# Wealth Accumulation, Credit Card Borrowing, and Consumption-Income Comovement

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# 1 Self control problems

- People are patient in the long run, but impatient in the short run.

- Tomorrow we want to quit smoking, exercise, and eat carrots.

- Today we want our cigarette, TV, and frites.

Self control problems in savings.

- Baby boomers report median target savings rate of 15%.

- Actual median savings rate is 5%.

- 76% of household's believe they should be saving more for retirement (Public Agenda, 1997).

- Of those who feel that they are at a point in their lives when they "should be seriously saving already," only 6% report being "ahead" in their saving, while 55% report being "behind."

- Consumers report a preference for flat or rising consumption paths.

Further evidence: Normative value of commitment.

- "Use whatever means possible to remove a set amount of money from your bank account each month before you have a chance to spend it."
- Choose excess withholding.
- Cut up credit cards, put them in a safe deposit box, or freeze them in a block of ice.
- "Sixty percent of Americans say it is better to keep, rather than loosen legal restrictions on retirement plans so that people don't use the money for other things."
- Social Security and Roscas.
- Christmas Clubs (10 mil. accounts).

An *intergenerational* discount function introduced by Phelps and Pollak (1968) provides a particularly tractable way to capture such effects.

Salience effect (Akerlof 1992), quasi-hyperbolic discounting (Laibson, 1997), present-biased preferences (O'Donoghue and Rabin, 1999), quasi-geometric discounting (Krusell and Smith 2000):

$$1, \beta\delta, \beta\delta^2,\ \beta\delta^3,\ ...$$

$$U_t = u(c_t) + \beta\delta u(c_{t+1}) + \beta\delta^2 u(c_{t+2}) + \beta\delta^3 u(c_{t+3}) + ...$$

- For exponentials: $\beta = 1$

$$U_t = u(c_t) + \delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \delta^3 u(c_{t+3}) + ...$$

- For hyperbolics: $\beta < 1$

$$U_t = u(c_t) + \beta \left[\delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \delta^3 u(c_{t+3}) + ...\right]$$

## Outline

1. Introduction
2. Facts
3. Model
4. Estimation Procedure
5. Results
6. Conclusion

## 2 Consumption-Savings Behavior

- Substantial retirement wealth accumulation (SCF)

- Extensive credit card borrowing (SCF, Fed, Gross and Souleles 2000, Laibson, Repetto, and Tobacman 2000)

- Consumption-income comovement (Hall and Mishkin 1982, many others)

- Anomalous retirement consumption drop (Banks et al 1998, Bernheim, Skinner, and Weinberg 1997)

## 2.1 Data

| Statistic | $m_e$ | $se_{m_e}$ |
|---|---|---|
| % borrowing on 'Visa'? (*% Visa*) | 0.68 | 0.015 |
| borrowing / mean income ($mean$ *Visa*) | 0.12 | 0.01 |
| C-Y comovement (*CY*) | 0.23 | 0.11 |
| retirement C drop (*C drop*) | 0.09 | 0.07 |
| median 50-59 $\frac{wealth}{income}$ | 3.88 | 0.25 |
| weighted mean 50-59 $\frac{wealth}{income}$ (*wealth*) | 2.60 | 0.13 |

- Three moments on previous slide (*wealth, % Visa, mean Visa*) from SCF data. Correct for cohort, household demographic, and business cycle effects, so simulated and empirical hh's are analogous. Compute covariances directly.

- *C-Y* from PSID:

$$\Delta \ln(C_{it}) = \alpha E_{t-1} \Delta \ln(Y_{it}) + X_{it}\beta + \varepsilon_{it} \quad (1)$$

- *C drop* from PSID

$$\Delta \ln(C_{it}) = I_{it}^{\text{RETIRE}} \gamma + X_{it}\beta + \varepsilon_{it} \quad (2)$$

# 3 Model

- We use simulation framework

- Institutionally rich environment, e.g., with income uncertainty and liquidity constraints

- Literature pioneered by Carroll (1992, 1997), Deaton (1991), and Zeldes (1989)

- Gourinchas and Parker (2001) use method of simulated moments (MSM) to estimate a structural model of life-cycle consumption

## 3.1 Demographics

- Mortality, Retirement (PSID), Dependents (PSID), HS educational group

## 3.2 Income from transfers and wages

- $Y_t =$ after-tax labor and bequest income plus govt transfers (assumed exog., calibrated from PSID)

- $y_t \equiv \ln(Y_t)$. During working life:

$$y_t = f^W(t) + u_t + \nu_t^W \tag{3}$$

- During retirement:

$$y_t = f^R(t) + \nu_t^R \tag{4}$$

## 3.3 Liquid assets and non-collateralized debt

- $X_t + Y_t$ represents liquid asset holdings at the beginning of period $t$.

- Credit limit: $X_t \geq -\lambda \cdot \bar{Y}_t$

- $\lambda = .30$, so average credit limit is approximately $8,000 (SCF).

## 3.4 Illiquid assets

- $Z_t$ represents illiquid asset holdings at age $t$.

- $Z$ bounded below by zero.

- $Z$ generates consumption flows each period of $\gamma Z$.

- Conceive of $Z$ as having some of the properties of home equity.

- Disallow withdrawals from $Z$; $Z$ is perfectly illiquid.

- $Z$ stylized to preserve computational tractability.

1. House of value $H$, mortgage of size $M$.

2. Consumption flow of $\gamma H$, minus interest cost of $\eta M$, where $\eta = i \cdot (1 - \tau) - \pi$.

3. $\gamma \approx \eta \Longrightarrow$ net consumption flow of $\gamma H - \eta M \approx \gamma(H - M) = \gamma Z$.We've explored different possibilities for withdrawals from $Z$ before..

## 3.5 Dynamics

- Let $I_t^X$ and $I_t^Z$ represent net investment into assets $X$ and $Z$ during period $t$

- Dynamic budget constraints:

$$\begin{aligned} X_{t+1} &= R^X \cdot (X_t + I_t^X) \\ Z_{t+1} &= R^Z \cdot (Z_t + I_t^Z) \\ C_t &= Y_t - I_t^X - I_t^Z \end{aligned}$$

- Interest rates:

$$R^X = \begin{cases} R^{CC} & \text{if } X_t + I_t^X < 0 \\ R & \text{if } X_t + I_t^X > 0 \end{cases} ; \qquad R^Z = 1$$

- Three assumptions for $\left[R^X, \gamma, R^{CC}\right]$:

| | |
|---|---|
| Benchmark: | [1.0375, 0.05, 1.1175] |
| Aggressive: | [1.03, 0.06, 1.10] |
| Very Aggressive: | [1.02, 0.07, 1.09] |

## 3.6 Time Preferences

- Discount function:

$$\{1, \beta\delta, \beta\delta^2, \beta\delta^3, ...\}$$

- $\beta = 1$: standard exponential discounting case

- $\beta < 1$: preferences are qualitatively hyperbolic

- *Null hypothesis:* $\beta = 1$

$$U_t(\{C_\tau\}_{\tau=t}^T) = u(C_t) + \beta \sum_{\tau=t+1}^{T} \delta^\tau u(C_\tau) \qquad (5)$$

In full detail, self $t$ has instantaneous payoff function

$$u(C_t, Z_t, n_t) = n_t \cdot \frac{\left(\frac{C_t + \gamma Z_t}{n_t}\right)^{1-\rho} - 1}{1-\rho}$$

and continuation payoffs given by:

$$\beta \sum_{i=1}^{T+N-t} \delta^i \left(\Pi_{j=1}^{i-1} s_{t+j}\right)(s_{t+i}) \cdot u(C_{t+i}, Z_{t+i}, n_{t+i})...$$
$$+\beta \sum_{i=1}^{T+N-t} \delta^i \left(\Pi_{j=1}^{i-1} s_{t+j}\right)(1 - s_{t+i}) \cdot B(X_{t+i}, Z_{t+i})$$

- $n_t$ is effective household size: adults+(.4)(kids)
- $\gamma Z_t$ represents real after-tax net consumption flow
- $s_{t+1}$ is survival probability
- $B(\cdot)$ represents the payoff in the death state

## 3.7 Computation

- Dynamic problem:

$$\max_{I_t^X, I_t^Z} \quad u(C_t, Z_t, n_t) + \beta\delta E_t V_{t,t+1}(\Lambda_{t+1})$$
$$s.t. \text{ Budget constraints}$$

- $\Lambda_t = (X_t + Y_t, Z_t, u_t)$ (state variables)

- Functional Equation:

$$V_{t-1,t}(\Lambda_t) = \{s_t[u(C_t, Z_t, n_t) + \delta E_t V_{t,t+1}(\Lambda_{t+1})] + (1 - s_t) E_t B(\Lambda_t)\}$$

- Solve for eq strategies using backwards induction

- Simulate behavior

- Calculate descriptive moments of consumer behavior

# 4 Estimation

Estimate parameter vector $\theta$ and evaluate models wrt data.

- $m_e =$ N empirical moments, VCV matrix $= \Omega$
- $m_s(\theta) =$ analogous simulated moments
- $q(\theta) \equiv (m_s(\theta) - m_e)\,\Omega^{-1}\,(m_s(\theta) - m_e)'$, a scalar-valued loss function
- Minimize loss function: $\hat{\theta} = \arg\min_{\theta} q(\theta)$
- $\hat{\theta}$ is the MSM estimator.
- Pakes and Pollard (1989) prove asymptotic consistency and normality.
- Specification tests: $q(\hat{\theta}) \sim \chi^2(N - \#parameters)$

# 5 Results

- Exponential ($\beta = 1$) case:

$$\hat{\delta} = .857 \pm .005; \qquad q\left(\hat{\delta}, 1\right) = 512$$

- Hyperbolic case:

$$\begin{cases} \hat{\beta} = .661 \pm .012 \\ \hat{\delta} = .956 \pm .001 \end{cases} \qquad q\left(\hat{\delta}, \hat{\beta}\right) = 75$$

(Benchmark case: $\left[R^X, \gamma, R^{CC}\right] = [1.0375,\ 0.05,\ 1.1175]$)

Punchlines:

- $\beta$ estimated significantly below 1.
- Reject $\beta = 1$ null hypothesis with a t-stat of 25.
- Specification tests reject both the exponential and the hyperbolic models.

| Benchmark Model | Exponential | Hyperbolic | Data | Std err |
|---|---|---|---|---|
| Statistic: | $m_s(1,\hat{\delta})$<br>$\hat{\delta} = .857$ | $m_s(\hat{\beta},\hat{\delta})$<br>$\hat{\beta} = .661$<br>$\hat{\delta} = .956$ | $m_e$ | $se_{m_e}$ |
| % $Visa$ | 0.62 | 0.65 | 0.68 | 0.015 |
| $mean\ Visa$ | 0.14 | 0.17 | 0.12 | 0.01 |
| $CY$ | 0.26 | 0.35 | 0.23 | 0.11 |
| $Cdrop$ | 0.16 | 0.18 | 0.09 | 0.07 |
| $wealth$ | 0.04 | 2.51 | 2.60 | 0.13 |
| $q(\hat{\theta})$ | 512 | 75 | | |

# Robustness

$$\text{Benchmark: } \left[R^X, \gamma, R^{CC}\right] = [1.0375,\ 0.05,\ 1.1175]$$

$$\text{Aggressive: } \left[R^X, \gamma, R^{CC}\right] = [1.03,\ 0.06,\ 1.10]$$

$$\text{Very Aggressive: } \left[R^X, \gamma, R^{CC}\right] = [1.02,\ 0.07,\ 1.09]$$

| | Benchmark | Aggressive | Very Aggressive |
|---|---|---|---|
| exp $\hat{\delta}$ | .857<br>(.005) | .930<br>(.001) | .923<br>(.002) |
| $q\left(\hat{\delta}, 1\right)$ | 512 | 278 | 64 |
| hyp $\left[\hat{\delta}, \hat{\beta}\right]$ | [.956, .661]<br>(.001) , (.012) | [.944, .815]<br>(.001) , (.014) | [.932, .909]<br>(.002) , (.016) |
| $q\left(\hat{\delta}, \hat{\beta}\right)$ | 75 | 45 | 33 |

| Aggressive | Exponential | Hyperbolic | Data | Std err |
|---|---|---|---|---|
| Statistic: | $m_s(1, \hat{\delta})$<br>$\hat{\delta} = .930$ | $m_s(\hat{\beta}, \hat{\delta})$<br>$\hat{\beta} = .815$<br>$\hat{\delta} = .944$ | $m_e$ | $se_{m_e}$ |
| % $Visa$ | 0.44 | 0.65 | 0.68 | 0.015 |
| $mean\ Visa$ | 0.08 | 0.16 | 0.12 | 0.01 |
| $CY$ | 0.10 | 0.22 | 0.23 | 0.11 |
| $Cdrop$ | 0.08 | 0.14 | 0.09 | 0.07 |
| $wealth$ | 2.50 | 2.61 | 2.60 | 0.13 |
| $q(\hat{\theta})$ | 278 | 45 | | |

| V. Agg. | Exponential | Hyperbolic | Data | Std err |
|---|---|---|---|---|
| Statistic: | $m_s(1, \hat{\delta})$<br>$\hat{\delta} = .923$ | $m_s(\hat{\beta}, \hat{\delta})$<br>$\hat{\beta} = .909$<br>$\hat{\delta} = .932$ | $m_e$ | $se_{m_e}$ |
| % $Visa$ | 0.58 | 0.65 | 0.68 | 0.015 |
| $mean\ Visa$ | 0.12 | 0.15 | 0.12 | 0.01 |
| $CY$ | 0.14 | 0.19 | 0.23 | 0.11 |
| $Cdrop$ | 0.12 | 0.14 | 0.09 | 0.07 |
| $wealth$ | 2.53 | 2.66 | 2.60 | 0.13 |
| $q(\hat{\theta})$ | 64 | 33 | | |

# 6 Conclusion

- Structural test using the method of simulated moments rejects the exponential discounting null.

- Specification tests reject both the exponential and the hyperbolic models.

- Quantitative results are sensitive to interest rate assumptions.

- Hyperbolic discounting does a better job of matching the available empirical evidence on consumption and savings.