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US Monetary Policy and International Bond Markets

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Abstract

This paper uses high-frequency data to analyze the effects of US monetary policy—during the conventional and unconventional policy regimes—on foreign government bonds markets in advanced and emerging market economies. The results indicate that an expansionary US monetary policy steepens the foreign yield curve—denominated in local currency—during a conventional US monetary policy regime and flattens the foreign yield curve during an unconventional policy regime. The passthrough of unconventional US monetary policy to foreign bond yields is, on balance, comparable to that of conventional policy. In addition a conventional US monetary easing leads to a significant narrowing of the credit spreads on dollar-denominated sovereign bonds that are issued by countries with a speculative-grade sovereign credit rating. However, during the unconventional policy regime, yields on speculative-grade sovereign debt denominated in dollars move one-to-one with yields on comparable-maturity US Treasury securities.

JEL Classification: E4, E5, F3
Keywords: conventional and unconventional US monetary policy; sovereign yields and credit spreads; financial spillovers

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1 Introduction

Among financially interconnected economies, unanticipated changes in the stance of monetary policy in one country can quickly "spill over" to other countries. While the debate surrounding monetary policy spillovers has a storied history in international economics (see Fleming, 1962; Mundell, 1963), the 2008–09 global financial crisis and its aftermath—a period during which the Federal Reserve and many other central banks implemented new and unconventional forms of monetary stimulus—has sparked intense interest in such international monetary policy spillovers, in both academic and policy circles.

The canonical view of international monetary policy interactions, as exemplified by the Mundell-Fleming model, identifies the exchange rate channel as the primary mechanism through which domestic monetary policy actions affect macroeconomic conditions abroad. According to this view, a monetary easing at home lowers the domestic interest rate relative to foreign rates, inducing a depreciation of the domestic currency. One key implication of the Mundell-Fleming framework is that a central bank cannot freely adjust its policy rate to stabilize domestic output, while also maintaining a fixed exchange rate and an open capital account—a tradeoff frequently referred to as the "international policy trilemma" (see Obstfeld and Rogoff, 2002).

Consistent with this prediction Obstfeld et al. (2005), Goldberg (2013), Klein and Shambaugh (2015), and Obstfeld (2015), have shown that short-term interest rates of countries with flexible exchange rates have an appreciably lower correlation with the short-term rate of the "base" country, relative to countries with fixed exchange rates. Recently, however, Rey (2013, 2016) has argued that even floating exchange rates will not suffice to insulate domestic financial conditions from foreign monetary policy shocks—at least not without additional restrictions on capital mobility—thereby, reducing the "trilemma" to a "dilemma." To examine the issue of trilemma versus dilemma, Aizenman et al. (2016) and Han and Wei (2018) analyze the role of the nominal exchange rate regime and capital controls in the international transmission of monetary policy shocks—including the period of unconventional monetary policy in the US—and find that a flexible exchange rate regime cannot fully insulate periphery countries from monetary policy shocks when the core country lowers its policy rate. Capital controls, according to their findings, are much more effective at mitigating the effects of such international monetary policy spillovers.

Moving beyond the short-term, or policy, interest rates, a monetary policy easing at home will also lower domestic longer-term interest rates and raise prices of risky financial assets in the home country. With highly integrated global financial markets, investor portfolio rebalancing efforts will lead to capital flows to foreign countries, putting downward pressure on foreign longer-term yields and upward pressure on foreign asset prices. The resulting easing of financial conditions abroad will provide a further impetus to GDP in foreign countries.[1]

In this paper, we contribute to the understanding of this so-called financial spillover channel. Specifically, using high-frequency financial market data, we empirically quantify the transmission

[1] See Ammer et al. (2016) for a highly readable review of the various spillover channels—and their quantitative significance—arising from changes in the stance of US monetary policy.

of US monetary policy shocks in international bond markets for advanced and emerging economies. Compared with all of the aforementioned papers, we use a nearly ideal measure of unexpected changes in the stance of US monetary policy to identify monetary policy shocks. And while the work of Bredin et al. (2010), Ehrmann et al. (2011), and Hausman and Wongswan (2011) documents the extent of spillovers in the international bond markets resulting from the unanticipated changes in the conventional stance of US monetary policy, there is relatively little empirical evidence of how the strength and scope of these spillover effects differ between conventional and unconventional policy regimes. Thus in addition to comparing the spillover effects of conventional US monetary policy for advanced and emerging economies, we also analyze whether the spillover effects from conventional policy actions to foreign bond yields and sovereign credit spreads differ from those of unconventional policies. Furthermore, we examine how US monetary policy actions affect the yields on foreign bonds denominated in US dollars, an approach that allows to to abstract from the policy-induced movements in exchange rates that can confound the response of yields on foreign bonds denominated in local currencies.

To compare the transmission of conventional and unconventional policy measures to international bond markets, we follow Hanson and Stein (2015) and Gertler and Karadi (2015) and use changes in the two-year nominal US Treasury yield on policy announcement days as a common instrument across the two policy regimes. In contrast to these two papers, we rely on the *intraday* changes in the two-year US Treasury yield within a narrow window surrounding Federal Open Market Committee (FOMC) and other policy announcements to identify unanticipated US policy actions.[2] Implicit in this approach is a highly reasonable identifying assumption that any movement in the two-year US Treasury yield in a narrow window bracketing policy announcements is due to the unanticipated changes in the stance of US monetary policy or the FOMC's communication regarding the path for policy going forward.

During the unconventional policy regime, the Federal Reserve implemented different forms of forward guidance regarding the future path of the federal funds rate.[3] They also implemented a number of Large-Scale Asset Purchase programs (LSAPs), the primary goal of which was to influence longer-term yields on US Treasury and agency MBS securities through direct purchases of those assets. These policy actions were introduced to the public via announcements, either following the regularly-scheduled FOMC meetings or in special announcements that were held

[2] Hanson and Stein (2015) and Gertler and Karadi (2015) use *daily* changes in the two-year US Treasury yield to identify monetary policy surprises. The use of intraday data allows us to rule out the potential reverse causality, a situation in which the daily change in the two-year US Treasury yield, even on a policy announcement day, may not solely reflect changes in the stance of monetary policy but may also reflect the endogenous response of policy to changes in the economic outlook or other global macroeconomic or financial shocks.

[3] The start of the unconventional US policy regime can be dated to November 25, 8:15 a.m. Eastern Standard Time, when the FOMC announced—outside its regular meeting schedule—that it was going to initiate a program to purchase the direct obligations of, and mortgage-backed securities (MBS) issued by, the housing-related government-sponsored enterprises. A mere three weeks later, at the conclusion of its regular meeting on December 16, the FOMC announced that it was lowering the target federal funds rate to a range between 0 to 1/4 percent—its effective lower bound. These unprecedented actions were taken in response to a mutually reinforcing phenomenon between a rapidly deteriorating economic outlook and escalating turmoil in financial markets, a destructive feedback loop that was beginning to engulf the global economy.

outside the regular FOMC schedule. To analyze the effects of these unconventional measures on global interest rates, we also consider a subset of policy announcements during the unconventional policy regime that exclude direct information about the LSAPs.

Our paper contains two sets of related empirical exercises. In the first set, we analyze the response of shorter- and longer-term interest rates on sovereign bonds denominated in local currencies to an unanticipated change in the stance of US monetary policy. As alluded to earlier and discussed more fully later, we consider three distinct US monetary policy regimes: (1) the conventional policy regime; (2) the unconventional policy regime; and (3) a subset of the unconventional regime that excludes FOMC announcements that were most closely associated with the Federal Reserve's balance sheet policies. We perform this analysis for a set of 10 advanced foreign economies and a group of six emerging market economies.

The results from this exercise indicate that conventional US monetary policy is transmitted very effectively to both shorter- and longer-term bond yields of advanced foreign economies. Although the degree of passthrough to shorter-term interest rates differs noticeably across these countries, the passthrough of conventional monetary policy to longer-term global interest rates is much more uniform. In comparison, US unconventional monetary policy operates primarily through the long end of the yield curve. In other words, there is virtually no passthrough of unconventional monetary policy to yields on shorter-term government bonds issued by the advanced foreign economies. However, yields on longer-term securities issued by these countries react significantly to US monetary policy surprises during the unconventional policy regime. However, the degree of passthrough is, on balance, roughly similar to that estimated for the conventional policy regime.

Conventional US monetary policy appears to have relatively little systematic effect on the yields of sovereign securities—denominated in local currencies—issued by our set of emerging market economies. This is not too surprising because many of these countries actively manage their exchange rates and can intervene in foreign exchange markets to offset US policy-induced movements in their benchmark interest rates. However, our results also indicate that US unconventional monetary policy had large effects on longer-term interest rates in emerging markets, a finding consistent with that for advanced foreign economies.

In an effort to abstract from the policy-induced movements in exchange rates and, thus, more cleanly identify the transmission of US monetary policy to the international bond market, our second set of empirical exercises focuses on sovereign debt denominated in US dollars. Specifically, from the Thompson Reuters Datastream, we obtained daily secondary market prices of dollar-denominated sovereign bonds issued by nearly 80 countries, both emerging market and advanced economies. We exploit the cross-sectional heterogeneity of our data by constructing sovereign bond portfolios, conditional on whether a country falls into a speculative- or investment-grade portion of the credit quality spectrum. Consequently, we are able to quantify how the effects of US monetary policy on sovereign bond yields (and credit spreads) differs not only across the conventional and unconventional policy regimes but also across "high" and "low" risk countries. An additional advantage of building bond portfolios from the "ground up" is that we can construct credit spreads that are not subject to the duration mismatch, which is a common problem to the standard sovereign credit spread indexes, such as the EMBI or EMBI+.

The results from this set of exercises show that conventional US monetary policy has economically large and statistically significant effects on credit spreads on dollar-denominated debt of countries with a speculative-grade credit rating. Specifically, credit spreads on risky sovereign debt are estimated to narrow significantly in response to an unanticipated policy easing during the conventional regime. In contrast, the sovereign credit spreads for investment-grade countries are left unchanged; that is, sovereign bond yields for low-risk countries are estimated to decline by about as much as the yields on comparable-maturity US Treasury securities.

The spillovers to sovereign debt markets during the unconventional policy regime are somewhat more muted according to our estimates. An unanticipated easing of US monetary policy during this period induces a decline in speculative-grade sovereign bond yields that is commensurate with that in yields on a portfolio of comparable US Treasuries. Interestingly, our results indicate that the passthrough of unconventional US monetary policy to sovereign bond yields for investment-grade countries is essentially one-to-one—the same as during the conventional policy regime. Our analysis thus indicates that the unconventional policy actions undertaken by the FOMC over the past five years or so did not affect, on average, the level of sovereign credit spreads across the sovereign credit quality spectrum.

Our paper fits into a rapidly growing empirical literature aimed at quantifying the effects of unconventional policy measures on financial asset prices. Not too suprisingly, much of this research to date has analyzed whether purchases of large quantities of Treasuries, agency MBS, and agency debt by the Federal Reserve and various forms of forward guidance have lowered longer-term US benchmark yields and the associated private interest rates (see Gagnon et al. (2011); Hancock and Passmore (2011, 2012); Krishnamurthy and Vissing-Jorgensen (2011); Krishnamurthy and Vissing-Jorgensen (2013); Swanson (2011); Hamilton and Wu (2012); Christensen and Rudebusch (2012); Justiniano et al. (2012); Wright (2012); D'Amico and King (2013); Gilchrist and Zakrajšek (2013); Nakamura and Steinsson (2013); Li and Wei (2013); Bauer and Rudebusch (2014); and Gilchrist et al. (2015); and Hanson and Stein (2015)). While employing a variety of empirical approaches, a common finding that emerges from these studies is that the unconventional policy measures employed by the FOMC since the end of 2008 have led to a significant reduction in Treasury yields and that this broad-based reduction in longer-term interest rates has been passed fully to lower borrowing costs for businesses and households.[4]

To gauge the impact of LSAPs beyond US borders, Neely (2015) employs an event-style methodology and finds that these unconventional policy actions substantially lowered the foreign exchange value of the US dollar and reduced longer-term yields yields for a small sample of advanced foreign economies; Chen et al. (2014) report similar results for emerging market economies. In a follow-up paper, Bauer and Neely (2014) use dynamic term structure models to parse out the extent to

[4] Rogers et al. (2014), on the other hand, compares the efficacy of unconventional policy measures employed by the Bank of England, European Central Bank, and the Bank of Japan.

which the declines in foreign interest rates occurred through the signaling or portfolio rebalancing channels and find evidence that both channels were in operation. Our paper is also related to the recent work of Fratzscher et al. (2013) and Bowman et al. (2015); the former paper systematically analyzes the global spillovers of the Federal Reserve's asset purchase programs on a broad array of financial asset prices, while the latter study empirically quantifies the spillover effects of US unconventional policies on emerging market economies. The key takeaway of these two papers is that US unconventional monetary policy measures induced a significant portfolio reallocation among investors and led to a notable repricing of risk in global financial markets.

The outline for the reminder of the paper is as follows: Section 2 outlines our empirical methodology. Section 3 contains the results of our comparison of the effects of US monetary policy on yields on foreign government bonds denominated in local currencies across the two policy regimes. In Section 4, we present our main results: subsection 4.1 discusses the construction of the dollar-denominated sovereign portfolios using bond-level data; and, subsection 4.2 contains the results that compare the effects of US monetary policy on sovereign credit spreads—for both speculative- and investment-grade countries—across the different policy regimes. Section 5 concludes.

2 Empirical Framework

This section outlines the empirical approach that is used to estimate the impact of US monetary policy on international bond markets during both the conventional and unconventional policy regimes. Central to our approach is the use of *intraday* data, from which we can directly infer monetary policy surprises associated with FOMC announcements. In combination with the daily data on foreign interest rates, these high-frequency policy surprises allow us to estimate the causal effect of policy actions on foreign bond yields.

Central to out approach is the dating of the two monetary policy regimes. The sample period underlying our analysis runs from January 2, 1992, to May 30, 2014. We divide this period into two distinct policy regimes: (1) a *conventional* monetary policy regime, a period in which the primary policy instrument was the federal funds rate; and (2) an *unconventional* monetary policy regime, during which the funds rate has been stuck at the effective lower bound, and the FOMC primarily conducted monetary policy by altering the size and composition of the Federal Reserve's balance sheet and also by issuing various forms of forward guidance regarding the future trajectory for the federal funds rate.

As discussed in detail by Gilchrist et al. (2015), the dating of these two regimes is relatively straightforward. We assume that the unconventional policy regime began on November 25, 2008, and that prior to that day, the conventional policy regime was in effect. Nearly all of the 143 announcements during the conventional policy period followed regularly-scheduled FOMC meetings; only six were associated with the intermeeting policy moves.[5] According to our chronology, the last

[5]As is customary, we excluded from the sample the announcement made on September 17, 2001, which was made when trading on major stock exchanges was resumed after it was temporarily suspended following the 9/11 terrorist attacks. The other six intermeeting moves occurred on April 18, 1994; October 15, 1998; January 3, 2001; April 18,

FOMC meeting during the conventional policy regime took place on October 29, 2008, at which point, the FOMC lowered its target for the federal funds rate by 50 basis points, to 1 percent.

The standard analysis of how changes in the stance of conventional US monetary policy affect financial asset prices has historically relied on a single factor—the "target" surprise or the unanticipated component of the change in the current federal funds rate target (see, Kuttner (2001); Cochrane and Piazzesi (2002); and Bernanke and Kuttner (2005)). However, as shown by Gürkaynak et al. (2005), this characterization is incomplete, and another factor—that is, changes in the future policy rates that are independent of the current target rate—is needed to capture fully the effect of conventional monetary policy. This second factor, which is commonly referred to as a "path" surprise, is closely associated with the FOMC statements that accompany changes in the target rate and represents a communication aspect of monetary policy that assumed even greater importance after the target rate was lowered to its effective lower bound in December 2008.

To facilitate the comparison of the spillover effects from conventional and unconventional US monetary policy, we follow Hanson and Stein (2015) and Gertler and Karadi (2015), and assume that the change in the two-year nominal US Treasury yield over a narrow window bracketing an FOMC announcement captures both aspects of US monetary policy. Under this assumption, the effect of unanticipated changes in the stance of US monetary policy on foreign interest rates can be inferred by estimating the following regression:

$$\Delta_h y^{(n)}_{i,t+h-1} = \alpha^{(n)}_i m^{US}_t + \epsilon^{(n)}_{i,t+h-1}, \tag{1}$$

where $\Delta_h y^{(n)}_{i,t+h-1}$ denotes an h-day change (from day $t-1$ to day $t+h-1$) bracketing an FOMC announcement on day t in the yield on an n-year sovereign bond of country i; m^{US}_t is the *intraday* change in the (on-the-run) two-year nominal US Treasury yield over a narrow-window surrounding an FOMC announcement; and, $\epsilon^{(n)}_{i,t+h-1}$ is a stochastic disturbance capturing the information that possibly was released earlier in the day, and also noise from other financial market developments that took place through day $t+h-1$.

For the conventional US policy regime, we measure the unanticipated changes in the stance of monetary policy m^{US}_t using a *30-minute* window surrounding FOMC announcements (10 minutes before to 20 minutes after). However, the unconventional policy regime includes a number of key speeches/testimonies through which the policymakers elaborated on the various aspects of unconventional policy measures being employed by the FOMC. In these instances, we try to capture the information content of announcements that reflects the market participants' interpretation of the statements and speeches—as opposed to conveying information about the precise numerical value of the target funds rate—so we use a wider *60-minute* window bracketing an announcement (10 minutes before to 50 minutes after) to calculate the intraday changes in the two-year US Treasury yield. The use of a 60-minute window to calculate the policy surprise m^{US}_t during this period should allow

2001; January 22, 2008; and October 8, 2008. Most of the FOMC announcements took place at 2:15 p.m. (EST); however, announcements for the intermeeting policy moves were made at different times of the day. We obtained all of the requisite times from the Office of the Secretary of the Federal Reserve Board.

Table 1 – LSAP-Related Unconventional Monetary Policy Actions

Date	Time[a]	FOMC[b]	Highlights
11/25/2008	08:15	N	Announcement that starts LSAP-I.
12/01/2008	08:15	N	Announcement indicating potential purchases of Treasury securities.
12/16/2008	14:20	Y	Target federal funds is lowered to its effective lower bound; statement indicating that the Federal Reserve is considering using its balance sheet to further stimulate the economy; first reference to forward guidance: "... economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time."
01/28/2009	14:15	Y	"Disappointing" FOMC statement because of its lack of concrete language regarding the possibility and timing of purchases of longer-term Treasuries.
03/18/2009	14:15	Y	Announcement to purchase Treasuries and increase the size of purchases of agency debt and agency MBS; also, first reference to extended period: "interests rates are likely to remain low for an extended period."
08/10/2010	14:15	Y	Announcement that starts LSAP-II.
09/21/2010	14:15	Y	Announcement reaffirming the existing reinvestment policy.
11/03/2010	14:15	Y	Announcement of additional purchases of Treasury securities.
09/21/2011	14:15	Y	Announcement of the Maturity Extension Program (MEP).
06/20/2012	12:30	Y	Announcement of continuation of the MEP through end of 2012.
09/13/2012	12:30	Y	Third "calendar-based" forward guidance: "likely maintain the Federal funds rate near zero at least through mid-2015." In addition, first forward guidance regarding the pace of interest rates after lift-off: "likely maintain low rates for a considerable time after the economic recovery strengthens," and announcement of LSAP-III (flow-based; $40 billion per month of agency MBS).
12/12/2012	12:30	Y	Announcement of an increase in LSAP-III (from $40 billion to $85 billion per month); first "threshold-based" forward guidance: maintain the funds rate near zero for as long as unemployment is above 6.5%, inflation (1–2 years ahead) is below 2.5%, and long-term inflation expectations remain well-anchored.

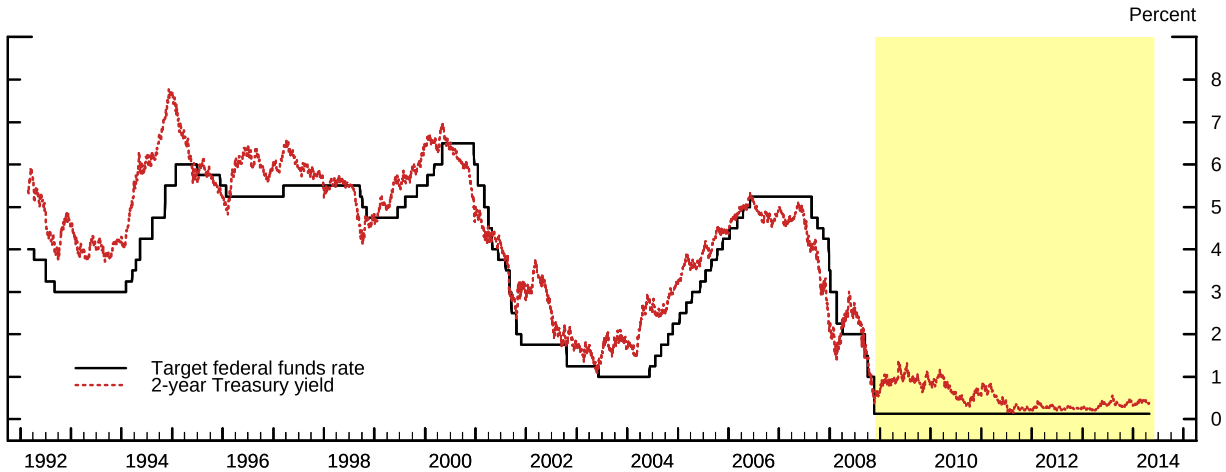
[a] All announcements are at Eastern Standard Time.
[b] Y = an announcement associated with a regularly-schedule FOMC meeting; N = an intermeeting policy announcement.

the market a sufficient amount of time to digest the news contained in announcements associated with unconventional policy measures. Lastly, to separate the effect of balance sheet policies from other forms of unconventional policy, we also consider a subsample of the unconventional policy period that excludes the 12 announcements listed in Table 1, which are most closely identified with the asset purchase programs.

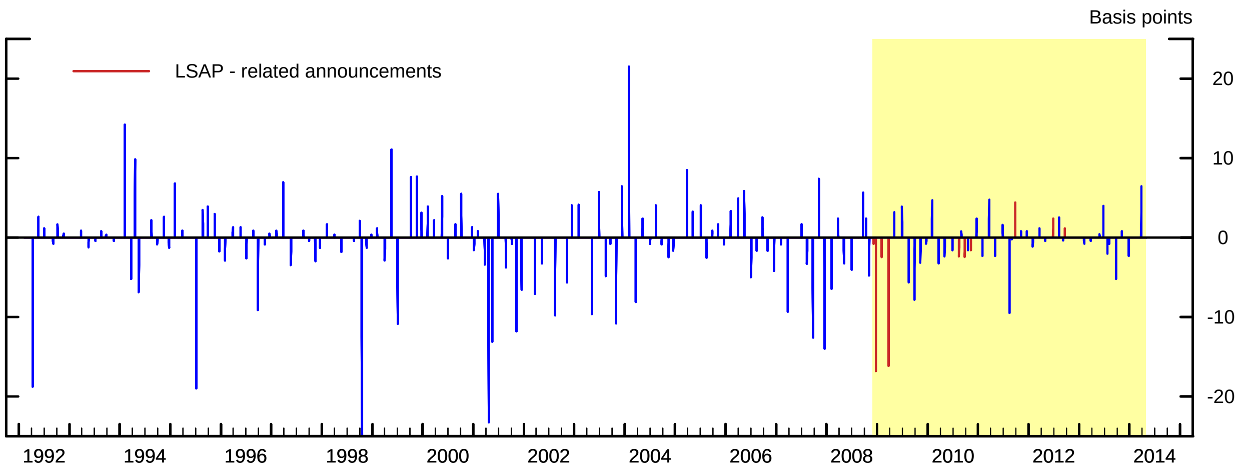
Panel (a) of Figure 1 shows the path of the target federal funds rate and the two-year Treasury yield over the entire sample period. Our sample period is marked by substantial variation in shorter-term interest rates and contains a number of distinct phases of US monetary policy: The 1994–1995 tightening phase that followed the "jobless" recovery during the early-1990s; the tightening phase that preceded the bursting of the "tech bubble" in early 2001; the subsequent easing of policy in response to a rapid slowdown in economic activity and the emergence of substantial disinflationary pressures; the 2003–2004 period of very low interest rates; the gradual removal of monetary accommodation that commenced in the spring of 2004; the aggressive reduction in the target federal funds rate during the early stages of the 2007–2009 financial crisis; and, the period when the federal funds rate was stuck at its effective lower bound.

Panel (b) depicts the sequence of monetary policy surprises—that is, the value of m_t^{US}—associated with the FOMC's actions during this period. During the conventional policy regime, the

Figure 1 – The Stance of US Monetary Policy



(a) Selected interest rates



(b) Unanticipated changes in the stance of monetary policy

Note: Sample period: daily data from 01/02/1992 to 05/30/2014. The solid line in panel (a) depicts the daily target federal funds rate and the dotted line the daily two-year Treasury yield. Panel (b) depicts unanticipated changes in the stance of monetary policy, as measured by the narrow-window changes in the two-year Treasury yield bracketing FOMC announcements (see the text for further details). The shaded region represents the unconventional monetary policy regime.
Source: For panel (a), Board of Governors of the Federal Reserve System, Statistical Release H.15, "Selected Interest Rates." For panel (b), Bloomberg Finance LP.

largest (absolute) policy surprises are associated with the intermeeting policy actions. As shown by the red spikes, the largest (absolute) surprises during the unconventional policy regimes correspond to the early LSAP announcements. For all three policy regimes under consideration, we estimate equation (1) by OLS. As noted above, implicit in this approach is the assumption that movements in the two-year Treasury yield in narrow windows bracketing FOMC announcements are entirely due to the unanticipated changes in the stance of US monetary policy. By any measure, this is a reasonable assumption because we are virtually certain that no other economic news was released within such a short interval of time.

The comparison of the response coefficient $\alpha_i^{(n)}$ (for a fixed i and n) from equation (1) across different policy regimes is complicated by the fact that the effect of US monetary surprises on US benchmark interest rates may differ across the conventional and unconventional policy regimes. An economically more meaningful estimate of the spillover effect is given by the passthrough coefficient $\beta_i^{(n)}$ from the following regression:

$$\Delta_h y_{i,t+h-1}^{(n)} = \beta_i^{(n)} \Delta_h y_{i,t+h-1}^{(n),US} + \nu_{i,t+h-1}^{(n)}, \tag{2}$$

where $\Delta_h y_{i,t+h-1}^{(n),US}$ denotes an h-day change (from day $t-1$ to day $t+h-1$) bracketing an FOMC announcement on day t in the yield on an n-year US Treasury security. Given our identifying assumptions, a consistent estimate of the passthrough effect can be obtained via an instrumental variable (IV) regression, where $\Delta_h y_{i,t+h-1}^{(n),US}$ is instrumented with the high-frequency policy surprise m_t^{US}.[6]

3 US Monetary Policy and Local Currency Sovereign Yields

In this section, we analyze the effects of US monetary policy shocks on the yields of foreign government bonds denominated in local currencies. We focus on the 2- and 10-year maturities and look at both advanced foreign and emerging market economies. The former include Australia, Canada, Switzerland, Germany, Spain, France, Italy, Japan, Sweden, and the United Kingdom, while the latter set includes Brazil, India, Republic of Korea, Mexico, Singapore, and Thailand. The selection of these countries is based on the data availability, particularly the coverage of the local currency denominated government bonds during the conventional monetary policy regime. In all of the specifications, we set the horizon h, or the number of days used to calculate the change in foreign bond yields, equal to two. This choice reflects the timing of the daily data on foreign interest rates.

3.1 Advanced Foreign Economies

The effects of US monetary policy on shorter-term foreign interest rates for advanced foreign economies (AFEs) are presented in Table 2, while Table 3 shows the corresponding effects on foreign longer-term bond yields. According to the column labeled "Conventional" in Table 2, a policy-induced reduction in the two-year US Treasury yield of 10 basis points during the conventional policy regime leads to a decline of between 3 and 10 basis points in the yields on two-year government bonds issued by AFEs—the exception to this pattern are Switzerland, Japan, and Sweden, where the response coefficients to US monetary shocks are statistically indistinguishable from

[6] Because we are dealing with (non-adjacent) changes in yields, the disturbance terms $\epsilon_{i,t+h-1}^{(n)}$ and $\nu_{i,t+h-1}^{(n)}$ associated with the regression specifications (1) and (2), respectively, are almost certain to exhibit conditional heteroskedasticity. To ensure a robust inference of the parameters of interest, we report in both cases heteroskedasticity-consistent asymptotic standard errors computed according to White (1980).

Table 2 – The Effect of US Monetary Policy on Shorter-Term Foreign Interest Rates
(*Two-year Government Bond Yields for Selected Advanced Foreign Economies*)

	US Monetary Policy Regime		
Country	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Australia (AU)	0.621***	0.875***	0.681*
	(0.184)	(0.216)	(0.376)
Canada (CA)	0.972***	0.294	−0.010
	(0.145)	(0.265)	(0.267)
Switzerland (CH)	0.156	0.072	0.072
	(0.141)	(0.113)	(0.195)
Germany (DE)	0.364***	0.558*	0.362
	(0.090)	(0.320)	(0.405)
Spain (ES)	0.344***	0.396	0.667
	(0.113)	(0.421)	(0.535)
France (FR)	0.269***	0.642**	0.443
	(0.085)	(0.303)	(0.383)
Italy (IT)	0.428***	0.450	0.430
	(0.095)	(0.390)	(0.454)
Japan (JP)	0.104	0.127	−0.014
	(0.068)	(0.091)	(0.079)
Sweden (SE)	0.071	0.597	0.519
	(0.146)	(0.411)	(0.499)
United Kingdom (UK)	0.518**	0.768***	0.445
	(0.239)	(0.240)	(0.289)

Note: In each specification, the dependent variable is $\Delta_2 y^{(2)}_{t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the two-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.
[a] 143 FOMC announcements (02/06/1992–11/24/2008).
[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).
[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

zero. These results are comparable to those reported by Obstfeld et al. (2005), Goldberg (2013), Klein and Shambaugh (2015), and Obstfeld (2015).

During the conventional policy regime, the largest effect of US monetary policy actions on foreign shorter-term interest rates is in Canada, followed by the responses of Australian and UK yields. In contrast, during the unconventional policy regime (column labeled "Unconventional"), the US monetary policy surprises have an effect on two-year yields in only Australia, France, and the UK. Shorter-term interest rates for the other AFEs do not respond to the US monetary surprises associated with the unconventional policy actions. This result is reinforced when we exclude the LSAP-related FOMC announcements from that period (column labeled "Non-LSAP"). In this case, only Australian shorter-term interest rates appear to react to the US monetary policy shocks.

Table 3 presents the same analysis for longer-term foreign interest rates. During the conventional

Table 3 – The Effect of US Monetary Policy on Longer-Term Foreign Interest Rates
(*10-year Government Bond Yields for Selected Advanced Foreign Economies*)

	US Monetary Policy Regime		
Country	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Australia (AU)	0.483***	1.346***	0.879**
	(0.164)	(0.243)	(0.375)
Canada (CA)	0.435***	0.880***	0.625
	(0.128)	(0.255)	(0.377)
Switzerland (CH)	0.121	0.583***	0.598**
	(0.087)	(0.146)	(0.266)
Germany (DE)	0.262***	0.723***	0.397
	(0.100)	(0.213)	(0.336)
Spain (ES)	0.367***	0.873**	1.435***
	(0.127)	(0.340)	(0.519)
France (FR)	0.285**	0.651***	0.451
	(0.117)	(0.189)	(0.319)
Italy	0.366***	1.061***	1.254***
	(0.110)	(0.270)	(0.465)
Japan (JP)	0.151**	0.217***	0.102
	(0.065)	(0.078)	(0.132)
Sweden (SE)	0.391**	0.916**	0.637
	(0.177)	(0.369)	(0.499)
United Kingdom (UK)	0.407*	0.890***	0.874**
	(0.220)	(0.299)	(0.382)

Note: In each specification, the dependent variable is $\Delta_2 y_{t+1}^{(10)}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 10-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.
[a] 143 FOMC announcements (02/06/1992–11/24/2008).
[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).
[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

policy regime, the estimated responses are economically and statistically significant for all AFEs, except Switzerland. Specifically, in response to an unanticipated conventional monetary easing that lowers the two-year US Treasury yield 10 basis points, the 10-year foreign government bond yields decline between 3 and 11 basis points. In combination with the results from Table 2, these estimates indicate that an easing of US monetary policy during the conventional period leads to a broad-based decline in foreign interest rates along the entire term structure. At the same time, the estimated response coefficients of the 10-year foreign bond yields are, on balance, somewhat smaller than those on their two-year counterparts, indicating that a conventional US monetary stimulus induces a steepening of the yield curve in most industrialized countries.

During the unconventional policy regime, longer-term bond yields of AFEs all respond significantly to the US monetary policy surprises. Evidently, the unconventional US monetary policy actions have been very effective in lowering the long-end of foreign yield curves across a range of industrialized countries. In combination with the results from Table 2, this implies that an unconventional US monetary policy easing narrows the yield spread between long- and short-term nominal foreign interest rates. This finding is consistent with those reported for the US by Gilchrist et al. (2015) and for the other advanced economies by Bauer and Neely (2014) and Neely (2015). Note also that this effect persists even when we exclude the LSAP-related announcements from that period, although it is estimated somewhat less precisely.

Table 4 summarizes the estimates of the passthrough coefficients—to both shorter- and longer-term foreign bond yields—of US monetary policy across the different policy regimes. These estimates quantify the extent to which US policy-induced movements in the 2- and 10-year US Treasury yields are transmitted to comparable-maturity foreign bond yields and, thus, are directly comparable across the different policy regimes. During the conventional policy regime, the estimated passthrough coefficients for the two-year foreign bond yields range between 0.3 (France) and 1.3 (Canada). The exceptions are Switzerland, Japan, and Sweden, where the estimated conventional US policy passthrough is economically and statistically indistinguishable from zero. Thus, only Canada experiences a complete passthrough of conventional US monetary policy at the short-end of the yield curve. This result reflects the close economic ties between the two countries.

The passthrough of conventional US monetary policy onto longer-term foreign interest rates is more complete, as evidenced by the fact that the estimated passthrough coefficients for the 10-year yields are, in general, larger—although in most cases it is still significantly below one—than those for the two-year yields. Moreover, the international transmission of US monetary policy to longer-term foreign interest rates is, on average, fairly similar between the conventional and unconventional policy regimes. Clear exceptions to these patterns are Canada and United Kingdom, where the unconventional policy passthrough is estimated to be noticeably lower.

When we exclude the LSAP-related announcements from the unconventional policy regime, the estimates of the passthrough coefficients to longer-term foreign interest rates generally decline; the exceptions are Spain, Italy, and the United Kingdom. It is worth noting that in the case of Spain and Italy, the comparison of the passthrough coefficients with those for Germany indicates that the *spreads* on 10-year Spanish and Italian euro-denominated bonds—relative to those of 10-year German bunds—narrowed significantly in response to the unconventional US monetary policy actions that were not explicitly focused on the Federal Reserve's asset purchase programs.

3.2 Emerging Market Economies

We now consider the effect of US monetary policy on government bond yields for selected emerging market economies (EMEs). As shown in Tables 5–6, the spillover effects from conventional US monetary policy to EMEs are much less systematic. Focusing first on the shorter-term interest rates (Table 5), an unanticipated conventional US policy easing that lowers the two-year US Treasury yield 10 basis points causes two-year Mexican and Singaporean government bond yields to decline by about 5 basis points. In contrast, the effect of a conventional US policy shock is insignificant

Table 4 – The Passthrough of US Monetary Policy to Foreign Interest Rates
(*Selected Advanced Foreign Economies*)

	US Monetary Policy Regime					
	Conventional[a]		Unconventional[b]		Non-LSAP[c]	
Country	2-year	10-year	2-year	10-year	2-year	10-year
AU	0.719***	0.954***	1.411**	0.755***	0.902*	0.689**
	(0.195)	(0.255)	(0.564)	(0.151)	(0.508)	(0.335)
CA	1.125***	0.858***	0.474	0.493***	−0.013	0.490***
	(0.113)	(0.184)	(0.562)	(0.053)	(0.347)	(0.138)
CH	0.198	0.239*	0.116	0.327***	0.095	0.469***
	(0.175)	(0.134)	(0.206)	(0.067)	(0.240)	(0.106)
DE	0.422***	0.517***	0.900	0.406***	0.480	0.311*
	(0.090)	(0.133)	(0.808)	(0.092)	(0.460)	(0.181)
ES	0.401***	0.673***	0.639	0.489**	0.884	1.124***
	(0.125)	(0.191)	(0.828)	(0.209)	(0.646)	(0.430)
FR	0.309***	0.556***	1.035	0.365***	0.587	0.354**
	(0.086)	(0.166)	(0.833)	(0.094)	(0.419)	(0.163)
IT	0.502***	0.722***	0.752	0.595***	0.569	0.983***
	(0.104)	(0.153)	(0.827)	(0.186)	(0.549)	(0.306)
JP	0.128	0.300**	0.205	0.122***	−0.019	0.080
	(0.079)	(0.119)	(0.219)	(0.047)	(0.102)	(0.110)
SE	0.089	0.768***	0.963	0.514**	0.688	0.499**
	(0.178)	(0.277)	(0.987)	(0.212)	(0.610)	(0.225)
UK	0.600**	0.803**	1.238	0.499**	0.589**	0.685***
	(0.262)	(0.393)	(0.823)	(0.198)	(0.288)	(0.123)

Note: In columns labeled "2-year," the dependent variable is $\Delta_2 y^{(2)}_{t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the two-year government bond yield for the specified country, while in columns labeled "10-year," the dependent variable is $\Delta_2 y^{(10)}_{t+1}$, the corresponding change in the 10-year government bond yield. In columns labeled "2-year," the endogenous explanatory variable is the two-day change in the two-year US Treasury yield, while in columns labeled "10-year," the endogenous explanatory variable is the two-day change in the 10-year US Treasury yield. The entries denote the 2SLS estimates of the country-specific passthrough coefficients, using a US policy-induced surprises in the two-year US Treasury yield as an instrument (see the text for further details): AU = Australia; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR =France; IT = Italy; JP = Japan; SE =Sweden; and UK = United Kingdom. All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

for the other EMEs in our sample.

A similarly mixed picture emerges for the US monetary actions during the unconventional regime. In fact, Mexico is the only country where the movements in shorter-term interest rates are in sync with the US monetary policy in both the conventional and unconventional policy regimes. This result highlights the tight link between the Mexican and US economies, and also with the Mexican exchange rate policy. However, most of the reaction of the Mexican two-year bond yield

Table 5 – The Effect of US Monetary Policy on Shorter-Term Foreign Interest Rates
(*Two-year Government Bond Yields for Selected Emerging Market Economies*)

	US Monetary Policy Regime		
Country	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Brazil (BR)	1.220	1.750***	1.440*
	(1.299)	(0.407)	(0.758)
India (IN)	0.145	0.306	0.819
	(0.159)	(0.336)	(0.845)
Rep. of Korea (KR)	−0.103	0.568	1.008***
	(0.105)	(0.384)	(0.337)
Mexico (MX)	0.678***	0.946**	0.556
	(0.190)	(0.411)	(0.497)
Singapore (SG)	0.416***	0.129	0.205
	(0.120)	(0.112)	(0.196)
Thailand (TH)	0.161	1.035**	0.862**
	(0.129)	(0.435)	(0.326)

Note: In each specification, the dependent variable is $\Delta_2 y^{(2)}_{t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the two-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.
[a] 143 FOMC announcements (02/06/1992–11/24/2008).
[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).
[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

to US policy actions appears to reflect the LSAP-related announcements. Brazil and Thailand are the only other two countries whose shorter-term interest rates respond significantly to the unconventional US monetary policy shocks. The heterogeneity in responses of short-term foreign interest rates in emerging market economies to US unconventional policy actions likely reflects these countries' different exchange rate arrangements and differences in their degree of financial openness (see Rey, 2013; Klein and Shambaugh, 2015; Obstfeld, 2015; Aizenman et al., 2016; Han and Wei, 2018).

As shown in Table 6, longer-term interest rates for all of the EMEs in our sample responded significantly to the unconventional US monetary policy actions. This results stands in sharp contrast to that for the conventional policy regime, which, on balance, indicates very little sensitivity of longer-term interest rates to conventional US monetary policy shocks. In part, this divergence could be due to the fact that for many of these countries, markets for government bonds denominated in local currency were considerably less developed in the early part of our sample period. Consequently, the limited liquidity in these markets might be biasing the response coefficients toward zero during the conventional policy regime. Aside from these concerns, our estimates imply that during the unconventional monetary policy regime, US monetary policy announcements prompted significant movements in longer-term interest rates across EMEs.

TABLE 6 – The Effect of US Monetary Policy on Longer-Term Foreign Interest Rates
(*10-year Government Bond Yields for Selected Emerging Market Economies*)

	US Monetary Policy Regime		
Country	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Brazil (BR)	3.429***	2.299***	2.313
	(1.198)	(0.525)	(1.433)
India (IN)	0.231***	0.839***	0.791***
	(0.087)	(0.308)	(0.313)
Korea (KR)	−0.057	0.864***	0.739**
	(0.121)	(0.145)	(0.303)
Mexico (MX)	0.506*	1.513**	1.563**
	(0.282)	(0.631)	(0.783)
Singapore (SG)	0.146	0.642***	1.044**
	(0.115)	(0.234)	(0.409)
Thailand (TH)	0.455**	1.729***	1.950**
	(0.176)	(0.428)	(0.884)

NOTE: In each specification, the dependent variable is $\Delta_2 y^{(10)}_{t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 10-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

Table 7 shows the passthrough coefficients of US monetary policy to both shorter- and longer-term interest rates for these EMEs. Under the conventional policy regime, the implied passthrough is only significant for Mexico and Singapore for the two-year bond yields. For the unconventional policy regime, our estimates point to substantial spillover effects, especially for longer-term bond yields. However, compared with the AFEs, the passthrough of US monetary policy onto local currency denominated government bond yields for EMEs is far more idiosyncratic. This likely reflects the shallowness of local currency government bond markets, shorter sample period, and the relatively inflexible exchange rate regimes for many of these countries.

4 US Monetary Policy and Dollar-Denominated Sovereign Yields

4.1 Data Sources and Methods

To abstract from the policy-induced movements in exchange rates that confound the response of yields on foreign bonds denominated in local currencies, this section focuses on sovereign debt denominated in US dollars. To that purpose, we downloaded from Thompson Reuters Datastream daily secondary market prices of dollar-denominated sovereign bonds issued by nearly 80 countries (see Table A-1 in Appendix A for further details). The micro-level aspect of our data allows us

Table 7 – The Passthrough of US Monetary Policy to Foreign Interest Rates
(*Selected Emerging Market Economies*)

	US Monetary Policy Regime					
	Conventional[a]		Unconventional[b]		Non-LSAP[c]	
Country	2-year	10-year	2-year	10-year	2-year	10-year
BR	1.781	16.757	2.822*	1.223***	1.908*	2.813
	(1.769)	(29.156)	(1.548)	(0.366)	(0.967)	(2.019)
IN	0.231	0.588*	0.528	0.471**	1.162	0.620**
	(0.250)	(0.309)	(0.649)	(0.205)	(1.263)	(0.313)
KR	−0.151	−0.144	0.916	0.485***	1.355**	0.579***
	(0.160)	(0.329)	(0.926)	(0.089)	(0.588)	(0.196)
MX	0.883***	0.902	1.525	0.849**	0.736	1.225***
	(0.313)	(0.623)	(1.142)	(0.427)	(0.541)	(0.464)
SG	0.584***	0.390	0.208	0.360**	0.271	0.818***
	(0.156)	(0.306)	(0.211)	(0.158)	(0.219)	(0.246)
TH	0.235	1.224*	1.649	0.970***	1.098**	1.528***
	(0.184)	(0.655)	(1.351)	(0.305)	(0.545)	(0.454)

Note: In columns labeled "2-year," the dependent variable is $\Delta_2 y^{(2)}_{t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the two-year government bond yield for the specified country, while in columns labeled "10-year," the dependent variable is $\Delta_2 y^{(10)}_{t+1}$, the corresponding change in the 10-year government bond yield. In columns labeled "2-year," the endogenous explanatory variable is the two-day change in the two-year US Treasury yield, while in columns labeled "10-year," the endogenous explanatory variable is the two-day change in the 10-year US Treasury yield. The entries denote the 2SLS estimates of the country-specific passthrough coefficients, using a US policy-induced surprises in the two-year US Treasury yield as an instrument (see the text for further details): BR = Brazil; IN = India; KR = Korea; MX = Mexico; SG = Singapore; and TH = Thailand. All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

to construct credit spreads that are free of the duration mismatch, which is a common problem in many of the standard credit spread indexes. In our analysis, we construct a synthetic US Treasury security that exactly replicates the cash-flows of the corresponding sovereign debt instrument.

Formally, we consider a dollar-denominated sovereign bond k (issued by country i) that at time t is promising a sequence of cash-flows denoted by $\{C(s) : s = 1, 2, \ldots, S\}$.[7] The price of this bond at time t is given by

$$P_{it}[k] = \sum_{s=1}^{S} C(s) D(t_s),$$

where $D(t) = \exp(-r_t t)$ denotes the discount function in period t. To calculate the price of the corresponding synthetic US Treasury security—as denoted by $P^{US}_t[k]$—we discount the cash-flow sequence $\{C(s) : s = 1, 2, \ldots, S\}$ using continuously-compounded zero-coupon US Treasury yields

[7] The cash-flow sequence $\{C(s) : s = 1, 2, \ldots, S\}$ consists of the regular coupon payments and the repayment of the principle at maturity.

Table 8 – Selected Sovereign Bond Characteristics
(*Dollar-Denominated Sovereign Bonds*)

Bond Characteristic	Mean	StdDev	Min	P50	Max
No. of bonds per country	16.50	51.44	1	6	450
Maturity at issue (years)	12.64	7.76	2	10	30
Term to maturity (years)	7.01	4.95	1.00	5.85	30.00
Duration (years)	5.63	3.32	0.91	5.06	18.87
Par amount ($millions)[a]	766.62	946.96	1.06	429.85	11,209
Sovereign credit rating (Moody's)	-	-	Ca	A1	Aaa
Coupon rate (pct.)	4.20	3.51	0.00	4.50	13.63
Nominal yield to maturity (pct.)	4.93	3.22	0.11	4.31	36.57
Credit spread (bps.)	205	269	−50	107	3,000

Note: Sample period: daily data from 01/01/1992 to 05/30/2014. No. of bonds = 1,287; No. of countries = 78; Obs = 1,474,612; see Table A-1 in Appendix A for a list of countries included in the sample. All of the reported statistics are based on trimmed data (see the text for further details).
[a] The par amount issued is deflated by the US CPI (2005 = 100).

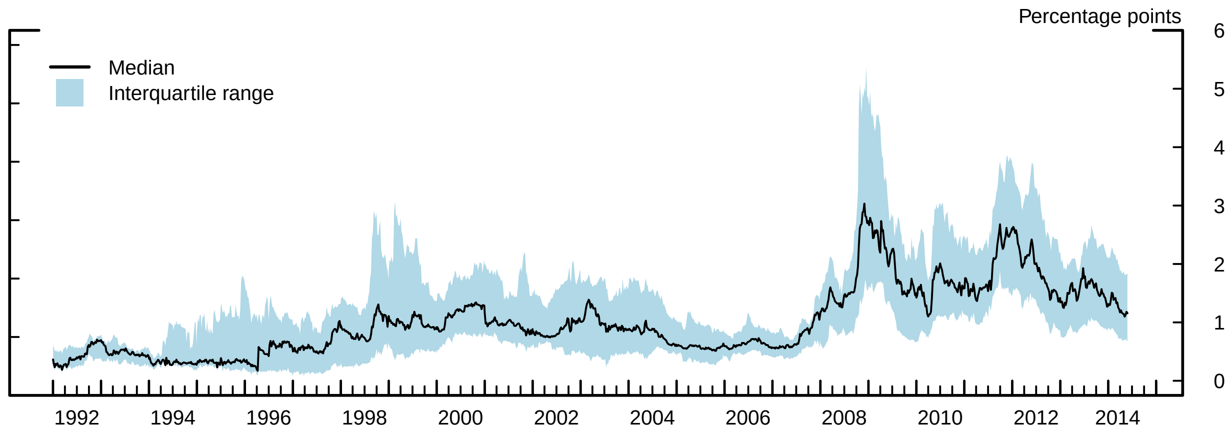
in period t, which are obtained from the daily estimates of the US Treasury yield curve based on the methodology of Gürkaynak et al. (2007). The resulting price $P_t^{US}[k]$ can then be used to calculate the yield—denoted by $y_t^{US}[k]$—of a hypothetical US Treasury security with exactly the same cash-flows as the underlying sovereign bond. The resulting credit spread $s_{it}[k] = y_{it}[k] - y_t^{US}[k]$, where $y_{it}[k]$ denotes the yield of the sovereign bond k, is therefore free of the bias that would occur if the spreads had been computed simply by matching the sovereign yield to the estimated yield of a US Treasury security of the same maturity.

Table 8 contains the summary statistics for the key characteristics of bonds in our sample.[8] An average country in our sample has almost 17 sovereign bond issues outstanding at any point in time. However, this distribution is skewed significantly to the right by a few countries that have a very large number of issues trading in the secondary market at a point in time. In fact, the median country has only six such issues trading in any given day.

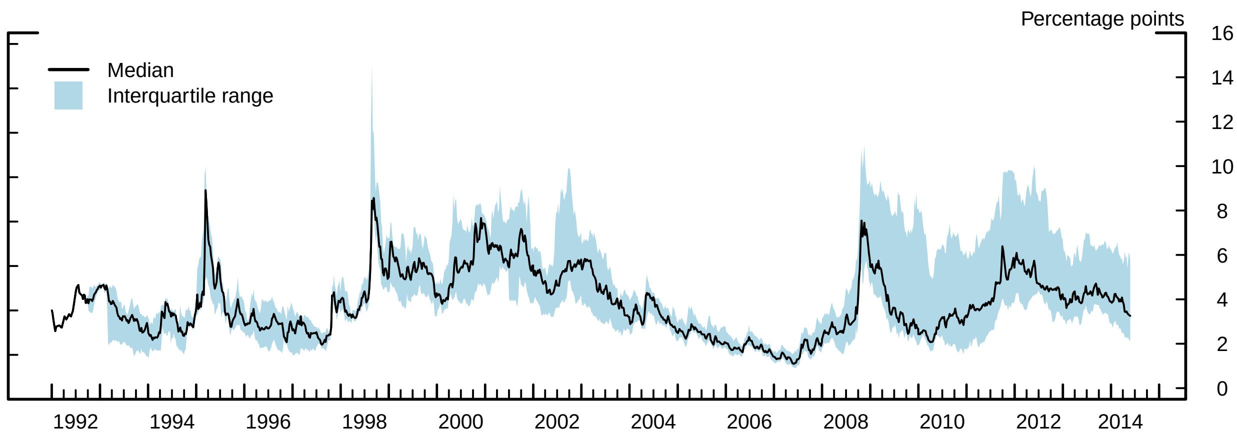
The size distribution of the sovereign bond issues is similarly skewed, with the range running from $1.6 million to more than $11 billion. The maturity of these debt instruments is fairly long, with the average maturity at issue of almost 13 years. In terms of default risk—at least as measured by the Moody's sovereign credit ratings—our sample spans a significant portion of the credit-quality spectrum. However, at "A1," the median observation is well within the investment-grade category. An average sovereign bond in our sample has an expected return of 205 basis points more than a comparable US Treasury security, while the standard deviation of 270 basis points is indicative of the wide range of credit qualities in our sample.

[8]To ensure that our results are not driven by a small number of extreme observations, we have eliminated all of the observations with credit spreads of less that −50 basis points and more than 3,000 basis points. In addition, we dropped from our sample any very small sovereign debt issues (par value of less than $1 million in 2005 dollars) and all observations with a remaining term-to-maturity of less than one year or more than 30 years. These selection criteria yielded a sample of 1,278 individual securities for the period between 01/01/1992 and 05/30/2014.

FIGURE 2 – Sovereign Credit Spreads



(a) Investment-grade sovereign credits



(b) Speculative-grade sovereign credits

NOTE: Sample period: weekly averages of daily data from 01/02/1992 to 05/30/2014. The solid line in panel (a) depicts the median credit spread across country-specific portfolios of (dollar-denominated) sovereign bonds with an investment-grade credit rating, while the shaded bands denotes the corresponding interquartile (P75 − P25) range. Panel (b) shows the same information for countries with a speculative-grade sovereign rating.
SOURCE: Thompson Reuters, Datastream Professional.

We exploit the cross-sectional heterogeneity of our data by constructing daily sovereign bond portfolios, conditional on whether the issuing country has a speculative- or investment-grade sovereign credit rating in the previous day. By building sovereign bond portfolios from the ground up, we can also construct portfolios of corresponding US Treasury securities, once again conditional on the sovereign's credit rating.[9] The difference between these portfolio yields provides a measure of the spread on the sovereign yield relative to the yield on US Treasuries with matched payout characteristics.

The solid line in panel (a) of Figure 2 depicts the cross-sectional median of sovereign spreads across the investment-grade country portfolios, while the shaded band represents the corresponding

[9] All of the portfolios are weighted by the market value of the underlying bond issues in the previous day.

interquartile range; the same information for the speculative-grade country portfolios is shown in panel (b).[10] Clearly there is considerable cross-sectional and time-series variation in the sovereign bond portfolios in both credit rating categories. Sovereign credit spreads for riskier countries spiked up during the Mexican peso crisis that started in December 1994, as investors fled, not only Mexico, but emerging markets in general. In contrast, the jump in spreads during the Asian financial crisis in mid-1997 was noticeably less severe. The Russian financial crisis during the late summer of 1998 also led to "financial contagion," in the sense that sovereign spreads of speculative-grade countries increased sharply. Note that during these international financial crises, credit spreads on dollar-denominated sovereign bonds issued by countries with an investment-grade rating barely budged.

The collapse of Lehman Brothers on September 15, 2008, an event that sparked a world-wide financial panic, sent spreads sharply higher for both investment- and speculative-grade sovereign credits. Consistent with previous international financial crises, the cross-sectional dispersion of credit spreads also widened significantly and remained high in both credit rating categories for the remainder of our sample period. The effects of the European debt crisis that started at the end of 2009 and intensified in early 2010 and thereafter are especially evident in the elevated and volatile investment-grade sovereign spreads, as it took some time for the periphery eurozone countries at the center of the crisis to be downgraded to "junk" status. Especially during this period, the impact of US unconventional monetary policy on advanced and emerging market economies became a hotly debated topic in global and national policy circles.

4.2 Results

We begin by discussing the effect of a US monetary policy surprise on sovereign yields and the yields for the matched US Treasury portfolios. Specifically, we use OLS to estimate the following system of equations:

$$\begin{aligned}\Delta_h y_{p,t+h-1} &= \alpha_p m_t^{US} + \epsilon_{p,t+h-1};\\ \Delta_h y_{p,t+h-1}^{US} &= \beta_p m_t^{US} + \nu_{p,t+h-1},\end{aligned}$$

where $\Delta_h y_{p,t+h-1}$ denotes an h-day change (from day $t-1$ to day $t+h-1$) in the sovereign bond portfolio yield associated with credit quality $p =$ SG (speculative grade) and IG (investment grade) and $\Delta_h y_{p,t+h-1}^{US}$ is the corresponding h-day change in the yield on a matched portfolio of US Treasuries. The response of the sovereign credit spreads to US monetary policy surprises may then be directly inferred from the difference in response between these two portfolio yields; that is, $\alpha_p - \beta_p$, for $p =$ SG and IG.

Table 9 documents the effect of an increase in the two-year US Treasury yield during the narrow window around a monetary policy announcement on the two-day change in the sovereign bond yield and its matched US Treasury equivalent, for both speculative- and investment-grade sovereign

[10] For visual purposes, we smoothed the data by taking weekly averages of the daily country-specific portfolio spreads.

Table 9 – The Effect of US Monetary Policy and Sovereign Bond Yields
(*Investment- vs. Speculative-Grade Portfolio Yields*)

	US Monetary Policy Regime		
Dependent Variables (two-day changes)	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Sovereign yield (SG)	0.977***	1.254**	0.335
	(0.196)	(0.521)	(0.885)
Sovereign yield (IG)	0.727***	1.374***	0.976**
	(0.100)	(0.241)	(0.402)
US Treasury yield (SG)	0.506***	1.597***	1.246***
	(0.116)	(0.343)	(0.417)
US Treasury yield (IG)	0.693***	1.375***	1.183***
	(0.111)	(0.306)	(0.368)
Implied credit spread response[d]			
Credit spread (SG)	0.471**	−0.343	−0.911
	(0.193)	(0.605)	(0.950)
Credit spread (IG)	0.035	−0.001	−0.207
	(0.091)	(0.333)	(0.358)

Note: In each specification, the dependent variable is $\Delta_2 y_{p,t+1}$, a two-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the specified portfolio yield: SG = portfolio of (dollar-denominated) bonds issued by countries with a speculative-grade sovereign credit rating at $t-1$; and IG = portfolio of (dollar-denominated) bonds issued by countries with an investment-grade sovereign credit rating at $t-1$. US Treasury (SG/IG) corresponds to a two-day change in the yield on the portfolio of synthetic US Treasury securities of identical duration as the sovereign bonds in the (SG/IG) portfolios. The entries denote the OLS estimates of the portfolio-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

[d] The response of the sovereign credit spreads for the SG and IG credit rating categories is computed as the difference between the estimated response of sovereign bond yields and the estimated response of US Treasury yields in the portfolio of comparable-maturity US Treasuries in that category.

bond portfolios. We again conduct a separate analysis across the three monetary policy regimes—conventional, unconventional, and unconventional that excludes the LSAP-related announcements.

The results in Table 9 imply that during the conventional period, a 1 percentage point monetary policy induced increase in the two-year US Treasury yield leads to a 0.977 percentage point rise in the yields on speculative-grade sovereign bonds and a 0.727 percentage point increase in the yields on their investment-grade counterparts. Both of these effects are statistically significant at the 1 percent level. The matched portfolio US Treasury yield for speculative-grade sovereign bonds increases by 0.506 percentage points over this two-day period, while that of the investment-grade bonds rises by 0.693 percentage points.

The implied credit spread response, which is computed as the difference between these two numbers, is 0.471 percentage points for speculative-grade sovereign bonds and only 0.035 percentage points for the investment-grade sovereign bonds. The standard errors associated with these responses imply that the credit spread response for speculative-grade bonds is statistically different from zero at the 5 percent significance level, while the response for investment-grade securities is not statistically indistinguishable from zero. Thus, during the conventional period, a US monetary policy easing that causes a 1 percentage point reduction in the two-year US Treasury yield leads to about a 50 basis point narrowing in speculative-grade sovereign credit spreads but has essentially zero impact on credit spreads for investment-grade sovereign credits. These results are consistent with the notion that US monetary policy has a direct impact on global asset prices by reducing foreign investment-grade yields one-for-one with US Treasury yields and has an additional impact by reducing the credit risk premia on speculative-grade sovereign bonds by an additional 50 basis points.

The second column of the table reports analogous results for the unconventional policy regime. Again, we observe an economically important and statistically significant response in the two-day change of both sovereign and matched US Treasury yields to the US monetary policy surprise. Consistent with our previous findings, the size of the response of both the sovereign yields and the yields on comparable US Treasuries is substantially greater than those we obtain during the conventional period. During the unconventional regime, a US monetary policy easing reduces longer-term yields by more than short-term yields. Hence, this finding reflects the fact that portfolios of US Treasury securities with matched payout characteristics to speculative- and investment-grade sovereign bonds are of significantly longer duration than the two-year (zero-coupon) US Treasury note.

Taking the difference in response between the sovereign bond yields and the matched US Treasury yields again allows us to infer the response of the credit spread of dollar-denominated sovereign bonds to an unanticipated change in the stance of US monetary policy. In contrast to the conventional policy regime, there is no statistically significant decline in the credit spread on speculative-grade sovereign bonds during the unconventional period. The response of the credit spread for investment-grade sovereign bonds is again zero: both economically and statistically. Thus, during the unconventional policy regime, monetary policy has a direct effect on both speculative- and investment-grade sovereign debt by reducing yields on comparable US Treasury securities that are then transmitted one-for-one to yields on dollar-denominated sovereign bonds but has no additional impact via a reduction in sovereign credit risk.

The third column of the table reports the results for the unconventional period that excludes the LSAP-related announcements. Excluding these announcements results in roughly similar responses of US Treasury and investment-grade sovereign bond yields to US monetary policy shocks as does the full unconventional sample. However, the coefficient on speculative-grade sovereign bonds is now substantially muted (0.335 during the non-LSAP sample versus 1.254 for the full unconventional sample) and is also estimated with a large degree of imprecision. The credit spread coefficient on speculative-grade sovereign bonds is consequently large and negative but is imprecisely estimated. Consequently, there is no evidence that US monetary policy easing leads to a reduction in sovereign credit spreads during the unconventional period.

Given the potentially illiquid nature of sovereign bonds, which would likely lead to a delayed

Table 10 – The Effect of US Monetary Policy and Sovereign Bond Yields
(*Investment- vs. Speculative-Grade Portfolio Yields*)

	US Monetary Policy Regime		
Dependent Variables (six-day changes)	Conventional[a]	Unconventional[b]	Non-LSAP[c]
Sovereign yield (SG)	1.746***	1.358	−1.114
	(0.515)	(1.097)	(1.489)
Sovereign yield (IG)	0.725***	1.617***	1.374**
	(0.138)	(0.409)	(0.692)
US Treasury yield (SG)	0.316**	1.852***	2.092***
	(0.144)	(0.234)	(0.479)
US Treasury yield (IG)	0.455***	1.479***	1.903***
	(0.136)	(0.258)	(0.456)
Implied credit spread response[d]			
Credit spread (SG)	1.430***	−0.493	−3.206**
	(0.494)	(1.061)	(1.300)
Credit spread (IG)	0.270***	0.138	−0.529
	(0.091)	(0.393)	(0.440)

Note: In each specification, the dependent variable is $\Delta_6 y_{p,t+5}$, a six-day change (from day $t-1$ to day $t+5$) bracketing an FOMC announcement on day t in the specified portfolio yield: SG = portfolio of (dollar-denominated) bonds issued by countries with a speculative-grade sovereign credit rating at $t-1$; and IG = portfolio of (dollar-denominated) bonds issued by countries with an investment-grade sovereign credit rating at $t-1$. US Treasury (SG/IG) corresponds to a six-day change in the yield on the portfolio of synthetic US Treasury securities of identical duration as the sovereign bonds in the (SG/IG) portfolios. The entries denote the OLS estimates of the portfolio-specific response coefficients to a US policy-induced surprise in the two-year US Treasury yield (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

[d] The response of sovereign credit spreads for the SG and IG credit rating categories is computed as the difference between the estimated response of sovereign bond yields and the estimated response of US Treasury yields in the portfolio of comparable-maturity US Treasuries in that category.

yield response to US monetary policy announcements, we now consider the effect of a US monetary policy surprise on the six-day change in the sovereign bond yields and their matched US Treasury portfolios. These results are summarized in Table 10.

During the conventional regime, the response of speculative-grade sovereign yields shows a substantially greater response at the six-day horizon (1.746) than at the two-day horizon (0.977). In contrast, the response of investment-grade sovereign yields is equal at both horizons. This suggests that there is some price discovery or market illiquidity in the speculative-grade segment of the sovereign debt market that dissipates over several days. In addition, the response of the yields on the matched portfolios of US Treasury securities shows attenuation at the six-day horizon relative to the two-day horizon. Consequently, when we allow for the longer horizon, the response of credit spreads to a US monetary policy surprise becomes larger in absolute value, and it is statistically significant for both speculative- and investment-grade sovereign bonds. A monetary policy-induced change of 1 percentage point in the two-year US Treasury yield now implies a 1.43 percentage point narrowing of credit spreads on speculative-grade sovereign bonds and a 0.27 percentage point decline in credit spreads on investment-grade bonds—note that both coefficients are statistically significant at the 1 percent level.

These findings are likely to reflect the confluence of two factors: first, a decline in international risk-free interest rates could lead to narrower sovereign credit spreads because it improves the creditworthiness of riskier countries; and second, international investors' attempts to enhance portfolio returns in a low interest rate environment by increasing their risk exposure could also put downward pressure on credit spreads of riskier sovereigns. While intuitive, our results stand in sharp contrast to those from the earlier literature, which found than an *increase* in US shorter-term interest rates led to a *narrowing* of sovereign credit spreads, especially for the EMEs (see Kamin and von Kleist, 1999; Eichengreen and Mody, 2010; Uribe and Yue, 2006). Importantly, these papers rely on monthly or quarterly changes in US interest rates to estimate the spillover effects of US monetary policy to international bond markets. In contrast, our analysis highlights the advantage of using high-frequency data to more cleanly identify the unanticipated changes in the stance of US monetary policy and to trace out the causal effect of these changes on sovereign credit spreads.

During the unconventional period, the coefficient estimates imply a modest increase in the response of both speculative- and investment-grade sovereign yields at the six-day horizon compared with the two-day horizon. In contrast, there is a substantially greater response of US Treasuries over the six-day horizon relative to the two-day horizon. The combination of these two forces again implies no statistically significant effect of a US monetary policy surprise on sovereign credit spreads during the unconventional policy regime. This result is further reinforced when we consider the sample that excludes LSAP-related announcements. In fact, the coefficient estimate on speculative-grade sovereign bonds is now large and negative (-3.21) and is statistically significant at the 5 percent level. Given the limited sample and large standard errors, we are reluctant to conclude from this evidence that US monetary policy easing caused a widening of credit spreads on speculative-grade sovereign bonds. Nonetheless, these estimates reinforce the finding that US monetary policy easings do not lead to narrower sovereign spreads during the unconventional period, whether or not one includes or excludes the LSAP-related announcements in the analysis.

To further examine this issue, we now consider estimates based on the micro-level data, which allows us to directly control for potential liquidity concerns by including an interaction between the monetary policy surprise and bond characteristics that likely influence liquidity premia. In addition to explicitly controlling for observable liquidity characteristics, the panel data analysis may be viewed as providing the equivalent of an equally-weighted portfolio analysis.

Formally, we estimate the following regression specification:

$$\begin{aligned}\Delta_h s_{i,t+h-1}[k] = \beta_{SG} m_t^{US} \times \mathbf{1}[\mathrm{RTG}_{i,t-1} \in \mathrm{SG}] + \beta_{IG} m_t^{US} \times \mathbf{1}[\mathrm{RTG}_{i,t-1} \in \mathrm{IG}] \\ + \boldsymbol{\theta}' \mathbf{x}_{i,t}[k] \times m_t^{US} + \epsilon_{i,t+h-1}[k],\end{aligned} \tag{3}$$

TABLE 11 – The Effect of US Monetary Policy and Sovereign Credit Spreads
(*Investment- vs. Speculative-Grade Sovereign Credit Spreads*)

	US Monetary Policy Regime		
Explanatory Variables	Conventional[a]	Unconventional[b]	Non-LSAP[c]
(a) *Two-day changes* ($h = 2$)			
$\beta_{SG} m_t^{US} \times \mathbf{1}[\text{RTG}_{i,t-1} \in \text{SG}]$	0.222	−0.372	−0.403
	(0.170)	(0.302)	(0.409)
$\beta_{IG} m_t^{US} \times \mathbf{1}[\text{RTG}_{i,t-1} \in \text{IG}]$	−0.056	0.183	−0.109
	(0.066)	(0.298)	(0.267)
(b) *Six-day changes* ($h = 6$)			
$\beta_{SG} m_t^{US} \times \mathbf{1}[\text{RTG}_{i,t-1} \in \text{SG}]$	0.757***	−0.292	−1.052**
	(0.255)	(0.284)	(0.428)
$\beta_{IG} m_t^{US} \times \mathbf{1}[\text{RTG}_{i,t-1} \in \text{IG}]$	0.141	−0.074	−0.096
	(0.095)	(0.169)	(0.208)

NOTE: The dependent variable is $\Delta_h s_{i,t+h-1}[k]$, an h-day change (from day $t-1$ to day $t+h-1$) bracketing an FOMC announcement on day t in the credit spread on (dollar-denominated) sovereign bond k issued by country i. The entries denote the OLS estimates of the response coefficients to a US policy-induced surprise in the two-year US Treasury yield interacted with the country's sovereign credit rating indicator at $t-1$: SG = speculative-grade sovereign credit rating; and IG = investment-grade sovereign credit rating. The response coefficients are evaluated at the sample mean of the bond-specific characteristics, which are included to control for liquidity of individual bond issues (see the text for further details). All of the specifications include a constant (which is not reported). Robust asymptotic standard errors reported in parentheses are clustered in the i and t dimensions (see Cameron et al., 2011): * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008); No. of bonds = 417; No. of countries = 48; and Obs = 16,040.

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014); No. of bonds = 1,038; No. of countries = 75; and Obs = 32,253.

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014); No. of bonds = 1,035; No. of countries = 75; and Obs = 25,983.

where $\Delta_h s_{i,t+h-1}[k] \equiv \Delta_h y_{it}[k] - \Delta_h y_t^{US}[k]$, is the h-day change in the credit spread on sovereign bond k (issued by country i); $\mathbf{1}[\text{RTG}_{i,t-1} \in p]$ is an indicator variable that equals 1 if country i's sovereign credit rating at $t-1$ falls into the p = SG and IG credit-rating category; and, $\mathbf{x}_{i,t}[k]$ is a vector of (pre-determined) observable bond characteristics that may influence the liquidity of the issue k. Specifically, $\mathbf{x}_{i,t}[k]$ consists of $\ln \text{PAR}_i[k]$, $\ln(1 + \text{AGE}_{i,t}[k])$, $\ln(1 + \text{COUP}_i[k])$, and $\ln \text{DUR}_{i,t}[k]$, where $\text{PAR}_i[k]$ is the inflation-adjusted size of the sovereign bond issue, $\text{AGE}_{i,t}[k]$ is the age (in days) of the issue, $\text{COUP}_i[k]$ is the fixed coupon rate, and $\text{DUR}_{i,t}[k]$ is the bond's duration. These characteristics are interacted with the policy surprise m_t^{US} and thus control for the fact that a portion of the credit spread response may reflect movements in liquidity premium that is a function of the specified pre-determined bond characteristics.[11]

Table 11 reports the estimated effects of monetary policy on both the two- and six-day changes

[11] As before, we estimate equation (3) by OLS. To take into account cross-sectional dependence in the disturbance term $\epsilon_{i,t+h-1}[k]$ arising from the fact that our sample consists of FOMC announcement days only, as well as the fact that error terms of bonds issues by the same country are likely to be correlated, we report asymptotic standard errors clustered across time (t) and countries (i) computed according to Cameron et al. (2011).

in sovereign credit spreads. Consistent with the view that some part of the credit spread response may be attributed to a liquidity premium that varies with issue size and other bond characteristics, the panel-data estimates imply a smaller response of credit spreads to monetary policy surprises during the conventional period relative to those obtained from the aggregate portfolio analysis. The coefficient on the two-day change in credit spreads (panel (a)) for speculative-grade sovereign bonds declines from an estimated value of 0.471, when estimated at the portfolio level, to 0.222 when estimated using the micro data. Similarly, the coefficient estimate on the six-day change in the response of speculative-grade credit spread (panel (b)) falls from 1.43 to 0.757, but nonetheless remains highly statistically significant. In summary, the panel-data estimates do not change our conclusions regarding the lack of any impact of US monetary policy on sovereign credit spreads during the unconventional period.

To provide a more insightful comparison of the results across both the conventional and unconventional regime, we now compute the effective passthrough of US monetary policy to sovereign bond yields and credit spreads. The passthrough measures by how much the dollar-denominated sovereign yields respond to a monetary policy-induced change in US Treasuries of comparable maturity. Note that this can be computed as the ratio of the coefficient on the sovereign yield response relative to the response of the yield on the matched portfolio of Treasury securities that are reported in Tables 9–10. We report these passthrough coefficients along with their standard errors in Table 12.

When we consider two-day changes in yields (panel (a), the passthrough coefficient is economically and statistically equal to one for investment-grade bonds during both the conventional and unconventional policy regimes. The passthrough coefficient for speculative-grade sovereign bonds is 1.931 during the unconventional period and 0.785 during the unconventional period. Although the passthrough coefficients during the unconventional period do not differ across the two- and six-day horizons, the estimated passthrough is substantially greater when we consider six-day changes (panel (b)) relative to the two-day changes during the conventional period. The estimate coefficients across a six-day change imply that a monetary policy-induced reduction in US Treasury yields of 10 basis points leads to a 16 basis point decline in investment-grade sovereign yields and a 55 basis point drop in speculative-grade sovereign yields. Thus, during the conventional regime, US monetary policy had an economically large and statistically significant effect on both sovereign bond yields and the corresponding credit spreads. In contrast, during the unconventional period, US monetary policy caused one-for-one movements in comparable maturity sovereign bond yields and, therefore, had no discernible impact of sovereign credit spreads.

5 Conclusion

This paper compares the effects of conventional US monetary policy on foreign government bond yields with those of the unconventional measures employed after the target federal funds rate hit the effective lower bound. We measure the US monetary policy surprises using narrow-window

Table 12 – The Passthrough of US Monetary Policy to Sovereign Bond Yields
(*Investment- vs. Speculative-Grade Portfolio Yields*)

	US Monetary Policy Regime		
Dependent Variables (h-day changes)	Conventional[a]	Unconventional[b]	Non-LSAP[c]
(a) *Two-day changes* ($h = 2$)			
Sovereign yield (SG)	1.931***	0.785**	0.269
	(0.486)	(0.357)	(0.709)
Pr > CLR[d]	0.000	0.011	0.652
Sovereign yield (IG)	1.050***	0.999***	0.825***
	(0.136)	(0.242)	(0.286)
Pr > CLR	0.000	0.000	0.004
(b) *Six-day changes* ($h = 6$)			
Sovereign yield (SG)	5.532***	0.734	−0.533
	(2.592)	(0.576)	(0.783)
Pr > CLR	0.001	0.133	0.407
Sovereign yield (IG)	1.593***	1.093***	0.722***
	(0.305)	(0.271)	(0.253)
Pr > CLR	0.002	0.000	0.024

Note: In each specification, the dependent variable is $\Delta_h y_{p,t+h-1}$, and h-day change (from day $t-1$ to day $t+h-1$) bracketing an FOMC announcement on day t in the specified sovereign bond portfolio yield. SG = portfolio of (dollar-denominated) bonds issued by countries with a speculative-grade sovereign credit rating at $t-1$; and IG = portfolio of (dollar-denominated) bonds issued by countries with an investment-grade sovereign credit rating at $t-1$. The endogenous explanatory variable in each specification is the corresponding h-day change in the yield on the portfolio of synthetic US Treasury securities of identical duration as the sovereign bonds in the specified credit risk portfolios. The entries denote the 2SLS estimates of the portfolio-specific passthrough coefficients, using a US policy-induced surprise in the two-year US Treasury yield as an instrument (see the text for further details). All of the specifications include a constant (which is not reported). Heteroskedasticity-consistent asymptotic standard errors are reported in parentheses: * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

[a] 143 FOMC announcements (02/06/1992–11/24/2008).

[b] 52 LSAP- and non-LSAP-related FOMC announcements (11/25/2008–04/30/2014).

[c] 40 non-LSAP-related FOMC announcements (11/25-2008–04/30/2014).

[d] p-value for the Moreira (2003) weak instruments conditional likelihood ratio test of the null hypothesis that the estimated passthrough coefficient is equal to zero.

changes in the two-year US Treasury yield around policy announcements. We find that during the conventional monetary policy regime, US monetary policy has a significant effect on the shorter-term interest rates of advanced foreign countries. Meanwhile, during the unconventional policy regime, the US monetary policy is more effective in moving the longer-term foreign interest rates. During the conventional policy regime, expansionary US monetary policy steepens, on balance, the foreign yield curve—denominated in local currency—and it flattens the foreign yield curve during the unconventional regime. On average, however, the average passthrough of unconventional policy to longer-term foreign bond yields is roughly comparable to that of conventional policy.

To abstract from the confounding effects of policy-induced movements in exchange rates, we also examine the response of yields on dollar-denominated sovereign bonds issued by a large sample of advanced and developing countries. We analyse both the bond portfolios—which are sorted by the issuing country's sovereign credit rating—and the micro-level bond yields. Our results indicate that during the conventional US monetary policy regime, the yields on speculative-grade sovereign bonds decline more than one-for-one in response to an unanticipated easing of US monetary policy, which implies that there is a significant narrowing of sovereign credit spreads for riskier countries. In contrast, during the unconventional policy regime, the response of speculative-grade sovereign bond yields to US monetary policy shocks is one-to-one.

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Appendices – For Online Publication

A Data Appendix

Table A-1 – Sample Composition

Country Name	Country Code	IFSC	Start Date	End Date	No. of Bonds	Obs.
United Kingdom	GBR	112	07/30/2009	05/07/2013	7	2,756
Austria	AUT	122	05/19/2004	05/30/2014	15	10,717
Belgium	BEL	124	01/01/1992	05/30/2014	19	27,514
Denmark	DNK	128	07/30/2009	05/30/2014	8	3,113
Italy	ITA	136	01/01/1992	05/30/2014	49	59,443
Netherlands	NLD	138	02/24/2012	05/30/2014	4	2,078
Norway	NOR	142	01/01/1992	04/12/1996	6	2,076
Sweden	SWE	144	01/02/2001	05/30/2014	36	21,429
Canada	CAN	156	02/14/2012	05/30/2014	3	790
Japan	JPN	158	01/01/1992	05/30/2014	75	96,789
Finland	FIN	172	01/01/1992	05/30/2014	23	23,203
Greece	GRC	174	05/24/1994	09/12/2011	21	8,871
Iceland	ISL	176	01/02/2001	05/30/2014	6	4,102
Ireland	IRL	178	01/01/1992	07/15/2009	6	8,923
Portugal	PRT	182	09/08/1999	03/25/2014	3	3,142
Spain	ESP	184	09/23/1992	05/30/2014	15	14,215
Turkey	TUR	186	05/05/1992	05/30/2014	29	39,816
Australia	AUS	193	07/30/2009	05/30/2014	1	1,262
New Zealand	NZL	196	01/01/1992	05/30/2014	10	15,740
South Africa	ZAF	199	12/12/1994	05/30/2014	11	19,712
Argentina	ARG	213	10/01/1992	05/30/2014	12	13,294
Bolivia	BOL	218	10/29/2012	05/30/2014	4	1,234
Brazil	BRA	223	05/15/1994	05/30/2014	26	52,249
Chile	CHL	228	10/16/2001	05/30/2014	6	7,991
Colombia	COL	223	10/11/1996	05/30/2014	17	38,274
Costa Rica	CRI	238	07/30/2009	05/30/2014	5	2,314
El Salvador	SLV	253	10/25/2002	05/30/2014	5	6,150
Guatemala	GTM	258	06/06/2012	05/30/2014	4	1,712
Honduras	HND	268	03/15/2013	05/30/2014	4	872
Mexico	MEX	273	03/03/1993	05/30/2014	17	31,275
Panama	PAN	283	05/11/1997	05/30/2014	9	20,436
Paraguay	PRY	288	01/25/2013	05/30/2014	2	702
Peru	PER	293	11/26/2002	05/30/2014	6	13,101
Uruguay	URY	298	11/18/2005	05/30/2014	3	3,654
Venezuela	VEN	299	01/01/1992	05/30/2014	28	47,703
Bahamas	BHS	313	11/20/2009	05/30/2014	4	2,556
Barbados	BRB	316	01/02/2001	05/30/2014	5	7,868
Bermuda	BMU	319	07/20/2010	05/30/2014	6	3,444
Jamaica	JAM	343	12/19/2001	05/30/2014	7	12,857
Trinidad & Tobago	TTO	369	01/02/2009	05/30/2014	3	1,651
Cayman Islands	CYM	377	11/24/2009	05/30/2014	2	2,357
Rebublic of Korea	KOR	410	04/09/1998	05/30/2014	60	65,464
Cyprus	CYP	423	01/29/1998	06/26/2001	1	889
Israel	ISR	436	05/10/2000	05/30/2014	450	505,116
Jordan	JOR	439	11/12/2010	05/30/2014	2	1,078
Quatar	QAT	453	04/09/2009	05/30/2014	9	8,713
Egypt	EGY	469	07/02/2001	05/30/2014	5	5,311
Sri Lanka	LKA	524	11/04/2010	05/30/2014	11	6,557
Hong Kong, China	HKG	532	07/22/2004	08/01/2013	2	4,712

Table A-1 – Sample Composition (continued)

Country Name	Country Code	IFSC	Start Date	End Date	No. of Bonds	Obs.
India	IND	534	02/25/2004	05/07/2014	14	13,744
Indonesia	IDN	536	03/20/2004	05/30/2014	29	33,550
Malaysia	MYS	548	05/28/1999	07/15/2010	2	4,705
Pakistan	PAK	564	02/12/2004	05/30/2014	5	7,830
Philippines	PHL	566	11/23/1996	05/30/2014	15	32,448
Thailand	THA	578	12/23/2005	09/28/2012	1	1,766
Viet Nam	VNM	582	11/03/2005	05/30/2014	4	6,735
Ghana	GHA	652	07/26/2013	05/30/2014	4	868
Morocco	MAR	686	11/12/2012	05/30/2014	2	768
Senegal	SEN	722	05/05/2011	05/30/2014	3	2,278
Namibia	NAM	728	11/03/2011	05/30/2014	2	1,344
Fiji	FJI	819	07/30/2009	09/12/2011	2	1,132
Belarus	BLR	913	08/03/2010	05/30/2014	2	1,872
Albania	ALB	914	11/01/2010	05/30/2014	1	935
Georgia	GEO	915	10/06/2010	05/30/2014	3	2,036
Kazakhstan	KAZ	916	12/11/1996	11/10/2006	5	5,263
Bulgaria	BGR	918	04/10/2002	01/15/2014	2	6,142
Russian Federation	RUS	922	11/22/1996	05/30/2014	25	33,363
People's Republic of China	PRC	924	07/05/1996	05/21/2010	4	6,762
Ukraine	UKR	926	11/20/2001	05/30/2014	32	27,699
Latvia	LVA	941	06/16/2011	05/30/2014	6	3,496
Hungary	HUN	944	02/03/2005	05/30/2014	7	5,963
Lithuania	LTU	946	10/15/2009	05/30/2014	9	8,194
Mongolia	MNG	948	12/05/2012	05/30/2014	4	1,552
Croatia	HRV	960	02/12/1997	05/30/2014	13	9,093
Slovenia	SVN	961	07/25/1996	05/30/2014	11	3,284
Poland	POL	964	06/30/1995	05/30/2014	10	13,331
Serbia	SRB	965	07/15/2013	05/30/2014	6	1,178
Romania	ROU	968	02/07/2012	05/30/2014	6	2,056

Note: No. of bonds = 1,278; No. of countries = 78; Obs. = 1,474,612. Bonds in default are excluded.