Master's Thesis Conference

Modelling the Yield Curve in the United States and the Euro Area

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2. Methodology
   - The Nelson-Siegel Model
   - SVAR
3. Empirical Results
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The Yield Curve in 2022

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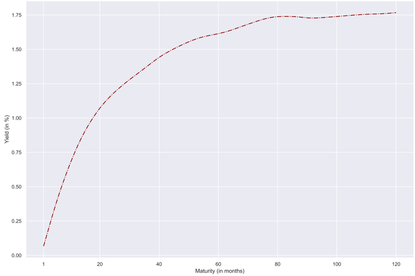

Figure: US Treasury Yield Curve, January 2022

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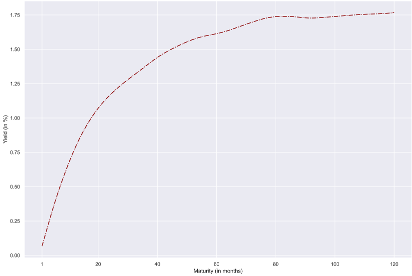

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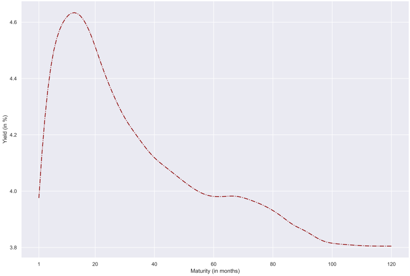

Figure: US Treasury Yield Curve, December 2022

The Yield Curve and the Macroeconomy

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Yields-to-Macro Channel

- Yields are central for the transmission of monetary policy — especially considering unconventional monetary policy tools such as QE and Forward Guidance (see: Gürkaynak, Sack, and Swanson (2005), Gürkaynak and Wright (2012), Altavilla et al. (2019), and Swanson (2021))

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- Yields are also highly relevant for fiscal policy (public debt)
- An inversion of the yield curve has (historically) been a very accurate predictor of recessions

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1. Step 1: Nelson-Siegel decomposition of the respective yield curve with maturities 3, 6, 9, 12, 15, 18, 21, 24, 30, 36, 48, 60, 72, 84, 96, 108 and 120 months

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1. Step 1: Nelson-Siegel decomposition of the respective yield curve with maturities 3, 6, 9, 12, 15, 18, 21, 24, 30, 36, 48, 60, 72, 84, 96, 108 and 120 months
2. Step 2: Identification via an SVAR using short-run zero-restrictions

Nelson-Siegel Model

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Following the representation of Diebold and Li (2006), the yield curve is assumed to be represented by the Nelson and Siegel (1987) three factor model

$$y_t(\tau) = L_t + S_t \left(\frac{1 - \mathrm{e}^{-\lambda\tau}}{\lambda\tau} \right) + C_t \left(\frac{1 - \mathrm{e}^{-\lambda\tau}}{\lambda\tau} - \mathrm{e}^{-\lambda\tau} \right) + \varepsilon_t \tag{1}$$

Nelson-Siegel Model

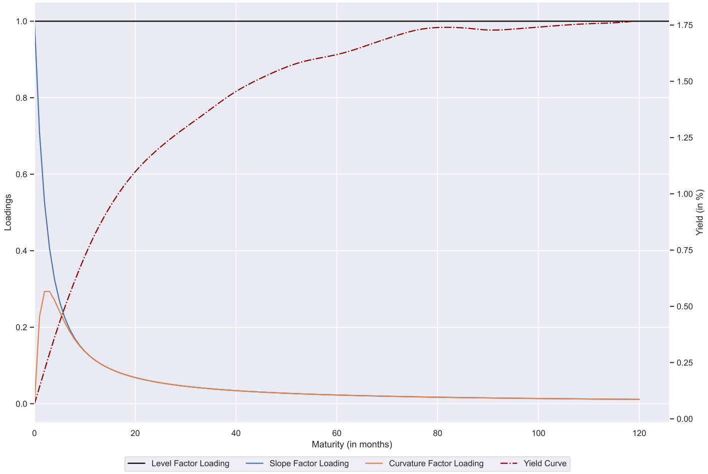

Figure: Actual Nelson-Siegel Factor Loadings as of January 2022, US

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$$\boldsymbol{Y_t} = [IP_t,\ \pi_t,\ i_t,\ FS_t,\ L_t,\ S_t,\ C_t,\ M_t]$$

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Cholesky Decomposition

$$
\begin{bmatrix} \varepsilon_t^{IP} \\ \varepsilon_t^{\pi_t} \\ \varepsilon_t^{i_t} \\ \varepsilon_t^{FS_t} \\ \varepsilon_t^{L_t} \\ \varepsilon_t^{S_t} \\ \varepsilon_t^{C_t} \\ \varepsilon_t^{M_t} \end{bmatrix} = \begin{bmatrix} b_0^{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_0^{21} & b_0^{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ b_0^{31} & b_0^{32} & b_0^{33} & 0 & 0 & 0 & 0 & 0 \\ b_0^{41} & b_0^{42} & b_0^{43} & b_0^{44} & 0 & 0 & 0 & 0 \\ b_0^{51} & b_0^{52} & b_0^{53} & b_0^{54} & b_0^{55} & 0 & 0 & 0 \\ b_0^{61} & b_0^{62} & b_0^{63} & b_0^{64} & b_0^{65} & b_0^{66} & 0 & 0 \\ b_0^{71} & b_0^{72} & b_0^{73} & b_0^{74} & b_0^{75} & b_0^{76} & b_0^{77} & 0 \\ b_0^{81} & b_0^{82} & b_0^{83} & b_0^{84} & b_0^{85} & b_0^{86} & b_0^{87} & b_0^{88} \end{bmatrix} \begin{bmatrix} \omega_t^{IP} \\ \omega_t^{\pi_t} \\ \omega_t^{i_t} \\ \omega_t^{FS_t} \\ \omega_t^{L_t} \\ \omega_t^{S_t} \\ \omega_t^{C_t} \\ \omega_t^{M_t} \end{bmatrix} \tag{4}
$$

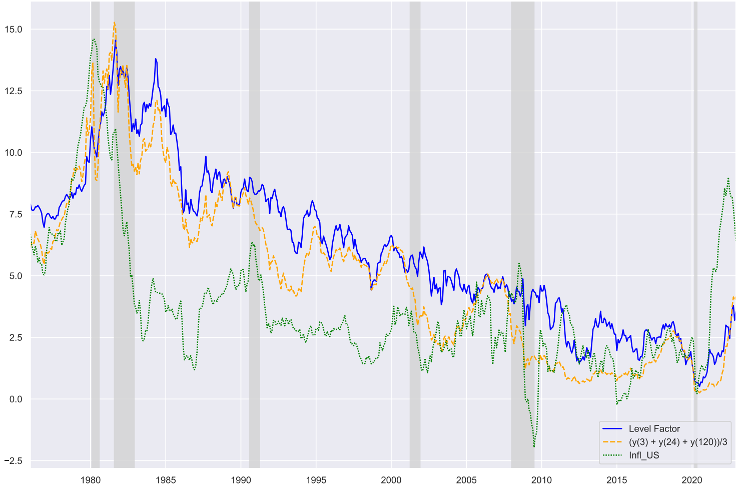

Figure: Level factor, empirical proxy and inflation, US

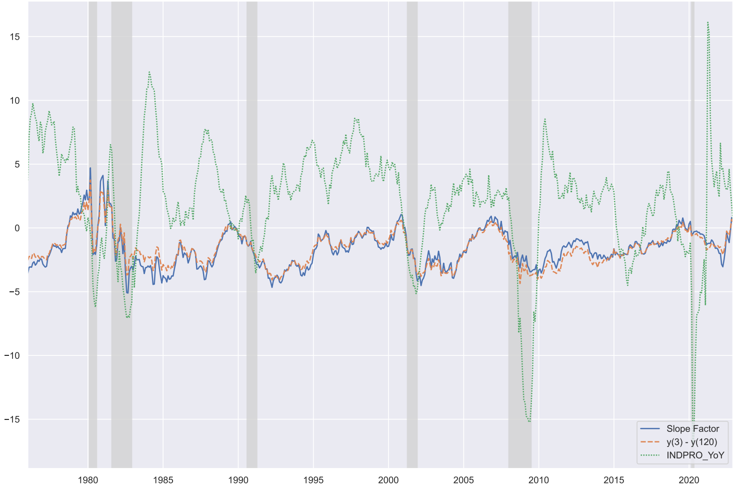

Figure: Slope factor, empirical proxy and Industrial Production, US

IRF US

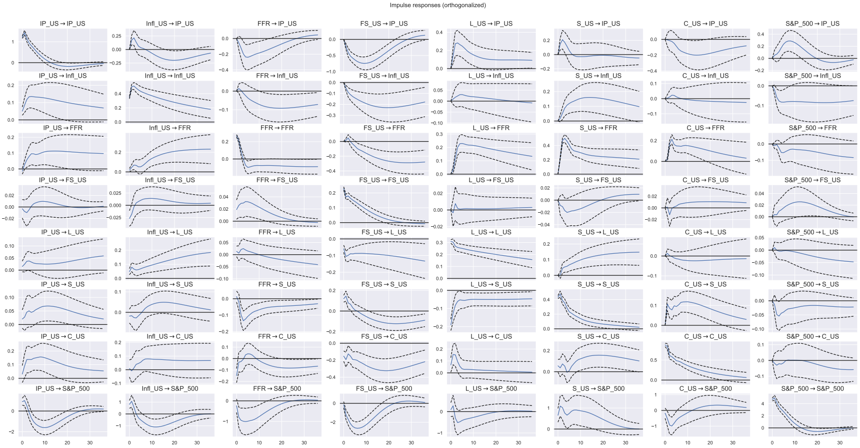

Figure: Impulse Responses SVAR(6), US

IRF EA

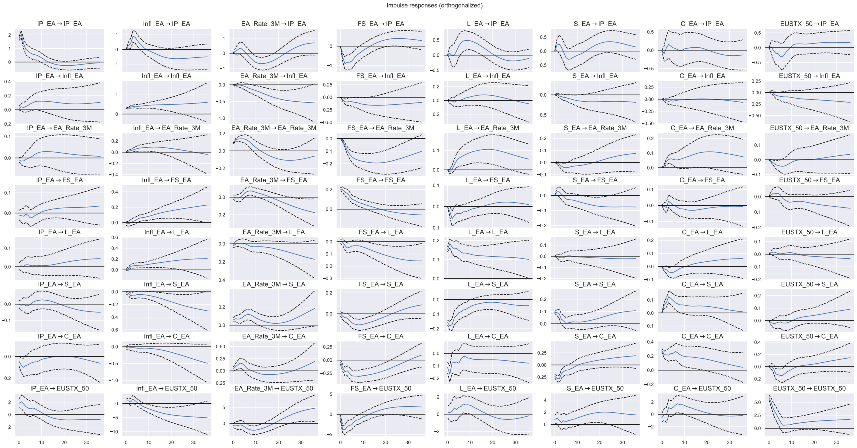

Figure: Impulse Responses SVAR(6), EA

Management Summary

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- Level factor (L_t) seems to be a good approximation of long-run inflation expectations — especially assuming a real interest rate given by $r_t = i_t - L_t$

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- Inflation expectations (L_t) seem to become somewhat unanchored given an aggregate supply (π_t) or aggregate demand (IP_t) shock in both the US and the EA
- Slope Factor (S_t) is associated with an economic contraction only in the EA
- A monetary policy shock (i_t) induces a decrease in the level factor (L_t), underlining the high credibility and transparency of the Fed and ECB

Data

Data US

- Sample: January 1976 – December 2022
- Industrial Production (FRED: INDPRO)
- CPI (FRED: CPIAUCSL)
- Federal Funds Effective Rate (FRED: DFF)
- S&P 500 (Yahho Finance: ^GSPC)
- Excess Bond Premium (EBP)[1]
- β factors based on yields data provided by Liu and Wu (2021))[2]

[1] source: Fed Note Data

[2] source: Liu-Wu Yield Data

Data EA

- Sample: October 2004 – September 2022
- Industrial Production (FRED: EA19PRINTO01GYSAM)
- Inflation (FRED: CPHPTT01EZM659N)
- 3M Interbank Rate (FRED: IR3TIB01EZM156N)
- Eurostoxx 50 (Yahho Finance: ^STOXX50E)
- Credit Risk EA[3]
- β factors based on yields data provided by the ECB[4]

[3] source: Banque de France

[4] source: dataset "All years - AAA"

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