

A Macroeconomy with Intuitive Thinkers

Maren Bartels¹ Johannes Binswanger² Albert Flak² Manuel Oechlin¹

¹University of Lucerne

²University of St. Gallen

Motivation

- Expectations = key in macroeconomics (e.g., $x_t = A\mathbb{E}_t x_{t+1} + u_t$).
- Much recent empirical evidence challenges full information rational expectations (FIRE).
(E.g. narratives *Andre et al. (2022)*, grocery prices *D'Acunto et al. (2021)*, ...)
- Our contribution: **dual system model of expectation formation**.
- Intuition: “Slow” (rigorous, rational) thinking gets perturbed by “fast” (intuitive) thinking.
- Application: stagflationary subjective model in a tractable DSGE framework; calibrate impulse responses to an “intuitive inflation expectation shock”.

Motivating Evidence: A Stagflationary Intuitive Model

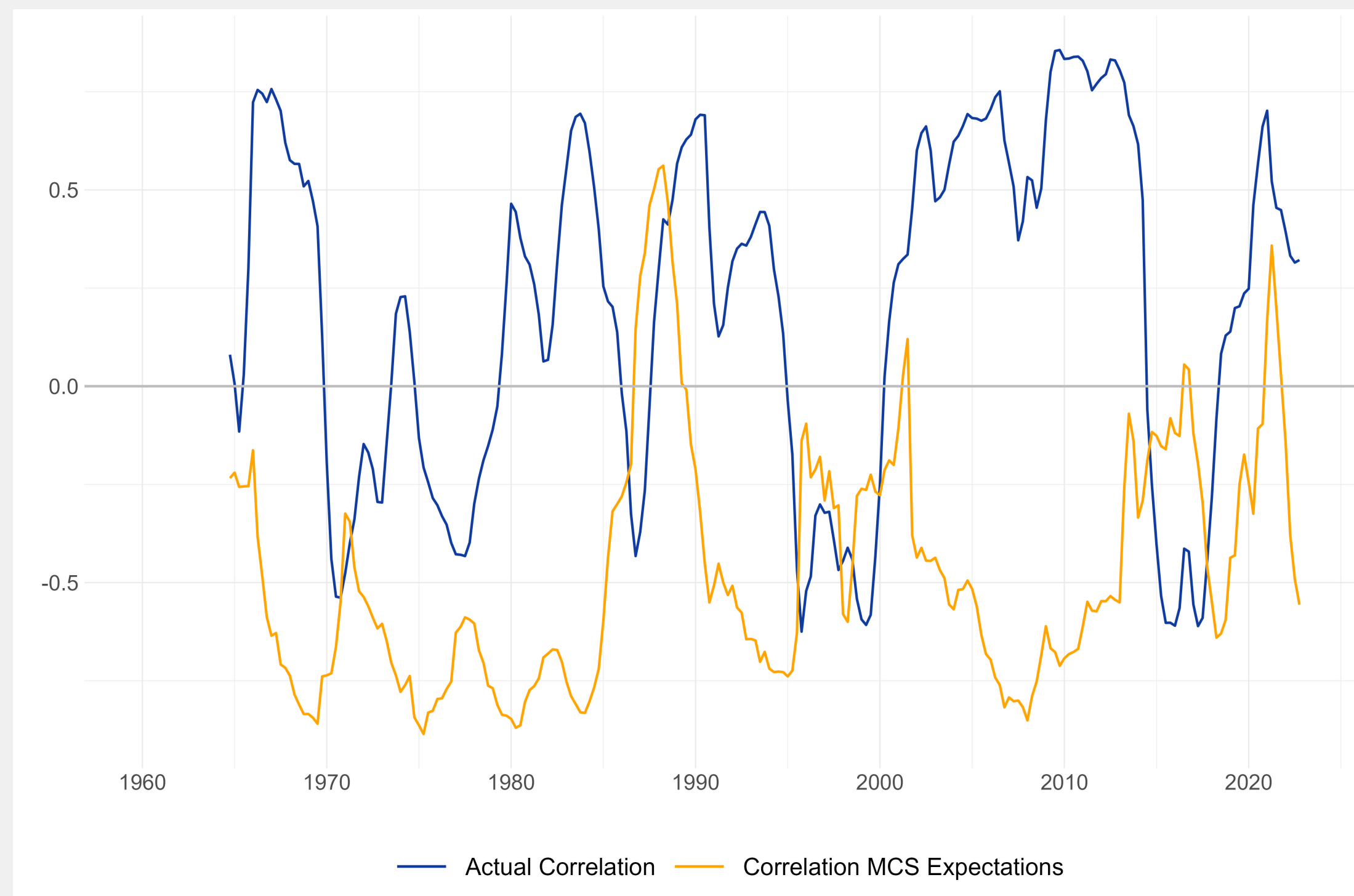


Figure 1. Correlations: Actual Macroeconomic Data vs. Michigan Survey Expectations

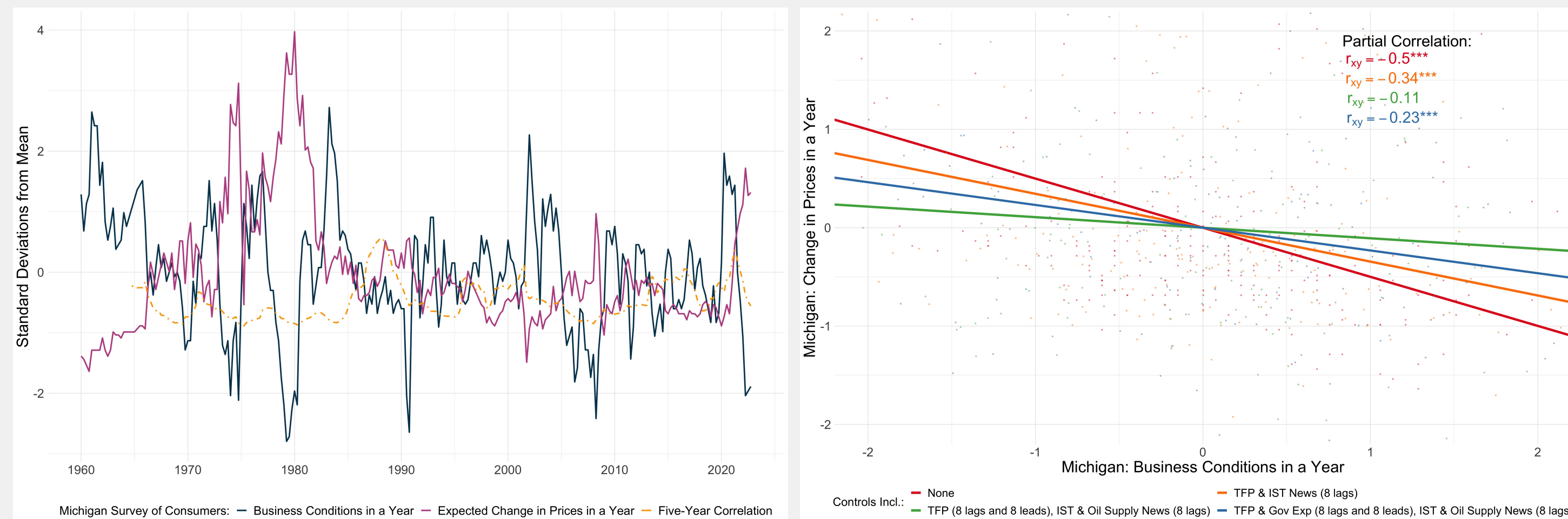


Figure 2. Associating High Inflation with Negative Economic Outlook? The Stagflationary View.

The Model: Dual System Expectations

Solution to a Blanchard-Kahn-type recursive equilibrium ($x_t = A\mathbb{E}_t[x_{t+1}] + Bu_t$) is a weighted sum of expected future fundamental disturbances u_{t+h} :

$$x_t = Bu_t + A\mathbb{E}_t[Bu_{t+1}] + A^2\mathbb{E}_t[Bu_{t+2}] + \dots \quad (1)$$

We propose the following “perturbation” by the intuitive mind:

$$\mathbb{E}_t[Bu_{t+h}] \rightarrow \mathbb{E}_t^{DS}[Bu_{t+h}] = \underbrace{\Psi^{\text{“rational”}}}_{\text{rational signal(s)}} \cdot u_t + \underbrace{\Psi^{\text{“intuitive”}}}_{\text{“gut signal(s)”}} \cdot s_t \quad (2)$$

Note:

- The term s_t (“sentiments”) captures agents’ non-FIRE elements of expectation formation (e.g. shocks to grocery prices, diagnostic expectations, ...).
- Agents feel that $\text{Cov}(u_{t+h}, s_t) \neq 0$; and so sentiments (unconsciously) enter their forecasts of future fundamental states.
- $\Psi^{\text{“intuitive”}}$ determines the relative importance of the intuitive system.

The equilibrium becomes:

$$x_t = (I - \delta\rho A)^{-1}Bu_t + \delta A(I - \delta A)^{-1}\bar{\Gamma}s_t \quad (3)$$

$$\mathbb{E}_t^{DS}x_{t+1} = \delta\rho(I - \delta\rho A)^{-1}Bu_t + \delta(I - \delta A)^{-1}\bar{\Gamma}s_t \quad (4)$$

- The parameter δ ($0 < \delta \leq 1$) reflects cognitive discounting à la *Gabaix (2020)*.
- We assume that sentiments s_t are independent of fundamentals u_t .
- EQ (4) naturally links to empirical applications.

Note: We need to assure that EQ (1) still holds under dual system expectations. For this, we develop a distinction between *deductive reasoning* and *estimation reasoning*.

Linking the Model to the Data

- EQ (4) gives us an approach to estimate sentiments from survey data: Take residuals from regressing empirical expectations on fundamentals, solve for s_t .
- Assume

$$s_t = \Phi s_{t-1} + \eta_t \quad (5)$$

with $s_t = (s_t^y, s_t^\pi)'$; generally, $\text{Cov}(\eta_t^y, \eta_t^\pi) \neq 0$.

- Use this in EQ (3) to derive impulse responses to an innovation in agents’ intuition. Example: surprising and “emotionally loaded” increase in grocery gasoline prices (*D'Acunto et al., 2021*).
- Output sentiment changes conditional on inflation sentiment. This “identification” is based on *Binetti et al. (2024)*, *Stancheva (2024)*

IRF Results

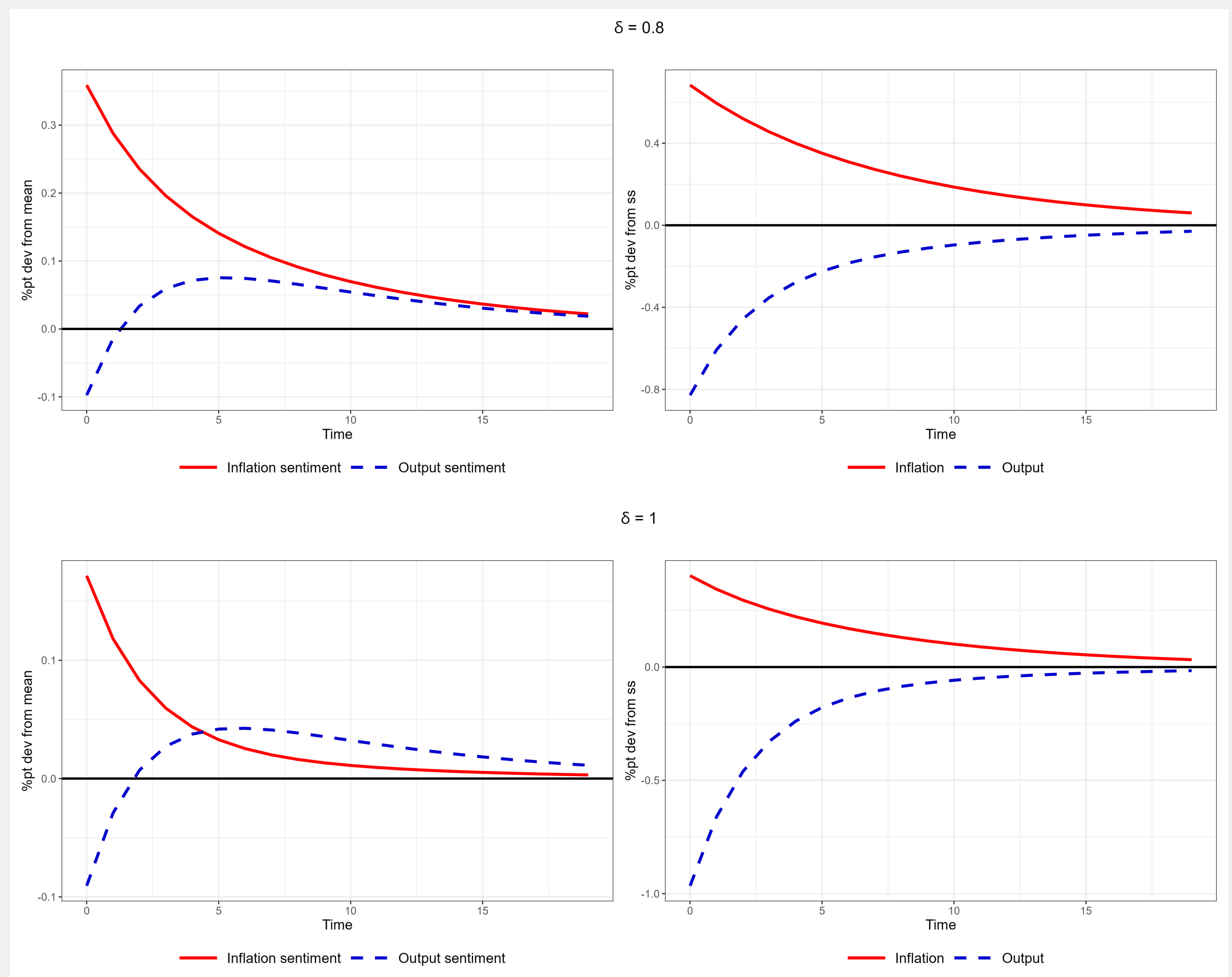


Figure 3. Estimated Impulse Responses

- Stagflationary model manifests itself in sentiments (initial shifts)
- Sentiments become partially self-fulfilling
- The impulse responses look like a supply shock since agents have the template of a supply shock in their mind

Microfoundation of Intuition: Diagnostic Expectations

The stagflationary model can be microfounded and embedded in the sentiment framework using diagnostic expectations.

	Red hair	Other hair		Low output growth	Other output growth
Irish	10%	90%	High inflation	43%	57%
Rest of the world	1%	99%	Other inflation	19%	81%
Diagnostic value	10	0.91	Diagnostic v.	2.24	0.71

Table 1. Taken from Bordalo et al. (2018)

Table 2. Estimated based on UoM Survey of Consumers

- The probability of low output (red hair) gets overestimated when faced with high inflation (an Irish).
- The same applies to low output growth when inflation is relatively high.
- Leads to negative correlation between inflation and output growth expectations.

Outlook

- Heterogeneity in cognitive sophistication
- Further development of microfoundations for the intuitive model
- Correlations between fundamentals and sentiments; monetary policy (communication) may influence sentiments
- Large(r) DSGE models
- What makes for a *good* monetary policy in a world inhabited by intuitive (dual-processing) agents?