HOUSEHOLD CONSUMPTION AND LONG-TERM INTEREST RATES

A Thesis
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Master of Public Policy
in Public Policy

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Washington, DC
April 9, 2015

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ABSTRACT

Following the financial crisis there were many questions raised about the proper role and efficacy of monetary and fiscal policy. One such area of debate surrounds the effects of changes to interest rates have on household consumption. This paper use Consumer Expenditure Survey data along with state base Mortgage Interest Rate Survey data to estimate this relationship. The analysis finds a slight but significant positive correlation suggesting that households contracted their spending when interest rates went down. These findings suggest that there are other important factors that determined consumption spending, and that monetary and fiscal policy makers should aim to understand what caused households to lower their spending even as interest rates fell.

INDEX WORDS: Consumption, Interest Rate, Wealth

INTRODUCTION

The financial crisis of 2007-2009 raised many questions about role and efficacy of fiscal and monetary policy in addressing economic cycles and shocks. Some of this debate has focused on how these policy tools influence household consumption. Understanding how households adjust their consumption patterns to the economic environment around them is important informing which policy options are likely to be most effective, and help shape policy makers' expectations. One important question raised about the nexus between economic policy and household consumption, is to what extent households change their consumption in response to changes in interest rates.

Understanding how households change their consumption/ savings decisions to changes in interest rates is of importance for both monetary and fiscal policy because both change interests rates with fiscal policy affecting the amount of national saving available, and monetary policy effecting monetary base and where investment is allocated Elmendorf [4]. Households' response to interest rates has been seen as driver of the financial crisis and as a justification for policy responses to the crisis. These positions are not mutually exclusive but better understanding of this relationship is needed to evaluate how sound these arguments are.

The argument that economic policy was a driver housing and financial crisis, postulates that both expansionary monetary policy and home ownership policies helped support creation of sub-prime mortgages and growth of the mortgage-backed securities market [9]. Mian and Sufi [10] show a large increase in household debt leading

Figure 1.1: U.S. Household Debt to Income, Mian and Sufi [10]
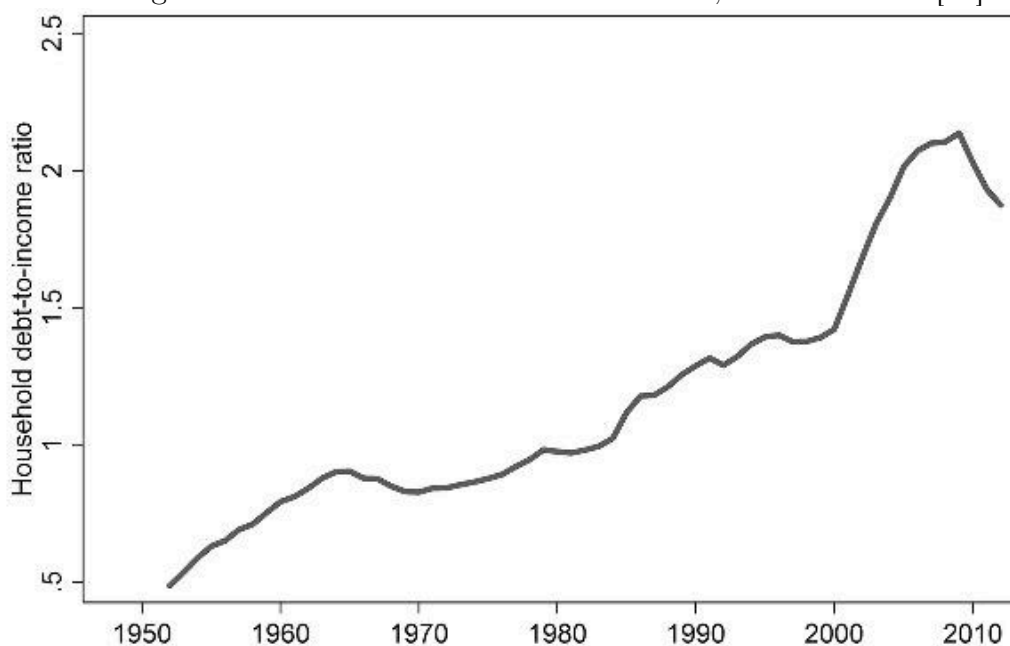
up to financial crisis shown in Figure 1 which supports this argument. The increase in household debt suggests that households were borrowing to supplement incomes. This phenomenon was observed by Krueger and Perri [7], who found that despite a well document increases in income inequality from 1980 to 2003, they did not find any significant change in consumption inequality between groups, and argue that this is in some part due to change financial markets allowing households to insure them-selves against income labor income shocks. This idea is interesting in hindsight appears that households were less able to insure themselves as they were able to take on debt.

The second argument is a Macroeconomic argument, which contend that in short-run periods of below expected output, monetary and fiscal policy can be used to stimulate demand by households or firms. This argument is generally characterized

2

as the Keynesian perspective or demand-side perspective, argues that in a crisis or economic downturn, demand is weakened by a contracting economy, and thus lower interest or higher levels of income are needed to stimulate demand for investment or consumption. One part of this perspective, suggests that lowing interest rates should correspond to higher demand for investment by firms with little reference about how household whose savings is a component of available loadable funds.

Underpinning the debates about fiscal and monetary policy are assumptions the relationship between household consumption behavior and interest rates. This paper examines this topic and presents estimates of this relationship. The remainder of the paper will be organized as follows. Section 2 will present the theoretical foundation behind consumption and its importance in the Macroeconomics. The section will then provide a review of literature on consumption and its determinants leading into Section 3 which will explain the data used in this analysis. Section 4 will present the used for analysis along with a discussion of its limitations. Section 5 will present the empirical results with a discussion of the model diagnostics, leading into Section 6 which conclude with the policy implications of the results presented, and area for further research or improvement.

CHAPTER 2

LITERATURE REVIEW

Consumption is a topic that is major interest for economics and economic policy for many reasons. Practically, personal consumption expenditures (PCE) accounts for the largest portion of gross domestic product in the United States, and while panel A of Figure 2 shows that PCE has trended around 50 to 60 percent of GDP panel B shows that since the 1950s it has increase from to 58 percent of GDP to 68 percent. The trends in PCE provide a sense of the economic quality of life for Americans, which is likely skewed due to distributional and geographical features of income and purchasing power. The variation between income and consumption has lead some such as Stiglitz et al. [12] to suggest that Consumption measures are better indicators of welfare and quality of life. The potential for national statistics to be skew because of geographic variation or distribution, suggests that a micro-level analysis is need better understand how households respond.

It is helpful to understanding any analysis of consumption decisions, to first layout a simplified theoretical model, which can inform our expectations of both relationships of interests and possible relationships that if ignored would weaken our analysis. For this, it is common in the economics of consumption to think about households making consumption in the context of two periods. In this context individuals are thought of as having some preference for consumption in one period or the other but still wish to smooth their consumption across both periods. The individuals consumption decisions are constrained by their income and their wealth. Another factor that is important

Figure 2.1: Personal Consumption Expenditure as a Share of GDP

Panel A. Long-Run Prespective

Panel B. Shorter-Term Perspective
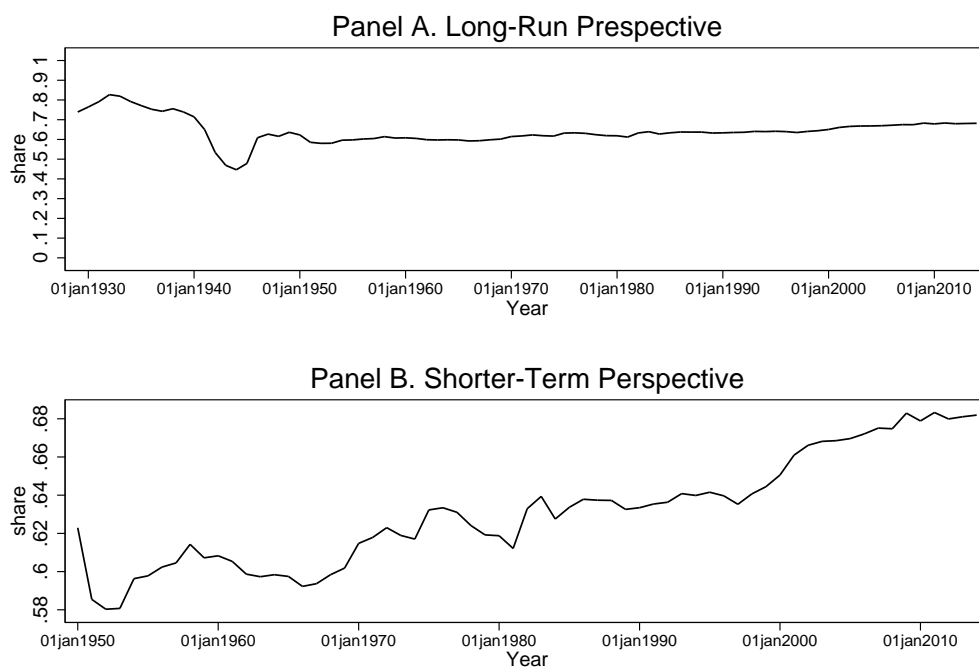
Source: Authors Calculation and Buruea of Economic Analysis

with in this stylized model is that relative cost difference of consumption between periods, which is understood as the interest rate or discount rate. This stylized model has in identified Income, wealth, and interest rates as key variables of interest in analyzing the determinate s of consumption.

When extending the simple two period model to an analysis of consumption over an individuals life, it is necessary to make assumptions about the how they smooth their consumption. The most common of these assumptions is the defines the life-cycle model of consumption, which argues that people smooth their consumption over their life [4]. Part of the life-cycle model is assumption that people utilize their all of their resources over their life. As Elmendorf [4] discusses there are alternative models of consumption which emphasize either different time frames over which individuals maximize their utility, or targeting of relative levels of consumption or utility. This paper will analyze consumption in the context of the life-cycle model , which has implications for variables that are included in the model. The life-cycle model suggests that we should see age based variation in consumption changes. This expectation is stems from the reasoning that, as individuals get older they has less time to consume any unexpected increases income while they live.

The two period model of consumption provides insight into the possible effect of interest rate changes consumption.the relationship that is of interest to this paper is the effect of long-term state based mortgage interest rate on the consumption-savings decision. The two-period model is helpful for decomposing the different effects that interest rates have on this decision. The income, cost and wealth effects are the three commonly understood effect that changes in interest rates have on consumption. Understanding of these effects is important for understanding what type of impact policy have might have on households and what that effect means for households.

INCOME EFFECTS

Interest rates play an important role in economics and economic analysis. In the two period model an individual has a choice in period one to consume all of there income or to save that income for consumption in period two. The interest rate is the opportunity cost of foregone consumption in period one, and conversely it is the difference in purchasing power power and cost of borrowing between periods, in a risk free environment. This means that in a risk free world, the interest rate is the expected change in purchasing power on a quantity of money.

Changes in short-term interest rates can produce an income effect on consumption by changing the amount of income needed to smooth consumption. For example, an increase in interest rate will be associate with a lower cost to future consumption, allowing for the same level of consumption between period to be achieve at a lower cost. This allows individuals and household to maintain their present consumption , because cost will be lower in the future [1]. The effects of long term interest rate changes may be less certain as they are likely more dependent on the income the household, because a higher interest rate will increases the cost of borrowing to support consumption in the present.

COST EFFECTS

Cost effects are the result of changes in relative value of two choices. Typically, households deciding between consumption today or in future, higher short term interest rates make consumption in the present more costly than in the future. This change in cost over time should incentivize a shift in consumption to the future.

Elmendorf [4] discusses the literature on the the sensitivity (elasticity) of household consumption to interest rates in two distinct categories based on their level of

analysis. This distinction is helpful for providing clarity on the literature and will be used here. The categories of studies are those that use aggregate data and those that use household data, with each method having its own strengths and weaknesses.

Aggregate Studies

Studies that examine changes in the aggregate consumption have a more classical macroeconomic foundation. Research by Hall [5], tested the relationship between alternative measures of expected rates on consumption over time periods. While the results showed no real relationship, the models were expanded by Mankiw [8] to test the idea of household having different inter-temporal consumption functions. They found that there was reason to believe that in the aggregate, consumers might not adhere to the life-cycle model. This is important in macroeconomic modeling, as it may mean that a significant number of households optimize their consumption through some alternative method rather then over their lifetime. These results while informative are limited because analysis being at the aggregate level does not help to identify how other consumers make decisions.

Household studies

Household data studies are a little more diverse in their approach to understanding consumption behavior.Notably these studies tend to explore consumption choices in the face of liquidity constraints. Runkle [11] looked at consumption in the face of liquidity constraints using the Panel Study of Income Dynamics (PSID), He did not find evidence of liquidity constraints, but did find a cost effect for household with high wealth-income ratios.

Liquidity constraints can generally be understood as money constraints where liquidity constrained households have limited access to money or resources for consumption. The study of liquidity constraints is important for the analysis of Iacoviello [6], which studied the relationship between housing prices and consumption. Iacoviello's analysis of housing prices was an application to the liquidity constraint analysis at the aggregate level, and it found robust estimates that housing prices explained changes in consumption. These results are still limited by the aggregation assumptions that are made using macroeconomic data. Iacoviello's results while interesting are part of a larger literature that is less clear, and is even disputed by findings in Dynan [3] who found insignificant housing price effect.

It is also worth noting that household data have also been used to estimate the strength of desire to save. Dynan [2] used the CES data to estimate this relationship, and found a small risk averse saving motive.

Household studies are limited by available data. Data source like the CES and PSID are usually coded for anonymity which limits usefulness to studying demographic and geographic factors.

WEALTH EFFECTS

The wealth effect is a change in behavior that is associated with changes in wealth due to saving over multiple periods. The multi-period nature of this effect means that the an increase in the interest rate is associated with a decrease in both the value of saving and future income. This means that they are unable to purchase as much in the future, so they are likely to save more to cover the difference based on their own preferences.

Dynan [3] used CES data to examine wealth effect from two factors. First studying the effect of stock market changes on the consumption of stock holding and non-stock

9

holding households, she found that there is a difference in wealth effect. However, that when new data extended the analysis into the 2000's, the relationship was weakened.

Dynan [3] also examined the effect of state based housing prices on consumption. While this analysis did not address the issue of liquidity constrained household, it did not find a significant relationship between state housing prices and consumption. This paper will expand on her model but include state level mortgage interest rates with are likely associated with both housing prices and consumption.

DATA SOURCES

This paper utilizes Bureau of Labor Statistics (BLS) Consumer Expenditure Survey (CES) Public Use Micro Data to study households. CES data are collected by the Census Bureau and used by BLS to produce expenditure and price index data. The survey has been collected since the 1930s and contains a significant amount of information on the households surveyed. The public use data have been cleaned up to ensure anonymity of the respondents. The survey is split into two different parts, the interview survey and the diary survey, which collect different expenditure information. This paper will use the interview survey data, which collects a larger range of expenditure types.

The interview survey is conducted every quarter collecting data on types of expenditures for the three months prior. Respondents are households and they are interviewed for five quarters with the first interview not being published. Households or consumer units (CUs) are replaced after the fifth interview, with a fifth of the respondent pool cycling out every quarter.

CES data allows for a unique insight into consumption because of the quarterly panel structure. The periodicity of the interview survey allows for comparison of consumption expenditure by households between quarters, which is beneficial to the analysis of how households adjust to economic conditions. Where the CES data is falls short for this analysis is in the response rate for households.

This paper also uses a quarterly tabulation of the Mortgage Interest Rate Survey from the Federal Housing Finance Authority (FHFA). The data were provided as monthly data and subsequently averaged by state for the three months of the quarter. These data were combined with FHFA state housing price data to control for housing price changes.

This paper utilizes the model used by Dynan [3] to study the wealth effects of stock price changes on consumption. The model estimates the changes between quarters, rather than over the entirety of the interview. The model takes the form:

$$\Delta ln C_{it} = \alpha_0 + \beta_1 \Delta R_{it} + \beta_2 X_{it} + \epsilon_{it} \tag{4.1}$$

Where $\Delta ln C_{it}$ is the change from the first interview to the last interview, in the log of real consumption. $\Delta ln R_{it}$ is the change in the average effective mortgage interest rate for the state of residence for the consumer. While X_{it} is a vector of consumer unit characteristics that will be controlled for and are consistent with Dynan [3]. Table 4.1 lists the variables of the model, along with a description and the literature that used them.

The time indicator t is understood to reference the last interview for a consumer unit. This time structure will allow for a first difference estimate of consumption changes given changes in interest rates. To ensure that the data are measuring real changes in the behavior over time, economic data are converted into real values using available indices from the Bureau of Economic Analysis. Most importantly the consumption expenditures are adjusted using National Personal Consumption Expenditure price index with a base year of 2009 dollars. Controls for age, family size education level, average income between the first and last interview, change in logged

Table 4.1: Variable Descriptions Expected Relationships and Justifications

Variable	Label	Variable	Expected Relationship	Justification
Variable Of Interest				
– CH_lnrcost	Percent Change Log Consumption	Y	N/A	N/A
– CH_lneff_rate	Percent Change Interest Rate	X_1	Inverse	Hypothesis
– CH_indexEXP_nsa	Percent Change HPI	X_2	Direct	Dynan (2010)
– CH_lnincome	Percent Change in Income	X_3	Direct	Dynan (2010)
– income	Average Income	X_4	Direct	Dynan (2010)
– renter	Renter	X_5	Indirect	Dynan (2010)
Controls and other Variables				
– cuid	Household ID	N/A	N/A	
– age_ref	Age	X_6	Direct	Dynan (2010)
– educ_ref	Education	X_7	Direct	Dyan(2010)
– fam size	Family Size	X_8	Direct	Dynan (2010)

income are included in the model. These covariates may correlate with the how households adjust to interest rate changes. The model also includes controls for the square of age and a dummy variable for renter of home, to allow for nonlinear age effects and to observe differential effects for home renters and owners. Table 4.2 lists the mean consumption and interest rate for all observations in by region of residence. On inspection of Table 4.2 it is observed that average regional consumption varies over the time period, while interest rates for all region have a definite downward trend.

Table 4.2: Mean Consumption Expenditure and Interest Rate by Region and Year, For 2006-2012

					Consumption Expenditures			
Year	New England	Mideast	Great Lakes	Plains	Southeast	Southwest	Rocky Mountain	Farwest
2006	2317.215	2110.63	1954.792	2039.369	2074.876	2057.692	1937.142	2575.55
2007	3000.276	2882.18	2508.275	2697.738	2576.7	2561.997	2702.26	2884.287
2008	3143.631	2694.512	2428.163	2381.49	2555.36	2641.945	2626.918	2824.444
2009	2623.685	2573.008	2407.002	2327.6	2573.569	2600.457	2646.21	2739.583
2010	2593.226	2554.213	2499.813	2144.857	2451.458	2339.231	2530.269	2630.135
2011	2750.509	2626.996	2327.444	2141.239	2307.153	2368.635	2253.469	2666.15
2012	2587.86	2535.532	2230.21	2407.225	2379.78	2328.714	2688.993	2554.933
					Interest Rates			
2006	6.475	6.567	6.651	6.5251	6.658	6.65	6.567	6.461
2007	6.453	6.522	6.65	6.504	6.55	6.583	6.533	6.424
2008	6.122	6.162	6.266	6.185	6.215	6.221	6.175	6.13
2009	5.024488023	5.144934606	5.199484952	5.167535753	5.130713764	5.187456162	5.12	5.16
2010	4.77	4.855	4.872	4.884	4.873	4.892	4.857	4.924
2011	4.5475	4.599	4.615	4.703	4.631	4.669	4.712	4.67
2012	3.761	3.799	3.845	3.888	3.854	3.889	3.90	3.91

Results

Table 5.1 shows the means and estimated effects of the independent variables in the difference in logged consumption. with robust t-statistics. Looking at the means of the control variables it is of importance to note that over the period there was an average decline in the housing price index, which is likely a feature of time period covered by the analysis, and limits the generalizable of the study.

Column 2 and 3 of Table 5.1 shows the raw estimates of the housing price index change and interest rate change on the change in logged consumption. The results are shown with robust t-statistics as White test shown at the bottom of the table showed there were heteroskedastic errors.

Columns 4 and 5 of Table 5.1 show the results of two similar models with row 5 controlling for not linear age effects. Interpreting the results of interest rates on consumption, the models in columns 4 and 5 show that a 1 percent change in interest rates is associate with a 0.03 percent increase in consumption, which is relatively small but statistically significant. This result is interesting because it suggest that higher interest rates lead to higher consumption. Housing price also has a statistically significant relationship suggesting a 1 percentage point increase in housing price is correlates with an approximately 0.13 percent increase in consumption. These results suggest that long term housing prices and mortgage interest rates.

Both of the results just discussed are substantively interesting, but it is important to note that there are limitations to the interpretation of the results. The Link tests at

Table 5.1: First Difference Regression Results

	Mean Mean/t	Model 2 b/t/vif	Model 3 b/t/vif	Model 4 b/t/vif	Model 5 b/t/vif
Change in State Average Effective Interest Rate	-0.347		0.042** (3.252) [1.000]	0.035** (2.804) [1.005]	0.035** (2.804) [1.005]
HPI	-0.039	0.177** (2.744) [1.000]		0.132* (2.040) [1.006]	0.133* (2.067) [1.006]
Percent Change in Income	-0.024			0.083*** (11.666) [1.002]	0.083*** (11.653) [1.002]
Average Income over period	97373.016			-0.000 (-0.817) [1.294]	-0.000 (-0.489) [1.315]
Age of Household	51.888			0.000 (1.106) [1.291]	-0.004* (-2.021) [36.336]
Education	13.326			0.006 (1.942) [1.213]	0.007* (2.039) [1.215]
Family Size	2.571			0.007 (1.649) [1.276]	0.007 (1.815) [1.283]
Rents Home	0.277			0.010 (0.794) [1.205]	0.007 (0.505) [1.223]
Age squared					0.000* (2.229) [36.397]
Constant		0.020*** (3.437)	0.028*** (4.012)	-0.087 (-1.598)	0.017 (0.240)
Observations	9580	9697	9697	9580	9580
R-Squared		0.001	0.001	0.049	0.050
F-Test		7.530	10.574	20.033	18.521
		Link Test			
_hat		1.053 (2.875)	1.406 (3.728)	1.002*** (22.247)	1.001*** (22.377)
_hatsq		20.857 (1.496)	-26.219 (-1.860)	-0.071 (-1.020)	-0.054 (-0.777)
		White-Test			
White Chi-Squared		1.103	1.603	562.985***	571.520***
White Degrees of Freedom		2.000	2.000	43.000	52.000
White P-value		0.576	0.449	0.000	0.000

Robust t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the bottom of the table suggest that while there is no significant specification problem, the t-statistics have a high enough value to warrant concern about specification. It is also very likely that there are missing variables that were not available for the analysis, along with possible change to the data made by the Bureau of Labor Statistics limit the certainty of any results.

CHAPTER 6

CONCLUSION

The results above are interesting for their implications of how people respond to the their local economic conditions. The positive correlation between state mortgage interest rates and consumption along with the positive correlation between housing price and changes in consumption may suggest that households are sensitive to economic conditions around them. However, this analysis is limited in its ability to make causal inference, both because of data limitation and because of likely time dependent characteristics. The data in this analysis covers much of the housing and financial crisis, which was marked by a significant changes in housing price, household debt, and interest rates [10].

For policy makers the results of this analysis suggest that there is a need to learn more about why long-term interest rates are positively associated with changes in consumption. For monetary policy this is an interesting result because it seems those households were contracting their consumption as mortgage interest rate decreased. This could be important for formulating fiscal and monetary response to future financial and housing crises because it may suggest alternative approached to stimulating household consumption demand.

Finally, the analysis presented above was limited by the data that was available. There are several other variables of interest for which there wasnâĂŹt available data, and would have helped to isolate correlation and causality. There is much more

research need on this subject, which has potential for improving how policy makers approach fiscal and monetary policy.

Bibliography

[1] Deaton, A. (1992). *Understanding consumption.* Clarendon Press Oxford.

[2] Dynan, K. (1993). How prudent are consumers? *Journal of Political Economy,* pages 1104–1113.

[3] Dynan, K. (2010). Wealth effects and the changing economy. Technical report, mimeo, Brookings Institution.

[4] Elmendorf, D. W. (1996). *The effect of interest-rate changes on household saving and consumption: a survey.* Federal Reserve Board.

[5] Hall, R. E. (1988). Intertemporal substitution in consumption.

[6] Iacoviello, M. (2004). Consumption, house prices, and collateral constraints: a structural econometric analysis. *Journal of Housing Economics,* 13(4):304–320.

[7] Krueger, D. and Perri, F. (2006). Does income inequality lead to consumption inequality? evidence and theory. *The Review of Economic Studies,* 73(1):163–193.

[8] Mankiw, N. G. (1987). Consumer spending and the after-tax real interest rate. In *The Effects of Taxation on Capital Accumulation,* pages 53–68. University of Chicago Press.

[9] McLean, B. and Nocera, J. (2011). *All the devils are here: The hidden history of the financial crisis.* Penguin.

[10] Mian, A. and Sufi, A. (2014). *House of Debt: How They (and You) Caused the Great Recession, and how We Can Prevent it from Happening Again*. University of Chicago Press.

[11] Runkle, D. E. (1991). Liquidity constraints and the permanent-income hypothesis: Evidence from panel data. *Journal of Monetary Economics*, 27(1):73–98.

[12] Stiglitz, J., Sen, A., and Fitoussi, J.-P. (2009). The measurement of economic performance and social progress revisited. *Reflections and overview. Commission on the Measurement of Economic Performance and Social Progress, Paris.*