U.S Monetary Policy and Foreign Bond Yields

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Abstract

This paper compares the effects of conventional U.S. monetary policy on foreign government bonds yields with those of the unconventional measures employed after the target federal funds rate hit the zero lower bound in late 2008. We measure the U.S. monetary policy surprises using narrow-window changes in the 2-year Treasury yield bracketing FOMC announcements. The results indicate that an expansionary U.S. monetary policy steepens the foreign yield curve—denominated in local currency—during conventional period and flattens the foreign yield curve during unconventional period. The passthrough of unconventional U.S. monetary policy is, on balance, roughly comparable to that of conventional policy. We also find that a conventional U.S. monetary policy easing leads to a significant narrowing of credit spreads on dollar-denominated sovereign bonds 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 Treasury securities.

JEL Classification: E4, E5, F3
Keywords: conventional and unconventional U.S. monetary policy; sovereign yields and credit spreads; spillovers

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1 Introduction

Late 2008 marks a watershed moment in the history of U.S. monetary policy. On November 25 at 8:15 a.m. EST—outside its regular meeting schedule—the Federal Open Market Committee (FOMC) announced that it will 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 is 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 soon engulfed the global economy.

The effects of these unconventional monetary policy actions—on both the real economy and financial asset prices—soon became one of the hottest area of research in macroeconomics. In this paper, we ask whether the Federal Reserve's unconventional monetary policy actions had much impact on asset markets beyond U.S. borders, especially on foreign bond yields and sovereign credit spreads. A considerable body of previous research has documented the extent of spillovers in the international bond market resulting from U.S. monetary policy (see Bredin, Hyde, and O'Reilly, 2010; Hausman and Wongswan, 2011; Ehrmann, Fratzscher, and Rigabon, 2011). To date, however, there is relatively empirical little evidence on how the strength and scope of these spillover effects differ across conventional and unconventional policy regimes. Our aim is to systematically quantify differences—if any—in the transmission of U.S. monetary policy to international bond market between these two policy regimes.

To compare the transmission of conventional and unconventional policy measures to international bond market, we follow Hanson and Stein (2012) and Gertler and Karadi (2013) and use changes in the 2-year nominal Treasury yield on policy announcement days as a common instrument across the two policy regimes. In contrast to the above two papers, we rely on the *intraday* changes in the 2-year Treasury yield within a narrow window surrounding FOMC and other policy announcements to identify unanticipated U.S. policy actions.[1] Implicit in this approach is the identifying assumption that movements in shorter-term Treasury yields in a narrow window bracketing policy announcements are due primarily to the unanticipated changes in the stance of U.S. 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, as well as a number of Large-Scale Asset Purchase programs (LSAPs), the primary goal of which was to influence longer-term yields on Treasury and MBS securities through direct purchases of those assets. These policy actions were introduced to the public via announcements, either following the regularly-scheduled

[1] Hanson and Stein (2012) and Gertler and Karadi (2013) use daily changes in the 2-year 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 2-year Treasury yield, even on a policy announcement day, may not reflect solely changes in the stance of monetary policy, but also the endogenous response of policy to changes in the economic outlook or other common shocks.

FOMC meetings or in special announcements outside the regular FOMC schedule. To gauge 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.

The 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 U.S. monetary policy. As alluded to earlier and discussed more fully below, we consider three distinct U.S. monetary policy regimes: the conventional policy regime; the unconventional policy regime; and a subset of the unconventional regime that excludes FOMC announcements that were most closely associated with the Fed'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 U.S. 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, U.S. unconventional monetary policy operates primarily through the long end of the yield curve. That is, 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 those countries react significantly to U.S. monetary policy surprises during the unconventional policy regime. That said, the degree of passthrough is, on balance, roughly similar to that estimated for the conventional policy regime.

Conventional U.S. monetary policy appears to have relatively little systematic effect on yields on sovereign securities—denominated in local currencies—issued by our set of emerging market economies. In some sense that is not too surprising, as many of these countries actively manage their exchange rates and can intervene in foreign exchange markets to offset U.S. policy-induced movements in their benchmark interest rates. Interestingly, however, our results indicate that U.S. 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 U.S. monetary policy to international bond market, our second set of empirical exercises focuses on sovereign debt denominated is U.S. dollars. Specifically, from Thompson Reuters Datastream, we obtained daily secondary market prices of dollar-denominated sovereign bonds issued by nearly 80 countries, both emerging market and advanced foreign 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. As a result, we are able to quantify how the effects of U.S. monetary policy on sovereign bond yields (and 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," a problem common to the standard sovereign credit spread indexes, such as the EMBI or EMBI+.

The results from this set of exercises show that conventional U.S. 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; sovereign credit spread for investment-grade countries, by contrast, are left unchanged—that is, sovereign bond yields for low-risk countries are estimated to decline about as much as the yields on comparable-maturity U.S. 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 U.S. 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 U.S. Treasuries. Interestingly, our results indicate that the passthrough of unconventional U.S. monetary policy to sovereign bond yields for investment-grade countries is essentially one-to-one—the same as during the conventional policy regime. Thus, 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 is part of a rapidly growing effort that tries to quantify empirically the effects of unconventional policy measures on financial asset prices. To date, much of this research has focused on the question of whether purchases of large quantities of Treasuries and MBS by the Federal Reserve and various forms of forward guidance have lowered longer-term U.S. benchmark yields and the associated private interest rates.[2] Recent work by Rogers, Scotti, and Wright (2014), by contrast, compares the efficacy of unconventional policy measures employed by the Bank of England, European Central Bank, and the Bank of Japan.

To gauge the impact of LSAPs beyond U.S. borders, Neely (2010) employs an event-style methodology and finds that these unconventional policy actions substantially lowered the foreign exchange value of the U.S. dollar and reduced longer-term yields yields for a small sample of advanced foreign economies; Chen, Filardo, He, and Zhu (2012) report similar results for emerging market economies. In a follow-up paper, Bauer and Neely (2012) use dynamic term structure models to parse out the extent to 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, Lo Duca, and Straub (2013), who

[2]See, for example, Gagnon, Raskin, Remache, and Sack (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), D'Amico, English, López Salido, and Nelson (2012), Hanson and Stein (2012), Justiniano, Evans, Campbell, and Fisher (2012), Wright (2012), D'Amico and King (2013), Gilchrist and Zakrajšek (2013), Li and Wei (2013), Bauer and Rudebusch (2013), Nakamura and Steinsson (2013), and Gilchrist, López-Salido, and Zakrajšek (2014). Although 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.

systematically analyze the global spillovers of the Federal Reserve's asset purchase programs on a broad array of financial asset prices; their results show that these unconventional policy measures induced a significant portfolio reallocation among investors and led to 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 that compare the effects of U.S. 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 U.S. 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 used to estimate the impact of U.S. monetary policy on international bond market 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.

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

As discusses in detail by Gilchrist, López-Salido, and Zakrajšek (2014), 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.[3] According to our chronology, the last 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 50 basis points, to 1 percent.

[3]As is customary, we excluded from the sample the announcement made on September 17, 2001, which was made when trading on major stock exchanges 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, 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 the requisite times from the Office of the Secretary of the Federal Reserve Board.

Standard characterization of changes in the stance of conventional U.S. monetary policy generally relies on a single factor—the "target" surprise or the unanticipated component of the change in the current federal funds rate target (see Cook and Hahn, 1989; Kuttner, 2001; Cochrane and Piazzesi, 2002; Bernanke and Kuttner, 2005). However, as shown by Gürkaynak, Sack, and Swanson (2005), this characterization is incomplete, and another factor—changes in the future policy rates that are independent of the current target rate—is needed to fully capture the effect of conventional monetary policy on financial asset prices. This second factor, 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 U.S. monetary policy, we follow Hanson and Stein (2012) and Gertler and Karadi (2013) and assume that the change in the 2-year nominal Treasury yield over a narrow window bracketing an FOMC announcement captures both aspects of U.S. monetary policy. Under this assumption, the effect of unanticipated changes in the stance of U.S. monetary policy on foreign interest rates can be inferred from

$$\Delta_h y_{i,t+h-1}(m) = \beta_i m_t^{US} + \epsilon_{i,t+h-1}, \tag{1}$$

where $\Delta_h y_{i,t+h-1}$ 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 m-year sovereign bond of country i; m_t^{US} is the *intraday* change in the (on-the-run) 2-year nominal Treasury yield over a narrow-window surrounding an FOMC announcement; and ϵ_t is a stochastic disturbance capturing the information that possibly was released earlier in the day as well as noise from other financial market developments that took place through day $t+h-1$.

For the conventional U.S. policy regime, we measure the unanticipated changes in the stance of monetary policy m_t^{US} using a *30-minute* window surrounding FOMC announcements (10 minutes before to 20 minutes after). The unconventional policy regime, however, 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 are trying to capture the information content of announcements that reflects the market participants' interpretation of 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 2-year Treasury yield. The use of a 60-minute window to calculate the policy surprise m_t^{US} during this period should allow the market a sufficient amount of time to digest the news contained in announcements associated with unconventional policy measures. And 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, which excludes the 12 announcements most closely identified with the asset purchase programs (see Table 1 for details).

Table 1: LSAP-Related Unconventional Monetary Policy Actions

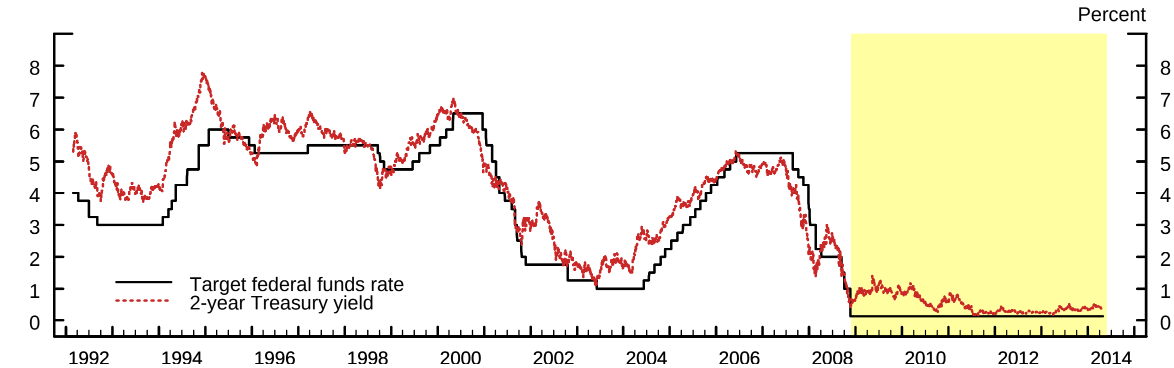
Date	Time[a]	FOMC[b]	Highlights
11/25/2008	08:15	N	Announcement that starts LSAP-I.
12/01/2008	08:15	N	Announcement indicating potential purchases of Treasury securities
12/16/2008	14:20	Y	Target federal funds is lowered to its effective lower bound; statement indicating that the Federal Reserve is considering 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.

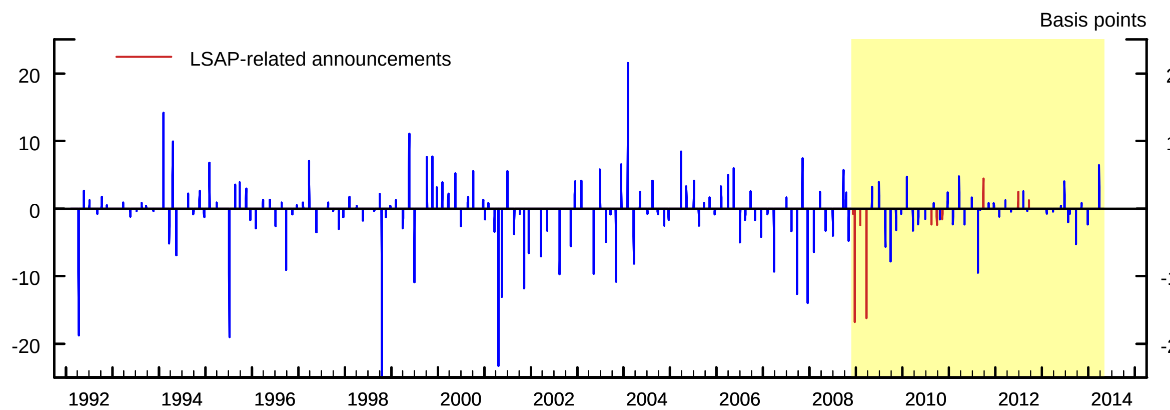
The top panel of Figure 1 shows the path of the target federal funds rate and the 2-year Treasury yield over the entire sample period. Clearly, our sample period is marked by substantial variation in shorter-term interest rates and contains a number of distinct phases of U.S. monetary policy: The 1994–95 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 2003–04 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 2007–09 financial crisis; and the period when the federal funds rate was stuck at the zero lower bound.

The bottom panel depicts the sequence of monetary policy surprises—that is, the m_t^{US}'s—associated with the FOMC's actions during this period. During the conventional policy regime, the 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. Implicit in this approach is the assumption that movements in the 2-year Treasury yield in narrow windows bracketing FOMC announcements are due entirely to the

Figure 1: The Stance of U.S. 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 2-year Treasury yield. Panel (b) depicts unanticipated changes in the stance of monetary policy, as measured by the narrow-window changes in the 2-year Treasury yield bracketing FOMC announcements (see the text for details). The shaded region represents the unconventional monetary policy regime.

unanticipated changes in the stance of U.S. 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 β_i (for a fixed i) from equation (1) across different policy regimes is complicated by the fact that the effect of U.S. monetary surprises on U.S. 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 α_i from the following regression:

$$\Delta_h y_{i,t+h-1}(m) = \alpha_i \Delta_h y^{US}_{i,t+h-1}(m) + \epsilon_{i,t+h-1}, \tag{2}$$

where $\Delta_h y^{US}_{i,t+h-1}$ 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 m-year U.S. Treasury security. Given our identifying assumptions, a consistent estimate of the passthrough effect can be obtained via an IV regression, where $\Delta_h y^{US}_{i,t+h-1}$ is instrumented with the policy surprise m^{US}_t.

3 U.S. Monetary Policy and Local Currency Sovereign Yields

In this section, we analyze the effects of U.S. 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 United Kingdom, while the latter set consists of Brazil, India, Korea, Mexico, Singapore, and Thailand. The selection of the countries is based on the data availability, particularly the coverage of the local currency denominated government bond yields during the conventional monetary policy regime. In all specifications, we set h, the number of days used to calculate the change in foreign bond yields, equal to 2, a choice reflecting the timing of the daily data on foreign interest rates.

3.1 Advanced Foreign Economies

The effects of U.S. 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 2-year U.S. 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 2-year government bonds issued by AFEs—the exception to this pattern are Switzerland, Japan, and Sweden, where the response coefficients to U.S. monetary shocks are statistically indistinguishable from zero.

During the conventional policy regime, the largest effect of U.S. monetary policy actions on foreign shorter-term interest rates is in Canada, followed by the responses of Australian and U.K. yields. During the unconventional policy regime (column labeled "Unconventional"), by contrast, the U.S. monetary policy surprises have an effect on 2-year yields in only Australia, France, and United Kingdom. Shorter-term interest rates for the other AFEs do not respond to the U.S. 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 U.S. monetary policy shocks.

Table 3 presents the same analysis for longer-term foreign interest rates. During the conventional 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 2-year U.S. 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 Ta-

Table 2: The Effect of U.S. Monetary Policy on Shorter-Term Foreign Interest Rates
(*2-year Government Bond Yields for Selected Advanced Foreign Economies*)

	U.S. Monetary Policy Regime		
Dependent Variables (2-day changes)	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 $\Delta_2 y_{t+1}(2)$, a 2-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 2-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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).

ble 2, these estimates indicate that an easing of U.S. monetary policy during the conventional period leads to a broad-based decline in foreign interest rates along the entire term structure (see Hausman and Wongswan, 2011). At the same time, the estimated response coefficients of the 10-year foreign bond yields are, on balance, somewhat smaller than those on their 2-year counterparts, indicating that a conventional U.S. 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 U.S. monetary policy surprises. Evidently, the unconventional U.S. 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

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

	U.S. Monetary Policy Regime		
Dependent Variables (2-day changes)	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 2-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 U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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).

unconventional U.S. monetary policy easing narrows the yield spread between long- and short-term nominal foreign interest rates, a finding consistent with those reported for the U.S. by Gilchrist, López-Salido, and Zakrajšek (2014). This effect persists even when we exclude the LSAP-related announcements from that period, though 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 U.S. monetary policy across the different policy regimes. These estimates quantify the extent to which U.S. policy-induced movements in the 2- and 10-year 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 2-year foreign bond yields range between 0.3 (France) and

Table 4: The Passthrough of U.S. Monetary Policy to Foreign Interest Rates
(*Selected Advanced Foreign Economies*)

	U.S. 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 $\Delta_2 y_{t+1}(2)$, a 2-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 2-year government bond yield for the specified country, while in columns labeled "10-year," the dependent variable is $\Delta_2 y_{t+1}(10)$, the corresponding change in the 10-year government bond yield. In columns labeled "2-year," the endogenous explanatory variable is the 2-day change in the 2-year Treasury yield, while in columns labeled "10-year," the endogenous explanatory variable is the 2-day change in the 10-year Treasury yield. The entries denote the 2SLS estimates of the country-specific passthrough coefficients, using a U.S. policy-induced surprises in the 2-year Treasury yield as an instrument. (see the text for details): AU = Australia; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR =France; IT = Italy; JP = Japan; SE =Sweden; and UK = United Kingdom. All specifications include a constant (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).

1.3 (Canada), the exceptions being Switzerland, Japan, and Sweden, countries for which the estimated conventional U.S. policy passthrough is economically and statistically indistinguishable from zero. Thus only Canada experiences a complete passthrough of conventional U.S. monetary policy at the short-end of the yield curve, a result reflecting close economic ties between the two countries.

The passthrough of conventional U.S. 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—though in most cases still significantly below one—than those for the 2-year yields. Moreover, the international transmission of U.S. monetary policy to longer-term foreign interest rates is, on average, fairly similar between the conventional and unconventional policy regimes. Clear exceptions to this patterns are Canada and United Kingdom, two countries for which 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, with the exception of 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 unconventional U.S. monetary policy actions that were not explicitly focused on the Fed's asset purchase programs.

3.2 Emerging Market Economies

We now consider the effect of U.S. monetary policy on government bond yields for selected emerging market economies (EMEs). As shown in Tables 5–6, the spillover effects from conventional U.S. monetary policy to EMEs are much less systematic. Focusing first on the shorter-term interest rates (Table 5), an unanticipated conventional U.S. policy easing that lowers the 2-year Treasury yield 10 basis points causes 2-year Mexican and Singaporean government bond yields to decline about 5 basis points; for the other EMEs in our sample, in contrast, the effect of a conventional U.S. policy shock is insignificant.

A similarly heterogeneous picture emerges for the U.S. monetary actions during the unconventional regime. In fact, Mexico is the only country where movement in shorter-term interest rates are in sync with the U.S. monetary policy in both the conventional and unconventional policy regimes, a result that highlights the tight link between the Mexican and U.S. economies as well as the Mexican exchange rate policy. However, most of the co-movement between the Mexican 2-year bond yield and U.S. policy actions appears to reflect the LSAP-related announcements. Brazil and Thailand are the other two countries whose shorter-term interest rates respond significantly to the unconventional U.S. monetary policy shocks.

As shown in Table 6, longer-term interest rates for all of the EMEs in our sample responded significantly to the unconventional U.S. 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 U.S. 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. As a result, limited liquidity in these markets might be biasing the response coefficients toward zero during the conventional policy regime. Aside from those concerns, our estimates imply that during the unconventional monetary policy regime, U.S. monetary policy announcements prompted

Table 5: The Effect of U.S. Monetary Policy on Shorter-Term Foreign Interest Rates
(*2-year Government Bond Yields for Selected Emerging Market Economies*)

	U.S. Monetary Policy Regime		
Dependent Variables (2-day changes)	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)
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 $\Delta_2 y_{t+1}(2)$, a 2-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 2-year government bond yield for the specified country. The entries denote the OLS estimates of the country-specific response coefficients to a U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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).

significant movements in longer-term interest rates across EMEs.

Table 7 shows the passthrough coefficients of U.S. 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 2-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 U.S. monetary policy onto local currency denominated government bond yields for EMEs is far more idiosyncratic, likely reflecting the shallowness of local currency government bond markets, shorter sample period, and the relatively inflexible exchange rate regimes for many of these countries.

4 U.S. 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 is U.S. dollars. To that purpose, we downloaded from Thompson Reuters Datastream

Table 6: The Effect of U.S. Monetary Policy on Longer-Term Foreign Interest Rates
(*10-year Government Bond Yields for Selected Emerging Market Economies*)

	U.S. Monetary Policy Regime		
Dependent Variables (2-day changes)	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 $\Delta_2 y_{t+1}(1)$, a 2-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 U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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).

daily secondary market prices of dollar-denominated sovereign bonds issued by nearly 80 countries (see Table A-1 in Appendix A for details). The micro-level aspect of our data allows us to construct credit spreads free of the "duration mismatch," a problem common to many of the standard credit spread indexes. We do so by constructing a synthetic Treasury security that exactly replicates the cash-flows of the corresponding sovereign debt instrument.

Formally, consider a dollar-denominated sovereign bond k (issued by country i) that at time t is promising a sequence of cash-flows denoted by $\{C(s) : s = 1, 2, \ldots, S\}$.[4] The price of this bond is given by

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

where $D(t) = e^{-r_t t}$ is the discount function in period t. To calculate the price of the corresponding synthetic Treasury security—denoted by $P_t^{US}[k]$—we discount the cash-flow sequence $\{C(s) : s = 1, 2, \ldots, S\}$ using continuously-compounded zero-coupon Treasury yields in period t, obtained from the U.S. Treasury yield curve estimated daily by Gürkaynak, Sack, and Wright

[4] 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 7: The Passthrough of U.S. Monetary Policy to Foreign Interest Rates
(*Selected Emerging Market Economies*)

	U.S. 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 $\Delta_2 y_{t+1}(2)$, a 2-day change (from day $t-1$ to day $t+1$) bracketing an FOMC announcement on day t in the 2-year government bond yield for the specified country, while in columns labeled "10-year," the dependent variable is $\Delta_2 y_{t+1}(10)$, the corresponding change in the 10-year government bond yield. In columns labeled "2-year," the endogenous explanatory variable is the 2-day change in the 2-year Treasury yield, while in columns labeled "10-year," the endogenous explanatory variable is the 2-day change in the 10-year Treasury yield. The entries denote the 2SLS estimates of the country-specific passthrough coefficients, using a U.S. policy-induced surprises in the 2-year Treasury yield as an instrument. (see the text for details): BR = Brazil; IN = India; KR = Korea; MX = Mexico; SG = Singapore; and TH = Thailand. All specifications include a constant (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).

(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 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 thus free of the bias that would occur were the spreads computed simply by matching the corporate yield to the estimated yield of a Treasury security of the same maturity.[5]

Table 8 contains summary statistics for the key characteristics of bonds in our sample. An average country in our sample has almost 17 sovereign bond issues outstanding at any point in time. This distribution, however, 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

[5] To ensure that our results are not driven by a small number of extreme observations, we eliminated all observations with credit spreads of less that −50 basis points and more than 3,000 basis points. In addition, we dropped from our sample 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.

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

Bond Characteristic	Mean	StdDev	Min	Median	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 for a list of countries included in the sample. All statistics are based on trimmed data (see the text for details).
[a] The par amount issued is deflated by the CPI (2005 = 100).

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. At "A1," however, 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 Treasury security, while the standard deviation of 270 basis points reflects the wide range of credit quality in our sample.

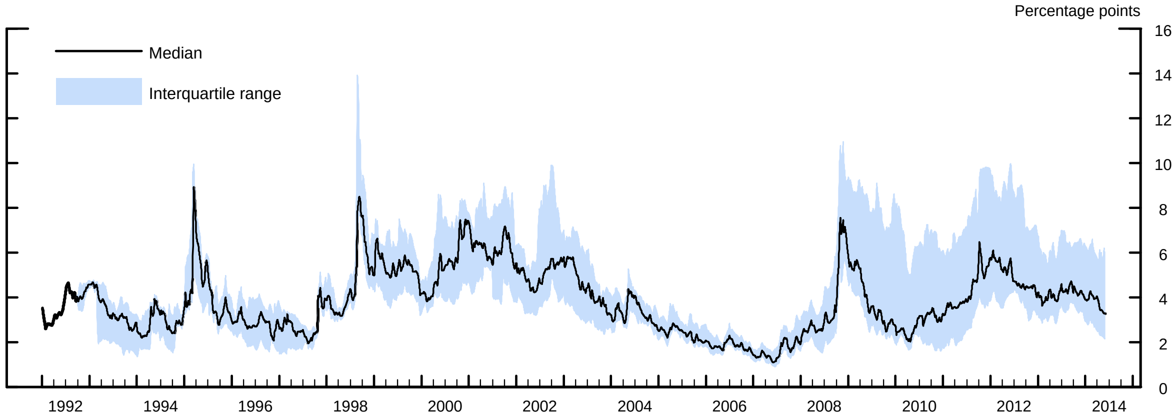
We exploit the cross-sectional heterogeneity of our data by constructing daily sovereign bond portfolios, conditional on whether issuing country has a speculative- or investment-grade sovereign credit rating in the previous day. By building sovereign bond portfolios from the "ground up," we can also construct portfolios of corresponding Treasury securities, again conditional on the sovereign's credit rating.[6] The difference between these portfolio yields provides a measure of the spread on the sovereign yield relative to the yield on U.S. Treasuries with matched payout characteristics. As shown in Figure 2, there is considerable cross-sectional and time-series variation in the sovereign bond portfolios in both credit rating categories.

4.2 Results

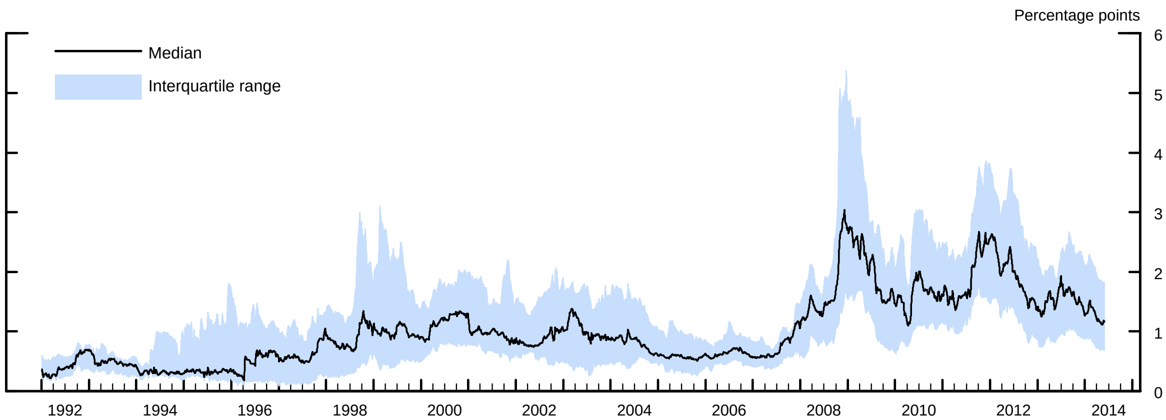
We begin by discussing the effect of a U.S. monetary policy surprise on sovereign yields and the yields for the matched U.S. Treasury portfolios. Specifically, we use OLS to estimate the following

[6] All portfolios are weighted by the market value of the underlying bond issues.

Figure 2: Sovereign Credit Spreads



(a) Speculative-grade sovereign credits



(b) Investment-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 a speculative-grade credit rating, while the shaded bands denotes the corresponding interquartile (P75 − P25) range. Panel (b) shows the same information for countries with an investment-grade sovereign rating.

system of equations:

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

where $\Delta_h y_{p,t+h-1}$ denotes an h-day change in the sovereign bond portfolio yield associated with credit quality $p = \text{SG}$ (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 U.S. Trasuries. The response of the sovereign credit spreads to U.S. monetary policy surprises may then be directly inferred from the difference in response between these two portfolio yields—that is, $\beta_p - \gamma_p$, for $p = \text{SG}$ and IG.

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

	U.S. Monetary Policy Regime		
Dependent Variables (2-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)
Treasury yield (SG)	0.506***	1.597***	1.246***
	(0.116)	(0.343)	(0.417)
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 $\Delta_2 y_{t+1}$, a 2-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 $t-1$. Treasury (SG/IG) corresponds to a 2-day change in the yield on the portfolio of synthetic 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 U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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 Treasury yields in the portfolio of comparable-maturity Treasuries in that category.

Table 9 documents the effect of an increase in the 2-year Treasury yield during the narrow window around a monetary policy announcement on the 2-day change in the sovereign bond yield and its matched U.S. Treasury equivalent, for both speculative- and investment-grade sovereign 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 2-year U.S. 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 Treasury yield for speculative-grade sovereign bonds increases by 0.506 percentage points over this 2-day period, while that of the investment-grade bonds rises by 0.693 percentage points.

The implied credit spread response, computed as the difference between these two numbers, is 0.471 percentage points for speculative-grade sovereign bonds and 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 significantly different from zero at the 5 percent level, while the response for investment-grade securities is not statistically indistinguishable from zero. Thus, during the conventional period, a U.S. monetary policy easing that causes a 1 percentage point reduction in the 2-year Treasury yield leads to a 50 basis point decline 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 U.S. monetary policy has a direct impact on global asset prices by reducing foreign investment-grade yields one-for-one with U.S. 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 2-day change of both sovereign and matched U.S Treasury yields to the U,S. monetary policy surprise. Consistent with our previous findings, the size of the response of both the sovereign yields and the yields on comparable U.S. Treasuries is substantially greater than what we obtain during the conventional period. During the unconventional regime, a U.S. monetary policy easing reduces longer-term yields by more than short-term yields. Hence, this finding reflects the fact that portfolios of Treasury securities with matched payout characteristics to speculative- and investment-grade sovereign bonds are of significantly longer duration than the 2-year (zero-coupon) Treasury note.

Taking the difference in response between the sovereign bond yields and the matched 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 U.S. 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 U.S. 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 results for the unconventional period that excludes the LSAP-related announcements. Excluding these announcements results in roughly similar responses of U.S. Treasury and investment-grade sovereign bond yields to U.S. 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 imprecisely estimated. As

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

	U.S. Monetary Policy Regime		
Dependent Variables (6-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)
Treasury yield (SG)	0.316**	1.852***	2.092***
	(0.144)	(0.234)	(0.479)
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 $\Delta_6 y_{t+5}$, a 6-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 $t-1$. Treasury (SG/IG) corresponds to a 6-day change in the yield on the portfolio of synthetic 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 U.S. policy-induced surprise in the 2-year Treasury yield (see the text for details). All specifications include a constant (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 Treasury yields in the portfolio of comparable-maturity Treasuries in that category.

a result, there is no evidence that U.S. monetary policy easing leads to a reduction in sovereign credit spreads during the unconventional period.

Given the potentially illiquid nature of sovereign bonds, and the delayed response of Treasury securities to the effects of monetary policy announcements, we now consider the effect of a U.S. monetary policy surprise on the 6-day change in the sovereign bond yields and their matched U.S. 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 6-day horizon (1.746) than at the 2-day horizon (0.977). The response of investment-grade sovereign yields, by contrast, 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 Treasury securities shows attenuation at the 6-day horizon relative to the 2-day horizon. As a result, the response of credit spreads to a U.S. monetary policy surprise becomes larger in absolute value and statistically significant for both speculative- and investment-grade sovereign bonds , when we allow for the longer horizon. A monetary policy-induced change of 1 percentage point in the 2-year Treasury yield now implies a 1.43 percentage point narrowing of credit spreads on speculative-grade sovereign bonds and a 0.270 percentage point decline in credit spreads on investment-grade bonds—note that both coefficients are statistically significant at the 1 percent level.

These findings likely 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 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 U.S. 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 U.S. interest rates to estimate the spillover effects of U.S. monetary policy to international bond markets. Our analysis, by contrast, highlights the advantage of using high-frequency data to more cleanly identify the unanticipated changes in the stance of U.S. monetary policy and 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 6-day horizon compared with the 2-day horizon. In contrast, there is a substantially greater response of U.S. Treasuries over the 6-day horizon relative to the 2-day horizon. The combination of these two forces again implies no statistically significant effect of a U.S. 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 statistically significant at the 5 percent level. Given the limited sample and large standard errors, we are reluctant to conclude from this evidence that U.S. monetary policy easing causes a widening of credit spreads on speculative-grade sovereign bonds. Nonetheless, these estimates reinforce the finding that U.S. 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 allow us to control directly 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:

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

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 bond characteristics.

Table 11 reports the estimated effects of monetary policy on both the 2- and 6-day changes 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 coefficients on the 2-day change in credit spreads for speculative-grade sovereign bonds falls from an estimated value of 0.47, when estimated at the portfolio level, to 0.22 when estimated using the micro data. Similarly, the coefficient estimate on the 6-day change in the response of speculative-grade credit spread falls from 1.43 to 0.757, but nonetheless remains highly statistically significant. In sum, the panel-data estimates do not change our conclusions regarding the lack of any impact of U.S. monetary policy on sovereign credit spreads during the unconventional period.

To provide a more insightful comparison in results across both the conventional and unconventional regime, we now compute the effective passthrough of U.S. monetary policy to sovereign bond yields and credit spreads. The passthrough measures by how much dollar-denominated sovereign yields respond to a monetary policy-induced change in U.S. Treasuries of comparable maturity. Note that this can 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 2-day changes in yields, 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 passthrough coefficients during the unconventional period are not different across the 2- and 6-day horizons, the estimated passthrough is substantially greater when we consider 6-day changes relative to the 2-day changes during the conventional period. The estimate coefficients across a 6-day change imply

Table 11: The Effect of U.S. Monetary Policy and Sovereign Credit Spreads
(*Investment- vs. Speculative-Grade Sovereign Credit Spreads*)

	U.S. Monetary Policy Regime		
Dependent Variables	Conventional[a]	Unconventional[b]	Non-LSAP[c]
2-day changes ($h = 2$)			
Credit spread (SG)	0.222	−0.372	−0.403
	(0.170)	(0.302)	(0.409)
Credit spread (IG)	−0.056	0.183	−0.109
	(0.066)	(0.298)	(0.267)
6-day changes ($h = 6$)			
Credit spread (SG)	0.757***	−0.292	−1.052**
	(0.255)	(0.284)	(0.428)
Credit spread (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 U.S. policy-induced surprise in the 2-year 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 included to control for liquidity of individual bond issues (see the text for details). All specifications include a constant (not reported). Robust asymptotic standard errors reported in parentheses are clustered in the i and t dimensions (see Cameron, Gelbach, and Miller, 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.

that a monetary policy-induced reduction in Treasury yields of 10 basis points leads to 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, U.S. monetary policy had an economically large and statistically significant effect on both sovereign bond yields and corresponding credit spreads. During the unconventional period, by contrast, U.S. 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 U.S. monetary policy on foreign government bond yields with those of the unconventional measures employed after the target federal funds rate hit the zero lower bound. We measure the U.S. monetary policy surprises using narrow-window changes in the 2-year Treasury yield around policy announcements. We find that during the conventional

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

	U.S. Monetary Policy Regime		
Dependent Variables	Conventional[a]	Unconventional[b]	Non-LSAP[c]
2-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
6-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 $\Delta_h y_{t+h-1}$, an 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 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 U.S. policy-induced surprise in the 2-year Treasury yield as an instrument (see the text for details). All specifications include a constant (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.

monetary policy regime, U.S. monetary policy has a significant effect on the shorter-term interest rates for advanced foreign countries, while during the unconventional policy regime, the U.S. monetary policy is more effective in moving the longer-term foreign interest rates. During the conventional policy regime, expansionary U.S. monetary policy steepens, on balance, the foreign yield curve—denominated in local currency— and flattens the foreign yield curve during 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 conduct the analysis on both the bond portfolios—sorted by the issuing country's sovereign credit rating—and the micro-level bond yields. Our results indicate that during the conventional U.S. monetary policy regime, the yields on speculative-grade sovereign bonds decline more than one-for-one in response to an unanticipated easing of U.S. monetary policy, implying a significant narrowing of sovereign credit spreads for riskier countries. During the unconventional policy regime, by contrast, the response of speculative-grade sovereign bond yields to U.S. monetary policy shocks is one-to-one.

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Appendices

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
South 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	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
Vietnam	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
Russia	RUS	922	11/22/1996	05/30/2014	25	33,363
China	CHN	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.