

The Rational Inattention Framework: Recent Developments

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Introduction

- Rational inattention is a theory of decision-making.
- It formalizes the idea that agents have limited attention and attention is a choice.
- The theory of rational inattention was introduced by Christopher A. Sims in 2003.

- The static rational inattention problem
- The dynamic rational inattention problem
- The Rational Inattention NK model
- The Rational Inattention RBC model

The static rational inattention problem

- Timing:

- ① The agent chooses an attention strategy to refine her belief about the state, so as to maximize the expectation of utility less of the cost of paying attention, while considering the action strategy she applies later. The attention strategy is described by what signal s the agent gets for a given realized state x , i.e., by a distribution $f(s|x)$.
- ② The agent receives a signal s and her posterior is formed.
- ③ The agent chooses an action y .

- Formally,

$$\max_{f(s|x)} \{E[U(y, x)] - \lambda I(s; x)\}$$

$$\text{subject to } y = \arg \max_z E[U(z, x) | s]$$

Features of the solution

- Randomness: For example, when U is quadratic and $x \sim N(\mu, \sigma_x^2)$,

$$s = x + \varepsilon \quad \varepsilon \sim N(0, \sigma_\varepsilon^2)$$

- Kahneman, Sibony, Sunstein: “Noise,” 2021.
- Under-reaction:

$$y = \frac{1}{1 + \frac{\sigma_\varepsilon^2}{\sigma_x^2}} (x + \varepsilon)$$

- Higher stakes and higher volatility increase attention.
- More accurate posteriors in some states of the world. Discreteness.
- Multi-dimensional simplification

The dynamic rational inattention problem

- Example:

$$\max_{f_t(s_t|x_t)} \sum_{t=0}^{\infty} \beta^t \{E[U(y_t, x_t)] - \lambda I(s_t; x_t | I_{t-1})\}$$

subject to

$$y_t = \arg \max_z E[U(z, x_t) | I_t]$$

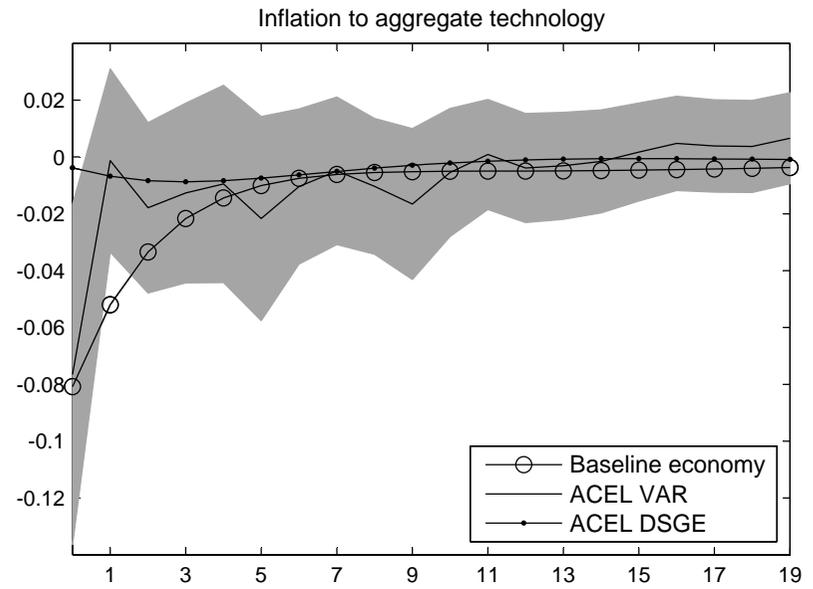
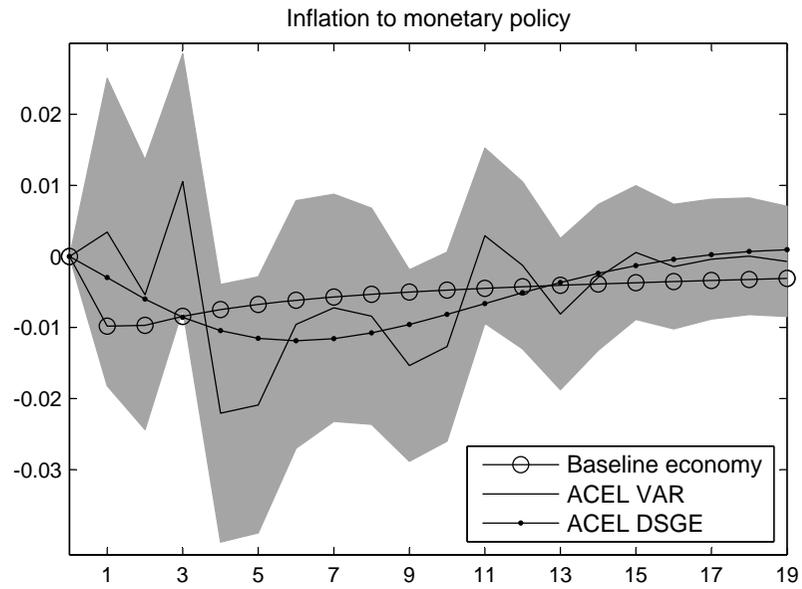
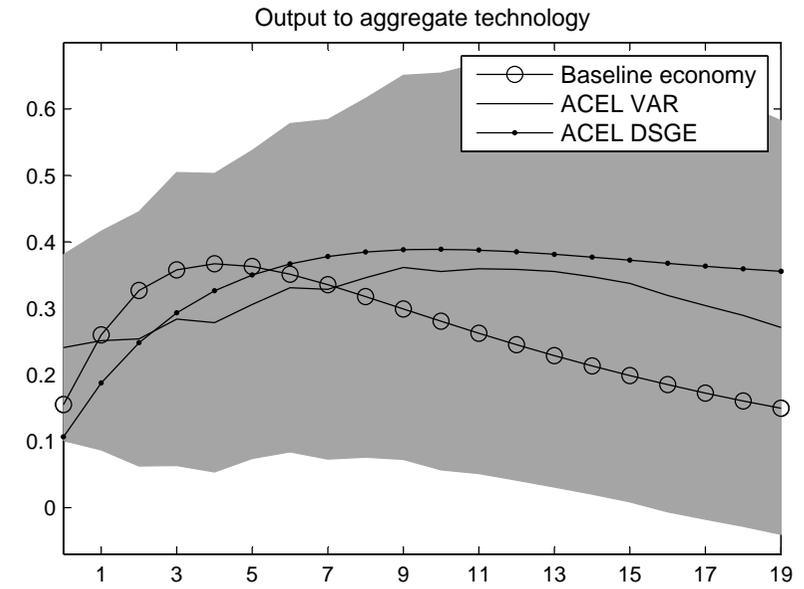
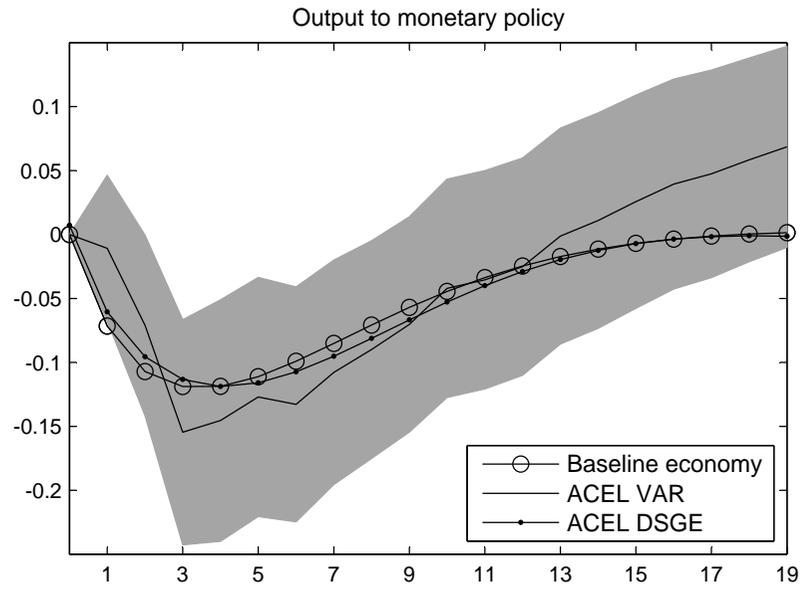
$$x_{t+1} = Fx_t + v_t$$

$$I_t = I_{t-1} \cup \{s_t\}$$

The Rational Inattention NK model

- Paper: Maćkowiak and Wiederholt, “Business Cycle Dynamics under Rational Inattention,” Review of Economic Studies, 2015.
- Motivation: Investigate the original conjecture of Sims (1998) that the inertia in aggregate data could be understood as the result of a single source of slow adjustment – rational inattention.
- What we do: We take a New Keynesian model. We discard all sources of slow adjustment (Calvo price setting, Calvo wage setting, habit formation in consumption). We introduce RI on the firm side and the household side as the only source of slow adjustment. Two free parameters: λ_{firm} and $\lambda_{household}$. Two questions: Do there exist parameters for which the model can match the IRFs to monetary policy shocks? For the same parameters, can the model match the IRFs to technology shocks?
- What we find: Yes and yes.

Figure 1: Impulse responses in the baseline economy and in Altig et al. (2011)



Sources: Altig et al. (2011) and own calculations.

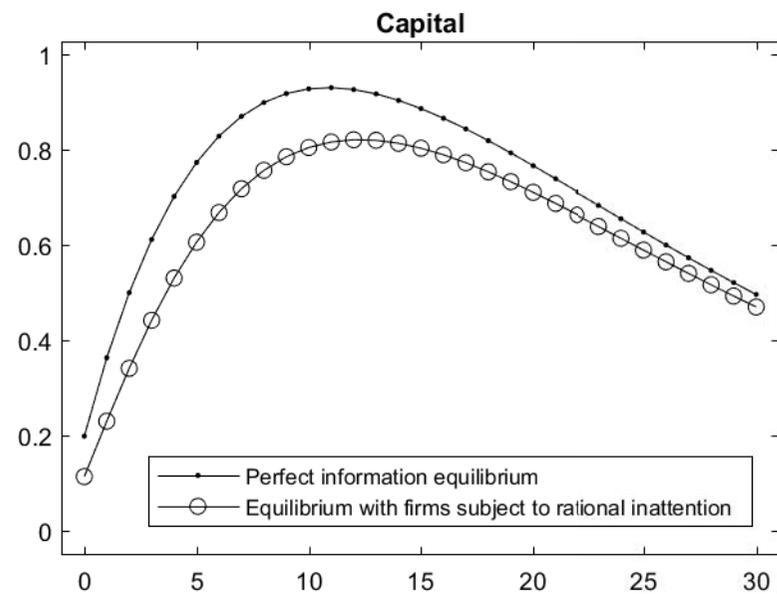
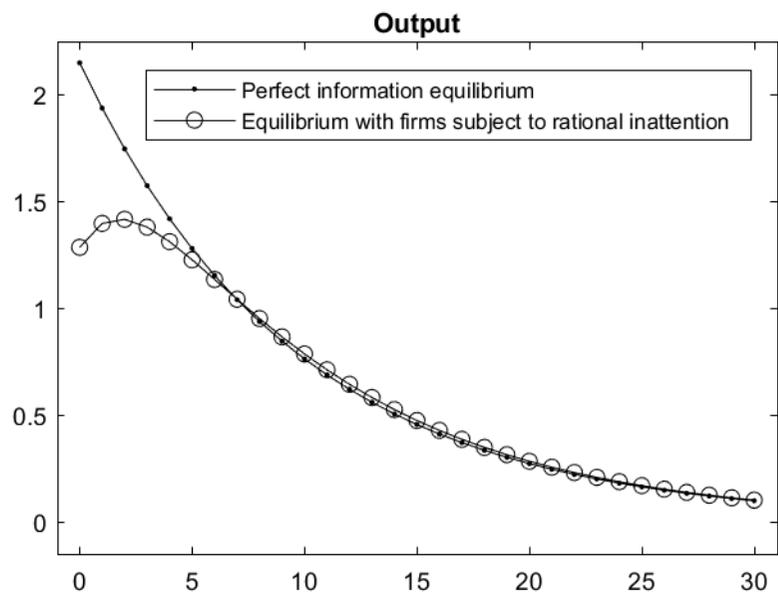
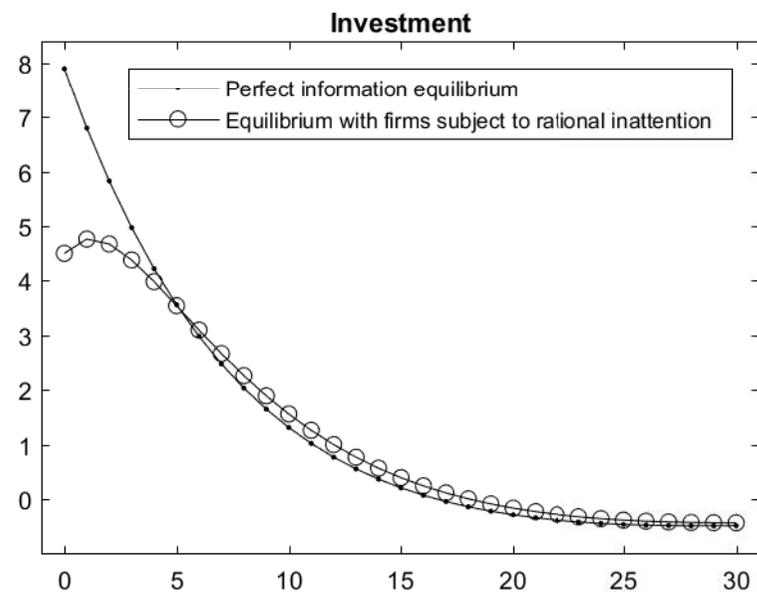
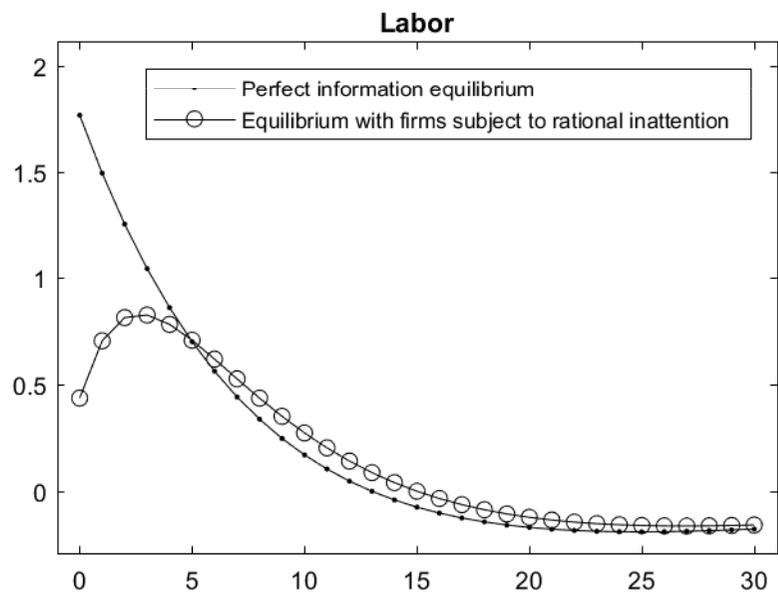
An impulse response equal to 1 means a 1 percent deviation from the non-stochastic steady state.

The ACEL VAR impulse responses are shown with 95 percent confidence intervals.

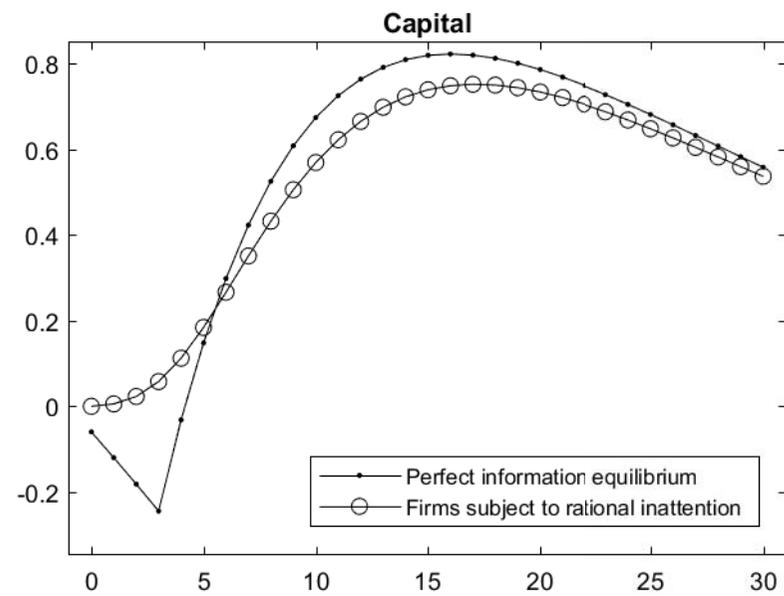
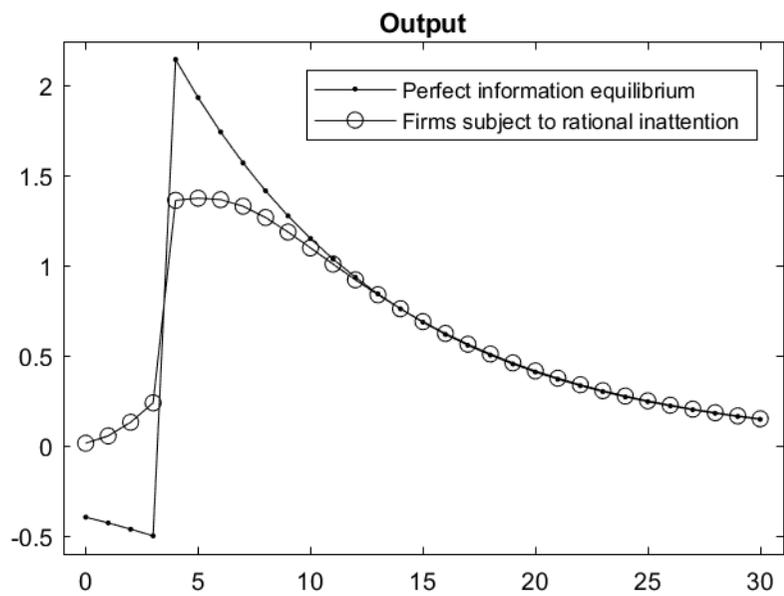
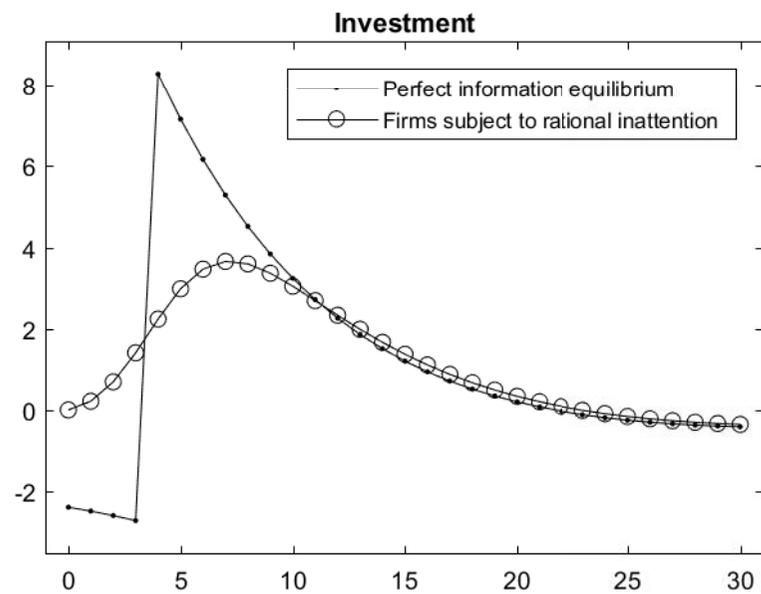
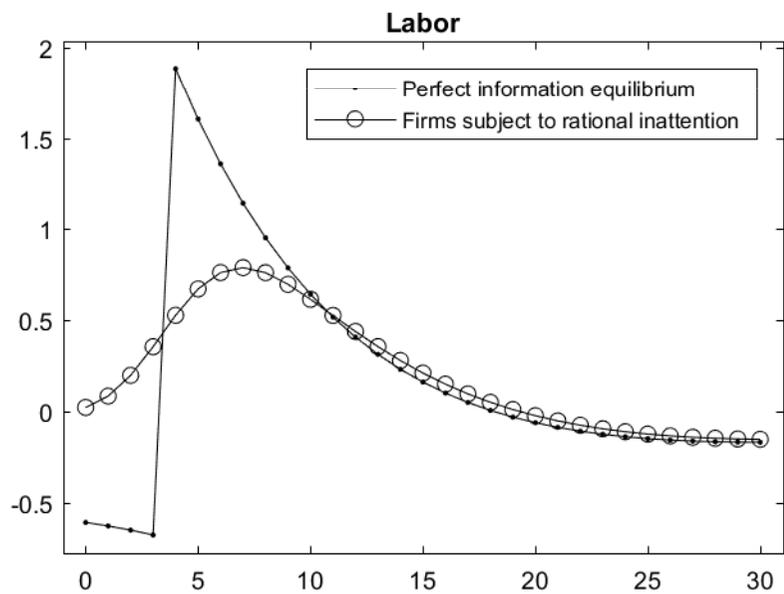
The Rational Inattention RBC model

- Paper: Maćkowiak and Wiederholt, “Rational Inattention and the Business Cycle Effects of Productivity and News Shocks,” Unpublished Manuscript, 2021.
- Motivation: Investigate whether rational inattention helps to address weaknesses of the RBC model.
- What we do: We introduce RI on the firm side into the RBC model.
- What we find:
 - Rational inattention generates internal persistence.
 - Rational inattention creates co-movement after news shocks.

Impulse responses to a productivity shock, $\alpha > 0$ and $\phi > 0$



Impulse responses to a news shock, $\alpha > 0$ and $\phi > 0$



Conclusions

- Rational inattention formalizes the idea that agents have limited attention and attention is a choice.
- For a review of the existing literature on rational inattention, see Maćkowiak, Matějka, Wiederholt: “Rational Inattention: A Review,” *Journal of Economic Literature*, forthcoming.
- In a DSGE model:
 - Rational inattention generates inertia.
 - Rational inattention generates internal persistence.
 - Rational inattention creates co-movement after news shocks.