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Internal habits in an endogenous growth model with elastic labor supply☆

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ABSTRACT

This paper studies the implications of introducing internal versus external habits in an endogenous growth model with elastic labor supply. We first show that the comparative-static effects of a shock in habits parameters are qualitatively different depending on how habits are specified. An increase in the weight of habits in utility raises long-run growth and labor supply in the external-habits model, whereas it reduces labor supply and has an ambiguous effect on long-run growth in the internal-habits model. Increasing the speed of adjustment of habits to current consumption has no effect on long-run values with external habits, but has a negative effect on long-run growth and labor supply with internal habits. Numerical simulations reveal that the qualitative differences are also quantitatively important. Finally, we illustrate the dynamic effects of an increase in productivity. On impact and in the long-run this shock has a positive effect on growth, labor supply and the savings rate in both models. However, along the transition labor supply exhibits a procyclical response to the productivity increase in the internal-habits model, but a countercyclical response in the external-habits model. These results could be helpful on the still open debate on whether habits are internally or externally formed.

1. Introduction

One way to generate smoothness in consumption, and in its rate of change, is by assuming the habit formation hypothesis in consumption, so that individual's utility depends on current consumption as well as on how it compares to a reference level — the habits stock. Therefore, this hypothesis has been widely used in various fields to explain, among other issues, the equity premium puzzle (Abel, 1990), the behavior of the savings rate (Carroll et al., 2000), the effects of monetary policy (Fuhrer, 2000) or, more recently, the life-cycle household allocations (Aydilek, 2013), the dynamics effects of oil price shocks (Schubert, 2014), and some stylized facts of business cycles (Khorunzhina, 2015). The literature distinguishes between internal habits (IH) formed from individual's own past consumption, and external habits (EH) formed from average economy-wide past consumption. Although recent empirical evidence provides support to the habit formation hypothesis (e.g., Chen and Ludvigson, 2009; Korniotis, 2010), whether habits are internally or externally formed appears to be still an open question. This, together with the important role of habits in the recent macroeconomics literature, makes it interesting to analyze the different implications that introducing habits internal or externally formed could have on the dynamics and long-run performance of the economy.

This paper studies the implications of introducing internal habits in an endogenous growth model with elastic labor supply, and compares them with the implications of introducing external habits, which have been studied in Gómez (2015). As Gómez (2015), who in turn follows Carroll et al. (1997), we keep the production side of the economy as simple as possible and consider an AK-type technology à la Romer (1986). As it is well-known, standard AK-type models with time-separable utility do not exhibit transition dynamics. Hence, this simplification allows to isolate the effect of habits on the dynamics of the economy, so that the dynamics of the economy is driven exclusively by preferences; i.e., by the presence of habits.

First, we prove that the economy has a unique feasible steady-state equilibrium, which is locally saddle-path stable. Although not surprising, this result is interesting because the complexity of the involved dynamic systems prevented an analytical study of the stability properties of the steady state in related settings (e.g., Alonso-Carrera et al., 2004; Alvarez-Cuadrado et al., 2004; Turnovsky and Monteiro, 2007).[2]

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[2] Gómez (2012) proves the existence, uniqueness and saddle-path stability of steady-state equilibrium in the neoclassical growth model with habit formation and elastic labor supply. However, he assumes that utility is additively separable in adjusted consumption and leisure; an assumption that reduces significantly the complexity of the dynamic system. In particular, this allows computing the steady-state value of leisure time explicitly as a function of the parameters of the model, and not implicitly as it happens in the present model (see Section 3). Furthermore, he does not compare the implications of assuming internal or external habits on the transition dynamics or the long-run equilibrium.

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Furthermore, habits can generate multiplicity and indeterminacy of equilibrium or endogenous fluctuations when labor supply is elastic (e.g., Chen et al., 2013; Gori and Sodini, 2014), so local determinacy should not be taken for granted.

Second, we characterize the comparative-static effects of a shock in preference parameters in the IH model, and compare them with the ensuing ones in the EH model analyzed in Gómez (2015). An increase in the weight of habits in utility has a negative effect on long-run work time in the IH model. Intuitively, as the agent takes into account the negative indirect effect that current consumption has on future utility through its effect on a higher habits stock, an increase in the weight of habits in utility makes consumption less desirable relative to leisure which, therefore, increases. This is in stark contrast with the EH model, where an increase in the weight of habits in utility causes an increase in the long-run work time (Gómez, 2015). Furthermore an increase in the weight of habits in utility has a direct positive effect on growth and savings through its positive impact on the effective EIS, and an indirect effect through its impact on leisure. In the IH model, both effects have opposite signs, and so, the overall effect on long-run savings rate and growth is ambiguous. In contrast, Gómez (2015) shows that both effects are positive in the EH model, so long-run savings and growth rates increase.

Third, we find that an increase in the relative importance of current consumption in the formation of the habit stock (or adjustment speed of habits) has a negative effect on long-run growth, savings rate and work time in the IH model, whereas Gómez (2015) showed that it has no effect in the EH model. Intuitively, in the IH case, the agents takes into account the effect that his decisions about consumption have on the habit stock and indirectly on future utility. Therefore, an increase in how fast habits adjust to current consumption, increases the weight that current consumption has on the formation of the habit stock, which in turn increases the negative indirect effect it will have on utility. This leads agents to substitute consumption for leisure reducing the time spent working and consequently the savings and the long-run growth rate. In contrast, in the EH case, the agent does not take into account how his current decisions about consumption affect the habit stock, and thus changes in how fast the habit sock adjust to current consumption has no effect on the long-run values. We also show that long-run growth, work time and the savings rate are higher with external habits than with internal habits.

Finally, we present some numerical simulations that confirm and supplement the theoretical findings in several dimensions. The numerical simulations show that the different effects are also quantitatively important both in the balanced growth path and along the transition. An increase in productivity leads to an immediate increase in consumption and hours worked relative to their pre-shock levels. The agent in the EH economy does not take into account the negative impact of larger consumption on the reference stock. In contrast, the agent in the IH economy is aware of that, and uses leisure to compensate for the negative impact that current consumption increase will have on future welfare. Thus, on impact, the increase in consumption and hours worked is lower in the IH case than it is in the EH case. Over time the agent in the IH economy goes on increasing hours worked to maintain the higher growth rate of consumption, which started the initial jump up. In the EH economy, because of their complementarity, the higher consumption is accompanied with an increase in leisure time along the transition.

Several authors have studied the equilibrium dynamics in growth models with internal and external habit-forming preferences. However, most of them have considered that labor supply is inelastic (e.g., Carroll et al., 1997; Alonso-Carrera et al., 2006; Gómez, 2006, 2010, in the AK model, Alonso-Carrera et al., 2004, 2005; Alvarez-Cuadrado et al., 2004; Gómez, 2007, in the neoclassical growth model). Turnovsky and Monteiro (2007) analyze the equilibrium dynamics in a non-scale growth model with elastic labor supply, and compare the EH and IH versions of the model. However, its semi-endogenous growth nature entails that preferences – in particular, the presence of habits – have no role on the determination of long-run growth. Recently, Gómez (2015) provides a comprehensive analysis of the AK model with elastic labor supply. However, with the aim of obtaining analytical results, he focuses on the model with external habits. Thus, he does not consider the case when habits are internally formed and, therefore, he does not compare the different implications that specifying habits as internal or external could have. This paper tries to fill this gap.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes the equilibrium dynamics. Section 4 studies the comparative-static effects of introducing habits into utility. Sections 5 and 6 present some numerical results on the effects of changes on the habits parameters on the steady state and the transitional dynamics, respectively. Section 7 concludes.

2. The model

Consider an economy populated by a continuum of mass one of identical individuals, who own shares of a mass one of identical firms. Each individual is endowed with a unit of time, part of which, $(1-L)$, can be supplied as labor input and the remainder, L, consumed as leisure.

2.1. Preferences

At any instant of time each individual derives utility from her current consumption, C, leisure, L, and also from the current level of the reference consumption level (habits stock), H. Thus the agent's utility is represented by an iso-elastic function of the type employed by Abel (1990), Carroll et al. (1997), and others:

$$U=\frac{1}{1-\varepsilon}\int_0^{\infty}\left(CL^{\eta}/H^{\gamma}\right)^{1-\varepsilon}e^{-\beta t}dt \quad \beta>0,\ \ \varepsilon>1,\ \ 0<\gamma<1,\ \ \eta>0, \quad (1)$$

where γ reflects the importance of habits in utility, β is the rate of time preference, η reflects the importance of leisure in utility, and $1/\varepsilon$ is the elasticity of intertemporal substitution (EIS) in the time-separable case ($\gamma=0$).[3] Following Fisher and Hof (2000), we shall term $\sigma=1/[\gamma+\varepsilon(1-\gamma)]$ as the "effective" elasticity of intertemporal substitution (effective EIS).

Following Alvarez-Cuadrado et al. (2004), we consider that the rate of adjustment of the habits stock, is given by

$$\dot{H}=\rho\left(C^{\xi}\hat{C}^{1-\xi}-H\right). \quad (2)$$

where $\hat{C}=\int_0^1 C(i)di$ denotes the economy-wide average consumption, and ρ reflects the relative importance of recent consumption in determining the stock of habits. As Carroll et al. (1997) point out, the case of externalities associated with current consumption is obtained as a limiting case when $\rho\to+\infty$, so that $H\to C^{\xi}\hat{C}^{1-\xi}$. This expression (2) encompasses the two extreme specifications typically considered in the literature, which are identified by the different values of ξ. Setting $\xi=0$ corresponds to the external-habits (EH) case in which habits are formed from economy-wide average past consumption alone, whereas $\xi=1$ corresponds to the internal-habits (IH) case in which habits arise from own past consumption. It is the latter case we are mostly interested in, but we also want to compare the results of the internal-habits model with the ones derived by Gómez (2015) for the external-habits model. Hence, we consider a formulation of habits that encompasses as particular cases the IH and EH models.

[3] King et al. (1988) have shown that in a Ramsey model without habits this specific form is consistent with balanced growth. The assumption that $\varepsilon>1$ is borrowed from Alonso-Carrera et al. (2005) and Hiraguchi (2008), who show that otherwise the agent's optimization problem might not be well-defined in a similar IH model with inelastic labor supply.