Global Information Spillovers*

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The amount of information produced in an economy varies over time. Stock prices, in particular, are informative, but their degree of informativeness changes over time.[1] Agents do not produce the same amount of information in every macroeconomic state of the world or in anticipation of every state. Although a baseline level of information is always produced, spending additional resources on information production is not always beneficial. In fact, it is so only when the expected benefits exceed the costs. In particular, more information is produced when distinguishing between firms is more important. This is most likely when many firms may fail, as in a financial crisis. In this paper, we show how the amount of information produced varies over time. We then focus on the informational links between economies, both advanced and emerging, on a global scale. We show that: (1) stock price based measures of information produced *within a set of advanced economies* predict crises in *other advanced economies and in emerging markets*; (2) stock price based measures of information predict global imbalances, with funds flowing towards countries with

* This paper is based on a preliminary version of Chousakos et al. (2016). The results here should be viewed as tentative, since the sample currently is small, with only 24 countries, seven of which are emerging markets. Thanks to Enrique Mendoza, Ernesto Pasten, Diego Saravia, Yuliy Sannikov, and participants at the Annual Conference of the Central Bank of Chile for comments and suggestions. We also thank Shah Kahn and Tim Rudner for research assistance and the National Science Foundation for support.

1. The foundation for this is that stock markets are at least weakly (market) efficient; see, e.g., Fama (2014) and Grossman (1981).

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more information production, thus suggesting that the reallocation of resources that occurs among economies is a result of information production; (3) global imbalances are associated with financial crises for a number of economies. These results suggest that economies are integrated via an information channel.

In Gorton and Ordoñez (2014, 2016), the macroeconomic dynamics are caused by agents producing more information about firms at certain times, but not at other times. These papers focus on collateralized debt, and the information about collaterals is not directly useful for investment purposes, but is indeed useful for credit allocations. In this paper, we shift the focus to stock prices and ask a related question: Do agents produce more information about firms at certain times rather than other times and, if so, is there any reallocation of resources in response? We find that the answer to both questions is yes. The stock price based measures of information that we propose are successful in predicting recessions with a financial crisis and reallocation of resources at a global level.

For reasons discussed in Gorton and Ordoñez (2016), and in Chousakos and others (2016), we start by proposing definitions of "recession" and "growth" periods. Our definitions are agnostic, intuitive, and ad hoc.[2] Our data set includes a list of financial crises for a panel of countries, which mostly happen during a recession. We compute and examine measures of aggregate information about the economy's fragility (defined below) prior to and during the different types of aggregate activity. In all, we define four possible states of the macroeconomy: *recession with no crisis, recession with crisis, growth*, and *normal* (which is none of the other categories). Note that these can occur in any order. In particular, growth and recession need not alternate. We validate this dating procedure for macroeconomic states by showing how information varies across these states, and by further showing that reallocation occurs as a function of the information. We focus on the information relationships between advanced and developing markets.

The information inter-linkages that we analyze in this paper relate to the phenomenon of globalization, i.e., information produced in a set of countries is important for a number of other economies.

2. But they are no more ad hoc than the choice of a smoothing parameter when detrending by using the Hodrick-Prescott filter. See Hodrick and Prescott (1997). Nor are our definitions more *ad hoc* than dating *via* peaks and troughs, which requires that peaks follow troughs and *vice versa*.

We find strong evidence in favor of global information spillovers. More specifically, by using principal component analysis (PCA), we estimate a number of common information factors across an initial set of advanced countries with a long history of stock data. We show that these information factors consistently predict instances of recessions with crises not only in the countries used in the estimation, but also in other advanced and developing economies. However, we cannot test for an informational channel running in the opposite direction, that is, from the omitted advanced economies and emerging markets to the more advanced economies. This impossibility is due to data limitations, because emerging countries' stock markets have limited histories and few listings, in general. Actually, this is itself very suggestive in that it may be a possible reason why emerging market participants may use information produced in advanced economies; however, we produce no evidence of that in this paper.

Motivated by the predictive power of information measures over recessions associated with crises, we conjecture that if these information measures are indeed informative, a reallocation of resources is likely to occur as a response to the information produced. We provide strong evidence in favor of this hypothesis. Aggregate measures of information have a significant predictive power over global imbalances. More specifically, we show that an increase in information production is associated with a higher level of domestic imbalances and with a lower level of foreign imbalances. This implies that more information is related to a higher level of domestic assets which, in turn, are funded with foreign liabilities. The relation between information production and global imbalances suggests a possible link between information production and reallocation of capital at a global level. Finally, we show that global imbalances predict instances of recessions associated with financial crises.

All this evidence combined suggests an informational narrative about international information linkages: information production in a set of advanced countries results in international capital flowing towards the country with more and better information, thus creating global imbalances. These global imbalances seem to be related to crises in other countries with outflows of funds. We finally investigate whether information production is associated with reallocation of capital within an economy. Towards that, for each country in our sample, we group companies on the basis of their Tobin's Q-ratios into quintiles and measure the fraction of companies that remain in the same bin or switch bins over two consecutive years. We find that

lagged innovations in information production are weakly associated with changes in companies' Q-ratios, both in normal times and in times of recessions with crises, which implies that information production only weakly affects reallocation of resources within a given economy. This finding is in contrast to the strong relation between information production and reallocation at a global level, which suggests that the economy that generates information may face other circumstances that impede the exploitation of more and better information.

Our findings on the predictive ability of information measures on economic events are consistent with Gorton and Ordoñez (2016) and the literature that shows that economic agents can forecast when an upcoming recession will be particularly bad, i.e., one with a financial crisis. With regard to information spillovers, there are a number of papers that focus on stock market contagion, in which a stock market crash in one country causes declines in the stocks of other countries, e.g., King and Wadhwani (1990), Calvo (2004), and Calvo and Mendoza (2000). Gande and Parsley (2003) find evidence of information spillovers when one country's sovereign debt is downgraded, thus resulting in increased spreads on other countries' sovereign debt. This link has also been rationalized by Cole and others (2016) with a model of contagion in sovereign bond spreads through the incentives for information acquisition generated by a optimal portfolio reallocation across sovereign bonds. Our question is different: We ask whether the information produced in advanced economies forecasts financial crises and global imbalances in emerging markets, and whether reallocation occurs as a function of the information.

This paper is also related to work on the reallocation of resources, particularly during recessions and crises. There is a large literature on whether there are "cleansing effects" of recessions, which means that capital and labor are moved—reallocated—from low- to high-productivity firms and industries. Such reallocation is relatively less costly to do during recessions. There is a large literature on this subject, including Schumpeter (1939), Foster and others (2016), and Caballero and Hammour (1994, 1996). Reallocation involves some firms exiting, but also capital (and labor) moving between firms or sectors as well. Except for exit, reallocation may be difficult because, in a financial crisis, the banking system is damaged.

The paper proceeds as follows. Section 1 explains and summarizes the data we use, and defines aggregate economic episodes and information measures. Section 2 shows how information measures relate to macroeconomic fluctuations. Section 3 examines how our

measures of information spill over across countries. Section 4 studies the reallocation of resources, both at a global level and within an economy, as a result of information production. Section 5 briefly summarizes our results and concludes.

1. Definitions and Data

In this section, we discuss the data, define the different phases of aggregate economic activity, and explain various information measures.[3]

1.1 Economic Fluctuations

We do not want to impose a great deal of preconceived structure on the data, such as detrending or defining peaks and troughs, because there is no theoretical justification for this. Instead, we define recessions and growth periods differently, as follows: To determine recession periods, at date t we look backward four years and compute the difference in the level of real GDP (*rGDP*) between date $t-4$ and all consecutive dates until date t. The measure of a recession at time t (that we denote as α_t) is defined as the minimum difference across all the above mentioned differences in *rGDP* levels over the four-year period prior to t. A *recession* period begins when α_t is less than 0.5% (this is when $\alpha_t \leq -0.5\%$), and ends when the previous peak is again attained. This definition is based on the level of real GDP. As Burns and Mitchell (1946) put it: "Aggregate [economic] activity can be given a definite meaning and made conceptually measurable by identifying it with gross national product" (p. 72). We determine *growth* periods by the same backward-looking procedure, but with a new (growth) threshold of $\alpha_t \geq 1\%$.[4]

A financial crisis may start at any date during a recession period and continue until the end of both the crisis and the recession. However, in a few cases, financial crises are not associated with a recession. In what follows we will look at predictive regressions to try to explain the starting date of recessions and the starting dates of crises.

3. For further details, see Chousakos and others (2016).

4. Our results are robust to alternative thresholds for recessions ($\alpha_t \leq -0.4\%$, or $\alpha_t \leq -0.6\%$) and growth periods ($\alpha_t \geq 0.5\%$, or $\alpha_t \geq 1.5\%$).

Note that the structure imposed on real GDP is the choice of the thresholds and the length of the look-back period. We impose the same thresholds and look-back length on all countries in our sample. Recessions fall into two types: recessions with a crisis and recessions with no crisis. We make this classification by first defining recessions and then checking against Valencia and Laeven (2012) who provide crisis dates worldwide since 1970.[5] Under our definitions, there can be a pattern of aggregate activity such as: recession, normal, recession, growth, normal, recession with a crisis, normal, and so on, where "normal" refers to a period that is neither a recession period nor a growth period; it is a normal period of economic activity. Based on the data discussed below we identify the different types of aggregate economic activity, which are shown in Table 1.

The first column in Table 1 shows the number of each type of episode across the countries of our sample. As expected, episodes of "normal times" predominate. There are 66 growth episodes and 68 recessions, among which 18 are associated with crises and 61 include instances of no crisis.[6] The second column shows statistics on the average duration in years of each event type. The average duration of a recession with a crisis episode is longer than that of a recession with no crisis. Growth episodes are the briefest.

Table 1. Summary Statistics - Duration of Economic Events

	Count	*Mean*	*St Dev*	*Min*	*Max*
Normal times	89	2.61	1.92	1.00	9.00
Growth	66	1.55	0.95	1.00	5.00
Recessions	68	2.84	1.39	1.00	7.00
Recessions with crisis	18	3.06	0.94	1.00	5.00
Recessions with no crisis	61	2.26	1.15	1.00	5.00

Duration in years of normal times, growth, recession, recession with crisis, and recession with no crisis episodes. The economic episodes are computed by using quarterly real GDP data from the OECD iLibrary over a period of thirty years from 1980 until 2010.

5. Valencia and Laeven (2012) define a systemic banking crisis by two conditions: (1) There are significant signs of financial distress in the banking system, evidenced by significant bank runs, losses to banks, and/or bank liquidations. (2) There are significant banking policy interventions in response to large losses in the banking system. Interventions can include: (1) extensive liquidity support, (2) bank restructuring with gross costs of at least 3% of GDP, (3) significant bank nationalizations, (4) significant guarantees put into place, (5) significant asset purchases (at least 5% of GDP), (6) deposit freezes and/or bank holidays.

6. A number of recessions begin as recessions with no crisis and become recessions with crisis later, since a crisis might occur towards the end of a recession. In other words, there are recession episodes which include both crises and no crises episodes.

1.2 Measures of Information and Fragility

Now we propose two series of information in stock markets. One is the inverse of stock-market volatility, which is closely related to the fragility of firms (i.e., possible bankruptcy) in the economy. The other one relates to the cross-sectional dispersion (CSD) of stock price volatilities, and constitutes more direct evidence of private information acquisition, as it widens the range of beliefs about stocks.

The definition of fragility is from Atkeson and others (2013). Based on Leland's (Leland, 1994) and Merton's (Merton, 1974) structural models, these authors develop two concepts of default: Distance-to-Insolvency and Distance-to-Default. They then show that the variable one over the firm's equity volatility ($1/Vol$) is bounded between these two measures. Intuitively, when a firm's equity volatility is high, the firm is more likely to default (for given leverage). The fragility of an economy varies over time and spikes significantly during a crisis. Atkeson and others (2013) study the U.S. over 1926-2012 and show that 1932-1933, 1937, and 2008 stand out as especially fragile periods. Vassalou and Xing (2004) use the Merton (1974) model measure of default risk to show that default risk is a systematic risk and that the Fama-French asset pricing factors partially reflect such default risk.

We examine the median $1/Vol$ of each country in each year as a state variable about the *fragility* of the economy. Fragility is essentially a measure of economy-wide bankruptcy risk. There is a history of research that shows that firms are increasingly prone to bankruptcy leading up to a recession. Burns and Mitchell (1946) show that the liabilities of failed non-financial firms is a leading indicator of recession.[7] Gorton (1988) shows that, when the unexpected component of this variable spikes, there was a banking panic during the U.S. National Banking Era. There was never a panic without the threshold being exceeded; and the threshold was never exceeded without a panic.[8]

We also examine an additional measure of information in the economy which is defined as the cross-section of firms' stock-price volatilities. In particular, we look at the standard deviation of firms' volatilities: $CsVol$. In other words, this variable is a cross-section characterization. This variable is related to the cross-section of firms' average returns: $CsAvg$. These two variables are highly correlated (0.96), so we will restrict attention to $CsVol$. We label this second

7. Also see Zarnowitz and Lerner (1961).
8. See the discussion in Gorton (2012), p. 75-77.

variable *Information* because movements in this variable reflect information in stock prices. We have in mind the idea that underlying these variables are agents in the economy who are producing more or less information in reaction to the unobserved (to us) state of the economy. Based on the private information that these agents produce, they trade, and stock prices respond. This interpretation is not crucial. It could be public information, or a combination of public and private information. In a later section, we will show that it is not unreasonable to consider both these measures to be informative. We find that the proposed measures of information are associated with the reallocation of capital among economies at a global level, especially during instances of recessions with crises.

These variables are calculated as follows. By using daily stock price data, monthly return and volatility are calculated for each firm in each country of the sample. Both returns and volatilities are annualized and $1/Vol$ is computed. For each country, we find the median $(1/Vol)$ and compute the cross-sectional standard deviation of firm-level volatilities. Then, these two monthly series are averaged across quarters to create quarterly series. The annual series are formed by using the last quarter observation of the quarterly series.[9]

1.3 Measures of Global Imbalances

In addition to domestic phases of macroeconomic volatility and domestic measures of information acquisition, in what follows, we examine the currency composition (domestic *versus* foreign) of assets and liabilities, and ask whether and how the currency composition changes in response to the changing information produced in advanced countries. The various assets and liabilities in a country are categorized by currency (either domestic or foreign) based on where the security was issued. For example, an asset in country A owned by nation B is classified as a foreign asset on the national balance sheet of country B, and a liability issued by country A and owned by a nation overseas is classified as a foreign liability on the national balance sheet

9. Another approach to the construction of the annual series would be to use an annual measure of our information variables, or the last month's observation. The reasons why we choose the last observation of the quarterly series is, *first*, that it captures information in a more timely fashion and exhibits more variation as compared to the annual measure, which is extremely smooth, and *second*, that it is less volatile than the monthly series, which is a significantly noisier series.

of country B. We standardize all measures by GDP levels, where the standardization is based on expressing the GDP denominator in the same currency as the numerator.[10] Global imbalances are defined as the difference between assets and liabilities denominated in the same currency. We use the following measures: $GI(DOM)$ for imbalances in domestic currency; $GI(FOR)$ for global imbalances denominated in foreign currencies; $GI(USD)$ for imbalances in U.S. dollars; $GI(EUR)$ for imbalances in euros; and $GI(TOT)$ for total imbalances, which are the sum of global imbalances issued in domestic and foreign currency.[11] For additional details see Bénétrix and others (2015).[12]

1.4 Data Sources and Summary Statistics

Annual Real GDP is from the Penn World Tables (PWT), TFP is from Kose and others (2008), domestic credit to private sector is from the World Development Indicators, and labor productivity is constructed by using the hours-adjusted output-labor ratio from the Total Economy Database (TED). Our measures of economy-wide fragility and the level of information in the economy are constructed by using daily stock price data for the countries in our sample, as discussed above. The source of stock price data is Thomson/Reuters DataStream.[13] Data on global imbalances are from the online appendix of Bénétrix and others (2015).

10. This method guarantees that results cannot be due to currency fluctuation effects.

11. For additional details see Bénétrix and others (2015).

12. The dataset can be found on Philip Lane's website http://www.philiplane.org/BLSJIE2015data.htm.

13. Table 9 in the Appendix shows the sample period of stock prices for each country.

Table 2. Summary Statistics – Annual Frequency

	Count	*Mean*	*StDev*	*Min*	*Max*
TFP	1270	462.685	171.680	133.540	823.585
Credit/rGDP	1004	66.306	49.441	6.325	232.097
Labor Productivity in hours	1057	15.934	8.709	2.012	40.215
Recession Measure	637	-0	0.023	-0.161	0.061
$\Delta rGDP$	1090	0.035	0.056	-0.313	0.591
ΔTFP	1238	0.003	0.038	-0.180	0.236
$\Delta Credit/rGDP$	979	0.041	0.199	-0.671	2.881
$\Delta Labor\ Productivity$	1029	0.020	0.031	-0.179	0.196
1/Vol	665	3.296	1.151	0.921	8.067
CsVol	665	0.447	0.353	0.046	3.657
CsAvg	665	0.125	0.079	0.018	0.854
$\Delta(1/Vol)$	643	0.009	0.898	-4.210	3.403
$\Delta CsVol$	643	0.012	0.303	-1.886	2.181
$\Delta CsAvg$	643	0.003	0.069	-0.403	0.536
GI(DOM)	646	-41.078	42.345	-516.487	54.671
GI(FOR)	646	15.425	43.028	-62.745	15.291
GI(TOT)	646	-25.653	28.720	-165.921	60.271

The table reports summary statistics for *realGDPinbillion$*, *TFP*, *Credit/GDP*, *LaborProductivityinhours*, *RecessionMeasure* (*a*), $\Delta rGDP$, ΔTFP, $\Delta Credit/GDP$, $\Delta LaborProductivity$, *1/Vol*, *CsAvg*, *CsVol*, $\Delta(1/Vol)$, $\Delta CsVol$, $\Delta CsAvg$, *GI(DOM)*, *GI(FOR)*, and *GI(TOT)*. The data are from the Penn World Tables (PWT), WIPO statistics database, World Development Indicators, Total Economy Database (TED), and Thomson/Reuters (DataStream), and span a period from 1973 until 2010. "Count" label refers to country-years.

2. Information and the Macroeconomy

We now turn to the first set of results, which concerns how information fluctuates over time in a country in relation to macroeconomic fluctuations. We do this through a univariate comparison of variables prior to the different types of aggregate economic events (recession with crisis, recession with no crisis, growth, and normal). Table 3a shows a univariate comparison of key variables *four quarters prior* to the beginning of a recession with crisis episode *versus* the beginning of a recession with no crisis episode. Leading up to a recession with crisis, growth in real GDP ($\Delta rGDP$) is lower, and

our recession measure (α) of the minimum difference of real GDP levels over a four-year period from the real GDP level at the beginning of the period is negative. Prior to recessions with crises, we observe a higher level of fragility (1/*Vol* is smaller). The significant difference in fragility is natural. As an economy heads towards a crisis, the distance-to-default of the average firm decreases. Leading up to a recession with a crisis, *CsAvg* and *CsVol*, i.e., the standard deviation of average returns and the standard deviation of firm level volatility, are both significantly higher. This is an indication of a higher dispersion of volatility and returns among companies, which we interpret as an increase in the information produced by agents in the economy in an attempt to distinguish between possible surviving firms and possible failures. Domestic and foreign global imbalances, which capture the difference between assets and liabilities issued by domestic and foreign investors respectively, exhibit the opposite pattern between instances of recessions with crises *versus* recessions with no crises. Domestic global imbalances are lower and foreign global imbalances are higher prior to recessions with crises episodes.

Table 3b reports the results of a univariate comparison of the same variables four quarters prior to the beginning of a recession *versus* prior to the beginning of a growth period. The only variable which is statistically different between the two events is *CsAvg* with a higher value prior to a growth episode. This suggests that the short-lived (average duration of 1.55 years) growth stage is associated with more production of information.

Table 3 shows that information measures have predictive content at a domestic level. Figure 1 in the appendix illustrates this finding. It shows plots of the two information measures averaged over recessions with a crisis and recessions with no crisis, starting *15 quarters before* the start of the average recession with a crisis and the average recession with no crisis. It is apparent that these measures of information and fragility vary depending on whether the coming recession will involve a financial crisis or not. We observe that fragility is higher and more information is produced prior to the beginning of a recession with a crisis episode.[14] We discuss the global imbalances measures below, when we separate advanced and developing economies.

14. We must remember that the economy is more fragile when Vol increases, and so 1/Vol decreases.

Table 3. Summary Statistics - 4 Quarters Prior to Economic Events (All Economies)

(a) Recessions with crises vs. recessions with no-crises

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.032	-0.005	0.037***
			(6.59)
α	0.004	-0.033	0.037***
			(13.51)
$1/Vol$	3.447	2.388	1.059***
			(6.57)
$CsVol$	0.407	0.645	-0.238***
			(-5.19)
$CsAvg$	0.115	0.173	-0.057***
			(-5.59)
$\Delta(1/Vol)$	0.016	-0.319	0.335*
			(2.57)
$\Delta CsVol$	0.002	0.107	-0.106*
			(-2.54)
$\Delta CsAvg$	0	0.024	-0.024*
			(-2.48)
$GI(DOM)$	-43.861	-64.154	20.293***
			(3.47)
$GI(FOR)$	20.714	35.239	-14.526*
			(-2.47)
$GI(TOT)$	-23.148	-28.915	5.767
			(1.29)
N	78	18	60

t-statistics in parentheses.
+p <0.10; * p <0.05; ** p <0.01; *** p <0.001.

Table 3. (continued)

(b) Recessions vs. growth

	Recession	*Growth*	*Mean Diff.*
$\Delta rGDP$	0.025	0.040	-0.015***
			(-3.68)
α	-0.001	0.007	-0.009***
			(-3.90)
$1/Vol$	3.384	3.223	0.161
			(1.36)
$CsVol$	0.425	0.442	-0.017
			(-0.50)
$CsAvg$	0.118	0.131	-0.013+
			(-1.71)
$\Delta(1/Vol)$	-0.055	0.136	-0.191*
			(-2.04)
$\Delta CsVol$	0.016	-0.006	0.022
			(0.74)
$\Delta CsAvg$	0.004	-0.002	0.005
			(0.75)
$GI(DOM)$	-46.459	-46.983	0.524
			(0.11)
$GI(FOR)$	23.344	20.101	3.243
			(0.66)
$GI(TOT)$	-23.115	-26.882	3.767
			(1.01)
N	85	89	-4

t-statistics in parentheses.
+p <0.10; * p <0.05; ** p <0.01; *** p <0.001.

The table summarizes mean values for $\Delta rGDP$, α, $1/Vol$, $CsVol$, $\Delta(1/Vol)$, $\Delta CsVol$, $GI(DOM)$, $GI(FOR)$, and $GI(TOT)$ four quarters prior to the event for (a) recessions with a crisis vs. recessions with no crisis and (b) recessions vs. growth. The third column reports the difference in means and the t-statistic of the difference.

Table 4a compares our information measures and global imbalances measures *during* recessions associated with crises *versus* recessions associated with no crises.[15] The levels of all the information variables are significantly different. Recessions with a crisis are significantly deeper in terms of the level of the real GDP decline. Fragility is significantly higher (1/*Vol* is smaller), as are both *CsAvg* and *CsVol*, i.e., the standard deviation of returns and the standard deviation of volatility. These two measures are higher, thus implying a higher dispersion of volatility and returns among companies. None of the other information-related measures are significantly different. Table 4b shows that, in terms of information production during the economic event, recession periods are not different from growth periods.

We also explore any potential differences in global imbalances between recessions with crises and recessions with no crises. Table 4a shows that in recessions with crises, as compared to recessions with no crises, there is a significant *decrease* in the domestic currency denominated component of the imbalance and a significant *increase* in the foreign denominated component of the imbalance. This hints at a possible reallocation of resources taking place among economies at a global scale during financial crises. In Section 4.1 we further explore the implications of information production on global imbalances. We now turn to looking at these univariate comparisons separately for developed and emerging economies.

Tables 5 and 6 display univariate results for advanced and developing economies, respectively. These tables show that, in recessions with no crises, global imbalances of foreign issued assets and liabilities (*GI(FOR)*) are positive for both advanced and developing economies, thus suggesting a lower level of foreign issued liabilities as compared to that of foreign assets held by domestic investors. The positive foreign global imbalances are counterbalanced by negative imbalances of domestically-held assets and -issued liabilities (*GI(DOM)*) for both advanced and developing economies. However, in recessions with crises, the behavior of foreign global imbalances differs between advanced and developing economies. *GI(FOR)* increases for advanced economies and decreases for developing economies, thus reflecting shrinking foreign denominated liabilities. These results suggest a reallocation of investment with the exit of foreign assets. Such reallocation takes the form of capital outflows from developing economies, which means capital inflows to advanced economies.

15. "Global imbalances" refers to the difference between financial assets and liabilities standardized by the level of GDP of each country.

One question is whether the *GI(FOR)* results constitute a sudden stop which is usually defined as an abrupt decline or reversal of capital inflows, regardless of currency denomination.[16] It should be noted, however, that the dating of sudden stops is quite different than the dates of crises, and there are many more sudden stops than there are crises.

Table 4. Summary Statistics - Contemporary to Economic Events (All Economies)

(a) Recessions with crises vs. recessions with no crises

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.012	-0.005	0.017***
			(3.77)
α	-0.009	-0.042	0.033***
			(8.54)
$1/Vol$	3.519	2.388	1.131***
			(6.56)
$CsVol$	0.341	0.645	-0.304***
			(-5.70)
$CsAvg$	0.100	0.173	-0.073***
			(-6.18)
$\Delta(1/Vol)$	0.055	0.041	0.015
			(0.10)
$\Delta CsVol$	0.004	0.076	-0.072
			(-1.56)
$\Delta CsAvg$	0.002	0.016	-0.014
			(-1.30)
$GI(DOM)$	-36.214	-72.775	36.561***
			(3.73)
$GI(FOR)$	11.072	41.512	-30.440***
			(-3.41)
$GI(TOT)$	-25.142	-31.263	6.121
			(1.04)
N	187	57	130

t-statistics in parentheses
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

16. See, e.g., Eichengreen and Gupta (2016).

Table 4. (continued)

(b) Recessions vs. growth

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.006	0.048	-0.042***
			(-10.95)
α	-0.019	0.017	-0.035***
			(-13.90)
$1/Vol$	3.267	3.223	0.043
			(0.32)
$CsVol$	0.410	0.442	-0.032
			(-0.82)
$CsAvg$	0.116	0.131	-0.015+
			(-1.67)
$\Delta(1/Vol)$	0.040	-0.020	0.059
			(0.57)
$\Delta CsVol$	0.033	-0.002	0.035
			(0.98)
$\Delta CsAvg$	0.009	-0.001	0.010
			(1.16)
$GI(DOM)$	-50.171	-48.872	-1.298
			(-0.18)
$GI(FOR)$	23.306	20.713	2.593
			(0.39)
$GI(TOT)$	-26.865	-28.159	1.295
			(0.28)
N	233	134	99

t-statistics in parentheses.
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes mean values for $\Delta rGDP$, α, $1/Vol$, $CsVol$, $\Delta(1/Vol)$, $\Delta CsVol$, $GI(DOM)$, $GI(FOR)$, and $GI(TOT)$ for (a) recessions with a crisis vs. recessions with no crisis and (b) recessions vs. growth. The third column reports the difference in means and the t-statistic of the difference.

Table 5. Summary statistics - Contemporary to economic events (Advanced Economies)

(a) Recessions with crises vs. recessions with no crises

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.012	-0.007	0.019***
			(4.58)
α	-0.008	-0.038	0.030***
			(8.15)
$1/Vol$	3.788	2.417	1.371***
			(7.70)
$CsVol$	0.312	0.686	-0.375***
			(-6.47)
$CsAvg$	0.089	0.177	-0.088***
			(-6.91)
$\Delta(1/Vol)$	0.030	0.042	-0.012
			(-0.08)
$\Delta CsVol$	0.017	0.057	-0.040
			(-0.85)
$\Delta CsAvg$	0.005	0.014	-0.009
			(-0.83)
$GI(DOM)$	-38.632	-79.371	40.740**
			(3.20)
$GI(FOR)$	15.387	50.479	-35.092**
			(-3.13)
$GI(TOT)$	-23.245	-28.892	5.647
			(0.74)
N	148	50	98

t-statistics in parentheses.
$+p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 5. (continued)

(b) Recessions vs. growth

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.006	0.041	-0.035***
			(-7.78)
α	-0.017	0.015	-0.032***
			(-11.57)
1/Vol	3.438	3.409	0.029
			(0.17)
CsVol	0.411	0.391	0.020
			(0.42)
CsAvg	0.112	0.113	-0.001
			(-0.11)
Δ(1/Vol)	0.032	-0.088	0.119
			(0.91)
ΔCsVol	0.032	-0.006	0.038
			(1.03)
ΔCsAvg	0.008	-0.002	0.010
			(1.17)
GI(DOM)	-56.674	-62.831	6.158
			(0.55)
GI(FOR)	31.116	29.322	1.794
			(0.18)
GI(TOT)	-25.557	-33.509	7.952
			(1.12)
N	192	88	104

t-statistics in parentheses
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes mean values for $\Delta rGDP$, α, *1/Vol*, *CsVol*, Δ(*1/Vol*), *Δ(CsVol), GI(DOM), GI(FOR)*, and *GI(TOT)* for (a) recessions with a crisis vs. recessions with no crisis and (b) recessions vs. growth. The third column reports the difference in means and the *t*-statistic of the difference.

Table 6. Summary Statistics - Contemporary to Economic Events (Developing Economies)

(a) Recessions with crises vs. recessions with no crises

	No-Crisis	*Crisis*	*Mean Diff.*
ΔrGDP	0.014	0.007	0.007
			(0.38)
α	-0.013	-0.074	0.061***
			(4.24)
1/Vol	2.478	2.182	0.296
			(0.90)
CsVol	0.454	0.350	0.104
			(0.82)
CsAvg	0.142	0.146	-0.003
			(-0.12)
Δ(1/Vol)	0.155	0.034	0.121
			(0.31)
ΔCsVol	-0.048	0.208	-0.255+
			(-1.73)
ΔCsAvg	-0.007	0.031	-0.038
			(-1.19)
GI(DOM)	-31.916	-25.658	-6.258
			(-0.86)
GI(FOR)	3.400	-22.539	25.940**
			(3.21)
GI(TOT)	-28.515	-48.197	19.681***
			(3.62)
N	39	7	32

t-statistics in parentheses
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 6. (continued)

(b) Recessions vs. growth

	No-Crisis	*Crisis*	*Mean Diff.*
$\Delta rGDP$	0.009	0.061	-0.052***
			(-6.94)
α	-0.027	0.019	-0.047***
			(-7.74)
$1/Vol$	2.440	2.887	-0.447*
			(-2.20)
$CsVol$	0.409	0.534	-0.125+
			(-1.84)
$CsAvg$	0.137	0.163	-0.026+
			(-1.71)
$\Delta(1/Vol)$	0.078	0.103	-0.025
			(-0.14)
$\Delta CsVol$	0.040	0.006	0.034
			(0.35)
$\Delta CsAvg$	0.009	0	0.009
			(0.41)
$GI(DOM)$	-30.834	-34.913	4.080
			(1.08)
$GI(FOR)$	0.081	12.104	-12.022*
			(-2.25)
$GI(TOT)$	-30.752	-22.810	-7.943*
			(-2.27)
N	41	46	-5

t-statistics in parentheses
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
The table summarizes mean values for $\Delta rGDP$, α, $1/Vol$, $CsVol$, $\Delta(1/Vol)$, $\Delta(CsVol)$, $GI(DOM)$, $GI(FOR)$, and $GI(TOT)$ for (a) recessions with a crisis vs. recessions with no crisis and (b) recessions vs. growth. The third column reports the difference in means and the *t*-statistic of the difference.

3. A Global Information Factor

Are there information spillovers across countries? To address this question, we extract principal components for the information and fragility measures, respectively, by using a number of advanced countries in our sample.[17] We first examine whether the first and second principal components of the information and fragility measures predict economic episodes (recessions and recessions with crises), and *second* explore the relation between those principal components and global imbalances (domestic and foreign).

3.1 Information Spillovers from Advanced Economies to Other Markets

In this section, we focus on the ability of the first two principal components of information and fragility measures to predict the occurrence of recessions with crises on a country-by-country basis. More specifically, for each of the countries of our sample, we regress the occurrence of a recession with a crisis on the first and second principal component of the information measure *(CsVol)* and the distance to insolvency measure (1/*Vol*), controlling for a number of macroeconomic variables ($\Delta Credit$, ΔTFP, and ΔLP).

Using principal components we are able to separate information from noise. The first two principal components of *CsVol* and 1/*Vol* summarize a large part of the variation of the *CsVol* and 1/*Vol* series among the advanced countries of our sample. Due to the nature of the methodology, we cannot actually identify the nature of the information that is summarized by the principal components. However, we know that principal components are orthogonal to each other and explain a large portion of the variability of the original series. If our measures are informative, then their principal components ought to predict economic events and global imbalances.

Figure 2 in the appendix summarizes the regression coefficients and a 95% confidence interval around the estimates for the first two principal components of the information measure and the distance to insolvency measure, along with the F-statistics and p-values of country

17. We extract the principal components by using the information and fragility measures for countries for which we have a complete time series from 1973 until 2010. The list of countries with complete time series is: Australia, Austria, Belgium, Denmark, France, the United Kingdom, Ireland, Japan, the Netherlands, and the United States.

level regressions. We observe that the results of these regressions with respect to the predictive power of the principal components of the information measure are fairly dramatic.[18] The principal components of the information measures are generally successful in predicting recessions with crises. The coefficient of the first principal component is positive, whereas that of the second is negative.

Since we employ principal components as explanatory variables, it is hard to accurately identify their nature and the fundamental information that they summarize. Nevertheless, the fact that the first two principal components of the information and the distance to insolvency measures explain the largest part of the variability of the data (see figure 5 in the appendix) allows us to distinguish the relevant information from noise. We observe that the principal components, extracted from the information measures of specific countries (Australia, Austria, Belgium, Denmark, France, the United Kingdom, Ireland, Japan, the Netherlands, and the United States) with long time series for this measure, predict the occurrence of recessions with crises in other economies, both advanced (e.g., Finland, Greece, Portugal, and Spain) and developing (e.g., Argentina). This is suggestive of information spillovers from the countries of the sample to other economies.

3.2 Global Information and Global Imbalances

In the previous section we provided evidence in favor of information spillovers. Information produced by a set of advanced countries predicts recessions with crises in other advanced and developing economies. In this section we explore an additional aspect of information spillovers and their possible source: information produced by a set of countries predict global imbalances (domestic and foreign). Empirically, at a country level, we regress series of global imbalances on the first and second principal component of our information measures ($1/Vol$ and $CsVol$).

Figures 3 and 4 in the appendix summarize the individual country regression coefficients and a 95% confidence interval for the estimated values. Figure 3 looks at global imbalances denominated in foreign currency. The coefficients on both principal components of the distance to insolvency measure, even though statistically significant for a number of countries, are somewhat noisy overall. However, the coefficients on the first principal component of the information measure

18. In the Appendix the same figure is shown for the case of predicting recessions (see figure 6). In this figure, neither principal component appears with a statistically significant predictive power over the occurrence of recessions in the countries of our sample.

are consistently negative across the countries of our sample, while the coefficients on the second principal component are positive only for a subset of countries. Figure 4 looks at global imbalances measured in foreign currency. Here the results are reversed. Most coefficients on the first principal component of the information measure are positive, while those on the second principal component are negative. This finding is consistent with the opposite signs we document in Table 7.

Table 7. Explanatory Regression - Global Imbalances (panel)

	(1) $GI(DOM)_t$	*(2)* $GI(FOR)_t$	*(3)* $GI(USD)_t$	*(4)* $GI(EUR)_t$	*(5)* $GI(TOT)_t$
$CsVol_t$	11.913***	-5.611*	-2.102	6.753	6.303*
	(3.42)	(-2.05)	(-1.23)	(1.08)	(2.50)
$CsVol_{t-1}$	6.966*	-3.337	-3.850**	1.128	3.629+
	(2.26)	(-1.31)	(-2.72)	(0.31)	(1.78)
Vol_t	2.854	-1.222	-1.339	2.344	1.633
	(0.92)	(-0.56)	(-0.76)	(0.58)	(0.67)
Vol_{t-1}	-3.472	1.484	0.811	-0.403	-1.987
	(-1.18)	(0.53)	(0.47)	(-0.11)	(-0.93)
$Credit_{t-1}$	-0.478*	0.173	0.086	-0.680*	-0.305+
	(-2.29)	(0.97)	(0.76)	(-1.98)	(-1.82)
TFP_{t-1}	0.018	0.076	0.050	0.030	0.094
	(0.19)	(0.78)	(1.23)	(0.25)	(1.07)
LP_{t-1}	-3.430	4.121	-1.517	-3.058	0.691
	(-1.09)	(1.25)	(-0.82)	(-0.55)	(0.33)
Constant	16.713	-69.858*	3.166	8.910	-53.145**
	(0.68)	(-2.46)	(0.17)	(0.23)	(-2.71)
N	449	449	449	449	449
R^2	0.72	0.80	0.75	0.61	0.69
FE (year)	YES	YES	YES	YES	YES
FE (country)	YES	YES	YES	YES	YES

t-statistics in parentheses

+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes the explanatory power of *1/Vol*, *CsVol*, and their one-year lagged observations on (1) global imbalances denominated in domestic currency, (2) global imbalances denominated in foreign currency, (3) global imbalances denominated in U.S. dollars, (4) global imbalances denominated in euros, (5) total global imbalances (see, e.g., Bénétrix and others (2015)). The regression specification is: $GI_{n,t} = \alpha + \beta' X_{n,t} + \varepsilon_{n,t}$, where $X_{n,t} = (1 / Vol_{n,t}, 1 / Vol_{n,t-1}, CsVol_{n,t}, CsVol_{n,t-1}, Credit_{n,t-1}, TFP_{n,t-1}, LP_{n,t-1})'$. Data are from Bénétrix and others (2015) and DataStream, and span a period from 1990 until 2010. All specifications include year and country fixed effects. Robust *t-statistics* adjusted for country-level clustering are reported in parentheses.

The results in Figures 3 and 4 provide additional evidence in favor of information spillovers. Global information measures predict instances of recessions with crises and also are correlated with domestic and foreign imbalances, which means that they explain the reallocation of resources among economies. This finding strengthens our interpretation of our information measures as being indeed informative.

4. Reallocation of Resources

In the previous section we provided evidence of reallocation of resources across countries as a result of information production. Here we explore this reallocation effect of information in more detail.

4.1 Reallocation of capital across countries

Do measures of information have any predictive power over global imbalances (both domestic and foreign)? We primarily focus on three measures of global imbalances: (i) imbalances denominated in domestic currency, (ii) imbalances denominated in foreign currency, and (iii) total imbalances. Changes in global imbalances reflect a reallocation of capital among countries. There is a large literature on global imbalances, a summary of which would be outside the scope of this paper.[19]

Table 7 shows regression results of the contemporaneous association and the effects of lagged information values (*1/Vol, CsVol*), as well as lagged credit-to-private sector as a percentage of GDP (*Credit*), total factor productivity (*TFP*), and labor productivity (*LP*) separately on a number of global imbalance measures, i.e., in domestic currency (*GI*(*DOM*)), foreign currency (*GI*(*FOR*)), U.S. dollars (*GI*(*USD*)), euros (*GI*(*EUR*)) and total (*GI*(*TOT*)). Contemporaneous and lagged *CsVol* are positively related to the domestic global imbalance measure and negatively related to the foreign global imbalance measure. This means that an increase in information production is associated with a larger level of domestic assets as compared to domestic liabilities, and with a lower level of foreign assets as compared to foreign liabilities.

This finding is consistent with our conjecture that a higher level of information produced in the economy leads to a reallocation of

19. See, e.g., Gourinchas and Rey (2013).

resources among countries, and towards countries where information has been produced. More information is associated with a higher level of domestic assets which are funded with foreign liabilities. The sum of the first two columns of Table 7 yields the coefficients for the total global imbalances for each country in the sample. Finally, we observe that the economy-wide solvency measure (*Vol*), as well as a number of macroeconomic variables (Credit, TFP, and LP), do not correlate with global imbalances.

Motivated by this predictive power of the information measures on global imbalances, we address the question of whether lagged measures of global imbalances (*GI(DOM)* and *GI(FOR)*, respectively) have any predictive power with respect to the occurrence of financial crises. Table 8 summarizes the results of a logit regression of the probability of a recession with a crisis on the global imbalances measures. We observe that a decrease in foreign global imbalances is associated with an increase in the probability of a recession with a crisis. More specifically, when the difference between foreign assets and liabilities decreases, recessions with crises become more likely.

In what follows, we further look into the predictive ability of global imbalances with respect to recessions with crises at a country level. Figures 7 and 8 in the Appendix summarize our results. We find that lagged measures of domestic global imbalances do predict instances of recessions associated with crises in about half of the countries of our sample (Austria, Greece, Ireland, the Netherlands, Portugal, Spain, Sweden, and the United States). On the other hand, foreign global imbalances predict crises in more than half of the countries (Denmark and Mexico, in addition to the above mentioned countries). The weak results are primarily attributed to the small number of recessions associated with crises in our sample (18 observations). The documented predictive power of global imbalances on the occurrence of crises is consistent with, for example, Bernanke (2005) and Bernanke (2007).

Table 8. Predictive regressions

	(1) $GI(DOM)_t$	(2) $GI(FOR)_t$	(3) $GI(TOT)_t$
$GI(DOM)_t$	-0.006		
	(-0.63)		
$GI(FOR)_t$		-0.030*	
		(-2.11)	
$GI(TOT)_t$			-0.033+
			(-1.86)
$\Delta Credit_{t-1}$	-1.181	-1.016	-0.809
	(-0.74)	(-0.63)	(-0.70)
ΔTFP_{t-1}	-38.703*	-44.755*	-38.128*
	(-2.14)	(-2.38)	(-2.08)
ΔLP_{t-1}	13.549	15.740	7.265
	(0.71)	(0.84)	(0.35)
Constant	-1.241	0.802	-1.186*
	(-1.62)	(1.20)	(-2.18)
N	266	266	266
FE (Year)	YES	YES	YES
FE (Country)	YES	YES	YES

t-statistics in parentheses
+$p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes the predictive power of (1) global imbalances denominated in domestic currency, (2) global imbalances denominated in foreign currency, and (3) total global imbalances (see, e.g., [4]) on the occurrence of recessions with crises. The regression specification is: $logit\left(E[Y_{i,t} \mid X_{i,t-1}]\right) = logit(p_{i,t}) = \alpha + \beta' X_{t-1} + \varepsilon_t$, where $X_{t-1}=(GI(type)_{t-1}, \Delta Credit_{t-1}, \Delta TFP_{t-1}, \Delta LP_{t-1})', type \in \{domestic, foreign, total\}$, and $p_{i,t}$ is the probability of a recession with a crisis occurring for country i at time t. Data are from [4] and DataStream, and span a period from 1990 until 2010. All specifications include year and country fixed effects. Robust *t–statistics* adjusted for country-level clustering are reported in parentheses.

4.2 Reallocation of capital within a country

We have showed that a higher level of produced information is associated with a higher level of domestic assets which are funded with foreign liabilities. This finding suggests that the production of information locally leads to a reallocation of resources across economies at a global scale. In this section we shift our focus to the domestic reallocation of resources as a result of the production of information in the economy. If our measures are actually associated with domestic reallocation, then we would expect to find a statistically significant relation between the information and fragility measures and future changes in a firm's Tobin's Q-ratio. An increase in the information produced in the economy would be expected to be followed by an increase in the Q-ratios of firms with Q-ratios less than one and a decrease in the Q-ratios of firms whose Q-ratios are more than one, thus reflecting a reallocation of resources from the firms with high Q-ratios to those with low Q-ratios.

Tables 10 and 11 in the Appendix show the effect of one- and four-year lagged innovations in information production ($\Delta CsVol$), respectively, on the fraction of firms (1) remaining in the first (lowest) quintile of firms ranked on the basis of their Tobin's Q-ratio, (2) switching from the first to the second quintile, (3) switching from the first to the third quintile, (4) remaining in the fifth (highest) quintile, (5) switching from the fifth to the fourth quintile, and (6) switching from the fifth to the third quintile. We observe that an increase in the production of information prior to a financial crisis is associated with a decrease in the fraction of firms that remain in the lowest quintile of Q-ratios and a subsequent increase in the fraction of firms that switch from the first to the second and third quintiles. The absence of statistically significant coefficients for the other cases considered in the regression analysis suggests that the reallocation of resources within an economy following the production of information is rather limited.

This finding is in contrast with that of Section 4.1 and implies that the reallocation of resources is more pronounced among economies as a whole, rather than among firms within a given economy. The weak reallocation of resources within an economy in periods of crises is in line with evidence of a malfunctioning financial system. On the other hand, the strong reallocation of resources among economies at a global scale indicates that the financial system operates efficiently at a global level.

5. Conclusion

Globalization is a much-discussed phenomenon, one aspect of which we study in this paper, namely: information spillovers from a set of advanced economies to a number of other advanced and developing economies. Our preliminary results provide evidence in favor of the existence of global information spillovers. We show that measures of information produced in advanced countries predict crises in other advanced and developing markets. The same information measures are also associated with global imbalances, thereby suggesting a possible mechanism through which reallocation of capital takes place at a global level and how crises are contagious in the world. More specifically, we find that more information is related to a higher level of domestic assets which are, in turn, funded with foreign liabilities, and global imbalances predict instances of recessions associated with financial crises. The results of this paper should be viewed as tentative because of the small sample of countries, particularly for emerging market economies.

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APPENDIX A

Table A1. Equity data - Start and end dates at a country level

Country	*Start Date*	*End Date*
Argentina	1993	2010
Australia	1973	2010
Austria	1973	2010
Belgium	1973	2010
Brazil	1996	2010
Chile	1995	2010
Colombia	2000	2010
Denmark	1973	2010
Finland	1987	2010
France	1973	2010
Greece	1988	2010
India	1996	2010
Ireland	1973	2010
Israel	1995	2010
Japan	1973	2010
Mexico	1988	2010
Netherlands	1973	2010
New Zealand	1987	2010
Portugal	1988	2010
Spain	1986	2010
Sweden	1973	2010
Turkey	1988	2010
United Kingdom	1973	2010
United States	1973	2010

The table summarizes the start and end dates for equity data used to compute the measures of distance to insolvency ($1/Vol$) and information ($CsVol$). The data are from WorldScope.

Table A2. Predictive Regression - Reallocation at a Country Level

	(1)	(2)	(3)	(4)	(5)	(6)
	Q1→Q1	*Q1→Q2*	*Q1→Q3*	*Q5→Q5*	*Q5→Q4*	*Q5→Q3*
$\Delta CsVolt$	0.071	0.009	-0.007	0.064	0.002	-0.008
	(0.57)	(0.27)	(-0.56)	(0.85)	(0.06)	(-0.37)
$\Delta CsVolt\ x1t(Crisis)$	-0.479*	0.093	0.131+	-0.085	-0.095	0.043
	(-2.45)	(1.48)	(1.69)	(-0.44)	(-1.17)	(0.52)
$\Delta(1/Vol)t$	0.018	-0.017	-0.005	0.003	-0.018	0.001
	(0.27)	(-0.82)	(-0.43)	(0.09)	(-1.03)	(0.10)
$\Delta(1/Vol)t\ x1t(Crisis)$	-0.074	0.026	-0.023	-0.024	0.051	0.003
	(-0.51)	(0.41)	(-0.44)	(-0.23)	(1.00)	(0.15)
$\Delta CsVolt\text{-}1$	0.073	-0.018	0.024	0.098	0.043	-0.003
	(0.41)	(-0.51)	(1.25)	(0.94)	(0.81)	(-0.08)
$\Delta CsVolt\text{-}1\ x1t(Crisis)$	-0.533	0.123*	-0.123	-0.260	-0.054	0.090
	(-1.60)	(2.50)	(-1.46)	(-1.28)	(-0.47)	(1.26)
$1/Vol\ t\text{-}1$	-0.043	0.007	-0.007	-0.009	-0.001	-0.001
	(-0.64)	(0.39)	(-0.62)	(-0.18)	(-0.03)	(-0.09)
$1/Volt\text{-}1\ x1t(Crisis)$	0.010	0.002	0.018+	0.004	0.004	-0.009
	(0.27)	(0.17)	(1.75)	(0.22)	(0.48)	(-1.18)
Constant	1.016**	0.253**	0.175***	0.562*	0.261+	0.075
	(3.43)	(2.80)	(4.62)	(2.13)	(1.94)	(1.01)
N	215	213	213	225	219	220
R^2	0.35	0.52	0.58	0.43	0.42	0.54
Cluster (Country)	YES	YES	YES	YES	YES	YES
FE (Time)	YES	YES	YES	YES	YES	YES
FE (Country)	YES	YES	YES	YES	YES	YES

t-statistics in parentheses

$+p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes the predictive power of $1/Vol$, $\Delta 1/Vol$, cross-sectional volatility ($CsVol$), change in cross-sectional volatility ($\Delta CsVol$), and their interaction with a dummy indicating a crisis on the fraction of firms (1) remaining in quintile 1, (2) switching from quintile 1 to quintile 2, (3) switching from quintile 1 to quintile 3, (4) remaining in quintile 5, (5) switching from quintile 5 to quintile 4, and (5) switching from quintile 5 to quintile 3. All fractions are computed for a single economic episode (recession with crisis, recession with no-crisis, normal periods, growth periods). The regression specification is: $fr(Qx_{start} \to Qy_{end})_{n,t} = \alpha_n + \beta' X_{n,t-1} + \gamma' X_{n,t-1} \mathbb{1}(Crisis)_{n,t} + \varepsilon + n,t$, where $X_{n,t} = (CsVol_{n,t-1}, \Delta CsVol_{n,t}, 1/Vol_{n,t-1}, \Delta(1/Vol)_t)'$ and $x, y \in \{1,\ldots,5\}$. Data are from WorldScope and span a period from 1980 until 2010. All specifications include year and country fixed effects. Robust *t–statistics* adjusted for country-level clustering are reported in parentheses.

Table A3. Predictive Regression - Reallocation at a Country Level

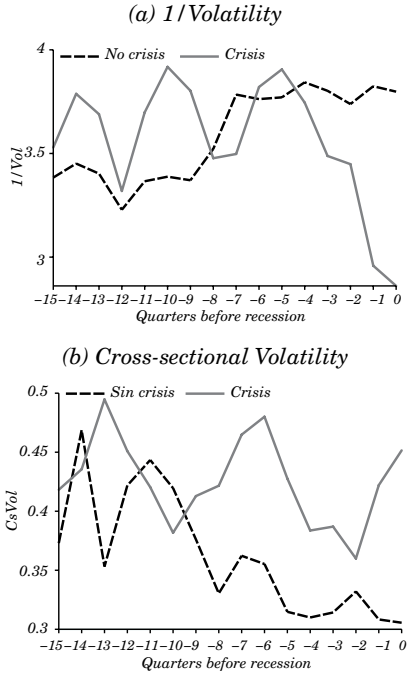
	(1)	(2)	(3)	(4)	(5)	(6)
	$Q1 \to Q1$	$Q1 \to Q2$	$Q1 \to Q3$	$Q5 \to Q5$	$Q5 \to Q4$	$Q5 \to Q3$
$\Delta CsVol_{t-4}$	0.066	0.012	-0.027*	0.046	-0.027	-0.012
	(0.87)	(0.45)	(-2.44)	(0.94)	(-1.62)	(-0.84)
$\Delta CsVol_{t-4}\ x1_t(Crisis)$	-0.244**	0.085*	0.070	-0.002	-0.035	0.053+
	(-3.49)	(2.46)	(1.63)	(-0.02)	(-0.91)	(1.73)
$\Delta(1/Vol)_{t-4}$	0.050	-0.025	-0.003	-0.005	0.005	-0.001
	(0.99)	(-1.41)	(-0.40)	(-0.11)	(0.40)	(-0.05)
$\Delta(1/Vol)_{t-4}\ x1_t(Crisis)$	-0.011	-0.036	-0.050	-0.027	0.012	0.021
	(-0.12)	(-0.87)	(-1.61)	(-0.29)	(0.36)	(1.03)
$\Delta CsVol_{t-5}$	-0.036	-0.008	-0.007	-0.029	-0.001	0.022
	(-0.33)	(-0.27)	(-0.43)	(-0.43)	(-0.04)	(1.07)
$\Delta CsVol_{t-5}\ x1_t(Crisis)$	-0.186	0.075	-0.025	-0.029	0.032	0.039
	(-1.15)	(1.05)	(-0.57)	(-0.23)	(0.49)	(1.01)
$1/Vol_{t-5}$	0.001	0.001	-0.002	0.001	-0.001	0.008
	(0.01)	(0.03)	(-0.24)	(0.03)	(-0.08)	(0.98)
$1/Vol_{t-5}\ x1_t(Crisis)$	-0.068*	-0.011	0.009	-0.033	-0.019	-0.002
	(-2.17)	(-0.78)	(0.75)	(-1.04)	(-0.99)	(-0.35)
$Constant$	0.993*	0.303*	0.156**	0.567**	0.290***	0.051+
	(2.16)	(2.49)	(3.37)	(3.43)	(4.24)	(1.81)
N	170	169	168	180	175	175
R^2	0.43	0.56	0.71	0.51	0.54	0.69
$Cluster\ (country)$	YES	YES	YES	YES	YES	YES
$FE\ (time)$	YES	YES	YES	YES	YES	YES
$FE\ (country)$	YES	YES	YES	YES	YES	YES

t-statistics in parentheses
$+p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The table summarizes the predictive power of $1/Vol$, $\Delta 1/Vol$, cross-sectional volatility ($CsVol$), change in cross-sectional volatility ($\Delta CsVol$), and their interaction with a dummy indicating a crisis on the fraction of firms (1) remaining in quintile 1, (2) switching from quintile 1 to quintile 2, (3) switching from quintile 1 to quintile 3, (4) remaining in quintile 5, (5) switching from quintile 5 to quintile 4, and (5) switching from quintile 5 to quintile 3. All fractions are computed for a single economic episode (recession with crisis, recession with no crisis, normal periods, growth periods). The regression specification is: $fr(Qx_{start} \to Qy_{end})_{n,t} = \alpha_n + \beta' X_{n,t-4} + \gamma' X_{n,t-4} 1(Crisis)_{n,t} + \varepsilon + n,t$, where $X_{n,t-4} = (CsVol_{n,t-5}, \Delta CsVol_{n,t-4} 1/Vol_{n,t-5}, \Delta(1/Vol)_{t-4})'$ and $x, y \in \{1,\ldots,5\}$.
Data are from WorldScope and span a period from 1980 until 2010. All specifications include year and country fixed effects. Robust *t–statistics* adjusted for country-level clustering are reported in parentheses.

APPENDIX B

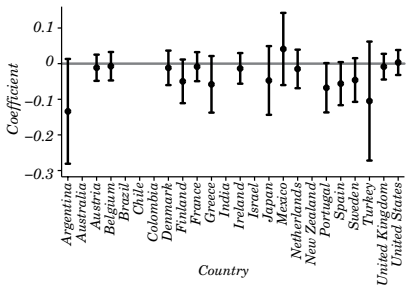
Figure B1. Average Distance to Insolvency and Cross-Sectional Volatility



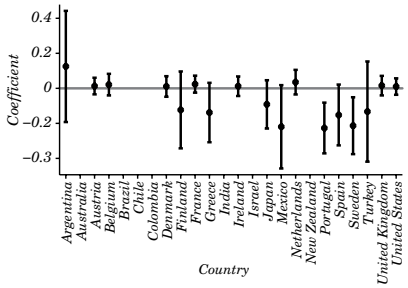
Average Distance to Insolvency and Cross-Sectional Volatility over 15 quarters before the beginning of: (*a*) a recession with a crisis, and (*b*) a recession with no crisis.

Figure B2. Predictive Regressions - Recessions with Crises

(a) PC1 1/Volatility



(b) PC2 1/Volatility



(c) PC1 Cross-Sectional Volatility

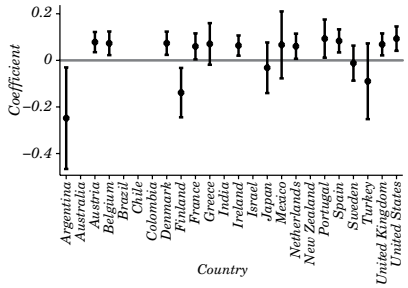
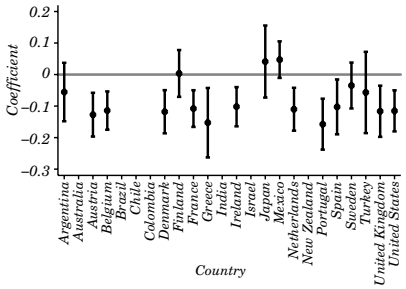
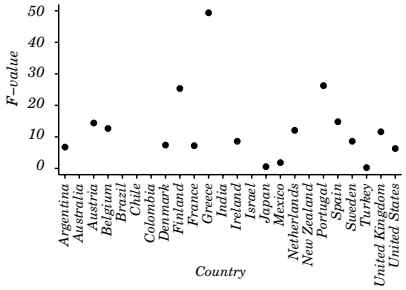


Figure B2. (continued)

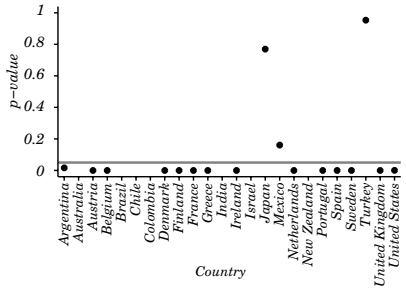
(d) PC2 Cross-Sectional Volatility



(e) F-statistic



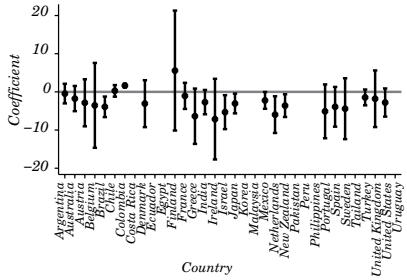
(f) p-value



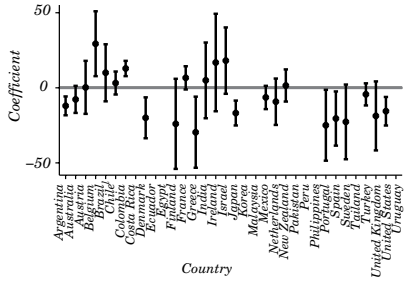
Figures (*a*) through (*d*) summarize the predictive power of the first two principal components of 1/*Vol* and *CsVol* on the occurrence of recessions with crises. The figures show the point estimates of the regression coefficients along with a 95% confidence interval around the point estimates. Figures (*e*) and (*f*) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected using Newey and West (1987) with one lag. The regression specification is: $\mathbb{1}_t(Recession \cap Crisis) = \alpha + \beta' X_{t-1} + \varepsilon_t$, where $X_{t-1} = (PC1(1/Vol_{t-1}), PC2(1/Vol_{t-1}), PC1(CsVol_{t-1}), PC2(CsVol_{t-1}), \Delta Credit_{t-1}, \Delta TFP_{t-1}, \Delta LP_{t-1},)'$.

Figure B3. Predictive Regressions - Domestic Global Imbalances (Country Level)

PC1 1/Volatility



(b) PC2 1/Volatility



(c) PC1 Cross-Sectional Volatility

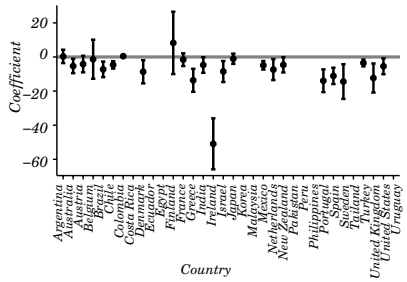
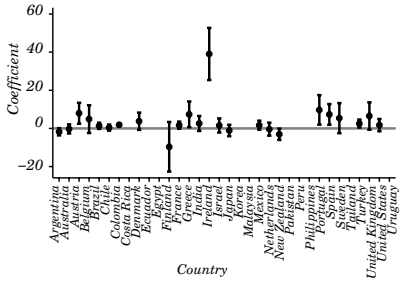
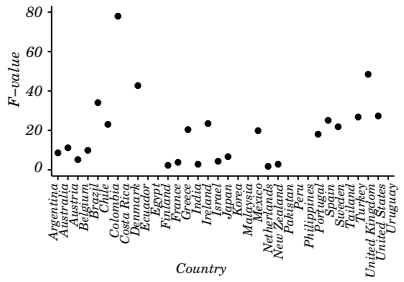


Figure B3. (continued)

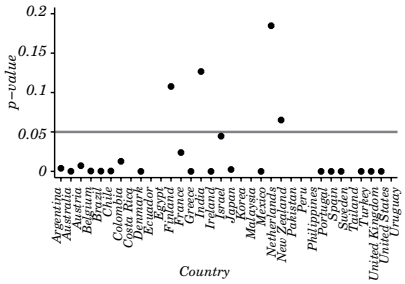
(d) PC2 Cross-Sectional Volatility



(e) F-statistic



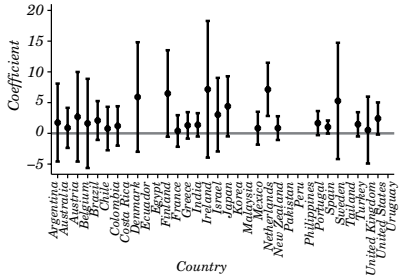
(f) p-value



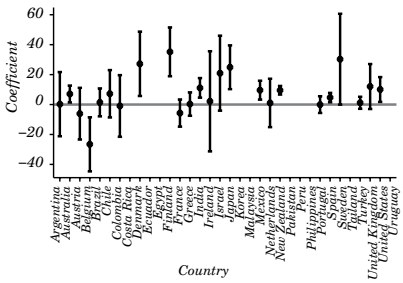
Figures (a) through (d) summarize the predictive power of the first two principal components of $1/Vol$ and $CsVol$ on global imbalances denominated in domestic currency. The figures show the point estimates of the regression coefficients along with a 95% confidence interval round the point estimates. Figures (e) and (f) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected by using Newey and West (1987) with one lag. The regression specification is: $GI(DOM)_t = \alpha + \beta' X_{t-1} + \varepsilon_t$, where $X_{t-1} = (PC1(1/Vol_{t-1}), PC2(1/Vol_{t-1}), PC1(CsVol_{t-1}), PC2(CsVol_{t-1}))'$.

Figure B4. Predictive regressions - Foreign global imbalances (country level)

(a) PC1 1/Volatility



(b) PC2 1/Volatility



(c) PC1 Cross-Sectional Volatility

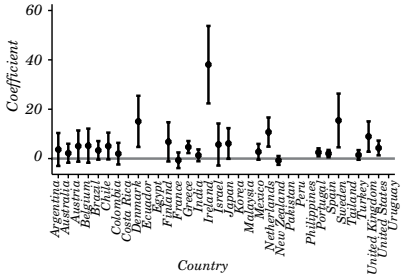
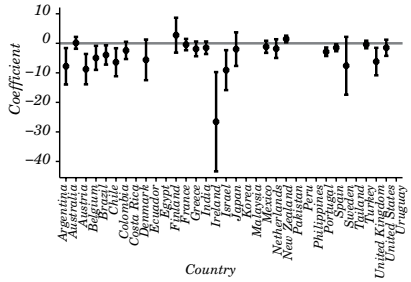
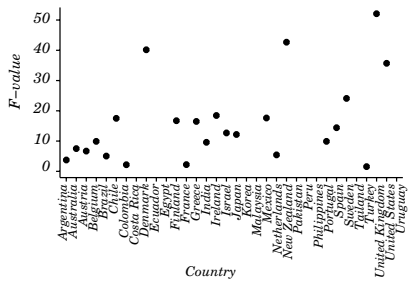


Figure B4. (continued)

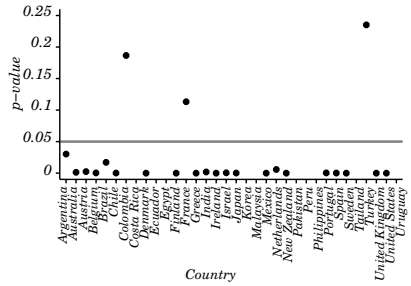
(d) PC2 Cross-Sectional Volatility



(e) F-statistic



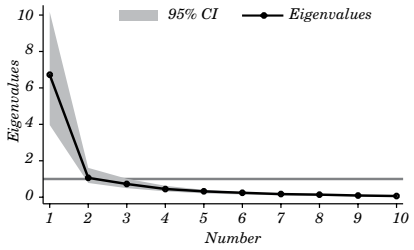
(f) p-value



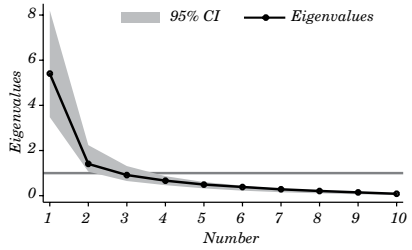
Figures (*a*) through (*d*) summarize the predictive power of the first two principal components of $1/Vol$ and $CsVol$ on global imbalances denominated in foreign currency. The figures show the point estimates of the regression coefficients along with a 95% confidence interval round the point estimates. Figures (*e*) and (*f*) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected by using Newey and West (1987) with one lag. The regression specification is: $GI(FOR)_t = \alpha + \beta' X_{t-1} + \varepsilon_t$ where $X_{t-1} = (PC1(1/Vol_{t-1}), PC2(1/Vol_{t-1}), PC1(CsVol_{t-1}), PC2(CsVol_{t-1}))'$.

Figure B5. Principal Component Analysis - Eigenvalues

(a) 1/Volatility



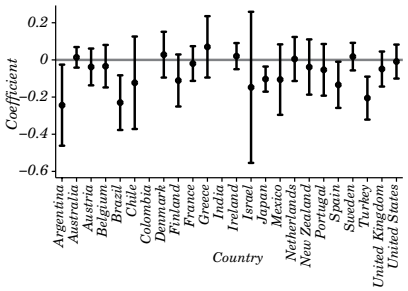
(b) Cross-Sectional Volatility



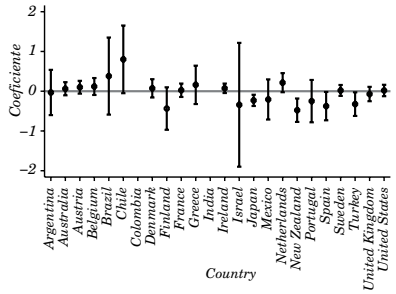
The figure summarizes the eigenvalues of the first ten principal components along with a 95% confidence interval for 1/*Vol* and *CsVol*.

Figure B6. Predictive Regressions - Recessions

(a) PC1 1/Volatility



(b) PC2 1/Volatility



(c) PC1 Cross-Sectional Volatility

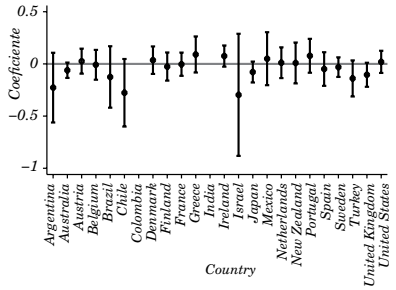
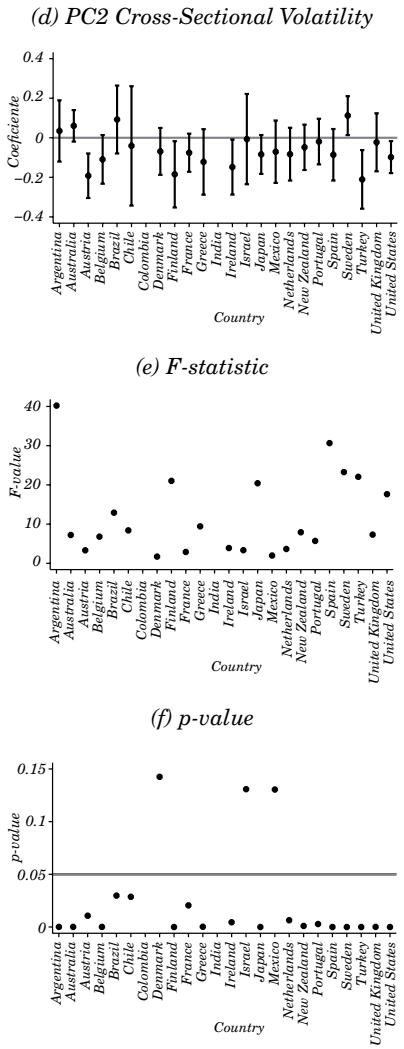


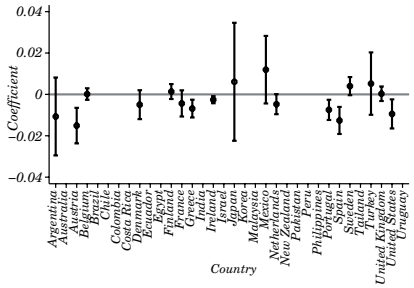
Figure B6. (continued)



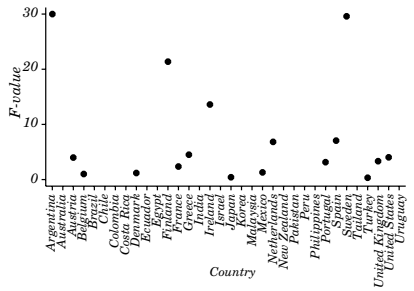
Figures (*a*) through (*d*) summarize the predictive power of the first two principal components of 1/*Vol* and *CsVol* on the occurrence of recessions. The figures show the point estimates of the regression coefficients along with a 95% confidence interval round the point estimates. Figures (*e*) and (*f*) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected by using Newey and West (1987) with one lag. The regression specification is: $1_t(Recession) = \alpha + \beta' X_{t-1} + \varepsilon_t$ where $X_{t-1} = (PC1(1/Vol_{t-1}), PC2(1/Vol_{t-1}), PC1(CsVol_{t-1}), PC2(CsVol_{t-1}), \Delta Credit_{t-1}, \Delta TFP_{t-1}, \Delta LP_{t-1},)'$.

Figure B7. Predictive Regressions - Domestic Imbalances and Recessions with Crises

(a) Global Imbalances (domestic)



(b) F-statistic



(c) p-value

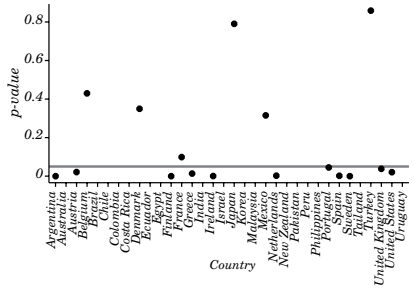


Figure (*a*) summarizes the predictive power of global imbalances denominated in domestic currency on the occurrence of recessions with crises. The figure shows the point estimates of the regression coefficients along with a 95% confidence interval round the point estimates. Figures (*b*) and (*c*) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected by using Newey and West (1987) with one lag. The regression specification is: $\mathbb{1}_t(Recession \cap Crisis) = \alpha + \beta' X_{t-1} + \varepsilon_t$, where $X_{t-1} = (GI(DOM)_{t-1}, \Delta Credit_{t-1}, \Delta TFP_{t-1}, \Delta LP_{t-1},)'$.

Figure B8. Predictive Regressions - Foreign Imbalances and Recessions with Crises

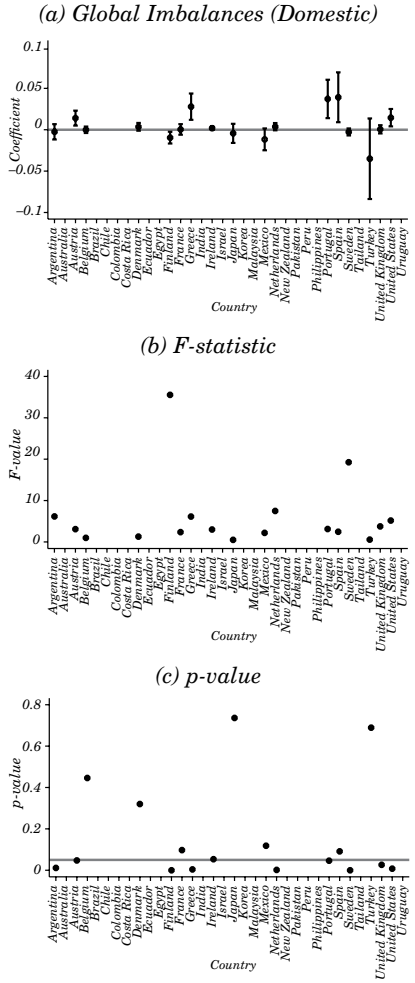


Figure (*a*) summarizes the predictive power of global imbalances denominated in foreign currency on the occurrence of recessions with crises. The figure shows the point estimates of the regression coefficients along with a 95% confidence interval round the point estimates. Figures (*b*) and (*c*) report the *F–statistic* and the *p–value* of the regressions, respectively. All regressions are performed at the country level and standard errors are corrected by using Newey and West (1987) with one lag. The regression specification is: $\mathbb{1}_t(Recession \cap Crisis) = \alpha + \beta' X_{t-1} + \varepsilon_t$, where $X_{t-1} = (GI(FOR)_{t-1}, \Delta Credit_{t-1}, \Delta TFP_{t-1}, \Delta LP_{t-1})'$