Appendix

A1. Parameter Values in Simulation in Chapter 1 and Chapter 2

For the income parameters of the 16 occupation/education groups, we use the estimates reported in Ludvigson and Paxson (2001). The parameter values as well as the proportion of each group within the sample are summarized in Table A1.

Table A1. Parameter Values of Income Processes

Group	μ	ϕ	σ	Proportion (%)
Professional, Technical , and Kindred				
< 12 Years of School	–	–	–	–
12 Years of School	0.047	0.159	0.153	1.40
> 12 Years of School	0.082	0.288	0.147	14.46
Managers (Self-Employed and Employees)				
< 12 Years of School	–	–	–	–
12 Years of School	0.027	0.342	0.176	3.95
> 12 Years of School	0.056	0.397	0.165	9.90
Clerical and Sales				
< 12 Years of School	0.038	0.407	0.137	0.93
12 Years of School	0.038	0.809	0.150	3.22
> 12 Years of School	0.053	0.314	0.188	5.89
Craftsmen and Kindred				
< 12 Years of School	0.024	0.329	0.196	6.29
12 Years of School	0.025	0.341	0.170	12.92
> 12 Years of School	0.034	0.273	0.171	6.48
Operatives (Transport and Nontransport)				
< 12 Years of School	0.020	0.432	0.171	6.93
12 Years of School	0.025	0.366	0.170	9.83
> 12 Years of School	0.047	0.299	0.177	3.25
Laborers and Service Workers				
< 12 Years of School	0.046	0.563	0.182	5.39
12 Years of School	0.048	0.464	0.210	5.80
> 12 Years of School	0.050	0.263	0.220	3.36

Notes. Professionals and managers with less then 12 years of school are excluded from the simulation, because there are not enough samples in the PSID.

A2. Proofs of Chapter 3

In this appendix, we prove that when p rises, consumption increases when there are borrowing constraints facing consumers. Moreover, this increment is smaller than the unconstrained case, which is $\frac{4}{3}\delta$. Specifically, we will prove that in equation (3.14), $0 \leq \frac{\partial C_1^B}{\partial p} \leq \frac{4}{3}\delta$.

Rearranging W_H and W_L yields

$$\begin{aligned} W_H &= \bar{Y} + \frac{3}{2}\left(\bar{Y} - Y_L\right) \\ &= \widetilde{Y} + (2p-1)\delta + \frac{3}{2}\left[\left(\widetilde{Y} + (2p-1)\delta\right) - \left(\widetilde{Y} - \delta\right)\right] \\ &= \widetilde{Y} + (5p-1)\delta; \end{aligned}$$

$$\begin{aligned} W_L &= \bar{Y} - \left(\frac{1-p}{2}\right)(\bar{Y} - Y_L) \\ &= \widetilde{Y} + (2p-1)\delta - \left(\frac{1-p}{2}\right)2p\delta \\ &= \widetilde{Y} + (p^2 + p - 1)\delta. \end{aligned}$$

We also know that $\frac{\partial}{\partial W_1}\left(\frac{\partial C_1^B}{\partial p}\right) < 0$. This $\frac{\partial C_1^B}{\partial p}$ reaches its maximum at $W_1 = W_L$; and its minimum at $W_1 = W_H$. Therefore, to prove that $0 \leq \frac{\partial C_1^B}{\partial p} \leq \frac{4}{3}\delta$, showing that $\frac{\partial C_1^B}{\partial p} \geq 0$ when $W_1 = W_H$, and $\frac{\partial C_1^B}{\partial p} \leq \frac{4}{3}\delta$ when $W_1 = W_L$ will suffice. We proceed first by showing that consumption increases when p raises, i.e. $\frac{\partial C_1}{\partial p} \geq 0$. Substituting $W_1 = W_H$ into equation (3.14) gives

$$\begin{aligned} \frac{\partial C_1^B}{\partial p} &= \left[\frac{3 + 8p - p^2}{(4-p)^2}\right]2\delta - \left[\frac{2}{(4-p)^2}\right][\widetilde{Y} + (5p-1)\delta - \widetilde{Y}] \\ &= \left[\frac{4 + 3p - p^2}{(4-p)^2}\right]2\delta \\ &= \left[\frac{4 + 2p + p(1-p)}{(4-p)^2}\right]2\delta \geq 0. \end{aligned}$$

The optimal consumption increases with p when there are borrowing constraints facing consumers.

We then prove that the increment of C_1^B is less than that of C_1^N, $\frac{4}{3}\delta$. Substituting

$W_1 = W_L$ into equation (3.14) yields

$$\begin{aligned} \frac{\partial C_1^B}{\partial p} &= \left[\frac{3+8p-p^2}{(4-p)^2}\right] 2\delta - \left[\frac{2}{(4-p)^2}\right] [\widetilde{Y} + (p^2+p-1)\delta - \widetilde{Y}] \\ &= \left[\frac{5+6p-3p^2}{(4-p)^2}\right] 2\delta. \end{aligned}$$

This is the maximum increment of C_1^B. Contrasting with $\frac{4}{3}\delta$:

$$\begin{aligned} \frac{4}{3}\delta - \left[\frac{5+6p-3p^2}{(4-p)^2}\right] 2\delta &= \left[\frac{17-26p+11p^2}{3(4-p)^2}\right] 2\delta \\ &\geq 0, \forall p \in [0,1]; \end{aligned}$$

we then have proved that the increment in consumption is smaller when there are possibly binding borrowing constraints in the economy.