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Pervasive inattentiveness☆

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HIGHLIGHTS

- To match the data, economic models need stickiness.
- This paper explores the business cycle implications of a model with pervasive information stickiness.
- Prices, wages, consumption and capital investment decisions are based on outdated information.
- The model matches business cycles moments remarkably well.

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ABSTRACT

In this paper we analyze how inattentiveness in capital investment decisions shapes business cycle dynamics in a dynamic stochastic general equilibrium (DSGE) model with inattentiveness. We find that the model with pervasive inattentiveness matches several business cycle moments much better than an otherwise identical model without informational frictions in investment. These findings reinforce the need for pervasive stickiness to mimic the inertia found in macroeconomic data.

1. Introduction

Economic models have to include stickiness if they are to match the data (Sims, 1998). Stickiness is usually included by assuming sticky actions—staggered price and wage setting with partial indexation, habit persistence in consumption and investment adjustment costs (see *e.g.* Christiano et al., 2005). Recently, Mankiw and Reis (2002) introduced stickiness in form of sticky information (or inattentiveness). The idea is that information disseminates slowly through the population because it is costly for agents to collect and process information and to make decisions based on that information (Reis, 2006a,b; Verona, forthcoming). Faced with such costs, agents are inattentive and so react only with a delay to shocks.

Mankiw and Reis (2006) develop the first DSGE model in which sticky information is the only rigidity.[1] They show that pervasive information stickiness is necessary to explain business cycle dynamics in sticky information models. One missing feature of the Mankiw and Reis (2006) model is investment and capital accumulation. Verona (2011) takes a step toward improving the Mankiw and Reis (2006) model by augmenting it with a set of firms that make capital investment decisions inattentively, as micro-founded in Verona (forthcoming). In Verona (2011), inattentiveness is the only friction, and it affects all decisions: consumption, wages, prices and capital investment decisions are all based on somewhat outdated information.

In this paper, we use the Verona (2011) model to analyze how and to what extent inattentiveness in the capital investment decision shapes business cycle dynamics. We also examine whether the capital-augmented version of the Mankiw and Reis (2006) sticky information DSGE model matches the business cycle moments presented in Mankiw and Reis (2006).

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1 See also Mankiw and Reis (2007) and Reis (2009a,b).

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The paper is organized as follows. Section 2 gives an overview of the model and presents the key equations. Section 3 analyzes the implications of inattentiveness for aggregate dynamics, and Section 4 concludes.

2. The model

2.1. An overview of the model

There are three sets of agents: firms, households and the central bank. Within the firms sector, there are two types of firms, intermediate- and final-good firms. Monopolistically competitive firms produce a continuum of intermediate goods by hiring labor varieties, and set the prices for their goods. A continuum of perfectly competitive final-good firms produces the final good by combining their optimally chosen firm-specific capitals with a Dixit–Stiglitz aggregator of varieties of intermediate goods. The final output is divided into consumption and investment goods. Households include consumers and workers. Consumers consume, save and borrow, while each monopolistic worker provides differentiated labor services to intermediate-good firms. Finally, the central bank sets the nominal interest rate according to a Taylor-type rule.

The only rigidity in the model is sticky information. There are four agents making decisions: consumers, workers, intermediate-good firms and final-good firms. We assume that, at any date, only a fraction δ of consumers, ω of workers, λ of price-setting firms and η of capital-investing firms update their information and make plans for, respectively, consumption, wages, prices and capital adjustments for the future.

2.2. The sticky information equilibrium

A detailed presentation of the model log-linearization is presented in Verona (2011, Appendix A). Here we discuss the key reduced-form relations.[2]

Aggregate investment (inv_t) develops according to

$$\text{inv}_t = \frac{1}{\rho}k_t - \frac{1-\rho}{\rho}k_{t-1}, \tag{1}$$

where ρ denotes the depreciation rate and k_t the aggregate capital stock given by

$$k_t = \eta \sum_{\tau=0}^{\infty} (1-\eta)^{\tau} E_{t-\tau} \times \left[\frac{1}{1-\alpha}y_{t+1}^{FIN} - \frac{\alpha}{1-\alpha}k_t - \frac{r}{(r+\rho)(1-\alpha)}r_t\right]. \tag{2}$$

There are three determinants of the stock of capital: (i) higher expected future output (y_{t+1}^{FIN}) increases the current stock of capital, (ii) the higher the current capital stock, the lower the current accumulated capital stock (due to decreasing returns to scale in production, $\alpha < 1$), (iii) the lower the real interest rate (r_t), the lower the opportunity cost of holding capital and thus the greater the incentive to increase the capital stock. If many firms are informed (η is high), capital is highly responsive to changes in these determinants; otherwise, capital adjusts slowly over time.

The Phillips curve is given by

$$p_t = \lambda \sum_{\tau=0}^{\infty} (1-\lambda)^{\tau} E_{t-\tau} \times \left[p_t + \frac{\beta(w_t - p_t) + (1-\beta)y_t - a_t}{\beta + \upsilon(1-\beta)}\right]. \tag{3}$$

The price level (p_t) depends on past expectations of its current value and real marginal costs.[3] Real marginal costs are higher (i) the higher the real wages paid to workers ($w_t - p_t$), (ii) the greater the output (y_t) due to decreasing returns to scale ($\beta < 1$), and (iii) the lower the productivity (a_t). Productivity follows a random walk with standard deviation σ_a. The higher the value of λ, the larger the number of informed price-setting firms that respond immediately to shocks.

The IS curve is given by

$$c_t = \delta \sum_{\tau=0}^{\infty} (1-\delta)^{\tau} E_{t-\tau} \left(c_t^n - R_t\right), \tag{4}$$

where $c_t^n = \lim_{T\to\infty} E_t c_{t+T}$ is a measure of consumers' wealth and $R_t = \sum_{T=0}^{\infty} (r_{t+T})$ is the long-term real interest rate. Higher expected future wealth encourages current consumption (c_t), while higher expected interest rates encourage savings and cause postponement of consumption. Unexpected shocks only raise current consumption by δ because only this fraction of consumers is aware of the news.

The wage curve is:

$$w_t = \omega \sum_{\tau=0}^{\infty} (1-\omega)^{\tau} E_{t-\tau} \left[p_t + \frac{\gamma}{\gamma+\psi}(w_t - p_t) + \frac{l_t}{\gamma+\psi} + \frac{\psi}{\gamma+\psi}\left(c_t^n - R_t\right)\right]. \tag{5}$$

Current wages (w_t) are the higher (i) the higher the price level (since workers care about real wages), (ii) the higher the real wages in the economy (as these increase the demand for a particular labor variety via substitution), (iii) the higher the level of employment (l_t) (because of increasing marginal disutility of working), (iv) the greater the wealth (because of the income effect), and (v) the lower the interest rates (since the return on savings is lower and the incentive to work in order to save is also lower).[4] Wages become more responsive to shocks as ω increases, because many workers are informed.

The aggregate resource constraint is

$$y_t^{FIN} = \alpha_c c_t + \alpha_i \text{inv}_t, \tag{6}$$

where $\alpha_c = c/(c + \text{inv})$ and $\alpha_i = \text{inv}/(c + \text{inv})$.

Intermediate output and labor are respectively given by

$$y_t = \frac{y_t^{FIN} - \alpha k_{t-1}}{1-\alpha} \tag{7}$$

and

$$l_t = \frac{y_t - a_t}{\beta}. \tag{8}$$

The central bank sets the nominal interest rate i_t according to

$$i_t = \phi_\pi \Delta p_t + \phi_y \left(y_t^{FIN} - y_t^{FIN,n}\right) - \varepsilon_t, \tag{9}$$

where $y_t^{FIN,n} = \lim_{T\to\infty} E_t y_{t+T}^{FIN}$ and ε_t is a policy shock that follows an $AR(1)$ process with the persistence parameter ρ_ε and standard deviation of the innovation σ_ε. Finally, the Fisher equation holds:

$$r_t = i_t - E_t(\Delta p_{t+1}). \tag{10}$$

Eqs. (1)–(10) characterize the equilibrium for (y_t^{FIN}, c_t, w_t, p_t, inv_t, k_t, r_t, i_t, y_t, l_t) given exogenous shocks to (ε_t, a_t). Having presented the model's key relations, we proceed to compare the model's predictions with some second-order moments characterizing the US economy.

[2] Variables with a t subscript refer to log-linearized values around their non-stochastic steady state. Letters with no subscript denote parameters or steady-state values.

[3] υ is the elasticity of substitution across goods' varieties.

[4] γ is the elasticity of substitution across labor varieties, and ψ is the Frisch elasticity of labor supply.