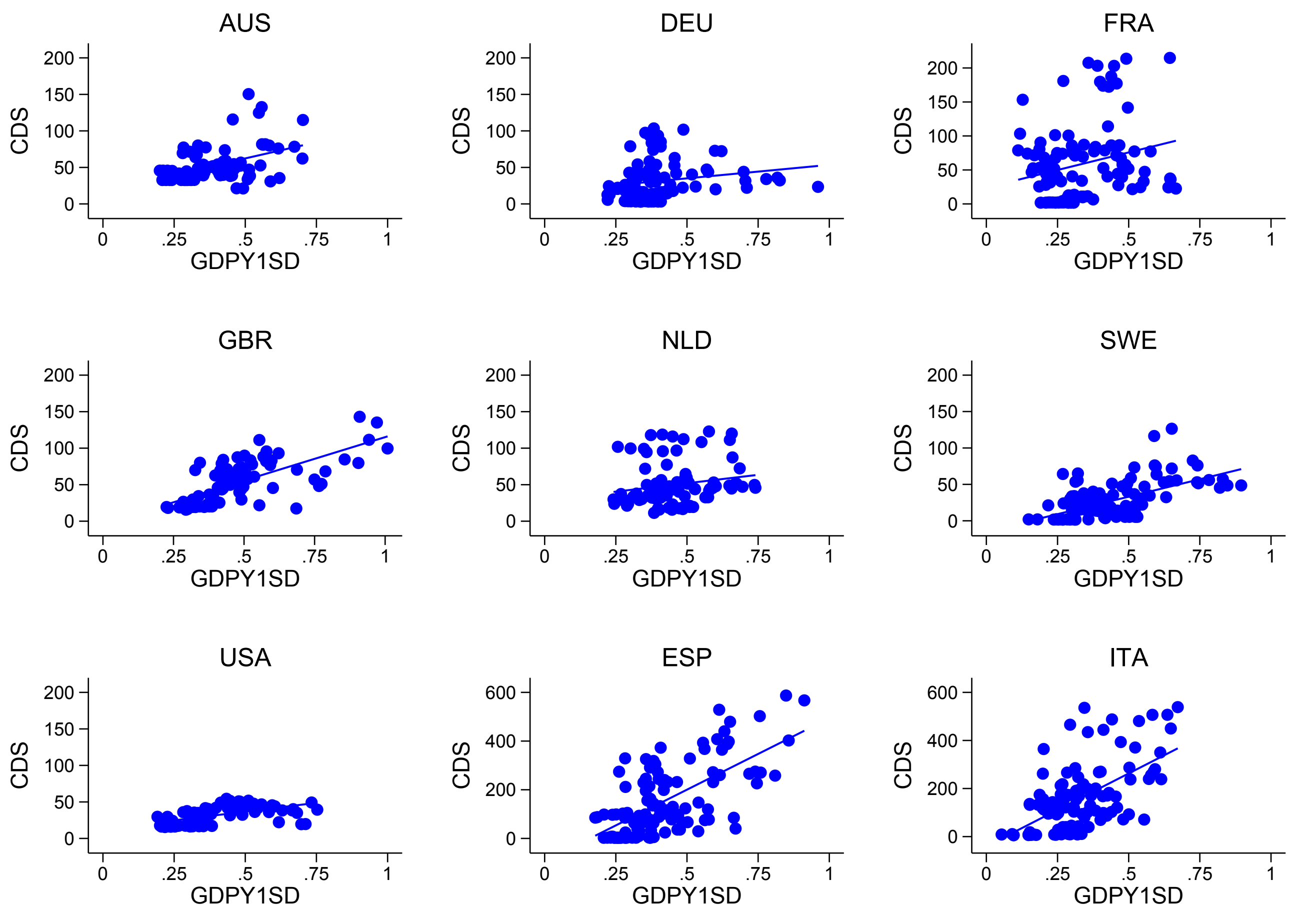
	ALL			Advanced			Emerging		
Quintile	**GDPY1SD**	**CDS Spread**		***GDPY1SD***	***CDS Spread***		***GDPY1SD***	***CDS Spread***	
	Mean	Mean	Freq	Mean	Mean	Freq	Mean	Mean	Freq
1	0.26	82.30	509	0.22	50.73	186	0.29	125.55	323
	(0.05)	(90.12)		(0.04)	(58.05)		(0.05)	(93.21)	
2	0.36	94.57	509	0.31	46.93	186	0.40	128.97	323
	(0.02)	(81.48)		(0.02)	(62.00)		(0.03)	(81.44)	
3	0.45	115.18	509	0.38	71.81	186	0.50	159.95	323
	(0.03)	(92.86)		(0.02)	(86.12)		(0.04)	(97.35)	
4	0.57	149.43	509	0.46	71.93	186	0.67	192.03	323
	(0.05)	(117.83)		(0.03)	(70.67)		(0.07)	(151.20)	
5	1.21	486.98	509	0.63	115.50	186	1.47	651.11	323
	(0.74)	(783.76)		(0.11)	(134.68)		(0.83)	(936.85)	

Notes. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP growth forecast. Standard deviation in parentheses. Source: Central Bank of Chile.

Table 2 shows a positive relation between *CDS Spread* and the proxy we use for dispersed information: Sovereign spreads of both advanced and emerging economies tend to be higher, the more dispersed economic forecasters' one year ahead GDP growth forecasts are. The way we read this finding is that sovereign bond markets might be pricing dispersed information, when evaluating the cost of sovereign debt. Interestingly, this is also consistent with the positive relation found in Margaretic (2016), for a sample of 11 emerging markets. Finally, the positive relation is robust to the use of the coefficient of variation, as reported in table A3, in appendix.

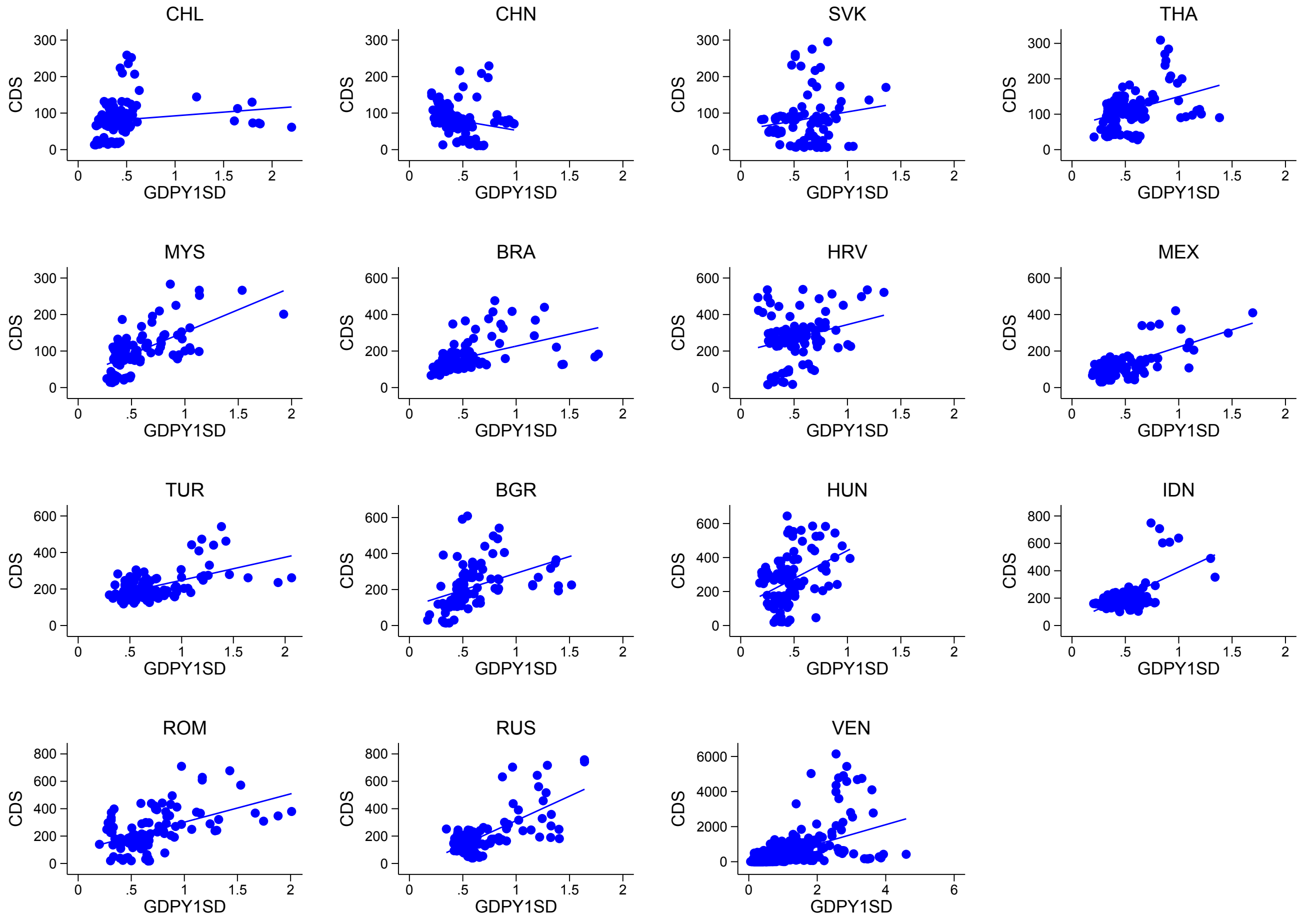
While in the next sections we determine in a more rigorous way the extent to which dispersed information influences sovereign risk premia, in what follows, we examine whether the positive link between *CDS Spread* and *GDPY1SD* still holds at the country level. For it, we present some scatter plots relating these variables and we include the regression line in each plot.

Figure 5: Scatter plot of *CDS Spread* and *GDPY1SD*, with regression line - Advanced Economies



Notes. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP forecast. We consider the following advanced economies, abbreviated through the three digit ISO codes, namely, AUS: Australia, DEU: Germany, FRA: France, GBR: Great Britain, NLD: Netherlands, SWE: Sweden, USA: United State, ESP: Spain and ITA: Italy. Source: Central Bank of Chile.

Figure 6: Scatter plot of *CDS Spread* and *GDPY1SD*, with regression line - Emerging Economies



Notes. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP forecast. We consider the following emerging economies, abbreviated through the three digit ISO codes, that is, CHL: Chile, CHN: China, SVK: Slovakia, THA: Thailand, MYS: Malaysia, BRA: Brazil, HRV: Croatia, MEX: Mexico, TUR: Turkey, BGR: Bulgaria, HUN: Hungary, IDN: Indonesia, ROM: Romania, RUS: Russia and VEN: Venezuela. Source: Central Bank of Chile.

Figures 5 and 6 confirm the positive relation between *CDS Spread* and *GDPY1SD*, at the country level. The only exception is China. In order to better understand the Chinese case, we distinguish between the mortgage subprime crisis (which we define, without loss of generality, between September 2007 and May 2009) and the remaining time frame. As displayed in figures 9 and 10, in appendix, we observe in the case of China, a positive relation between *CDS Spread* and *GDPY1SD* during the subprime crisis period. Interestingly, we also find that the positive slope of the regression lines tend to be steeper during the subprime crisis period, with 3 exceptions.

As discussed in Baetje and Friedrici (2016), one of the most commonly used indicators to capture economic uncertainty is the disagreement among professional forecasters' subjective beliefs. Indeed, the linkage between survey−based dispersion and economic uncertainty relies on the assumption that forecasters disagree more strongly during more volatile (uncertain) times, when the outcome gets harder to forecast. Interestingly, we show that the positive relation between *CDS Spread* and the dispersion of economic forecasters' GDP growth forecasts also becomes stronger during volatile periods.[15]

4 Methodology

Section 4 starts by presenting the basic model specification, which does not account for informational interdependence. Second, it proposes a matrix of informational interdependence that reflects the extent to which countries may be linked through dispersed information. Third, relying on the results from the spatial econometrics literature, it modifies the basic model specification to quantify the importance of informational interdependence on sovereign bond spreads.

4.1 The model specification without informational interdependence

Consider N countries over T periods. At any time period $t \leq T$, let Spr_t^{CDS} be an $N \times 1$ vector of CDS spreads. In addition, let X_t be the $N \times k$ matrix of explanatory variables, including the cross−sectional dispersion of economic forecasters' one year ahead GDP growth forecasts, the macroeconomic control variables, the international portfolio funds and the global factors. The model specification without informational interdependence then becomes,

$$Spr_t^{CDS} = \alpha + X_t \times \beta + \varepsilon_t, \tag{1}$$

where α is the $N \times 1$ vector of country fixed−effects; β is the $k \times 1$ parameter vector and ε_t is the error term. Finally, without loss of generality, we assume a log−normal model specification.

For estimation, we rely on a fixed−effect (FE) estimator: Provided the model is correctly specified and that the explanatory variables are not perfectly collinear, we can estimate the parameters α and β, under the assumption that the error terms are *iid*, with zero mean and constant variance; the FE estimator is asymptotically consistent.

4.2 A matrix of informational interdependence

Several papers have investigated the specific channels by which a shock in one country spreads to other countries. Overall, we can divide the proposed channels into two broad groups, namely, fundamental economic factors, such as trade (for instance, Forbes, 2004) and investor linkages, such as portfolio re−balancing (Boyer *et al.* 2006; Jotikasthira *et al.* 2012). However, the relative importance of these groups remains hotly debated, since it is difficult to identify the independent effects of the different channels.

[15]Another situation which is worth mentioning is the Chilean case: The almost horizontal regression line in the corresponding plot of figure 6 is due to a few observations, registering high values of *GDPY1SD* over the last months of 2009.

In this paper, we examine empirically whether dispersed information, proxied by forecast dispersion, can be considered as an additional channel of transmission of shocks across countries. In order to do so, we propose a methodology, according to which we first construct a weight matrix, the matrix of informational interdependence, that reflects the extent to which countries may be linked through dispersed information. We then use this matrix to assess whether this informational linkage can help enhance our understanding of the determinants of sovereign bond spreads and the way they co−move across international markets.

There is no consensus about how to best define the weight matrix and several alternative forms have been used in the literature. Typically, they depend in some form of distance between individuals or countries. In this paper, we estimate W, relying on the information on forecast dispersion. For the estimation, we follow the literature that addresses the identification of significant linkages by the non−zero elements of an assumed sparse covariance matrix or its inverse; in particular, we are closed to Bailey *et al.* (2016).

Let the matrix of informational interdependence, W, be a $N \times N$ non−negative sparse weight matrix, with element $w_{i:j} = 1$ if countries i and j are linked through dispersed information and $w_{i:j} = 0$ otherwise. By convention, $w_{i:i} = 0$. In addition, define $\hat{\rho}_{i:j}$ the sample estimate of the pair−wise correlation of the dispersion of economic forecasters' one year ahead GDP growth forecasts, for any two pairs of countries i and j, over $t = 1, ..., T$, that is,

$$\hat{\rho}_{i:j} = \frac{\sum_{t=1}^{T} \left(x_{i,t} - \bar{x}_i\right)\left(x_{j,t} - \bar{x}_j\right)}{\left[\sum_{t=1}^{T} \left(x_{i,t} - \bar{x}_i\right)^2\right]^{1/2} \left[\sum_{t=1}^{T} \left(x_{j,t} - \bar{x}_j\right)^2\right]^{1/2}}, \tag{2}$$

with $\bar{x}_i = T^{-1} \sum_{t=1}^{T} x_{i,t}$.

Bailey *et al.* (2016) identify the non−zero elements of W with those elements of $\hat{\rho}_{i:j}$ in (2) that are different from zero at a suitable significance level. The latter requires that the time dimension be sufficiently large. More specifically, they apply Holm (1979) multiple testing procedure to distinct non−diagonal elements of the sample estimate $\hat{R} \equiv (\hat{\rho}_{i:j})$ and show that the zeros of $W = (w_{i:j})$ can consistently be estimated by,

$$\hat{w}_{i:j} = I\left(|\hat{\rho}_{i:j}| > \frac{c_p(N)}{\sqrt{T}}\right), \tag{3}$$

with $c_p(N) = \Phi^{-1}\left(1 - \frac{p}{2 \times f(N)}\right)$, p is the pre−specified overall size of the test, $\Phi^{-1}(.)$ is the inverse of the cumulative standard normal distribution and $f(N)$ is such that it increases linearly in N.

To implement their procedure, we first compute $\hat{\rho}_{i:j}$, that is, the correlation of the de−factored dispersion of economic forecasters' one year ahead GDP growth forecasts, for any two pairs of countries.[16] Second, we set $p = 0.05$ and order $|\hat{\rho}_{i:j}|$ in a descending manner. Denote the largest

[16]Because we reject the null of weak cross−sectional dependence, as it is standard in this literature, we model the implied strong cross−sectional dependence by means of a factor model. This way, we obtain the de−factored

value of $|\hat{\rho}_{i:j}|$, over all $i \neq j$ by $|\hat{\rho}^1|$, the second largest by $|\hat{\rho}^2|$ and so on, to obtain the ordered sequence $|\hat{\rho}^s|$ for $s = 1, 2, .., N^2$. Finally, without loss of generality, let $f(N) \equiv N - s + 1$.

Two distinct countries i and j, with associated $|\hat{\rho}^s|$, are informationally linked if $|\hat{\rho}^s| > T^{-1/2}\Phi^{-1}\left(1 - \frac{p/2}{N-s+1}\right)$; otherwise, they are not. It is important to mention that for estimation, we row−normalize W, such that $\sum_j w_{ij} = 1$. Summing up, the matrix of informational interdependence $\hat{W} = (\hat{w}_{i:j})$ is such that $\hat{w}_{i:j} > 0$ if the countries i and j are linked according to the Holm procedure or $\hat{w}_{i:j} = 0$, otherwise.

4.3 The model specification with informational interdependence

The final objective of the paper is to determine whether the informational linkage is a critical channel for understanding the way sovereign bond spreads co−move across international markets: If the matrix of informational interdependence contains useful information, we should expect that it helps explain sovereign bond spreads. We rely on the spatial econometrics literature to quantify its importance, if any, on sovereign bond spreads.

From an econometrics standpoint, the failure to account for informational interdependence, when it exists, may lead to inefficient estimated coefficients and prediction bias, among others. In order to assess whether informational interdependence plays any role when estimating sovereign bond spreads, we consider the following modified model specification, which adds $\hat{W}$ to the one defined in (1):

$$Spr_t^{CDS} = \alpha_S + X_t^1 \times \beta + \psi \times \hat{W} \times Spr_t^{CDS} + \hat{W} \times X_t^1 \times \theta + \varepsilon_t, \qquad (4)$$

where X_t^1 is the $N \times (k-1)$ matrix of explanatory variables, excluding from X_t the cross−sectional dispersion of economic forecasters' one year ahead GDP growth forecasts; α_S is the vector of spatial fixed−effects; ψ is a constant parameter; β and θ are the $(k-1) \times 1$ parameter vectors and finally, ε_t is the error term.

Importantly, the inclusion of $\hat{W}$ in (4) to account for informational interdependence results in some of the members of the family of spatial econometric models. First, setting $\theta = 0$ results in a *Spatial Auto−regressive model* (SAR), where the informational interdependence is modeled as occurring in Spr_t^{CDS}; $\hat{W} \times Spr_t^{CDS}$ is the endogenous interaction effect among CDS spreads.

The parameter ψ then measures the strength to which sovereign bond spreads in different countries are linked through dispersed information. Furthermore, it is worth mentioning that the higher ψ is, the stronger the linkage should be. This is because as LeSage and Pace (2009) show,

observations as residuals from OLS regressions of the standard deviation of economic forecasters' one year ahead GDP growth forecasts on some principal components (PCs). To select the number of PCs to include in each OLS regression, we follow a stepwise procedure, based on the Akaike information criterion. For details, see Bailey *et al.* (2015, 2016).

the plausible interval for ψ is $\psi \in (\gamma_{min}^{-1}, \gamma_{max}^{-1})$, with γ_{min} and γ_{max} the minimum and maximum eigenvalues of W, respectively. In our case, they equal -0.8 and 1.0, respectively.

Second, the situation where $\psi \neq 0$ and $\theta \neq 0$ yields the *Spatial Durbin model* (SDM), which allows both for endogenous and exogenous interaction effects, with $\hat{W} \times X_t^1$, the exogenous interaction effects among (all or some of) the independent variables. Intuitively, in the presence of informational interdependence between countries, changes in the characteristic k of country i, $X_i^{1,k}$, can impact CDS spreads in country i, as well as CDS spreads in countries to which i is informationally linked according to W, "the neighbors", as well as CDS spreads in neighbors to those neighboring countries and so on. θ then measures the extent to which changes in country i's characteristics can impact CDS spreads of i, as well as other countries.

Finally, note that if $\psi = \theta = 0$, (4) reduces to the log−normal model specification (1), with independent observations. For estimation, we rely on maximum likelihood (ML) estimation procedures, based on the technical results in LeSage and Pace (2009).

4.3.1 Interpreting the SAR and SDM model estimates

To quantify the type of diffusion of effects arising from a change in the characteristic k in X^1 (for ease of exposition, hereafter, we omit the subindex t), we can compute the $N \times N$ matrix of partial derivatives of the reduced form in (4):

$$\partial Spr^{CDS}/\partial X^{1,k} = \begin{pmatrix} \partial Spr_1^{CDS}/\partial X_1^{1,k} & \partial Spr_1^{CDS}/\partial X_2^{1,k} & ... & \partial Spr_1^{CDS}/\partial X_N^{1,k} \\ \partial Spr_2^{CDS}/\partial X_1^{1,k} & \partial Spr_2^{CDS}/\partial X_2^{1,k} & ... & \partial Spr_2^{CDS}/\partial X_N^{1,k} \\ \vdots & \vdots & & \partial Spr_N^{CDS}/\partial X_N^{1,k} \end{pmatrix}. \tag{5}$$

In the case of the SAR model, (5) equals

$$\partial Spr^{CDS}/\partial X^{1,k} = (I_N - \psi \times W)^{-1} I_N \times \beta_k, \tag{6}$$

while if we consider the SDM model, it results in,

$$\partial Spr^{CDS}/\partial X^{1,k} = (I_N - \psi \times W)^{-1} I_N \times (\beta_k + W \times \theta_k). \tag{7}$$

Matrices (6) and (7) show that a change in a country's k^{th} characteristic could impact the same country's CDS spreads, plus (potentially) CDS spreads of all other countries, with the strength of these other country effects depending on the level of ψ and β_k (and $W \times \theta_k$ in the case of the SDM). As Elhorst (2014) points out, (6) and (7) arise from recognizing that ψ, β_k and θ_k do not change over time in the panel.

LeSage and Pace (2009) propose an average of the main diagonal elements of the matrices (6) and (7) as a scalar summary measure of own−partial derivatives, which they label direct effects.

Intuitively, the direct effect characterizes the average impact (over all countries) that a change in a country's characteristic has on the sovereign CDS spread of the same country.

In addition, the authors propose a scalar summary measure of the indirect effects (spillover), based on the cumulative sum of the off−diagonal elements from each row, averaged over all rows. The indirect effect then determines the mean impact of a change in an independent variable in a given country on other countries' CDS spreads. Finally, a scalar summary measure of the total effects is the sum of the scalar direct plus indirect effects estimates. According to them, these scalar summary measures simplify the task of interpreting estimates from the spatial model, which takes the form of an $N \times N$ matrix for each of the k explanatory variables.

To conclude, it is worth highlighting that an important limitation of the SAR model is that the ratio between the indirect and direct effect of a particular explanatory variable is independent of β_k and therefore, it is the same for every explanatory variables. Indeed, this magnitude depends on the spatial auto−regressive parameter ψ and the specification of the weight matrix W. In many applications, this may not be very likely.

5 Results

Section 5 starts by presenting the model estimates of specification (1), which does not account for informational interdependence. Next, it depicts the matrix of informational interdependence, which results from applying the methodology described in section 4.2. It also compares the pattern of significant linkages that this matrix generates to the ones we obtain when considering other macroeconomic variables. Finally, it reports the estimates of the model specifications in (4) and quantifies the importance of informational interdependence on sovereign bond spreads.

5.1 CDS spreads determinants

Table 3 reports the model estimates of specification (1), without informational interdependence. In this table, there are 3 blocks of 3 columns of results, with different variables measuring the dispersion of economic forecasters' one year ahead GDP growth forecasts: The first three columns of results, the baseline specification, rely on *GDPY1SD*; columns 4 to 6 consider *log(GDPY1SD)* and finally, the last 3 columns use *log*($GDPY1_{75-25}$). In addition, each block of 3 columns distinguishes between all countries, advanced and emerging economies. Finally, all model specifications in table 3 includes monthly dummy variables, to account for the effect of seasonality of *GDPY1SD*.

Table 3: Baseline and alternative model specifications

Variables	All	Advanced	Emerging	All	Advanced	Emerging	All	Advanced	Emerging
IP	-0.01***	-0.02	-0.01***	-0.01***	-0.02	-0.01***	-0.01**	0.00	-0.01***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Ext Debt over GDP[1]	1.71**	0.69**	2.39***	1.70**	0.74**	2.41***	1.69**	0.75**	2.25***
	(0.80)	(0.34)	(0.54)	(0.81)	(0.35)	(0.56)	(0.72)	(0.31)	(0.48)
Inflation	0.03	0.20***	0.03*	0.03	0.18***	0.03*	0.03	0.19***	0.01
	(0.03)	(0.06)	(0.02)	(0.03)	(0.06)	(0.02)	(0.03)	(0.06)	(0.01)
Inter Port Funds over GDP[2]	-0.06*	-0.14**	-0.04	-0.05	-0.15**	-0.04	-0.04	-0.12*	-0.03
	(0.04)	(0.07)	(0.03)	(0.04)	(0.07)	(0.03)	(0.03)	(0.06)	(0.03)
VIX	0.26***	0.17***	0.27***	0.24***	0.17***	0.26***	0.26***	0.20***	0.27***
	(0.02)	(0.05)	(0.03)	(0.02)	(0.05)	(0.02)	(0.01)	(0.04)	(0.02)
Libor3M	-0.53***	-0.99***	-0.32***	-0.52***	-0.99***	-0.31***	-0.49***	-0.96***	-0.30***
	(0.10)	(0.09)	(0.07)	(0.09)	(0.10)	(0.07)	(0.09)	(0.09)	(0.07)
GDPY1SD	0.09***	0.49***	0.05***						
	(0.03)	(0.18)	(0.02)						
log(GDPY1SD)				0.27***	0.38***	0.14***			
				(0.08)	(0.15)	(0.05)			
log($GDPY1_{75-25}$)							0.16***	0.21***	0.11***
							(0.03)	(0.05)	(0.04)
Observations	2,419	902	1,517	2,419	902	1,517	2,419	902	1,517
R^2 within	0.65	0.81	0.70	0.66	0.81	0.70	0.67	0.83	0.70
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Monthly time effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Log-Like	-1606	-564.4	-472.7	-1575	-569.4	-469.7	-1437	-487.5	-419.1
RMSE	0.47	0.46	0.33	0.47	0.46	0.33	0.45	0.44	0.33

Notes: (1) Lagged one year (annual). (2) Annualized flows from EPFR, MA(11). Constant is not reported. Variables are standardized except for *log(GDPY1SD)* and *log*($GDPY1_{75-25}$). All estimations are with at least 7 forecasters per month. FE estimation. Bootstrapped standard errors. Level of significance: *** p<0.01, ** p<0.05, * p<0.1. Source: Central Bank of Chile.

From table 3, it is possible to extract the following conclusions. First, no matter the way we measure the dispersion of economic forecasters' GDP growth forecasts and regardless of whether we consider the whole sample or the subsamples (advanced or emerging economies), table 3 shows that CDS spreads are greater, the more dispersed economic forecasters' one year ahead GDP growth forecasts are. In other words, sovereign bond markets are pricing dispersed information, when evaluating the cost of sovereign debt. This is a crucial result and confirms the bi−variate descriptive analysis of section 3.5, as well as the findings of Margaretic (2016).

One way to read the previous result is that when investors (proxied by economic forecasters) disagree more strongly about the future evolution of the economy, for instance, because it becomes more difficult to predict, they may perceive this country as riskier and charge an extra premium to insure against the risk that it entails. Importantly, while the previous mechanism seems to operate both in normal and crisis periods, based on the evidence exhibited in section 3.5, we could expect that it operates more strongly in crisis periods.

Second, table 3 indicates that the coefficient estimate for *GDPY1SD*, in the case of advanced economies is always above the same estimate for emerging economies, suggesting that among advanced economies, *CDS Spread* is more sensitive to *GDPY1SD*. The latter might be due to the fact that, as we show in section 3.5, GDP forecasts tend to be less dispersed within advanced economies. Third, as in Aguiar *et al.* (2016), we find that industrial production growth and external debt to GDP ratio are almost always significant drivers of sovereign bond spreads, with *IP* (*Ext Debt over GDP*) exhibiting, as expected, a negative (positive) relation with *CDS Spread*.

Fourth, regarding the international portfolio funds and the global factors, we find, on one hand, that *Inter Port Funds over GDP* tends to exhibit negative and significant coefficients, being always significant within advanced economies; on the other hand, that the global factors in table 3 are significant and with the expected signs. Interestingly, Aguiar *et al.* (2016) document that VIX and the LIBOR interest rate correlate with their estimated common factors driving emerging sovereign bond spreads.

We conduct several robustness checks. To begin with, we study whether our results change when allowing for persistence in sovereign bond spreads, through the inclusion of the 12−month lagged *CDS Spread*. Importantly, we find that the overall fit and the significance of the covariates of interest barely change, relative to the model estimates in table 3. We then correct for the dynamic panel bias that arises when adding the lagged *CDS Spread*. Not surprisingly, the coefficient estimates hardly change. This is because we have a long panel in its time dimension T.[17]

Second, we investigate whether our results are sensitive to the potentially delayed nature of the macroeconomic variables' announcements. To do so, we allow for alternative lead and lag structures and, in addition, instead of *IP*, we employ the mean of the economic forecasters' one year ahead GDP growth forecasts. More specifically, regarding the alternative lead and lag structures, we include the three−month lead and lagged values of the industrial production growth and the consumer price inflation. Also, we incorporate further leads and lags of the external debt to GDP ratio.

Crucially, we find that the fundamental results in table 3 are largely unchanged (in particular, the significance and coefficient estimate for *GDPY1SD*), if we allow for these alternative lead and lag structures or if we change the way to measure economic activity. Therefore, our results remain consistent with the interpretation of the macro/international finance literature that macroeconomic variables drive sovereign risk premia, beyond the international portfolio funds and the global factors.

Third, we examine whether our results continue to hold with different restrictions on the minimum number of forecasters per month for an observation to be included and with alternative manners to account for the seasonality of *GDPY1SD*. For the latter, we consider two alternative means: On one hand, instead of the monthly time effects, we include 23 time to forecast horizon dummies. On the other hand, we estimate the baseline specification of table 3 at fixed points in

[17] In addition, we test the assumption of homogenous coefficients (through Hausman tests and mean group−estimation), finding no evidence in favor of heterogeneous coefficients.

time. Without loss of generality, we select the month of September. Importantly, in all cases, we confirm the conclusions of table 3.

Fourth, we incorporate other macroeconomic variables, such as the government fiscal balance, the foreign exchange reserves to GDP ratio and the exports to GDP ratio, all lagged. While these additional covariates do not alter the findings in table 3, overall, they were non−significant. Thus, we choose not to include them.

Finally, table A4, in appendix, presents some additional model estimates, which differ from the baseline specification, in the way we measure the international capital funds. More specifically, we consider two alternatives measures. On one hand, we distinguish between equity and bond portfolio funds; on the other hand, we rely on balance of payment data. Importantly, table A4 confirms our previous fundamental findings.

As an illustration, relying on the model estimates of the baseline in table 3, table 4 reports the average predicted impact on *CDS Spread* that a 1 standard deviation increase in the economic forecasters' one year ahead GDP growth forecast dispersion would imply. Because advanced and emerging economies appear to have different point estimates, table 4 distinguishes between them. In addition, for the computation of the averages, we exclude Venezuela, since the levels of *CDS Spread* and *GDPY1SD* for that country are much higher, thus over− influencing the mean values.

Table 4: Impact on *CDS Spread* of a +1 standard deviation increase in economic forecasters' GDP forecast dispersion

Average impact	Basis points
All countries (without Venezuela)	20
Advanced economies	37
Emerging economies (without Venezuela)	19

Notes: Own calculations. Source: Central Bank of Chile.

It is interesting to compare the results of table 4 with the ones in the literature. In particular, using a dataset of corporate bonds, Güntay and Hackbarth (2010) find that a +1 standard deviation increase in the dispersion of analysts' earning forecasts results in a +14 basis points expansion of credit spreads.

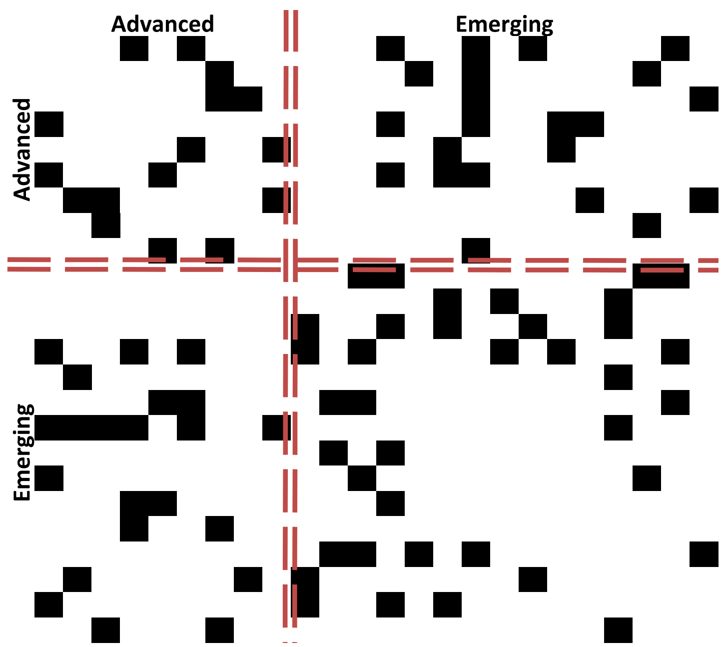
Summing up, the results in this section show that the dispersion in economic forecasters' GDP growth forecasts matter to explain sovereign bond spreads: Spreads are greater, the more dispersed economic forecasters' one year ahead GDP growth forecasts are.

5.2 The matrix of informational interdependence

This section starts by presenting the matrix of informational interdependence that results from applying the methodology described in section 4.2. Second, although determining the relative importance of the informational linkage, relative to the other ones identified in the literature, exceeds the scope of this paper, we compare the informational interdependence matrix with the matrices we could obtain if relying on alternative macroeconomic variables to identify the significant country−pair connections. This is interesting, because it may indicate whether the type of linkage we are measuring is different from the ones already stressed in the literature.

According to our methodology, if dispersed information creates a significant linkage between countries i and j, we should observe a value greater than zero in the corresponding entry of $\hat{W}$, $\hat{w}_{i:j}$. Figure 7 depicts the estimated weight matrix, with black cells representing the elements with positive values. In addition, to better display the significant linkages, we order the countries, from advanced to emerging economies.

Figure 7: Spatial weight matrix based on GDPY1SD

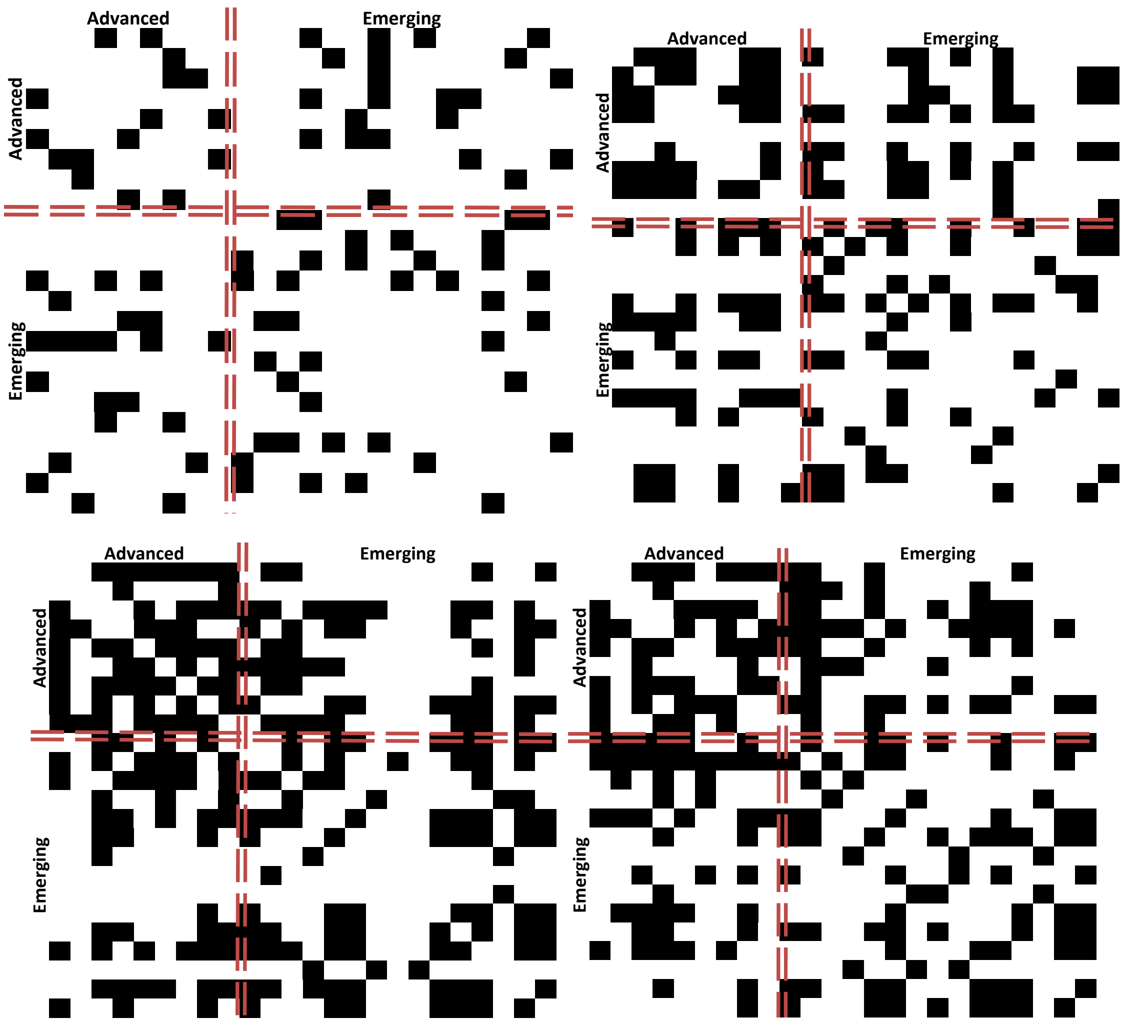


Notes: Own calculations. Source: Central Bank of Chile.

Importantly, figure 7 shows that dispersed information, as proxied by the dispersion of economic forecasters' one year ahead GDP growth forecasts, creates significant linkages between countries, with positive values representing 17% of the total number of possible entries in the matrix of informational interdependence. Interestingly, we do not observe distinct patterns between the submatrices advanced−advanced, advanced−emerging or emerging−emerging economies (the non−zero elements of each submatrix represent 20%, 16% and 17% of total entries, respectively).

We now address the question of how this measure of informational interdependence compares to the weight matrices that we could obtain if relying on alternative macroeconomic variables to identify the significant country−pair connections. In order to do so, we consider the cross−sectional mean of economic forecasters' one year ahead GDP growth forecasts, the real GDP per capita and the ratio of exports to GDP. Figure 8 depicts the alternative weight matrices we obtain in each case.

Figure 8: Spatial weight matrix based on *GDPY1SD* (top−left), the cross−sectional mean of GDP growth forecasts (top−right), real GDP per capita (bottom−left) and Exports over GDP (bottom−right).



Notes: Own calculations. Source: Central Bank of Chile.

As it becomes clear from figure 8, the pattern of significant connections that arises from *GDPY1SD* is different from the one that we obtain when considering the cross−sectional mean of the one year ahead GDP growth forecasts, the real GDP per capita or the exports to GDP ratio. Furthermore, the weight matrices derived from GDP per capita or the ratio of exports to GDP are not sparse matrices (their positive values account for 40% and 38%, respectively, of total entries).

Summing up, dispersed information, as proxied by the dispersion of economic forecasters' one year ahead GDP growth forecasts, creates significant linkages between countries. Furthermore, the pattern of significant connections that it generates is different from the one that we obtain when considering other macroeconomic variables.

5.3 Informational interdependence and sovereign bond spreads

Table 5 reports the ML estimates of the spatial SAR and SDM model, which account for informational interdependence. The exogenous interaction effects we include are *IP*, *Ext Debt over GDP*, *Inflation* and *Inter Port Funds over GDP*. We choose not to include exogenous interaction effects for VIX and *Libor3M*, since these are common factors. In addition, in order to focus on the comparison between spatial models, table 5 no longer distinguishes between the subsamples advanced and emerging economies.

Table 5: Spatial models allowing for informational spillovers: SAR and SDM.

Variables	SAR Coefficient	SDM Coefficient
IP	-0.02	-0.02
	(-0.99)	(-0.65)
Ext Debt over GDP[1]	0.32***	0.38***
	(6.02)	(7.16)
Inflation	0.10***	0.09***
	(2.79)	(2.48)
Inter Port Funds over GDP[2]	-0.05***	-0.03
	(-2.17)	(-0.99)
VIX	0.14***	0.12***
	(4.87)	(3.99)
Libor3M	-0.10***	-0.09***
	(-3.60)	(-3.12)
$W \times$ *IP*		0.05
		(1.11)
$W \times$ *Ext Debt over GDP*[1]		0.35***
		(4.61)
$W \times$ *Inflation*		-0.34***
		(-4.07)
$W \times$ *Inter Port Funds over GDP*[2]		-0.09***
		(-2.31)
$W \times$ *CDS Spread*	0.54***	0.49***
	(28.17)	(23.88)
Observations	2832	2832
R-squared	0.58	0.58
Log-likelihood	-4560.26	-45540.2
Monthly time effects	YES	YES
P-value of LR test SAR versus SDM	0.00	

Notes: (1) Lagged one year (annual). (2) Annualized flows from EPFR, MA(11). ML estimation. Constant is not reported. Variables are standardized. Level of significance: *** p<0.01, ** p<0.05, * p<0.1. Source: Central Bank of Chile.

The first important conclusion to extract from table 5 is that the matrix of informational interdependence contains useful information to explain sovereign bond spreads: The coefficient estimate for ψ, which measures the strength to which sovereign bond spreads in different countries are linked through dispersed information, is significant and positive. On top of that, since the estimated $\hat{\psi}$ equals 0.54 in the SAR model and 0.49 in the SDM model, it indicates that the informational linkage is considerable. This is because given our estimated $\hat{W}$, $\hat{\psi}$ should range between $(-0.8^{-1}, 1.0)$, with higher values reflecting stronger informational linkage.

Second, the fact that $\hat{\psi}$ is positive, regardless of the spatial model, implies that *CDS Spread* of different countries positively affect one another. Intuitively, when investors disagree more strongly about the future evolution of a given economy (relative to a previous situation), the extra premium they may charge to insure against this risk will not only impact the sovereign spreads of that economy, but potentially the CDS spreads of other economies as well. Thanks to the spatial econometrics literature, we are able to quantify this effect.

Third, table 5 shows that except for *IP*, all the exogenous interaction effects in the SDM are significant. Interestingly, this is indicating that changes in a country's characteristic (which needs to be part of $\hat{W} \times X_t^1$) significantly impact CDS spreads in the country experiencing the changes, as well as CDS spreads in other countries. In the following paragraphs, we analyse in more detail the interpretation of the estimated exogenous interaction effects.

Fourth, regardless of the spatial model we consider, table 5 shows that *Ext Debt over GDP*, *Inflation*, *VIX* and *Libor3M* continue to be significant at usual confidence levels and with the expected signs. Regarding *IP* and *Inter Port Funds over GDP*, we observe that in the former case, the coefficient estimate (and the exogenous interaction effect) is no longer significant, relative to the results in table 3, whereas the coefficient estimate for the latter is only significant in the SAR model.

Because a direct comparison of the FE estimates and the ML parameter estimates from the SAR and the SDM is not valid, we now turn to the computation of the effect measures, distinguishing between direct, indirect and total effects.[18] Regarding the statistical significance of the effect estimates, LeSage and Pace (2009) suggest simulating the distribution of the direct and indirect effects, using the variance covariance matrix implied by the maximum likelihood estimates. Following Halleck Vega and Elhorst (2015), we draw $1,000$ simulations from the multivariate normal distribution implied by the ML estimates.

The next table reports the approximate effect estimates for the 6 explanatory variables in the model specifications reported in table 5, distinguishing between the direct, indirect and total effect of a unit change in each of these control variables. It also displays the t−statistics, between parenthesis.

[18] This is because the spatial auto−regressive parameter ψ feeds back, obliging analysts to base interpretation not on the fitted parameters of the independent variables, but rather on correctly formulated effect measures.

Table 6: Direct, indirect and total effects in the SAR and SDM models.

Variables	SAR			SDM		
	Direct	Indirect	Total	Direct	Indirect	Total
IP	-0.03	-0.03	-0.05	-0.01	0.07	0.05
	(-0.99)	(-0.98)	(-0.99)	(-0.43)	(0.86)	(0.60)
Ext Debt over GDP[1]	0.34***	0.35***	0.69***	0.46***	1.00 ***	1.46 ***
	(5.94)	(5.43)	(5.78)	(7.82)	(6.37)	(7.46)
Inflation	0.11***	0.11***	0.22***	0.05**	-0.52***	-0.47***
	(2.89)	(2.82)	(2.87)	(1.26)	(-3.43)	(-2.74)
Inter Port Funds over GDP[2]	-0.06***	-0.06***	-0.12 ***	-0.04**	-0.19***	-0.23***
	(-2.17)	(-2.14)	(-2.16)	(-1.55)	(-2.71)	(-2.89)
VIX	0.16***	0.16***	0.31***	0.13***	0.11***	0.24***
	(5.14)	(5.21)	(5.26)	(3.89)	(3.84)	(3.91)
Libor3M	-0.10***	-0.10***	-0.21	-0.09***	-0.08***	-0.16***
	(-3.58)	(-3.54)	(-3.59)	(-2.81)	(-2.81)	(-2.82)

Notes: (1) Lagged one year (annual). (2) Annualized flows from EPFR, MA(11). For statistical significance of the effect estimates, we run 1000 simulations of their distributions. Level of significance: *** p<0.01, ** p<0.05, * p<0.1. Source: Central Bank of Chile.

From table 6, it is possible to extract the following conclusions. To begin with, the reported scalar summary measures for the SAR model illustrate one of its properties, namely, that the ratio between the indirect and direct effect is the same for every explanatory variables. Second, the comparison between the direct and indirect effects in the SAR versus the SDM reveals that while all direct effects are of equal sign in both spatial models, the indirect effects for two out of the six explanatory variables exhibit different signs. The two covariates are *IP* and *Inflation*.

Because some indirect effect estimates are of opposite signs in the SAR and the SDM, together with the lack of flexibility of the SAR, we need to determine which spatial model is the most likely to describe the data. In order to do so, we run a likelihood ratio (LR) test, which examines whether we can reduce the SDM to the SAR model. More specifically, the null hypothesis is $H_o : \theta = 0$. As displayed in table 5, since the LR test rejects the SAR in favor of the SDM, we conclude that the SDM is the most likely to best describe the data. Therefore, hereafter, we analyze the effect estimates of the SDM.

Third, table 6 shows that with the exception of *IP*, the direct, indirect and total effects in the SDM model are significant, and interestingly, when comparing them with the FE estimates, they tend to be of equal sign. In addition, it is worth stressing that, in the case of *Ext Debt over GDP*, *Inflation* and *Inter Port Funds over GDP*, the indirect effects (in absolute values) more than double the direct ones, thus implying that informational spillovers are important. In contrast, the direct and indirect effect estimates for *VIX* and *Libor3M* are close to their estimated coefficients in table 5. This is because these variables are not spatially lagged.

Fourth, table 6 reveals that because the indirect effect of *Ext Debt over GDP* (*Inter Port Funds over GDP*) reinforces the direct one, it implies that, on average, a larger external debt to GDP ratio in a given country not only increases (decreases) sovereign CDS spreads of that country, but also other countries' CDS spreads. Oppositely, in the case of *Inflation*, the direct and indirect effects have opposite signs. Intuitively, a higher inflation, for instance, due to a more lax monetary policy, results, on average, in larger CDS spreads for the country with higher inflation, while at the same time, it implies lower CDS spreads in the other countries. Interestingly, this might be reflecting a substitution effect between sovereign bonds.

Finally, *IP* exhibits non−significant effect measures. The latter may be due to the fact that the standard deviation of economic forecasters' one year ahead GDP growth forecast already enters in the computation of W, thus turning the direct and indirect effects for *IP* non−significant, once we include the feedback loops of $W \times Spr^{CDS}$.

Summing up, we show that the matrix of informational interdependence contains useful information to explain sovereign bond spreads and that the coefficient estimates to measure the strength to which sovereign bond spreads in different countries are linked through dispersed information are significant, positive and of considerable size.

In addition, the evidence we present indicates that changes in a country's characteristic significantly impact CDS spreads in the country experiencing the changes, as well as CDS spreads in other countries. Furthermore, in three out of the six explanatory variables, the indirect effects more than double the direct ones, thus implying that informational spillovers are important.

Therefore, from a policy standpoint, while a country's sovereign bond spread is likely to be influenced by those of other countries through a variety of channels, our results suggest that informational interdependence could be considered as an additional channel.

6 Conclusion

In this paper, we examine empirically the link between sovereign bond spreads and the dispersion in economic forecasters' forecasts about a country's macroeconomic fundamentals. We conjecture that forecast dispersion is a proxy for dispersed information among investors. First, we show that economies with more dispersed forecasts about their macroeconomic fundamentals bear a higher cost of debt. Second, we provide evidence that forecast dispersion creates linkages between countries which, in turn, leads to informational interdependence in sovereign bond spreads.

One venue of future research could be to further exploit the heterogeneities between countries and estimate other members of the family of spatial econometric models. The objective would be to test other types of interactions between countries, for instance, whether informational interdependence is more likely to be a global or a local phenomenon. A second venue of future research could be to assess the relative importance of the informational linkage, relative to (at least some of the) other linkages identified in the literature, thus providing evidence for the relative contribution of the different channels.

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Appendix A

Table A1: Mean of the control variables by country

Country	*CDS Spread*	*GDPY1SD*	$\bar{N}$	*Inflation*	*IP*	*Ext Debt over GDP*	*Port Inv over GDP Inw*	*Port Inv over GDP Out*	*FDI over GDP Inw*	*FDI over GDP Out*	*Inter Port Funds over GDP*	**Sample**
AUS	53.08	0.39	18	0.55	0.60	95.82	6.97	3.34	3.42	0.66	0.02	2008m8-15m12
DEU	30.93	0.39	28	0.35	0.28	152.36	2.23	4.14	1.70	3.24	0.01	2006m3-15m12
ESP	154.23	0.42	15	0.39	-0.64	156.19	2.75	-0.03	2.78	3.78	0.02	2006m3-15m12
FRA	57.65	0.32	20	0.30	-0.26	194.61	5.37	3.09	1.63	2.82	0.01	2006m3-15m12
GBR	52.99	0.48	24	0.54	-0.22	352.51	5.59	3.24	1.99	0.47	0.02	2008m8-15m12
ITA	155.54	0.32	15	0.39	-0.54	114.82	1.59	1.20	0.78	1.67	0.02	2006m3-15m12
NLD	50.00	0.46	10	0.38	-0.18	509.62	2.15	4.43	21.80	24.71	0.03	2008m9-15m12
SWE	26.93	0.44	14	0.27	-0.21	182.11	7.19	4.45	2.85	5.01	0.03	2006m3-15m12
USA	32.34	0.41	30	0.39	0.61	96.80	3.39	1.77	1.52	2.36	0.06	2009m9-15m12
BGR	213.52	0.59	12	0.83	-0.19	91.81	0.54	1.04	7.82	-0.21	0.00	2007m5-15m4
BRA	165.20	0.56	18	1.46	-0.08	13.21	1.66	-0.02	3.24	0.93	0.02	2006m3-15m12
CHL	81.85	0.47	17	0.87	0.18	39.00	2.76	4.93	8.18	4.93	0.01	2006m3-15m12
CHN	80.04	0.50	18	0.76	2.86	8.31	0.58	0.43	3.36	0.96	0.01	2006m3-15m12
HRV	274.76	0.53	11	0.56	-0.49	99.45	1.45	0.46	4.18	-1.02	0.01	2007m5-15m4
HUN	262.25	0.46	16	0.84	0.44	123.58	0.75	0.62	5.11	-3.86	0.03	2006m3-15m4
IDN	204.61	0.51	15	1.45	1.17	29.60	1.64	0.26	1.96	0.90	0.02	2006m3-15m12
MEX	122.17	0.51	18	0.99	0.23	26.51	2.75	0.49	2.43	0.94	0.02	2006m3-15m12
MYS	99.72	0.56	15	0.61	0.92	53.36	2.57	2.17	3.46	4.93	0.03	2006m3-15m12
ROM	240.21	0.70	12	1.11	0.95	59.69	1.40	0.17	3.22	-0.11	-0.00	2006m3-15m4
RUS	211.17	0.72	16	2.33	0.26	28.66	-0.03	0.48	2.77	3.05	0.01	2006m3-15m4
SVK	83.90	0.61	11	0.38	0.53	69.49	3.88	0.62	2.20	0.64	0.00	2006m3-15m4
THA	112.43	0.55	16	0.58	1.04	29.76	0.78	1.26	2.73	1.87	0.02	2006m3-15m12
TUR	215.21	0.74	15	1.96	0.88	42.62	1.87	0.12	2.02	0.41	0.01	2006m3-15m4
VEN	1327.22	1.93	14	9.23	-0.27	38.74	0.38	-0.22	0.74	0.58	0.02	2006m3-15m12

Notes: Mean value of each variable. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP growth forecast. $\bar{N}$: Average number of analysts. *Inflation*: Quarter on quarter inflation, measured by the consumer price index. *IP*: Industrial production quarter on quarter growth. *Ext Debt over GDP*: External Debt, as a proportion of GDP. *Port Inv Inward over GDP*: Portfolio Investment Inward, as a proportion of GDP. *Port Inv Outward over GDP*: Portfolio Investment Outward, as a proportion of GDP. *FDI Inward over GDP*: Foreign Direct Investment Inward, as a proportion of GDP. *FDI Outward over GDP*: Foreign Direct Investment Outward, as a proportion of GDP. *Inter Port Funds over GDP*: International Portfolio Funds, as proportion of GDP. Source: Central Bank of Chile.

Table A2: Data Availability

Country	*CDS Spread*	*GDPY1SD*	$\bar{N}$	*Inflation*	*IP*	*Ext Debt over GDP*	*Port Inv over GDP Inw*	*Port Inv over GDP Out*	*FDI over GDP Inw*	*FDI over GDP Out*	*Inter Port Funds over GDP*	**Sample**
AUS	87	87	87	83	83	87	87	87	87	87	87	2008m8-15m12
DEU	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
ESP	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
FRA	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
GBR	89	89	89	86	86	89	89	89	89	89	89	2008m8-15m12
ITA	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
NLD	38	38	38	38	38	38	38	38	38	38	38	2008m9-15m12
SWE	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
USA	76	76	76	73	73	76	76	76	76	76	76	2009m9-15m12
BGR	92	92	92	89	89	92	92	92	92	92	92	2007m5-15m4
BRA	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
CHL	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
CHN	113	113	113	107	107	113	113	113	113	113	113	2006m3-15m12
HRV	61	61	61	60	60	61	61	61	61	61	61	2007m5-15m4
HUN	103	103	103	94	94	103	103	103	103	103	103	2006m3-15m4
IDN	113	113	113	107	107	113	113	113	113	113	113	2006m3-15m12
MEX	118	118	118	115	115	118	118	118	118	118	118	2006m3-15m12
MYS	112	112	112	106	106	112	112	112	112	112	112	2006m3-15m12
ROM	87	87	87	82	82	87	87	87	87	87	87	2006m3-15m4
RUS	103	103	103	94	94	103	103	103	103	103	103	2006m3-15m4
SVK	82	82	82	65	65	82	82	82	82	82	82	2006m3-15m4
THA	112	112	112	104	104	112	112	112	112	112	112	2006m3-15m12
TUR	102	102	102	93	93	102	102	102	102	102	102	2006m3-15m4
VEN	111	111	111	108	108	111	111	111	111	111	111	2006m3-15m12

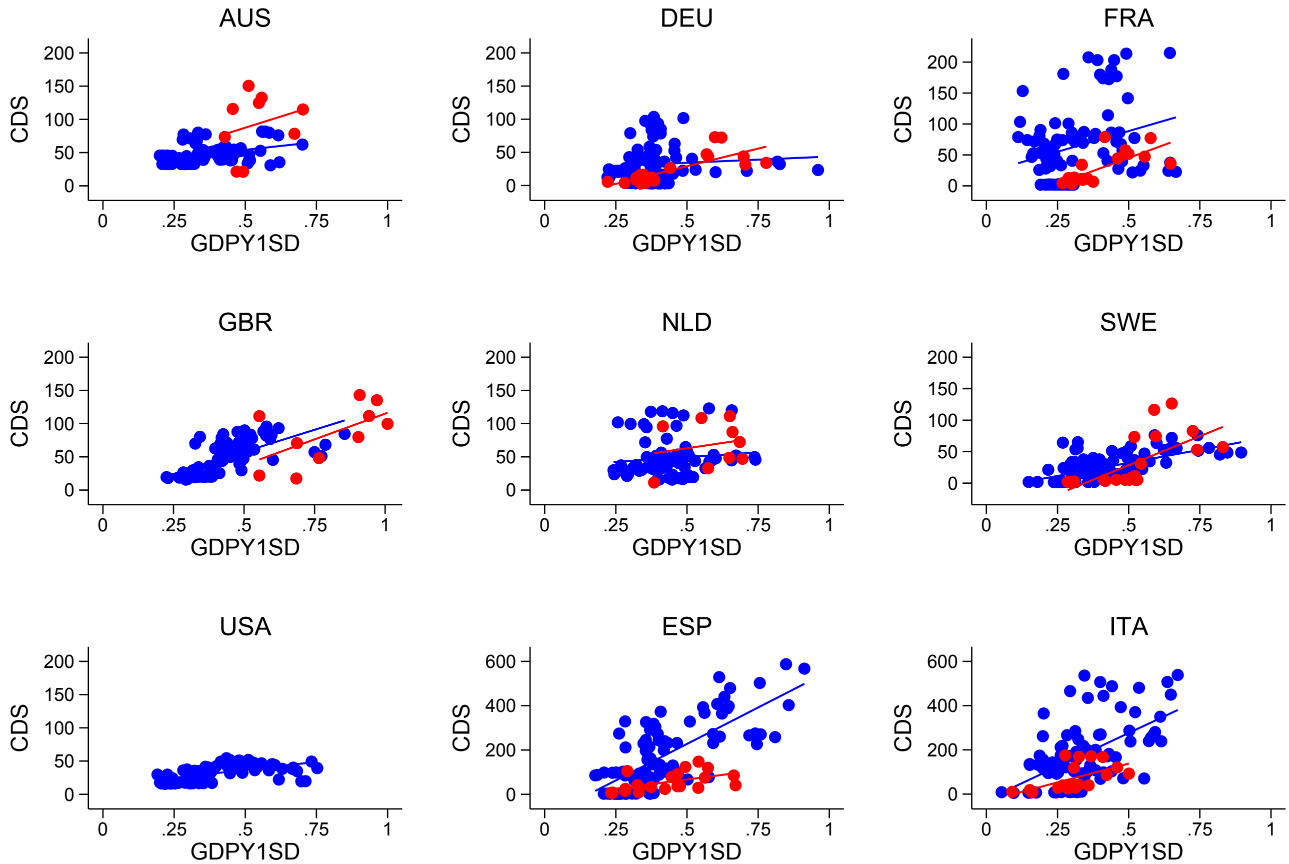
Notes: Number of observations for each variable. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP growth forecast. $\bar{N}$: Average number of analysts. *Inflation*: Quarter on quarter inflation, measured by the consumer price index. *IP*: Industrial production quarter on quarter growth. *Ext Debt over GDP*: External Debt, as a proportion of GDP. *Port Inv Inward over GDP*: Portfolio Investment Inward, as a proportion of GDP. *Port Inv Outward over GDP*: Portfolio Investment Outward, as a proportion of GDP. *FDI Inward over GDP*: Foreign Direct Investment Inward, as a proportion of GDP. *FDI Outward over GDP*: Foreign Direct Investment Outward, as a proportion of GDP. *Inter Port Funds over GDP*: International Portfolio Funds, as proportion of GDP. Source: Central Bank of Chile.

Table A3: Mean and standard deviation of *CDS Spread*, for each quintile constructed with coefficient of variation $\frac{GDPY1SD}{GDPY1M}$.

Quintile	$\frac{GDPY1SD}{GDPY1M}$ Mean	***CDS Spread*** Mean	Freq
1	0.35	88.42	509
	(0.11)	(59.15)	
2	0.43	97.78	509
	(0.13)	(74.91)	
3	0.47	118.32	509
	(0.17)	(109.76)	
4	0.56	159.01	509
	(0.25)	(169.67)	
5	0.99	464.92	509
	(0.72)	(785.67)	

Notes. *CDS Spread*: CDS spread. $\frac{GDPY1SD}{GDPY1M}$: Ratio of standard deviation of economic forecasters' one year ahead GDP growth forecast and the mean of economic forecasters' one year ahead GDP growth forecast. Standard deviation in parentheses. Source: Central Bank of Chile.

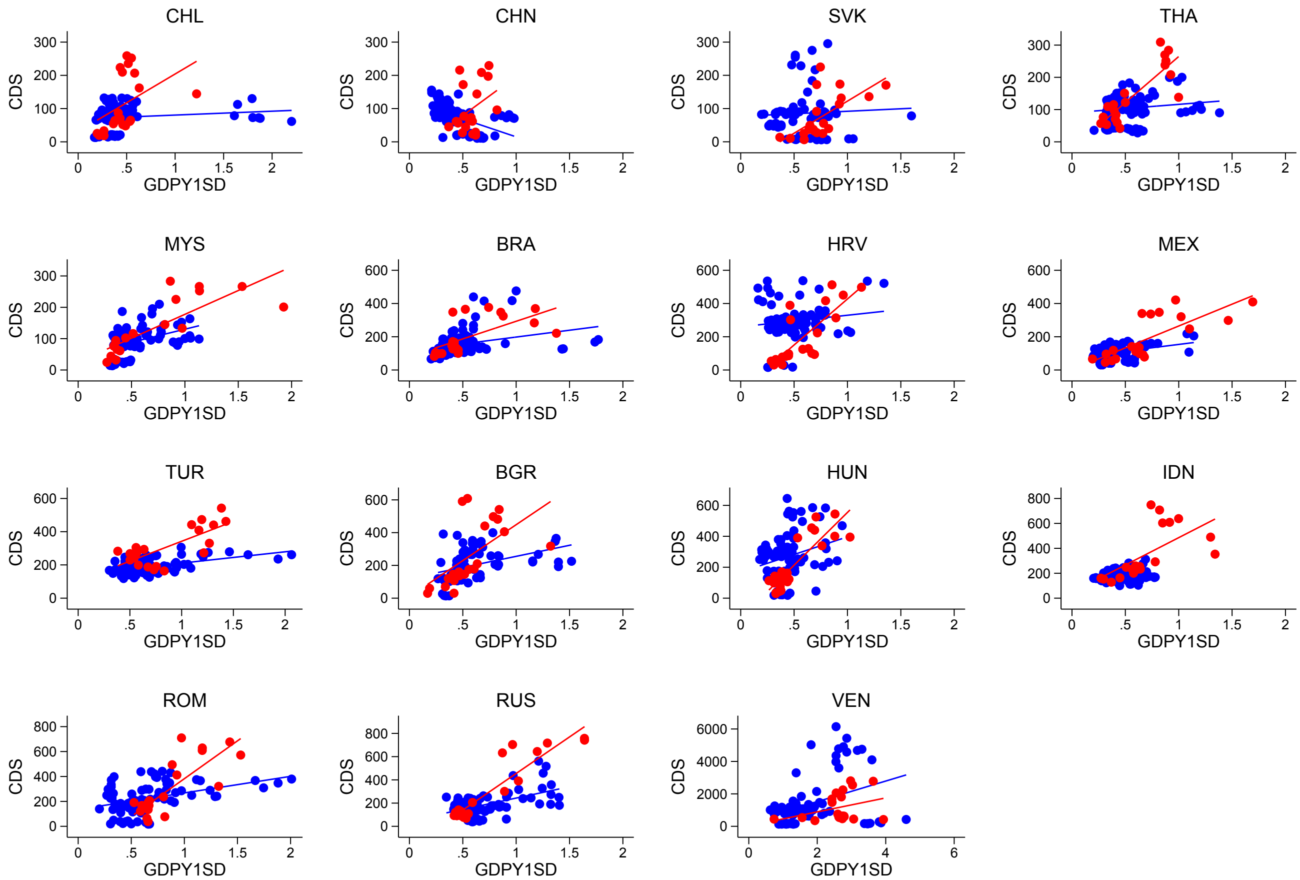
Figure 9: Scatter plot of *CDS Spread* and *GDPY1SD*, with regression line - Advanced Economies



Red dots correspond to subprime crisis (2007m9-2009m5). Graphs are in different scales

Notes. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP forecast. Regression line. We consider the following advanced economies, abbreviated through the three digit ISO codes, namely, AUS: Australia, DEU: Germany, FRA: France, GBR: Great Britain, NLD: Netherlands, SWE: Sweden, USA: United State, ESP: Spain and ITA: Italy. Source: Central Bank of Chile.

Figure 10: Scatter plot of *CDS Spread* and *GDPY1SD*, with regression line - Emerging Economies



Red dots correspond to subprime crisis (2007m9-2009m5). Graphs are in different scales

Notes. *CDS Spread*: CDS spread. *GDPY1SD*: Standard deviation of economic forecasters' one year ahead GDP forecast. Regression line. We consider the following advanced economies, abbreviated through the three digit ISO codes, namely, CHL: Chile, CHN: China, SVK: Slovakia, THA: Thailand, MYS: Malaysia, BRA: Brazil, HRV: Croatia, MEX: Mexico, TUR: Turkey, BGR: Bulgaria, HUN: Hungary, IDN: Indonesia, ROM: Romania, RUS: Russia and VEN: Venezuela. Source: Central Bank of Chile.

Table A4: Robustness checks for international portfolio funds

Variables	All	Advanced	Emerging	All	Advanced	Emerging	All	Advanced	Emerging
IP	-0.01***	-0.02	-0.01***	-0.01***	-0.02	-0.01***	-0.01***	-0.02**	-0.01***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Ext Debt over GDP[1]	1.71**	0.69**	2.39***	1.66**	0.62*	2.51***	1.66**	0.68	2.21***
	(0.80)	(0.34)	(0.54)	(0.84)	(0.37)	(0.68)	(0.69)	(0.79)	(0.68)
Inflation	0.03	0.20***	0.03*	0.04	0.17***	0.03	0.03*	0.21***	0.03**
	(0.03)	(0.06)	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)	(0.06)	(0.01)
Inter Port Funds over GDP[2]	-0.06*	-0.14**	-0.04						
	(0.04)	(0.07)	(0.03)						
VIX	0.26***	0.17***	0.27***	0.25***	0.16***	0.27***	0.27***	0.23***	0.28***
	(0.02)	(0.05)	(0.03)	(0.02)	(0.05)	(0.03)	(0.02)	(0.06)	(0.03)
Libor3M	-0.53***	-0.99***	-0.32***	-0.52***	-0.99***	-0.30***	-0.51***	-0.95***	-0.28***
	(0.10)	(0.09)	(0.07)	(0.09)	(0.10)	(0.07)	(0.11)	(0.10)	(0.07)
GDPY1SD	0.09***	0.49***	0.05***	0.08***	0.39**	0.05***	0.10***	0.62***	0.06**
	(0.03)	(0.18)	(0.02)	(0.03)	(0.18)	(0.02)	(0.03)	(0.19)	(0.03)
Equity Funds over GDP[2]				-0.11***	-0.15***	-0.09**			
				(0.04)	(0.04)	(0.04)			
Bond Funds over GDP[2]				0.03*	-0.01	0.01			
				(0.02)	(0.06)	(0.03)			
FDI Inward over GDP[1]							0.03	0.20	-0.18***
							(0.12)	(0.21)	(0.07)
FDI Outward over GDP[1]							-0.01	-0.10	0.20*
							(0.31)	(0.26)	(0.12)
Port Inv Inward over GDP[1]							-0.05	-0.01	-0.01
							(0.06)	(0.09)	(0.04)
Port Inv Outward over GDP[1]							-0.10*	-0.04	-0.11
							(0.06)	(0.07)	(0.07)
Observations	2,194	820	1,374	2,161	820	1,341	2,194	820	1,374
R^2 within	0.70	0.84	0.67	0.72	0.84	0.71	0.70	0.83	0.66
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Monthly time effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Log-Like	-949.6	-338.6	-248.4	-865.4	-323.5	-165.9	-966.4	-354.8	-273.3
RMSE	0.38	0.37	0.30	0.36	0.37	0.28	0.38	0.38	0.30

Notes: (1) Lagged one year (annual). (2) Annualized flows from EPFR, MA(11). FE estimation. Constant is not reported. Variables are standardized; bootstrapped standard errors. Level of significance: *** p<0.01, ** p<0.05, * p<0.1. All estimations with at least 7 forecasters per month. Source: Central Bank of Chile.

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