

Box 2

Assessing global asset price developments through the lens of a structural BVAR model

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This box describes a simple structural Bayesian vector autoregression (BVAR) model that uses sign restrictions to determine the relative importance of distinct economic and financial shocks in shaping

the co-movement of key global financial variables. The model provides intuitive and economically plausible interpretations of gyrations in key US and global asset markets over the past six months. The model ascribes them to a multitude of factors, including strong nominal US demand, heightened investor risk aversion as well as the prospect of higher US inflation and tighter monetary conditions.

The model can be used to disentangle the underlying causes of market movements and to infer the macroeconomic implications of such movements. For instance, in the past six months, trade tensions and currency crises in some emerging market economies (EMEs) caused price corrections in EME financial markets, while putting downward pressure on US Treasury yields reflecting flight-to-quality dynamics. At the same time, tightening US monetary policy, robust growth (supported by expansionary fiscal policy) and rising inflation pushed US Treasury yields up. Strong nominal growth also provided support to US equity prices and to the dollar. Without a structural model, the macroeconomic implications of these asset price movements would remain challenging as some developments push financial asset prices in different directions.⁵

The structural model considers a small set of financial variables and structural shocks. In particular, developments in five important financial variables are modelled jointly: (i) US equity prices, scaled by the current level of annual earnings; (ii) a basket of EME bond yields for US dollar-denominated sovereign debt; (iii) yields of US Treasury bonds with ten-year maturity; (iv) the US nominal effective exchange rate (NEER); and (v) US inflation expectations, derived from long-term inflation swaps. The model explains the co-movement of these variables by a linear combination of four structural economic and financial shocks, identified by means of sign restrictions (a summary of the sign restrictions can be found in Table A):

1. **US monetary shock:** A US monetary shock is identified as an innovation in long-term US bond yields (and thus also dollar-denominated EME bond yields). A monetary shock triggers a decline in equity prices, a fall in inflation expectations and an appreciation of the exchange rate given wider yield differentials vis-à-vis other major currencies.
2. **US demand shock:** Positive news about aggregate demand in the US economy raises domestic bond yields and inflation expectations, leads to an appreciation of the US dollar and boosts equity valuations. The increase in Treasury yields also leads to an increase in dollar-denominated EME bond yields.
3. **US inflationary shock:** Inflationary shocks in the US economy raise inflation expectations and bond yields and depress equity valuations. The increase in bond yields also leads to tighter financial conditions in EMEs.
4. **Global risk shock:** A fall in investors' risk appetite leads to a reduction of their exposure to risky assets, namely EME sovereign bonds (implying an increase in yields) and US equities. At the same time, investors turn towards safe-haven assets, namely US Treasury bonds (leading to a decline in yields) and the US dollar.

⁵ For instance, fears of a slowing-down of the global business cycle would put downward pressure on US long-term Treasury yields, while expansionary US fiscal policy and monetary policy tightening push them upwards.

Table A

Sign restrictions of the structural BVAR model

	US monetary shock	US demand shock	US inflationary shock	Global risk shock
US inflation expectations	-	-	+	
US equity prices (CAPE)	-	-	-	-
US Treasury yields (ten-year)	+	-	+	-
EMBI	+	-	+	+
US dollar effective exchange rate	+	-		+

Sources: Datastream and ECB calculations.

Notes: The signs determine the direction of the shock's impact on the respective variable in the first period (i.e. "on impact"). The BVAR model is estimated using Bayesian techniques from the BEAR toolbox; for details see Dieppe, A., van Roye, B. and Legrand, R., "The BEAR toolbox", *Working Paper Series*, No 1934, ECB, July 2016. CAPE stands for cyclically adjusted price/earnings ratio and EMBI for Emerging Market Bond Index.

Heightened investor risk aversion, strong US demand, as well as the prospect of higher inflation and tighter monetary policy, have governed global financial markets over recent months. The model identifies a multitude of underlying drivers behind developments in global financial markets over the review period (see **Chart A**). Most prominently, positive US demand shocks, reflecting inter alia fiscal stimulus measures as well as large repatriations of foreign profits, put upward pressure on US Treasury yields, US equity prices and the US dollar. At the same time, a global risk shock, associated with uncertainty about global trade policies, put selling pressure on risky assets. EME sovereign bonds were particularly hard hit, but also the rise in US equity prices was dampened by higher investor risk aversion. The associated flight to safety contributed to the appreciation of the US dollar and kept a lid on US Treasury yields. In October, a renewed increase in risk aversion (global risk shock) put downward pressure on both US Treasury yields and equity valuations. At the same time, a swifter than anticipated US monetary policy tightening (US monetary shock) added downward pressure on equity prices, while limiting the decline in US Treasury yields.

Chart A

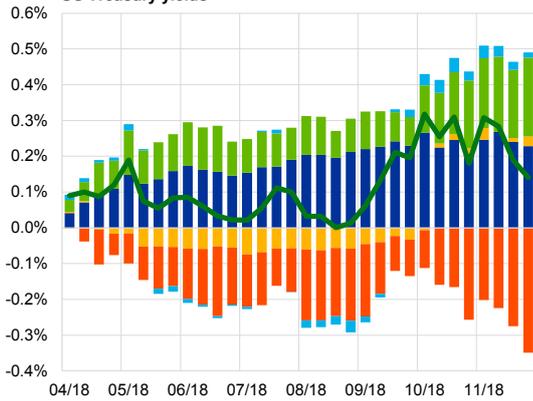
Strong US growth and increasing risk aversion are driving global markets

BVAR decomposition of key global financial variables

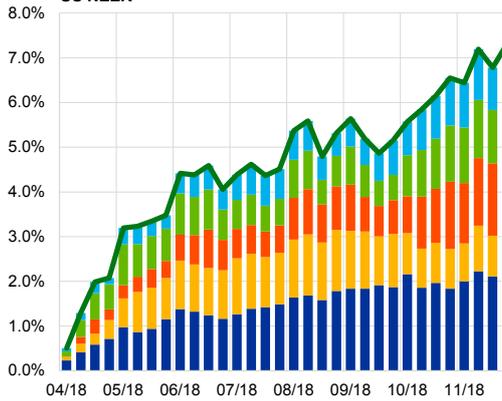
(13 Apr.-21 Nov. 2018, cumulative percentage change: 13 Apr. 2018 = 0)

- US demand shock
- US supply shock
- Global risk shock
- US monetary shock
- Unexplained
- US Treasury yields (cumulative change)

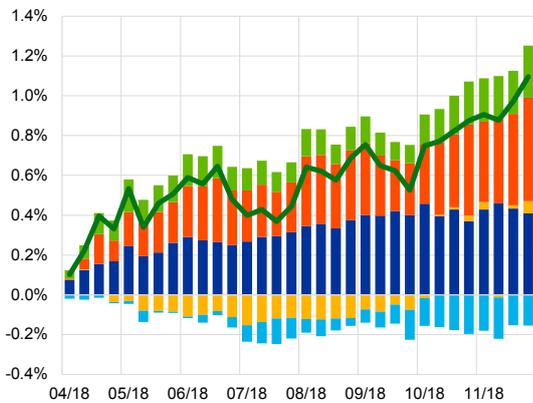
US Treasury yields



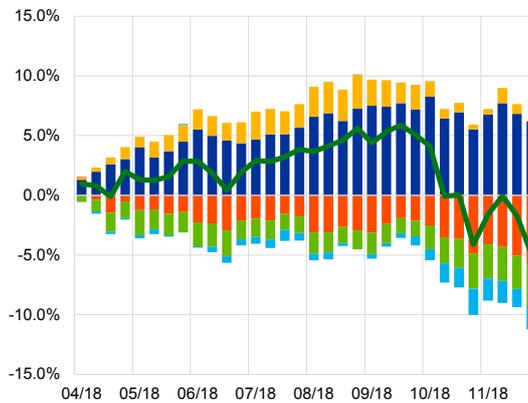
US NEER



EME sovereign yields



US equity (CAPE)



Sources: JP Morgan and ECB staff estimates based on the BEAR toolbox of Dieppe et al (2016).

Notes: The decomposition is derived from a structural BVAR with sign restrictions. The model decomposes data for the US economy (equity prices, risk-free bond yields (ten-year), market-implied inflation expectations, the effective exchange rate of the US dollar and EME sovereign bond yields (EMBI)) into four structural shocks: (i) demand shocks are identified by a concomitant decline in equity prices, inflation expectations, both risk-free and EME bond yields and the dollar; (ii) supply shocks are identified by a concomitant decline in equity prices and rise in inflation expectations and both risk-free and EME bond yields; (iii) risk shocks are identified by a concomitant decline in equity prices, risk-free bond yields and inflation expectations, as well as a simultaneous rise in EME bond yields and the dollar; and (iv) monetary (tightening) shocks are identified by a concomitant decline in equity prices and inflation expectations as well as a simultaneous rise in both risk-free and EME bond yields and the dollar.