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The analytics of technology news shocks ☆

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Abstract

This paper constructs several models in which, unlike the standard neoclassical growth model, positive news about future technology generates an increase in current consumption, hours and investment. These models are said to exhibit procyclical news shocks. We find that all models that exhibit procyclical news shocks in our paper have two commonalities. There are mechanisms to ensure that: (I) consumption does not crowd out investment, or vice versa; (II) the benefit of forgoing leisure in response to news shocks outweighs the cost. Among the models we consider, we believe, one model holds the greatest potential for explaining procyclical news shocks. Its critical assumption is that news of the future technology also illuminates the nature of this technology. This illumination in turn permits economic actors to invest in capital that is forward-compatible, i.e. adapted to the new technology. On the technical side, our paper reintroduces the Laplace transform as a tool for studying dynamic economies analytically. Using Laplace transforms we are able to study and prove results about the full dynamics of the model in response to news shocks.
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1. Introduction

The optimal response of aggregate consumption, investment and hours in the neoclassical growth model to an unanticipated permanent (or near permanent) technology increase is well-understood. For most specifications used by researchers, all three variables increase.[1] A technology improvement increases capital's efficiency; thus, the desired capital stock increases. The increase in the actual capital stock towards its desired level is achieved by greater investment. Importantly, greater investment need not come at the cost of a drop in consumption. Rather, since the technology improvement shifts out the production frontier immediately, creating additional consumption and investment is feasible. Moreover, an hours increase is optimal because a higher marginal product of labor induces a substitution effect away from leisure that outweighs the wealth effect, which pushes in the opposite direction.

Next, consider the standard growth model's response to news of a future technology increase. The responses of these variables and the incentives that drive these responses are different. In the standard model, all three variables will not increase. Typically, labor falls upon the arrival of the news. The above-described wealth effect on leisure is operative; however, there is no offsetting substitution effect because the technology increase has not materialized immediately.

With a labor decline, the only way consumption can increase in response to the news is if investment falls. An investment decline is optimal because there is incentive to delay building additional capital stock until technology actually increases. Thus, in the standard model, positive news about future technology can cause a decline in labor and investment, and an increase in consumption (see Fig. 1).[2,3]

This paper studies variants on the standard model that are capable of generating procyclical responses. Each model has mechanism(s) to ensure that: (I) consumption does not crowd out investment, or vice versa; (II) the return to forgoing leisure is sufficiently high.

In our first model, we modify the neoclassical production function to have a convex production frontier between consumption and investment, i.e. production complementarity. In the standard model, the marginal rate of transformation between consumption and investment is fixed at one. Here, this marginal rate of transformation depends upon the consumption-investment ratio. We provide both sufficient and necessary conditions for the model to exhibit procyclical technology news shocks. These conditions depend upon the values of the model's underlying parameters.

[1] Campbell [11] establishes this by simulation using several functional forms of preferences and model parameterizations. He does provide cases where, when preferences are non-separable in consumption and labor, consumption declines in response to technology shocks.

[2] An alternative, but equaling puzzling, response to good news about future technology is that labor hours increase, while consumption declines. This occurs for a small region of growth model's parameter space.

[3] There is some support for procyclical news shocks in U.S. data. Systematic empirical work supporting the news shock explanation includes Schmitt-Grohe and Uribe [29] and Beaudry and Portier [6]. The former estimate a business cycle model with news (anticipated) and current (unanticipated) shocks and find that news shocks explain a greater fraction of output volatility than current shocks. The latter estimate that the component of innovations to stock prices, not correlated with current productivity, is correlated with expected future productivity. Barsky and Sims [2], using a different identification scheme, deliver an opposite result (i.e. news shocks are not procyclical). Other relevant empirical research supporting this explanation includes Beaudry, Dupaigne, and Portier [3], Beaudry and Lucke [4], and Khan and Tsoukalas [22] as well as Leeper, Walker and Yang [24].

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