Wealth Effects (Plural) and U.S. Consumer Spending*

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Introduction

- Conventional models, in which long-run consumption depends on wealth, interest rates and permanent income, cannot account for:
  - Secular decline in the saving rate from late 1970s to 2007
  - The behavior of consumption and savings since then.
- Need to account for the evolving credit market architecture of U.S. household finance in order to do so
- Identify and quantify two important financial innovations contributing to household financial accelerators:
  - Changing consumer credit standards
  - Changing liquidity of housing wealth, the "housing wealth" (collateral) effect
- Estimated wealth effects differ by asset:
  - Approx. 8% for liquid assets minus consumer and mortgage debt
  - Approx. 1.5% for stocks and other illiquid financial assets
  - Housing collateral: Rising from about 1% in early 1980's to over 3¾% in the mid 2000's; Falls to under 2% in 2015; About 2¼% in mid-2017

Figure 1: Wealth-to-Income Ratio Alone Cannot Account for Saving Rate Trends

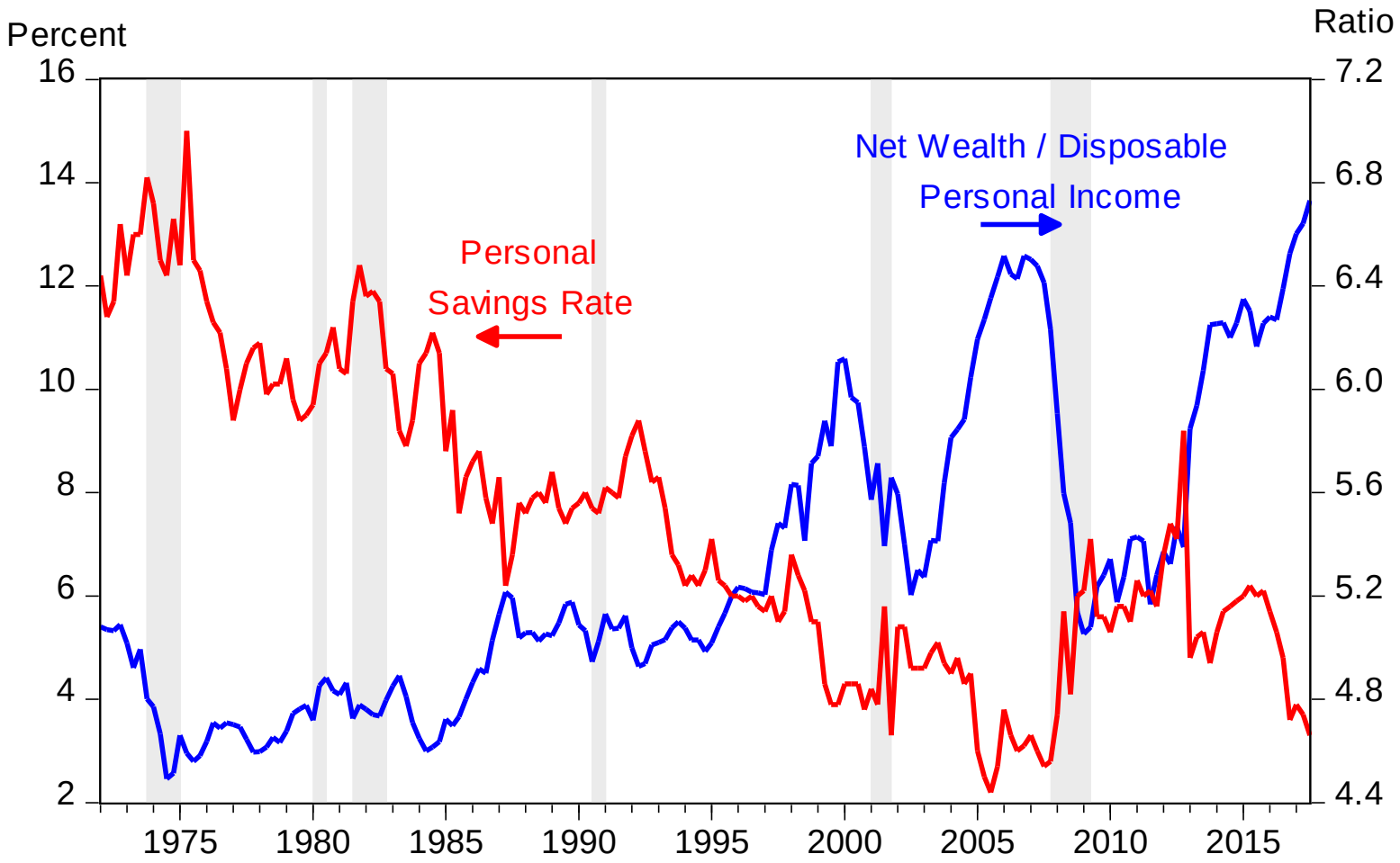
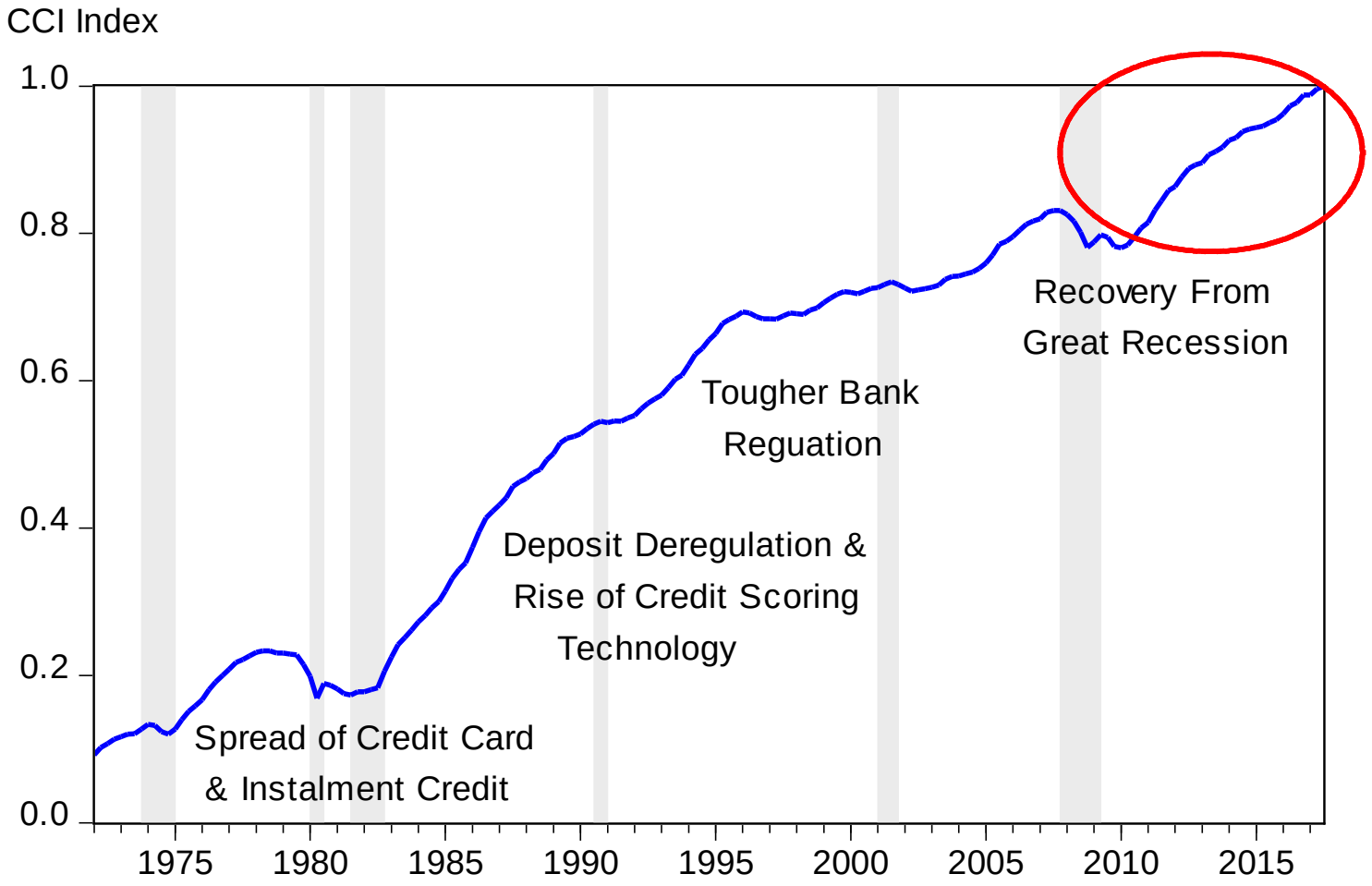


Figure 2: Consumer Credit Availability Contributed to Recovery from Great Recession



Notes: Consumer Credit Index (CCI) derived from cumulated exogenous component of the responses to the Senior Loan Officer Opinion Survey response to willingness to make consumer installment loan question.

State Space Model of Consumption and Refinancing

- We use a credit augmented consumption function
- We consider forward looking consumers who are aware of their inter-temporal budget constraint
- We do not assume a representative agent with rational expectations etc. as in most Euler equations
- In standard life-cycle, permanent income model consumption C is proportional to permanent income Y^p and wealth W, which implies:

$$\ln C_t = \alpha_0 + \ln Y_t + \gamma W_{t-1}/Y_t + \ln(Y_t^P/Y_t) + u_t$$

  where Y is labor and transfer income
- Adding expected income growth and intertemporal substitution yields:

$$\ln C_t = \alpha_0 - \alpha_1 r_t + \ln Y_t + \gamma W_{t-1}/Y_t + E_t \ln(Y_t^P/Y_t) + u_t$$

- Partial adjustment dynamics arise by adding habits, rational inattention etc.

$$\Delta \ln C_t = \lambda(\ln C_t^* - \ln C_{t-1}) + u_t$$
$$= \lambda\{\alpha_0 - \alpha_1 r_t + \ln Y_t - \ln C_{t-1} + \gamma W_{t-1}/Y_t + E_t \ln(Y_t^P/Y_t)\} + u_t$$

Credit Augmented Consumption Function (Cont'd)

- Add measure of consumer credit conditions (*CCI*)
- Disaggregate wealth into net liquid assets (*NLA* = liquid assets – consumer & mortgage debt), net illiquid financial assets (*NIFA*) and gross housing wealth (*HSG*)
- Allow variable liquidity of housing wealth (*HLI*)
- Add uncertainty and other credit constraint effects:

$$\begin{aligned}\Delta \ln C_t = \lambda\{&\alpha_0 + (\ln Y_t - \ln C_{t-1}) + \alpha_1 r_{t-1} + \alpha_2 CCI_{t-1} + \alpha_3 \ln(\widehat{Y^p_{t+1}}/Y_t) \\ &+ \gamma_1 NLA_{t-1}/Y_t + \gamma_2 NIFA_{t-1}/Y_t + \gamma_3 HSG_{t-1}/Y_t + HLI_t \times HSG_{t-1}/Y_t\} \\ &+ \beta_1 \Delta ur_t + \beta_2 \Delta i_t + \ldots + u_t\end{aligned}$$

  where ur is the unemployment rate, i is the nominal interest rate
- The unobserved liquidity of housing wealth state variable evolves as $HLI_t = HLI_{t-1} + \varepsilon_t$, where ε_t is a white noise, normal innovation
- Use state space model of permanent income with 10 year horizon à la Friedman (1956,1963), Deaton (1991, 1992) and Carroll (2001), and a high 5% discount rate à la Skinner (1988), Zeldes (1989), Kimball (1990) and Carroll (1997, 2001)

Mortgage Refinancing Equation

- *HLI* also appears in refi equations which helps us pin down the housing liquidity effect:

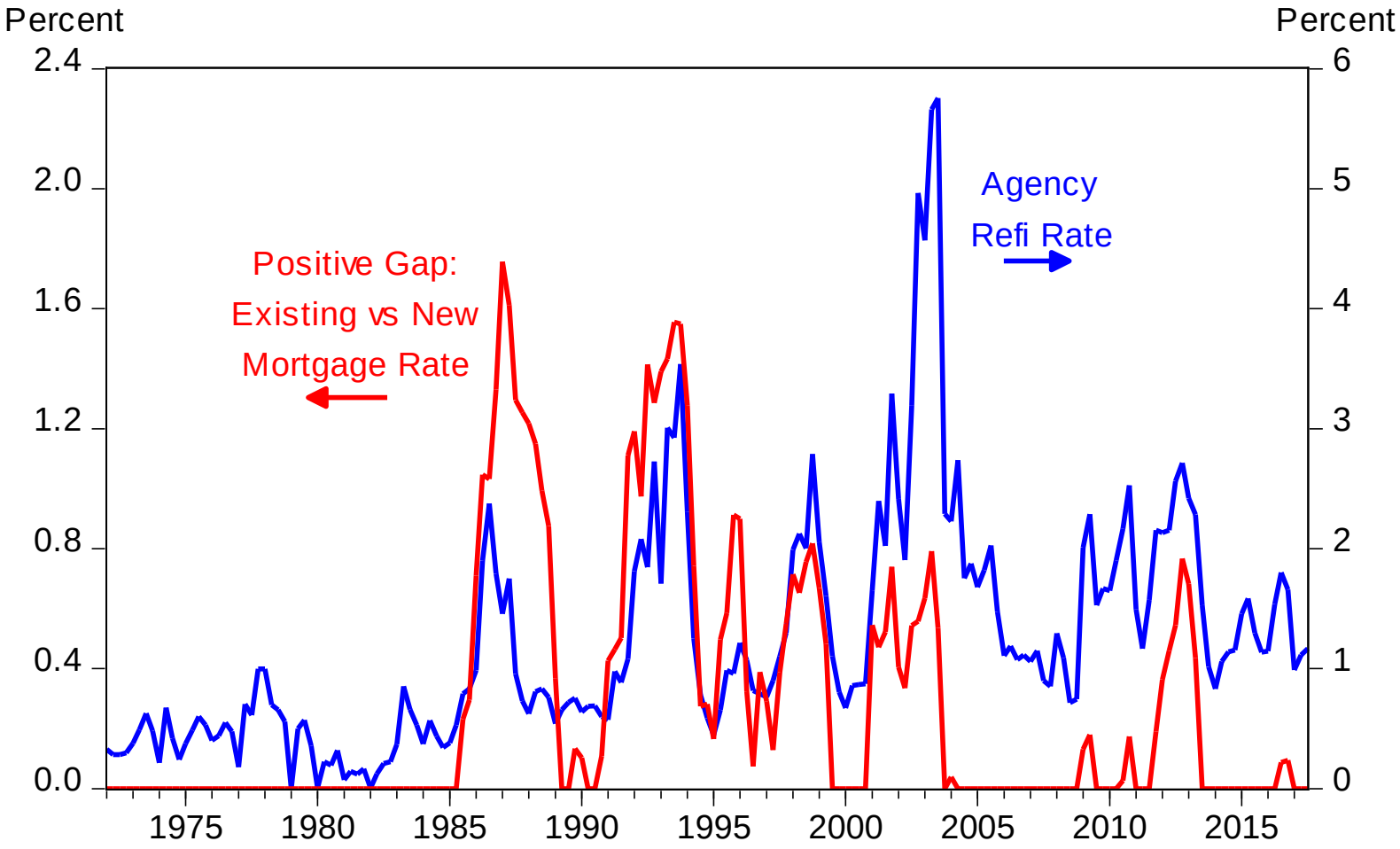
$$refi_t = \phi_1 refi_{t-1} + \phi_2 HLI_t + z_t'\delta + HLI_t \times z_t'\delta + v_t$$

$$z_t'\delta \equiv \delta_0 + \delta_1 PosGap_{t-1} + \delta_2 PosGap_{t-2} + \delta_3 Payback_t + \delta_4 Low_t + \delta_5 \Delta MortForeclose_{t-1}$$

where *refi* is share of agency mortgages that are refinanced

- *HLI* is positively related to the ability (willingness) to refinance, and negatively to the cost of refinancing
- As *HLI* ↑, so does *refi* and the response of *refi* to interest rate gaps etc.
- Inter alia, the $z_t'\delta$ term captures the incentive to refinance:
  - *PosGap* = outstanding minus new mortgage rate gap (if positive)
  - *Low* = 30 quarter mortgage rate low 0/1 indicator
  - *Payback* = captures end of mortgage refinancing booms - interaction of number of mortgage rate lows in the 8 prior quarters and an indicator if prior quarter marked an interest rate low but current quarter is not
  - *MortForeclose* = Percent of mortgages entering foreclosure

Figure 3: Refi Response to Mortgage Interest Rate Differentials Varies Over Time



Housing Wealth vs Housing Collateral Effects

- In stylized Classical model (perfect capital markets, dynastic Ricardian households), house prices have a small negative effect on non-housing consumption
- Positive estimated housing 'wealth' effect in U.S. data may arise from:
  - Non-rational expectations
  - Non-dynastic family behavior - little evidence of stronger housing wealth effect for older households
  - Omitted future income expectations, because permanent income not current income matters
  - Credit constraints (more important for young and altered by financial innovations)
- *HLI* allows for a collateral role for housing to affect consumption, so $HLI_t \times HSG_{t-1}/Y_t$ matters, not HSG_{t-1}/Y_t

Table 1: State Space Model of Consumption and Mortgage Refinancing

Consumption Function:

$$\begin{aligned}\Delta \ln C_t = \lambda\{&\alpha_0 + (\ln Y_t - \ln C_{t-1}) + \alpha_1 r_{t-1} + \alpha_2 CCI_{t-1} + \alpha_3 \ln(\widehat{Y^p_{t+1}}/Y_t) \\ &+ \gamma_1 NLA_{t-1}/Y_t + \gamma_2 IFA_{t-1}/Y_t + \gamma_3 HSG_{t-1}/Y_t + HLI_t \times HSG_{t-1}/Y_t\} \\ &+ \beta_1 \Delta ur_t + \beta_2 \Delta i_t + \beta_3 CrControls_t + u_t \qquad u_t \sim N(0, \sigma_u^2)\end{aligned}$$

Refinancing Equation:

$$\begin{aligned}refi_t &= \phi_1 refi_{t-1} + \phi_2 HLI_t + z_t'\delta + HLI_t \times z_t'\delta + v_t \qquad v_t \sim N(0, \sigma_v^2) \\ z_t'\delta &\equiv \delta_0 + \delta_1 PosGap_{t-1} + \delta_2 PosGap_{t-2} + \delta_3 Payback_t + \delta_4 Low_t \\ &\quad + \delta_5 \Delta MortForeclose_{t-1}\end{aligned}$$

State Equation for Liquidity ("mpc") of Housing Wealth:

$$HLI_t = HLI_{t-1} + \varepsilon_t \qquad \varepsilon_t \sim NID(0, \sigma_\varepsilon^2)$$

Table 2: Parameter Estimates (1972 q1 - 2017 q2)

Consumption Function:

$$\Delta \ln C_t = \underset{(8.97)}{0.372^{***}}\Big\{\underset{(1.29)}{0.040} + (\ln Y_t - \ln C_{t-1}) - \underset{(1.70)}{0.203^{*}}\, r_{t-1}/100 + \underset{(1.80)}{0.057^{*}}\, CCI_{t-1} + \underset{(2.28)}{0.266^{**}} \ln(\widehat{Y^{p}_{t+1}}/Y_t)$$

$$+ \underset{(2.93)}{0.079^{***}}\, NLA_{t-1}/Y_t + \underset{(2.03)}{0.014^{**}}\, IFA_{t-1}/Y_t + \widehat{HLI}_t \times HSG_{t-1}/Y_t\Big\}$$

$$- \underset{(3.97)}{0.198^{***}}\, \Delta ur_t/100 - \underset{(4.32)}{0.170^{***}}\, \Delta i_t/100 - \underset{(4.65)}{0.010^{***}}\, CrControls_t + \hat{u}_t \qquad \hat{\sigma}_u = \underset{(13.25)}{0.0038^{***}}$$

Refinancing Equation:

$$refi_t = \underset{(18.79)}{0.726^{***}}\, refi_{t-1} + \underset{(2.95)}{0.120^{***}}\, \widehat{HLI}_t + z_t'\hat{\delta} + \widehat{HLI}_t \times z_t'\delta + \hat{v}_t \qquad \hat{v}_t = \underset{(22.66)}{0.0035^{***}}$$

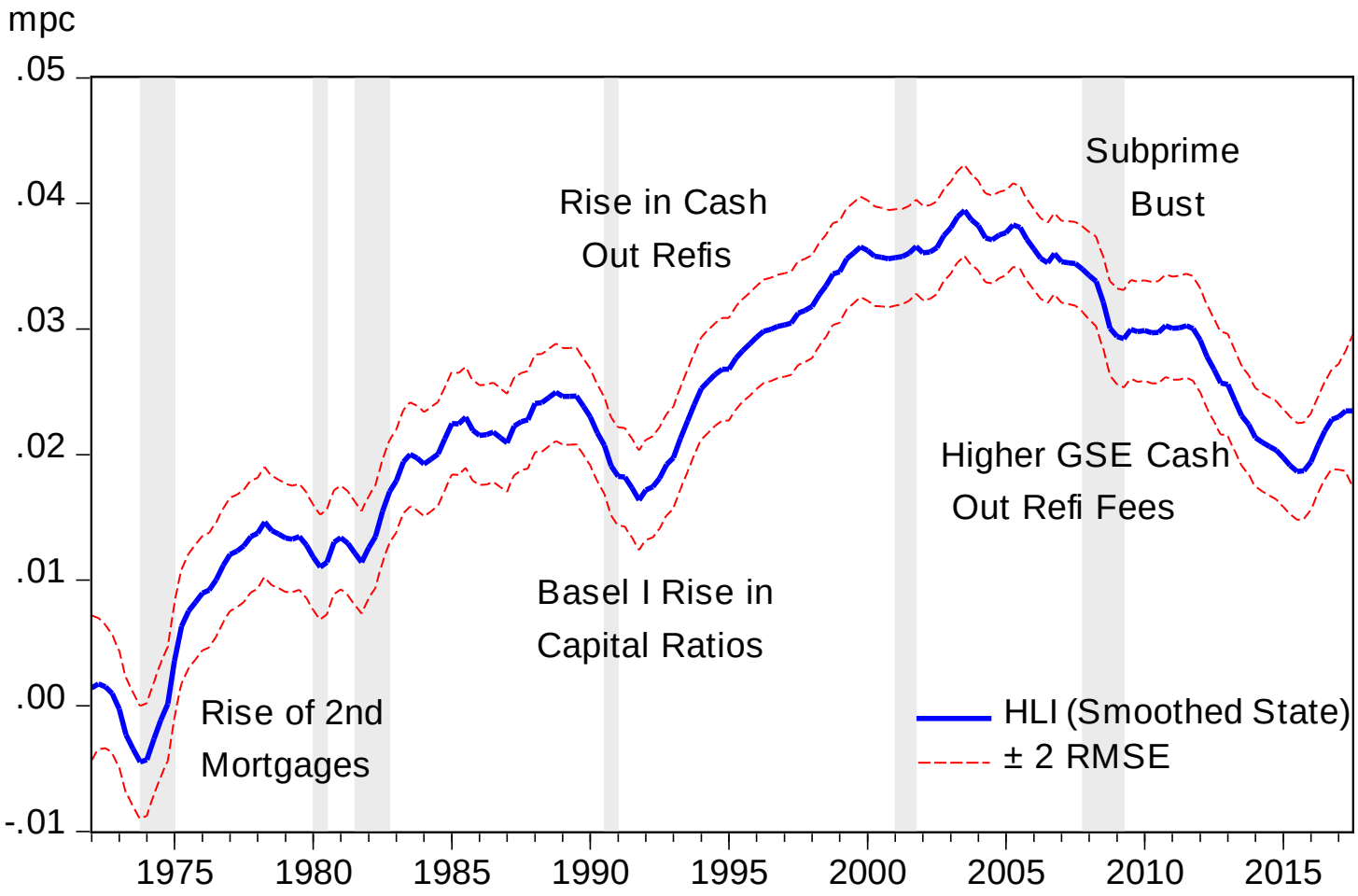
$$z_t'\delta \equiv (\underset{(3.84)}{0.715^{***}}\, PosGap_{t-1} - \underset{(4.09)}{0.748^{***}}\, PosGap_{t-2} - \underset{(5.40)}{0.138^{***}}\, Payback_t + \underset{(7.78)}{0.641^{***}}\, Low_t$$

$$- \underset{(1.68)}{0.918^{*}}\, \Delta MortForeclose_{t-1})/100$$

State Equation – Housing Liquidity:

$$HLI_t = HLI_{t-1} + \varepsilon_t \qquad \hat{\sigma}_\varepsilon = \underset{(5.28)}{0.0019^{***}}$$

Figure 3: Housing Liquidity / "Wealth" Effect
Smoothed State Estimates



Estimated Wealth Effects

- Estimated wealth mpcs:
  - 7.9% for net liquid assets
  - 1.4% for stocks and illiquid financial assets
- Estimated time varying housing collateral effect**:**
  - Close to zero in the early 1970's
  - Approx. 1% in the late 1970's and early 1980's
  - Jumps in the mid 1990's, peaking at over 3¾% in the mid 2000's
  - Falls back to under 2% by 2015
  - Recovered to about 2¼% in mid-2107
- Overall mpc somewhat smaller, more variable, than conventional 3% figure
- Housing collateral effect not a traditional housing wealth effect, consistent with micro studies, e.g. Hurst and Stafford (2004), Cooper (2009), and Browning, Gortz & Leth-Petersen (2008)
- Estimated housing mpc smaller than in some recent studies e.g., long run 9% mpc in Carroll, Otsuka & Slacalek (2011).
  - Why? We control for permanent income and consumer credit availability

Table 3: Estimated Wealth Effects and Specification of Consumption Function (1972 q1 - 2017 q2)

Model / Specification	MPC			Adj. Speed $\hat{\lambda}$	SE x 100	R^2
	NLA	NIFA	HSG			
Baseline *with W*		3.0%		0.09	0.58	0.23
Disaggregate *W* into *NLA,NIFA,HSG*	10.2%	2.3%	6.6%	0.11	0.57	0.27
Add *CCI,* $\widehat{HLI}$ and *Δur*	8.2%	1.4%	$\widehat{HLI}$	0.45	0.33	0.74
Conventional ARDL in *C, Y, W, r, Δur*		2.7%		0.03	0.48	0.48

Notes: *W* = net wealth, *NLA/NIFA/HSG* = dis-aggregation of net wealth, *CC*I = credit conditions index, $\widehat{HLI}$ = estimated housing liquidity index from 2 equation state space model, *ur* = unemployment rate. The baseline and autoregressive distributed lag (ARDL) models are:

$$\Delta \ln C_t = \lambda\{\alpha_0 + (\ln Y_t - \ln C_{t-1}) + \alpha_1 r_{t-1} + \alpha_2 CCI_{t-1} + \alpha_3 \ln(\widehat{Y^p_{t+1}}/Y_t) + \gamma W_{t-1}/Y_t\} + \beta_2 \Delta i_t + \beta_3 CrControls_t + u_t, \quad \text{and}$$

$$\Delta \ln C_t = \beta_0 + \beta_1 \Delta \ln C_{t-1} + \beta_2 \Delta \ln C_{t-2} + \beta_3 \Delta \ln Y_t + \beta_4 \Delta \ln Y_{t-1} + \beta_5 (\ln C_{t-1} - \ln Y_{t-1}) + \beta_6 W_{t-1}/Y_{t-1} + \beta_7 \Delta ur_t + \beta_7 \Delta r_t + \beta_8 CrControls_t + u_t$$

Table 4: Changing Credit Conditions and Wealth Important Drivers of Changes in Savings Rate

Estimated Long Run Effects on Ln *C/Y* (pps)

Period	**Actual** Change in *C/Y* Ratio	**Estimated** Long Run Credit & Wealth Effects	Contribution to Estimated Effects			
			Consumer Credit Availability (CCI)	Liquid Assets – (Consumer + Mortgage Debt)	Stock + Other Net Illiquid Assets	Housing Assets
Housing & Stock Bubbles 1995q1–2006 q4	4.8%	4.8%	**0.9%**	**-4.4%**	**2.1%**	**6.5%**
Housing & Financial Crises 2006 q3 - 2009 q2	-5.4%	-4.7%	-0.1%	**2.7%**	**-1.8%**	**-5.4%**
Modest Recovery 2009 q2 – 2012 q4	1.7%	0.8%	**0.6%**	-0.2%	**1.4%**	**-1.4%**
Moderate Growth 2013 q1 – 2017 q2	3.5%	3.3%	**0.6%**	**1.0%**	**1.3%**	**1.4%**

- The estimated long run effect is:

$$-0.203 r_{t-1}/100 + 0.057 CCI_{t-1} + 0.266 \ln(\widehat{Y^{p}_{t+1}}/Y_t) + (0.079 NLA_{t-1} + 0.014 NIFA_{t-1} + \widehat{HLI}_t \times HSG_{t-1})/Y_t$$

- Multiply entries by minus two-thirds to get approx. savings rate effects

Summary

- Financial innovations and frictions matter, especially in gauging the impact of wealth component and trends in the personal saving rate.
- Important roles for:
  - Changing composition of net wealth
  - Exogenous changes in supply of consumer credit (*CCI*)
  - Changing liquidity of housing wealth (state space *HLI* estimates)
- No single "wealth effect":
  - Liquid assets: ≈ 8%
  - Consumer and mortgage debt: ≈ -8%
  - Stocks & other illiquid financial assets: ≈ 1½%
  - Housing collateral:
    - Rising from ≈1% in early 1980's to over 3¾% in the mid 2000's
    - Falls to under 2% in 2015 and recovers to 2¼% in mid-2107
- In a housing boom, the collateral effect of higher housing wealth first boosts consumption, but the negative debt overhang effects linger after a bust