How Financial Innovations and Accelerators Drive Booms and Busts in U.S. Consumption

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Federal Reserve Bank of St. Louis
Research Symposium—Restoring Household Financial Stability After the Great Recession: Why Household Balance Sheets Matter

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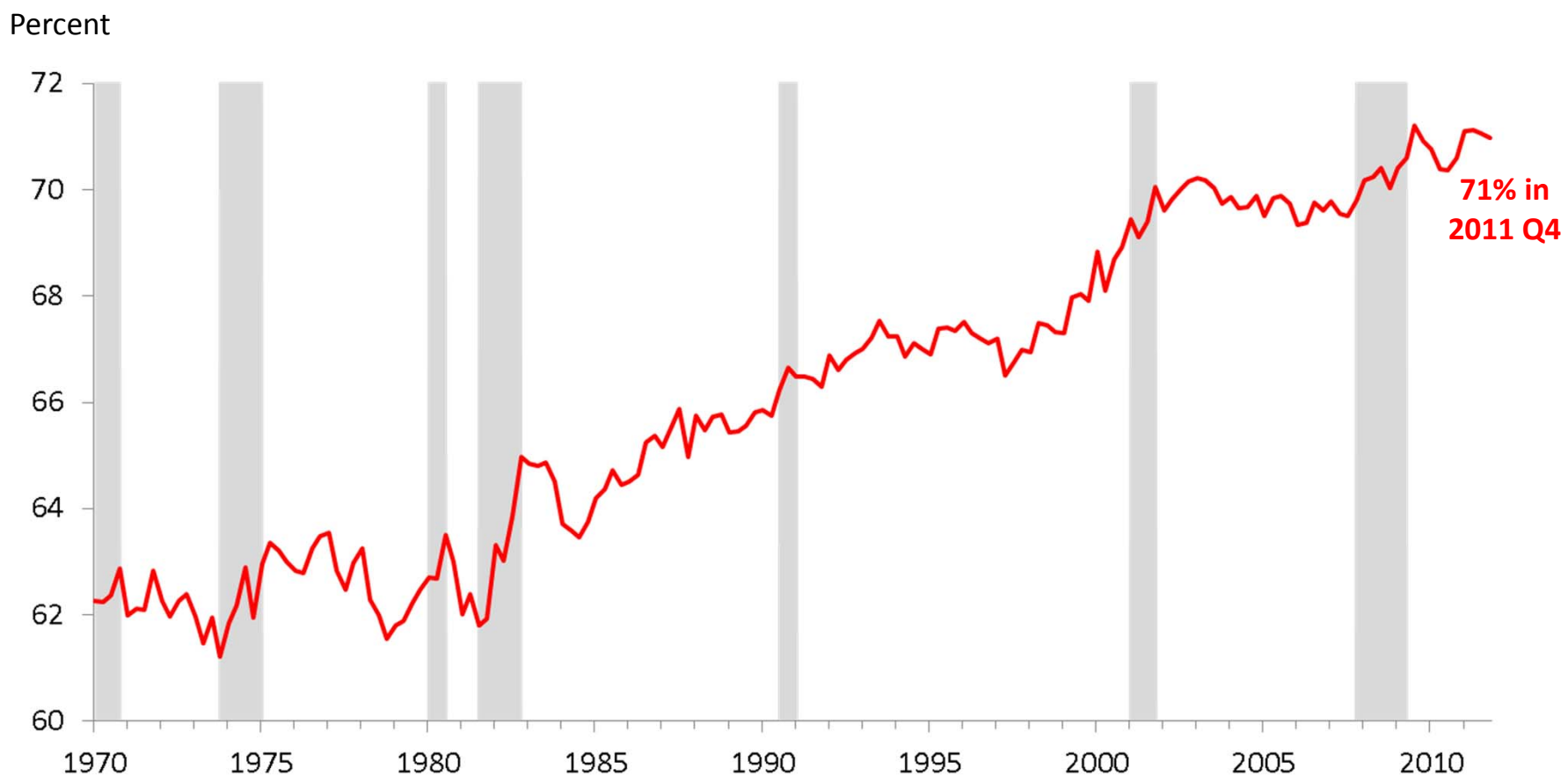
The views expressed are those of the authors, and are not necessarily those of the Federal Reserve Bank of Dallas or of the Federal Reserve System. We thank J.B. Cooke for excellent research assistance.

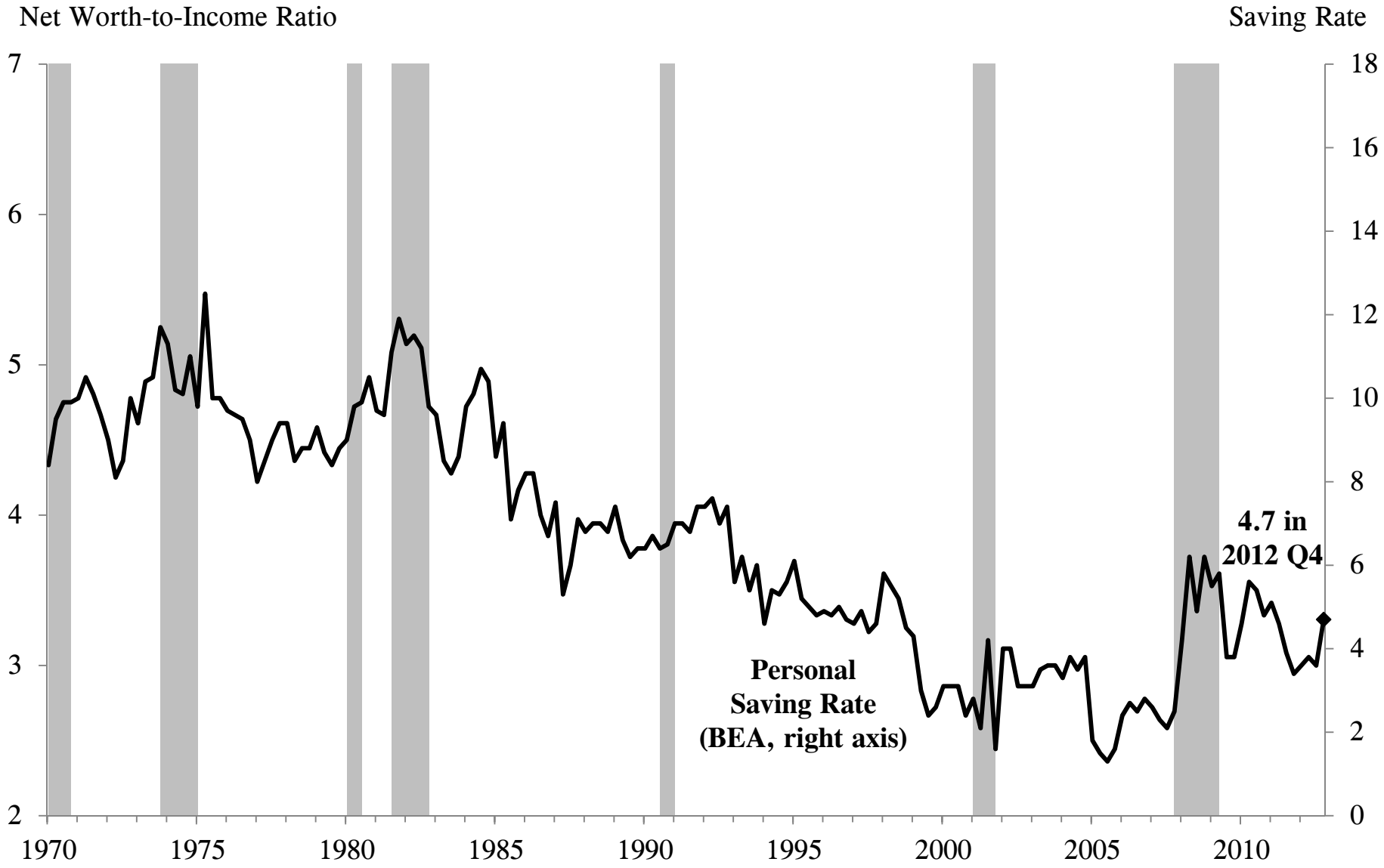
Introduction

- Conventional models: long-run consumption depends on wealth, interest rates, permanent income; cannot account for
  - Secular decline in the saving rate from late 1970s to 2007;
  - The 'unusual' behavior of PCE 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 the **household accelerators**:
  - Changing **consumer credit standards**;
  - Changing **liquidity of housing wealth**, a.k.a. the "housing wealth" effect or the mpc of housing wealth.

Rise in Household Spending as a Share of GDP



Trends in Saving Reflect More Than Movements in Household Net Worth



Sources: BEA, Federal Reserve, author's calculations, and "How Financial Innovations and Accelerators Drive Booms and Busts in U.S. Consumption," by John Duca, John Muellbauer, and Anthony Murphy, May 2012.

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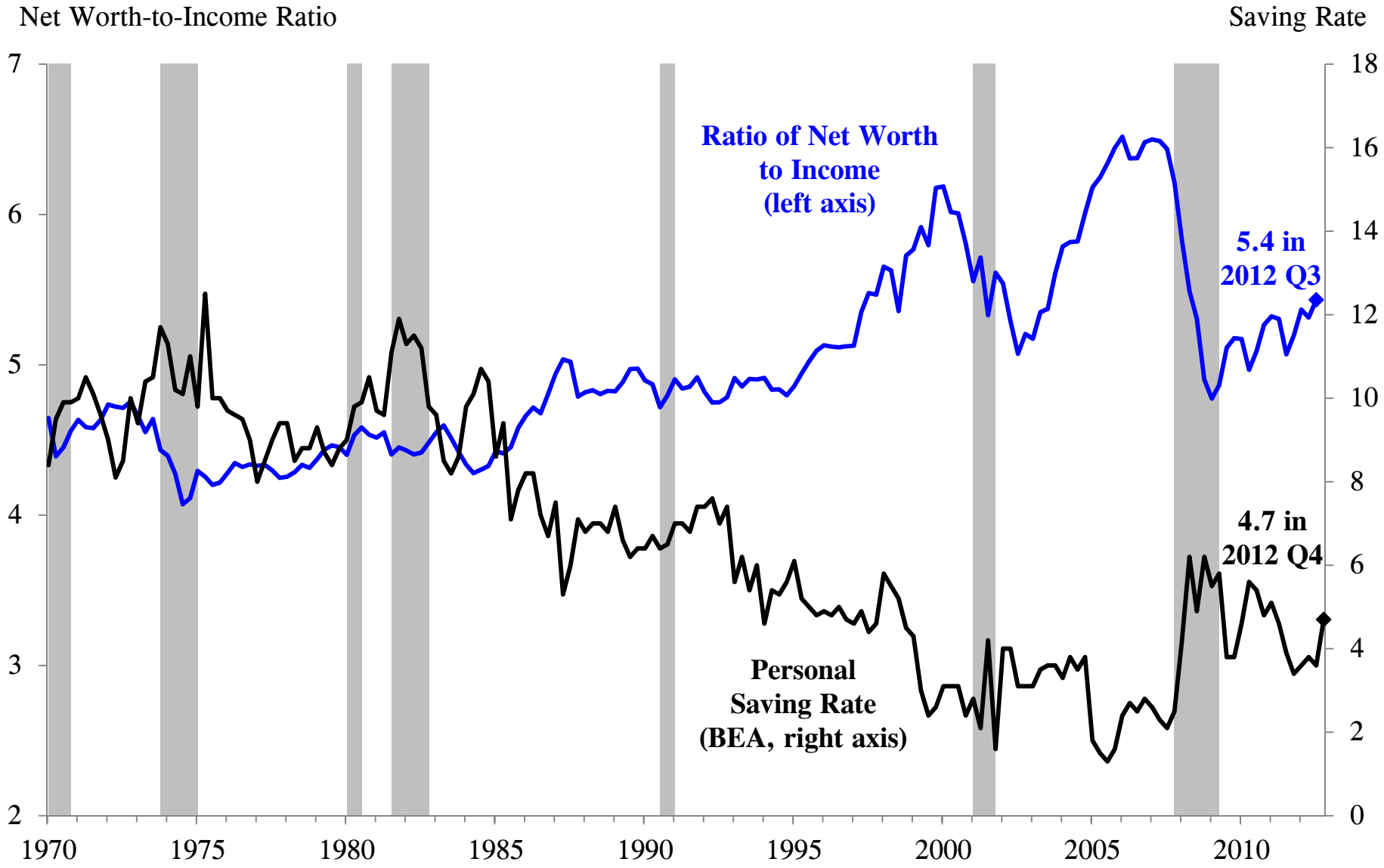

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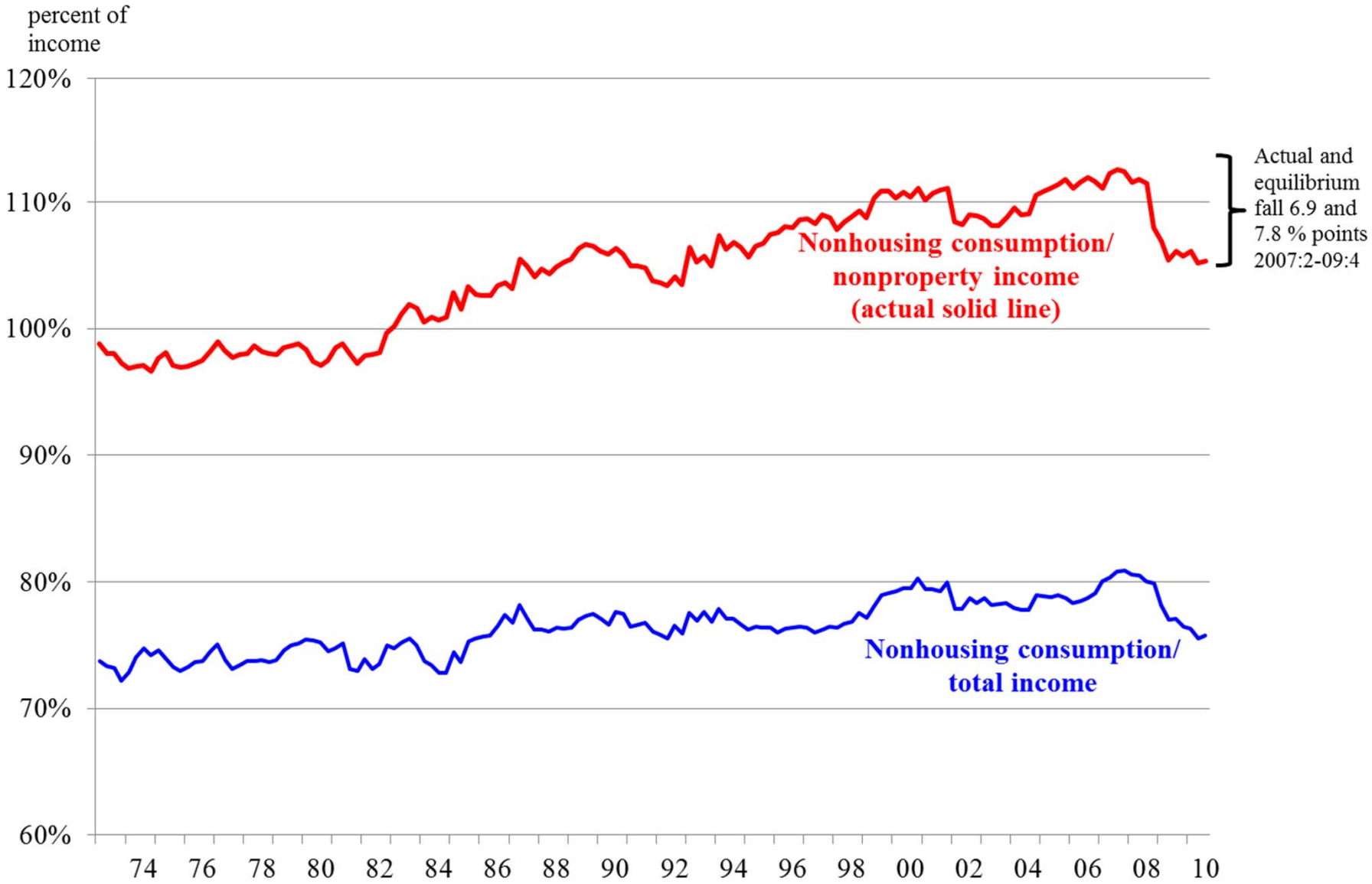
After Booming, the Consumption-to-Income Ratio Falls Since the Housing and Financial Crisis



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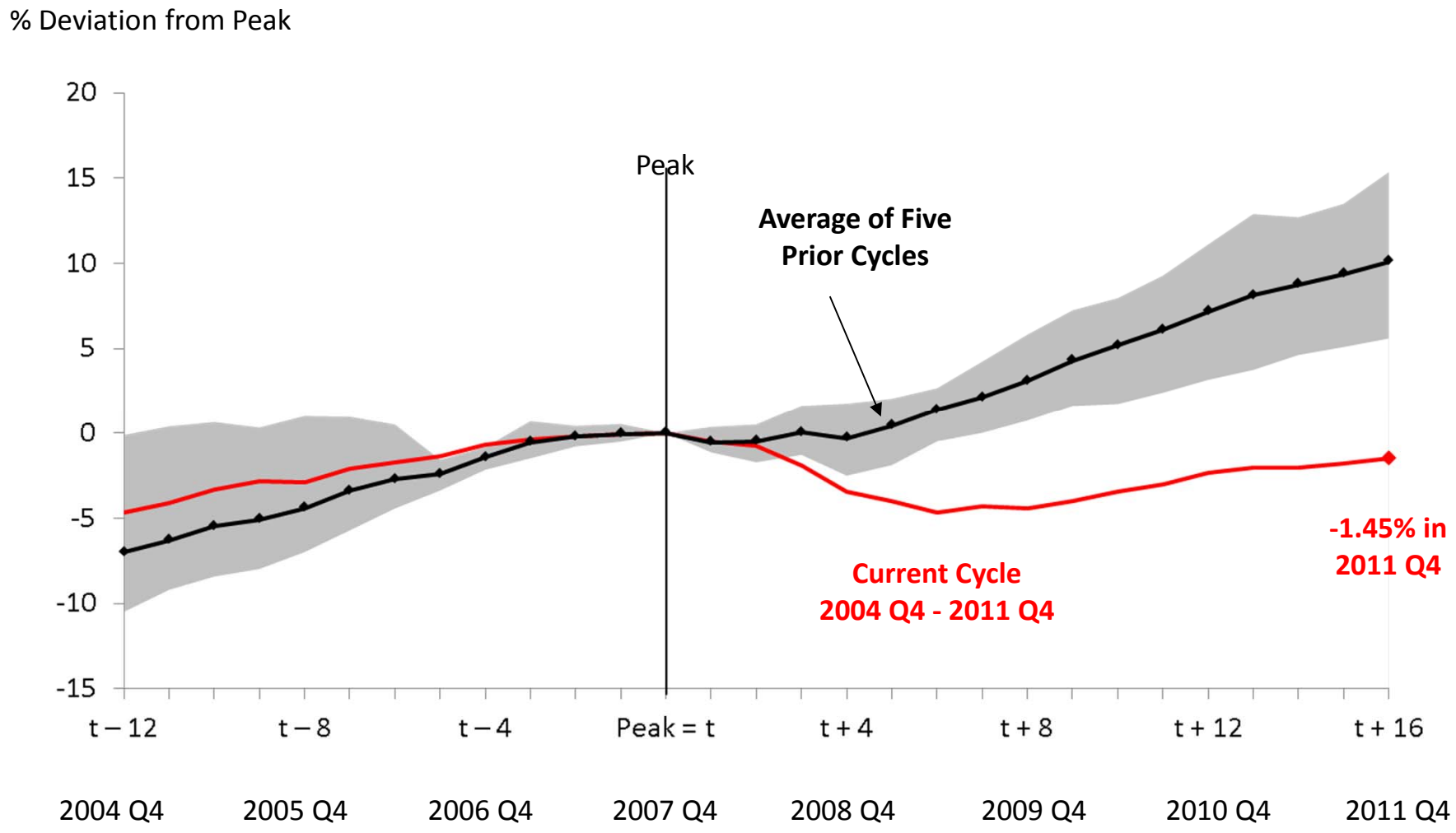
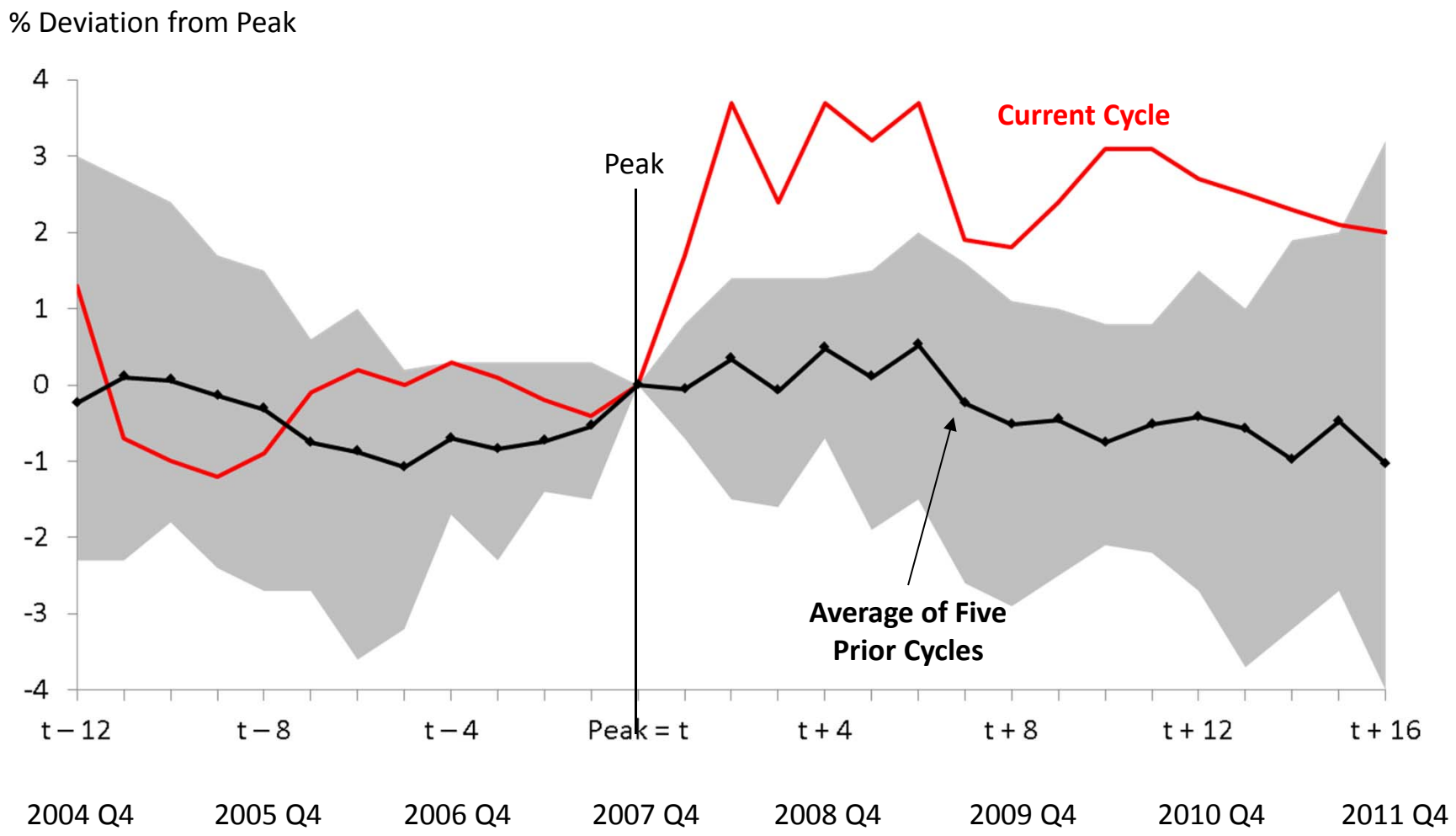
Weak Household Spending Since 2007



Notes: The grey area indicates the range of the last five major recessions (1970, 1974, 1981-82, 1990 and 2001, excluding the very short 1980 recession).

Higher Household Saving Rate Since 2007



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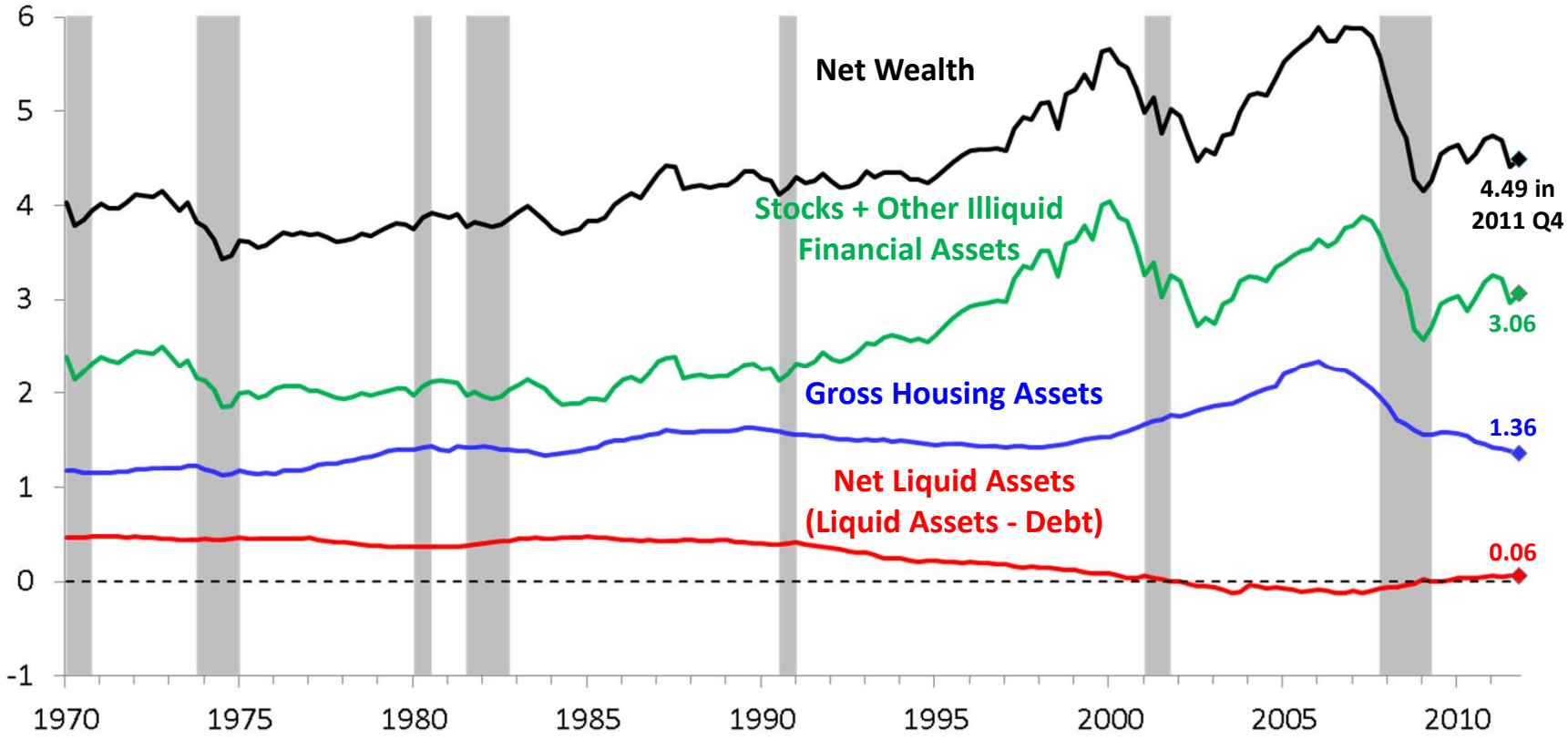
Outline of Model and Main Results

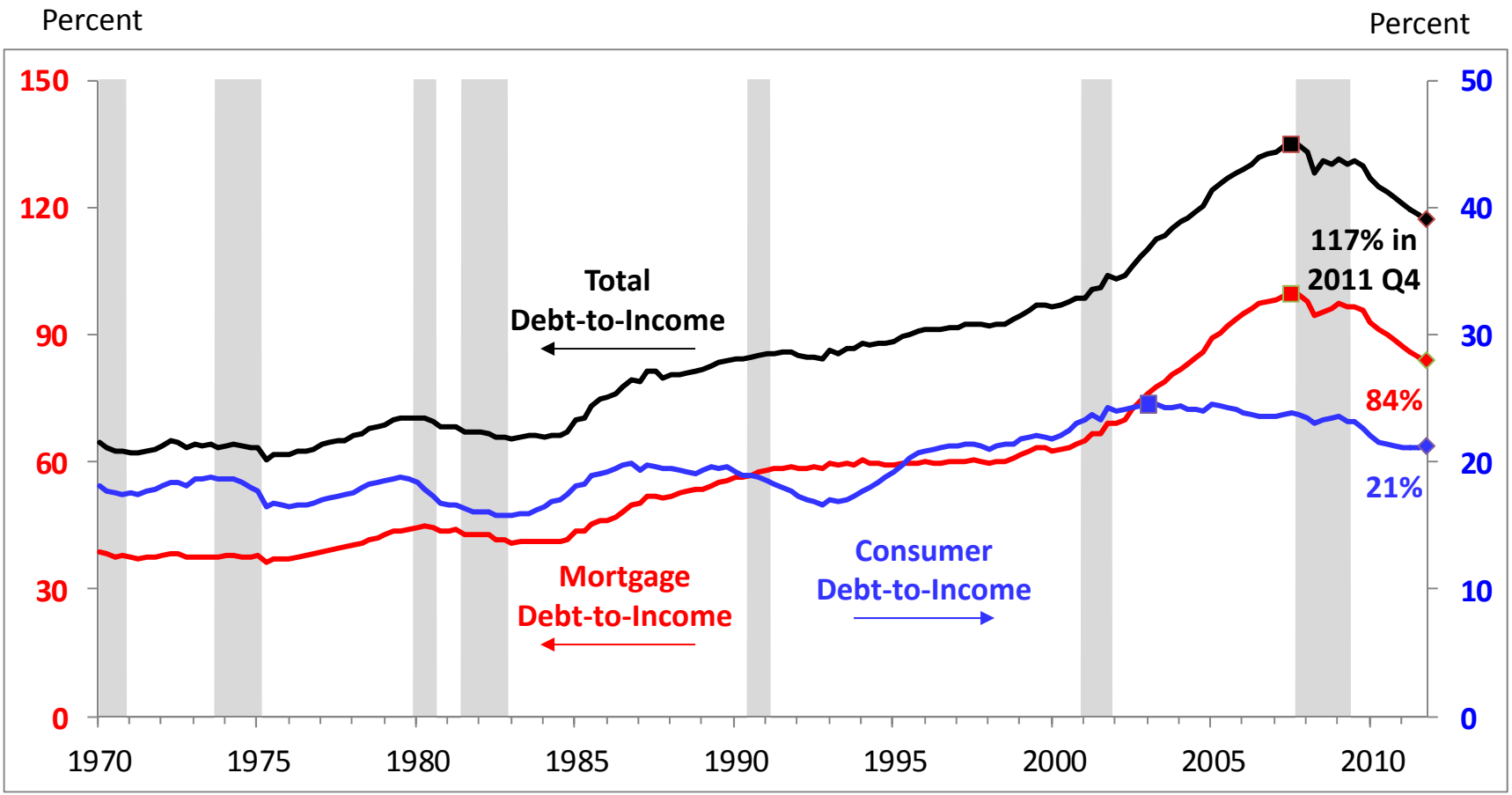
- Standard models: long-run consumption depends on wealth (sometimes disaggregated), interest rates, permanent income
- Modify Ando-Modigliani style consumption models in 3 ways.
- First, disaggregate wealth--some mainstream models do so
  - **Net liquid assets:** liquid assets – consumer/mortgage debt;
  - **Illiquid financial assets:** mainly stocks
  - **Gross housing assets:** gross because liquidity of it evolves

Changing Composition of Household Wealth

Ratio to Personal
Disposable Income



The Rise and Recent Fall in Household Sector Debt



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Consumer Credit Index CCI

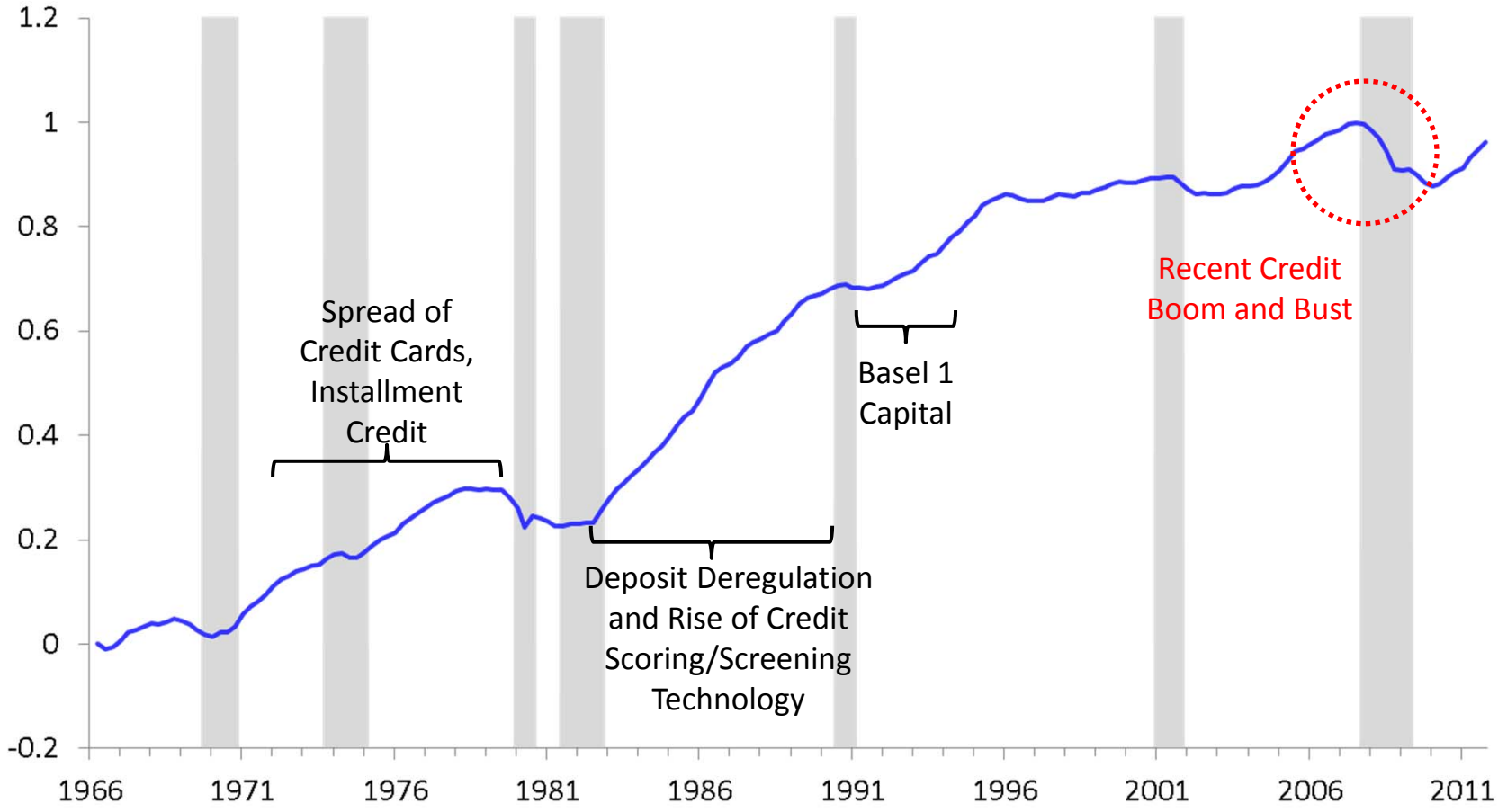
- Use **diffusion index**: How has bank's willingness to make consumer installment loans ***changed*** from 3 months ago? More willing (+2), somewhat more willing (+1), unchanged (0), somewhat less willing(-1), and much less willing (-2) .
- Negatively related to installment credit standards since 1994
- Model willingness to lend diffusion index (*DifIndex)* and adjust it for cyclical and interest rate effects:

  (i) *DiffusionIndex* = f[Δreal federal funds rate (-), macro outlook (+), loan delinquency(-), burden of regulation (-), financial frictions/crises (-)]

  (ii) $DiffusionIndex_t^{adjust}$ = *DiffusionIndex* minus estimated effects of real fed funds rate, macro outlook, and loan delinquency.
- Convert $DiffusionIndex^{adjust}$ into levels index ***CCI,*** a **measure of exogenous shifts in the supply of consumer credit**.

Changes in the Availability of Consumer Credit Were Very Important in the 1980's and Early 1990's

Index: 1966 Q2=0,
Maximum = 1.0



Vast Change in U.S. Credit Market Architecture Since 1970

- Falling IT costs transformed payment and credit screening systems.
- Deregulation, e.g. removal of deposit rate ceilings.
- Spread of credit card ownership, consumer installment loans
- Securitization of conventional and, much later, subprime mortgages
- Other changes especially affect the liquidity of housing wealth
  - Tax changes, e.g. 1986 Tax Reform Act: use mortgage over consumer credit
  - New products arise from tax changes and financial innovation – home equity lines of credit, home equity loans, cash out mortgage refinancing
- **Should expect structural change in consumption function**
  - **Shifts in consumer credit availability**
  - **Changing liquidity of housing implies changing effect of housing wealth**
- **Challenge – how to model the changes in a parsimonious and economically meaningful way.**

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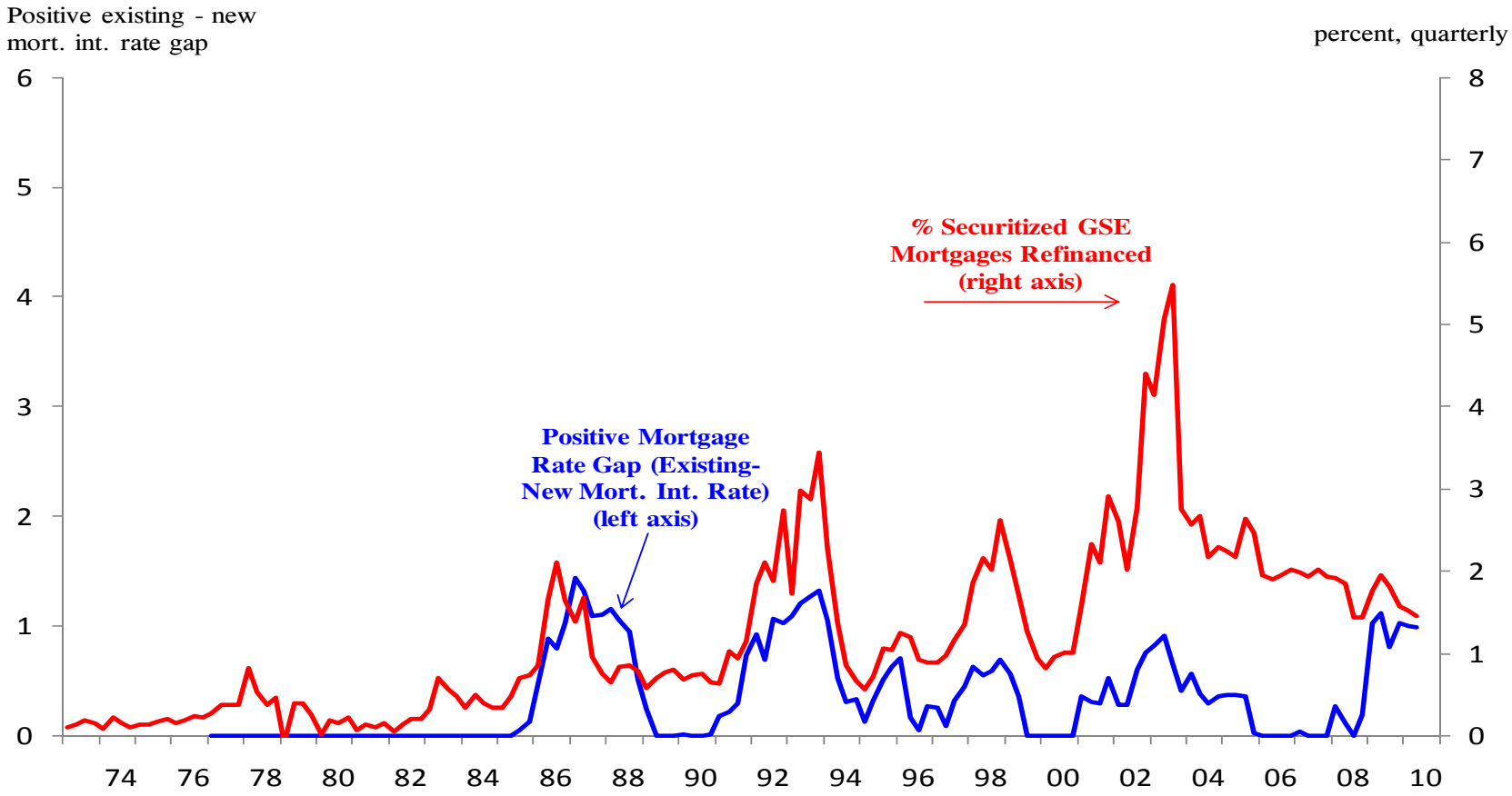
- Third, estimate evolving ability to borrow against housing. To do this, we estimate a two equation, state space model of:
  - **Non-housing consumption spending;**
  - **Mortgage refinancing.**

Outline of Model and Main Results (Cont'd)

- Estimate **housing liquidity index, *HLI*,** (households' changing ability to borrow against housing wealth) as a **common state variable**, interacted with other variables, in the 2 eq. model
- Model refinancing rate (Anderson/Duca data) as a function of observables (outstanding-new mortgage rates; mortgage rates at a low; debt-to-income ratios, interest rate expectations) and HLI which tracks the evolving ability/willingness to refinance that reflects refinancing costs and barriers that are hard to explicitly measure over time (in this case, decades)
- The **joint model** of consumption and refinancing provides **more precise estimates of the housing wealth mpc** because mortgage refinancing linked to the liquidity of housing wealth.
- Find housing **collateral effect**, not a traditional housing wealth effect **(housing wealth-to-income ratio insignificant in presence of significant housing wealth-to-income ratio x *HLI*)**

The Response of the Refinancing Rate to Interest Rate Savings from Refinancing Has Evolved

Figure 4: U.S. Financial and Tax Innovations Linked to Changes in Refinancing Sensitivity to Swings in Mortgage Interest Rates



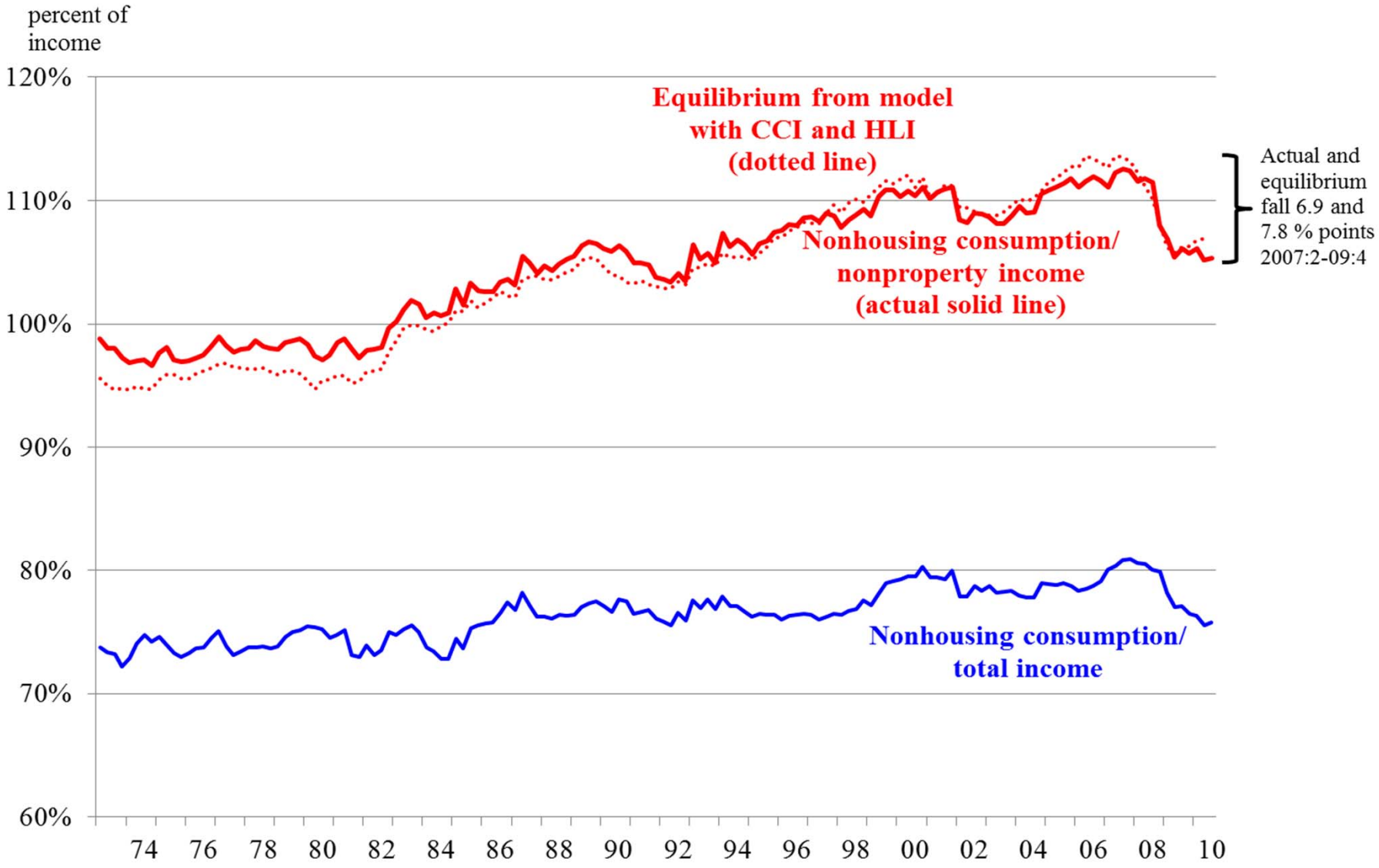
Housing Wealth Versus Housing Collateral Effects

- In classical model (perfect capital markets, dynastic Ricardian households), house prices will have **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;
  - **Consumer credit constraints/frictions** (likely affect young more) giving incentive to borrow against housing collateral, an ability altered by financial and tax innovations that affect time series relationships) .
- ***Housing Liquidity Index HLI*** allows for a **collateral** role for housing to affect non-housing consumption - only $HLI_t \times$ *housing wealth-to-income ratio* should matter, not the *housing wealth-to-income ratio*, what we find
- Mortgage equity withdrawal: active (home equity loans, cash-out refis); passive home sellers partial rollover gains to down-payment on next home

Outline of Model and Main Results (Cont'd)

- Obtain **plausible** estimates of consumer credit conditions and the liquidity of housing wealth, **consistent with narratives** in the literature.
- Tracking changing consumer and mortgage credit availability accounts for changes in the saving rate implied by the consumption-to-income ratio.
- Stable estimates given measures of consumer credit and housing liquidity.
- Estimated wealth mpcs: **13%** for **net liquid assets, 2% illiquid financial assets**.
- Estimate of HLI in a quarter uses information available in that quarter
- Estimated **time-varying housing collateral effect** :
  - Close to zero in the early 1970's;
  - Approx. 1% in the late 1970's and 1980's;
  - Jumps in the mid 1990's and peaked at over 3½% in the mid 2000's;
  - Has fallen back to just over 2% in 2011;
  - Smaller, more variable than conventional 5-6% estimates.

Figure 7: Long-run Equilibrium Relationship in Credit-Augmented Model Tracks the Fall in the Consumption-to-Income Ratio Since the Financial Crisis



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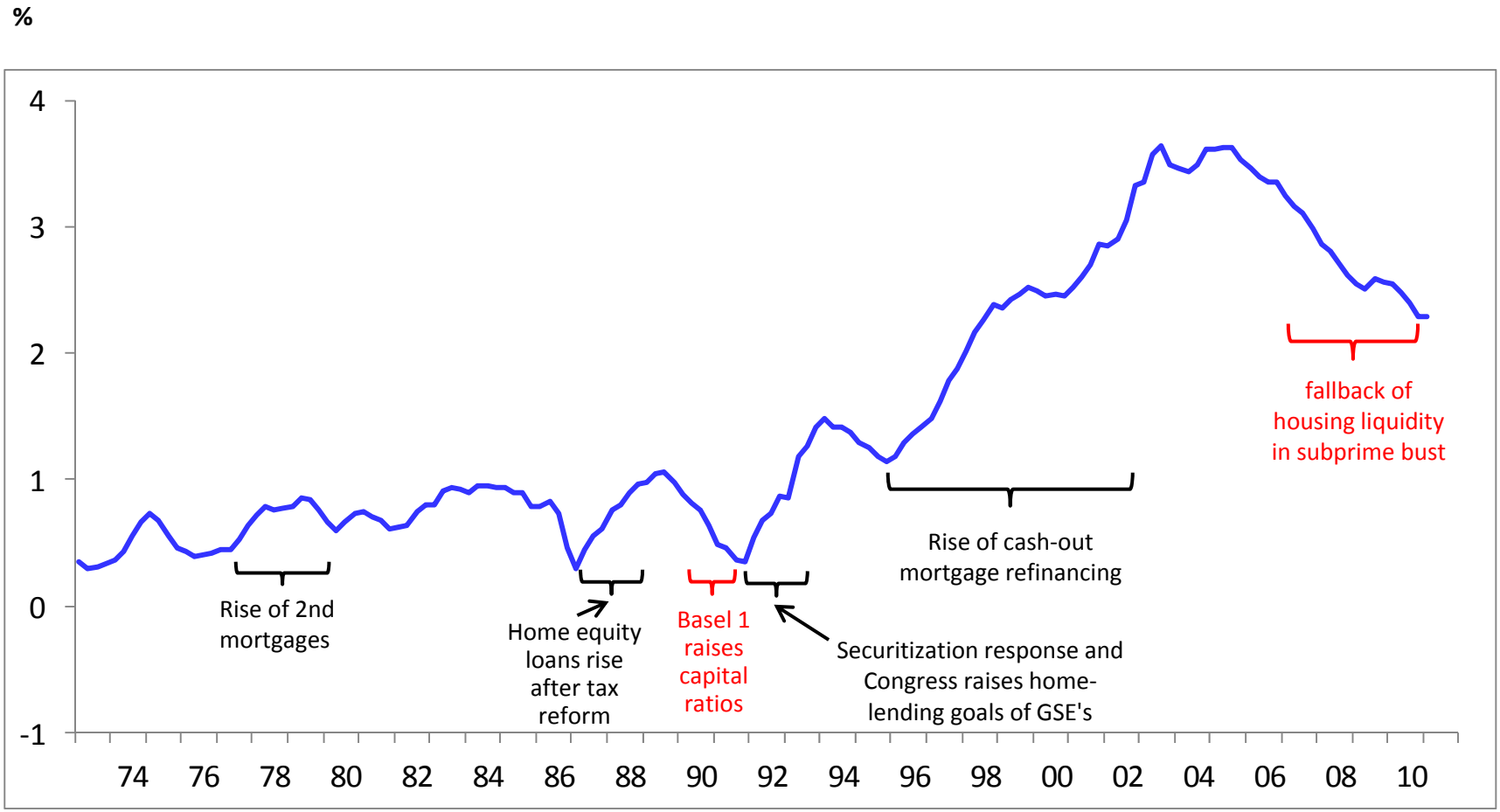
MPC of Housing Wealth Triples in Late 1990s, Retreats During the Subprime Bust



Source: "How Financial Innovations and Accelerators Drive U.S. Consumption Booms and Busts," J. Duca, J. Muellbauer, and A. Murphy, Dec. 2011.

Estimated Wealth MPC's

- **Housing collateral effect** not a **traditional housing wealth effect**, consistent with micro studies, e.g. Hurst and Stafford (2004), Cooper (2009), and Browning, Gortz, and Leth-Petersen (2008).
- Similar wealth mpc's using this framework for UK & Australia.
- **Relative size ranking** of mpc's consistent with most other studies that disaggregate wealth.
- Results accord with housing mpc's varying with end of sample periods. State space approach use info only up to
- Estimated **housing mpc smaller than in some recent studies** e.g., 6% in Slacalek (2009). Why? We control for permanent income and consumer credit availability.

Table 3: OLS and State Space Estimates of the Consumption Function

Dependent variable: $\Delta \ln c_t$ (consumption excluding housing services), Sample: 1973 q1 – 2010 q2

	Basic Equation OLS		One Equation State Space		Two Equation State Space	
	Coeff	t-Stat	Coeff	t-Stat	Coeff	t-Stat
Speed of adjustment (λ)	0.092*	3.16	0.261**	3.27	0.530**	10.06
Long Term Effects:						
Intercept	-0.017	0.95	-0.148+	1.88	-0.110	67.0
Unsecured credit conditions, *CCI*	-	-	0.106*	2.60	0.108	6.44
Lagged real interest rate	-0.0048	1.14	-0.0019	0.82	-0.0021	2.79
Future income growth	0.519*	1.76	0.333*	2.10	0.236	3.67
Net liquid assets / income	0.072+	1.84	0.089+	1.81	0.147	7.76
Illiquid financial assets / income	0.046**	3.57	0.019*	2.27	0.019	5.65
Housing wealth / income	0.050*	2.23	-	-	-	-
HLI x housing wealth / income	-	-	1	-	1	-
Short Run Effects:						
ΔLog income	0.272**	4.77	0.220**	3.38	0.103*	2.05
ΔNominal interest rate	-0.0064**	6.79	-0.0042**	4.55	-0.0036**	5.62
ΔUnemployment rate	-0.0090**	6.61	-0.0057**	4.84	-0.0049**	5.36
Oil shocks dummy	-0.0056*	2.12	-0.0045+	1.78	-0.0081**	6.54
State space housing wealth mpc:						
Maximum	-		0.041		0.038	
(Rmse)			(0.0024)		(0.0014)	
Equation SE ×100	0.53		0.44		0.40	
Adjusted R^2	0.54		0.67		0.74	
P Values (OLS Regression):						
AR(5)/MA(5)	0.58		0.22		0.11	
Heteroscedasticity	0.00		0.00		0.00	
RESET(2)	0.15		0.24		0.57	
Normality	0.75		0.17		0.25	

significant

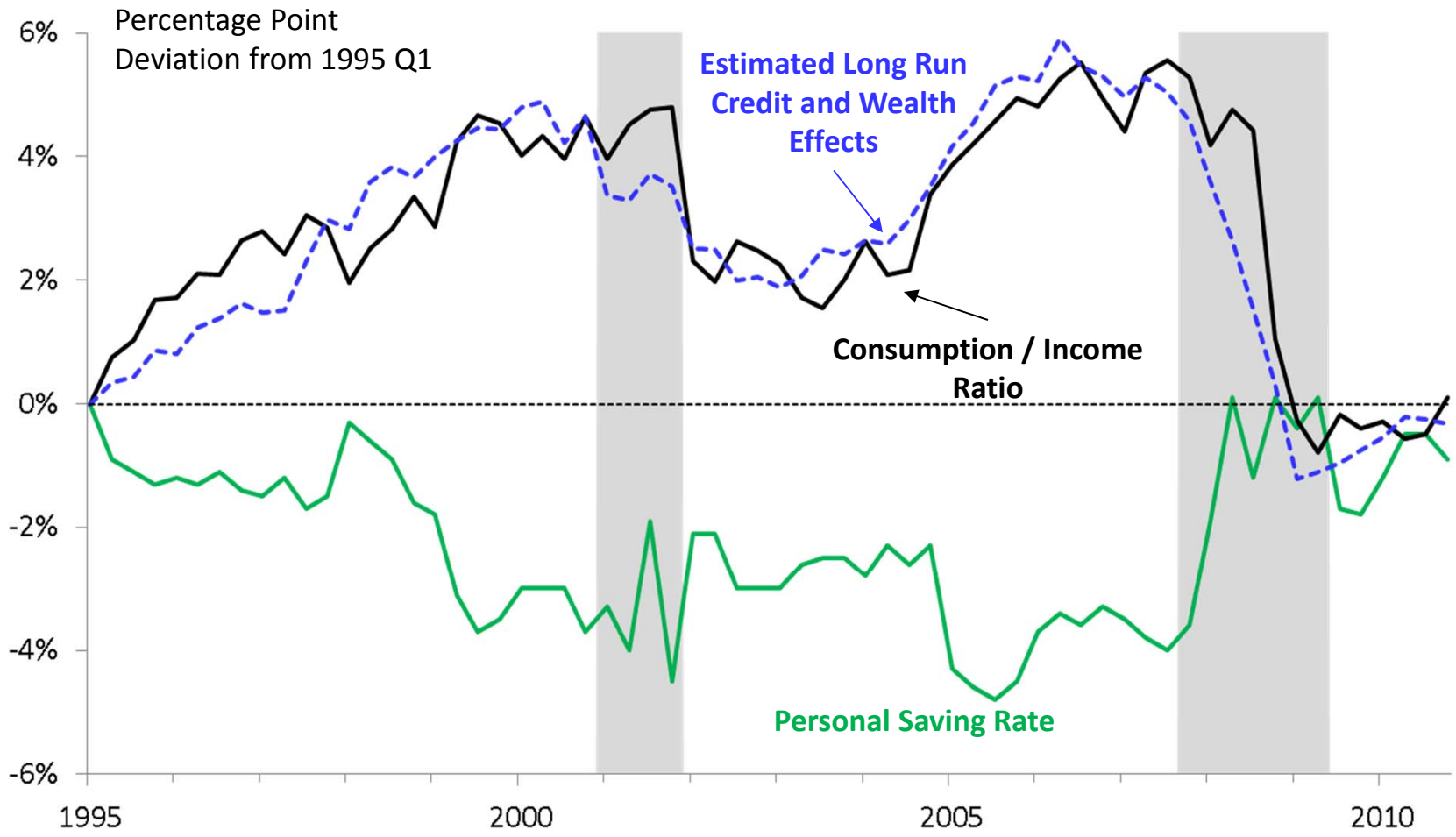
significant difference in mpc's

more precise housing mpc

CCI and HLI lower error, improve fit

Explaining the Boom and Bust in Consumption Since 1995

Wealth and Credit Effects are Key Non-Income Drivers of Household Spending



Impact of Credit Conditions and Wealth on the Ratio of Consumption to Income

Estimated % Point **Long-Run Effects** on Consumption-to-NonAsset Income Ratio
Imply Oppositely Signed Saving Rate Effects of Two-Thirds the Size)

Period	**Actual** Change in Consumption / Income Ratio	**Estimated** Long Run Credit & Wealth Effects	Contributions to Estimated Effect			
			Consumer Debt + Credit Conditions Index (*CCI*)	Stocks & Other Illiquid Financial Assets	Housing Assets - Mortgage Debt	Liquid Assets
Housing and Stock Bubbles 1995 Q1 – 2006 Q3	5.5	5.5	1.0	2.9	1.0	0.6
Housing and Financial Crisis 2006 Q3 – 2009 Q2	-6.3	-6.6	-0.7	-2.7	-5.2	2.1
Modest Recovery 2009 Q2 – 2011 Q3	2.1	1.9	0.9	1.6	0.6	-1.2

Consumer debt + *CCI* column reflects negative effect of higher consumer debt (via the strong effect of net liquid assets) and positive effect of consumer credit index on consumption. Housing assets-mortgage debt column reflects impact of housing wealth (*HLI* based) and the impact of mortgage debt (via the strong effect of net liquid assets). Liquid assets column omits impact of debt on net liquid assets—included in columns accounting for consumer and mortgage debt.

Conclusions – Understanding the Booms and Busts in U.S. Consumption

- Financial innovations and frictions matter, especially in gauging the impact of wealth component and trends in the personal saving rate.
- Important roles for:
  - **Exogenous changes in supply of consumer credit** (*CCI*);
  - **Changing composition of net wealth**;
  - **Changing liquidity of housing wealth** (state space *HLI* estimates).
- Evolving financial architecture played a critical role in the recent boom and bust in U.S. consumption and swings in the saving rate.
- Higher housing wealth via collateral boosts consumption at first, but negative debt overhang effects can linger after a housing bust.
- The state space approach we used may be applied to other countries which experienced financial liberalization.