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Big Players Out of Synch: Spillovers Implications of US and Euro Area Shocks

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Big Players Out of Synch: Spillovers Implications of US and Euro Area Shocks

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Abstract

Given the prospects of asynchronous monetary conditions in the United States and the euro area, this paper analyzes spillovers among 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, and are used to draw implications about spillovers. 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 non-systemic advanced economies could be dampened.

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Contents

I. INTRODUCTION[2]

Different speeds of recovery in systemic economies have given place to increasingly divergent monetary conditions. Monetary authorities in the United States (U.S.) have begun to withdraw unconventional monetary policy stimulus—with the Federal Reserve concluding its asset purchase program in late 2014 and prospects for lift-off firming up. By contrast, the recovery has been more sluggish in Japan and the euro area (EA), 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 continued its Quantitative and Qualitative Easing program.

Asynchronicity in monetary conditions may generate spillovers between the U.S. and the EA, and affect global financial conditions. For example, the liftoff plan in the U.S. may not only strengthen the dollar vis-à-vis the euro, but also push interest rates up in the EA. Similarly, Quantitative Easing (QE) in the EA may not only weaken the euro vis-à-vis the dollar, but also put downward pressure on long-term yields in the U.S. In turn, these adjustments can affect domestic monetary policy strategies in major central banks. As prospects are for persistently asynchronous monetary conditions in the U.S. and the EA—or Systemic Advanced Economies (SAEs)—further adjustments in exchange rates and bond yields are likely going forward. Further, spillovers from these two economies will likely have important global effects, given their large size and strong trade and financial linkages with other economies.

This paper analyzes divergences in real and monetary conditions in the U.S. and the EA, and the spillover implications for emerging markets and non-systemic advanced economies (EMNS). To this end, we first assess synchronicity in real and monetary conditions in the U.S. and EA during tightening/loosening episodes since the mid-1990s, as well as associated spillovers between the two economies. Second, we analyze the spillover implications of different degrees of synchronicity in monetary and/or real conditions among SAEs on EMNS macroeconomic and financial variables.

The analysis suggests that real and monetary conditions in the U.S. and the EA have oftentimes been asynchronous, and that spillovers between these economies have been significant. They suggest, 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 where, despite asynchronous real conditions, monetary conditions tightened in both economies, owing largely to spillovers from the U.S. to the EA (1994) or from the EA to the U.S. (1999). Over the last year, spillovers from the EA to the U.S. have been large, reflecting bold policy action by the ECB and a downward shift in inflation expectations in Europe.

[2] This working paper is an expanded version of a background note prepared for the 2015 Spillover Report, see https://www.imf.org/external/pubs/ft/pdp/2015/pdp1501.pdf

We also find evidence that spillovers could be amplified in synchronous episodes and dampened in asynchronous ones. Regardless of whether shocks originate in the U.S. or the EA, real shocks in SAEs—unanticipated improvements in economic prospects—have positive impacts on activity in other economies, while money shocks—unanticipated tightening of monetary conditions—have a negative impact.

Our paper is related to the empirical literature on the identification of monetary shocks and the analysis on their impact on financial and macroeconomic variables. Our empirical approach borrows elements from the structural VAR literature and from papers analyzing interdependence of financial markets, which help us overcome limitations associated with the period over which central banks have been undertaking unconventional monetary policy (UMP).

There is a fast-growing branch in the literature analyzing the impact and transmission channels of UMP. The findings generally suggest that Federal Reserve's UMP had a large impact on global asset prices and capital flows through both the signaling and portfolio re-balancing channels (Neely, 2010; Fratzscher and others, 2013; Moore and others, 2013; Bauer and Neely, 2014; Rogers and others, 2014). In contrast to the U.S. case, only a few studies have investigated spillovers from UMP in Europe. Fratzscher and others (2014) find that the ECB's Securities Markets Program (SMP) and the Outright Monetary Transactions (OMT) policies boosted global equity markets, and lowered credit risk among G20 banks and sovereigns, and Georgiadis and Grab (2015) find that that ECB's QE boosted equity prices globally. The literature on the cross-border effects on macroeconomic variables is scarce and inconclusive, as spillovers are found to depend on a wide range of factors. For instance, IMF (2014) shows that spillovers from a shock generating a synchronized movement in long-term yields in the US, UK, euro area and Japan (identified through a sign restricted VAR and factor analysis) depend on both the characteristics of the recipient country—fundamentals, exchange rate regime, and capital account openness—and the underlying driver of the change in yields—an exogenous shock or an endogenous response to a growth surprise.[3]

Many papers in this literature rely on the so-called narrative approach developed by Kuttner (2001) and Romer and Romer (2004), using variations that involve event studies to analyze the effects of unconventional monetary policy announcements after the inception of UMP (see for instance Gagnon and others, 2011; Neely, 2015; and Swanson, 2011).

An event study approach would not be instrumental to our objective of analyzing synchronicity of monetary conditions and cyclical developments, as monetary policy decisions by major central banks are not adopted at the same time, and economic news are released on different dates. The analysis would also be complicated by the fact that event

[3]Other examples are Chen and others (2012, 2014a, 2014b), who estimate a global VAR and assume the U.S. is the dominant economy. The authors find that the Fed's QE helps prevent recessions and has heterogeneous cross-border effects that vary across regions. Georgiadis (2015) also estimates a global VAR and finds significant effects from U.S. monetary policy, with the magnitude of spillovers depending on a number of country characteristics, including financial integration, trade openness, the exchange rate regime, industry structure, financial market development and labor market rigidities.

studies assess the impact on financial and macroeconomic variables over narrow windows of time around announcements—in order to isolate movements purely driven by the announcement. Since we intend to analyze spillovers over macroeconomic variables at a relatively lower frequency, we cannot rely on high frequency estimates.[4]

We take a different approach in this paper, exploiting the fact that asset prices swiftly respond to domestic monetary policy and macroeconomic news. Equity prices react to news because they reveal information about the fundamental value of stocks (McQueen and Roley, 1993); and in bond markets news alter interest rates along the yield curve, as market participants adjust their expectations on the economic outlook and reassess their expectations about the reaction of monetary policy to such news (Fleming and Remolona, 1997, 1999a and 1999b), or change their views about the credibility and effectiveness of monetary policy (Thornton, 1998). There is extensive empirical evidence showing a strong relation between asset prices and economic and monetary policy news during normal times , and the consensus is that the implementation of unconventional policies by major central banks successfully eased domestic financial conditions by reducing long-term yields (through a compression of the term premium) and boosting stock prices.

We build on the work by Matheson and Stavrev (2014), who estimate a sign restricted VAR for the U.S., assuming that unanticipated tightening of monetary conditions or inflation surprises (money shocks) pushes yields up and reduces stock prices, while unanticipated improvements in economic prospects increase both yields and stock prices (real shocks). The framework provides a tool to consistently identify shocks in periods of both conventional and unconventional monetary policy, thus overcoming some of the limitations of the narrative approach. We extend the Matheson and Stavrev framework in two ways. First, we control for risk-appetite using the VIX. Conditioning on this indicator is important for identification, as failing to take into account the impact of uncertainty on economic activity and/or monetary conditions can bias the results (see IMF, 2014 and Gambacorta and others, 2014). Second, we estimate a two-economy model of the U.S. and euro area to identify real and money spillovers between these two economies. Hence, our paper is also related to the literature on the interdependence of U.S. and euro area financial markets (see Ehrmann and Fratzscher 2002, 2003 and 2005; Ehrmann and others, 2011; and Scotti, 2011). Consistent with our findings, these papers show that there is interdependence between the U.S. and euro area, and that spillovers from the euro area to the U.S. have increased since the formation of the Economic and Monetary Union (EMU) in Europe.

That we are aware of, ours is the only paper to formally define and analyze the synchronicity of money and real conditions in the U.S. and euro area and assess its implications on spillovers to other economies. There are, however, two papers which are closely related to

[4] The identification of exogenous money shocks through de-jure policy changes may be more difficult after the inception of UMP and due to frequent reasssessements of the term premium in long term yields. This strategy may miss changes in monetary conditions outside announcement dates. Some papers also assume that policy annoucements are fully unanticipated, while UMP news come out gradually before the announcement, or are explained through press conferences after the announcement. There are exemptions that disentangle the expected and unexpected elements in announcements, notably Chen and others (2014).

ours but have a narrower focus. Scotti (2011) defines synchronization between the Fed and the ECB as the probability of one bank changing its policy rate decision, conditional on the other bank changing its policy rate, and finds some evidence of synchronization for the 1998–2008 period. The paper focuses only on monetary policy shocks, while we analyze real shocks and a broader set of money shocks. The other paper, He and others (forthcoming), finds that UMP by both the Fed and the ECB have significant effects on the supply of international dollar credit. Therefore, consistent with our results, his findings imply that the divergence of monetary policies between the U.S. and euro area could have a dampening effect on spillovers to other economies.

The paper is organized as follows. Section II discusses issues on data and the empirical methodology used in the analysis. Section III shows the results of the analysis of synchronicity and spillovers within systemic advanced economies. Section IV discusses spillovers from shocks in systemic economies to non-systemic economies. Finally, Section V covers robustness checks and Section VI concludes.

II. Data and Methodology

The analytical approach aims at addressing three challenges. First, the analysis of synchronicity in real and monetary conditions in the U.S. and the EA 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.[5] 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 U.S. and the EA as well as spillovers between these two economies.[6] 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.[7] 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)

[5] In this paper, 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. In other words, changes in monetary conditions can reflect the dynamics of any of these factors.

[6] 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.

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

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 U.S. and the EA as well as spillovers between them; and in the second stage, we assess the dynamic effect of these shocks on key EMNS variables.

A. 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.[8] We assume that the VIX impacts stock prices and yields contemporaneously, whereas these variables can only affect the VIX with a lag. 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.

- Second, a two-economy VAR is estimated to identify country-specific real and money shocks through sign restrictions, using the procedure developed by Rubio-Ramirez and others (2005). The vector of endogenous variables is comprised of the purged time series of stock prices and bond yields for the U.S. and the EA. 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] Given that the U.S. economy is bigger than the EA, this sign restriction is assumed to be satisfied contemporaneously if shocks originate in the U.S. and with a lag if shocks

[8] 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.

[9] Bekaert and others (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. Note, however, that the data still contains information on autonomous shocks to stock prices and bond yields that can affect the VIX.

[10] Ehrmann and others (2011) impose similar restrictions to identify country-specific shocks.

originate in the EA.[11] 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 below).[12] 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 U.S. and EA over the past 20 years. Through historical decompositions, we disentangle the contribution of structural country-specific real and money shocks to movements in U.S. and EA yields. Synchronicity is defined as episodes where 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.

Variables *

Shocks		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 data are monthly over the period from January 1994 to March 2015. For the U.S. the long-term bond yield series is the 10-year U.S. treasury bond yield and the equity price (S) series is the (log) S&P 500 index. For the EA long-term bond yields correspond to the purchasing power parity GDP-weighted average of the 10-year government bond in Germany, France, Italy, and Spain; similarly, the EA stock price series is the GDP weighted average of the DAX, CAC, FTSEMIB and IBEX indices.

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

[11] Assuming that shocks in both the U.S. and EA have contemporaneous positive cross-border spillovers within asset classes does not change the results. See Section V on robustness.

[12] Following Matheson and Stavrev (2014), the model is estimated in levels with one lag. The variables have a cointegration vector, which is incorporated in the estimation of the model in levels. Since, the impulse responses are stationary and the VAR is stable, estimating without first-differencing is acceptable. Finally, standard tests suggest that one lag length is optimal.

not model identification (Preston, 1978).[13] 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.

B. Framework to Assess Spillovers to Non-Systemic Advanced Economies

The dynamic effects of the identified shocks in SAEs ($X_{i,t}$) on key EMNS variables ($Y_{i,t}$) are estimated through a panel VAR of monthly data covering the period from January 2000 to December 2014. Specifically:

$$Y_{i,t} = \sum_{l=1}^{L} A_l Y_{i,t-l} + \sum_{l=0}^{L} B_l X_{i,t} + \varepsilon_{i,t}$$

where A_l and B_l represent reduced form coefficient matrices. 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 US-euro effective exchange rate, constructed as the trade-weighted average of the bilateral exchange rate vis-à-vis the US dollar and the euro.[14] 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 SAEs 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 for a group of EMNS comprising 6 non-systemic advanced economies (Australia, Canada, New 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.

[13] 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.

[14] 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.

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:

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

Where *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 and spillovers 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.

III. Spillovers Within Systemic Advanced Economies

A. Spillovers and Synchronicity

We analyze spillovers and synchronicity between the U.S. and EA 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 U.S. and the EA 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.

The current juncture is characterized by significant spillovers between the U.S. and the EA. The taper event tightened U.S. financial conditions sharply and had real and monetary spillovers to the EA. While spillovers associated with positive surprises in economic activity in the U.S. 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 EA to the U.S., especially after the ECB adopted bold monetary policy easing in the second half of the year (see Figure 1):

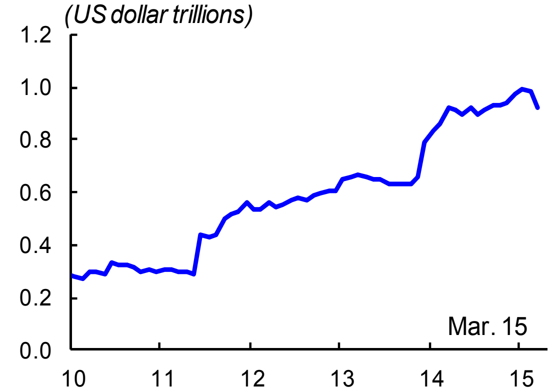
- Spillovers associated with positive prospects on economic activity in the U.S. became large in early 2014, and increased throughout the year (light red in panel 4, Figure 1). While there were negative growth surprises in the first quarter of 2014, these were relatively small and partially reversed during the second half of the year. In contrast, reflecting the surprisingly 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 EA 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 U.S. in terms of economic activity.[15]

- Since 2014, weak economic prospects in the EA have had spillovers on the U.S. Over the last year, domestic real shocks have contributed significantly to the downward trend in EA long-term yields (dark red 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 U.S. since mid-2014 (light red in panel 3, Figure 1).

- Easier financial conditions in the EA have had significant spillovers on the U.S. 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 EA's inflation expectations—which has been partly explained by a negative oil price shock. These developments are not only compressing yields in the EA (dark blue in panel 6, Figure 1), but also in the U.S., 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 EA

U.S. Treasury Securities Held by Euro Area Countries 1/
(US dollar trillions)



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

[15] The contribution of domestic real shocks to changes in the U.S. yields is in line with consensus forecasts revisions of U.S. growth. Further, the correlation of U.S. real shocks with the U.S. dollar Citi Surprise Index is positive and statistically significant.

to the U.S. (light blue in panel 5, Figure 1). Meanwhile, the impact of the monetary tightening associated with the tapering faded out throughout 2014 (Figure 1, dark blue in panel 5, light blue in panel 6).

- The contribution of domestic components of shocks to movements in yields—dark components in panels 3 to 6 (Figure 1)—also suggests that real and monetary conditions have become increasingly asynchronous between the U.S. and the EA since early 2014. Domestic real and money shocks in these two economies have driven yields in opposite directions. While the recovery in the U.S. has been gaining momentum and the Federal Reserve has hinted that the liftoff of the policy rate is approaching, growth prospects in the EA 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 EA yields. More recently, the negative pressure of domestic real shocks on EA bond yields has stabilized, reflecting some green shoots in economic news, whereas the release of unexpectedly weak economic figures in the U.S. is reducing the positive contribution of domestic real shocks to U.S. yields.

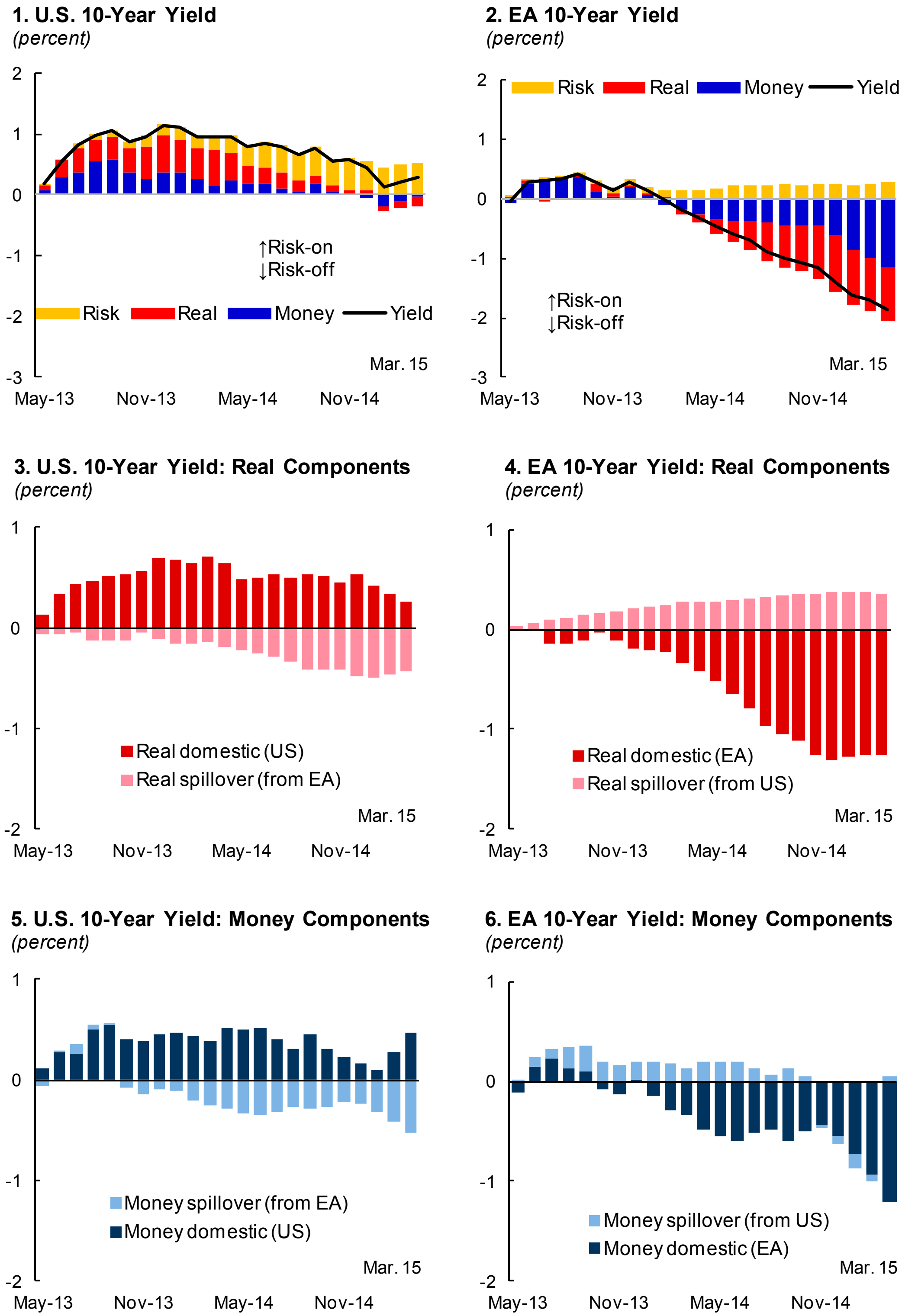
The recent asynchronicity should not be surprising, as real and monetary conditions between the U.S. and the EA have oftentimes been asynchronous during past monetary policy easing and tightening cycles. Based on the methodology described above, we document the drivers of movements in U.S. and EA yields 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 U.S. and the EA. 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 U.S. to the EA (1994) or from the EA to the U.S. (1999). A more detail 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.

Figure 1. U.S. and EA 10-Year Yield Decomposition
(cumulative change)

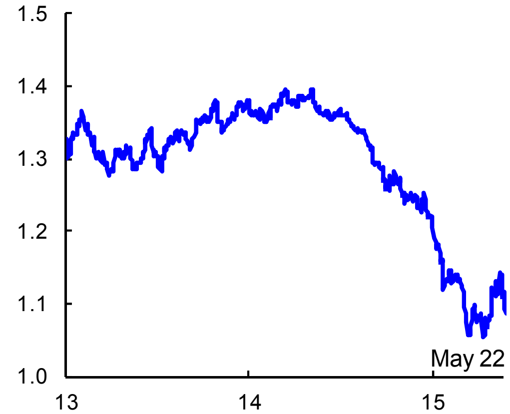


Source: Bloomberg L.P., and IMF staff estimates.
Note: U.S. = United States; EA=euro area.

B. Exchange Rate Implications

The effects of real and money shocks on the U.S. dollar-euro exchange rate are assessed with a simple VAR framework, 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.[16] 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 U.S. and EA 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. 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 EA that increases yields by 100 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 U.S.—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.

Dollar - Euro Exchange Rate
(U.S. dollars per Euro)



Source: Haver Analytics.

The constellation of shocks identified in our framework is consistent with the depreciation of the euro since early 2014. The combination of positive real shocks in the U.S. and negative real shocks alongside loosening monetary conditions in the EA 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).

IV. Spillovers to Emerging and Non-Systemic Advanced Economies

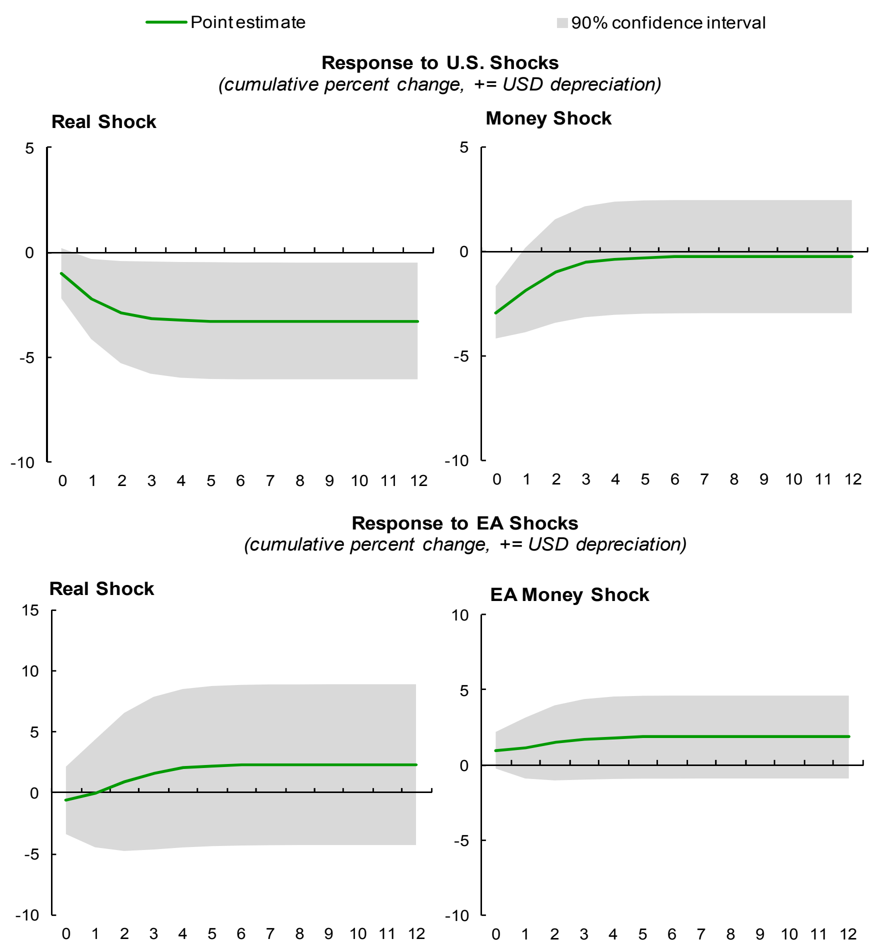
Consistent with IMF (2014), our results suggest that spillovers to EMNS depend on the underlying drivers of the increase in SAE yields (Figure 3). An increase in either U.S. or EA yields reflecting money shocks are followed by higher bond yields in EMNS, depressed economic activity, net portfolio outflows and a depreciation of the currency. In contrast, an increase in U.S. or EA 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

[16] The correlation of the monthly changes in the contribution of risk-appetite shocks to movements in U.S. and EA yields is 0.97, reflecting the global nature of these shocks.

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 U.S. or EA are followed by net portfolio outflows and currency depreciations in EMNS.

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 EA) induces capital to flow to the country where 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./EA. Our results suggest that the second effect dominates—likely reflecting the size of portfolio outflows from EMNS relative to outflows from SAEs.

Figure 2. Effects of U.S. and EA 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.

As cyclical and monetary conditions in major economies change, policymakers in EMNS face the challenge of articulating appropriate policy responses. Since cyclical and monetary conditions in major economies have oftentimes moved asynchronously (see Section 2.A), shocks in these countries during such periods may, in principle, have offsetting effects on key macroeconomic variables in EMNS. Thus, a key question is whether spillovers to EMNS are dampened when cyclical and/or monetary conditions in major players move in opposite directions. If this is the case, EMNS' macroeconomic reponse to multiple shocks would be contingent on their degree of synchroncity.

Our results suggest that spillovers to EMNS could be dampened in periods of asynchronicity. Since our framework allows us to disentangle shocks originating in the U.S. and the EA, we can compare their spillovers on recipient economies. The analysis points to similar effects of money and real shocks, regardless of whether they originate in the U.S. or the EA (see 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 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 EA money shocks, likely reflecting different transmission channels. Shocks originated in the EA tend to have larger effects on EMNS portfolio flows, whereas U.S. shocks have a more significant impact on economic activity (see Figure 3). While an analysis of transmission channels of spillovers is beyond the scope of this paper,[17] the results suggest that U.S. shocks have a particularly large impact on EMNS through trade links—i.e., external demand—whereas for shocks originated in the EA 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 EA 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.[18]

A. 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

[17] For transmission channels of spillovers from monetary policy shocks, see Chen and others (2014) and Chen and others (forthcoming).

[18] The supply of international dollar credit is largely influenced by the behavior of non-US international banks, particularly those headquartered in Europe (McCauley and others, 2015; and Ivashina and others, 2015) as they intermediate the lion's share of such credit flows. See also Rey (2013) and Cerutti and others (2014).

amplified (or dampened) by their spillover counterpart, so the index takes higher (lower) values in synchronous (asynchronous) periods. Figures 4 and 5 display the distribution of the difference in impulse responses during asynchronous states of the world (where the index takes the 10th percentile value) relative to synchronous ones (where 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 U.S. or the EA (see Figure 4). 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 (see Figure 5): 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 EA, asynchronicity is likely to dampen the impact on portfolio flows, reducing outflows from EMNS.

V. Robustness

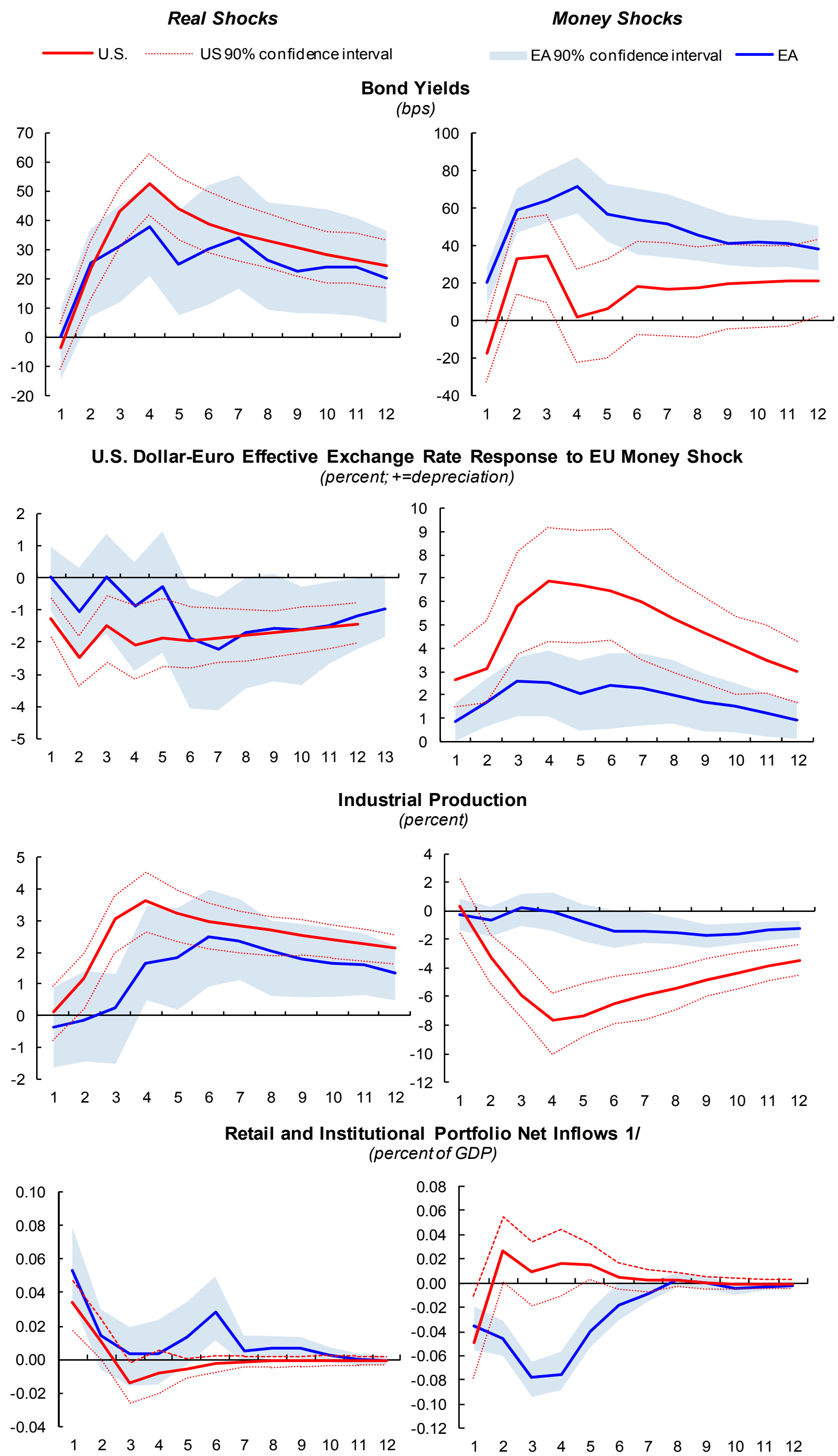
We conduct a number of robustness checks on the identification of shocks in SAEs, their exchange rate implications and spillovers to EMNS.

Regarding the identification of SAE shocks we considered three alternative specifications, all of which yield results which are broadly unchanged relative to those of the baseline specification. First, since the recursiveness assumption made to identify risk-appetite shocks may be more sensible at a daily frequency, we purge SAE yields and equity prices from risk-appetite shocks by estimating bi-variate VARs of each of variable and the VIX using daily time series.[19] We then cumulate the purged data into monthly time series and estimate the sign restricted VAR. Second, the assumption that shocks to EA financial variables generate spillovers to the U.S. with a lag maybe too strong, as the model is estimated with monthly time series and, within a month, shocks in the EA are likely to have had an impact on U.S. financial markets. We therefore estimate the sign restricted VAR assuming that shocks in both the U.S. and EA have contemporaneous positive cross-border spillovers within asset classes. Finally, it is reasonable to identify SAE shocks while remaining agnostic about

[19] The correlations between the monthly purged data and the daily purged data aggregated into a monthly frequency ranges between 0.97 (EA stock prices) and 0.99 (for EA yields and U.S. stock prices). The estimation of U.S. and euro area real and money shocks, as well as their spillover effects to EMNS, therefore remains broadly unchanged across the two methodologies. Note that to ensure orthogonality of the shocks for which spillovers to EMNS are examined, the sign restricted VAR and the panel VAR need to be estimated at the same frequency (monthly in this case).

Figure 3. Spillovers to EMNS from Shocks in the U.S. and EA

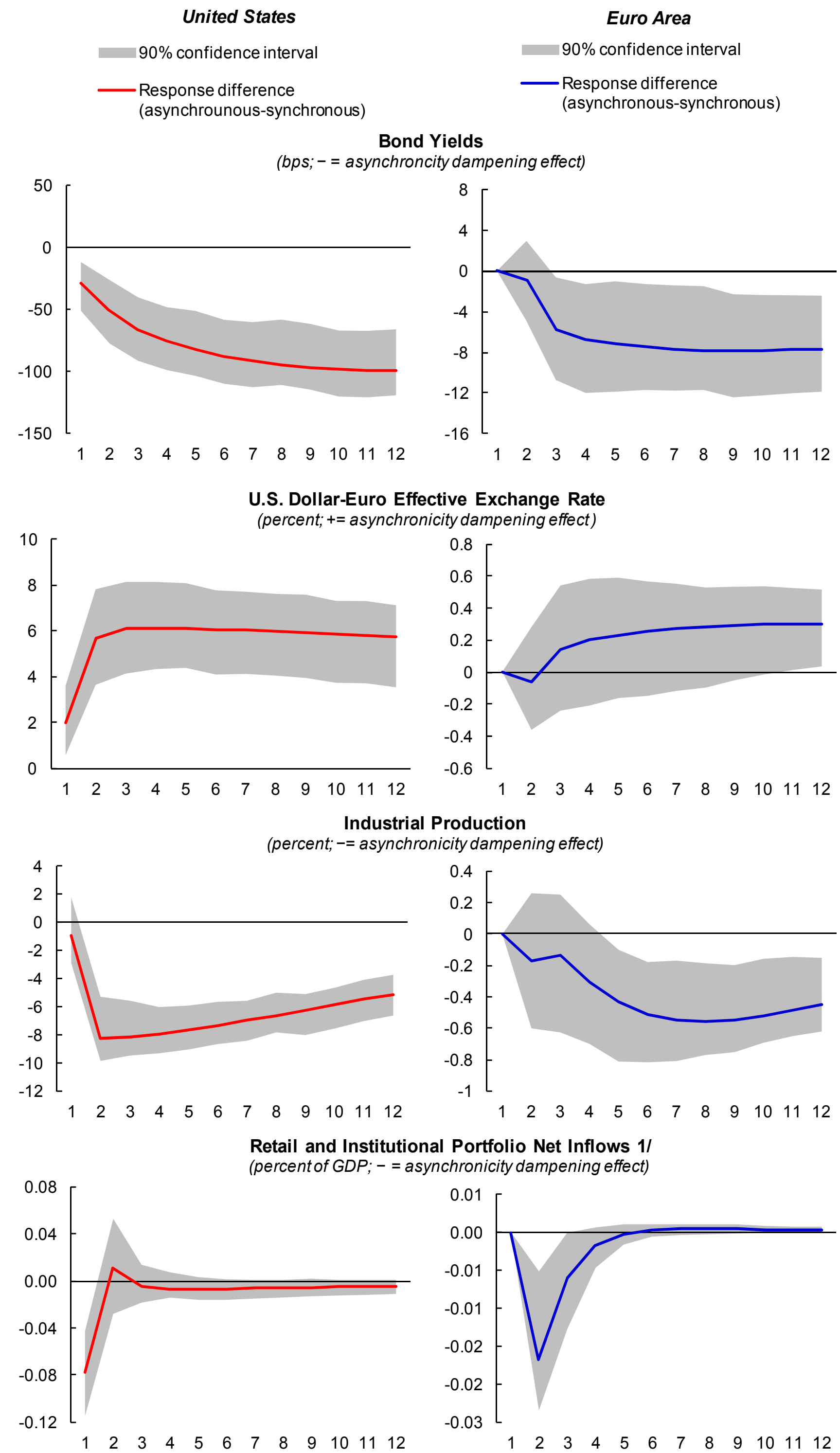
(response to a shock that raises the 10-year yield in the source country by 100 bps)



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

Figure 4. Responses to Real Shocks: Difference between Low and High Synchronicity

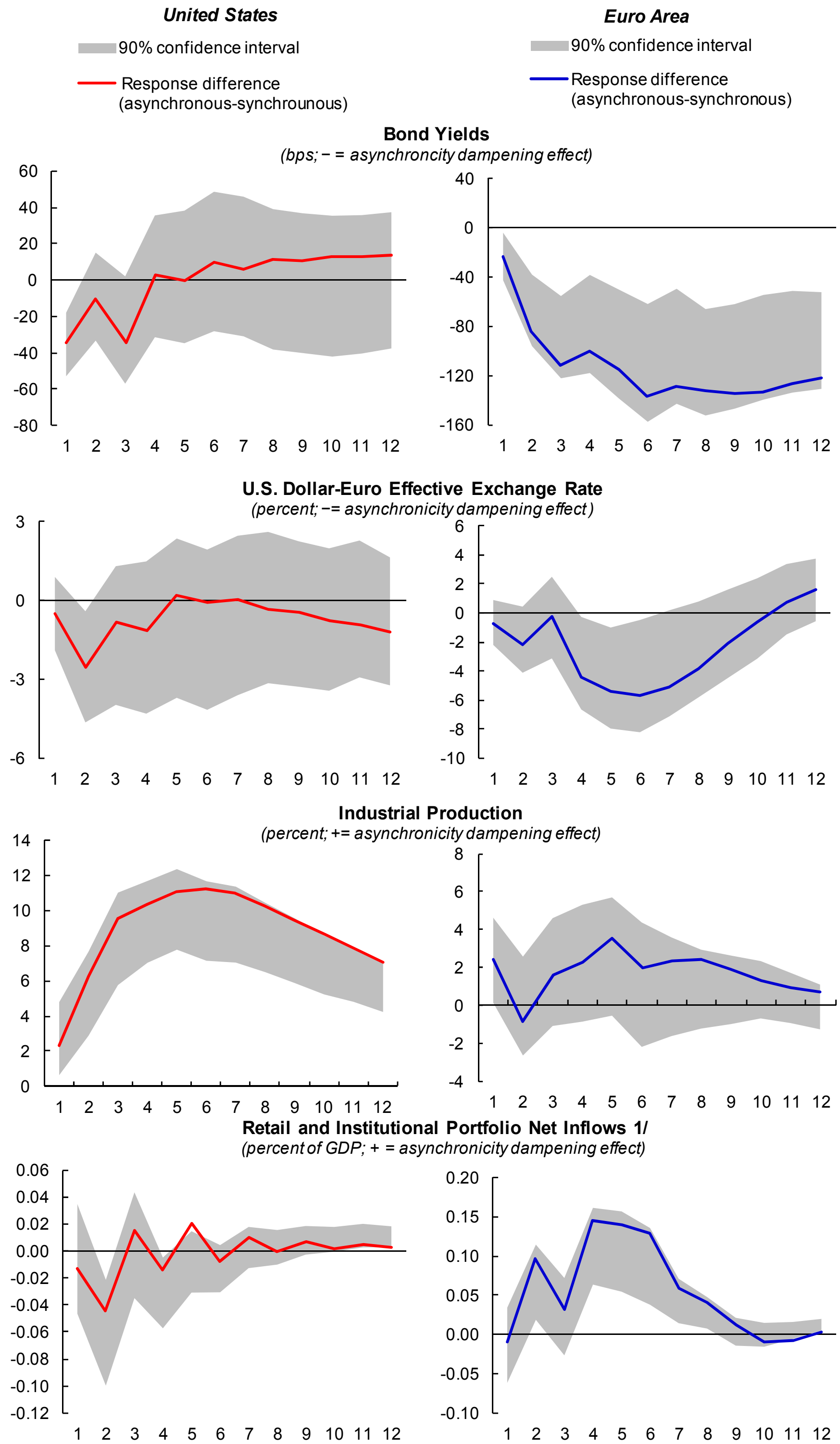
(difference in responses to a shock that raises yields in the source country by 100 bps)



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

Figure 5. 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.

cross-border spillovers between bond markets. Yields in the U.S. and EA tend to co-move, partly because both assets are regarded as safe havens. However, there may be instances, notably at the zero lower bound, where differences in market perceptions about the term premium in the two economies, and hence the possibility of a future adjustment, may generate negative cross-border spillovers from money shocks.[20] Hence, we also estimate the sign restricted VAR, imposing restrictions on cross-border spillovers across stock markets but not bond markets.

As for the implications of SAE shocks for the U.S. dollar -euro exchange rates, the results are robust to using the contributions of risk-appetite shocks to either U.S. or EA yields, or the VIX in first differences. In addition, the results are robust to identifying the shocks through a Choleski decomposition, using various recursive orderings.

Regarding the spillover effects of SAE shocks on EMNS, the results are robust to using different exchange rates for the estimation of spillovers from SAE shocks to EMNS, including the effective nominal exchange rate and the bilateral exchange rate vis-à-vis the U.S. dollar and the euro.

VI. Conclusions

This paper analyzes synchronicity in real and monetary conditions and spillovers within systemic economies, as well as their potential impact on spillovers to other economies. It finds that the increasingly divergent real and monetary conditions in the United States and the euro area are giving place to significant spillovers among them. In particular, spillovers from the euro area to the U.S. have been considerable since early 2014, reflecting monetary policy easing by the ECB and a downward shift in inflation expectations in the euro area. This is not only compressing yields in Europe, but also in the U.S. On the real side, positive prospects for activity in the U.S. and a more sluggish recovery in Europe likely contributed to the dollar appreciation vis-à-vis the euro since early 2014. This is also raising questions going forward, in particular whether liftoff in the U.S. may not only strengthen the dollar vis-à-vis the euro, but also push interest rates up in the euro area, or whether QE in the euro area may not only weaken the euro, but also continue putting downward pressure on U.S. yields. The paper also finds that spillovers to other non-systemic economies could be dampened in periods of asynchronicity. Spillovers from real and money shocks have conceptually similar impacts, 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.

Future research could expand the analytical work in this paper in several directions. The analysis of synchronicity should be refined. The synchronicity index constructed in this paper aims at capturing how spillovers from systemic to non-systemic economies can be dampened or amplified in the presence of shocks, and the analysis relies on an algorithm that is based

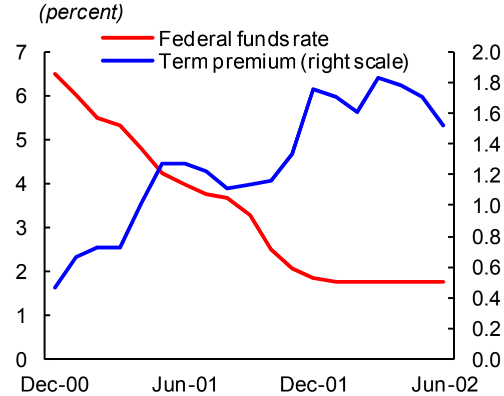
[20] For instance, assume the term premium in the U.S. is perceived to be too low (and hence likely to adjust) but not in the EA. In this context, a money shock in the U.S. may lead to lower yields in the EA, as safe-haven investors shift away from U.S. to EA bonds.

on the historical decomposition of the contributions of shocks to the change in yields. However, the analysis of synchronicity has a value on itself, in order to assess how cyclical positions or shocks to monetary conditions are playing in systemic economies. Variants of the synchronicity index should be explored in future work. The paper does not explore transmission channels of spillovers. As a general message, the literature on spillovers has emphasized that good communication policies in source countries and good fundamentals and sound policy frameworks in recipient countries would curb spillovers. A better grasping of transmission channels would allow more granular policy recommendations, in particular for recipient economies. Finally, an analysis of regional factors in cross border spillovers and the impact of real and money shocks on a more comprehensive measure of capital flows would also be useful going forward.

APPENDIX. SPILLOVERS AND SYNCHRONICITY IN THE U.S. 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 U.S. and the EA:

Federal Funds Rate and Term Premium
(percent)



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

- After years of rapid expansion, economic activity in the U.S. 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 (see Figure A1.1 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 (panel 3, dark red of Figure A1.1)—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.

- The EA 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 (see Figure A1.1 panels 2, 4, and 6). The negative contribution of domestic real shocks to EA 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 U.S. to the EA: money spillovers were large (light blue in panel 6 of Figure A1.1), and real spillovers were smaller but significant (light red in panel 4 of Figure A1.1). Spillovers from the EA to the U.S. were more modest: considerable in size for real shocks (see Figure A1.1, light red in panel 3) and negligible for money shocks (see Figure A1.1 light blue in panel 5).

The easing cycle in 2007–09 is an example of asynchronous real and monetary conditions in the U.S. and the EA:

- 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 of Figure A1.2). 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 Sterns to avert a sudden collapse of the company. In the second half of 2008, another wave of domestic real shocks in the U.S. 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 of Figure A1.2). 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 EA, as captured by the positive contribution of real domestic shocks to EA yields (dark red bars in panel 4 of Figure A1.2). However, output growth fell sharply in the second half of 2008, as the recession in the US generated negative growth spillovers to the EA (light red bars in panel 4 of Figure A1.2). 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 in Figure A1.2.). Subsequently, as the EA 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 EA 10-year yields (dark blue bars in negative territory of panel 6 in Figure A1.2.).

- 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 U.S. and EA (yellow bars in panels 1 and 2 of Figure A1.2).

- This period was characterized by important real spillovers from the U.S. to the EA, notably in the second half of 2008. In contrast, real spillovers from the EA to the U.S. 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.

The results of our analysis for the 1994 and 1999 episodes are consistent with Ehrmann and Fratzscher (2002, 2005). The authors find that U.S. markets did not react to euro area markets before 1999 but have, since then, become highly responsive to developments in Europe. One possible explanation is that, through the formation of the Economic and Monetary Union (EMU) in 1999, a single European market replaced national markets, allowing market participants in the U.S. to fully capture developments in Europe (as opposed to following a large number of variables giving independent and potentially conflicting signals, prior to EMU). The higher interdependence between the U.S. and EA markets could also be explained by the increased real integration of the two economies.

The 1994 U.S. tightening episode is characterized by large spillovers to Europe:

- The U.S. economy began to decelerate in 1990, and experienced a big recession in 1991. The economy entered a swift recovery in 1992, but it had its ups and downs, reaching a soft patch by mid-1993. By early 1994, the recovery accelerated sharply, reaching year-on-year growth rates above 4 percent by the second quarter. Concurrently, the Federal Reserve initiated a 10-quarter tightening cycle in February. Despite the incipient acceleration, the move by the Federal Reserve surprised markets. The recovery continued to display erratic dynamics, with growth decelerating again in late 1994, becoming tepid in 1995, and gathering strength by mid-1996.

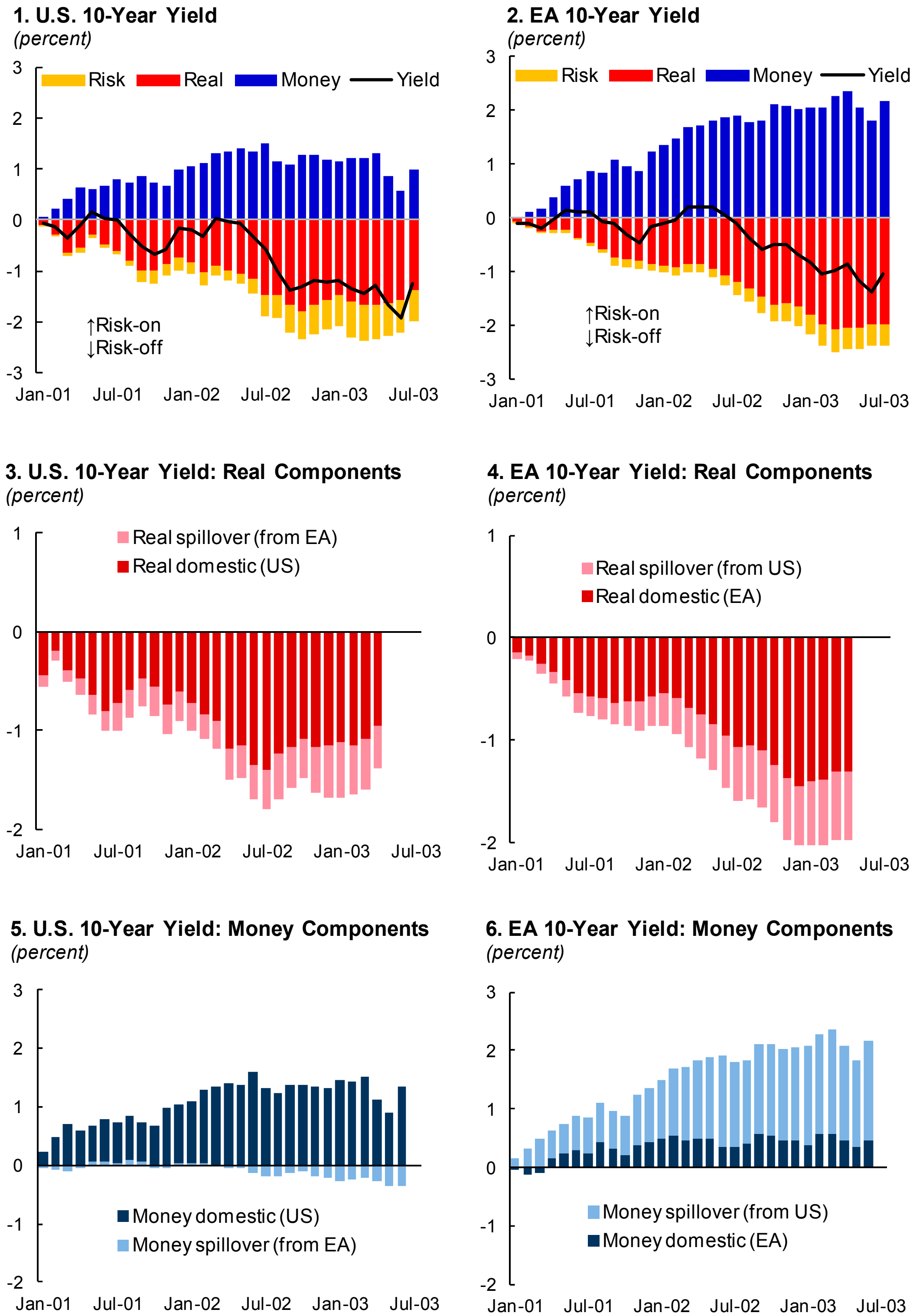
- Consistent with the characteristics of the recovery, our framework shows a somewhat irregular pattern of real shocks (Figure A1.3, panel 3) in the U.S., with positive growth surprises—at the time in which very rapid growth rates had likely surprised some market participants—and mostly negative surprises beginning in the second half of 1994—at a time in which the recovery during the first half of the year partially reversed. Most of the tightening in early 1994 comes as a money shock (Figure A1.3, panel 5), i.e. a tightening that is not warranted by news on the real front, and seems consistent with the surprise that the swift move by the Federal Reserve caused in markets. A significant portion of the tightening in Europe was also related to money spillovers from the United States (Figure A1.3, panel 6, light blue bars).

The 1999 episode is characterized by large spillovers from the EA to the U.S.:

- By mid-1999, when the Federal Reserve initiated a tightening cycle, the economy had experienced a prolonged expansion, displaying 13 consecutive quarters of year-on-year growth above 4 percent. Despite a brief deceleration during the third quarter, economic growth gathered new impetus by end 1999—year-on-year quarterly growth reached 5¼ percent by the second quarter of 2000. However, by end 2000, the economy began to decelerate swiftly. In Europe, the economy reached the final stage of a deceleration that had began in 1997, and growth began to pick up modestly in early 1999. The recovery, though, accelerated towards the end of the year and in early 2000. Meanwhile, in November 1999, the European Central Bank began an aggressive tightening cycle that took the main refinancing rate from 275 to 475 basis points by October 2000.

- Our framework displays positive real shocks in the U.S. in early 1999, and negative surprises that coincide with the brief deceleration during the third quarter of that year (Figure A1.4, panel 3, dark red bars). Positive real surprises resume as the economy accelerated sharply towards the end of 1999 and early 2000. Monetary tightening by the Federal Reserve was relatively mild in 1999, with our framework not showing significant money shocks in that year (Figure A1.4, panel 5, dark blue bars). However, spillovers from Europe become significant in the second half of the year (Figure A1.4, panel 5, light blue bars), as markets perceived more hawkish monetary conditions after the inception of the euro (Figure A1.4, panel 6, dark blue bars).

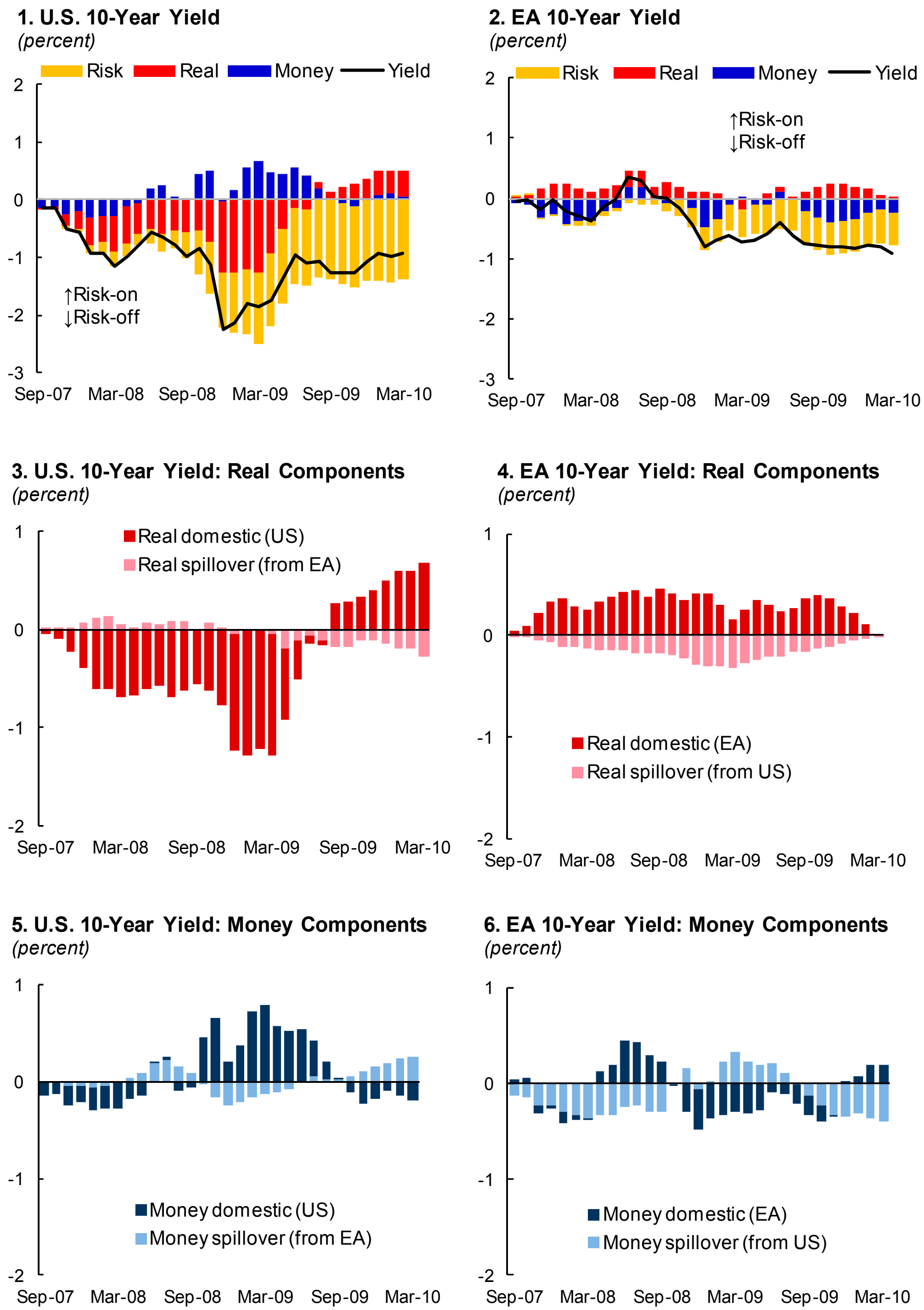
Figure A1.1. U.S. and EA 10-Year Yield Decomposition in the 2001 Federal Reserve Easing
(cumulative change)



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

Figure A1.2. U.S. and EA 10-Year Yield Decomposition in the 2007 Federal Reserve Easing

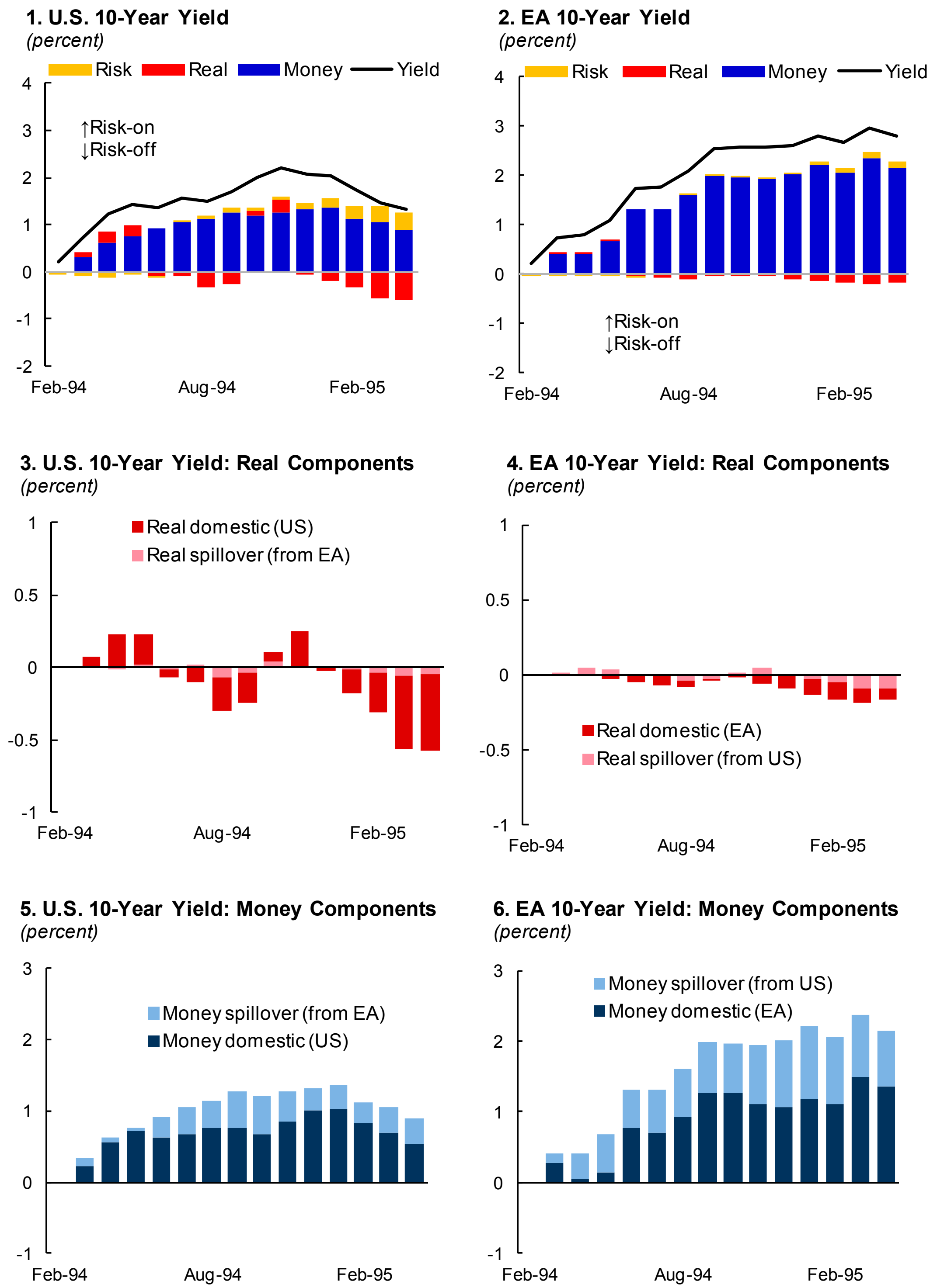
(cumulative change)



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

Figure A1.3. U.S. and EA 10-Year Yield Decomposition in the 1994 Federal Reserve Tightening

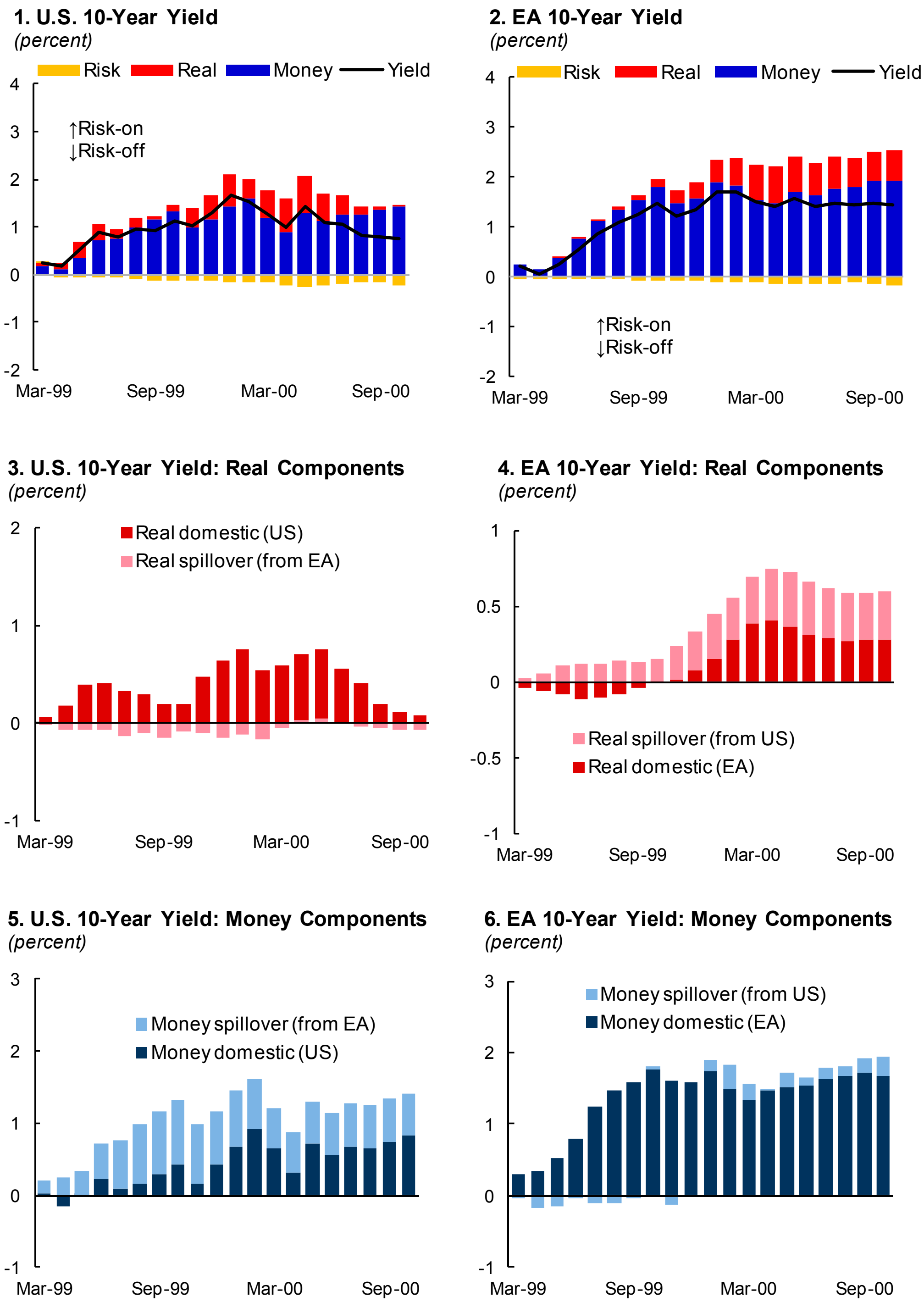
(cumulative change)



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

Figure A1.4. U.S. and EA 10-Year Yield Decomposition in the ECB 1999 Tightening Easing

(cumulative change)



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

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