Economic Modelling 28 (2011) 1559–1572

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Precautionary saving or denied dissaving ☆

James Feigenbaum

Department of Economics and Finance, Utah State University, United States

ARTICLE INFO

Article history:
Accepted 6 February 2011

JEL classification:
E21

Keywords:
Borrowing constraints
Anticipatory saving
Dissaving
Precautionary saving
Quadratic utility
Idiosyncratic risk
Uncertainty
Perturbation theory

ABSTRACT

Precautionary saving in response to uninsurable income risk can in principle explain the stylized fact that aggregate saving increases with the variance of income, but it is controversial how much of the observed variation in incomes is, in fact, unpredictable. Borrowing constraints offer an alternative explanation that does not require consumers to be uncertain about their future income. This paper employs a three-cohort, overlapping generations model with quadratic utility and no capital to show that, if agents are patient enough, heterogeneity alone can account for more than half the decrease in the equilibrium interest rate caused by a borrowing constraint. The possibility of facing a binding borrowing constraint in the future induces saving, and this saving increases with the cross-sectional variation in income. Another channel that pushes down the interest rate is the direct effect caused by currently constrained agents not being allowed to dissave. For patient agents, the two channels have roughly the same impact on the interest rate.

Why do people save? According to the Lifecycle/Permanent-Income Hypothesis, people save in order to smooth their consumption over their lifespan, but there has been much skepticism about whether consumption smoothing alone can generate enough saving to account for the observed accumulation of capital. Another reason to save that has received wide attention is the precautionary motive. Precautionary saving can account for many empirical properties of consumption that cannot be explained by a perfect-foresight lifecycle model, such as the correlation between saving and the cross-sectional variance of income across groups of consumers Carroll and Samwick (1997).[1]

However, the quantitative significance of precautionary saving depends on how much risk consumers face. Some researchers argue this has been overestimated.[2] Two 25-year-old individuals with the same level of education and similar family backgrounds might look identical to an econometrician, but they may have different ambitions and thus have different expectations about their lifetime income streams. If agents have a 50% chance of receiving either \$10,000 or \$20,000, turning off uncertainty does not mean everyone gets \$15,000.[3] Rather, it means that half the agents know beforehand they will receive \$10,000 and the other half know they will receive \$20,000. Since the degree of heterogeneity does not change, this is not a valid measure of uncertainty. For many questions of concern to economists, such as understanding how consumption inequality evolves over the lifecycle, the distinction between uncertainty and heterogeneity may be innocuous since both factors will contribute.[4] However, precautionary saving depends specifically on uncertainty, not heterogeneity. If the actual risk faced by individuals is significantly less than what we infer from the heterogeneity of the population, will this substantially change the quantitative predictions of precautionary saving models?[5]

Not necessarily because most models with uninsurable income risk also incorporate borrowing constraints, and borrowing constraints can generate many of the same properties independent of

☆ I would like to thank Jim Bullard, Frank Caliendo, Dave DeJong, Douglas Gale, Mark Huggett, Matt Mitchell, Gene Savin, Pedro Silos, and Dan Thornton for offering suggestions and advice, and I would especially like to thank B. Ravikumar, Chuck Whiteman, and Steve Williamson for their comments. Financial support was received from the Koch Foundation and the Federal Reserve Bank of St. Louis. All mistakes are my own.

E-mail address: J.Feigen@aggiemail.usu.edu.
URL: http://huntsman.usu.edu/~jfeigenbaum/.

[1] Other such properties include a large marginal propensity to consume Carroll (2000) and the hump in lifecycle profiles of consumption Attanasio et al. (1999), Carroll (1997), Carroll and Summers (1991), Feigenbaum (2009b), Hubbard et al. (1994) Gourinchas and Parker (2002).

[2] Cunha et al. (2005) estimate nearly half the cross-sectional variation in income across American households is predictable. Feigenbaum and Li (2010) found that, if more of the data available about individuals in the in the Panel Study of Income Dynamics is taken into account, the variances of forecasting errors regarding future income will be reduced on average by a third compared to previous estimates.

[3] This is what happens if we preserve uncertainty but allow agents to pool their risk.

[4] Guvenen (2007), Heathcote et al. (forthcoming) and Storesletten et al. (2004) consider the impact on consumption inequality of an individual-specific component to income that is realized (though not necessarily observed) before birth.

[5] Eeckhoudt et al. (2005) and Feigenbaum (2008) have also shown that, even if income is initially uncertain, if information about the shock is revealed prior to the earning of the income then precautionary effects will be diminished.

0264-9993/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.econmod.2011.02.006

uncertainty. The purpose of this paper is to demonstrate in a stylized quantitative model how much of the correlation between saving and the cross-sectional variance of income depends on uncertainty and how much can be explained by heterogeneity alone.[6] As in Huggett (1993), this is a model without capital, where bonds are in zero net supply, so it is actually a decrease in the equilibrium interest rate that will emerge as a consequence of an increased demand for saving.

The traditional explanation for precautionary saving, established by Leland (1968) and Sandmo (1970), requires the period utility function to have a strictly positive third derivative. However, Aiyagari (1994) and Huggett and Ospina (2001) found that uncertainty increased aggregate saving even when utility was quadratic. Carroll and Kimball (2001) accounted for this by showing that borrowing constraints open another channel for saving that does not depend on the third derivative of utility. Agents who are presently unconstrained but who may be constrained in the future can only smooth consumption up until they hit the constraint. Consequently, these agents behave as though they will only live until they become borrowing constrained. Since they spread their resources over a shorter time horizon, their marginal propensity to save diminishes. If we graph saving as a function of income, the saving function becomes nonlinear as the lower end bends upward.

Here we emphasize the fact that this bending of the saving function does not require uncertainty. Indeed, the saving function bends up more for those agents who know for certain they will be constrained than it does for agents who will only be constrained with some less than unit probability. In the aggregate, the bending of the saving function in the case of perfect certainty will be ameliorated by the presence of other agents who know for certain they will not be constrained and maintain linear saving functions. Nevertheless, some of the saving caused by the borrowing constraint is independent of how much information the agents in the model have.

In addition, there is a second, more direct channel by which a borrowing constraint increases saving that has nothing to do with precautionary saving. Agents who presently *are constrained* cannot borrow, so any dissaving they might prefer to partake in is disallowed. While most of the aforementioned literature has focused on how agents save more in response to future events, it turns out that for small discount factors denied dissaving has a bigger effect on the interest rate than precautionary saving, with or without uncertainty. For discount factors close enough to one, the two channels contribute about equally to the decline in the interest rate.

The paper is organized as follows. In Section 1, I describe the model. In Section 2, the resulting bond demand functions are specified, and the Carroll-Kimball mechanism is described both with and without uncertainty. In Section 3, I obtain the interest rate in general equilibrium and show how much of the interest-rate response to income heterogeneity persists in the absence of uncertainty. In Section 4, I discuss how these results would generalize to a model with capital. In Section 5, I summarize the results.

1. The model

Although one only needs a two-period model to exhibit precautionary saving through the Leland–Sandmo mechanism, three periods are needed to get precautionary saving induced by a borrowing constraint via the Carroll–Kimball mechanism. Two periods are needed so agents have a consumption-saving decision that can be constrained, and then an additional period before this decision is required so agents can anticipate whether they will be constrained.[7]

We consider an overlapping generations (OLG) model where the population is constant and the economy is stationary with no aggregate uncertainty. Agents live for three periods, and at any time three cohorts will exist simultaneously: the young (age 0), the middle-aged (age 1), and the old (age 2). Nothing depends on absolute time, but quantities pertaining to a specific agent may depend on his age, which will be indexed with a subscript. Agents have the utility function

$$U = E\left[\sum_{t=0}^{2} \beta^t u(c_t)\right], \tag{1}$$

where c_t is consumption at age t, $\beta \in (0,1]$ is the discount factor, and the period utility function $u(\cdot)$ is quadratic with bliss point M:

$$u(c) = -\frac{1}{2}(M-c)^2. \tag{2}$$

At age t, the agent receives the possibly stochastic income y_t. For both young and old agents, income is $y_0 = y_2 = \mu < M$. For the middle-aged, income is $y_1 = \mu(1 \pm \delta)$ with equal probability, where $0 \le \delta \ll 1$ is small enough so that agents always consume at or below the bliss point in equilibrium.[8] Thus $\delta^2\mu^2$ is the cross-sectional variance of income for the middle-aged, and δ is the coefficient of variation.

Risk-free bonds are the only available intertemporal asset, and they are in zero net supply with a gross return $R > 0$. The demand for bonds that pay off at age t is denoted b_t. Note that b_1 is the bond demand of a young agent while b_2 is the bond demand of a middle-aged agent.

The optimization of Eq. (1) can then be expressed as a system of recursive Bellman equations. For $t = 0, 1$,

$$v_t(b_t, y_t) = \max_{b_{t+1}, c_t} \{u(c_t) + E_t[v_{t+1}(b_{t+1}, y_{t+1})]\} \tag{3}$$

subject to

$$\begin{aligned} b_{t+1} + c_t &= y_t + Rb_t \\ b_0 &= 0 \end{aligned} \tag{4}$$

while

$$v_2(b_2, y_2) = u(y_2 + Rb_2).$$

The heart of the paper is then to examine what happens when, in addition, we impose the borrowing constraint

$$b_2 \ge -Q, \tag{5}$$

where $Q \ge 0$, so middle-aged agents are limited in how much they can borrow.

Note that there are potentially two frictions in this model: the borrowing constraint and uninsurable risk. Thus we introduce four models to consider what happens when we turn each friction on or

[6] Nirei (2006) considers the effects of a borrowing constraint and uncertainty on excess sensitivity of consumption. Cordoba (2008) considers the differing effects of a borrowing constraint vs uninsurable risk on the wealth distribution.

[7] An alternative to this OLG economy would be a finite-horizon model where a single cohort lives for three periods and then the economy terminates for everyone. This would simplify the appearance of the market-clearing equations at each period, but solving for the equilibrium would not be any simpler since the interest rate will no longer be stationary. I prefer the OLG approach taken here because the stationary equilibrium allows a more straightforward comparison to infinite-horizon and lifecycle models.

[8] This is necessary to maintain the budget constraint as an equality without abandoning free disposal. Under the equality constraint, we have a simple linear-quadratic optimization problem with certainty-equivalent policy functions. Without the equality constraint, certainty equivalence generally will not hold even in the absence of borrowing constraints. (See Carroll and Kimball (2001) for more discussion of this point.)