Heterogenous Consumption Responses and Inequality over the Business Cycle

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Motivation

- Recent research has highlighted the importance of understanding heterogeneous behaviour for fiscal policy, monetary policy transmission and welfare*
- While work on estimating the distribution of marginal propensity to consume (MPCs) is growing, most work focuses on heterogeneity over the cross-section
- Little attention is given to its behaviour over time, in particular how it behaves over the business cycle.

*See (Heathcote et al., 2009) for a review.

Research Question

- What do incomplete market heterogenous agent models predict for the distribution of MPCs over the cycle?
- Is this consistent with the data?
  - Using US PSID survey data for 2003-2013

Related Literature

Difficulty is in identifying transitory and permanent components of income shocks.

- Structural models which simulate a distribution of MPCs:
  - Carroll et al. (2017), (Carroll et al., 2014)
- Reduced-form:
  - Proxies for transitory income changes, such as unemployment or illness; bankrupcy flags (Gross et al., 2020)
  - Subjective expectations of income (Pistaferri, 2001)
  - Consumption responses to tax rebates: Kaplan et al. (2014), Parker et al. (2013), Johnson et al. (2004), Misra and Surico (2014) Lewis et al. (2019)
  - Covariance restrictions: Blundell et al. (2008), Kaplan and Violante (2014)
- *This paper*: Distribution of MPCs over the cycle

Structural Model

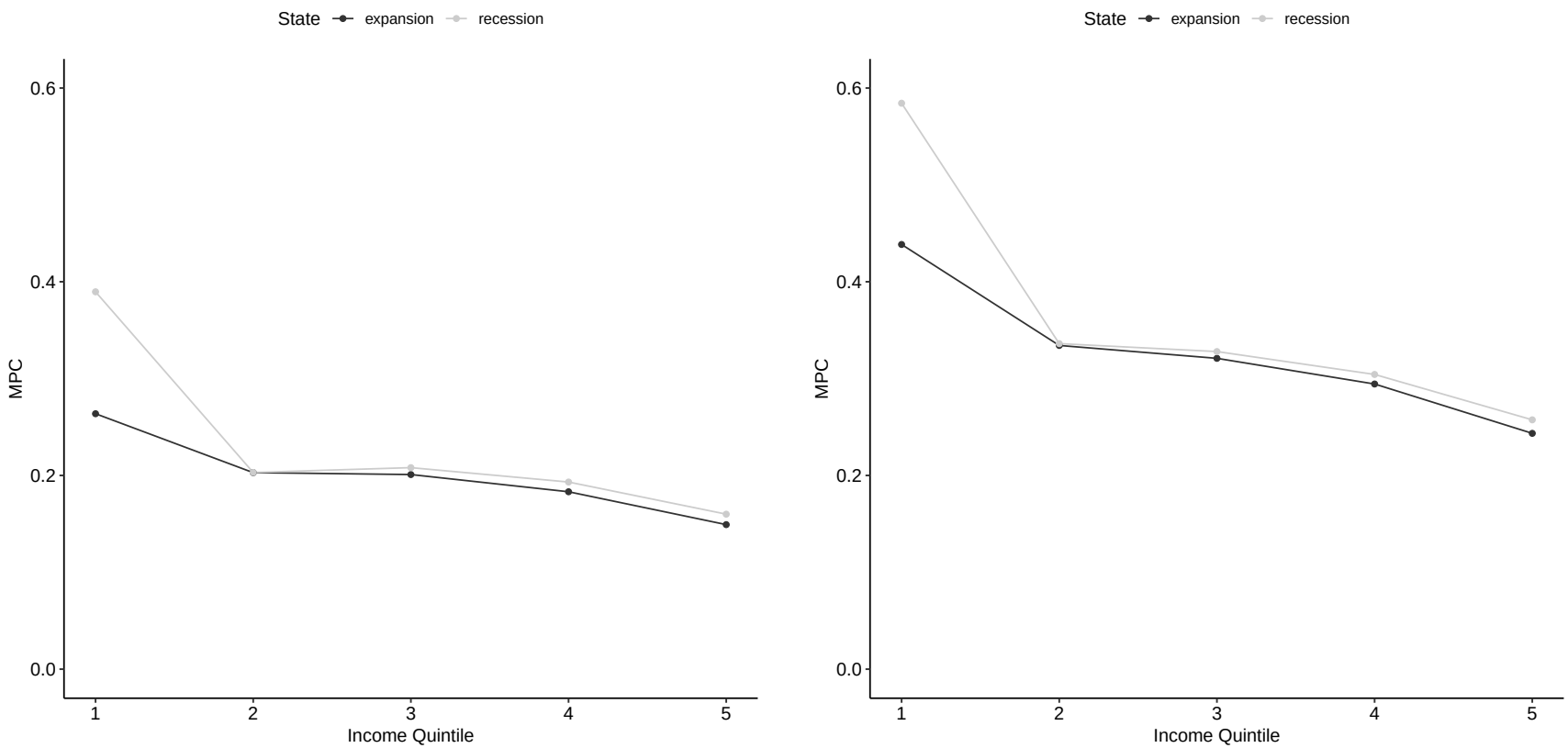
- Incomplete markets heterogenous agents model of Krusell and Smith (1999)
  - Continuum of agents that face employment shocks e, u and aggregate shocks z_g, z_b over which the only insurance is individual wealth k subject to borrowing constraint $k > 0$
- Following Castañeda et al. (2003) and Carroll et al. (2017) choose time preference parameters to be distributed uniformly in the population between $\grave{\beta} \pm \nabla$ to fit the proportion of wealth w held by richest 20,40, 60 and 80%, ie:

$$\{\grave{\beta}, \nabla\} = \underset{\beta, \nabla}{\text{argmin}} \left(\sum_{i=20,40,60,80} (w_i(\beta, \nabla) - w_i)^2 \right)^{1/2} \quad (1)$$

- Calibrate this to US PSID wealth distributions for 2007 and 2009 (pre-recession, recession periods)

	Krusell–Smith (KS): β-Dist							
Model	2007 Calibration				2009 Calibration			
Scenario	Baseline	Recession	Expansion		Baseline	Recession	Expansion	
Overall average	0.25	0.27	0.24		0.35	0.37	0.33	
By Income Quintile								
Q1	0.33	0.39	0.26		0.51	0.58	0.43	
Q2	0.2	0.2	0.2		0.34	0.34	0.33	
Q3	0.2	0.21	0.2		0.32	0.33	0.32	
Q4	0.19	0.19	0.18		0.3	0.3	0.29	
Q5	0.15	0.16	0.15		0.25	0.26	0.24	
By employment status								
Employed	0.22	0.23	0.22		0.31	0.31	0.31	
Unemployed	0.58	0.6	0.56		0.73	0.74	0.72	
Time preference parameters[‡]								
$\grave{\beta}$		0.9837				0.9787		
∇		0.00108				0.0172		
PSID 2007 % of wealth held by the richest:	20%	40%	60%	80%				
	80.6	95.1	99.9	100.8				
PSID 2009 % of wealth held by the richest:					20%	40%	60%	80%
					85.5	97.3	100.8	101.3

Notes: Annual MPC is calculated by $1 - (1 - \text{quarterly MPC})^4$. *The scenarios are calculated for the* β*-Dist models calibrated to the net worth distributions described. For the KS aggregate shocks, the results are obtained by running the simulation over 1,000 periods, and the scenarios are defined as 'Recessions/Expansions': bad/good realization of the aggregate state.* [‡] *Discount factors are uniformly distributed over the interval* $[\grave{\beta} - \nabla, \grave{\beta} + \nabla]$.



MPC at the income quintiles generated from 2007 calibration in pre-recession (left) and 2009 calibration in recession (right)

Reduced-form Model Overview

- First-step pooled OLS model of forecastable income and consumption
- Collect residuals and take first differences
- Second-step Instrumental Variables Quantile Regression to estimate MPCs over its conditional distribution
- Plot MPCs by rank-score quantile of the conditional distribution of MPCs in pre-recession and post-recession periods

Following Blundell et al. (2008) and Kaplan et al. (2014), assume income follows the process:

$$\log Y_{i,t} = Z'_{it}\Phi_t + P_{i,t} + \epsilon_{i,t} \tag{2}$$

i: individual at time t, Y: income, Z: observable income characteristics, $P_{i,t} = P_{i,t-1} + \xi_{i,t}$: martingale permanent income process with i.i.d. shock ξ; ϵ: i.i.d. transitory income shock.

By estimating equation 2 via Pooled OLS I recover the first-differenced residuals to obtain unexplained income growth:

$$\Delta y_{i,t} = \xi_{i,t} + \Delta\epsilon_{i,t}$$

Similarly for consumption:

$$\Delta c_{i,t} = \psi^P_{i,t}\xi_{i,t} + \psi^T_{i,t}\Delta\epsilon_{i,t}$$

$y_{i,t} = \log Y_{i,t} - Z'_{it}\hat{\Phi}_t$, $c_{i,t} = \log Y_{i,t} - Z'_{it}\hat{\Psi}_t$,

$\psi^P_{i,t}$ and $\psi^T_{i,t}$: loading factors on permanent and transitory income shocks

True marginal propensity to consume out of a transitory income shock:

$$\text{MPC}_t = \frac{\text{cov}(\Delta c_{i,t}, \epsilon_{i,t})}{\text{var}(\epsilon_{i,t})}$$

Covariance restriction: individuals have no foresight about future shocks, i.e. $\text{cov}(\Delta c_{i,t}, \epsilon_{i,t+1}) = \text{cov}(\Delta c_{i,t}, \xi_{i,t+1}) = 0$.

Then can consistently estimate:

$$\widehat{\text{MPC}_t} = \frac{\text{cov}(\Delta c_{i,t}, \Delta y_{i,t+1})}{\text{cov}(\ \Delta y_{i,t}, \Delta y_{i,t+1})} \tag{3}$$

Following Chernozhukov and Hansen (2005), estimate (3) using Instrumental Variable Quantile Regression:

$$Q_{\Delta\widehat{MPC}_t}(\tau), \quad \tau = 0.5, 0.10...0.95$$

Data

- PSID 2003, 2005, 2007, 2009, 2011, 2013
- Keep households that have a minimum of 3 consecutive periods of data
- After-tax income calculated using TaxSim; consumption includes food, transport, childcare, healthcare, education, housing, vacations, recreation and clothing
- Drop households with zero or negative consumption or income
- Z contains cohort dummies, education, race, family structure, employment, region
- Sample of $\approx 31,000$

Note on time dummies

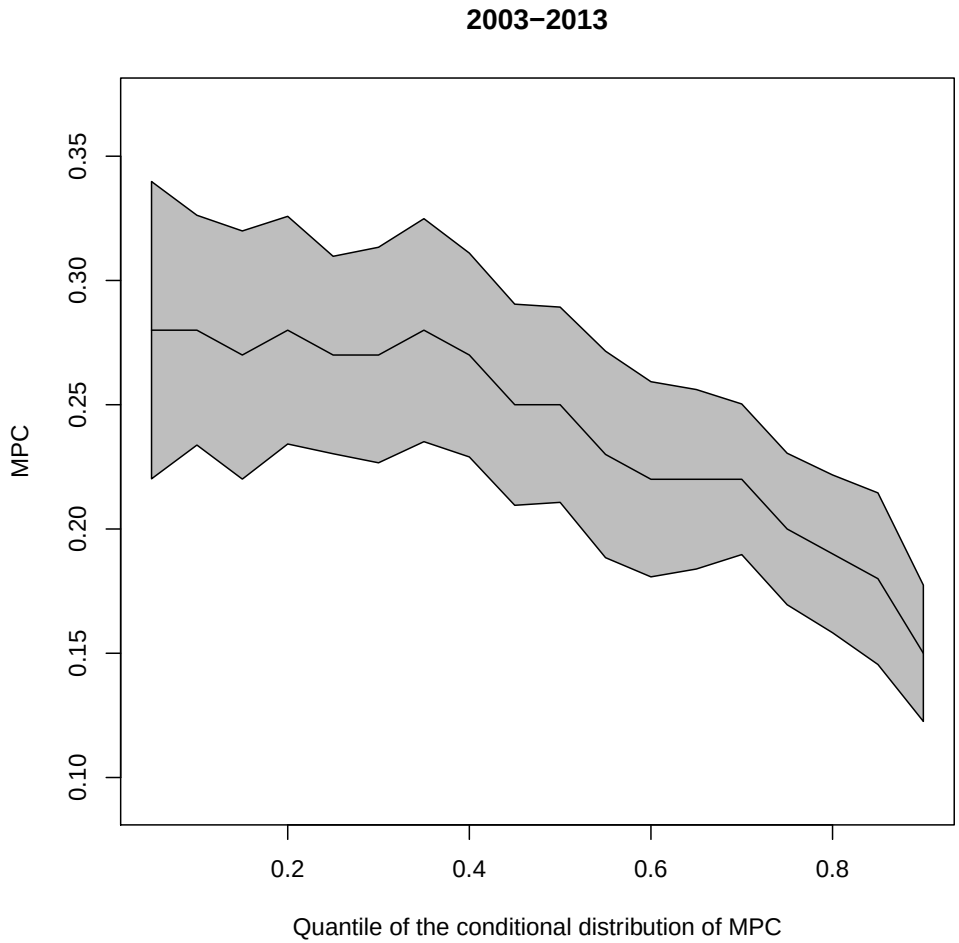
- (Blundell et al., 2008) and (Kaplan and Violante, 2014) include a set of time dummies in the first stage regression, I do not
- Important to include in Pooled OLS if we think the model changes over time
- I do not include because:
  - This would attribute all cyclical variation to forcastable permanent income
  - Consumption fell much less than income in the Great Recession
  - We do not model permanent income as a function of the cycle

Results - First Step Pooled OLS

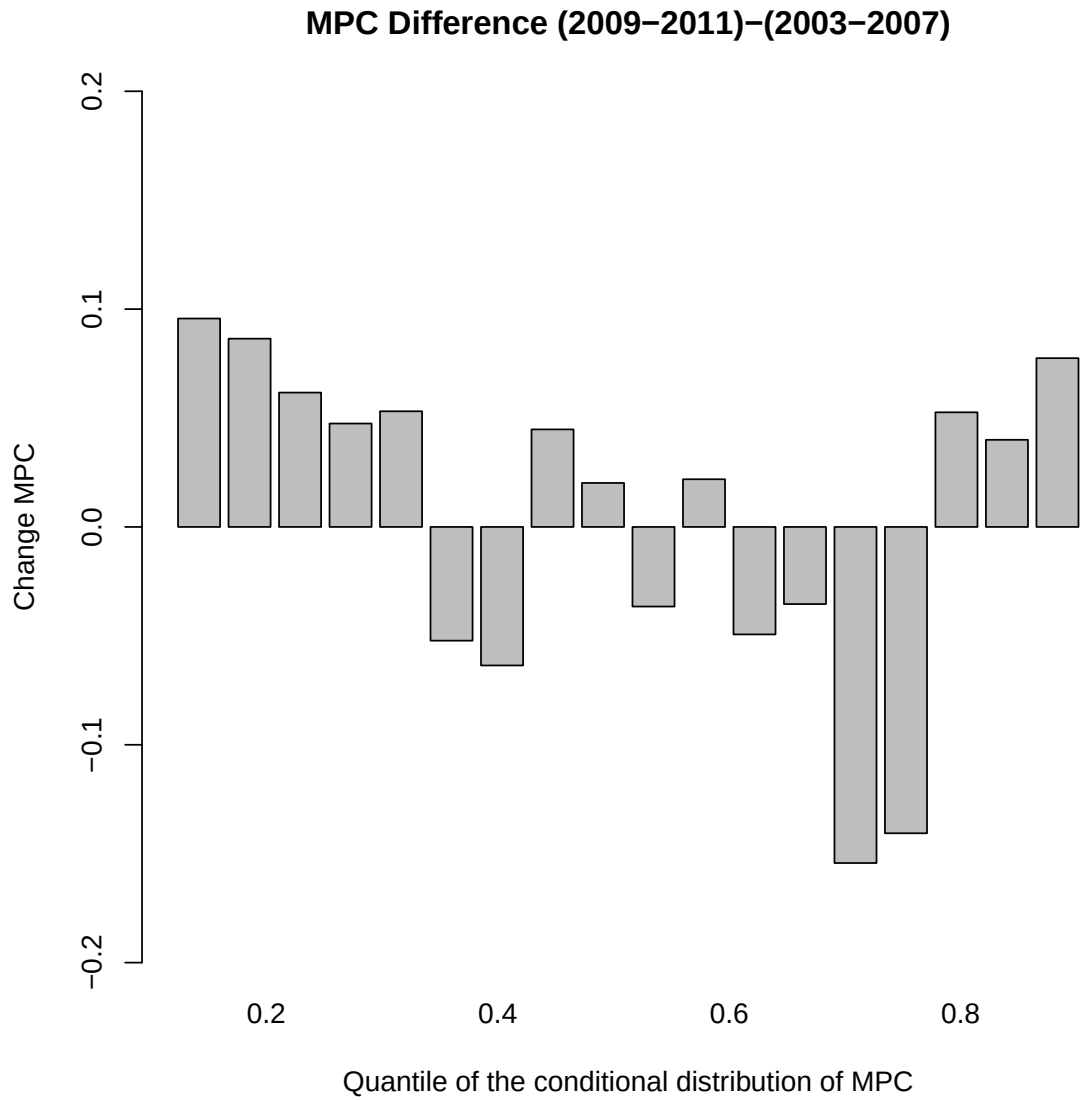
	$\log(c_{it})$	$\log(y_{it})$
	(1)	(2)
Education=Medium	0.207***	0.361***
	(0.024)	(0.031)
Education=High	0.503***	0.760***
	(0.025)	(0.031)
Race=Black	−0.211***	−0.354***
	(0.026)	(0.028)
Race=Other	−0.094**	−0.184***
	(0.039)	(0.055)
Family Size	0.388***	0.423***
	(0.012)	(0.015)
Number of Kids	−0.282***	−0.374***
	(0.013)	(0.014)
Kids Out of HH	0.125***	0.220***
	(0.015)	(0.023)
Status=Unemployed	−0.232***	−0.421***
	(0.020)	(0.027)
Status=Retired	−0.435***	−0.691***
	(0.035)	(0.043)
Status=Inactive	−0.510***	−0.843***
	(0.039)	(0.045)
Extra Family Income	−0.057***	−0.006
	(0.018)	(0.020)
Region=Midwest	−0.166***	−0.136***
	(0.030)	(0.041)
Region=South	−0.103***	−0.128***
	(0.028)	(0.039)
Region=West	−0.078***	−0.079**
	(0.028)	(0.035)
Constant	9.251***	9.496***
	(0.189)	(0.233)
N	30,976	30,976
R^2	0.4196	0.4242

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

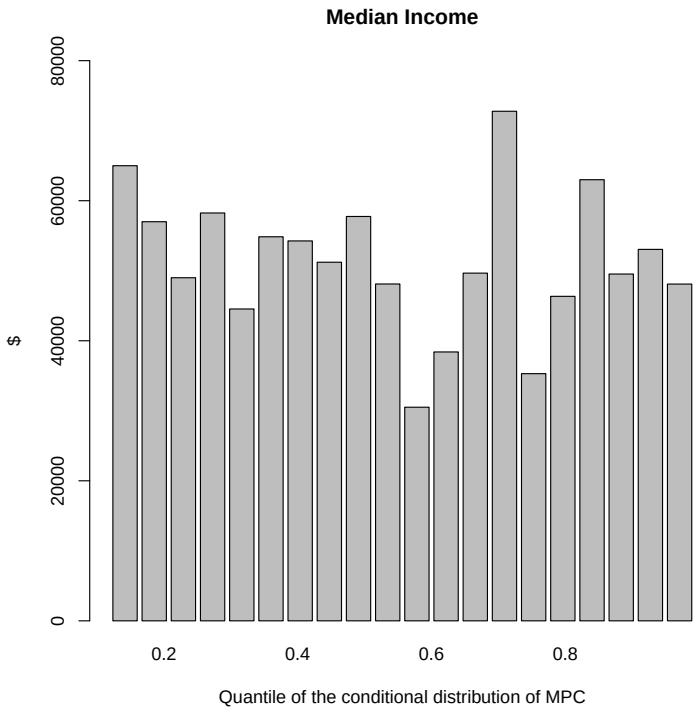
Results - Second Step IV Quantile Regression

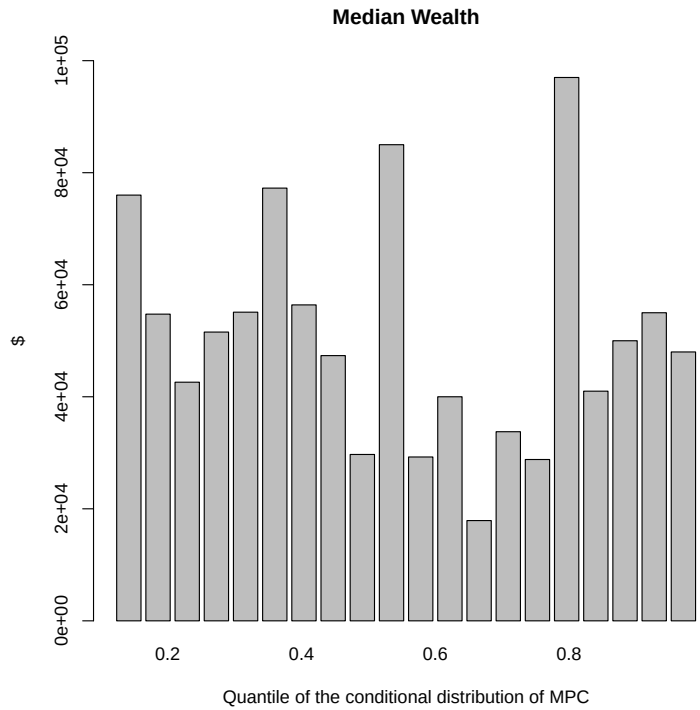


Results


MPC Difference (2009−2011)−(2003−2007)
Change MPC
0.2
0.1
0.0
−0.1
−0.2
0.2
0.4
0.6
0.8
Quantile of the conditional distribution of MPC

Results


Median Income
$
0
20000
40000
60000
80000
0.2
0.4
0.6
0.8
Quantile of the conditional distribution of MPC


Median Wealth
$
0e+00
2e+04
4e+04
6e+04
8e+04
1e+05
0.2
0.4
0.6
0.8
Quantile of the conditional distribution of MPC

Summary

- In a canonical incomplete markets heterogenous agents model with heterogenous discount factors
  - internal business cycle dynamics imply that just the poorest income quintiles' MPCs increase in a recession
  - fitting the empirical wealth distribution implies a shift across the whole MPC distribution
- Significant heterogeneity in MPCs in the cross section
- Suggestive empirical evidence that MPC distribution also varies over the cycle
- However, MPC does not seem to vary with state variables such as income, wealth
- Caveat - work in progress: in particular, think about expectations - at least some of the cycle is forecastable

Thanks for listening!

Any questions?

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