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1

SPILLOVER NOTES

SPILLOVER IMPLICATIONS

of Differences in Monetary Conditions in the United States and in the Euro Area

Carolina Osorio Buitron and Esteban Vesperoni

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Overview

Given the prospects of asynchronous monetary conditions in the United States and the euro area, this note analyzes spillovers between these two economies, as well as the implications of asynchronicity for spillovers to other advanced economies and emerging markets. Through a structural vector autoregression analysis, country-specific shocks to economic activity and monetary conditions since the early 1990s are identified. The empirical findings suggest that real and monetary conditions in the United States and the euro area have oftentimes been asynchronous. The results also point to significant spillovers among them, in particular since early 2014—with spillovers from the euro area to the United States being particularly large. Against the backdrop of asynchronous conditions in these two economies, spillovers from real and money shocks to emerging markets and nonsystemic advanced economies could be dampened.

1 Background and Main Findings

Different speeds of recovery in systemic economies have given place to increasingly divergent monetary conditions.[1] Monetary authorities in the United States have begun to withdraw unconventional monetary policy stimulus—with the Federal Reserve concluding its asset purchase program in late 2014. By contrast, the recovery has been more sluggish in Japan and the euro area, and inflation has been persistently low. Against this backdrop, the European Central Bank (ECB) launched an ambitious program of asset purchases in early 2015, and the Bank of Japan decided to continue its Quantitative and Qualitative Easing program. Over the last year, increasingly divergent monetary conditions in systemic economies have been associated with large adjustments in bilateral exchange rates—through an appreciation of the currencies of countries in which monetary conditions are tightening—and a generalized compression of bond yields, which has been associated with a collapse of the term premium. As prospects are for persistently asynchronous monetary conditions in the United States and the euro area—or Systemic Advanced Economies (SAEs)—further adjustments in exchange rates and bond yields are likely going forward.

Asynchronicity in monetary conditions may generate significant spillovers between the United States and the euro area and affect global financial conditions. For example, the liftoff plan in the United States may not only strengthen the dollar vis-à-vis the euro, but also push interest rates up in the euro area. Similarly, the implementation of Quantitative Easing (QE) in the euro area may not only weaken the euro vis-à-vis the dollar, but also put downward pressure on long-term yields in the United States In turn, these adjustments can affect domestic monetary policy strategies in all major central banks. Spillovers from these two economies will likely have important global effects, given their relatively large size and strong trade and financial linkages with other economies.

This note analyzes divergences in real and monetary conditions in the United States and the

[1] In this note, monetary conditions refer to the evolution of long-term yields—as opposed to short-term rates—which reflect conventional and unconventional monetary policy developments, exogenous shocks to the term premium, and inflation surprises, including in response to oil price shocks. So, changes in monetary conditions can reflect the dynamics of any of these factors at different times.

euro area, and the spillover implications for emerging markets and nonsystemic advanced economies (EMNS).[2] Building on the *2014 Spillover Report* (IMF 2014), a novelty of this note is the analysis of spillovers from asynchronicity between the United States and euro area—both in terms of growth and monetary conditions—as well as its impact on the bilateral exchange rate. Informed by this analysis, the note also assesses the implications of asynchronicity on spillovers to EMNS. Specifically, the paper aims at answering the following questions:

- How synchronous have real and monetary conditions in the United States and euro area been during tightening/loosening episodes since the mid-1990s, and what has been the behavior of the exchange rate? What have been the spillovers across the two economies?
- What can be expected in terms of spillovers on key EMNS variables during asynchronous monetary and/or real conditions among SAEs?

The main results of the analysis can be summarized as follows:

- *Real and monetary conditions between the United States and the euro area have oftentimes been asynchronous*. The analysis suggests, for example, that the easing cycle in 2001 showed synchronous real and monetary conditions. In contrast, the 2007 easing cycle and the adjustments following the taper talk in 2013 show asynchronous real and monetary conditions. There are also periods in which, despite asynchronous real conditions, monetary conditions tightened in both economies, owing largely to spillovers from the United States to the euro area (1994) or from the euro area to the United States (1999).
- *Over the last year, spillovers from the euro area to the United States have been large*.[3] Monetary policy action by the ECB—forward guidance, interest rate cuts, new long-term refinancing operations and asset-backed securities operations, and the asset purchase program—likely convinced markets that the authorities are launching forceful monetary easing. There was also a downward shift in the euro area's inflation expectations—which has been explained, in part, by a negative oil price shock. These developments are compressing yields not only in the euro area, but also in the United States Positive

[2] Focusing only in the United States and the euro area ensures tractability of the analysis, in particular to analyze synchronicity. What is more, the analysis could allow drawing broader lessons about synchronicity, as the recovery in the United Kingdom is similar to the one in the United States, and the one in Japan similar to the euro area.

[3] Other references for spillovers from the euro area to the United States are, for example, Ehrmann and Fratszcher (2005) and IMF (2015).

prospects for activity in the United States and a more sluggish recovery in the euro area have likely contributed to the dollar appreciation vis-à-vis the euro since 2014.

- *As in the 2014 Spillover Report (IMF 2014), the analysis suggests that spillovers to EMNS depend on the underlying drivers of the yield increase in SAEs.* In particular, higher yields associated with better economic prospects in SAEs have a positive impact on economic activity in other countries, while the opposite is true if higher SAE yields are related to monetary policy changes, changes in market perceptions that affect the term premium, or unanticipated changes in inflation expectations.
- *Spillovers to EMNS could be dampened in periods of asynchronicity.* Real shocks in SAEs—unanticipated improvements in economic prospects—have positive impacts on economic activity in other economies, while money shocks—unanticipated tightening of monetary conditions—have a negative impact. This is true regardless of whether shocks originate in the United States or the euro area. Hence, spillovers could be amplified in synchronous episodes and dampened in asynchronous ones.

2 Data and Methodology

The analytical approach aims at addressing three challenges. First, the analysis of synchronicity in real and monetary conditions in the United States and the euro area requires a consistent framework to jointly identify shocks in the two economies. Second, the model must encompass a broad definition of money shocks, as both the Federal Reserve and the ECB have engaged in unconventional monetary policy over the past several years, and the term premium seems to be increasingly reflecting changes in markets perceptions that are not always related to specific policy decisions by monetary authorities. And third, the estimation of spillovers to EMNS ought to tackle limitations owing to short time-series data in key emerging market variables.

To address the first challenge, a two-economy model is estimated, thus allowing for the identification of domestic shocks in the United States and the euro area as well as spillovers between these two economies.[4] To tackle the second challenge, changes in monetary conditions are defined as shocks to long-term yields, thereby capturing surprises due to exogenous shocks to the term premium and changes to the policy reaction function of central banks, which are relevant at the zero lower bound.[5] Finally, spillovers of identified SAE shocks on key EMNS variables are estimated through a panel vector autoregression (VAR). This framework allows for more degrees of freedom relative to country-by-country structural VARs, as (limited) economy-specific observations are pooled. As such, the estimates provide a sense of the average spillovers to EMNS.

The empirical analysis has two stages. In the first stage, we identify domestic real and money shocks in the United States and the euro area as well as spillovers between them; and in the second stage, we assess the dynamic effect of these shocks on key EMNS variables.

[4] In contrast, approaches that rely on the identification of money shocks on a country-by-country basis would not allow for the analysis of synchronicity and spillovers between systemic economies, as purely domestic shocks would not be well identified.

[5] Conversely, approaches that use narrow definitions of monetary policy—that is, based on the analysis of decisions on monetary policy rates—cannot address this challenge.

Framework to Assess Spillovers among Systemic Advanced Economies

The approach builds on Matheson and Stavrev (2014), who identify real and money shocks in a single economy. They assume that positive "money shocks" push sovereign yields up and depress stock prices (capturing an unanticipated tightening of monetary conditions), while positive "real shocks" increase both yields and stock prices (capturing an unanticipated improvement of economic prospects). We extend this framework in two dimensions:

- First, we control for autonomous risk-appetite shocks. Disentangling risk-appetite shocks and unanticipated improvements in economic prospects is important to define synchronicity in real conditions. Specifically, stock prices and bond yields are stripped out from risk-appetite shocks by estimating a bivariate VAR of each variable and the VIX.[6,7] We assume that the VIX impacts stock prices and yields contemporaneously, whereas these variables can only affect the VIX with a lag.[8] We then run historical decompositions and construct time series of each variable, excluding the contribution of structural risk-appetite shocks.[9] These "purged" time series are used in the next step.

[6] In general, there is agreement that the VIX, although an index of volatility in U.S. markets, captures developments that prompt global investors to search for safe haven assets (see Bekaert, Hoerova, and Lo Duca 2013). Since investors can move to safe assets in both Europe and the U.S., movements in the VIX can, in principle, impact yields in both economies.

[7] For the United States, we use the S&P 500 stock price index, and for the euro area stock prices and bond yields correspond to the purchasing power parity–GDP-weighted average of these variables in France, Germany, Italy, and Spain.

[8] The recursiveness assumption makes more sense for models estimated at a daily frequency. We purged the data using both daily and monthly time series, but the results did not change much qualitatively or quantitatively.

[9] Bekaert, Hoerova, and Lo Duca (2013) suggest that there is a two-way interaction between real and monetary developments and the VIX, which raises endogeneity issues in trying to disentangle movements in the VIX associated with "pure" risk-appetite shocks. The proposed methodology strips out the risk-appetite component associated with identified shocks to the VIX. However, the data still contain information on autonomous shocks to stock prices and bond yields that can affect the VIX.

- Second, a two-economy VAR is estimated to identify country-specific real and money shocks. The vector of endogenous variables is comprised of the purged time series of stock prices and bond yields for the United States and the euro area. Within each economy, real and money shocks are identified as in Matheson and Stavrev (2014). In addition, we assume positive cross-border spillovers within asset classes.[10] We do not impose restrictions on relations for which we do not have strong priors—that is, we are agnostic about the sign of cross-border, cross-asset spillovers (see table on the right). Notice that for each economy and for each shock, this framework can disentangle components associated with domestic developments and spillovers from the other economy. We also construct a metric to assess the degree of synchronicity of real and monetary conditions in the United States and euro area over the past 20 years. Through historical decompositions, we disentangle the contribution of structural country-specific real and money shocks to movements in United States and euro area yields. Synchronicity is defined as episodes in which domestic real (or money) shocks push yields in the two economies in the same direction, whereas in asynchronous periods domestic shocks push yields in opposite directions.

Shocks \ Variables *	U.S. stocks	U.S. 10yr yields	EA stocks	EA 10yr yields
Real U.S.	+	+	+	
Money U.S.	-	+		+
Real EA	+/= **		+	+
Money EA		+/= **	-	+

* Variables purged from risk-appetite shocks

** Restriction on lagged variable

The identification assumptions in the sign-restricted VARs can only bound the impulse response functions. That is, the econometric model is set-identified, as there is a set of models that satisfy the sign restrictions, each solving the structural identification problem, but a unique model cannot be identified, as it is unlikely that a unique parametrization would satisfy the sign restrictions. The methodology therefore achieves structural identification but not model

[10] Ehrmann, Fratzscher, and Rigobon (2011) impose similar restrictions to identify country-specific shocks. Given that the U.S. economy is bigger than the euro area, this sign restriction is assumed to be satisfied contemporaneously if shocks originate in the United States and with a lag if shocks originate in the euro area. If this restriction is imposed contemporaneously on shocks originated in both the United States and the euro area, the results presented in the next section remain broadly unchanged.

identification (Preston 1978).[11] To address this issue, we follow Fry and Pagan (2010) and choose the model whose impulse responses are closest to the median of a sample of 10,000 responses, each representing a random draw of the parametrizations that satisfy the sign restrictions. While the technique ensures that the impulse response function bounds are consistently estimated, the results should be seen as general guideposts for the size and direction of spillovers, and not as precise estimates. It should also be noted that while real shocks in the sign-restricted VAR capture unanticipated changes in economic prospects, money shocks are more complex. The latter include not only monetary policy actions, but also exogenous shocks to the term premium, inflation surprises—which may be associated to global developments, like oil price shocks—and unanticipated changes in inflation expectations.

Framework to Assess Spillovers to Nonsystemic Advanced Economies

The dynamic effects of the identified shocks in SAEs on key EMNS variables are estimated through a panel VAR. The vector of EMNS variables includes the local-currency 10-year sovereign bond yield, Emerging Portfolio Fund Research (EPFR) debt and equity net portfolio inflows (in percent of GDP), the annual change in industrial production, and the annual change of the U.S.–euro effective exchange rate, constructed as the trade-weighted average of the bilateral exchange rate vis-à-vis the U.S. dollar and the euro.[12] SAE shocks enter as exogenous variables and, since the shocks are orthogonal to each other, they are included separately in estimation. We also include the VIX, which can respond to SAE shocks. Therefore, although we do not analyze the spillover effects of autonomous risk-appetite shocks, changes in risk-appetite resulting from real or money shocks in SAE can have an impact on EMNS variables. Confidence bands for the impulse response functions are based on bootstrapped standard errors.

The (unbalanced) panel is estimated with monthly data from January 2000 to December 2014. The group of EMNS comprises 6 nonsystemic advanced economies (Australia, Canada, New

[11] The model identification issue is not specific to sign restricted VARs (Fry and Pagan 2010). For instance, if a recursive ordering is used to identify the model, many such orderings can have the same fit to the data.

[12] EPFR data track retail and institutional portfolio flows by country and asset type. The database covers some 11,000 equity funds and about 4,500 fixed-income funds, but the coverage for institutional investment flows is relatively small. Therefore, EPFR institutional portfolio flows may not be a good proxy for the entire universe of institutional investment flows.

Zealand, Norway, Sweden, Switzerland), 9 economies from central and eastern Europe (Bulgaria, Croatia, Czech Republic, Hungary, Israel, Poland, Romania, Slovak Republic, Turkey), 10 from Asia (China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, Singapore, Thailand), 3 from Latin America (Brazil, Colombia, Mexico), and South Africa.

We also examine whether spillovers to EMNS change with the degree of synchronicity among SAEs. To test differences in spillovers between synchronous and asynchronous states of the world, we interact each shock with a synchronicity index. The index is constructed for each shock (real and money) and each SAE, and measures how much domestic shocks are amplified (or dampened) by their spillover counterpart, while taking account of their joint impact on global interest rates. Specifically, the index is given by

$$I_t^x = \begin{cases} \left|c_t^{D,x}\right| + \left|c_t^{S,x}\right| & if \quad c_t^{D,x} / c_t^{S,x} > 0 \\ \left|c_t^{D,x}\right| - \left|c_t^{S,x}\right| & if \quad c_t^{D,x} / c_t^{S,x} < 0 \end{cases}$$

in which *x = {real U.S., money U.S., real EA, money EA}*, and $c_t^{D,x}$ and $c_t^{S,x}$ represent,

respectively, the contribution of the domestic (*D*) and spillover (*S*) components of *x* to the annual change in yields in *t*. Note that the index takes higher values if domestic shocks move in the same direction and have a significant impact on global interest rates. We then assess the relevance of the interaction effect by testing the statistical significance of the difference in impulse responses under low and high levels of synchronicity. The test statistic is computed by using the impulse responses of the bootstrapped draws. This exercise yields a distribution, which is used to compute a confidence band: the two impulse responses (under low and high synchronicity) are statistically different from each other if the confidence bands lie above (or below) zero.

3 Spillovers within Systemic Advanced Economies

Spillovers and Synchronicity

We analyze spillovers and synchronicity between the United States and euro area by looking at the contribution of the identified shocks to changes in the long-term yield of each economy. Since we can identify risk appetite shocks (a global factor) as well as real and money shocks associated with domestic developments and spillovers from the other economy, movements in SAE yields are decomposed into five factors. Panels 1 and 2 in Figure 1 show the contribution of the real, money, and risk-appetite shocks to changes in long-term yields in the United States and the euro area since May 2013. For each economy, panels 3 and 4 further separate real shocks into the domestic component and the spillover from the other economy. Similarly, panels 5 and 6 separate money shocks—which as explained above include monetary policy surprises, as well as shocks to the term premium, inflation, and inflation expectations—into their domestic and spillover components. As explained in the previous section, the analysis should be seen as general guideposts for the size and direction of spillovers.

The current juncture is characterized by significant spillovers between the United States and the euro area. The taper event tightened U.S. financial conditions sharply and had real and monetary spillovers to the euro area. While spillovers associated with positive surprises in economic activity in the United States have been persistent (light red in panel 4), spillovers from tightening monetary conditions began to fade after September 2013 following the "no taper" event (light blue in panel 6). The picture changed in 2014, showing somewhat larger contributions from higher risk-appetite to changes in yields, as well as large and increasing spillovers from the euro area to the United States, especially after the ECB adopted bold monetary policy easing in the second half of the year (Figure 1):

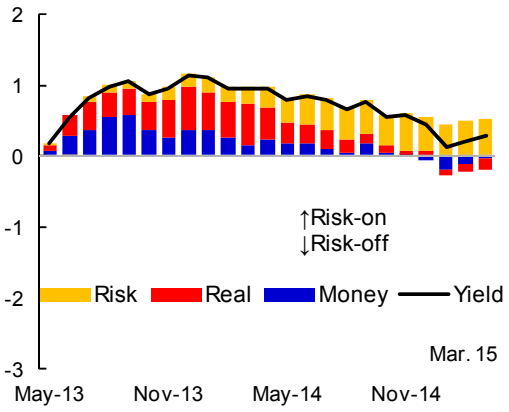
- Spillovers associated with positive prospects on economic activity in the United States became large in early 2014, and increased throughout the year (light red bars in panel 4, Figure 1). While there were negative growth surprises in the first quarter of 2014, these were relatively small and partially reversed during the second half of the year. In contrast, reflecting the surprisingly

Figure 1. United States and euro area 10-Year Yield Decomposition

(cumulative change)

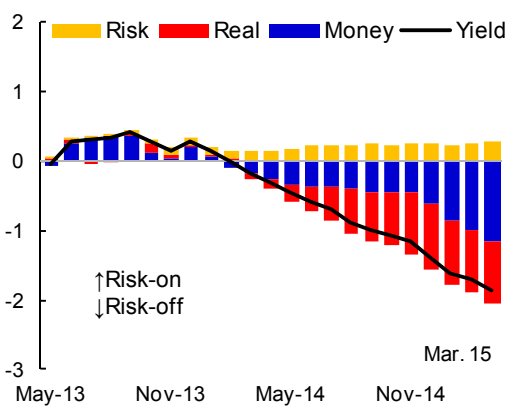
1. U.S. 10-Year Yield

(percent)



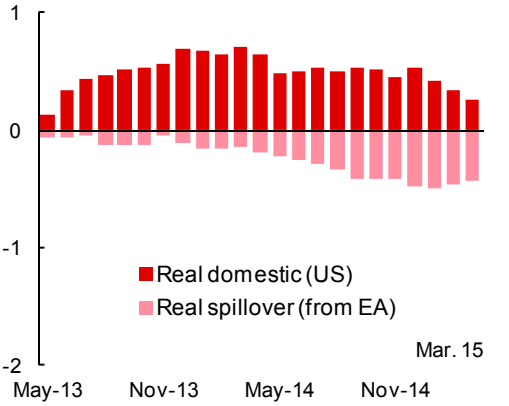
2. EA 10-Year Yield

(percent)



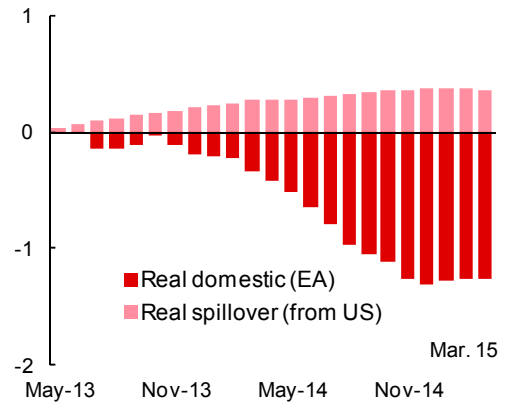
3. U.S. 10-Year Yield: Real Components

(percent)



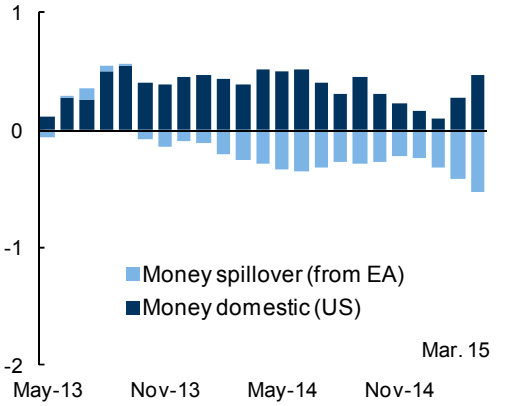
4. EA 10-Year Yield: Real Components

(percent)



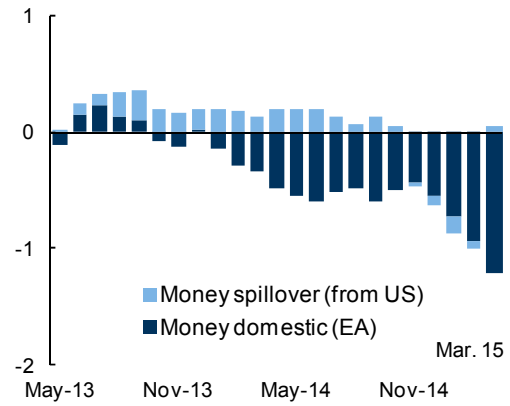
5. U.S. 10-Year Yield: Money Components

(percent)



6. EA 10-Year Yield: Money Components

(percent)

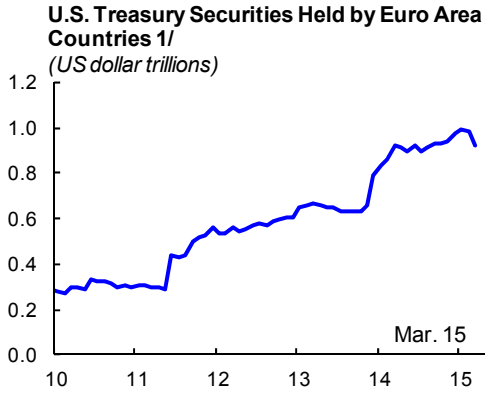


Source: Bloomberg L.P., and IMF staff estimates.
Note: U.S. = United States; EA=euro area.

weak U.S. growth figure in 2015:Q1, domestic real shocks pushed U.S. yields down significantly. Our framework suggests that these shocks have not had an impact on euro area yields yet, but they certainly may have had an impact on exchange rates (see below). In spite of these recent developments, the last couple of years have overall been characterized by positive news from the United States in terms of economic activity.[13]

- Since 2014, weak economic prospects in the euro area have had spillovers on the United States Over the last year, domestic real shocks have contributed significantly to the downward trend in euro area long-term yields (dark red bars in panel 4, Figure 1). Also, these shocks have had spillovers on the U.S. economy and have contributed to the downward trend in long-term yields in the United States since mid-2014 (light red bars in panel 3, Figure 1).

- Easier financial conditions in the euro area have had significant spillovers on the United States during the last year. Monetary policy action by the ECB—forward guidance, interest rate cuts, new long-term refinancing operations and asset-backed securities operations, and the asset purchase program— likely convinced markets that the authorities are launching forceful monetary easing. There was also a downward shift in the euro area's inflation expectations—which has been partly explained by a negative oil price shock. These developments are not only compressing yields in the euro area (dark blue bars in panel 6, Figure 1), but also in the United States, in part through increasing portfolio flows into the U.S. Treasury market (see chart on the right). Our framework identifies this phenomenon as a spillover from the euro area to the United States (light blue bars in panel 5, Figure 1). Meanwhile, the impact of the monetary tightening associated with the tapering faded out throughout 2014 (Figure 1, dark blue bars in panel 5 and light blue bars in panel 6).



Source: Haver Analytics.
1/ Euro area countries excluding Greece.

The contribution of domestic components of shocks to movements in yields—dark bars in panels 3 to 6 (Figure 1)—also suggests that real and monetary conditions have become increasingly asynchronous between the United States and the euro area since early 2014.

[13] The contribution of domestic real shocks to changes in the U.S. yields is in line with consensus forecasts revisions of U.S. growth.

Domestic real and money shocks in these two economies have driven yields in opposite directions. While the recovery in the United States has been gaining momentum and the Federal Reserve has hinted that the liftoff of the policy rate is approaching, growth prospects in the euro area have been deteriorating and the ECB has launched bold monetary policy accommodation. Against this backdrop, domestic money shocks put upward pressure on U.S. yields in the first quarter of 2015, reflecting a change in language at the Federal Reserve, which removed from its statement that interest rates would remain low "for a prolonged period of time" (in January) and that it would be "patient" in normalizing monetary policy (in March). In contrast, the ECB's announcement of a larger than expected QE program and its implementation put additional downward pressure from domestic money shocks on euro area yields. More recently, the negative pressure of domestic real shocks on euro area bond yields has stabilized, reflecting some green shoots in economic news, whereas the release of unexpectedly weak economic figures in the United States is reducing the positive contribution of domestic real shocks to U.S. yields.

The recent asynchronicity should not be surprising, as real and monetary conditions between the United States and the euro area have oftentimes been asynchronous during past monetary policy easing and tightening cycles. Based on the methodology described above, we document the drivers of movements in U.S. and euro area yields since 1994 and identify monetary policy cycles with different degrees of synchronicity (see table on the right). The analysis suggests, for example, that the easing cycle in 2001 showed synchronous real and monetary conditions in the United States and the euro area. In contrast, the 2007 easing cycle shows asynchronous real and monetary conditions. There are also a number of periods where, despite asynchronous real conditions, monetary conditions tightened in both economies, owing largely to spillovers from the United States to the euro area (1994) or from the euro area to the United States (1999). A more detailed discussion of these episodes is included in Appendix 1.

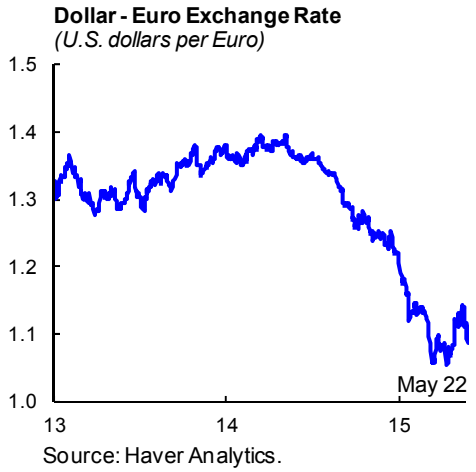
Synchronicity of Events

		Monetary Conditions	
		Synchronous	Asynchronous
Growth	Synchronous	1999 H2 2001	2010 H2
	Asynchronous	1994 1999 H1 2012 2013	2004 2007 2010 H1 2014

Source: IMF staff estimates.

Exchange Rate Implications

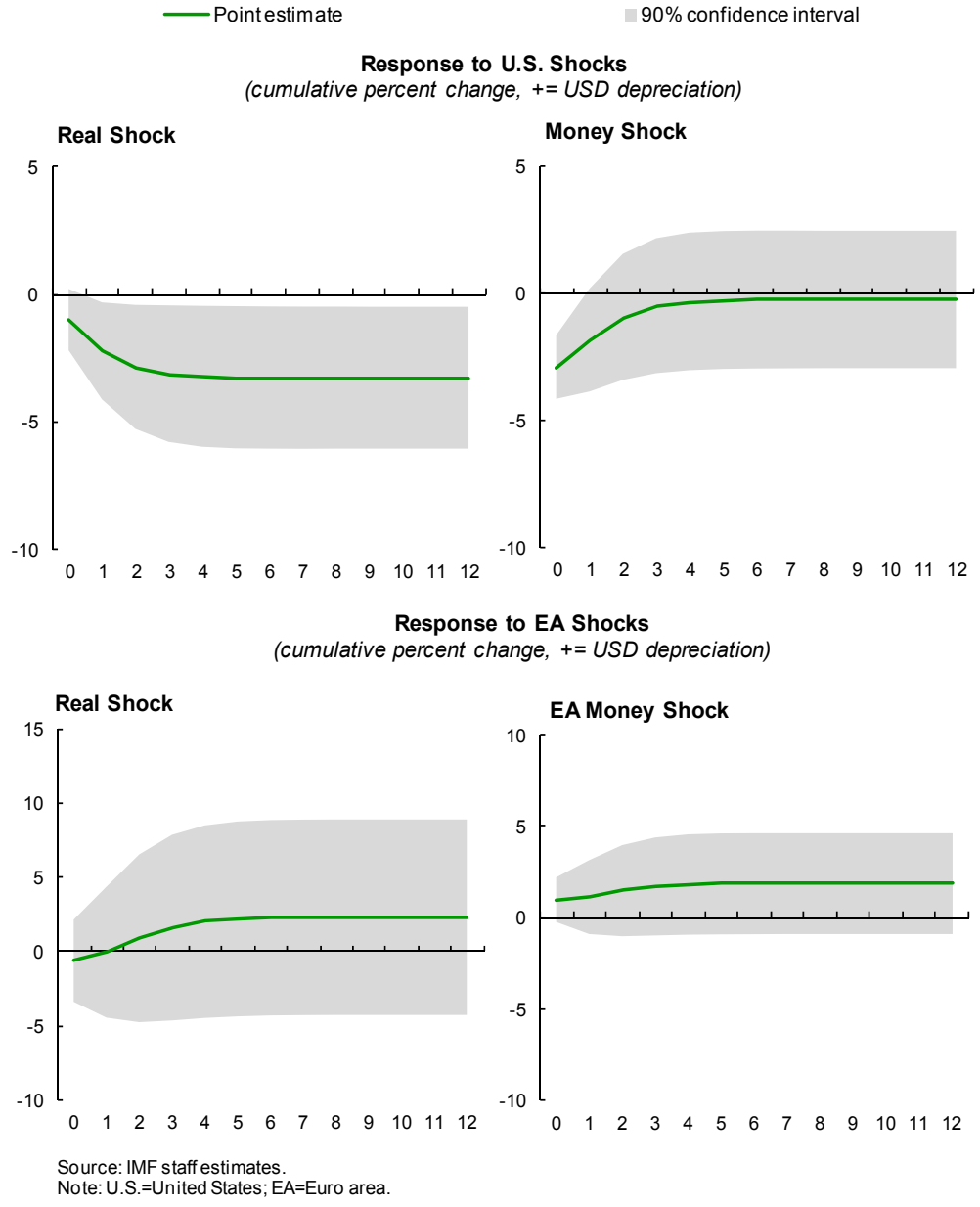
The constellation of shocks identified in our framework is consistent with the depreciation of the euro since early 2014. VAR analysis suggests that the shocks identified in the structural analysis have the expected impact on the bilateral U.S. dollar-euro exchange rate (Figure 2).[14] A domestic shock, normalized to raise yields by 100 bps, leads to a dollar appreciation of about 3 percent, which is permanent if the shock is real and temporary if the shock is monetary. On the other hand, a shock originating in the euro area that increases yields by 100 basis points (bps) is followed by a 2 percent appreciation of the euro if the shock is real and a 1 percent appreciation if the shock is monetary. While these estimates are statistically significant only for shocks originating in the United States—see Figure 2—they suggest that positive real shocks and tightening monetary conditions trigger an appreciation in the source country, in line with predictions of standard macroeconomic models. What does it imply for the series of shocks over the last year? The combination of positive real shocks in the United States and negative real shocks alongside loosening monetary conditions in the euro area point to a depreciation of the euro-U.S. dollar exchange rate, which is in line with developments in FX markets since early 2014 (see chart on the right).



[14] The effects of real and money shocks on the U.S. dollar-euro exchange rate are assessed with a simple VAR framework. The model is estimated at a monthly frequency. The vector of endogenous variables includes the monthly changes in the contribution of domestic real and money shocks to the yields of the two economies, the bilateral U.S. dollar-euro exchange rate, and the contribution of risk-appetite shocks to monthly changes in U.S. 10-year yields (the latter has a correlation of 0.97 with the contribution of risk-appetite shocks to changes in euro area yields, reflecting the global nature of the variable). The results are robust to using contributions of risk-appetite shocks to U.S. or euro area yields, as well as the VIX in first differences. The model is identified with exclusion restrictions in the matrix of contemporaneous coefficients. We assume that changes in yields driven by real and money shocks in the United States and euro area are independent from each other (consistent with the fact that the underlying shocks are orthogonal). We also assume that structural exchange rate shocks do not have a contemporaneous impact on the risk-appetite variable. The results are robust to identifying the shocks through a Choleski decomposition (using various recursive orderings).

Figure 2. Effects of United States and euro area Shocks on the U.S. Dollar–Euro Exchange Rate

(cumulative response to a shock that raises the 10-year yield in the source county by 100 bps)



Source: IMF staff estimates.
Note: U.S.=United States; EA=Euro area.

4 Spillovers to Emerging and Nonsystemic Advanced Economies

Consistent with the findings in the *2014 Spillover Report* (IMF 2014), our results suggest that spillovers to EMNS depend on the underlying drivers of the increase in SAE yields (Figure 3). An increase in either U.S. or euro area yields reflecting money shocks are followed by higher bond yields in EMNS, depressed economic activity, net portfolio outflows, and a depreciation of the currency. In contrast, an increase in U.S. or euro area yields due to better economic prospects (or a real shock) leads to higher yields and improved economic activity in EMNS. Moreover, the shock boosts investor risk-appetite, which causes capital to flow to EMNS and the currency to appreciate. However, if the model is restricted to prevent shocks in SAEs from affecting risk-appetite, then real shocks in the United States or euro area are followed by net portfolio outflows and currency depreciations in EMNS.[15]

The new result is that spillovers to EMNS could be dampened in periods of asynchronicity. Since our framework allows us to disentangle shocks originating in the United States and the euro area, we can compare their spillovers on recipient economies. This analysis suggests that the effects of money and real shocks are similar, regardless of whether they originate in the United States or the euro area (Figure 3). Further, the impulse responses and their confidence bands suggest that, in most cases, responses to shocks from these two economies are not statistically different from each other, at short horizons. Hence, spillovers to EMNS could be

[15] In other words, there are two relevant transmission channels. First, there is the "traditional channel", through which a growth shock in the U.S. (or euro area) induces capital to flow to the country in which the shock originates and causes an appreciation of the dollar (or the euro). Second, there is the "risk-appetite channel," through which a real shock boosts investor risk-appetite—which increases capital flows to EMNS and leads to an appreciation of their currencies—as investors envisage better global economic prospects owing to stronger growth in the U.S. and/or euro area. Our results suggest that the second effect dominates—likely reflecting the size of portfolio outflows from EMNS relative to outflows from SAEs.

amplified in synchronous episodes and dampened in asynchronous ones. This is, however, conditional on asynchronicity leading to relatively small movements in exchange rates, as large fluctuations may have adverse effects on EMNS balance sheets and economic activity.

At relatively long horizons, there are some differences in the spillover effects of U.S. and euro area money shocks, likely reflecting different transmission channels. Shocks originated in the euro area tend to have larger effects on EMNS portfolio flows, whereas U.S. shocks have a more significant impact on economic activity (Figure 3). While an analysis of transmission channels of spillovers is beyond the scope of this paper,[16] the results suggest that U.S. shocks have a particularly large impact on EMNS through trade links—that is, external demand—whereas for shocks originated in the euro area, financial links play a significant role in transmission. EMNS exchange rates seem to be more sensitive to U.S. shocks, likely reflecting the predominance of the U.S. dollar in international credit markets. In contrast, bond yields increase more in response to euro area shocks, possibly due to the intermediation role played by European global banks in international credit markets. These findings are consistent with Shin (2012), who describes how European global banks channel large quantities of dollar funds to Asian, Latin American, African, and Middle Eastern markets.[17]

Spillovers vary across regions, reflecting different economic links with the United States and euro area. While the impact of a U.S. real shock on economic activity is large across regions, the effect of a real shock in Europe is considerably larger in emerging Europe, owing to the stronger trade links of the region with the euro area. Real shocks in both the United States and euro area generate larger portfolio inflows to Asia than to other regions (Figure 4). This result is, in part, explained by the fact that the sample of Asian economies includes Hong Kong SAR and Singapore, two world financial hubs that experience much larger capital inflows than other EMNS. In addition, consistent with our results, Ahmed and Zlate (2014) find that even after excluding Singapore and Hong Kong SAR, increased risk-appetite plays a larger role in driving net inflows to Asia than to Latin America and eastern Europe.[18]

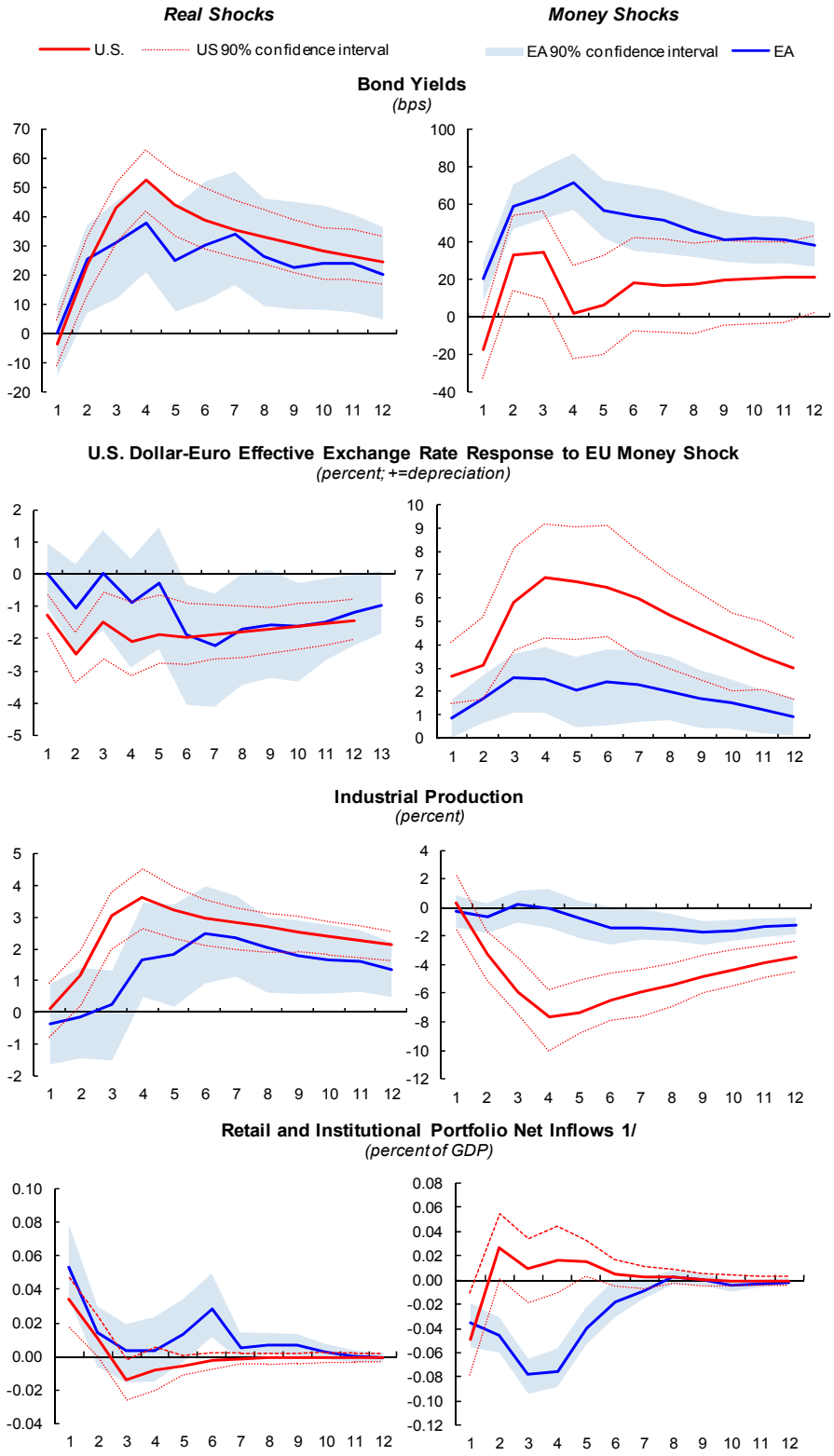
[16] For transmission channels of spillovers from monetary policy shocks, see Chen, Mancini-Griffoli, and Sahay (2014) and Chen, Mancini-Griffoli, and Saadi-Sedik (forthcoming).

[17] See also Rey (2013) and Cerutti, Claessens, and Ratnovski (2014).

[18] Recall that in our framework positive real shocks increase risk-appetite.

Figure 3. Spillovers to Nonsystemic Advanced Economies from Shocks in the U.S. and EA

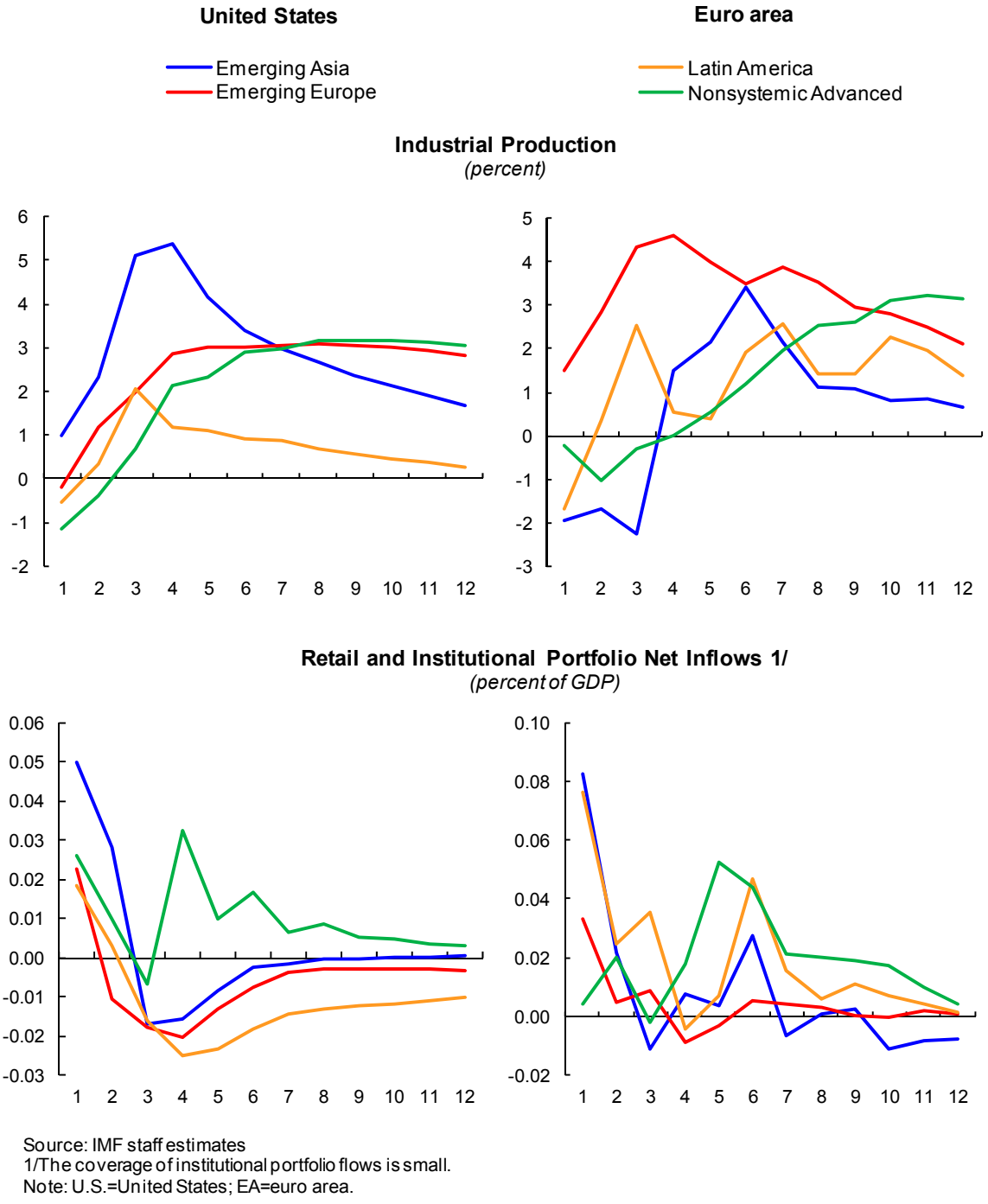
(response to a shock that raises the 10-year yield in the source country by 100 bps)



Source: IMF staff estimates.
1/ The coverage of institutional portfolio flows is small.
Note: U.S.=United States; EA=euro area

Figure 4. Spillovers from Real Shocks in the United States and euro area by Region

(response to a shock that raises the 10-year yield in the source country by 100 bps)



Source: IMF staff estimates

1/The coverage of institutional portfolio flows is small.

Note: U.S.=United States; EA=euro area.

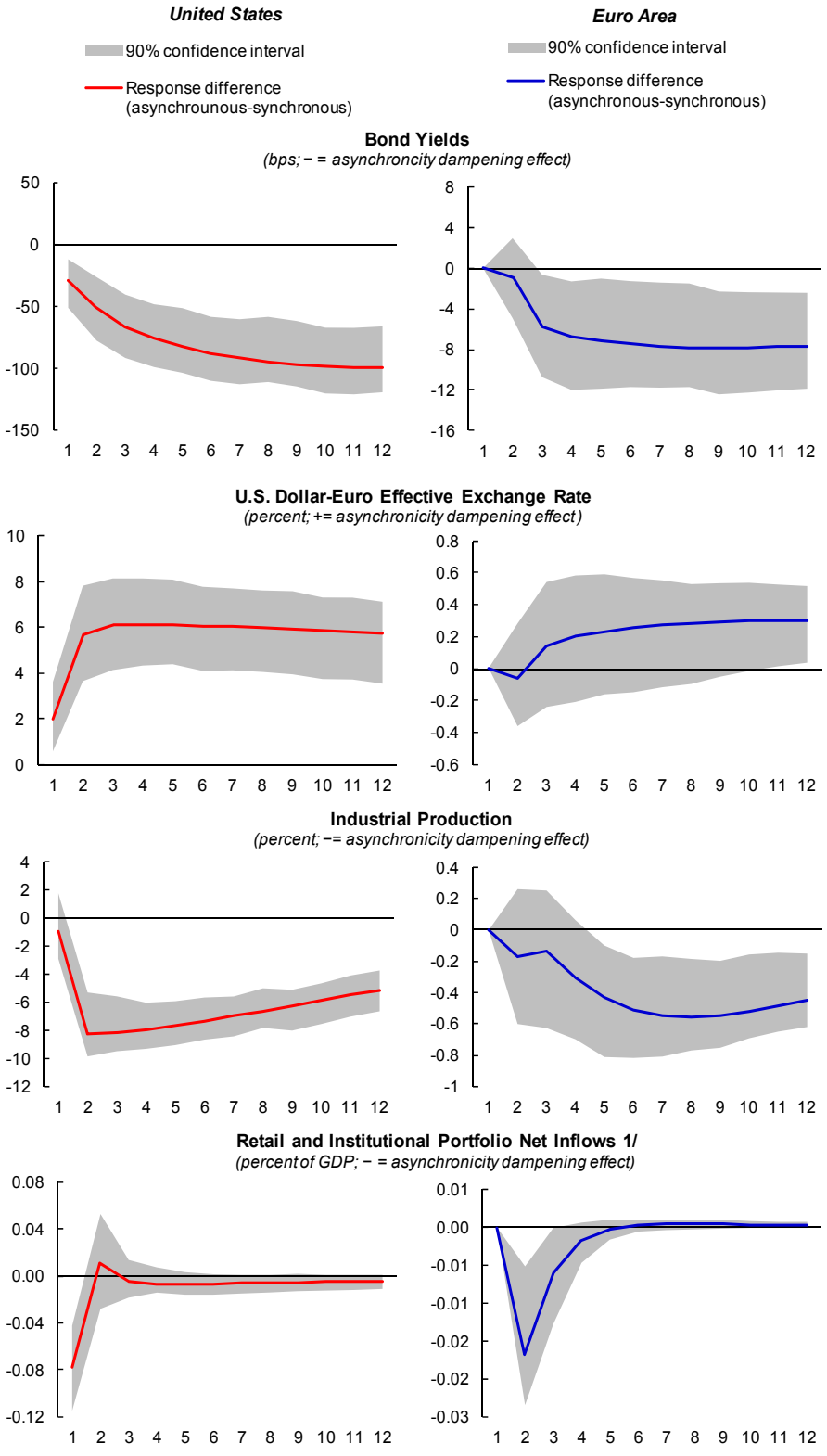
Testing the Dampening Effect of Asynchronicity

Following Towbin and Weber (2013), an interacted panel VAR is estimated to assess the effects of asynchronicity more rigorously. Each shock is interacted with a synchronicity index as described in Section 2. The index measures how much domestic shocks are amplified (or dampened) by their spillover counterpart, so the index takes higher (lower) values in synchronous (asynchronous) periods. Figures 5 and 6 display the distribution of the difference in impulse responses during asynchronous states of the world (in which the index takes the 10th percentile value) relative to synchronous ones (in which the index takes the 90th percentile value). Since we are looking at impulse responses at specific points of the synchronicity index distribution, the point estimate of the difference in impulse responses should be interpreted cautiously. If the response of a variable is positive (negative) and the difference in responses between asynchronous and synchronous states of the world is statistically smaller (greater) than zero, asynchronicity is likely to have a dampening effect on spillovers.

The results indicate that asynchronicity may dampen spillovers generated by real shocks in either the United States or the euro area (Figure 5). EMNS bond yields increase less and currency appreciation is less pronounced in the context of more modest portfolio inflows than in synchronous shocks. The positive spillovers on economic activity are also smaller during asynchronous episodes. In contrast, the evidence for money shocks is less clear cut (Figure 6): there is some evidence that bond yields increase by less during asynchronous states of the world; the negative spillovers from U.S. money shocks on economic activity seem to be dampened during asynchronous episodes; and, if the money shocks originate in the euro area, asynchronicity is likely to dampen the impact on portfolio flows, reducing outflows from EMNS.

Figure 5. Responses to Real Shocks: Difference between Low and High Synchronicity

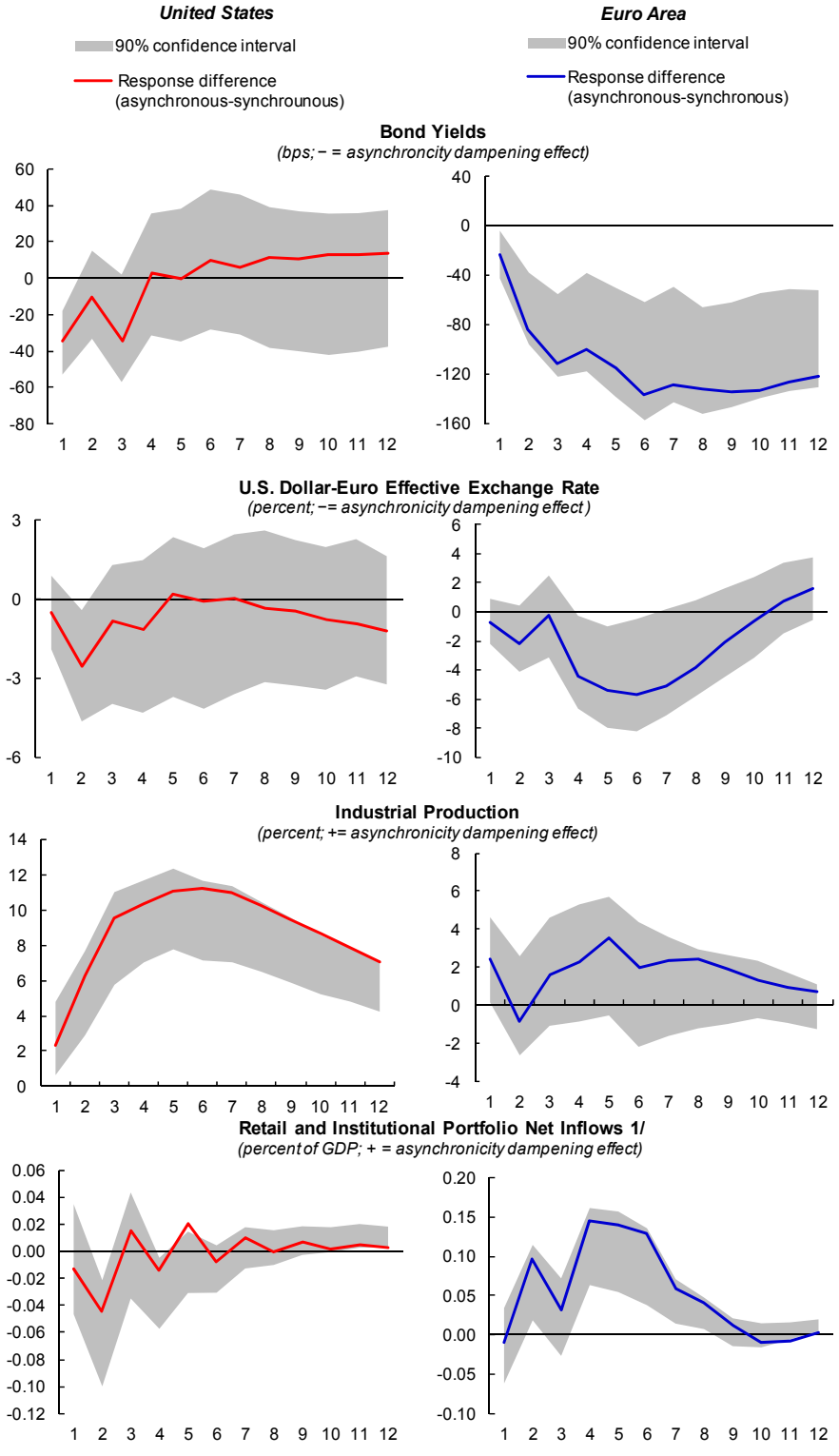
(difference in responses to a shock that raises yields in the source country by 100 bps)



Source: IMF staff estimates.
1/The coverage of institutional portfolio flows is small.

Figure 6. Responses to Money Shocks: Differences between Low and High Synchronicity

(difference in responses to a shock that raises yields in the source country by 100 bps)

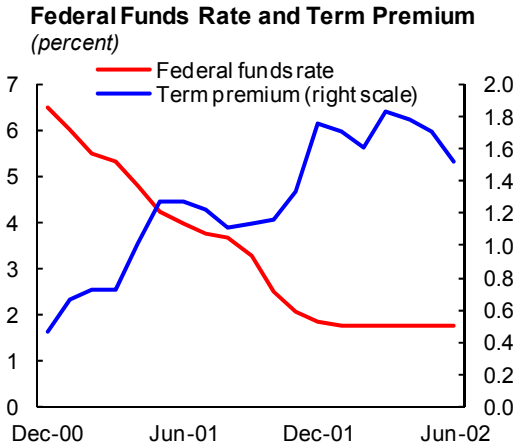


Source: IMF staff estimates.
1/The coverage of institutional portfolio flows is small.

Appendix 1: Spillovers and Synchronicity in the United States and the Euro Area: Developments During Selected Monetary Policy Cycles

The easing cycle in 2001–03 is an example of synchronous real and monetary conditions in the United States and the euro area:

- After years of rapid expansion, economic activity in the United States peaked in 2000:Q2, with annualized year-over-year growth reaching 5¼ percent. By end-2000, growth had collapsed to less than 3 percent, and the economy continued to decelerate in 2001, reaching a cyclical low toward the end of the year. The recovery was rather bumpy until mid-2003 but consolidated by early 2004. Despite the sharp deceleration in the second half of 2000, the Federal Reserve kept the policy rate constant until December and began a gradual easing in January 2001. The slow monetary easing and a surprising sharp increase in the term premium—from less than 0.4 percent in January 2001 to about 1.7 percent by the summer of 2002 (see chart on the right)—likely prevented monetary conditions to ease as warranted by cyclical developments (Figure A1.2, panels 1, 3, and 5). The downward pressure from domestic real shocks to U.S. yields point to negative surprises on economic activity throughout 2001 (dark red of panel 3, Figure A1.2)—with somewhat volatile perceptions, likely associated with volatility in underlying data, as noted above. The framework also captures the slow reaction by the Federal Reserve and the increase in the term premium as a positive contribution of money shocks to yields. 1



Source: Federal Reserve Board, and Kim and Wright (2005).

- The euro area economy had also experienced a rapid recovery starting in late 1998, with the economy peaking during the first quarter of 2001 (at an annualized year-over-year rate of 5½ percent). However, growth turned around in the second quarter and bottomed out in early 2002. Activity remained subdued until mid-2003, when a recovery began to take place. The ECB began a monetary easing cycle in early 2001, but it interrupted it in November of that year, keeping the policy interest rate constant for a year despite weak economic activity

(Figure A1.2, panels 2, 4, and 6). The negative contribution of domestic real shocks to euro area yields reflect persistent negative surprises on the economic outlook throughout 2001, which became larger during 2002 and early 2003. Panel 6 points to increasing upward pressure on yields from money shocks in late 2001, likely reflecting the interruption of monetary policy easing by the ECB. The positive contribution of domestic money shocks stabilized in late 2002, however, as the ECB resumed its loosening of monetary policy. This period was characterized by large spillovers from the United States to the euro area: money spillovers were large (light blue bars of panel 6, Figure A1.2), and real spillovers were smaller but significant (light red bars in panel 4, Figure A1.2). Spillovers from the euro area to the United States were more modest: considerable in size for real shocks (Figure A1.2, light red bars in panel 3) and negligible for money shocks (Figure A1.2, light blue bars in panel 5).

The easing cycle in 2007–09 is an example of asynchronous real and monetary conditions in the United States and the euro area:

- As the U.S. subprime crisis unraveled with larger-than-expected adverse effects on the real economy, domestic real shocks started to put downward pressure on U.S. 10-year yields (dark red bars in panel 3, Figure A1.3). The negative contribution of these shocks increased in the first quarter of 2008, as fears of a deeper-than-anticipated recession emerged, when the Federal Reserve provided an emergency loan to Bear Stearns to avert a sudden collapse of the company. In the second half of 2008, another wave of domestic real shocks in the United States started to drive yields down, this time reflecting negative growth surprises associated with the placement of Fannie Mae and Freddie Mac into conservatorship, the collapse of Lehman Brothers, and the bailout of AIG. Indeed, U.S. economic activity contracted sharply during this period, with average quarterly growth rates between 2007:Q3 and 2008:Q3 falling to virtually zero. The contribution of domestic U.S. money shocks was initially negative but very small, likely reflecting the fast and sharp easing of monetary policy stance at the onset of the crisis (dark blue bars in panel 5, Figure A1.3). However, toward the second half of 2008, domestic money surprises started to push U.S. 10-year yields up, possibly capturing the liquidity squeeze in financial markets around the collapse of Lehman Brothers, as well as market participants' misperceptions (or incomplete information) about the strategies authorities would follow toward stressed financial institutions.
- In 2007, growth held up relatively well in the euro area, as captured by the positive contribution of real domestic shocks to euro area yields (dark red bars in panel 4, Figure A1.3). However, output growth fell sharply in the second half of 2008, as the recession in the US generated negative growth spillovers to the euro area (light red bars in panel 4, Figure A1.3). Notwithstanding the deterioration in economic activity, the ECB kept its policy rate on hold through 2008:Q3. Market participants likely perceived the monetary policy stance as being "too tight" given the weak cyclical position, a phenomenon which our model captures

as a positive contribution to yields from domestic money shock (dark blue bars in positive territory of panel 6, Figure A1.3.). Subsequently, as the euro area economy fell into recession following the collapse of Lehman Brothers, the ECB started an easing cycle, cutting its policy rate aggressively by more than 400 bps between September 2008 and May 2009. These actions helped reduce euro area 10-year yields (dark blue bars in negative territory of panel 6, Figure A1.3.).

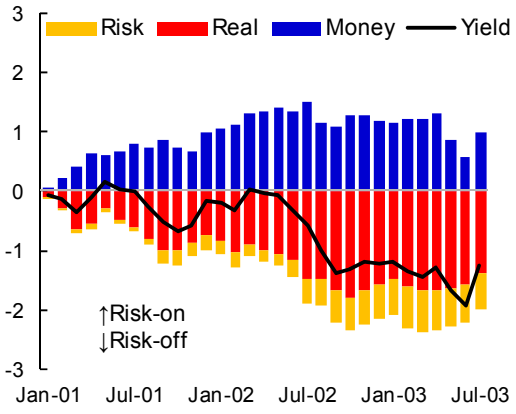
- Investor risk-aversion increased sharply with news about the vulnerabilities of large U.S. financial institutions (Bear Stearns, Lehman Brothers, etc.), pushing yields down ("risk-off") in both the United States and euro area (yellow bars in panels 1 and 2, Figure A1.3).
- This period was characterized by important real spillovers from the United States to the euro area, notably in the second half of 2008. In contrast, real spillovers from the euro area to the United States were small. As regards to money shocks, there were significant two-way spillovers between the two economies, which were mostly asynchronous. Therefore, external money shocks tended to dampen the effects of domestic ones on the economy's own yields.

Figure A1.2. U.S and EA 10-Year Yield Decomposition in the 2001 Federal Reserve Easing

(cumulative change)

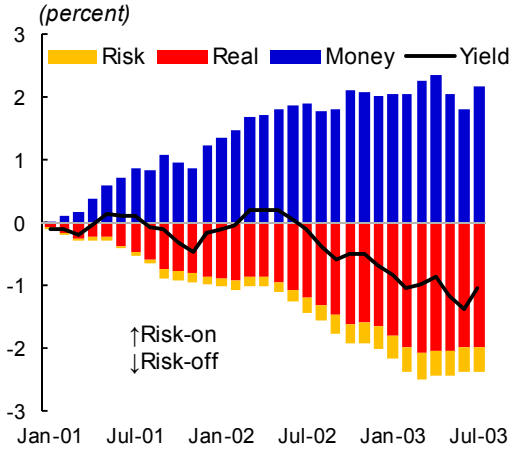
1. U.S. 10-Year Yield

(percent)



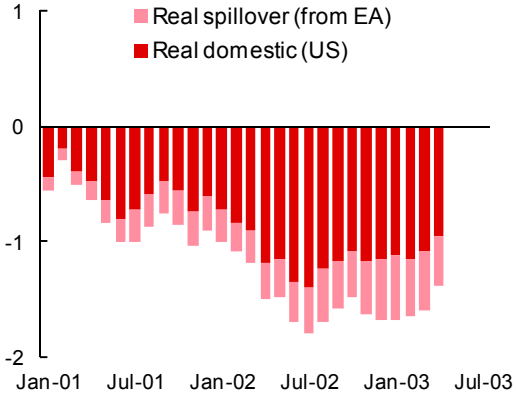
2. EA 10-Year Yield

(percent)



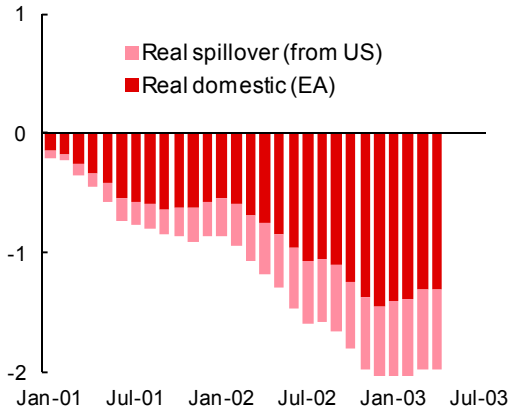
3. U.S. 10-Year Yield: Real Components

(percent)



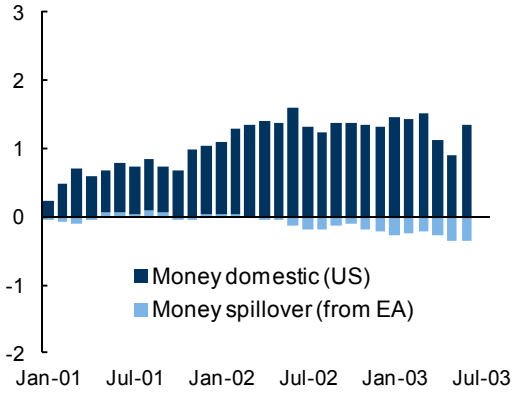
4. EA 10-Year Yield: Real Components

(percent)



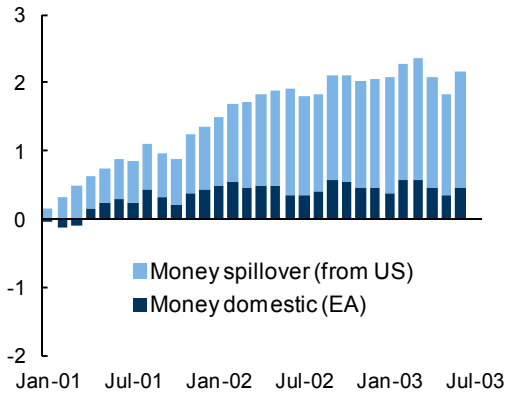
5. U.S. 10-Year Yield: Money Components

(percent)



6. EA 10-Year Yield: Money Components

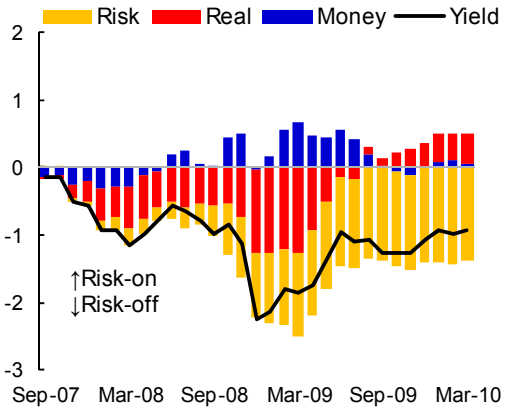
(percent)



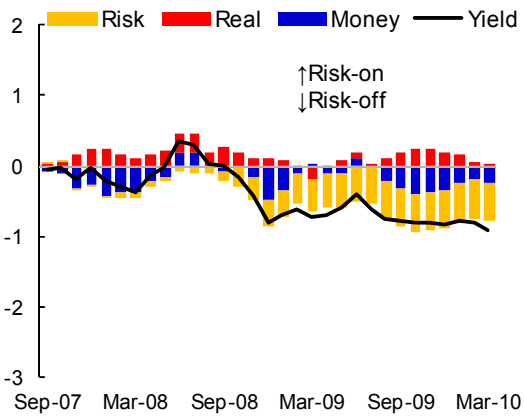
Sources: Bloomberg L.P.; and IMF staff estimates.
Note: U.S.=United States; EA=euro area.

Figure A1.3. United States and euro area 10-Year Yield Decomposition in the 2007 Federal Reserve Easing *(cumulative change)*

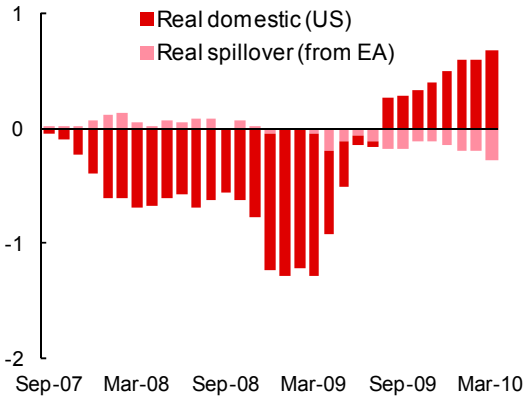
1. U.S. 10-Year Yield
(percent)



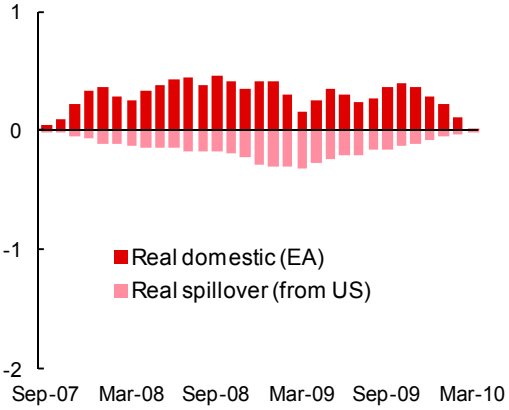
2. EA 10-Year Yield
(percent)



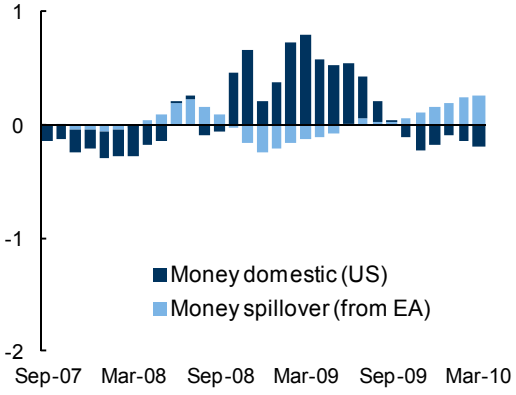
3. U.S. 10-Year Yield: Real Components
(percent)



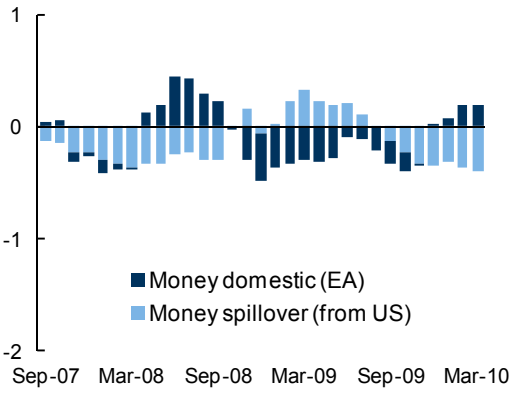
4. EA 10-Year Yield: Real Components
(percent)



5. U.S. 10-Year Yield: Money Components
(percent)



6. EA 10-Year Yield: Money Components
(percent)



Sources: Bloomberg L.P.; and IMF staff estimates.
Note: U.S.=United States; EA=euro area.

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