Table 1 Microeconomic Model Calibration

{table:Parameters}

Calibrated Parameters			
Description	Parameter	Value	Source
Permanent Income Growth Factor	$\mathcal{G}$	1.03	PSID: Carroll (1992)
Interest Factor	R	1.04	Conventional
Time Preference Factor	β	0.96	Conventional
Coefficient of Relative Risk Aversion	γ	2	Conventional
Probability of Zero Income	q	0.005	PSID: Carroll (1992)
Std Dev of Log Permanent Shock	σ_ψ	0.1	PSID: Carroll (1992)
Std Dev of Log Transitory Shock	σ_θ	0.1	PSID: Carroll (1992)

Table 2 Model Characteristics Calculated from Parameters

{table:Calibration}

Description	Symbol and Formula			Approximate Calculated Value
Finite Human Wealth Factor	$\tilde{\mathcal{R}}^{-1}$	$\equiv$	$\mathcal{G}/\mathsf{R}$	0.990
PF Value of Autarky Factor	$\beth$	$\equiv$	$\beta\mathcal{G}^{1-\gamma}$	0.932
Growth Compensated Permanent Shock	$\underline{\psi}$	$\equiv$	$(\mathbb{E}[\psi^{-1}])^{-1}$	0.990
Uncertainty-Adjusted Growth	$\underline{\mathcal{G}}$	$\equiv$	$\mathcal{G}\underline{\psi}$	1.020
Utility Compensated Permanent Shock	$\underline{\underline{\psi}}$	$\equiv$	$(\mathbb{E}[\psi^{1-\gamma}])^{1/(1-\gamma)}$	0.990
Utility Compensated Growth	$\underline{\mathcal{G}}$	$\equiv$	$\mathcal{G}\underline{\underline{\psi}}$	1.020
Absolute Patience Factor	Þ	$\equiv$	$(\mathsf{R}\beta)^{1/\gamma}$	0.999
Return Patience Factor	$\frac{\text{Þ}}{\mathsf{R}}$	$\equiv$	$\text{Þ}/\mathsf{R}$	0.961
Growth Patience Factor	$\frac{\text{Þ}}{\mathcal{G}}$	$\equiv$	$\text{Þ}/\mathcal{G}$	0.970
Modified Growth Patience Factor	$\frac{\text{Þ}}{\mathcal{G}}\mathbb{E}[\psi^{-1}]$	$\equiv$	$\text{Þ}/\underline{\mathcal{G}}$	0.980
Value of Autarky Factor	$\underline{\underline{\beth}}$	$\equiv$	$\beta\mathcal{G}^{1-\gamma}\underline{\underline{\psi}}^{1-\gamma}$	0.941
Weak Return Impatience Factor	$q^{1/\gamma}\text{Þ}$	$\equiv$	$(q\beta\mathsf{R})^{1/\gamma}$	0.071

Table 3 Definitions and Comparisons of

{table:Comparison}

Perfect Foresight Versions	Uncertainty Versions
Finite Human Wealth	
$\mathcal{G}/\mathsf{R} < 1$	$\mathcal{G}/\mathsf{R} < 1$
The growth factor for permanent income $\mathcal{G}$ must be smaller than the discounting factor R for human wealth to be finite.	The model's risks are mean-preserving spreads, so the PDV of future income is unchanged by their introduction.
Absolute Impatience Condition	
$\text{Þ} < 1$	$\text{Þ} < 1$
The unconstrained consumer is sufficiently impatient that the level of consumption will be declining over time: $$\boldsymbol{c}_{t+1} < \boldsymbol{c}_t$$	*If wealth is large enough,* the *expectation* of consumption next period will be smaller than this period's consumption: $$\lim_{m_t \to \infty} \mathbb{E}_t[\boldsymbol{c}_{t+1}] < \boldsymbol{c}_t$$
Return Impatience	
Return Impatience Condition	Weak RIC (WRIC)
$\text{Þ}/\mathsf{R} < 1$	$q^{1/\gamma}\text{Þ}/\mathsf{R} < 1$
The growth factor for consumption Þ must be smaller than the discounting factor R, so that the PDV of current and future consumption will be finite: $$\mathrm{c}'(m) = 1 - \text{Þ}/\mathsf{R} < 1$$	If the probability of the zero-income event is $q = 1$ then income is always zero and the condition becomes identical to the RIC. Otherwise, weaker. $$\mathrm{c}'(m) < 1 - q^{1/\gamma}\text{Þ}/\mathsf{R} < 1$$
Growth Impatience	
GIC	GIC-Mod
$\text{Þ}/\mathcal{G} < 1$	$\text{Þ}\mathbb{E}[\psi^{-1}]/\mathcal{G} < 1$
For an unconstrained PF consumer, the ratio of $\boldsymbol{c}$ to $\boldsymbol{p}$ will fall over time. For constrained, guarantees the constraint eventually binds. Guarantees $$\lim_{m_t \uparrow \infty} \mathbb{E}_t[\psi_{t+1} m_{t+1}/m_t] = \frac{\text{Þ}}{\mathcal{G}}$$	By Jensen's inequality stronger than GIC. Ensures consumers will not expect to accumulate m unboundedly. $$\lim_{m_t \to \infty} \mathbb{E}_t[m_{t+1}/m_t] = \frac{\text{Þ}}{\mathcal{G}}\mathbb{E}[\psi^{-1}]$$
Finite Value of Autarky	
PF-FVAC	FVAC
$\beta\mathcal{G}^{1-\gamma} < 1$ equivalently $\text{Þ} < \mathsf{R}^{1/\gamma}\mathcal{G}^{1-1/\gamma}$	$\beta\mathcal{G}^{1-\gamma}\mathbb{E}[\psi^{1-\gamma}] < 1$
The discounted utility of constrained consumers who spend their permanent income each period should be finite.	By Jensen's inequality, stronger than the PF-FVAC because for $\gamma > 1$ and nondegenerate ψ, $\mathbb{E}[\psi^{1-\gamma}] > 1$.

Table 4 Sufficient Conditions for Nondegenerate‡ Solution

{table:Required}

Consumption Model(s)	Conditions	Comments
$\bar{\mathrm{c}}(m)$: PF Unconstrained	RIC, FHWC°	RIC$\Rightarrow$ $\lvert \mathrm{v}(m)\rvert < \infty$; FHWC$\Rightarrow$ $0 < \lvert \mathrm{v}(m)\rvert$
$\underline{\mathrm{c}}(m) = \underline{\kappa} m$		PF model with no human wealth ($h = 0$)
Section 2.3.1:		RIC prevents $\bar{\mathrm{c}}(m) = \underline{\mathrm{c}}(m) = 0$
Section 2.3.1:		FHWC prevents $\bar{\mathrm{c}}(m) = \infty$
Eq (48) in Appendix A.2:		PF-FVAC+FHWC $\Rightarrow$ RIC
Eq (47) in Appendix A.2:		GIC+FHWC $\Rightarrow$ PF-FVAC
$\grave{\mathrm{c}}(m)$: PF Constrained	~~GIC~~, RIC	FHWC holds ($\mathcal{G} < \text{Þ} < \mathsf{R} \Rightarrow \mathcal{G} < \mathsf{R}$)
Section 5.1.1:		$\grave{\mathrm{c}}(m) = \bar{\mathrm{c}}(m)$ for $m > m_{\#} < 1$
		(~~RIC~~ would yield $m_{\#} = 0$ so $\grave{\mathrm{c}}(m) = 0$)
Appendix D:	GIC,RIC	$\lim_{m\to\infty} \grave{\mathrm{c}}(m) = \bar{c}(m)$, $\lim\limits_{m\to\infty} \grave{\boldsymbol{\kappa}}(m) = \underline{\kappa}$
		kinks where horizon to $b = 0$ changes*
Appendix D:	GIC,~~RIC~~	$\lim\limits_{m\to\infty} \grave{\boldsymbol{\kappa}}(m) = 0$
		kinks where horizon to $b = 0$ changes*
$\mathrm{c}(m)$: Friedman/Muth	Section 2.4.1 & 2.4.2	$\underline{\mathrm{c}}(m) < \mathrm{c}(m) < \bar{\mathrm{c}}(m)$
		$\underline{\mathrm{v}}(m) < \mathrm{v}(m) < \bar{\mathrm{v}}(m)$
Section 2.4.2:	FVAC, WRIC	Sufficient for Contraction
Section 5.2:		WRIC is weaker than RIC
Figure 7:		FVAC is stronger than PF-FVAC
Section 5.2.1: Case 3		~~FHWC~~+RIC $\Rightarrow$GIC, $\lim\limits_{m\to\infty} \boldsymbol{\kappa}(m) = \underline{\kappa}$
Section 5.2.1: Case 1		~~RIC~~ $\Rightarrow$~~FHWC~~, $\lim\limits_{m\to\infty} \boldsymbol{\kappa}(m) = 0$
Section 3.2:		"Buffer Stock Saving" Conditions
Theorem 3:		GIC $\Rightarrow \exists\ \check{m}$ s.t. $0 < \check{m} < \infty$
Theorem 2:		GIC-Mod $\Rightarrow \exists\ \hat{m}$ s.t. $0 < \hat{m} < \infty$

‡For feasible m satisfying $0 < m < \infty$, a nondegenerate limiting consumption function defines a unique optimal value of c satisfying $0 < c(m) < \infty$; a nondegenerate limiting value function defines a corresponding unique value of $-\infty < \mathrm{v}(m) < 0$.

°RIC, FHWC are necessary as well as sufficient for the perfect foresight case. *That is, the first kink point in $c(m)$ is $m_{\#}$ s.t. for $m < m_{\#}$ the constraint will bind now, while for $m > m_{\#}$ the constraint will bind one period in the future. The second kink point corresponds to the m where the constraint will bind two periods in the future, etc.

**In the Friedman/Muth model, the RIC+FHWC are sufficient, but *not* necessary for nondegeneracy

Table 5 Appendix: Perfect Foresight Liquidity Constrained Taxonomy

{table:LiqConstrSce

For constrained $\grave{c}$ and unconstrained $\bar{c}$ consumption functions

Main Condition Subcondition	Math			Outcome, Comments or Results
$\cancel{\text{GIC}}$		$1 <$	$\text{Þ}/\mathcal{G}$	Constraint never binds for $m \geq 1$
and RIC	$\text{Þ}/\mathsf{R}$	< 1		FHWC holds ($\mathsf{R} > \mathcal{G}$); $\grave{c}(m) = \bar{c}(m)$ for $m \geq 1$
and $\cancel{\text{RIC}}$		$1 <$	$\text{Þ}/\mathsf{R}$	$\grave{c}(m)$ is degenerate: $\grave{c}(m) = 0$
GIC	$\text{Þ}/\mathcal{G}$	< 1		Constraint binds in finite time $\forall\ m$
and RIC	$\text{Þ}/\mathsf{R}$	< 1		FHWC may or may not hold $\lim_{m\uparrow\infty} \bar{c}(m) - \grave{c}(m) = 0$ $\lim_{m\uparrow\infty} \grave{\boldsymbol{\kappa}}(m) = \underline{\kappa}$
and $\cancel{\text{RIC}}$		$1 <$	$\text{Þ}/\mathsf{R}$	$\cancel{\text{FHWC}}$ $\lim_{m\uparrow\infty} \grave{\boldsymbol{\kappa}}(m) = 0$

Conditions are applied from left to right; for example, the second row indicates conclusions in the case where ~~GIC~~ and RIC both hold, while the third row indicates that when the GIC and the RIC both fail, the consumption function is degenerate; the next row indicates that whenever the GIC holds, the constraint will bind in finite time.