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Foreign capital flows, credit spreads, and the business cycle ☆

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A B S T R A C T

Previous studies have found that foreign capital flows into the US Treasury and corporate-bond markets drive US long-term interest rates. In this paper, we extend the literature by showing that (1) foreign capital flows also drive the US risk structure of interest rates (i.e., credit spreads), and (2) the impacts of foreign capital flows through the credit spread on corporate financing and investment as well as aggregate economic activities are significant, even outside of the Global Financial Crisis period.

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1. Introduction

There is a growing literature on global saving and banking gluts. Bernanke (2005, 2007) introduces the notion of the Global Savings Glut (GSG), an excess of saving in emerging and oil-exporting countries primarily directed towards United States (US) Treasury securities. Warnock and Warnock (2009) find that global saving glut has significant impact on long-term Treasury yields. Caballero and Krishnamurthy (2009) and Bernanke et al. (2011) note the role played by European investors purchasing assets in the US. Shin (2011) refers to these foreign purchases mainly by European investors of asset-backed securities (ABS) and other structured products issued in the US as the Global Banking Glut (GBG). Bertaut et al. (2012) find that global saving and banking gluts significantly affect the interest rates on US Treasuries, corporates, as well as mortgages. Justiniano et al. (2014) develop a model to study the impact of global saving and banking gluts on the level of interest rates.

In this paper, we extend the extant literature by addressing two fresh issues. First, different from previous studies that focus on the level of interest rates (e.g., Warnock and Warnock, 2009; Bertaut et al., 2012), we study the risk structure of interest rates, the credit spread. This is important, because credits spreads impact both aggregate economic activities (e.g., Gilchrist and Zakrajsek, 2012) and corporate financing and investment (e.g., López-Salido et al., 2017). Since Treasury

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and corporate-bond markets interact through "reach for yield" and "flight to quality" (e.g., Bernanke et al., 1996; Bertaut et al., 2012), we conjecture that foreign capital flows into Treasury and corporate-bond markets all affect the credit supply and therefore credit spreads in the US corporate-bond market.

Second, we further explore if foreign capital flows influence corporate financing and investment as well as aggregate economic activities, through the credit-spread channel. This helps link foreign capital flows with the US business cycle, and has significant policy implications. We conjecture that the effects of foreign capital flows on corporate financing and investment should be particularly strong for financially constrained firms with limited access to the credit market. However, through multiplier (ripple) effects, we conjecture that foreign capital flows could also have significant effects on aggregate economic activities.

Empirically, we test our hypotheses with both aggregate and firm-level US data over the sample period from 1975 to 2015. We find robust evidence that foreign capital flows do affect the credit spread in the US, even after we account for the unwinding of past credit-market sentiment emphasized by López-Salido et al. (2017). Furthermore, complementing previous studies that mainly use foreign capital flows to help understand the Global Financial Crisis, we find that foreign capital flows, through the credit spread, significantly impact corporate financing and investment (particularly for financially constrained firms) as well as aggregate economic activities, even outside of the Global Financial Crisis period.

Our paper adds to the extant literature by showing that foreign capital flows influence not only the level but also the risk structure of interest rates, which in turn impacts corporate financing and investment as well as aggregate economic activities in the US. Furthermore, while previous studies generally focus on how foreign capital flows help explain the US housing bubble and the Global Financial Crisis (e.g., Bertaut et al., 2012), we find that the effects of foreign capital flows are not constrained only to the Global Financial Crisis period, suggesting that it is important to take into account foreign capital flows in policy decision making.

Our paper is related to the literature on the credit cycle. In a sample of 14 developed countries between 1870 and 2008, Schularick and Taylor (2012) find that bank credit expansions predict contractions in real economic activity. Gilchrist and Zakrajsek (2012) and Krishnamurthy and Muir (2016) document parallel findings with credit spreads. A large literature (e.g., Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Eggertsson and Krugman, 2012; Brunnermeier and Sannikov, 2014) relies on exogenous shocks and financial frictions to generate amplification and propagation effects. Our results suggest that foreign capital flows could be one particular type of exogenous shocks underlying the credit cycle.

The remainder of the paper is organized as follows: Section 2 provides the background on foreign capital flows and develops our hypotheses; Section 3 examines if foreign capital flows drive credit spreads in the US; Section 4 investigates if foreign capital flows, through the credit spread channel, influence corporate financing and investment as well as aggregate economic activities; Section 5 provides further analysis; Section 6 concludes the paper with a brief summary.

2. Background and hypotheses

2.1. Background

On February 16, 2005 the Chairman of the Federal Reserve Board, Alan Greenspan, delivered the semiannual Monetary Policy Report to Congress. During this testimony, Greenspan was clearly puzzled by the unforeseen behavior of bond markets. At the time, long term and short term interest rates were ostensibly disconnected. In fact, during the second half of 2004 and throughout 2005, the federal funds rate was being ratcheted up in a methodical fashion. At the completion of this tightening cycle, which began in 2004, the Federal Open Market Committee (FOMC) had raised the federal funds rate from 1 percent to 5¼ percent. Yet, during this same time period, the yield of the 10-year US Treasury remained relatively stable. This economic puzzle was perplexing to the Chairman and is often referred to as the Greenspan "conundrum".

Bernanke (2005) attempts to explain this puzzle by focusing on international capital flows, and it is during this speech, the phrase "the Global Savings Glut" is coined. The Global Savings Glut (GSG) refers to a time period when patterns of international capital flows were dramatically reversed. Rapid economic growth in East Asian, and in oil exporting countries, transformed these emerging-markets participants from net borrowers to large net lenders on international capital markets (Bernanke, 2007). Searching for perceived safe investments, these emerging-market glut of savings triggered an exogenous shock to U.S. Treasury markets. This upwelling in capital inflows brought about an increase in available U.S. credit and reduced long-term Treasury yields. Therefore the Greenspan conundrum can, at least partially, be explained by the GSG (Bernanke, 2005, 2007).

The global saving glut hypothesis is specifically driven by international capital inflows into U.S. Treasury and Agency debt, which are guaranteed by the U.S. government or by government sponsored enterprises (GSEs). These investments were considered "safe". Perhaps because of the lack of social safety nets, China (and other Asian developing economies), and oil exporting countries limited their purchases to these low-risk investments. Regardless of the motivation, leading up to the 2007–2008 Global Financial Crisis (GFC) inflows into what was considered "safe" US investments were substantial. In fact, during the short time horizon of 2003–2007, the amount of US Treasuries held by foreigners increased by over 60% (Bernanke et al., 2011). Slightly expanding the time period by four years, and looking at data from 2000 to 2008, foreigners holdings of US Treasuries increased by over 200%, according to the Federal Reserve's Financial Accounts of the United States (Z1) data. And, as the Global Financial Crisis was approaching, it was not only Treasuries, which were aggressively being

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purchased by foreigners. Foreigners' appetite for US Agency debt also increased during this time period. From 2003 to 2007 Agency debt held by foreigners increased by over 140% (Bernanke et al., 2011). As a result of these substantial capital inflows, yields on Treasuries and Agencies were pushed down in spite of the United States central bank tightening monetary policy in an attempt to raise interest rates during 2004 and 2005.

The above described Global Savings Glut and its accompanying literature, often refers to the fact that during the time period leading up to the Global Financial Crisis, the United States was running large trade deficits with emerging Asia, and some oil-exporting countries. As a result of the deficits, these foreign countries had an excess supply of savings, and they directed these savings toward "safe" assets in the United States, substantially increasing capital inflows into the United States.[1]

In addition to the global saving glut, which dramatically increased capital inflows into the US Treasury and Agency markets (pushing down the yields of these instruments), Bertaut et al. (2012) uncover another channel by which foreign capital inflows were intensely amplified leading up to the Global Financial Crisis. This conduit of capital flows was specifically driven by the "reaching for yield" phenomenon. Particularly, escalations of European purchases in US private labeled asset-backed securities (ABS) such as mortgage-backed and other structured investments were notable. During the time period leading up to the Global Financial Crisis, many of these financial instruments were also perceived to be relatively "safe". Given that the global saving glut had driven the yields on US Treasury and Agency debt to low levels, foreigners developed an appetite for the relative attractiveness of the yield of these alternative assets. Thus, they began to "reach for these yields". From 2003 to 2007, foreign holdings of AAA and non-AAA rated US Corporate debt increased by approximately 36% and 67%, respectively. During this same very short time period, foreign holdings of AAA and non-AAA rated US Mortgage Backed Securities (MBS) increased by approximately 386% and 293%, respectively (Bernanke et al., 2011).

Unlike the case of the global saving glut where the United States was running large trade deficits with emerging Asia and some oil-exporting countries, during this time period, Europe and the United States current accounts were approximately balanced. Thus, how were these capital inflows financed? Bertaut et al. (2012) eloquently illustrate how European Banks, taking advantage of the low interest rates on United States Treasuries resulting from the global saving glut, were borrowing in the dollar wholesale credit markets and using these funds to purchase the perceived "safe" alternative investments. Therefore, similar to Treasury and Agency markets experiencing huge inflows exemplified by the global saving glut, this additional channel of capital inflows resulted in tremendous growth in the gross positions of European banks holdings of U.S. private labeled ABS such as mortgage backed and other structured investment instruments. As a result of this inflow of capital, the yields on these alternative U.S. investments were also driven lower. Shin (2011) coins the phrase the "Global Banking Glut", referring to the enormous capital flows from international banks into the U.S. in spite of no apparent net trade imbalance from the countries involved.

During the immediate years leading up to the Global Financial Crisis of 2007–2008, capital inflows into the United States radically increased. The global savings glut and the global banking glut help to explain the dramatic inflow of capital into the United States.[2] Previous studies have emphasized the importance of how the global savings and banking gluts resulted in a low level of U.S. interest rates in spite of the United States central bank's attempt to raise rates during 2004–2005. The growing literature has promoted an explanation of Greenspan's "conundrum", and therefore a better understanding of the Global Financial Crisis. In this paper, we are interested in two fresh questions: Do international capital flows affect the risk structure of interest rates (i.e., credit spreads) in the US? Do international capital flows, through the credit spread channel, drive US firms' financing and investment activities as well as US aggregate economy?

2.2. Hypotheses

Because Treasury and corporate bond markets interact through "reach for yield" and "flight to quality" (Bernanke et al., 1996; Bertaut et al., 2012; Hanson and Stein, 2015; López-Salido et al., 2017), we expect that foreign capital flows into Treasury and corporate-bond markets all affect credit spreads. For instance, inflows into the Treasury market (e.g., GSG), by "pushing down yields on safe assets and increasing the appetite for alternative investments on the part of other investors" (Bertaut et al., 2012, p. 219), could indirectly increase the credit supply in the corporate-bond market and result in lower credit spreads.

Hypothesis 1. Foreign capital flows into Treasury and corporate-bond markets should influence the credit supply and therefore credit spreads, directly or indirectly.

If foreign capital flows influence credit spreads, such flows could drive firm financing and investment activities. However, the effects of foreign capital flows on financing and investment should be particularly strong for financially constrained firms. As Campello and Graham (2013) point out, financially constrained firms face financing frictions and have limited access to the credit market (e.g., due to asymmetric information as in Myers and Majluf (1984)). Thus, these firms should be more sensitive to credit-supply conditions. Furthermore, through multiplier effects, we expect that foreign capital flows could also have significant effects on US aggregate economic activities. Therefore, our second hypothesis is:

[1] Beltran et al. (2013) state: "Foreign official holdings of U.S. Treasuries increased from $400 billion in January 1994 to about $3 trillion in June 2010."

[2] See Justiniano et al. (2014) for an additional explanation of how dramatic these capital flows were on the U.S. economy. According to these authors the GSC and GBC was responsible for driving one fourth of the increase in housing prices, and one third of the increase in household debt leading up the 2007–2008 financial crisis.

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Hypothesis 2. If foreign capital flows influence the supply of credit and credit spreads, such flows could impact corporate financing and investment (particular for financially constrained firms) as well as aggregate economic activities.

3. Foreign capital flows and US credit spreads

3.1. Data and empirical methodology

López-Salido, Stein, and Zakrajšek (2017) (LSZ) recently find that there is a mean reversion in the credit spread. That is, the credit spread in year t is partially driven by an unwinding of past credit-market sentiment in year $t-2$. To test if foreign capital flows contribute to movements in the credit spread beyond the unwinding of past credit-market sentiment (Hypothesis 1), we estimate the following model,

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \sum_i \gamma_i X_{i,t-2} + \varepsilon_t \tag{1}$$

where Δs_t is the change in credit spreads, ΔT_t and ΔC_t are the first differences of the foreign capital flows into Treasuries and corporate bonds, and X's are the LSZ control variables to capture the credit-market sentiment in year $t-2$.

Throughout this paper, we use the credit spread constructed by Gilchrist and Zakrajsek (2012) (GZ spread) whose predictive ability for future economic activity significantly exceeds that of the common measures. However, we will also show that our results are robust to using the alternative credit spread measure, namely the spread between yields on corporate BAA bonds and yields on 10-year Treasury securities (BAA-Treasury) from the Federal Reserve Economic Data (FRED). The annual GZ spread series is available for the period from 1973 to 2015 from Professor Gilchrist's website,[3] and is plotted in Fig. 1.

Following previous studies (e.g., Warnock and Warnock, 2009), we use the foreign flows into US Treasuries and corporate bonds scaled by lagged US GDP from FRED to measure foreign capital flows, T_t and C_t. Fig. 2a and b depict these foreign capital flows over the period from 1948 to 2015, with shaded bars indicating the NBER recessions. As we can see, the foreign capital flows (particularly the flows into the corporate-bond market) increase dramatically before the Global Financial Crisis, which motivates the extant literature to use the global saving and banking gluts to explain the Global Financial Crisis and the housing bubble in the US. However, foreign capital flows, especially the flows into the Treasury market, have been nontrivial since 1970, suggesting that foreign capital flows could affect the credit spread and corporate financing and investment as well as aggregate economic activities even outside of the Global Financial Crisis period, through the reach-for-yield and flight-to-quality mechanisms.

In terms of LSZ control variables, following LSZ, we use the term spread (TS) and the excess bond premium (EBP) constructed by Gilchrist and Zakrajsek (2012). The term spread is defined as the yield spread between 10-year and 3-month Treasury securities from FRED. However, we will show that our results are robust to using alternative LSZ control variables, e.g., the level of the BAA-Treasury spread at the end of year $t-2$ ($\text{BAA-Treasury}_{t-2}$), and high-yield bond issuance in year $t-2$ expressed as a percentage of total bond issuance in the nonfinancial corporate sector (HYS_{t-2}). Panel A of Table 1 summaries the macro variables we use in the paper with their source information.

3.2. Empirical results

Following LSZ, we estimate Eq. (1) with annual data, to help understand business-cycle-frequency fluctuations. Our sample period is from 1975 to 2015, because the GZ excess bond premium starts in 1973 and we need two lags for our model. The results are reported in Panel A of Table 2. Heteroscedasticity- and autocorrelation-consistent asymptotic standard errors are computed according to Newey and West (1987) with the automatic lag selection method of Newey and West (1994).

Column (1) shows that there is also a mean reversion in the GZ credit spread, which is consistent with LSZ. EBP_{t-2} enters with a negative coefficient, implying that a low level of the excess bond premium (i.e., high risk-bearing capacity of the financial sector in year $t-2$) forecasts a reversal in the credit spread in year t. In Column (2), we add the change in the foreign capital flows into Treasuries, which is insignificantly correlated with the credit spread change. In Column (3), we account for the change in the foreign capital flows into corporate bonds. As we can see, the change in the foreign capital flows into corporate bonds is statistically negatively correlated with the change in the credit spread, implying that an increase in the foreign capital flows into the US corporate bond market helps increase the credit supply and decrease the credit spread in the US, even after we take into account the unwinding of past credit-market sentiment emphasized by LSZ. Furthermore, adding the change in the foreign capital flows into corporate bonds increases the adj-R^2 from 3.0% in Column (1) to 15.7%, suggesting that the change in the foreign capital flows into corporate bonds is also economically significant. In Column (4), we account for the foreign capital flows to both Treasuries and corporate bonds. The results show that only the change in the foreign capital flows into corporate bonds is significantly correlated with the change in the credit spread, which partially supports Hypothesis 1.

We next conduct a variety of robustness checks. In Column (5), we use alternative LSZ control variables, namely the level of the BAA-Treasury spread at the end of year $t-2$ ($\text{BAA-Treasury}_{t-2}$) and the log of high-yield bond issuance in year $t-2$

[3] http://people.bu.edu/sgilchri/Data/data.htm.

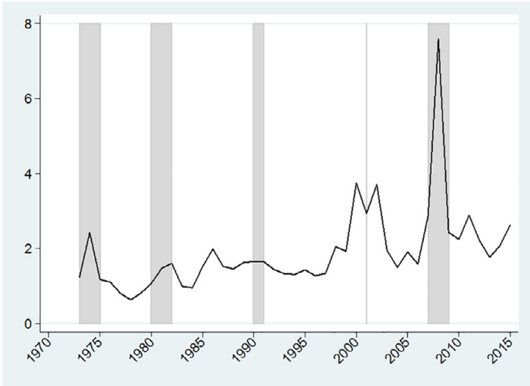

Fig. 1. GZ credit spread. The annual GZ spread series is available for the period from 1973 to 2015, and is plotted in figure.

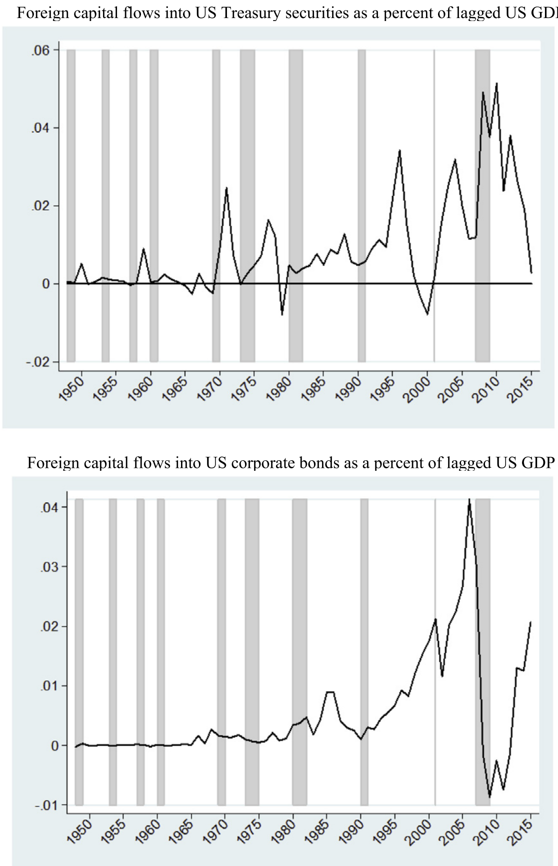

Fig. 2. Foreign capital flows. (a) Foreign capital flows into US Treasury securities as a percent of lagged US GDP. (b) Foreign capital flows into US corporate bonds as a percent of lagged US GDP. We use the foreign flows into US Treasuries and corporate bonds scaled by lagged US GDP from FRED to measure foreign capital flows. (a) and (b) depict these foreign capital flows over the period from 1948 to 2015, with shaded bars indicating the NBER recessions.

expressed as a percentage of total bond issuance in the nonfinancial corporate sector (HYS_{t-2}). In Column (6), we use the BAA-Treasury spread instead of the GZ spread. Consistent with LSZ, $\log(HYS_{t-2})$ enters with a positive coefficient, suggesting that a high level of the US high-yield bond issuance in year $t-2$ predicts a subsequent increase of the credit spread in year t. BAA-Treasury$_{t-2}$ enters with a negative coefficient, implying that a low level of the credit spreads in year $t-2$ forecasts a reversal in the spread in year t. Furthermore, in both cases, the change in the foreign flows into corporate bonds is still significantly correlated with the change in the credit spread, suggesting that our results are robust to alternative control variables and alternative credit spread measures.

Table 1
Data sources.

Variable	Source	Source Name
Panel A: Macro Variables		
(Real) GDP	FRED	GDPC1
(Nominal) GDP	FRED	GDP
Unemployment rate	FRED	UNRATE
Business Fixed Investment	FRED	GPDIC1
10 Year Treasury Yield	FRED	GS10
3-Month Treasury Yield	FRED	TB3MS
Foreign Capital Flow into Treasuries	FRED	ROWTSAQ027S
Foreign Capital Flow into Corporate Bonds	FRED	ROWCBAQ027S
Corporate BAA yield	FRED	BAA
Price Deflator for Business Fixed Investment	FRED	A006RD3Q086SBEA
Price Deflator for Non-farm Business Sector	FRED	IPDNBS
GZ credit spread	Prof. Gilchrist	GZ SPR
Excess Bond Premium	Prof. Gilchrist	EBP_OA
Panel B: Firm-level Variables		
Long-term Debt issuance	Compustat	DLTIS
Long-term Debt reduction	Compustat	DLTR
Sale of Common and preferred stock	Compustat	SSTK
Purchase of Common and preferred stock	Compustat	PRSTKC
Nominal Business Investment	Compustat	CAPX
Total assets	Compustat	AT
Nominal Sales	Compustat	SALE
S&P Domestic Long Term Issuer Credit Rating	Compustat	SPLTICRM
Profitability	WRDS	OPMBD
BM	WRDS	BM
Liquidity	WRDS	CURR_RATIO
Stock Returns	CRSP	RET

Table summaries the macro and firm-level variables we use in the paper with their source information.

Table 2
Foreign capital flows and the credit spread.

	(1) GZ	(2) GZ	(3) GZ	(4) GZ	(5) GZ	(6) BAA-Treasury	(7) GZ	(8) GZ
TS_{t-2}	−0.147	−0.103	−0.041	−0.033			−0.057	−0.118
	(−1.07)	(−0.93)	(−0.82)	(−0.53)			(−0.88)	(−1.28)
EBP_{t-2}	−0.005***	−0.006***	−0.004***	−0.005***			−0.000	0.000
	(−3.30)	(−2.86)	(−4.41)	(−3.27)			(−0.20)	(0.07)
$\text{BAA-Treasury}_{t-2}$					−0.164*	−0.223*		
					(−1.86)	(−1.83)		
HYS_{t-2}					0.102**	0.127***		
					(2.45)	(4.07)		
ΔT_t		0.348		0.219	0.164	0.142	−0.217**	−0.254**
		(1.61)		(1.17)	(0.90)	(1.02)	(−2.41)	(−2.30)
ΔC_t			−0.694***	−0.562***	−0.611***	−0.371**	−0.428**	−0.483***
			(−4.62)	(−3.70)	(−3.41)	(−2.64)	(−2.28)	(−3.32)
Constant	0.003	0.002	0.001	0.001	0.001	0.002	0.002	0.004*
	(1.05)	(1.05)	(1.05)	(0.90)	(0.57)	(0.53)	(1.03)	(1.85)
Exclude GFC	No	No	No	No	No	No	Yes	Yes
N	41	41	41	41	41	41	39	29
Adj-R^2	0.030	0.105	0.157	0.169	0.131	0.144	0.178	0.292

We estimate the following model, $\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \sum_i \gamma_i X_{i,t-2} + \varepsilon_t$ where Δs_t is the change in credit spreads, ΔT_t and ΔC_t are the first differences of the foreign flows into Treasuries and corporate bonds, and X's are the LSZ control variables to capture credit-market conditions in year $t-2$. Heteroscedasticity- and autocorrelation-consistent asymptotic standard errors are computed according to Newey and West (1987) with the automatic lag selection method of Newey and West (1994).

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

One concern is that our results may be driven by a small number of disproportionately influential observations. We investigate this issue more formally with the partial regression plots (i.e., the added variable plots) in Fig. 3. Specifically, we first compute the residuals of regressing Δs_t against the LSZ control variables (e.g., TS_{t-2} and EBP_{t-2}), then estimate the residuals from regressing ΔT_t (ΔC_t) against TS_{t-2} and EBP_{t-2}, and finally plot the residuals from the first step against the residuals from

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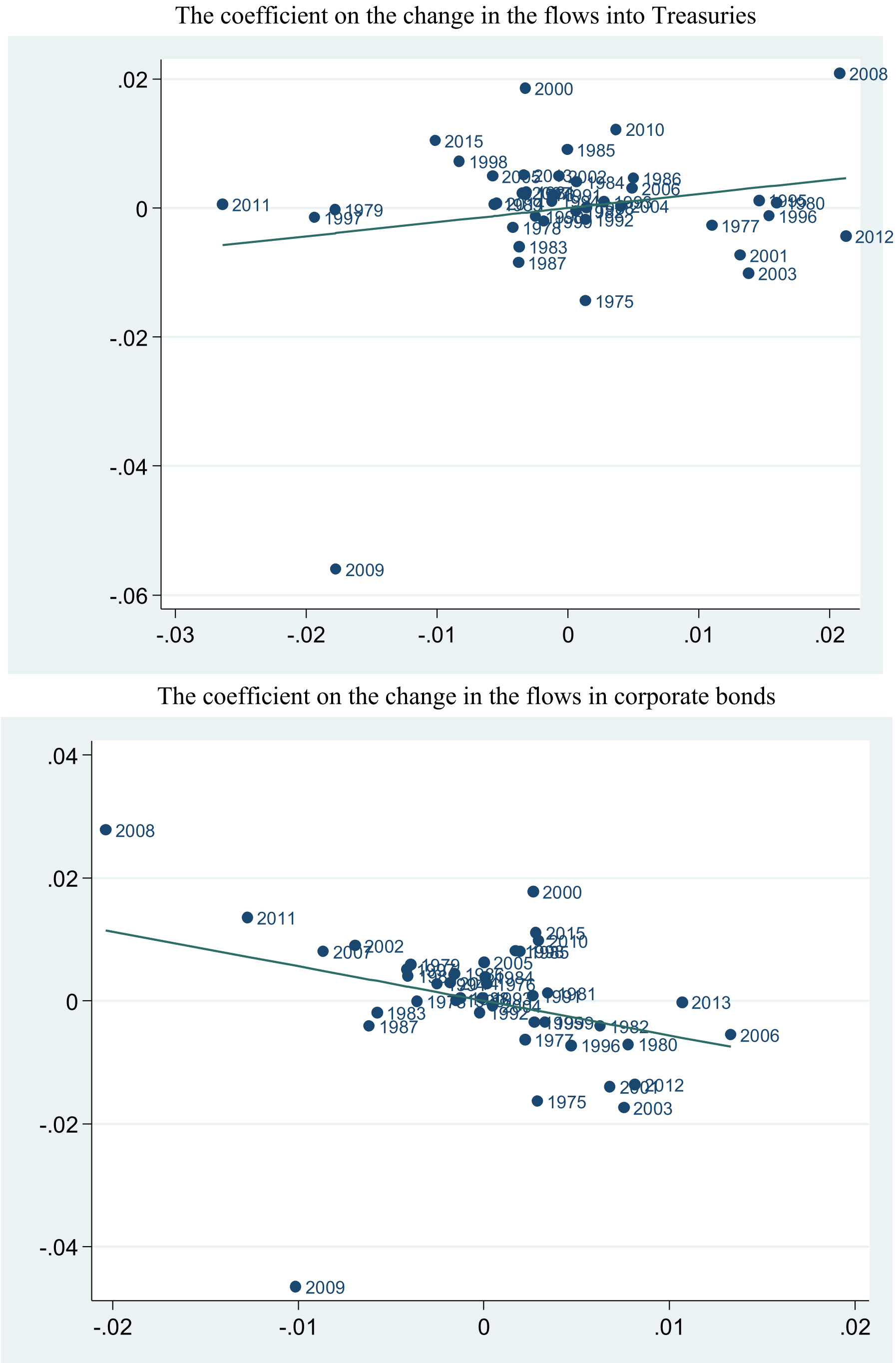

Fig. 3. Partial regression plots. (a) The coefficient on the change in the flows into Treasuries. (b) The coefficient on the change in the flows in corporate bonds. One concern is that our results may be driven by a small number of disproportionately influential observations. We investigate this issue more formally with the partial regression plots (i.e., the added variable plots) in Fig. 3. Specifically, we first compute the residuals of regressing Δs_t against the LSZ control variables (e.g., TS_{t-2} and EBP_{t-2}), then estimate the residuals from regressing $\Delta T_t/\Delta C_t$ against TS_{t-2} and EBP_{t-2}, and finally plot the residuals from the first step against the residuals from the second step in (a) and (b).

the second step in Fig. 3a (3b). In both cases, 2008 and 2009 (i.e., the Global Financial Crisis period), not surprisingly, stand out as influential observations. We therefore re-estimate Eq. (1) except that we exclude 2008 and 2009. The results for the sample from 1975 to 2015 are reported in Column (7). Interestingly, after we exclude the Global Financial Crisis period, the changes in the foreign capital flows into both Treasuries and corporate bonds are significantly negatively correlated with the change in the credit spread. That is, increases in the foreign capital flows into both Treasury and corporate bonds help significantly increase the credit supply and reduce the credit spread in the US, supporting Hypothesis 1. This result is plausible, because the Treasury and corporate bond markets are linked through the reach-for-yield mechanism (Bertaut et al., 2012; Hanson and Stein, 2015; López-Salido et al., 2017).

In Column (8), we restrict our regression to the sample period from 1985 to 2015. The idea is to match the sample period for our firm-level regressions. As we can see, our results are still robust. That is, the changes in the foreign capital flows into both Treasury and corporate bonds are significantly negatively correlated with the change in the US credit spread, supporting Hypothesis 1.

Our results are informative. First, while previous studies focus on how foreign capital flows affect the level of interest rates (e.g., Warnock and Warnock, 2009; Bertaut et al., 2012), we show here that foreign capital flows also impact the credit spread, the risk structure of interest rates. This motivates us to further explore the effects of foreign capital flows on corporate financing and investment as well as aggregate economic activities. Second, whereas previous studies mainly connect foreign capital flows to the Global Financial Crisis and the US housing bubble, we find that foreign capital flows influence the credit market well beyond the Global Financial Crisis period, even after we account for the unwinding of past credit-market sentiment emphasized by LSZ.

4. Foreign capital flows, corporate financing and investment, and aggregate economic activities

To the best of our knowledge, previous studies have not examined the impact of foreign capital flows on corporate financing and investment as well as aggregate economic activities. We fill this void.

4.1. Foreign capital flows, corporate financing and investment

4.1.1. Data and empirical methodology

If foreign capital flows influence the credit spread in the US, such flows could influence corporate financing and investment activities. However, the effects of foreign capital flows on financing and investment activities through the credit-spread channel should be stronger for financially constrained firms, because these firms face financing frictions and have only limited access to the credit market. Following Gilchrist and Himmelberg (1995), Cummins, Hasset, and Oliner (2006), and Campello and Graham (2013), we categorize the firms that do not have their public debt rated as financially constrained. It is well established that firms without credit ratings have limited access to the credit market. (e.g., Faulkender and Petersen, 2006; Harford and Uysal, 2014).

To examine the impact of foreign capital flows on corporate financing and investment, in the same spirit of LSZ, we take a two-step approach. In the first step, foreign capital flows and LSZ sentiment variables (i.e., term spread and excess bond premium) are used to predict the change in credit spreads in year t.

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t \tag{2}$$

We define $\Delta\hat{s}_t^S = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past credit-market sentiment), and $\Delta\hat{s}_t^F = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). In the second step, the predicted changes in the credit spread from the first step are used to forecast changes in various measures of firm financing and investment activities.

$$\Delta y_{i,t} = \theta_1 \Delta\hat{s}_{t-1}^S + \theta_2 \Delta\hat{s}_{t-1}^F + \sum_j \delta_j X_{i,t}^j + \mu_i + e_{i,t} \tag{3}$$

where $\Delta y_{i,t}$ is firm *i*'s financing or investment in year *t*, X's are firm-specific control variables, and μ_i is the firm fixed effect. In our benchmark regressions, we only include the control variables used by LSZ, namely the log first difference of real sales (Δ ln Sale), which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector, and the total log return during firm's fiscal year (r), which is calculated by cumulating daily returns from CRSP over the firm's fiscal year. Because sales and stock returns help control for the credit demand, the coefficients on the predicted changes in the credit spread, θ_1 and θ_2, help identify the effects of the credit supply, driven by changes in the market sentiment and foreign capital flows. In our robustness check tests, we also take into account additional firm-level control variables, such as profitability, book-to-market ratio, and liquidity from Financial Ratios Suite by Wharton Research Data Services (WRDS).

To test if the impacts of foreign capital flows on corporate financing and investment are particularly strong for financially constrained firms, in the same spirit of LSZ, we estimate the following model.

$$\Delta y_{i,t} = \theta_1^R \left(\Delta\hat{s}_{t-1}^S \times R_{i,t-1}\right) + \theta_2^R \left(\Delta\hat{s}_{t-1}^F \times R_{i,t-1}\right) + \theta_1^U \left(\Delta\hat{s}_{t-1}^S \times U_{i,t-1}\right) + \theta_2^U \left(\Delta\hat{s}_{t-1}^F \times U_{i,t-1}\right) + \sum_j \delta_j X_{i,t}^j + \mu_i + e_{i,t} \tag{4}$$

where R_i is equal to 1 if the firm is rated and zero otherwise, and U_i is equal to 1 if the firm is unrated and zero otherwise. For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firms but also spatial correlation across firms.

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In terms of firm financing, following LSZ, we examine both net debt issuance and net equity issuance. Net debt issuance (NDI) is defined as long-term debt issuance minus long-term debt reduction, and $\Delta NDI_{i,t} = \frac{NDI_{i,t} - NDI_{i,t-1}}{AT_{i,t-1}}$ where $AT_{i,t-1}$ is the book value of total assets of firm i at the end of year $t-1$. Net equity issuance (NEI) is defined as sale of common and preferred stock minus purchase of common and preferred stock, and $\Delta NEI_{i,t} = \frac{NEI_{i,t} - NEI_{i,t-1}}{AT_{i,t-1}}$. In terms of investment, we follow LSZ and focus on real business investment ($I_{i,t}$) which is defined as nominal capital expenditures deflated by the implicit price deflator for business fixed investment, and $\Delta I_{i,t} = \log(I_{i,t}) - \log(I_{i,t-1})$. All firm-level accounting data are from Compustat. To mitigate the effects of outliers, we follow LSZ and drop the observations below the 2.5th or above the 97.5th percentile.

Because we need both stock prices and accounting data, we focus on the public firms in the CRSP-Compustat merged database. Following LSZ, we exclude firms in the following NAICS sectors: Utilities, Postal Service, Finance and Insurance, Educational Services, Public Administration, and Unclassified. Furthermore, we use the long-term issuer credit ratings compiled by Standard & Poor's and reported on Compustat, which have also been used in the finance literature (e.g. Avramov et al., 2007). These ratings reflect S&P's assessment of the creditworthiness of the obligor with respect to its senior debt obligations. Panel B of Table 1 summaries the firm-level variables we use in the paper with their source information.

Panel A of Table 3 shows that, prior to 1985, few firms were rated by S&P. Thus, we limit our empirical tests related to corporate financing and investment to the post-1985 period, which is also the sample period used by LSZ. Panel B of Table 3 presents the summary statistics for rated and unrated firms. Fig. 4 depicts the net debt issuance, the net equity issuance, and the change in investment for rated and unrated firms. It seems that unrated firms are more sensitive to market conditions in that their financing and investment activities are more volatile. This is expected, as unrated firms are financially constrained.

Table 3
Summary statistics for US public firms.

	All Firms	Rated Firms		Unrated Firms	
	N	N	AT%	N	AT%
Panel A: Numbers and total assets of rated and unrated firms in the US					
1975	3776	0	0	3776	100
1980	3816	0	0	3816	100
1985	4549	719	68	3830	32
1990	4619	682	69	3937	31
1995	5925	963	70	4962	30
2000	5868	1323	81	4545	19
2005	4498	1244	84	3254	16
2010	3860	1081	83	2779	17
2015	3541	1091	81	2450	19

	ΔNDI	ΔNEI	ΔINV	Δ ln Sale	r	Profitability	BM	Liquidity
Panel B: Summary statistics								
Rated firms								
N	28,838	27,965	30,276	31,888	32,852	25,997	24,639	24,780
Mean	0.015	−0.002	0.045	0.071	0.025	−0.057	0.007	0.019
SD	0.150	0.092	0.520	0.235	0.467	8.982	0.010	0.016
P1	−0.316	−0.315	−1.585	−0.666	−1.560	−0.005	0.000	0.004
P5	−0.234	−0.123	−0.813	−0.266	−0.881	0.000	0.001	0.007
P25	−0.049	−0.014	−0.194	−0.028	−0.175	0.001	0.003	0.012
P50	0.000	0.000	0.052	0.051	0.085	0.001	0.005	0.016
P75	0.058	0.009	0.298	0.150	0.295	0.002	0.008	0.023
P95	0.334	0.108	0.853	0.481	0.691	0.004	0.016	0.039
P99	0.497	0.341	1.625	0.948	1.087	0.007	0.031	0.069
Unrated firms								
N	94,745	90,747	98,220	101,004	116,490	94,766	93,719	94,407
Mean	0.014	−0.015	0.013	0.089	−0.068	−0.050	0.007	0.038
SD	0.138	0.199	0.846	0.335	0.582	1.535	0.020	0.191
P1	−0.316	−0.602	−1.996	−0.721	−1.560	−0.474	0.000	0.002
P5	−0.208	−0.458	−1.617	−0.504	−1.235	−0.030	0.001	0.006
P25	−0.017	−0.021	−0.448	−0.062	−0.374	0.000	0.003	0.014
P50	0.000	0.000	0.046	0.068	0.000	0.001	0.005	0.023
P75	0.030	0.011	0.499	0.220	0.291	0.001	0.009	0.038
P95	0.294	0.349	1.521	0.749	0.875	0.003	0.019	0.100
P99	0.497	0.561	1.871	1.030	1.087	0.006	0.037	0.242

The summary statistics of rated and unrated firms in our merged database. Net debt issuance (NDI) is defined as long-term debt issuance minus long-term debt reduction, and $\Delta NDI_{i,t} = \frac{NDI_{i,t} - NDI_{i,t-1}}{AT_{i,t-1}}$ where $AT_{i,t-1}$ is the book value of total assets of firm i at the end of year $t-1$. Net equity issuance (NEI) is defined as sale of common and preferred stock minus purchase of common and preferred stock, and $\Delta NEI_{i,t} = \frac{NEI_{i,t} - NEI_{i,t-1}}{AT_{i,t-1}}$. Real business investment ($I_{i,t}$) is defined as nominal capital expenditures deflated by the implicit price deflator for business fixed investment, and $\Delta I_{i,t} = \log(I_{i,t}) - \log(I_{i,t-1})$. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. r is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year). Profitability, BM, and liquidity are operating profit margin before depreciation, book-to-market ratio, and current ratio from Wharton Research Data Services (WRDS), respectively.

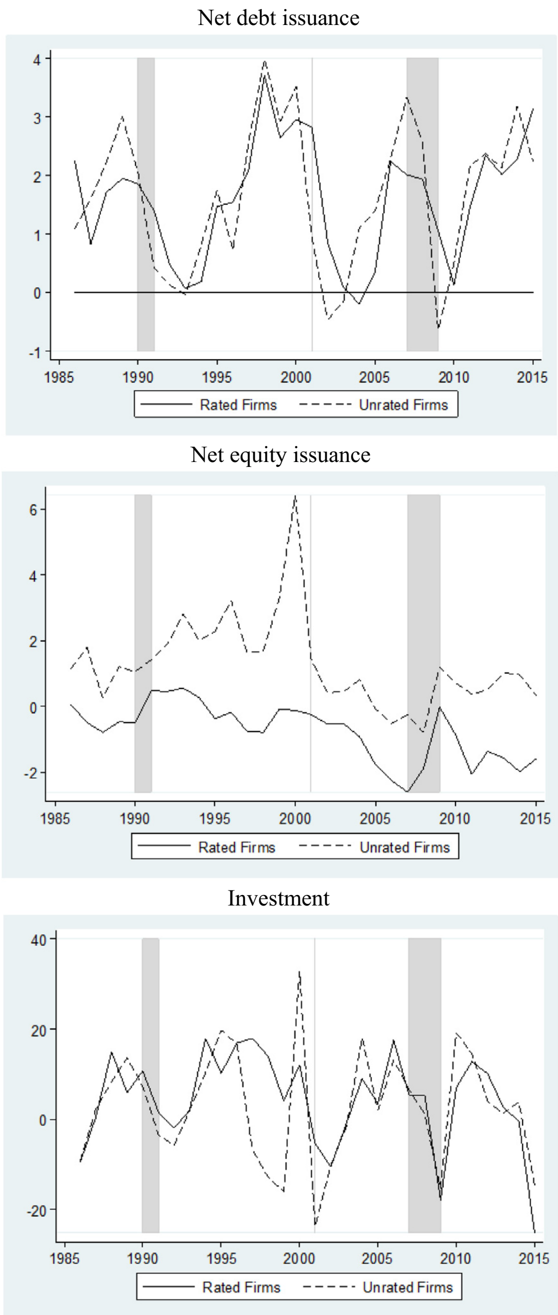

Fig. 4. Financing and investment of rated and unrated US firms. (a) Net debt issuance. (b) Net equity issuance. (c) Investment. Figure depicts the net debt issuance, the net equity issuance, and the change in investment for rated and unrated firms.

4.1.2. Empirical results

4.1.2.1. Financing and foreign capital flows. In Panel A of Table 4, we estimate the impact of the foreign capital flows on firm financing, Eq. (3). For comparison, we first only include the change in the credit spread that is due to the unwinding of past credit-market sentiment, $\Delta\hat{s}^S_{t-1}$, and the LSZ control variables (i.e., the log first difference of real sales, Δ ln $Sale_{it}$, and the total log return during firm's fiscal year, r_{it}). Consistent with LSZ, we observe a substitution between debt and equity in Columns (1) and (2). That is, if an unwinding of past credit-market sentiment predicts an increase in the credit spread ($\Delta\hat{s}^S_{t-1} > 0$), the debt issuance will decrease significantly, but the equity issuance will increase (although insignificantly). In Columns (3) and (4), we add the change in the credit spread driven by the foreign capital flows, $\Delta\hat{s}^F_{t-1}$. As we can see, even with the presence of $\Delta\hat{s}^S_{t-1}$, $\Delta\hat{s}^F_{t-1}$ still has a significantly negative effect on the net debt issuance. That is, controlling for the unwinding of past

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Table 4
Foreign flows and firm financing.

Variables	(1) ΔNDI	(2) ΔNEI	(3) ΔNDI	(4) ΔNEI
Panel A: Benchmark regressions				
Δs^S_{t-1}	−1.073**	1.081	−1.100***	1.089
	(−2.72)	(1.37)	(−4.29)	(1.40)
Δs^F_{t-1}			−0.865***	0.295
			(−7.18)	(0.94)
Δ ln Sale $_{i\ t}$	0.035***	−0.024***	0.034***	−0.023***
	(8.75)	(−5.00)	(8.86)	(−4.61)
r $_{i,t}$	0.005**	0.055***	0.006***	0.054***
	(2.52)	(12.72)	(4.10)	(12.38)
Firm FE	Yes	Yes	Yes	Yes
Observations	118,656	114,152	118,656	114,152
R-squared	0.061	0.103	0.063	0.103

Variables	(1) ΔNDI	(2) ΔNEI	(3) ΔNDI	(4) ΔNEI	(5) ΔNDI	(6) ΔNEI
Panel B: Robustness checks						
Δs^S_{t-1}	−1.080***	1.038	−1.081***	1.034	−0.914***	−0.049
	(−4.62)	(1.24)	(−4.57)	(1.24)	(−3.22)	(−0.06)
Δs^F_{t-1}	−0.741***	0.245	−0.741***	0.244	−0.476	−1.458*
	(−7.14)	(0.69)	(−7.08)	(0.69)	(−1.61)	(−1.71)
Δ ln Sale $_{i\ t}$	0.032***	−0.026***	0.033***	−0.026***	0.033***	−0.026***
	(8.78)	(−4.42)	(8.79)	(−4.42)	(8.73)	(−4.53)
$r_{i,t}$	0.003*	0.059***	0.003*	0.059***	0.004*	0.063***
	(1.95)	(13.48)	(1.94)	(13.51)	(1.91)	(14.63)
Profitability $_t$	0.001	−0.001	0.001	−0.001	0.000	−0.001
	(1.15)	(−0.99)	(1.16)	(−0.98)	(0.55)	(−0.82)
BM $_t$	−0.382**	0.437**	−0.380**	0.437**	−0.404**	0.435*
	(−2.41)	(2.16)	(−2.41)	(2.16)	(−2.23)	(1.99)
Liquidity $_t$	0.019**	0.022	0.019**	0.022	0.017**	0.021
	(2.21)	(1.15)	(2.27)	(1.15)	(2.16)	(1.08)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes	Yes
Exclude GFC	No	No	No	No	Yes	Yes
Observations	93,056	89,313	93,051	89,306	87,856	84,346
R^2 (within)	0.066	0.110	0.066	0.111	0.071	0.115

We take a two-step approach. In the first step, foreign capital flows and LSZ variables (i.e., term spread and excess bond premium) are used to predict the change in credit spreads in year *t*.

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$

We define $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past market conditions), and $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). In the second step, the predicted changes in the credit spread from the first step are used to forecast changes in various measures of firm financing and investment activities.

$$\Delta y_{i,t} = \theta_1 \Delta\hat{s}^S_{t-1} + \theta_2 \Delta\hat{s}^F_{t-1} + \sum_j \delta_j X^j_{i,t} + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$ is firm *i*'s financing in year *t*, X's are firm-specific control variables, and μ_i is the firm fixed effect. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. *r* is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year). Profitability, BM, and liquidity are operating profit margin before depreciation, book-to-market ratio, and current ratio from Wharton Research Data Services (WRDS), respectively.
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

credit-market sentiment, an increase in the credit spread due to the decreases in the foreign capital flows still push down debt financing.

In Panel B of Table 4, we conduct a variety of robustness tests. In Columns (1) and (2), we account for more firm-level control variables, such as profitability, book-to-market ratio, and liquidity. In Columns (3) and (4), we further include the industry fixed effects. In Columns (5) and (6), we exclude the Global Financial Crisis period of 2008 and 2009. As we can see, in all the cases, the results seem to be qualitatively similar. That is, even with the presence of $\Delta\hat{s}^S_{t-1}$, $\Delta\hat{s}^F_{t-1}$ still has a significantly negative effect on the net debt issuance, although not significant in Column (5). As we will see, this may be due to that foreign capital flows mainly affect financially constrained firms.

In Table 5, we test if the impact of foreign capital flows is particularly strong for financially constrained firms. In Columns (1) and (2), we estimate the benchmark model of Eq. (4). In Columns (3) and (4), we account for more firm-level control variables, such as profitability, book-to-market ratio, and liquidity. In Columns (5) and (6), we further include the industry fixed effects. In Columns (7) and (8), we exclude the Global Financial Crisis period of 2008 and 2009. The results in Table 5 seem to provide some supporting evidence, particularly when the Global Financial Crisis period is excluded. For instance, in Column (7), $\Delta\hat{s}^F_{t-1}$ significantly negatively affects the net debt issuance of unrated firms, but has no significant impact on that of rated firms, if the Global Financial Crisis period is excluded. This is a central finding of the paper. Previous studies mainly use foreign capital flows to help understand the Global Financial Crisis. Our finding suggests that foreign capital flows influence firms' financing decisions – particularly those of financially constrained firms, which is not only present during the Global Financial Crisis but remains present when the Global Financial Crisis period is excluded from the estimation.

4.1.2.2. Investment and foreign capital flows. Firm investment is important to understand the business cycle (Greenwood et al., 1988). In this section, we examine how foreign capital flows influence firm investment. Table 6 reports the results for all firms. In Column (1), we only include the change in the credit spread that is due to the unwinding of past credit-market sentiment, $\Delta\hat{s}^S_{t-1}$, and the LSZ control variables (i.e., the log first difference of real sales, Δ ln Sale_{it}, and the total log return during firm's fiscal year, r_{it}). Consistent with LSZ, a predicted increase in the credit spread due to an unwinding of past credit-market sentiment significantly depresses firm investment at the 10% level. In Column (2), we add the change in the credit spread driven by foreign capital flows, $\Delta\hat{s}^F_{t-1}$. As we can see, even with the presence of $\Delta\hat{s}^S_{t-1}$, $\Delta\hat{s}^F_{t-1}$ still has a significantly negative effect on firm investment. That is, controlling for the unwinding of past market sentiment, an increase in the credit spread

Table 5
Foreign flows and firm financing for rated and unrated firms.

Variables	(1) ΔNDI	(2) ΔNEI	(3) ΔNDI	(4) ΔNEI	(5) ΔNDI	(6) ΔNEI	(7) ΔNDI	(8) ΔNEI
$\Delta s^s_{t-1} \times R_{i,t-1}$	−0.457	1.083	−0.267	0.935	−0.271	0.942	0.554	−0.222
	(−1.18)	(1.43)	(−0.65)	(1.21)	(−0.66)	(1.22)	(0.91)	(−0.51)
$\Delta s^F_{t-1} \times R_{i,t-1}$	−0.857***	0.273	−0.828***	0.220	−0.829***	0.222	0.411	−1.069**
	(−3.49)	(0.84)	(−3.62)	(0.61)	(−3.59)	(0.62)	(0.69)	(−2.30)
$\Delta s^s_{t-1} \times U_{i,t-1}$	−1.347***	1.091	−1.356***	1.075	−1.356***	1.067	−1.418***	0.013
	(−4.70)	(1.25)	(−5.39)	(1.14)	(−5.37)	(1.13)	(−4.34)	(0.01)
$\Delta s^F_{t-1} \times U_{i,t-1}$	−0.869***	0.304	−0.712***	0.255	−0.711***	0.252	−0.792**	−1.600
	(−7.42)	(0.76)	(−6.71)	(0.56)	(−6.72)	(0.55)	(−2.29)	(−1.49)
Δ ln $\text{Sale}_{i\ t}$	0.034***	−0.023***	0.032***	−0.026***	0.033***	−0.026***	0.033***	−0.026***
	(8.85)	(−4.61)	(8.78)	(−4.43)	(8.80)	(−4.42)	(8.72)	(−4.53)
$r_{i,t}$	0.006***	0.054***	0.003*	0.059***	0.003*	0.059***	0.004*	0.063***
	(4.09)	(12.37)	(1.92)	(13.43)	(1.91)	(13.46)	(1.86)	(14.65)
Profitability_t			0.001	−0.001	0.001	−0.001	0.000	−0.001
			(1.16)	(−0.99)	(1.17)	(−0.97)	(0.57)	(−0.82)
BM_t			−0.381**	0.437**	−0.380**	0.437**	−0.402**	0.436*
			(−2.42)	(2.16)	(−2.41)	(2.15)	(−2.23)	(1.99)
Liquidity_t			0.019**	0.023	0.019**	0.022	0.017**	0.021
			(2.19)	(1.15)	(2.25)	(1.15)	(2.12)	(1.08)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes	Yes	Yes
Exclude GFC	No	No	No	No	No	No	Yes	Yes
Observations	118,656	114,152	93,056	89,313	93,051	89,306	87,856	84,346
R^2 (within)	0.063	0.103	0.066	0.110	0.067	0.111	0.071	0.115

We take a two-step approach. In the first step, foreign capital flows and LSZ variables (i.e., term spread and excess bond premium) are used to predict the change in credit spreads in year *t*.

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$

We define $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past market conditions), and $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). In the second step, we estimate the following model.

$$\Delta y_{i,t} = \theta^R_1(\Delta\hat{s}^S_{t-1} \times R_{i,t-1}) + \theta^R_2(\Delta\hat{s}^F_{t-1} \times R_{i,t-1}) + \theta^U_1(\Delta\hat{s}^S_{t-1} \times U_{i,t-1}) + \theta^U_2(\Delta\hat{s}^F_{t-1} \times U_{i,t-1}) + \sum_j \delta_j X^j_{i,t} + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$ is firm *i*'s financing in year *t*, X's are firm-specific control variables, μ_i is the firm fixed effect, R_i is equal to 1 if the firm is rated and zero otherwise, and U_i is equal to 1 if the firm is unrated and zero otherwise. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. *r* is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year). Profitability, BM, and liquidity are operating profit margin before depreciation, book-to-market ratio, and current ratio from Wharton Research Data Services (WRDS), respectively.
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 6
Foreign flows and firm investment.

Variables	(1) ΔINV	(2) ΔINV	(3) ΔINV	(4) ΔINV	(5) ΔINV
Δs^{s}_{t-1}	−8.957*	−9.341***	−9.281***	−9.304***	−8.943**
	(−1.76)	(−3.39)	(−3.30)	(−3.33)	(−2.48)
Δs^{F}_{t-1}		−9.061***	−8.686***	−8.681***	−7.270*
		(−5.83)	(−5.38)	(−5.36)	(−1.73)
Δ ln Sale $_{i\ t}$	0.713***	0.695***	0.709***	0.709***	0.703***
	(23.52)	(27.61)	(26.30)	(26.30)	(23.85)
$r_{i,t}$	0.087***	0.098***	0.072***	0.072***	0.090***
	(3.55)	(5.10)	(3.50)	(3.50)	(4.62)
Profitability_t			−0.023***	−0.023***	−0.023***
			(−3.65)	(−3.64)	(−2.94)
BM_t			−4.794***	−4.792***	−4.907***
			(−4.13)	(−4.11)	(−3.79)
Liquidity_t			0.419**	0.418**	0.398**
			(2.25)	(2.27)	(2.17)
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes
Exclude GFC	No	No	No	No	Yes
Observations	124,104	124,104	100,118	100,112	94,581
R^2 (within)	0.154	0.158	0.161	0.162	0.161

We take a two-step approach. In the first step, foreign capital flows and LSZ variables (i.e., term spread and excess bond premium) are used to predict the change in credit spreads in year *t*.

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$

We define $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past market conditions), and $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). In the second step, the predicted changes in the credit spread from the first step are used to forecast changes in various measures of firm financing and investment activities.

$$\Delta y_{i,t} = \theta_1 \Delta\hat{s}^S_{t-1} + \theta_2 \Delta\hat{s}^F_{t-1} + \sum_j \delta_j X^j_{i,t} + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$ is firm *i*'s investment in year *t*, X's are firm-specific control variables, and μ_i is the firm fixed effect. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. *r* is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year). Profitability, BM, and liquidity are operating profit margin before depreciation, book-to-market ratio, and current ratio from Wharton Research Data Services (WRDS), respectively.
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

due to the decreases in the foreign capital flows still depress firm investment significantly. Furthermore, the coefficient on $\Delta\hat{s}^F_{t-1}$ is close to that on $\Delta\hat{s}^S_{t-1}$.

In Columns (3) to (5), we conduct a variety of robustness tests. In Column (3), we account for more firm-level control variables, such as profitability, book-to-market ratio, and liquidity. In Column (4), we further include the industry fixed effects. In Column (5), we exclude the Global Financial Crisis period of 2008 and 2009. As we can see, in all the cases, the results seem to be qualitatively similar. That is, even with the presence of $\Delta\hat{s}^S_{t-1}$, $\Delta\hat{s}^F_{t-1}$ still has a significantly negative effect on firm investment.

In Table 7, we test if the impact of foreign capital flows is particularly strong for financially constrained firms. In Column (1), we estimate the benchmark model of Eq. (4). In Column (2), we account for more firm-level control variables, such as profitability, book-to-market ratio, and liquidity. In Column (3), we further include the industry fixed effects. In Column (4), we exclude the Global Financial Crisis period of 2008 and 2009. The results in Table 7 provide strong support for Hypothesis 2, no matter if we exclude or include the Global Financial Crisis period. For instance, in the benchmark regression in Column (1), while the coefficient of $\Delta\hat{s}^F_{t-1}$ for rated firms is −6.44 (t = −3.55), that for unrated firms is −10.14 (t = −6.75). If we exclude the Global Financial Crisis and include more controls as well as the industry fixed effects in Columns (4), the coefficient on $\Delta\hat{s}^F_{t-1}$ for rated firms reduces substantially to −3.66 (t = −0.87), whereas that for unrated firms decreases slightly to −8.53 (t = −1.94). This result suggests that foreign capital flows influence firms' investment decisions even outside of the well-studied Global Financial Crisis period, particularly for financially constrained firms.

4.2. Foreign capital flows and aggregate economic activity

The evidence so far suggests that the change in the credit spread driven by foreign capital flows has significant impact on corporate financing and investment activities, particularly for financially constrained firms. Although firm-level tests help

Table 7
Foreign flows and firm investment for rated and unrated firms.

Variables	(1) ΔINV	(2) ΔINV	(3) ΔINV	(4) ΔINV
$\Delta s^S_{t-1} \times R_{i,t-1}$	−7.722**	−8.206**	−8.246**	−7.524*
	(−2.43)	(−2.49)	(−2.51)	(−1.95)
$\Delta s^F_{t-1} \times R_{i,t-1}$	−6.439***	−5.972***	−5.957***	−3.659
	(−3.55)	(−3.03)	(−3.02)	(−0.87)
$\Delta s^S_{t-1} \times U_{i,t-1}$	−9.965***	−9.678***	−9.696***	−9.435**
	(−3.55)	(−3.39)	(−3.42)	(−2.43)
$\Delta s^F_{t-1} \times U_{i,t-1}$	−10.136***	−9.699***	−9.698***	−8.563*
	(−6.75)	(−6.23)	(−6.21)	(−1.94)
Δ ln $Sale_{i\ t}$	0.695***	0.709***	0.709***	0.703***
	(27.62)	(26.29)	(26.29)	(23.82)
$r_{i,t}$	0.098***	0.072***	0.072***	0.090***
	(5.13)	(3.52)	(3.52)	(4.64)
$Profitability_t$		−0.023***	−0.023***	−0.023***
		(−3.65)	(−3.63)	(−2.94)
BM_t		−4.783***	−4.781***	−4.902***
		(−4.13)	(−4.12)	(−3.79)
$Liquidity_t$		0.418**	0.417**	0.397**
		(2.25)	(2.26)	(2.17)
Firm FE	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Exclude GFC	No	No	No	Yes
Observations	124,104	100,118	100,112	94,581
R^2 (within)	0.159	0.161	0.162	0.161

We take a two-step approach. In the first step, foreign capital flows and LSZ variables (i.e., term spread and excess bond premium) are used to predict the change in credit spreads in year *t*.

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$

We define $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past market conditions), and $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). In the second step, we estimate the following model.

$$\Delta y_{i,t} = \theta^R_1(\Delta\hat{s}^S_{t-1} \times R_{i,t-1}) + \theta^R_2(\Delta\hat{s}^F_{t-1} \times R_{i,t-1}) + \theta^U_1(\Delta\hat{s}^S_{t-1} \times U_{i,t-1}) + \theta^U_2(\Delta\hat{s}^F_{t-1} \times U_{i,t-1}) + \sum_j \delta_j X^j_{i,t} + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$is firm *i*'s investment in year *t*, X's are firm-specific control variables, μ_i is the firm fixed effect, R_i is equal to 1 if the firm is rated and zero otherwise, and U_i is equal to 1 if the firm is unrated and zero otherwise. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. *r* is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year). Profitability, BM, and liquidity are operating profit margin before depreciation, book-to-market ratio, and current ratio from Wharton Research Data Services (WRDS), respectively.
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

identify underlying mechanisms, such tests may miss important externalities (e.g., multiplier effects). Therefore, in this section, we examine the impact of foreign capital flows on aggregate economic measures, through the credit-spread channel. Following LSZ and Du (2017), our benchmark aggregate economic measure is real GDP growth, and our alternative measures are changes in business fixed investment and unemployment. All macroeconomic data are from FRED, and are summarized in Panel A of Table 1.

We first reproduce the results in LSZ for our shorter sample period from 1975 to 2015. That is, we estimate the following two equations jointly.

$$\Delta s_t = \alpha + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t \quad (5)$$

$$\Delta y_t = \beta + \theta_1 \Delta\hat{s}^S_t + \delta \Delta y_{t-1} + e_t \quad (6)$$

where $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past credit-market sentiment), and Δy_t is the aggregate economic activity measure in year *t* (i.e., real GDP growth, ΔGDP). Following LSZ, to account for the error-in-the-variable bias, the above system of equations is estimated jointly by nonlinear least squares (NLLS). Heteroscedasticity- and autocorrelation-consistent asymptotic standard errors are computed according to Newey and West (1987) with the automatic lag selection method of Newey and West (1994). The results are reported in Column (1) of Table 8. The lower panel shows the first-step regression results, and the upper panel reports the results for the second-step regressions. Consistent with LSZ, the predicted change in the credit spread has negative impact on the real

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Table 8
Two-Step Results: credit spreads, capital flows, and economic activity.

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔUN	(6) ΔINV
Dependent variable: Δy_t						
Δs^S_{t-1}	−2.936	−3.377	−4.473	−3.832	3.022	−16.588
	(−1.58)	(−1.76)	(−1.69)	(−2.24)	(1.48)	(−1.69)
Δs^F_{t-1}		−0.502	−0.505	−0.622	0.611	−3.861
		(−1.45)	(−1.75)	(−1.45)	(1.72)	(−1.58)
Δy_{t-1}	0.328	0.275	0.335	0.442	0.033	0.040
	(2.01)	(1.87)	(3.09)	(3.12)	(0.17)	(0.28)
R^2	0.373	0.370	0.279	0.286	0.860	−14.669
	GZ	GZ	GZ	BAA-Treasury	GZ	GZ
Auxiliary forecasting regressions						
TS_{t-2}	−0.176	−0.128			−0.125	−0.123
	(−1.78)	(−2.30)			(−1.94)	(−2.49)
EBP_{t-2}	−0.004	−0.003			−0.002	−0.003
	(−1.69)	(−2.11)			(−1.32)	(−1.90)
BAA-Treasury$_{t-2}$			0.054	0.059		
			(1.50)	(1.36)		
HYS_{t-2}			−0.198	−0.262		
			(−1.78)	(−1.91)		
ΔT_t		0.227	0.175	0.142	0.236	0.181
		(1.25)	(0.90)	(0.88)	(1.62)	(1.24)
ΔC_t		−0.478	−0.586	−0.346	−0.446	−0.543
		(−2.69)	(−2.93)	(−2.05)	(−2.00)	(−3.22)
R^2	−0.604	−0.345	−0.387	0.195	−0.390	−0.346

In Column (1), we estimate the following two equations jointly.

$$\Delta s_t = \alpha + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$
$$\Delta y_t = \beta + \theta_1 \Delta\hat{s}^S_t + \delta\Delta y_{t-1} + e_t$$

where Δs_t is the change in credit spreads, TS is term premium, EBP is the excess bond premium, $\Delta\hat{s}^S_t = \hat{\gamma}_1 TS_{t-2} + \hat{\gamma}_2 EBP_{t-2}$ (the change in the credit spread due to the unwinding of past market conditions), and $\Delta y_t$is the aggregate economic activity measure in year *t*. To account for the error-in-the-variable bias, the above system of equations is estimated jointly by nonlinear least squares (NLLS). Heteroscedasticity- and autocorrelation-consistent asymptotic standard errors are computed according to Newey and West (1987) with the automatic lag selection method of Newey and West (1994). The lower panel shows the first-step regression results, and the upper panel reports the results for the second-step regressions. We also estimate the following system of equations:

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t$$
$$\Delta y_t = \beta + \theta_1 \Delta\hat{s}^S_t + \theta_2 \hat{s}^F_t + \delta\Delta y_{t-1} + e_t$$

where $\Delta T_t$and ΔC_t are the first differences of the foreign flows into Treasuries and corporate bonds, and $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). The results are presented in Column (2). We next explore alternative credit-market control variables in Column (3), the alternative credit-spread measure in Column (4), and alternative macroeconomic measures (i.e., changes in business fixed investment and unemployment) in Columns (5) and (6).

GDP growth, marginally significant at the 10% level for a one-sided test. Our results are weaker compared to those in LSZ, due to that our sample is considerably shorter.

We next examine if the change in the credit spread driven by foreign capital flows also has significant aggregate impact with the following system of equations:

$$\Delta s_t = \alpha + \beta_1 \Delta T_t + \beta_2 \Delta C_t + \gamma_1 TS_{t-2} + \gamma_2 EBP_{t-2} + \varepsilon_t \quad (2)$$

$$\Delta y_t = \beta + \theta_1 \Delta\hat{s}^S_t + \theta_2 \hat{s}^F_t + \delta\Delta y_{t-1} + e_t \quad (7)$$

where $\Delta\hat{s}^F_t = \hat{\beta}_1 \Delta T_t + \hat{\beta}_2 \Delta C_t$ (the change in the credit spread driven by foreign capital flows). Again, to account for the error-in-the-variable bias, the above system of equations is estimated jointly by nonlinear least squares (NLLS). The results are presented in Column (2) of Table 8. Even with the presence of $\Delta\hat{s}^S_t$, the coefficient on $\Delta\hat{s}^F_t$ is still significant at the 10% level for a one-sided test, suggesting that foreign capital flows, through the credit spread channel, have important effects on aggregate economic activity.

We next explore alternative credit-market control variables in Column (3), the alternative credit-spread measure in Column (4), and alternative macroeconomic measures, namely the change in unemployment (ΔUN) and the change in business fixed investment (ΔINV) in Columns (5) and (6). As we can see, in all the cases, our results are qualitatively similar. In the case of unemployment in Column (5), the coefficients on $\Delta\hat{s}^S_t$ and $\Delta\hat{s}^F_t$ are positive, consistent with the idea that higher credit spreads depress economic activity and increase unemployment.

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5. Further analysis

In the same spirit of LSZ, we use annual macro data to test the impact of foreign capital flows, through the credit spread, on corporate financing and investment as well as aggregate economic activities. In this section, we present the results based on quarterly macroeconomic data. Furthermore, we employ a multivariate structural VAR framework to address potential endogeneity/reverse-causation concerns.

5.1. Quarterly macroeconomic data

We estimate the following quarterly variant of our annual system of equations.

$$\Delta s_t = \alpha + \sum_{k=0}^{L} \beta_{1,l} \Delta T_{t-k} + \sum_{k=0}^{L} \beta_{2,l} \Delta C_{t-k} + \gamma_1 TS_{t-5} + \gamma_2 EBP_{t-5} + \varepsilon_t \quad (8a)$$

$$\Delta y_t = \beta + \theta_1 \Delta \hat{s}_t^S + \theta_2 \hat{s}_t^F + \delta \Delta y_{t-1} + e_t \quad (8b)$$

where $\Delta\hat{s}_t^S = \hat{\gamma}_1 TS_{t-5} + \hat{\gamma}_2 EBP_{t-5}$, and $\Delta\hat{s}_t^F = \sum_{k=0}^{L} \beta_{1,l} \Delta T_{t-k} + \sum_{k=0}^{L} \beta_{2,l} \Delta C_{t-k}$. We use AIC and BIC to help determine the lag length, L, for foreign capital flows. Empirically, both AIC and BIC support the lag length of 1 quarter. Again, following LSZ, to account for the error-in-the-variable bias, the above system of equations is estimated jointly by nonlinear least squares (NLLS). The results are reported in Table 9. The lower panel shows the first-step regression results, and the upper panel reports the results for the second-step regressions.

In Column (1), we estimate the system of equations without the foreign capital flows, with the real GDP growth (ΔGDP) as the macroeconomic measure. As we can see, the two-step regression results based on the quarterly data are qualitatively similar to those based on the annual data (in Column (1) of Table 8). Both the term spread (TS) and the excess bond premium (EBP) in t - 5 enter with significantly negative coefficients, suggesting a reversal in the GZ credit spread. Furthermore, the predicted change in the credit spread has significantly negative impact on the real GDP growth. In Column (2), we take into account the foreign capital flows. Again, the results are materially similar to those based on the annul data (in Column (2) of Table 8). In the first step regression, the foreign capital flows into US corporate bonds have (significantly) negative impact on

Table 9
Two-step regressions with quarterly data.

	(1) ΔGDP	(2) ΔGDP	(3) ΔINV	(4) ΔINV	(5) ΔUN	(6) ΔUN
$\Delta\hat{s}^s_{t-1}$	−1.840	−1.415	−11.480	−9.841	0.886	0.669
	(−1.93)	(−1.86)	(−1.86)	(−1.85)	(1.78)	(1.66)
$\Delta\hat{s}^F_{t-1}$		−0.776		−4.878		0.299
		(−2.90)		(−2.69)		(2.25)
Δy_{t-1}	0.324	0.342	0.253	0.273	0.446	0.464
	(3.84)	(4.02)	(2.75)	(2.94)	(4.38)	(4.58)
R^2	0.18	0.19	0.17	0.19	0.31	0.32
TS_{t-5}	−0.054	−0.039	−0.054	−0.041	−0.055	−0.041
	(−2.30)	(−1.87)	(−2.35)	(−2.11)	(−2.40)	(−2.39)
EBP_{t-5}	−0.001	−0.002	−0.001	−0.002	−0.001	−0.002
	(−1.75)	(−2.15)	(−1.88)	(−2.20)	(−1.75)	(−2.11)
ΔC_t		−0.177		−0.151		−0.170
		(−3.64)		(−3.53)		(−3.71)
ΔC_{t-1}		−0.150		−0.144		−0.149
		(−1.41)		(−1.49)		(−1.42)
ΔT_t		0.047		0.049		0.050
		(2.07)		(2.39)		(2.27)
ΔT_{t-1}		0.047		0.058		0.044
		(1.97)		(2.55)		(1.88)
R^2	0.05	0.19	0.05	0.18	0.04	0.19

We estimate the following quarterly variant of our annual system of equations.

$$\Delta s_t = \alpha + \sum_{l=0}^{k} \beta_{1,l} \Delta T_{t-l} + \sum_{l=0}^{k} \beta_{2,l} \Delta C_{t-l} + \gamma_1 TS_{t-5} + \gamma_2 EBP_{t-5} + \varepsilon_t$$

$$\Delta y_t = \beta + \theta_1 \Delta \hat{s}_t^S + \theta_2 \hat{s}_t^F + \delta \Delta y_{t-1} + e_t$$

where Δs_t is the change in credit spreads, TS is term premium, EBP is the excess bond premium, ΔT_t and ΔC_t are the first differences of the foreign flows into Treasuries and corporate bonds, $\Delta\hat{s}_t^S = \hat{\gamma}_1 TS_{t-5} + \hat{\gamma}_2 EBP_{t-5}$, *and* $\Delta\hat{s}_t^F = \sum_{l=0}^{k} \hat{\beta}_{1,l} \Delta T_{t-l} + \sum_{l=0}^{k} \hat{\beta}_{2,l} \Delta C_{t-l}$. Both AIC and BIC support the lag length of 1 quarter. To account for the error-in-the-variable bias, the above system of equations is estimated jointly by nonlinear least squares (NLLS). The results are reported in Table 9. The lower panel shows the first-step regression results, and the upper panel reports the results for the second-step regressions.

the credit spread, even after we account for the unwinding of past credit-market sentiment emphasized by LSZ with TS_{t-5} and EBP_{t-5}. Furthermore, adding the changes in the foreign capital flows increases the first-step R^2 from 5% in Column (1) to 19%, suggesting that foreign capital flows are also economically significant. In the second step regression, even with the presence of $\Delta\hat{s}_t^S$, the coefficient on $\Delta\hat{s}_t^F$ is still significant at the 5% level, suggesting that foreign capital flows, through the credit spread channel, have significant impact on the real GDP growth.

In Columns (3) to (6), we repeat the same exercises, with alternative economic measures. More specifically, we focus on the change in business fixed investment (ΔINV) in Columns (3) and (4) and the change in unemployment (ΔUN) in Columns (5) and (6), respectively. As can be seen, the results are consistent with those based on the real GDP growth. First, the foreign capital flows in the first step regressions are generally statistically significant, even with the presence of the lagged term premium and excess bond premium. Second, the changes in the credit spread predicted by the foreign capital flows in the second step regressions have marginal explanatory power, even after we control for the unwinding of past credit-market sentiment emphasized by LSZ.

We next repeat our firm-level panel regressions. The predicted quarterly changes in the credit spread, $\Delta\hat{s}_t^S$ and $\Delta\hat{s}_t^F$, are based on the parameter estimates of the first step regression in Column (2) of Table 9. Then, we take the sum of quarterly predicted changes in the credit spread in the second step of the analysis based on the annual firm-level data. The results for all firms are presented in Table 10, and are qualitatively similar to those based on the annual macroeconomic data (in Tables 4 and 6). For instance, for the net debt issuance (ΔNDI), Column (2) shows that even with the presence of $\Delta\hat{s}_{t-1}^S$, $\Delta\hat{s}_{t-1}^F$ still has a significantly negative impact. We further test if the impact of foreign capital flows is particularly strong for financially constrained firms. The results are reported in Table 11, and are similar to those based on the annual macroeconomic data (in Tables 5 and 7). For instance, for corporate investment (ΔINV), in the benchmark regression in Column (8), while the coefficient of$\Delta\hat{s}_{t-1}^F$ for unrated firms is −12.70 (t = −2.14), that for rated firms is −6.44 (t = −1.26). If we exclude the Global Financial Crisis period, Columns (9) shows that the coefficient on $\Delta\hat{s}_{t-1}^F$ for rated firms reduces to −5.00 (t = −0.81), whereas that for unrated firms increases to −18.89 (t = −2.62). This result reinforces the notion that foreign capital flows influence firms' investment decisions even outside of the well-studied Global Financial Crisis period, particularly for financially constrained firms.

5.2. Generated regressors

The main explanatory variables in the second-step regressions, the predicted changes in the credit spread, are generated regressors, subject to the well-known bias in the estimated covariance matrix (Murphy and Topel, 1985). For the firm-level measures (e.g., $\Delta INV_{i,t}$), it is difficult to account for this bias, as the first step is a macroeconomic time-series regression, but the second step is a firm-level panel regression. However, for the macroeconomic measures (e.g., ΔGDP_t), we could bootstrap the standard errors, as both steps are macro time-series regressions from the same population. With these bootstrap standard errors, we can, to some extent, assess the reliability of our two-step regression results.

Table 10
Corporate financing and investment regressions.

Variables	(1) ΔNDI	(2) ΔNDI	(3) ΔNEI	(4) ΔNEI	(5) ΔINV	(6) ΔINV
$\Delta\hat{s}_{t-1}^s$	−0.941**	−0.688*	1.164	1.045	−8.889	−6.214
	(−2.06)	(−1.85)	(1.53)	(1.36)	(−1.69)	(−1.49)
$\Delta\hat{s}_{t-1}^F$		−0.999**		0.463		−10.868*
		(−2.37)		(0.81)		(−1.93)
Δ ln $Sale_{i\ t}$	0.035***	0.035***	−0.024***	−0.023***	0.713***	0.706***
	(8.74)	(9.08)	(−5.03)	(−4.82)	(23.74)	(28.03)
$r_{i,t}$	0.005**	0.005**	0.055***	0.055***	0.085***	0.081***
	(2.31)	(2.37)	(13.19)	(13.87)	(3.29)	(3.41)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118,656	118,656	114,152	114,152	124,104	124,104
R^2 (within)	0.061	0.062	0.103	0.103	0.154	0.157

The predicted changes in the credit spread, $\Delta\hat{s}_t^S$ and $\Delta\hat{s}_t^F$, are based on the parameter estimates of the first step regression in Column (2) of Table 9. Table 10 reports the firm-level panel regressions in which the predicted changes in the credit spread, Δs_t^S and Δs_t^F, are used to forecast changes in various measures of firm financing and investment activities.

$$\Delta y_{i,t} = \theta_1 \Delta\hat{s}_{t-1}^S + \theta_2 \Delta\hat{s}_{t-1}^F + \sum_j \delta_j X_{i,t}^j + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$ is firm *i*'s financing/investment in year *t*, X's are firm-specific control variables, and μ_i is the firm fixed effect. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. *r* is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year).
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

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Table 11
Corporate financing and investment regressions for rated and unrated firms.

Variables	(1) ΔNDI	(2) ΔNDI	(3) ΔNDI	(4) ΔNEI	(5) ΔNEI	(6) ΔNEI	(7) ΔINV	(8) ΔINV	(9) ΔINV
$\Delta\hat{s}^S_{t-1} \times R_{i,t-1}$	0.916	1.349*	1.873**	1.264*	0.872	0.408	−4.413	−2.480	−2.796
	(1.19)	(1.79)	(2.55)	(1.74)	(1.68)	(0.76)	(−0.86)	(−0.53)	(−0.61)
$\Delta\hat{s}^F_{t-1} \times R_{i,t-1}$		−1.597**	1.104		1.547*	0.050		−6.444	−4.997
		(−2.51)	(0.90)		(1.89)	(0.05)		(−1.26)	(−0.81)
$\Delta\hat{s}^S_{t-1} \times U_{i,t-1}$	−1.644***	−1.447***	−1.430***	1.125	1.109	0.548	−10.581*	−7.636*	−9.420**
	(−3.76)	(−4.10)	(−3.42)	(1.26)	(1.19)	(0.54)	(−1.92)	(−1.83)	(−2.34)
$\Delta\hat{s}^F_{t-1} \times U_{i,t-1}$		−0.794	−1.142*		0.019	−2.221		−12.703**	−18.887**
		(−1.62)	(−1.72)		(0.03)	(−1.27)		(−2.14)	(−2.62)
Δ ln Sale $_{i\ t}$	0.035***	0.034***	0.034***	−0.024***	−0.023***	−0.024***	0.712***	0.705***	0.692***
	(8.65)	(9.02)	(8.50)	(−5.03)	(−4.82)	(−4.79)	(23.64)	(27.84)	(25.74)
$r_{i,t}$	0.005**	0.005**	0.006***	0.055***	0.055***	0.057***	0.084***	0.081***	0.107***
	(2.26)	(2.30)	(3.48)	(13.14)	(13.90)	(12.79)	(3.27)	(3.41)	(5.79)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118,656	118,656	111,670	114,152	114,152	107,540	124,104	124,104	116,944
R^2 (within)	0.062	0.063	0.068	0.103	0.104	0.107	0.154	0.157	0.159

The predicted changes in the credit spread, $\Delta\hat{s}^S_t$ and $\Delta\hat{s}^F_t$, are based on the parameter estimates of the first step regression in Column (2) of Table 9. Table 11 reports the firm-level panel regressions in which we estimate the following model.

$$\Delta y_{i,t} = \theta^R_1(\Delta\hat{s}^S_{t-1} \times R_{i,t-1}) + \theta^R_2(\Delta\hat{s}^F_{t-1} \times R_{i,t-1}) + \theta^U_1(\Delta\hat{s}^S_{t-1} \times U_{i,t-1}) + \theta^U_2(\Delta\hat{s}^F_{t-1} \times U_{i,t-1}) + \sum_j \delta_j X^j_{i,t} + \mu_i + e_{i,t}$$

where $\Delta y_{i,t}$ is firm i's financing/investment in year t, X's are firm-specific control variables, μ_i is the firm fixed effect, R_i is equal to 1 if the firm is rated and zero otherwise, and U_i is equal to 1 if the firm is unrated and zero otherwise. Δ ln Sale is the log first difference of real sales, which is defined as nominal sales from Compustat deflated by the implicit GDP deflator for the US nonfarm business sector. r is and the total log return during firm's fiscal year (we cumulate daily returns from CRSP over the firm's fiscal year).
For all our firm-level panel regressions, we cluster standard errors by both firm and year to allow not only serial correlation within firm but also spatial correlation across firms.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

More specifically, different from Section 5.1 in which we estimate the system of equations jointly, in the present exercise we first estimate Eqs. (8a) and (8b) separately to obtain the biased standard errors and associated t-statistics; then, we use the moving-block bootstrap to estimate the bootstrap standard errors. To account for the time-series property of our data, we explore different block lengths (e.g., 2 years, 5 years, and 10 years). Because the results are similar, we report the results based on the block length of 5 years. Table 12 presents the results, with the biased Newey and West (1987) t-statistics from the separate regressions in the parentheses and the bootstrap t-statistics based on 10,000 repetitions in the brackets. Columns (6), (7) and (8) show that the biased t-statistics from the separate two-step regressions for $\Delta\hat{s}^F_{t-1}$, the credit spread change driven by the foreign capital flows, are qualitatively similar to the bootstrap t-statistics. For instance, while the biased

Table 12
Generated regressors.

	(1) GZ	(2) ΔGDP	(3) ΔINV	(4) ΔUN	(5) GZ	(6) ΔGDP	(7) ΔINV	(8) ΔUN
$\Delta\hat{s}^S_{t-1}$		−1.255	−8.610	0.552		−0.865	−6.446	0.376
		(−1.68)	(−2.52)	(2.28)		(−1.62)	(−2.44)	(1.95)
		[−0.72]	[−1.09]	[0.53]		[−0.43]	[−0.59]	[0.28]
$\Delta\hat{s}^F_{t-1}$						−0.734	−4.084	0.242
						(−3.41)	(−3.20)	(3.49)
						[−2.13]	[−1.80]	[2.12]
Δy_{t-1}		0.347	0.279	0.492		0.359	0.298	0.493
		(4.14)	(3.42)	(5.98)		(4.39)	(3.76)	(6.64)
		[3.65]	[2.88]	[4.73]		[3.65]	[2.77]	[4.97]
TS_{t-5}	−0.033				−0.010			
	(−1.18)				(−0.75)			
	[−1.17]				[−0.76]			
EBP_{t-5}	−0.002				−0.002			
	(−4.00)				(−4.00)			
	[−3.02]				[−3.29]			
ΔC_t					−0.198			
					(−5.09)			
					[−3.51]			

Table 12 (*continued*)

	(1) GZ	(2) ΔGDP	(3) ΔINV	(4) ΔUN	(5) GZ	(6) ΔGDP	(7) ΔINV	(8) ΔUN
ΔC_{t-1}					−0.165 (−2.28) [−1.67]			
ΔT_t					0.038 (0.99) [0.92]			
ΔT_{t-1}					0.046 (0.99) [1.00]			
R^2	0.06	0.16	0.14	0.29	0.20	0.17	0.15	0.29

We first estimate the following equations separately to obtain the biased standard errors and associated t-statistics.

$$\Delta s_t = \alpha + \sum_{l=0}^{k}\beta_{1,l}\Delta T_{t-l} + \sum_{l=0}^{k}\beta_{2,l}\Delta C_{t-l} + \gamma_1 TS_{t-5} + \gamma_2 EBP_{t-5} + \varepsilon_t$$

$$\Delta y_t = \beta + \theta_1 \Delta\hat{s}_t^S + \theta_2 \hat{s}_t^F + \delta\Delta y_{t-1} + e_t$$

where Δs_t is the change in credit spreads, TS is term premium, EBP is the excess bond premium, ΔT_t and ΔC_t are the first differences of the foreign flows into Treasuries and corporate bonds, Δy_t is the macro indicator (i.e., real GDP growth, the change in business fixed investment, or the change in unemployment), $\Delta\hat{s}_t^S = \hat{\gamma}_1 TS_{t-5} + \hat{\gamma}_2 EBP_{t-5}$, and $\Delta\hat{s}_t^F = \sum_{l=0}^{k}\hat{\beta}_{1,l}\Delta T_{t-l} + \sum_{l=0}^{k}\hat{\beta}_{2,l}\Delta C_{t-l}$. Both AIC and BIC support the lag length of 1 quarter. Then, we use the moving-block bootstrap to simulate the bootstrap standard errors. To account for the time-series property of our data, we explore different block lengths (e.g., 2 years, 5 years, and 10 years). Because the results are similar, we report the results based on the block length of 5 years. Table 12 presents the results, with the biased Newey and West (1987) t-statistics from the separate regressions in the parentheses and the bootstrap t-statistics based on 10,000 repetitions in the brackets.

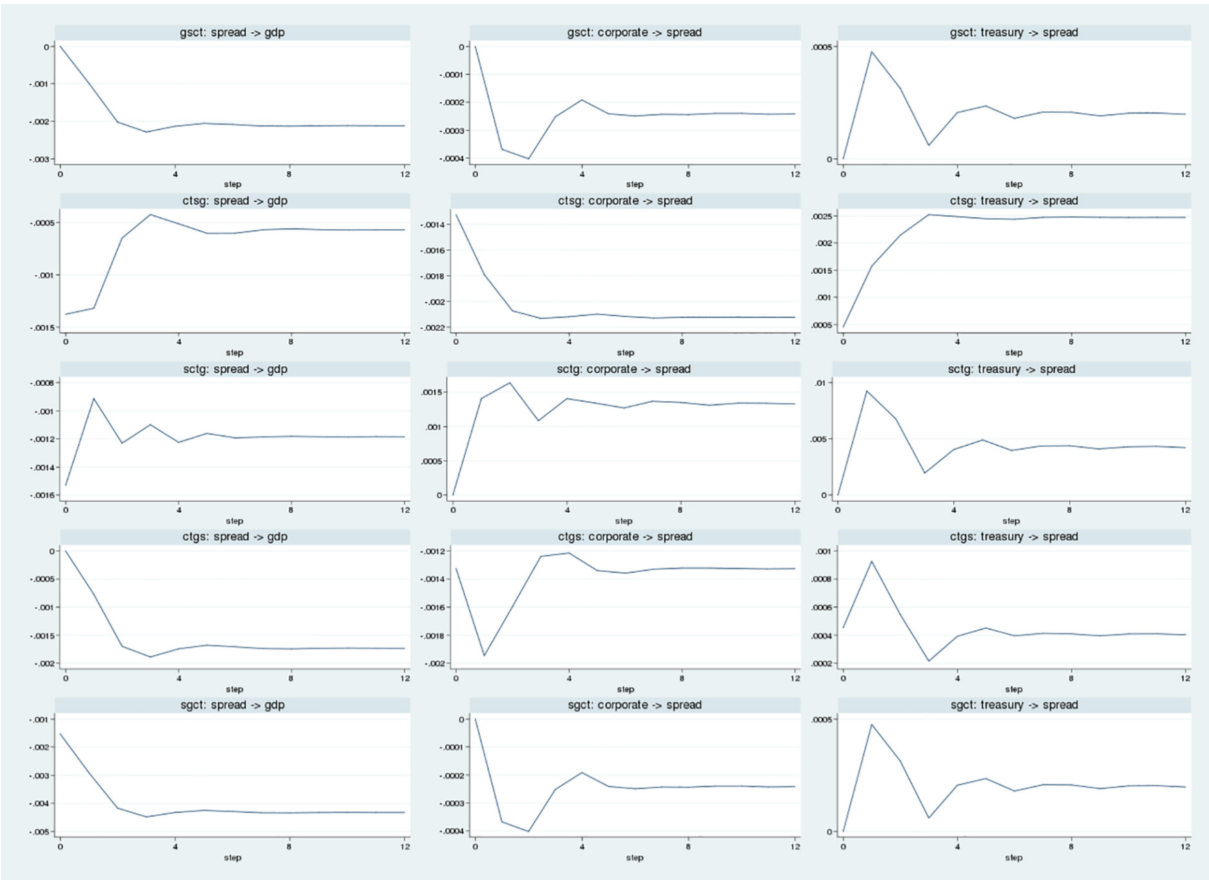

Fig. 5. Cumulative orthogonalized IRFs, 1975–2015. We estimate the VAR models over the sample period from 1975 to 2015. The cumulative orthogonalized IRFs (OIRFs) are depicted in figure. The first column shows the impacts of credit-spread shocks on quarterly real GDP (spread → gdp); the second column depicts the impacts of corporate-flow shocks on quarterly credit spread (corporate → spread); the third column presents the impacts of treasury-flow shocks on quarterly credit spread (treasury → spread). For robustness, we explore alternative orderings. In the first row, we have gdp → spread → corporate → treasury, which is named "gsct" (g for gdp, s for spread, c for corporate, and t for treasury). The other orderings are named in the same convention and reported in row 2 to row 5.

t-statistic in the ΔGDP regression for $\Delta\hat{s}^F_{t-1}$ is −3.41, the corresponding bootstrap t-statistic is −2.31. These results give us some comfort, suggesting that the inferences from our firm-level two-step regressions may be reliable.

5.3. Endogeneity

The two-step regressions for macroeconomic indicators (e.g., Table 9) may be subject to endogeneity/reverse-causation concern. For example, is it foreign capital flows that drive the credit spread or is it the other way round? To address this concern, we employ a multivariate structural VAR framework, with a short-run identification scheme imposing recursive order. More specifically, our quarterly VAR system includes the change in real GDP (gdp), the change in the credit spread (spread), the change in the capital flow into corporate bonds (corporate), and the change in the capital flow into Treasuries (treasury). We also take into account TS_{t-5} and EBP_{t-5} to control for the sentiment reversal emphasized by LSZ. To choose the lag length, we use AIC and SBC. AIC suggests a lag order of two quarters, and SBC suggests one quarter. Because the results based on the alternative lag lengths are similar, to save space, we only report the results based on the lag order of two quarters.

We estimate the VAR model over the sample period from 1975 to 2015. The cumulative orthogonalized IRFs (OIRFs) are depicted in Fig. 5. The first column shows the impacts of credit-spread shocks on quarterly real GDP (spread → gdp); the second column depicts the impacts of corporate-flow shocks on quarterly credit spread (corporate → spread); the third column presents the impacts of treasury-flow shocks on quarterly credit spread (treasury → spread). For robustness, we explore alternative orderings. In the first row, we have gdp → spread → corporate → treasury, which is named "gsct" (g for gdp, s for spread, c for corporate, and t for treasury). The other orderings are named in the same convention and reported in row 2 to row 5.

Although there is variation across different specifications of the structural VAR, a few common observations still arise. First, a positive credit-spread shock depresses real GDP, consistent with the notion emphasized by LSZ that the credit supply

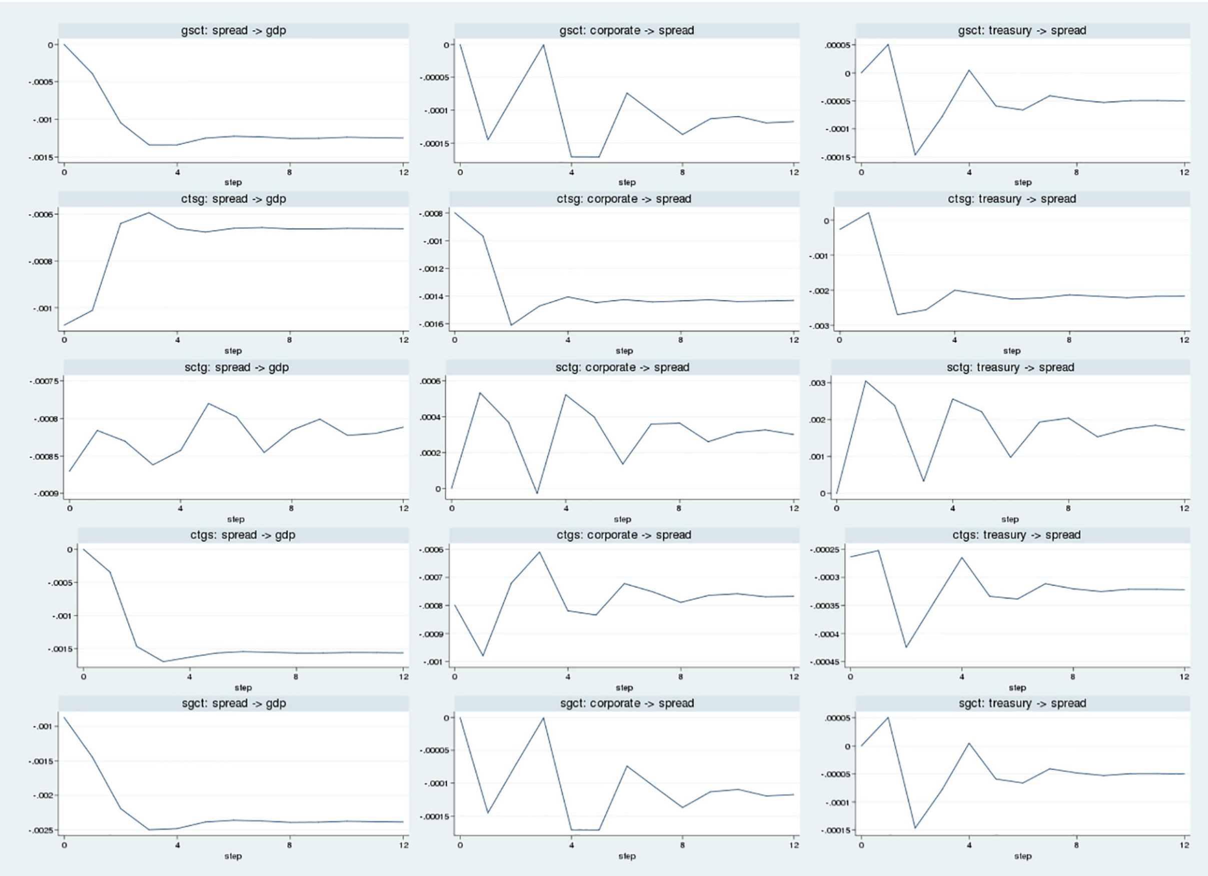

Fig. 6. Cumulative orthogonalized IRFs, excluding the Global Financial Crisis period. We exclude the Global Financial Crisis period to estimate the VAR models. The cumulative orthogonalized IRFs (OIRFs) are depicted in figure. The first column shows the impacts of credit-spread shocks on quarterly real GDP (spread → gdp); the second column depicts the impacts of corporate-flow shocks on quarterly credit spread (corporate → spread); the third column presents the impacts of treasury-flow shocks on quarterly credit spread (treasury → spread). For robustness, we explore alternative orderings. In the first row, we have gdp → spread → corporate → treasury, which is named "gsct" (g for gdp, s for spread, c for corporate, and t for treasury). The other orderings are named in the same convention and reported in row 2 to row 5.

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may be a driving force of the US business cycle. Second, a positive corporate-flow shock helps push down the credit spread, supporting Hypothesis 1. We emphasize that our structural VAR framework allows us to identify the impacts of the structural shocks, and therefore provides causal evidence of the influences of foreign capital flows on the credit spread. Third, consistent with the evidence in Table 2, a positive treasury-flow shock results in increases in the credit spread, which may be due to "flight-to-quality" in the Global Financial Crisis (recall Fig. 2a).

To shed more empirical light on the impacts of foreign capital flows, we re-estimate our structural VAR models, except that we exclude the Global Financial Crisis period. The cumulative orthogonalized IRFs (OIRFs) are presented in Fig. 6 in the same fashion as Fig. 5. First, outside of the Global Financial Crisis period, positive credit-spread shocks still reduce real GDP, and positive corporate-flow shocks still lead to decreases in the credit spread. Second, as soon as we exclude the Global Financial crisis, positive treasury-flow shocks result in reductions in the credit spread in four out of five cases, suggesting that "reach-for-yield" may be more dominant outside of the Global Financial Crisis.

6. Conclusions

Corporate financing and investment are important to understand the business cycle. Previous studies have found that theoretically and empirically foreign capital flows into the US Treasury and corporate bond markets could drive US long-term interest rates. In this paper, we extend the literature by showing that (1) foreign capital flows also drive the US risk structure of interest rates (i.e., credit spreads), and (2) the impacts of foreign capital flows through the credit spread on firm financing and investment are significant, particularly for financial constrained firms, even after we exclude the Global Financial Crisis period. Therefore, complementing previous studies that mainly use foreign capital flows to help understand the Global Financial Crisis, our paper implies that foreign capital flows influence financing and investment decisions of firms – particularly those of financially constrained firms, not only during but also outside of the Global Financial Crisis period.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.intfin.2018.06.001.

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