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Quantifying borrowing constraints and precautionary savings

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Abstract

This paper quantifies the effects of precautionary savings. It demonstrates that Zeldes' estimate of excess consumption growth for low asset holders is consistent with a dynamic general equilibrium model with uninsurable endowment shocks when borrowing is constrained at three months' worth of average wage income. I propose a Monte Carlo simulation of the stationary equilibrium as a method of indirectly testing the hypotheses of a no-borrowing specification and a natural debt limit specification. At the estimated borrowing constraint, an increase in endowment shocks within the range of empirical findings can cause a 1.6% increase in the savings rate and a 6.9% increase in capital.

JEL classification: E21; C68

Keywords: Liquidity constraint; Precautionary savings; Borrowing constraint; Natural debt limit; Excess consumption growth; Uninsured endowment shock

1. Introduction

This paper provides a numerical assessment of the importance of precautionary savings as an explanation of the excess consumption growth rate observed for consumers with low assets. In so doing, the paper also proposes a method of deriving a test distribution for the borrowing constraint that is inferred indirectly by an empirical estimate of the excess consumption growth.

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The analysis is built upon Aiyagari's (1994) dynamic general equilibrium model with uninsured endowment shocks and Zeldes' (1989) empirical findings on individual consumption growth. Zeldes reports that those who hold assets of less than two months' income experience consumption growth rates that are 1.7% higher, on average, than those who hold higher assets. Zeldes interprets this excess growth as an effect of liquidity constraints. Other researchers such as Carroll (1997), Deaton (1992), and Kimball (1990) have emphasized the importance of the precautionary motive of savings as an explanation for the excess growth. Empirically, the precautionary effect is often indistinguishable from the liquidity constraint effect (Browning and Lusardi, 1996). It has also been recognized theoretically that the two effects work together in a dynamic consumption decision (Carroll and Kimball, 2001; Huggett and Ospina, 2001). Thus, this paper deals with the combined effect of liquidity constraints and precautionary savings.

The purpose of the paper is to quantify the contribution of the two effects and to identify the parameter range in which Zeldes' estimate of excess growth is consistent with Aiyagari's (1994) model. The basic assumption is that the economy follows a stationary rational expectations equilibrium. I draw on Huggett's (1993) and Aiyagari's method of numerically computing such stationary equilibria when the households can only partially insure against idiosyncratic endowment shocks via limited borrowing.

First, I estimate the borrowing constraint point b which is consistent with Zeldes' estimate of excess growth. The population mean of the excess growth rates can be computed at the stationary equilibrium of the Aiyagari model. The result shows that the Zeldes' point estimate corresponds to the case when b is set at three months' worth of income. After this calibration exercise, I investigate the statistical robustness of the point estimate of b. In a Monte Carlo run, I randomly draw the model households and replicate Zeldes' estimator of the excess consumption growth rate for low asset holders. A test distribution for the estimator is constructed by using a large number of such Monte Carlo runs. I repeat the procedure for various values of b, and obtain 90% confidence intervals for b in which the simulated excess growth supports Zeldes' estimate. Although the p-values are close to significant, the interval shows that neither specification $b = 0$ (no borrowing) nor $b = w\underline{l}/r$ (natural debt limit) can be rejected at a significance level of 5%.

The methodological contribution is that the stationary equilibrium distribution of the households' states is utilized to form a test distribution for the average excess growth rates. The excess growth estimate contains sampling errors, since the households' states are heterogeneous *within* each group of constrained or unconstrained households. The stationary equilibrium distribution accounts for the distribution of these sampling errors under the null hypothesis. This procedure extends the usual calibration method, which yields a parameter value so that a *population* statistic of interest is consistent with an empirical estimate. The extended procedure calibrates not only the point estimate but also the standard error of the estimate.

Using the estimated borrowing constraint point b, I examine the aggregate consequence of endowment shocks. I simulate the model with the calibrated b for the minimum and maximum estimates of the endowment shock variances in the empirical micro literature cited by Aiyagari. The results show that the capital level increases by 6.9% and the saving rate increases by 1.6% at the stationary equilibrium when the endowment risk is increased from the minimum to the maximum. A broad range of lower-middle asset holders contributes to the increase in aggregate assets. These results suggest that labor market fluctuations can have a significant effect on aggregate savings.

The remainder of the paper is organized as follows. Section 2 presents the model, and defines and computes the liquidity constraint and precautionary savings effects. Section 3 tests two speci-