Assessing the risks of asset overvaluation: models and challenges

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Objective

- Estimate the degree of under- / over-valuation of financial assets
- Motivated by worries (voiced by several economists) that very accommodative monetary policies might be causing asset prices bubbles by inducing search-for-yield phenomena and excessive financial risk taking

Results

- No evidence of over-valuation
  - for stocks and corporate bonds
  - in the major economies (EA, US, Japan)

Fundamental value

- An asset has fundamental value

$$p_t^f = \sum_{j=1}^{\infty} \mathrm{E}\left[k_{t+j} d_{t+j}\right]$$

- Intuitively, p_t^f is the value that an economic agent derives from buying the asset and holding it "forever"
- Price p_t can deviate from fundamental value when agents recognize profit opportunities from buying an re-selling after a short period of time (Grossman and Diba AER 1988 and EJ 1988 give a rigorous definition).
- Bubbles (i.e., large deviations of price from fundamental) are eventually corrected by market forces, but correction tends to have harmful macro-economic consequences (e.g., Brunnermeier and Oehmke NBER 2012).

In practice

In most bubbles observed in practice:

- price rises much above fundamental price, on expectations of further price increases
- collateral value of asset increases, more money is borrowed through collateralized loans and used to buy the asset, price rises further
- eventually, market forces start to push price towards fundamental
  - supply (more houses are built, more stocks are issued in IPOs) -> can cause **inefficient allocation of capital**
  - demand (non-speculative buyers, e.g., long-term investors, divest)
- the bubble bursts, price starts to decrease
- margin calls on collateralized loans can trigger fire sales, negative feed-back loops and eventually **defaults**
- if there is contagion and uncertainty about who is losing what, there can be **bank runs** (classical, or of intermediaries on other intermediaries)

Harmful consequences

So, in practice, a bubble can have serious

- macroeconomic consequences (inefficient allocation of capital, with consequent low economic growth)
- financial consequences (defaults, bank runs)

This is why:

- macroprudential policies aimed at preventing bubbles are continuously discussed
- the debate whether monetary authorities should prick bubbles or not is still alive

Challenges

- Fundamental value

$$p_t^f = \sum_{j=1}^{\infty} \mathrm{E}\left[k_{t+j} d_{t+j}\right]$$

  is hard to estimate because:

  - no standard methodology to assign probability distributions to future cash flows d_{t+j}
  - discount factors k_{t+j} depend on things (e.g., preferences, covariances between macroeconomic outcomes and asset returns) that are hard to assess

Tackling uncertainty

- Explicitly take into account uncertainty in estimating cash flows and discount factors (confidence intervals)
- Agnostic approach:
  - uninformative prior on set of different methods for predicting cash flows
  - uninformative prior on set of required rates of return, obtained as sum of
    - current risk-free rate
    - draws from the empirical distribution of model-implied (ex-ante) risk-premia (assumption: values for the risk premium that have been observed more frequently in the past are more likely to be correct)
- Obtain confidence intervals for fundamental values
- Compare with current price

Stocks

- For stocks:
  - discount factors are in terms of required real returns;
  - cash flows are in terms of inflation-adjusted dividends:

$$P_t^f = \sum_{j=1}^{\infty} \frac{1}{\left(1 + y_t^f\right)^j} d_{t+j}$$

- Under reasonable hypotheses (such as irrelevance of dividend policy, e.g., Easton AR 2004, Ohlson and Juettner-Nauroth RAS 2005), fundamental value of a stock can be written as

$$P_t^f = \frac{\overline{E}_t}{y_t^f} = \frac{\overline{E}_t}{\rho_t^f + r_t} \tag{1}$$

  - where $\overline{E}_t$ are cyclically-adjusted real earnings per share
  - y_t^f is the real return that investors expect to obtain from equities over the long run
  - ρ_t^f is the fair risk premium
  - r_t is the risk-free rate

Stocks - CA Earnings

- Use several methods $\overline{E}_{t,i} : i \in I$ for the estimation of $\overline{E}_t$:
  - n-year moving averages of reported earnings (different values of n);
  - exponentially weighted moving averages (different decay factors);
  - HP filtered earnings (different parameters).
- Impose a discrete uniform uninformative prior on the different methods (prior ignorance on the right method)
- Obtain a probability distribution for $\overline{E}_t$ (at each date).

Stocks - Risk premia

- Set of estimated historical ex-ante risk premia

$$R = \left\{ \rho_{t,i} = \frac{\overline{E}_{t,i}}{P_t} - r_t : i \in I, t \in \{1, \ldots, T\} \right\}$$

where:

  - $\overline{E}_{t,i}$ the estimate of earnigns obtained with method $i \in I$;
  - I is the set of all methods used;
  - $\rho_{t,i} = \frac{\overline{E}_{t,i}}{P_t} - r_t$ is the risk premium required by investors if $P_t = P_t^f$ (i.e., if stocks are correctly valued at time t) and $\overline{E}_t = \overline{E}_{t,i}$ (i.e., if the estimate of $\overline{E}_t$ produced by method i is correct).

- Represent uncertainty about ρ_t^f by assigning a discrete uniform uninformative prior to the set R.

Stocks - Intutition

- Intuitively, economic hypothesis is:
  - most of the times (but not always) observed price is not too distant from fundamental and estimate of permanent earnings is not too distant from true value
- Consequence:
  - the set R should mostly (but not only) contain values that are reasonable estimates of the risk premium that an investor might require at any given time.
  - the set I should mostly (but not only) contain values that are reasonable estimates of the permanent component of earnings
- Our prior ignorance is represented by (agnostic) uniform prior on I and R

Confidence bands

- Priors on R and I induce a probability distribution on fundamental value P_t^f
- Distribution is used to compute confidence bands for P_t^f (level of confidence at 80% - discard first and last deciles)
- Actual price P_t is under/over-valued if it is out of confidence bands

Roughly speaking, this corresponds to a belief that in the past the price has been in line with fundamentals at least 80% of the times. Lower levels of confidence could be chosen to match beliefs that prices might have deviated more often from fundamentals.

Corporate bonds

- For corporate bonds, procedure similar to stocks:
  - discount factors are in terms of equilibrium yield-to-maturity
  - cash flows are in terms of coupons and principal repayments:

$$P_t^f = \sum_j \frac{1}{\left(1 + y_t^f\right)^j} C_{t+j}$$

  where y_t^f is the fair bond yield

- By using first order approximation, fundamental price can be written as

$$P_t^f = P_t \left[1 - D_t \left(\rho_t^f + \delta_t - s_t\right)\right]$$

  where:

  - P_t is the observed price
  - D_t is the duration of the bond
  - ρ_t^f is the fair risk premium
  - δ_t are expected default losses
  - s_t is the observed spread

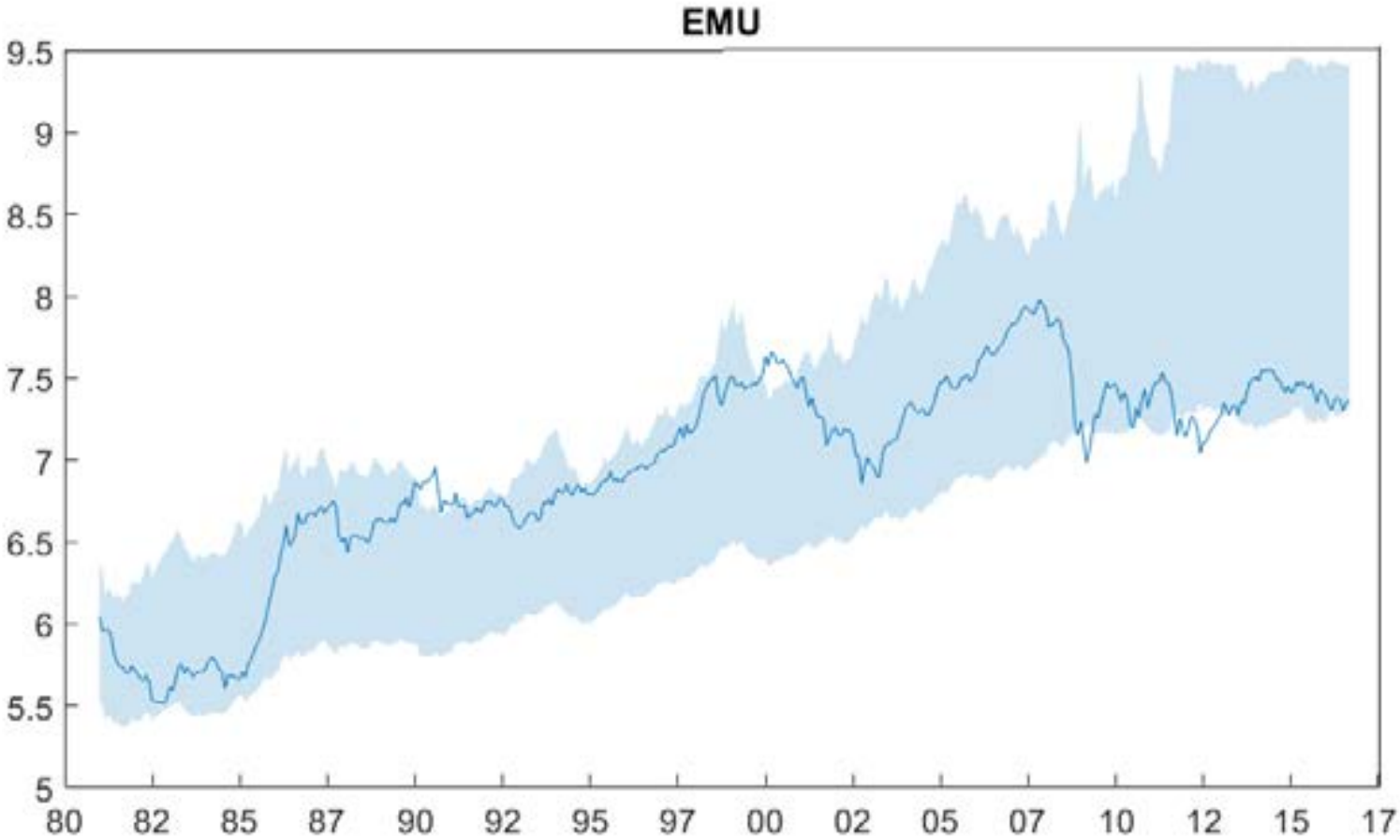
Corporate bonds - Risk premium

- Historically, expected default losses δ_t on investment grade bonds are negligible (e.g., Collin Dufresne et al. JF 2001, Collin-Dufresne et al. NBER 2003, Driessen RFS 2005 and Chen et al. WP 2015) and bond spread approximately concides with risk premium (it compensates for excess price volatility and liquidity risk)
- Several estimates $\widehat{\delta}_{t,i}$ $(i \in I)$ in our paper (from predictive regressions; all approx. zero on average)
- Set of estimated historical ex-ante risk premia is

$$R = \left\{ \rho_t = s_t - \widehat{\delta}_{t,i} : i \in I, t \in \{1, \ldots, T\} \right\}$$

- Represent uncertainty about fair premium ρ_t^f by assigning a discrete uniform uninformative prior to the set R.
- Interpretation is the same as for stocks, and confidence bands for P_t^f are obtained in a similar manner.

Stocks - EMU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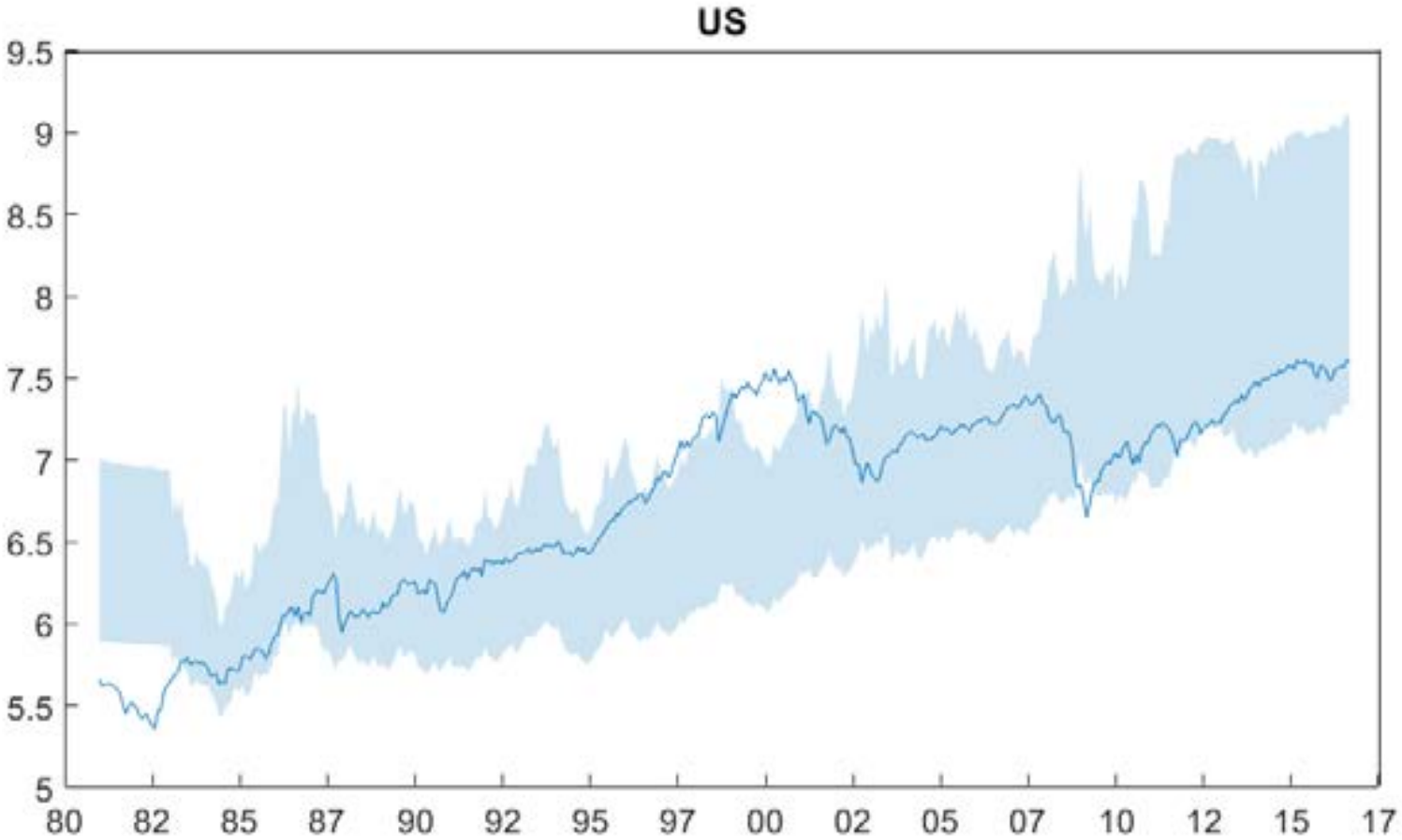
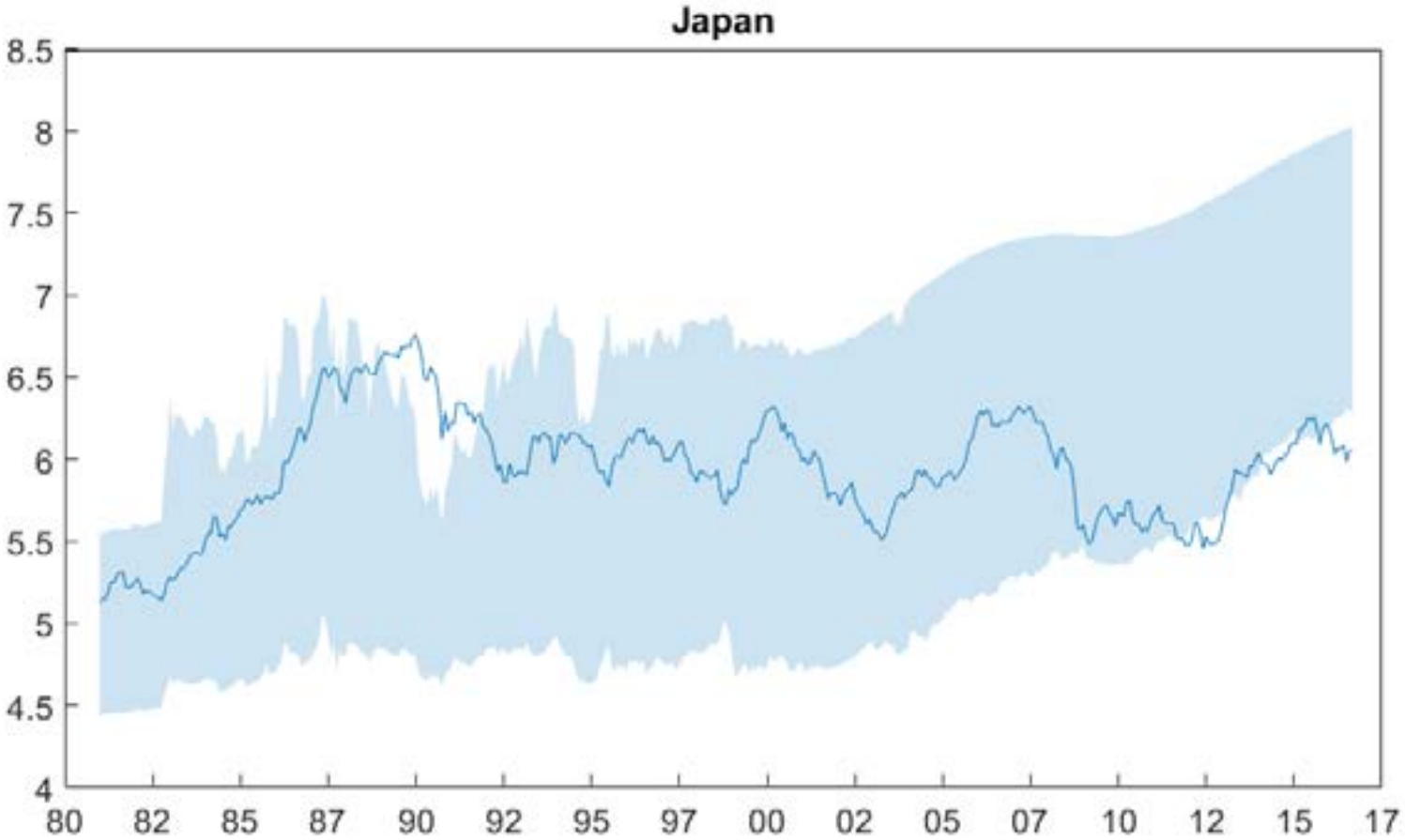
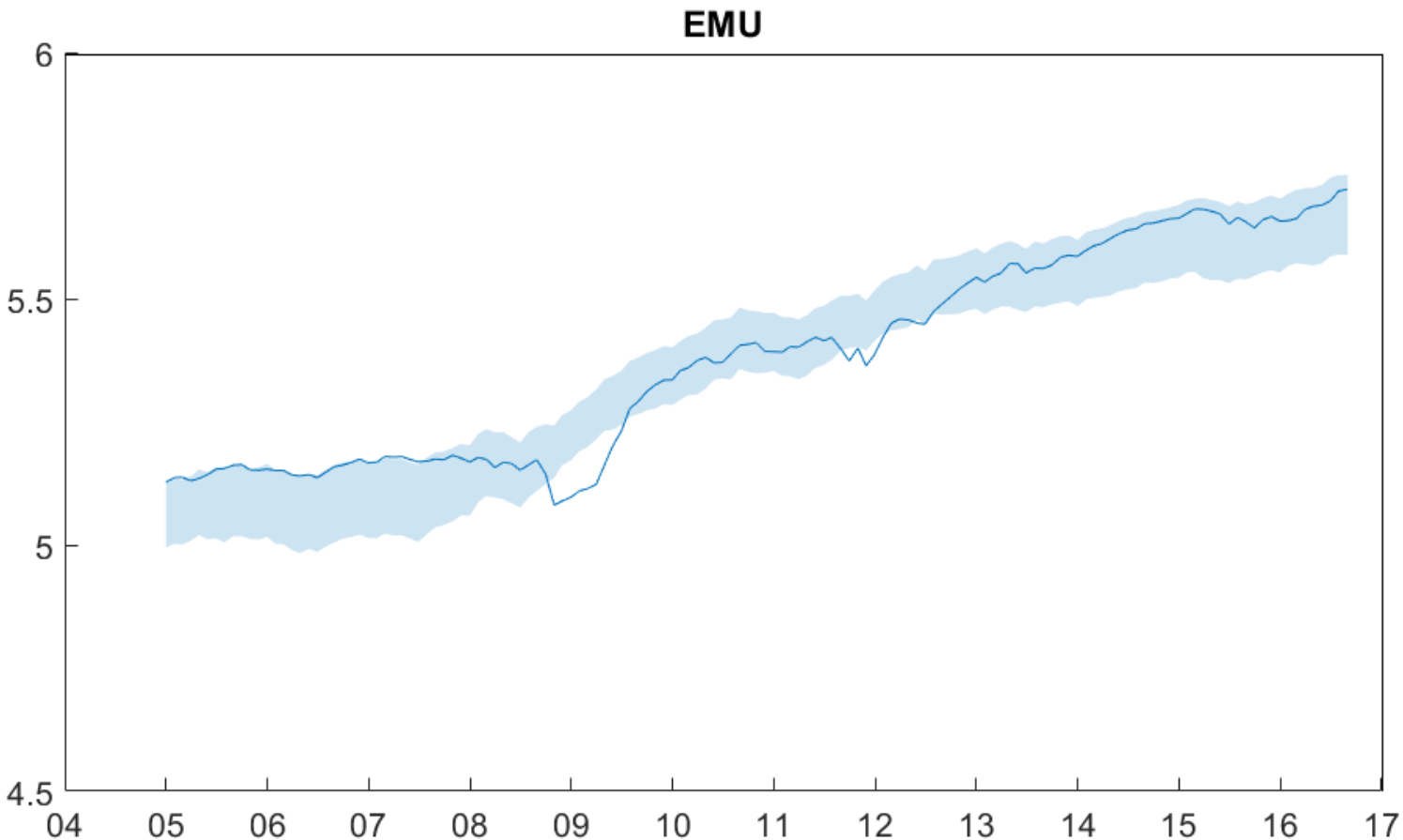
Stocks - USA



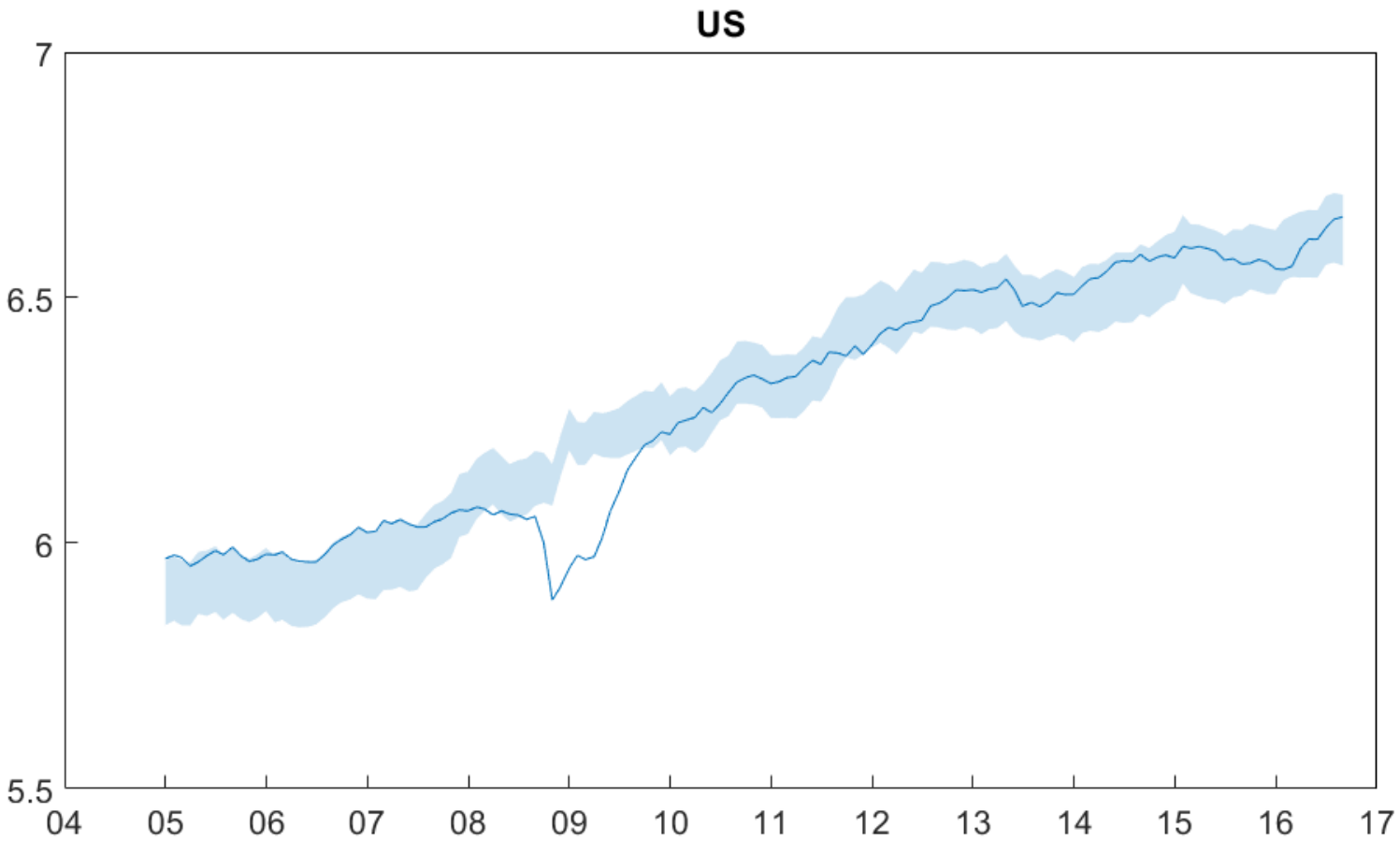
Stocks - Japan



BBB Corporates - EMU



BBB Corporates - US



Conclusions

- Well-known bubbles (tech, Heisei) are identified by our models
- Euro area and US stocks are currently not over-valued (if anything, they are quite cheap; their expected return is still much higher than that of bonds; see also Blanchard and Gagnon 2016)
- US corporates are fairly valued
- Euro area corporates are not over-valued but their valuation might be a little bit stretched
- NO EVIDENCE of distortions from accommodative policies