CIRJE-F-448

The Degree of Precautionary Saving: A Reexamination

Jeong-Joon Lee
Towson University

Yasuyuki Sawada
University of Tokyo

November 2006

The Degree of Precautionary Saving: A Reexamination*

Jeong-Joon Lee
Department of Economics
Towson University

Yasuyuki Sawada†
Faculty of Economics
University of Tokyo

November 2006

Abstract

Extending Dynan's methodology (1993), we show that a significant fraction of the prudence parameter puzzle can be explained by a downward omitted variable bias. Further, the estimated prudence is substantially higher for liquidity-constrained households.

JEL Classification: D12, E21
Keywords: Precautionary saving; Prudence; Liquidity constraints

*We would like to thank Dirk Krueger and Fabrizo Perri for making their CEX data set available to us. We are also grateful to Hidehiko Ichimura and an anonymous referee for their valuable suggestions.

†Corresponding author. Faculty of Economics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan. Tel: +81 3 5841 5572; Fax: +81 3 5841 5521. E-mail: sawada@e.u-tokyo.ac.jp

1 Introduction

Since the seminal work of Dynan (1993, hereafter Dynan), the small estimates of Kimball's (1990) prudence parameter has been one of the puzzles in the literature on consumption behavior. While a growing number of theoretical studies point out the importance of precautionary saving, the existing evidence suggests that precautionary saving motives may not be empirically important.[1] Most of the previous studies overlook the potential omitted variable bias caused in the consumption Euler equation estimation by liquidity constraints.[2]

This paper seeks to resolve the puzzle by integrating Dynan's framework with Zeldes' (1989, hereafter Zeldes) model of liquidity constraints. We show that estimating prudence without taking into account liquidity constraints could lead to a nonnegligible omitted variable bias.

2 Precautionary Saving under Liquidity Constraints

To examine the precautionary saving motives, we estimate relative prudence, considering the liquidity constraints. Following Zeldes, we augment the consumption Euler equation,

$$U'(C_{i,t}) = \left(\frac{1+r}{1+\delta}\right) E_t \left[U'(C_{i,t+1})\right] + \lambda_{i,t}, \tag{1}$$

where $C_{i,t}$ is household's consumption, r is interest rate, δ is discount rate, and E_t is the conditional expectation operator. $\lambda_{i,t}$ is the Lagrange multiplier

[1] Dynan found the estimated prudence to be in the range of 0.02 and 0.3 and argued that this was *too low to be consistent with widely accepted beliefs about risk aversion.* Merrigan and Normandin (1996) reported that based on the U.K. data, the estimated prudence would be between 0.78 and 1.33. Notable studies on precautionary saving include Parker and Preston (2005), Gourinchas and Parker (2002), and Banks, Blundell, and Brugiavini (2001).

[2] See Attanasio and Low (2004), Carroll (2001), and Ludvigson and Paxon (2001).

associated with the liquidity constraint.

Then, using the second-order Taylor approximation of $E_t[U'(C_{i,t+1})]$ around $C_{i,t}$ as in Dynan,

$$E_t\left(\frac{C_{i,t+1}-C_{i,t}}{C_{i,t}}\right)=\frac{1}{\sigma}\left(\frac{r-\delta}{1+r}\right)+\frac{\rho}{2}E_t\left[\left(\frac{C_{i,t+1}-C_{i,t}}{C_{i,t}}\right)^2\right]+\tilde{\lambda}_{i,t}, \qquad (2)$$

where σ is the coefficient of relative risk aversion, $-\frac{U''C_{i,t}}{U'}$; ρ is the coefficient of relative prudence, $-\frac{U'''\cdot C_{i,t}}{U''}$; and $\tilde{\lambda}_{i,t} \equiv \frac{\lambda_{i,t}}{C_{i,t}U''}$.

Because $\tilde{\lambda} > 0$ for the liquidity-constrained households in Equation (2), Dynan's specification, which estimates ρ excluding $\tilde{\lambda}$, is subject to the omitted-variable bias. In fact, people with more financial wealth are less likely to be facing a liquidity constraint and might be the ones who are taking bigger risks.[3] In this case, $corr\left(\tilde{\lambda},\ E_t\left[\left(\frac{C_t-C_{t+1}}{C_t}\right)^2\right]\right) < 0$, and the omission would result in a downward bias of the prudence coefficient.

3 Data and Estimation

As in Dynan, this study uses the 1985 Consumer Expenditure Survey (CEX) data.[4] We exclude all the observations of household heads below 16 or above 64 years of age and those who did not complete the entire set of four interviews.

We use the ratio of liquidity assets to one month's income as a threshold to divide our sample. The high-wealth households whose liquid assets exceed their one month's income are likely to be liquidity-unconstrained. Out of the total 1,625 households in our sample, 787 are unconstrained and 838 are constrained.[5] Table 1 shows that the liquidity-constrained households are younger, poorer, less

[3]Rich households with high financial wealth can be exposed to greater risks.

[4]Our CEX data set is compiled by Krueger and Perri (2005).

[5]Dynan used a total of 1,733 households, where 941 were liquidity-constrained and 792 were unconstrained. The discrepancies may be due to the compiled CEX data by Krueger and Perri (2005).

educated, less skilled, and have accumulated less financial assets. In particular, the unconstrained households are exposed to bigger risks than the constrained households.[6]

To obtain the final specification, we use an initial income as a proxy for $\tilde{\lambda}$ as in Zeldes. Thus, we get

$$\frac{1}{N}\sum_{t=1}^{N}\left(\frac{C_{i,t+1}-C_{i,t}}{C_{i,t}}\right)=\beta_0+\beta_1\frac{1}{N}\sum_{t=1}^{N}\left(\frac{C_{i,t+1}-C_{i,t}}{C_{i,t}}\right)^2+\beta_2 y_{i,0}+\eta_i, \quad (3)$$

where $\beta_0 = \frac{1}{\sigma}\left(\frac{r-\delta}{1+r}\right)$, $\beta_1 = \frac{\varrho}{2}$, N represents the number of periods, $y_{i,0}$ is the initial income, and η_i is the expectation error. We expect $\beta_2 < 0$ for the constrained and $\beta_2 = 0$ for the unconstrained. We use the instrumental variable (IV) technique and control for heterogeneity and time-specific effects by using age and month dummies, respectively.

Table 2 shows the replication results for Dynan's specification; it confirms the small prudence puzzle. When we include income, as shown in Table 3, $\hat{\beta}_2 < 0$ and the prudence estimates are uniformly greater than those in Table 2, suggesting that the small prudence puzzle may be a reflection of the omitted variable bias.

Finally, we split the sample and estimate the model. As Table 4 presents, we obtain $\hat{\beta}_2 < 0$ significant for the constrained households but $\hat{\beta}_2 = 0$ for the unconstrained ones. Moreover, the constrained households have stronger precautionary saving motives: they behave more prudently than the unconstrained ones. More importantly, the degree of prudence for the constrained households (ranging from 0.838 to 1.094) is significantly larger than that of Dynan (ranging from 0.14 to 0.166).

However, our estimates are still smaller than the expected size of the pru-

[6] We reject the equal squared consumption growth between the two groups at the 5% level of significance based on a one-tailed test; t = 1.807 and p-value is 0.0354.

dence that ranges from 2 to 5, which can be computed from the constant relative risk aversion (CRRA) utility with the coefficient of relative risk aversion ranging from 1 to 4. Hence, approximately 14% to 46% of the prudence puzzle can be attributed to the omitted variable bias.

To check the robustness of our findings, we conduct sensitivity analyses. First, we use the wealth-to-income ratio as a proxy $\tilde{\lambda}$. The results from the first panel of Table 5 are quite similar to those of the benchmark case in Table 4: the prudence estimates are still larger than those of Dynan, and we obtain $\hat{\beta}_2 < 0$ significant for the constrained households. Second, we use a lower cutoff (the ratio of liquidity assets to half a month's income) when we split our sample.[7] Overall, the qualitative results in the second panel of Table 5 do not change.

In summary, this study shows that adding $\tilde{\lambda}$ and splitting the sample help to resolve Dynan's small prudence puzzle. Explicitly considering liquidity constraints, our results are in line with the approximation bias argued by Ludvigson and Paxon (2001)[8] and the concavity of the consumption function elaborated by Carroll (2001) and Carroll and Kimball (2006).

4 Conclusion

This study shows that Dynan's prudence estimates are biased downward because of the omitted shadow value of the liquidity constraints, and the constrained households have stronger precautionary saving motives.

[7]Now, 644 households are constrained and 961 are unconstrained. The squared consumption growth is still larger for the unconstrained households: 0.199 vs. 0.162.

[8]They argued that Dynan's specification would produce a downward bias in the estimate of prudence for the less wealthy households.

References

[1] Attanasio, O. and H. Low, 2004, Estimating Euler equations, Review of Economic Dynamics, 7, 405–435.

[2] Carroll, C., 2001, Death to the log-linearized consumption Euler equation! (and very poor health to the second-order approximation), Advances in Macroeconomics, 1, Article 6.

[3] Carroll, C. and M. Kimball, 2006, Precautionary saving and precautionary wealth, in S. Durlauf and L. Blume, eds., The New Palgrave Dictionary of Economics, 2nd ed.

[4] Dynan, K., 1993, How prudent are consumers? Journal of Political Economy, 101, 1104–1113.

[5] Gourinchas, P. and J. Parker, 2002, Consumption over the life cycle, Econometrica, 70, 47–89.

[6] Kimball, M., 1990, Precautionary saving in the small and in the large, Econometrica, 58, 53–73.

[7] Krueger, D. and F. Perri, 2005, Does income inequality lead to consumption inequality? Evidence and theory, Review of Economic Studies, 73, 163–193.

[8] Ludvigson, S. and C. Paxon, 2001, Approximation bias in linearized Euler equations, Review of Economics and Statistics, 83, 242–256.

[9] Merrigan, P. and M. Mornandin, 1996, Precautionary saving motives: An assessment from UK time series of cross-sections, The Economic Journal, 106, 1193–1208.

[10] Parker, J. and B. Preston, 2005, Precautionary saving and consumption fluctuations, American Economic Review, 95, 1119–1143.

[11] Zeldes, S., 1989, Consumption and liquidity constraints: An empirical investigation, Journal of Political Economy, 97, 305–346.

Table 1: Descriptive Statistics

	All	C	Un-C
Variables	mean	mean	mean
Age[a]	41.1	39.9	42.3
	(11.3)	(11.2)	(11.7)
Education[a]	83.3	78.6	88.2
(%)			
Occupation[a]	24.9	18.0	32.4
(%)			
Consumption[b]	7,020	6,112	7,989
	(3,468)	(2,797)	(3,833)
(Consumption Growth)^2	0.184	0.157	0.212
	(0.608)	(0.305)	(0.814)
Income[b]	15,622	13,873	17,486
	(10,965)	(9,468)	(12,092)
Financial Assets[b]	6,467	315	13,019
	(16,175)	(458)	(21,378)
Total Wealth[b]	42,661	30,490	55,622
	(54,980)	(44,527)	(61,711)
Sample size	1625	838	787

Standard deviations are in parentheses. C denotes *constrained households* and Un-C, *unconstrained households*. *a* represents the head and *b*, the households. Education is measured as the percentage of people in the sample that have studied at least till high school; and occupation, as the percentage of people in the sample who are engaged in managerial/professional occupations. Consumption and income measures (in 1982–84 constant dollars per adult equivalent) are nondurable expenditures and after-tax income, respectively, as defined in Krueger and Perri (2005). Total Wealth (in 1982–84 constant dollars per adult equivalent) includes financial assets and property.

Table 2: Dynan's Specifications

Instrumental Variables (IV)	(1)	(2)	(3)	(4)
Education[a]	0.214	0.226	0.228	0.074
Occupation[a]	0.866	0.701	..	..
Earners[a]	0.406	0.879	0.367	0.852
Property[a]	0.018	0.177	0.021	0.237
Financial Assets[a]	0.000	..	0.000	..
First stage R^2	0.076	0.049	0.073	0.044
$(\text{Consumption Growth})^2$	0.141	0.204	0.137	0.225
	(0.025)***	(0.045)***	(0.026)***	(0.059)***
Implied Prudence	0.282	0.408	0.274	0.450
	(0.050)***	(0.090)***	(0.052)***	(0.118)***
Over ID[b]	0.515	0.615	0.142	0.233

Standard errors are in parentheses. Age dummies (not reported here) are included to control for life-cycle effects. Month dummies (not reported here) are included to control for time-specific effects. *a* represents the p-values of the F-tests from the first stage estimations and *b*, the over-identification tests based on Sargan F-tests. *** indicates significance at the 1% level; **, at the 5% level; and *, at the 10% level.

Table 3: Specifications with Liquidity Constraints

IV	(1)	(2)	(3)	(4)
First − stage R^2	0.077	0.049	0.074	0.044
(Consumption Growth)^2	0.149	0.213	0.943	0.241
	(0.024)***	(0.046)***	(0.025)***	(0.061)***
Implied Prudence	0.298	0.426	0.292	0.482
	(0.048)***	(0.092)***	(0.050)*	(0.122)***
Income	–2.155	–2.230	–2.147	–2.435
	(1.138)*	(1.148)**	(1.140)*	(1.190)**
Over ID[a]	0.600	0.731	0.191	0.381

Standard errors are in parentheses. IV (1) includes education, occupation, the number of earners, property, and financial assets; IV (2), education, occupation, the number of earners, and property; IV (3), education, the number of earners, property, and financial assets; and IV (4), education, the number of earners, and property. Age and month dummies (not reported here) are included to control for life-cycle effects and time-specific effects, respectively. *a* represents the over-identification tests based on Sargan F-tests. *** indicates significance at the 1% level; **, at the 5% level; and *, at the 10% level.

Table 4: Specifications with Liquidity Constraints and Split Samples

IV	(1)		(2)		(3)		(4)	
	C	Un-C	C	Un-C	C	Un-C	C	Un-C
(Consumption Growth)^2	0.427	0.130	0.418	0.150	0.547	0.130	0.529	0.162
	(0.105)***	(0.024)***	(0.106)***	(0.054)***	(0.154)***	(0.027)***	(0.156)***	(0.027)**
Implied Prudence	0.854	0.260	0.838	0.300	1.094	0.260	1.058	0.324
	(0.210)***	(0.048)***	(0.212)***	(0.108)	(0.308)***	(0.054***)	(0.312)***	(0.054**)
Income	–5.609	2.782	–5.245	2.209	–6.615	4.571	–6.023	3.630
	(1.731)***	(2.012)	(1.914)***	(2.404)	(2.050)***	(2.671)	(2.381)**	(3.363)
Over ID[a]	0.916		0.880		0.790		0.697	

Standard errors are in parentheses. C denotes constrained households and Un-C, unconstrained households. *** indicates significance at the 1% level; **, at the 5% level; and *, at the 10% level.

Table 5: Robustness–Specifications with Liquidity Constraints and Split Samples

IV	(1)		(2)		(3)		(4)	
	C	Un-C	C	Un-C	C	Un-C	C	Un-C
A. alternative proxy								
(Consumption Growth)^2	0.390	0.159	0.387	0.174	0.447	0.169	0.447	0.201
	(0.087)***	(0.024)***	(0.088)***	(0.045)***	(0.112)***	(0.028)***	(0.114)***	(0.058)***
Implied Prudence	0.780	0.318	0.774	0.348	0.894	0.338	0.894	0.402
	(0.174)***	(0.048)***	(0.176)***	(0.090)***	(0.224)***	(0.056)***	(0.228)***	(0.116)***
Wealth-to-Income	–48.158	–0.004	–44.894	–0.005	–54.075	–0.002	–47.677	–0.005
	(16.038)***	(0.022)	(18.213)**	(0.022)	(17.861)***	(0.022)	(20.757)**	(0.023)
Over ID[a]	0.882		0.850		0.630		0.589	
B. lower cutoff								
(Consumption Growth)^2	0.409	0.140	0.401	0.163	0.583	0.141	0.566	0.181
	(0.105)***	(0.024)***	(0.105)***	(0.052)***	(0.174)***	(0.027)***	(0.174)***	(0.069)***
Implied Prudence	0.818	0.280	0.802	0.326	1.166	0.282	1.132	0.362
	(0.210)***	(0.048)***	(0.210)***	(0.348)***	(0.054)***	(0.056)***	(0.348)***	(0.138)***
Income	–5.123	1.473	–4.648	0.934	–7.216	3.830	–6.356	2.855
	(2.028)***	(1.879)	(2.226)**	(2.153)	(2.711)***	(2.710)	(3.010)**	(3.098)
Over ID[a]	0.887		0.851		0.813		0.755	

Standard errors are in parentheses. Case A (alternative proxy) uses the wealth-to-income ratio as a proxy for $\tilde{\lambda}$, the shadow value of the liquidity constraint, instead of income. Case B (lower cutoff) uses the ratio of liquidity assets to half a month's income instead of the ratio of liquidity assets to one month's income to split the sample. *** indicates significance at the 1% level; **, at the 5% level; and *, at the 10% level.