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CONSUMPTION AND THE GREAT RECESSION

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ABSTRACT

We document some key facts about aggregate consumption and its subcomponents over time. We then document the behavior of some important determinants of consumption, such as consumers' expectations about their future income, and changes in the consumers' wealth positions. Finally, we use a simple permanent income model to show that the observed drop in consumption during the Great Recession can be explained by the observed drops in wealth and income expectations.

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Introduction

The Great Recession of 2008/2009 was characterized by the most severe year over year decline in consumption since 1945. The consumption slump was both deep and long lived. It took almost 12 quarters for total real Personal Consumption Expenditures (PCE) to go back to its level at the previous peak (2007:Q4).

This article documents key facts about aggregate consumption and its subcomponents over time and looks at the behavior of important determinants of consumption, such as consumers' expectations about their future income, and changes in the consumers' wealth positions due to changes in house prices and stock valuation. Then, the article uses a simple permanent income model to determine whether the observed drop in consumption can be explained by the observed drops in wealth and income expectations.

The data analysis starts by using macroeconomic data to study the behavior of consumption and its subcomponents. The analysis then turns to microeconomic data from the University of Michigan Survey of Consumers to study nominal expected income growth and inflationary expectations.

Our main findings from the Macro data are the following. First, the Great Recession marked the most severe and persistent decline in aggregate consumption since WWII. All subcomponents of consumption declined during this period. However, the large drop in services consumption stands out most compared to previous recessions. Second, while the decline was historic, the time path of consumption and its subcomponents leading up the recession was not substantially different from past recessionary periods. Third, the recovery path of consumption following the Great Recession has been uncharacteristically weak. It took nearly three years for total consumption to return to its level just prior to the recession. In contrast, the second worst rebound observed in the data followed the 1974 recession and lasted just over one year. We find that this persistence is reflected most in the subcomponents of non-durables and especially services consumption.

Our main findings from the analysis of the Micro data are as follows. First, expected nominal income growth declined significantly during the Great Recession. It is the worst drop ever observed in these data, and it has not yet fully recovered to pre-recession levels. Second,

the decline exists for all age groups, education levels, and income quintiles. Relative to previous recessions, however, those with higher levels of income and education are more pessimistic than their poorer and less educated counterparts. Third, expectations for real income growth have also declined, and the decline in expected real income growth is more severe when personal inflation expectations are used instead of actual CPI inflation. Fourth, expected income growth is a strong predictor of actual future income growth. Since expected income growth is a very important determinant of consumption decisions, the observed drop in expected income has the potential to explain at least part of the observed decline in consumption.

In the context of a simple permanent income model, we find that the negative wealth effect (coming from decreased stock market valuation and housing prices) and decreased consumers' income expectations were big factors in determining the observed consumption drop. In fact, we find that in this model the observed drops in wealth and income expectations can explain the observed drop in consumption in its entirety, depending on what is assumed about future income growth going forward, beyond the time horizon covered by the Michigan Survey of Consumers data set.

Macro data: total real PCE

Figure 1 displays the level of real PCE from 1962 to 2011:Q3. Even over this long horizon, the chart shows a flattening out of the consumption growth rate in 2008/2009. The fact that this pattern is clearly visible even over a period of almost 50 years highlights the severity and persistence of the Great Recession and the very slow recovery that is following it.

Fig. 1 Level of real PCE in 2005 dollars, in billions.

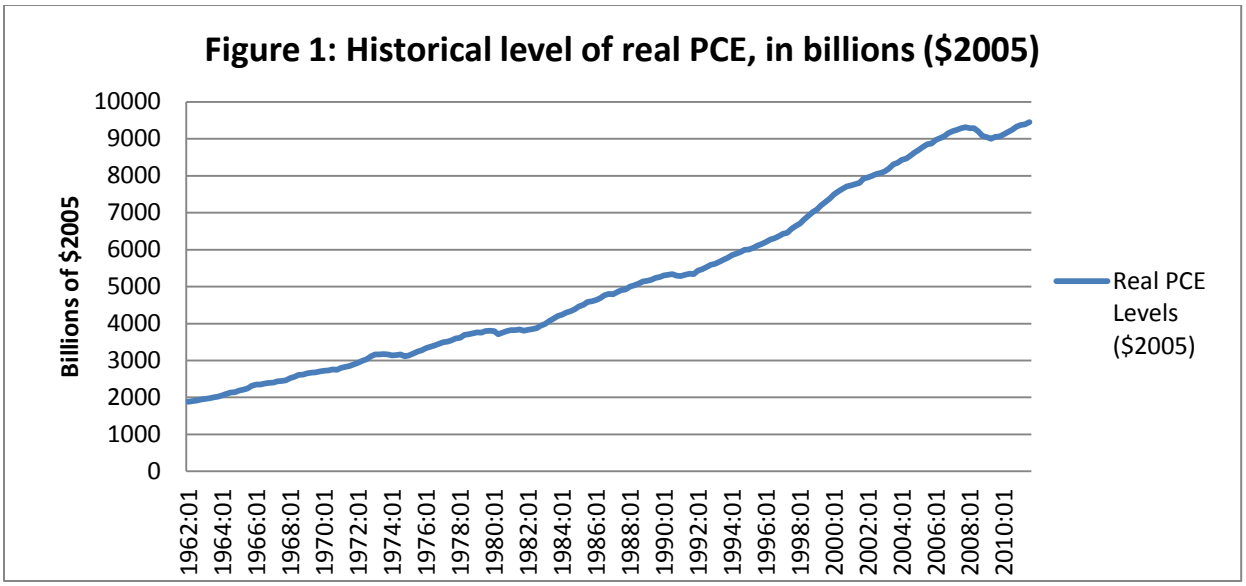
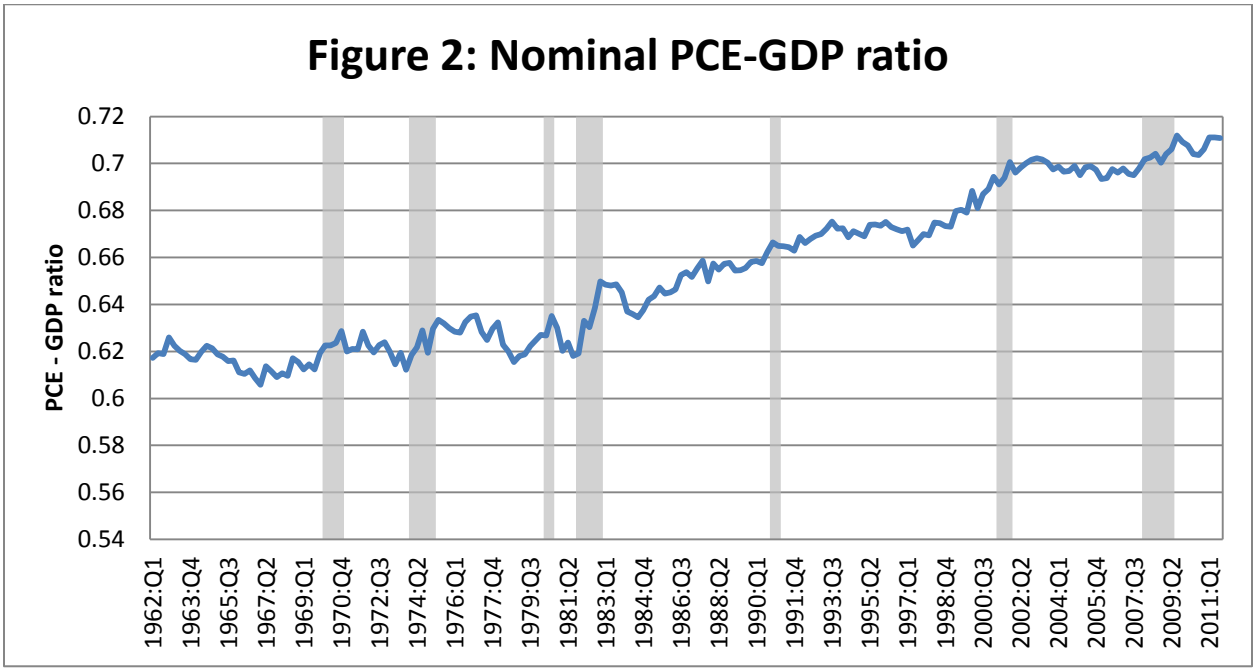


Figure 2 shows that consumption growth outpaced GDP growth through past recessionary periods. The nominal PCE-GDP ratio increases in each recession since 1962. In contrast, during the Great Recession, it increased more modestly. Even after the recession, this ratio has either fallen or stagnated. Thus, as a share of GDP, consumption has been hit harder than in previous recessions.

Figure 2. Nominal PCE to nominal GDP ratio with NBER recession shading since 1962.



Petev, Pistaferri, and Ecksten (2010) document that, while real per-capita consumption declines monotonically until the middle of 2009, real per-capita disposable income is relatively stable and that its decline was significantly smaller. This stability in per-capita income is explained entirely by a strong increase in government transfers to households, as wage and financial income fell. The increase in government transfers was partly due to higher take-up rates for unemployment insurance and food stamps, and partly due to the increased generosity of means-tested programs enacted by the legislators (such as extended unemployment benefits and increased in food stamps and emergency cash assistance). Given that these transfers are means-tested, they primarily help poorer households. Consistently with this finding, we find that in the Michigan Survey of Consumers the drop in income expectations over the next 12 months of the poor-income households was smaller than the one for all other households.

Figure 3 reports a spider chart comparing the time path of real PCE over several recessionary time periods. For each recession, the level of PCE is normalized to 1 at the NBER peak prior to the recession. The NBER dates for the recessions peaks are 1973:Q4, 1980:Q1, 1981:Q3, 1990:Q3, 2001:Q1, and 2007:Q4.

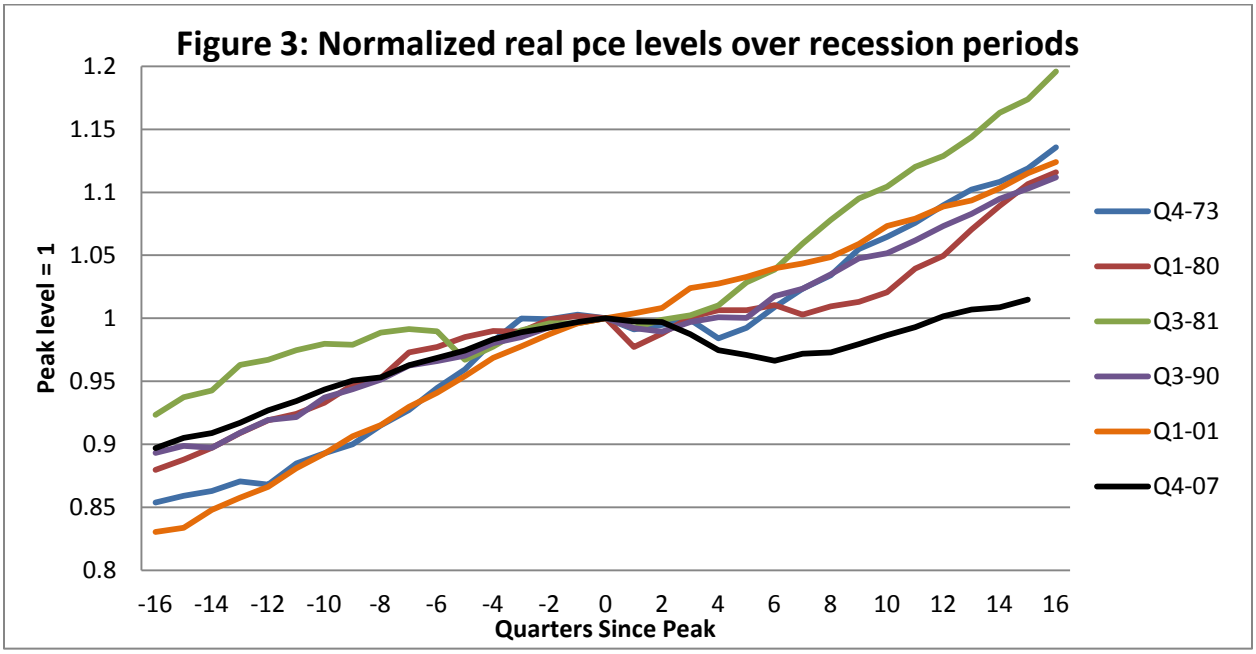
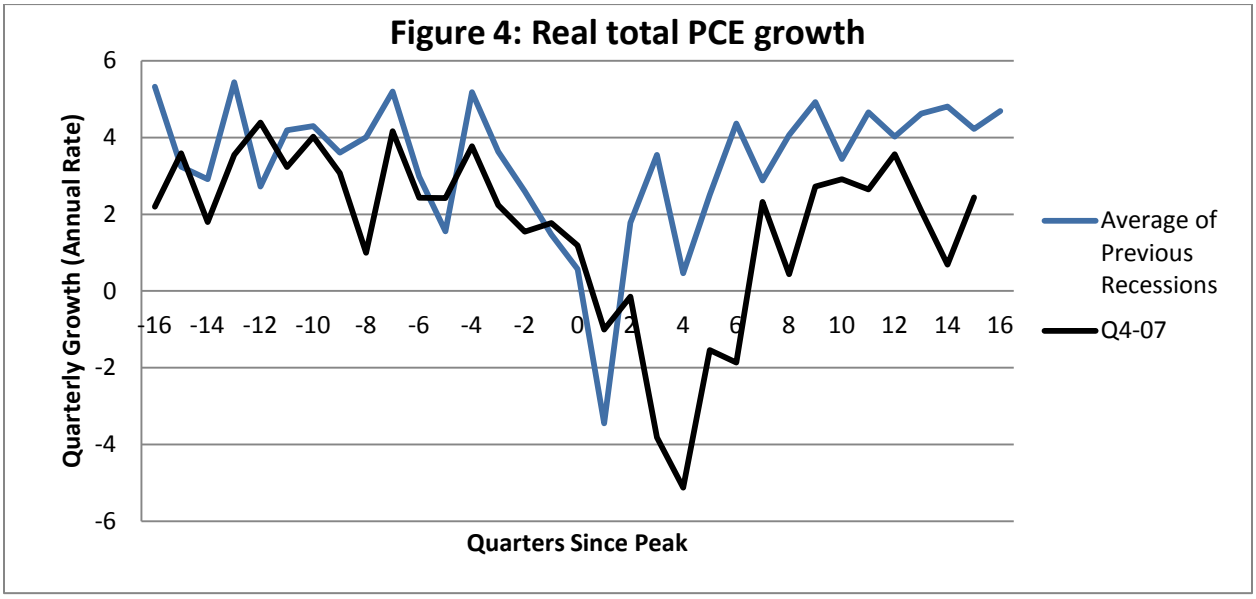


Figure 3 highlights that in the 2008/2009 recession consumption dropped 3.4% from peak to trough (6 quarters after the peak) and was slow to recover afterwards. This contrasts with every recession since 1974. During all previous recessionary periods, either consumption fell only modestly or increased following the peak.

Figure 4 displays the time path of the real PCE growth rate for the 2008/2009 recession around the NBER peak and compares it with the average real PCE growth rates from all other recessions since 1971. This graph shows that the average real PCE growth rate around the 2008/2009 recession was significantly lower than the corresponding average over the previous five recessions. Consumption has grown 4.1% in total over the last 5 years, or an average rate of .8% per year. This is in contrast with the fact that over the 1971-present consumption growth averaged 3.1% per year, adding up to about 15% growth over an average 5-year period. Thus, consumption expenditures are about 15%-4%=11% below what they would have been had they grown at their historical averages from 2007:Q4 onward.

Figure 4. Real total quarterly PCE growth over the 2008/2009 recession compared with the average quarterly growth rates of all other previous recessions since 1974.

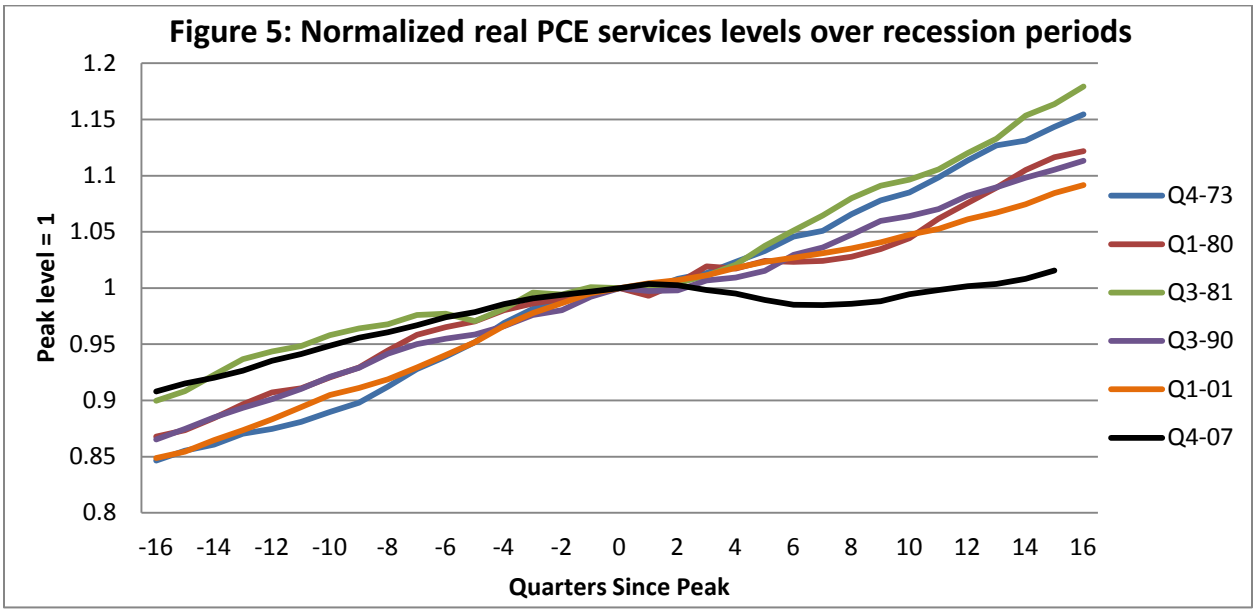


All sub-components of PCE fell during the Great Recession. Durables growth was somewhat weaker than in the previous five recessionary periods, both in terms of average growth rate and pattern of recovery. However, non-durables, and especially services, were the sub-components that were most depressed compared to the previous recessions.

Total real PCE services

Figure 5 highlights that the behavior of PCE services was starkly different over the last 2008/2009 recession compared to all other recessions since 1974. In all other recessions PCE services grew both before and after the peak, while during the last recession, it stagnated starting 2 quarters after the peak (four quarters before the trough) and kept stagnating for four additional quarters afterwards. It took until Q4 2010 to return to peak levels.

Figure 5. Spider chart comparing the time path of real PCE services over several recessionary time periods. For each recession, the level of PCE services is normalized to 1 at the NBER peak prior to the recession.



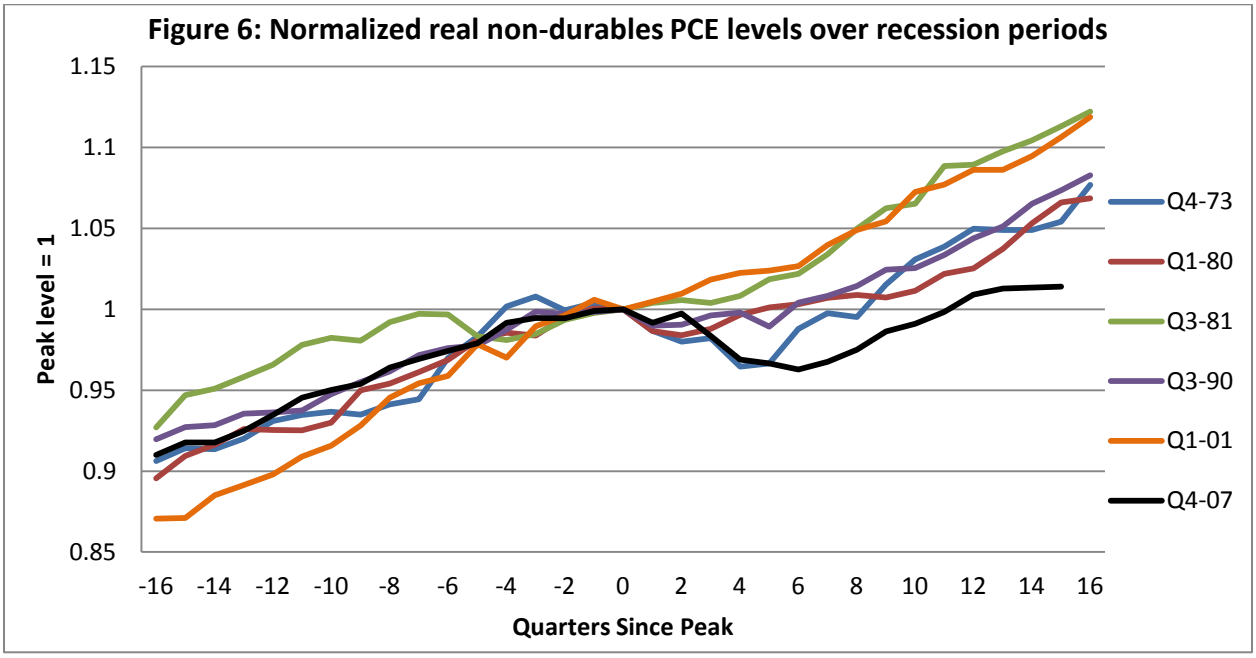
Regarding the main services subcomponents, Petev, Pistaferri, and Ecksten (2010) document that spending on health services increased, held stable for housing and utilities, but

declined substantially for services related to transportation, food and recreation. In sum, the most adjustable services dropped, while those that the consumer has little flexibility about, did not.

Total Real non-durables PCE

We can see from figure 6 that the rise in PCE non-durables was similar to most other recessions before the peak, but was among the worst of the recovery paths.

Figure 6. Spider chart comparing the time path of real non-durables PCE over several recessionary time periods. For each recession, the level of non-durables PCE is normalized to 1 at the NBER peak prior to the recession.



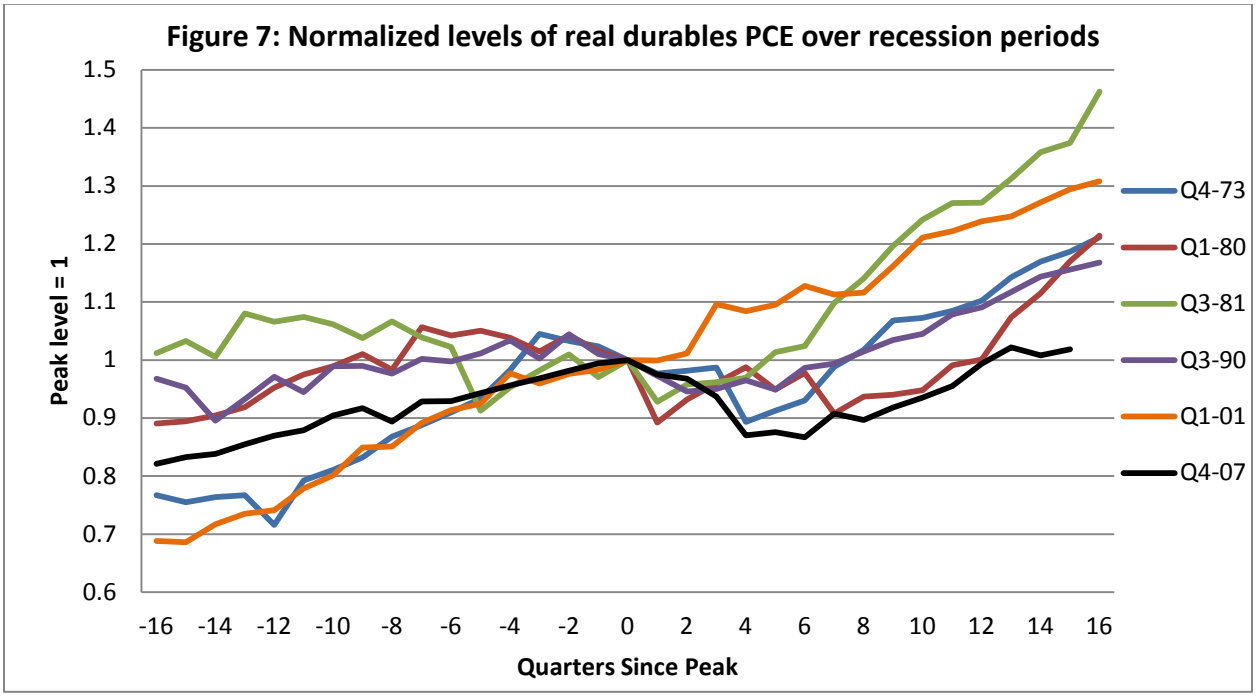
Petev, Pistaferri, and Ecksten (2010) document an unusual decline in food spending, a fundamental subsistence consumer category and a solid indicator of living standards, which raises concerns about the extent and depth of the strain that household underwent during the recession. An interesting new paper by Aguiar and Hurst (2011), however, documents that during the most recent recession a significant fraction of foregone market work hours went to

home production. Including childcare, that fraction of time is 35%. This is an important channel that could produce more goods (such as food) and services (such as childcare) at a lower cost. More work is needed to determine if home production could completely explain the observed decline in food spending.

Total real PCE durables

Figure 7 displays a large drop for durables over the most recent recession. Five to six quarters after the peak, this recession actually displayed the largest drop in durables, compared to the previous five recessions, and while durable then started recovering, the speed of recovery was low, as it took 12 quarters to go back to the previous peak level.

Figure 7. Spider chart comparing the time path of real durables PCE over several recessionary time periods. For each recession, the level of durables PCE is normalized to 1 at the NBER peak prior to the recession.



Petev, Pistaferri, and Ecksten (2010) document that the bulk in the decline in real per-capital spending is attributable to purchases of cars (a 25% decline by the end of 2008) and partly of furniture (a 9% decline).

To summarize, our main findings from the macro data are as follows. First, the Great Recession marked the most severe and persistent decline in aggregate consumption since WWII. All subcomponents of consumption declined during this period. However, we find that the significant drop in consumed services stands out most compared to previous recessions. Second, while the decline was historic, the time path of consumption and its subcomponents leading up the recession was not substantially different from past recessionary periods. Third, the recovery path of consumption following the Great Recession has been uncharacteristically weak. It took nearly three years for total consumption to return to its level just prior to the recession. In contrast, the second worst rebound observed in the data followed the 1974 recession and was just over one year. We find that this persistence is reflected most in the subcomponents of non-durables and especially services consumption.

The Micro evidence: expected income in the Michigan Survey of Consumers

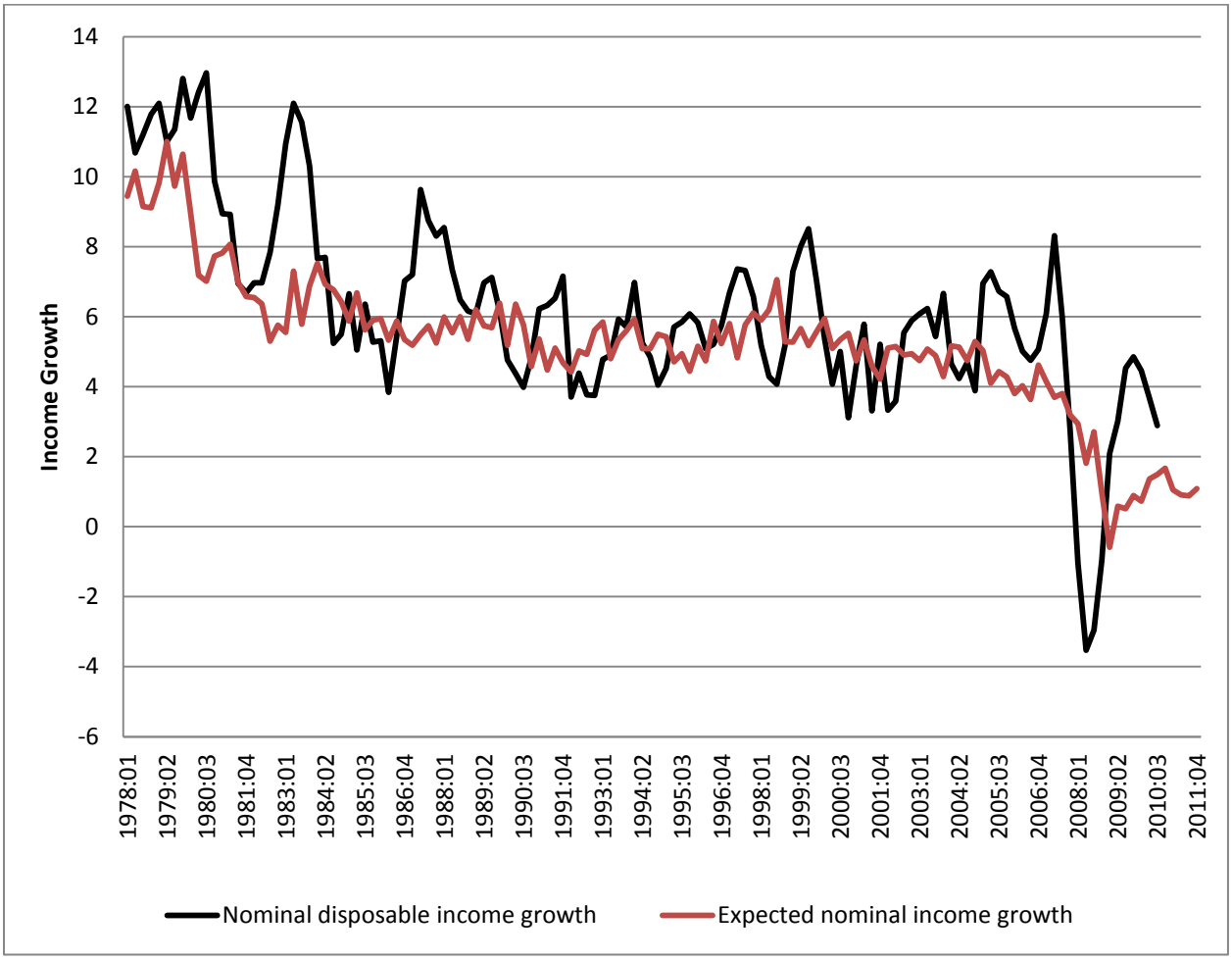
This section documents consumer expectations for future income, both in nominal and real terms, to see whether shocks to permanent income are contributing to the consumption dip. The survey asks two questions to identify the magnitude and sign of the income change.

i) "During the next 12 months, do you expect your income to be higher or lower than during the past year?"

ii) "By about what percent do you expect your income to (increase/decrease) during the next 12 months?"

The resulting index of expected income growth ranges between +95 and -95 in the cross-section and reflects the expected percent change in nominal income in the next year. The historical mean is +5.5%, split between +4.8% during recessions and +5.6% during expansions. Figure 8 below compares realized and expected nominal disposable income and shows that the two series track each other well.

Figure 8. Realized and expected nominal annual disposable income growth



The survey also asks about expected changes in the price level over the next 12 months. This number is historically very similar to realized CPI inflation. We construct expected real income growth by subtracting each individual's inflation expectations from his expected nominal income growth.

We construct time series from the micro data. For each month of the survey we take cross-sectional means within each demographic group addressed below, and then aggregate to quarterly frequency to minimize noise. The data begin in 1978 and go through the first half of 2011, though some series only go back to 1990. Thus, we typically have 5 recession periods to examine.

Nominal income growth expectations

Except for the Great Recession and the 1980 recession, income expectations show a downward trend for up to four quarters around the NBER peak, but then stabilize and actually rise by the end of our 4 year window (see figure 9). For both the 1980 and most recent recession, we observe larger and more prolonged dips. Besides the abnormal drop, both in terms of size and duration, the recovery periods also stand out for their length and sluggishness. Even well after 10 quarters from the peak, expected nominal income growth was still well below the pre-recessionary periods. In terms of levels, it should be noted that the most recent recession is the only one during which nominal income expectations reached negative growth rates. Along all of the previous recessions that we study, even when nominal income growth rates go down, they stay well above 4%. Of course, inflation has been lower during the most recent recession. We will discuss real income patterns later.

Figure 9. Average expected nominal income growth rates around recessionary periods.

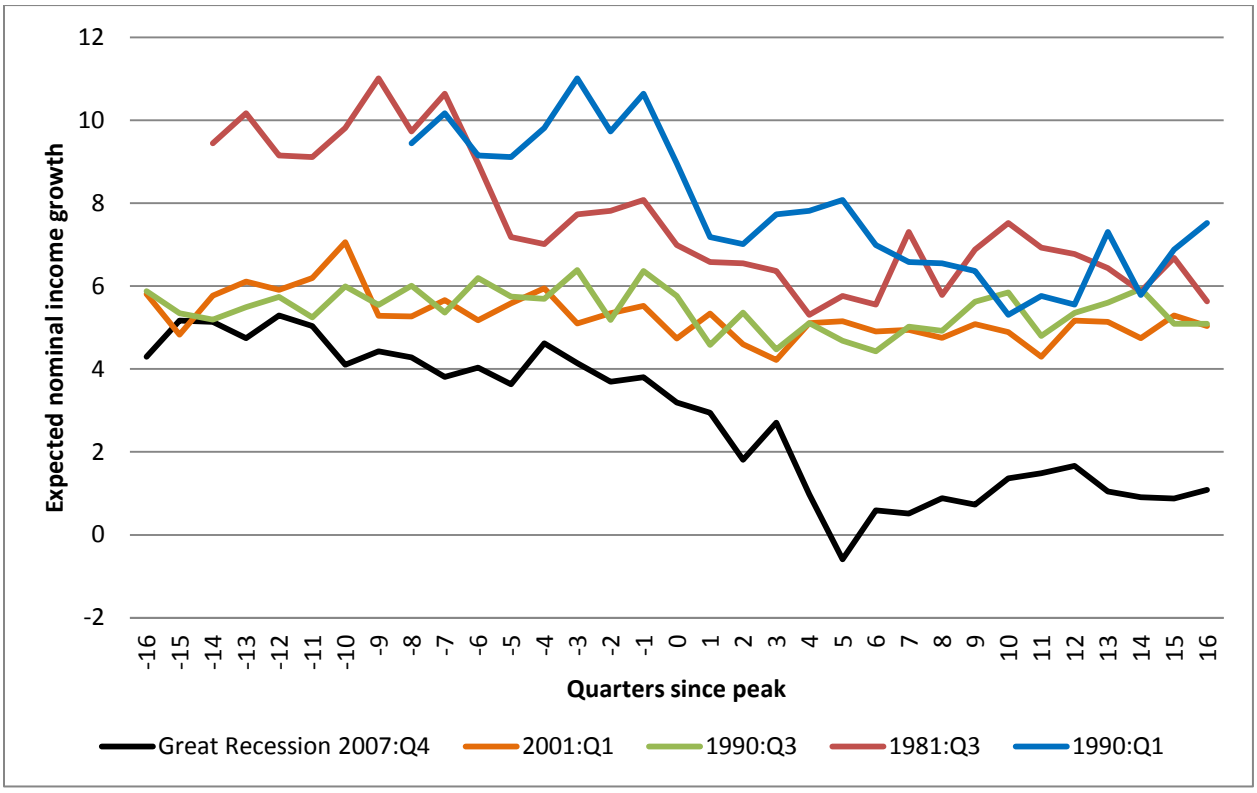
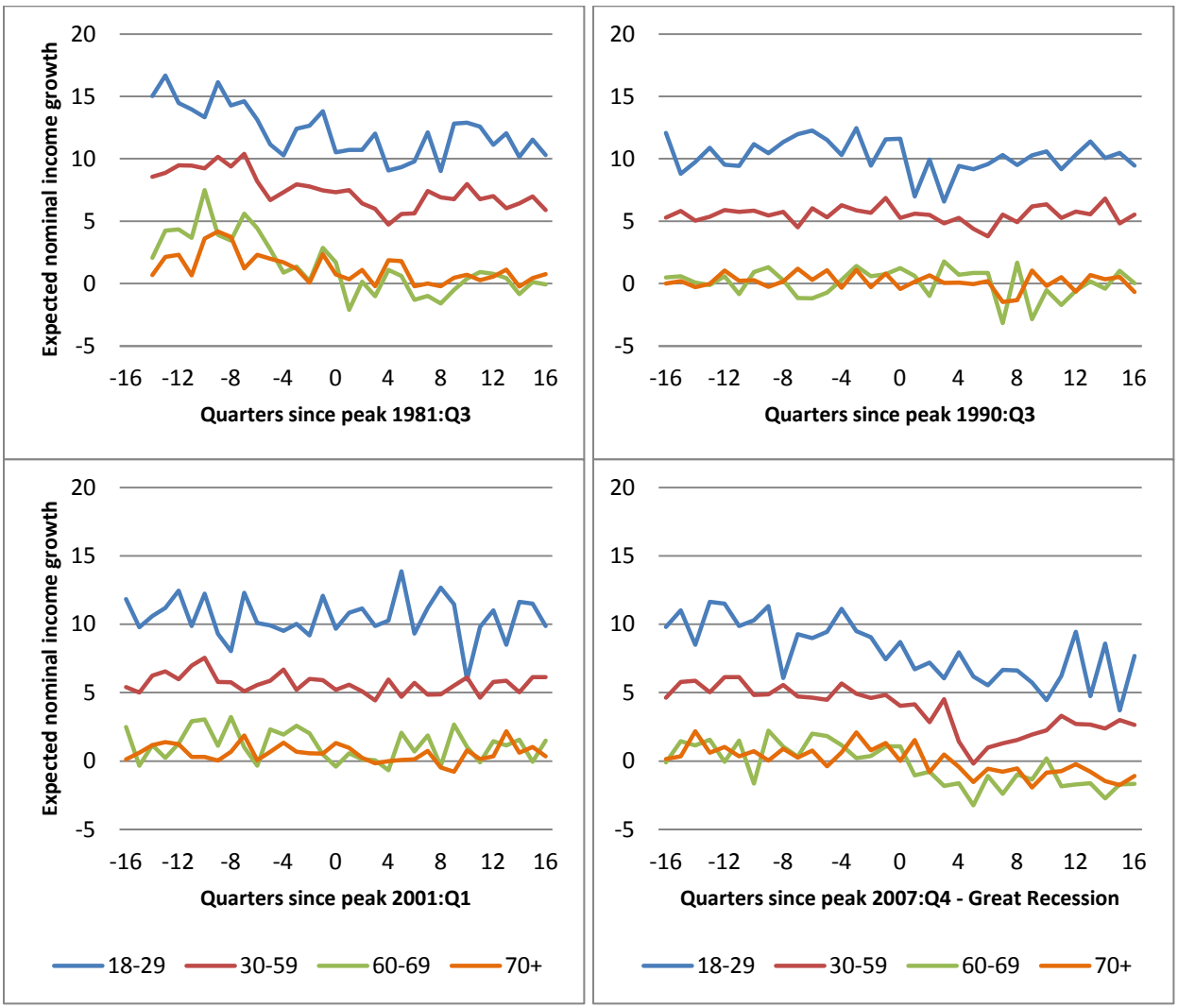


Figure 10 shows that after the late 1970s, nominal income growth expectations have not varied by demographics until the most recent recession. Prime age individuals (30-59) experienced the largest drop in expected nominal income growth during the Great Recession and are only partially recovering even 10 quarters after the peak. For younger consumers, expectations dropped well before, starting 5 quarters in advance, but then stabilized after the peak.

Figure 10. Expected nominal income growth, by age group.

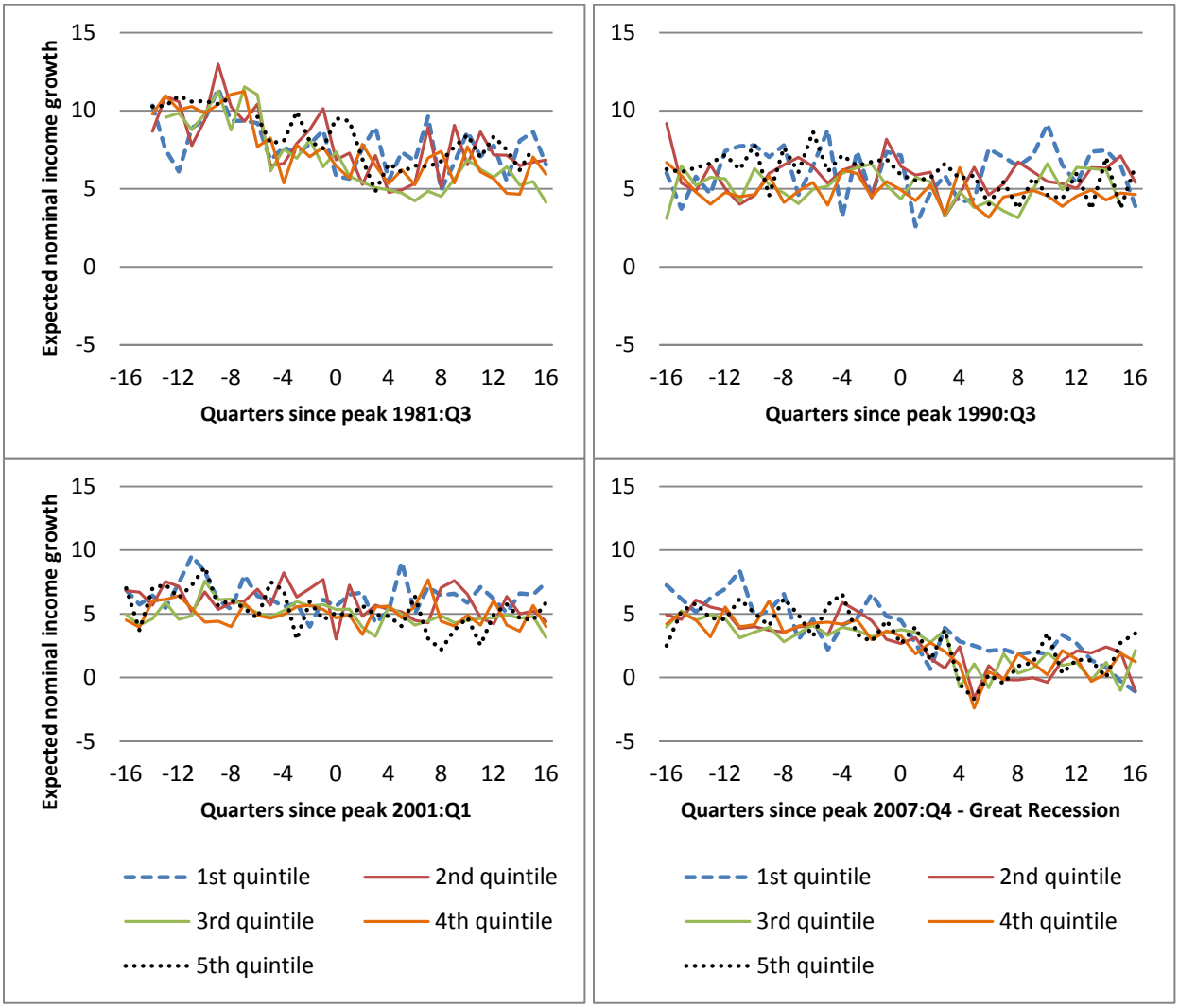


In past recession periods, nominal income expectations of the elderly population hovered around or just above zero. However, these expectations been markedly negative since the NBER peak in 2007:Q4. Focusing on this population, Christelis, Georgarakos, and Jappelli (2011) use the 2009 Internet Survey of Health and Retirement Study (HRS) to look at the effects of three different shocks: the drop in house prices, the decline in the stock market, and the increase in unemployment, on households' expenditures during the Great Recession. This data set refers to the population 50 and older. The HRS Internet Survey contains detailed measures of both housing wealth losses (between Summer 2006 and Mid-2009) and of losses in various financial assets (between October 2008 and Mid-2009). It also contains measures of consumption growth and qualitative indicators of consumption changes, allowing them to estimate the effect of the losses on adjustments in consumption expenditure. Their main finding is that capital losses (on housing and financial assets), as well as the income loss from becoming unemployed, lead households to reduce their spending. The estimated elasticity of consumption to financial wealth implies a marginal propensity to consume with respect to financial wealth equal to 3 percentage points. The decline in house prices also had an important impact on consumption: the estimated elasticity implies that the marginal propensity to consume is 1 percentage point. Additionally, households in which at least one of the two partners in the main couple (or the single head) became unemployed in 2008 and early 2009 reduced consumption by 10% in 2009. See Hurd and Rohwedder (2010a, 2010b) and the citations therein for more estimates on the responsiveness of consumption to asset and income shocks.

Figure 11 shows that all income levels have adjusted their expected income growth downward during the most recent recession. In past recessions the adjustments were smaller. In the most recent recession, the 1st quintile (the poorest) dropped the least. By the end of 2010 all income levels have roughly converged to the same post-peak level and are much closer together. This is consistent with Petev, Pistaferri, and Ecksten's findings. First, they find that increased government transfers propped up income among the poorest-income households during the Great recession. Second, using the Michigan Index of Consumer Sentiment, they document that high income people have become more pessimistic than other groups during

the Great Recession.[2] Finally, using the Consumer Expenditure Survey (CEX), they find that respondents in the top decile of the wealth distribution are the ones who decrease spending during the Great Recession (-5.4%). This finding holds for the subcategories of nondurables and services. This drop in consumption might be due to the large negative wealth effect experienced by these households due to the decrease in house values and stock market valuation.

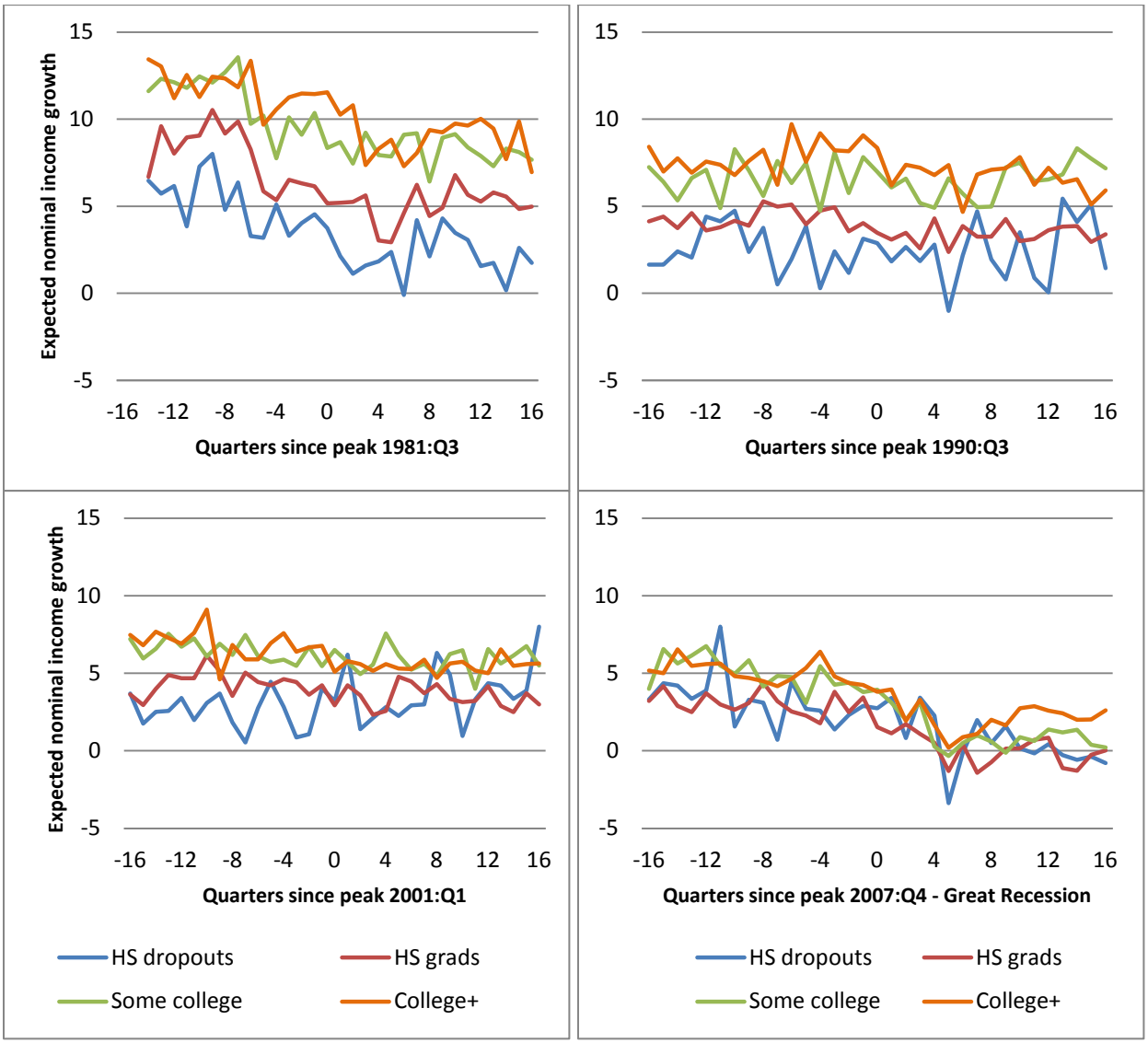
Figure 11. Expected nominal income growth by income quintile.



[2] As a possible explanation for the pessimism of the wealthy, Shapiro (2010) finds that these household were exposed more to the stock market and experienced larger declines in wealth as a consequence. The median decline in wealth was 15% in Shapiro's data, and those who lost at least 10% of their net worth had almost twice the mean wealth and 3.5 times the median wealth of the sample.

Figure 12 shows that in the previous recessions, income expectations by education groups were rather flat over the cycle. In the most recent recession, everyone reduced their expected income growth.

Figure 12. Expected nominal income growth by education level.

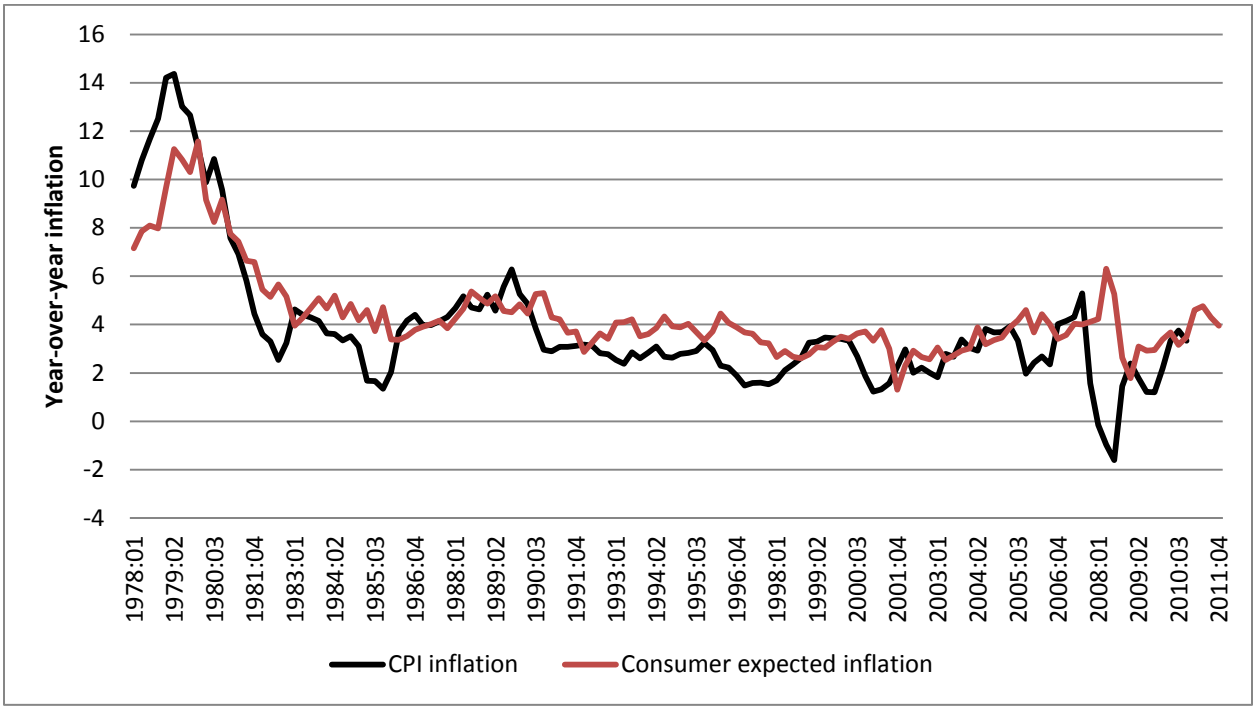


Real income growth expectations.

Nominal income growth during the Great Recession was low, but inflation was also low. To study the behavior of real income expectations, we measure inflation in two ways. First, we use actual CPI inflation over the 12 month period covered by the survey question, which assumes that consumers have perfect foresight over the next year concerning inflation. Second, we use the answer to the survey question about the individual's expectation about growth in prices over the next 12 months. Using these two measures, we construct individual-level expected real income growth and then aggregate up to population-quarter means.

The two inflation series have diverged in the past, but after the late 70s the differences are minor. At the start of the Great Recession, however, a large gap opened up, which makes for the largest discrepancy between these two data series. The swing in 2008 Q2 is +6% in expected inflation, compared to -1% actual CPI inflation. The two measures have since become closer together (see figure 13). The gap in these two measures of course impacts measured real income growth expectations as we document below.

Figure 13. Time series of 12 months forward inflation since 1978, comparing CPI and personal inflation expectations for the Michigan Survey of Consumers.



In figure 14 there is no clear cyclical pattern prior to the Great Recession in real income expectations. Before the most recent recession, real income growth was rather flat, dropped into negative territory several quarters before the peak, but then went up to about 4% four quarters after the peak. From then on, however, it had a large drop, reaching -3% five quarters after the peak. In summary, real income growth expectations deflated by CPI show a deterioration and lower average growth than during previous recessions.

Figure 14. Expected real income growth, CPI inflation.

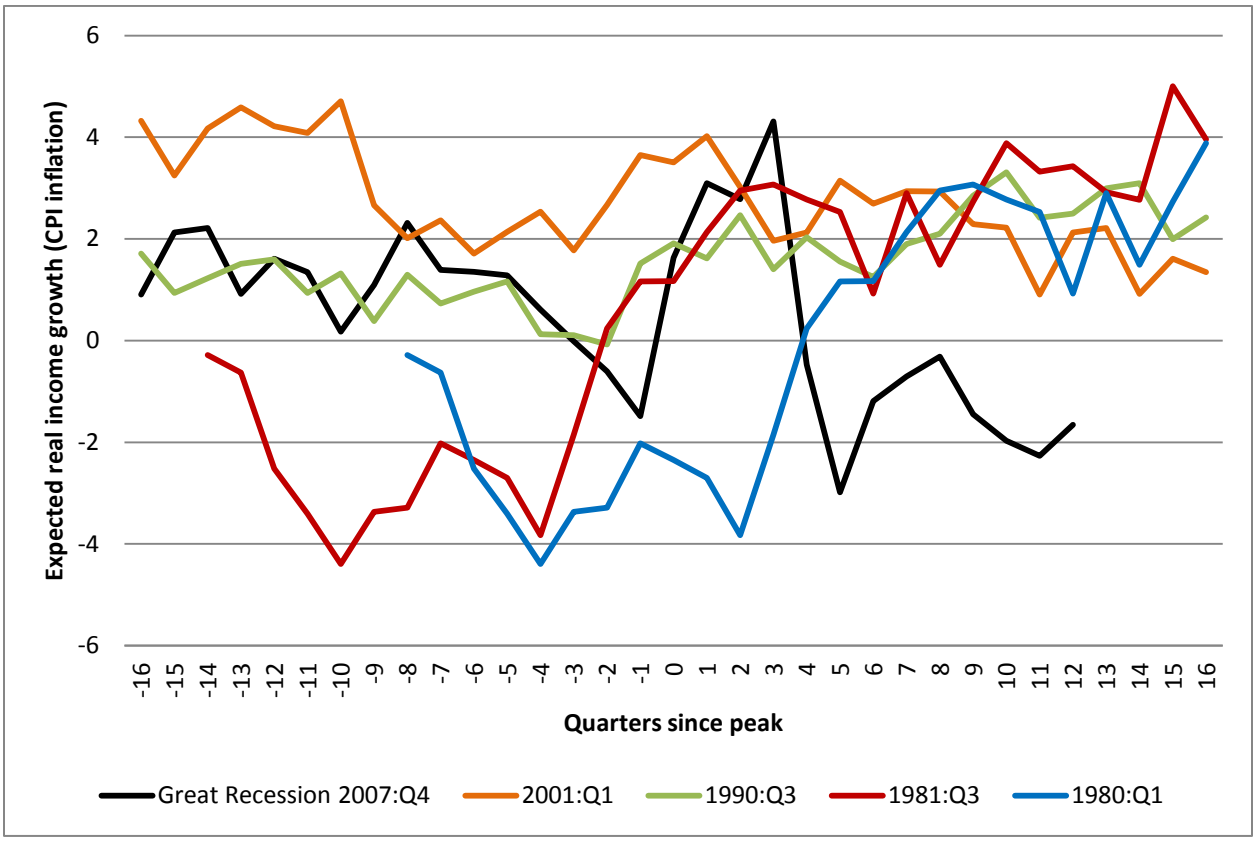
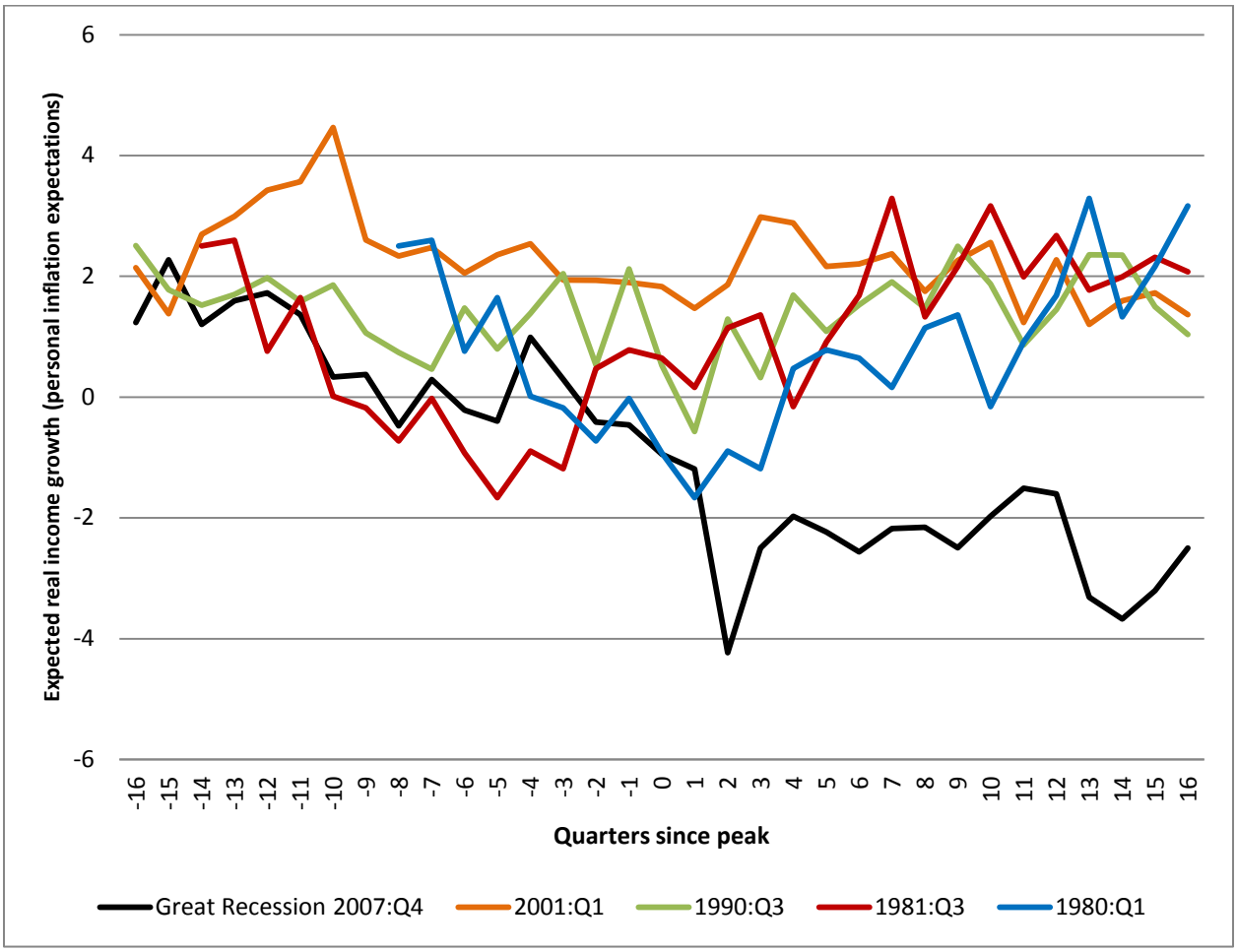


Figure 15 shows that perceived consumers' real income growth using the consumers' inflation expectactions provides a much more pessimistic outlook about consumers' purchasing power during the Great Recession. Consumers' perceived real income growth dipped in and out of negative territory well before the recession started, and sustained a large drop starting four

quarters before the peak. That drop brought expectations from almost +2% to -4% growth rate three quarters after the peak. It took two more quarters to go back up to a -2% growth rate expectation, but there has been stagnation ever since. The recession window in figure 15 ends in Q4 2011 at an expected real income growth of -2.5%. In 2011 the series has recorded values of -3.1%, -3.7%, and -2.9% for quarters 1 through 3, respectively.

Figure 15. Expected real income growth, using consumers' inflation expectations.



Our main findings from the analysis of the Micro data are as follows. First, expected nominal income growth declined significantly during the Great Recession. It is the worst drop ever observed in these data, and it has not recovered to pre-recession levels. Second, the decline exists for all age groups, education levels, and income quintiles. Relative to previous recessions, those with higher levels of income and education are more pessimistic than their poorer and less educated counterparts. Third, expectations for real income growth have also

declined, and the decline in expected real income growth is more severe when personal inflation expectations are used instead of actual CPI inflation.

Does the Michigan Expectations data have predictive power for future income and consumption growth?

Below we show that the Michigan data have a great deal of forecasting power for both future disposable income and consumption growth.[3] We estimate the regression for disposable income first:

$$((Y_{t+k+4} - Y_{t+k}) / Y_{t+k}) = \alpha_0 + \alpha_1((Y_t - Y_{t-4}) / Y_{t-4}) + \alpha_2 g_{Mt} + \varepsilon_{t+k}$$

where $\alpha_0, \alpha_1, \alpha_2$ are parameters to estimate and α_1 and α_2 are reported in the table below. The variable $((Y_{t+k+4} - Y_{t+k}) / Y_{t+k})$ is next year's annual income growth k quarters from now, so k is 0 when forecasting income growth over the next year and 4 when forecasting income growth over the subsequent year. $((Y_t - Y_{t-4}) / Y_{t-4})$ is income growth over the last year and g_{Mt} is expected real income growth from the Michigan survey, where we deflate using expected inflation from the Michigan survey.

As can be seen in table 1, lagged income growth has a negative coefficient and expected income growth has a positive coefficient. For income growth over the next year the coefficient on expected income growth is .80, indicating that a 1% decline in expected income growth reduces next year's income growth .80%, controlling for last year's income growth. The right hand column shows that predicted income growth over the next year (2011:Q3 to 2012:Q3) using lagged income growth and expected income growth is .6%, well below its average of 2.8% over the 1978-2011 sample period. Income growth between 2012:Q3 and 2013:Q3 is also forecasted to be low.

[3] See Souleles (2004), Ludvigson (2004), and Barsky and Sims (2009) for more on the predictive power of the Michigan surveys.

Expected income growth is also a good predictor of consumption growth. Table 1 also presents regressions using future consumption growth as the left hand side variable and lagged consumption growth and the Michigan expectations variable as the right hand side variables. The consumption forecast for 2011:Q3 to 2012:Q3 is for 0.1% growth.

In short, the low expected income growth in the Michigan Consumer Survey data suggest that the US will experience low income and consumption growth over the next two years. Obviously, there are many things not in our models so the estimates should only be taken as suggestive evidence. However, the results are fairly robust to changes in model specification and adding a few other variables, such as the unemployment rate.

Table 1: Regression Results

Dependent variable	Lagged income growth variable	Michigan income expectations	Lagged consumption growth variable	Forecasted annual growth, Q3/Q3	R-squared
Annual income growth 1 year forward	-0.35	0.80	--	0.61*	0.29
	(0.10)	(0.17)			
Annual income growth 2 years forward	0.06	0.36	--	1.24**	0.08
	(0.08)	(0.17)			
Annual income growth 3 years forward	-0.34	0.42	--	2.16***	0.08
	(0.13)	(0.20)			
Annual consumption growth 1 year forward	--	0.71	0.08	0.05*	0.37
		(0.23)	(0.13)		
Annual consumption growth 2 years forward	--	0.77	-0.25	0.13**	0.18
		(0.23)	(0.16)		
Annual consumption growth 3 years forward	--	0.58	-0.49	1.15***	0.11
		(0.27)	(0.19)		
Annual consumption growth 1 year forward	-0.20	0.75	0.18	0.39*	0.39
	(0.14)	(0.21)	(0.14)		
Annual consumption growth 2 years forward	0.10	0.76	-0.31	-0.07**	0.17
	(0.14)	(0.23)	(0.19)		
Annual consumption growth 3 years forward	-0.09	0.59	-0.44	1.36***	0.11
	(0.16)	(0.27)	(0.21)		

Notes:
Regressions are run with data from 1978:Q1 to 2011:Q2.
Newey-West standard errors in parentheses.
Average annual income and consumption growth are 2.78 and 2.91, respectively.
Using data up to 2011:Q3, forecast of growth between:
*2011:Q3 and 2012:Q3
**2012:Q3 and 2013:Q3

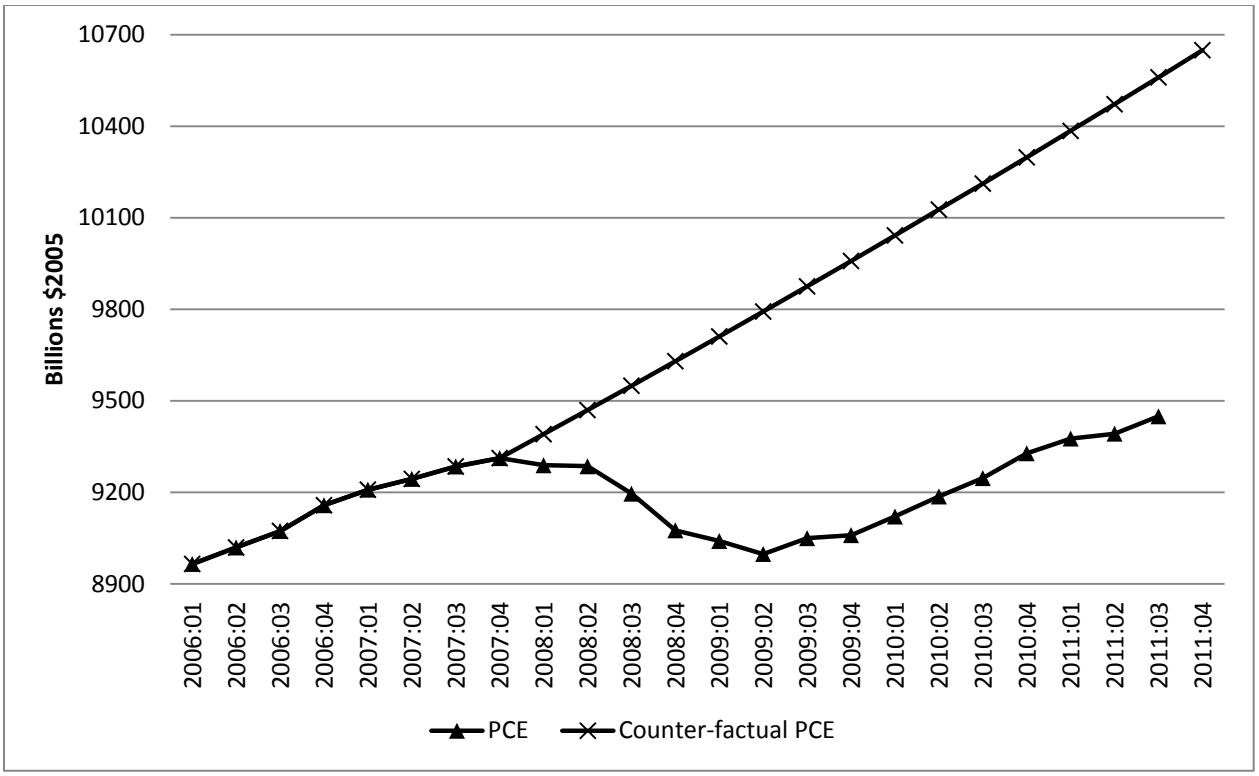
***2013:Q3 and 2014:Q3

Using a simple model to quantify the effects of the drops in wealth and income expectations

Data from the Federal Reserve Board of Governors' Flow of Funds shows that in 2008 American households experienced a loss of $13.6 trillion in wealth, with most of the loss concentrated in stock market wealth. Although stock market wealth partially recovered since then, housing wealth has continued to decline. The resulting wealth loss, combined with lower expected income growth, has the potential to explain why the consumers cut back consumption during the Great Recession to the extent that they did.

We turn to quantifying the effects of these declines by first calibrating a simple model of consumption that matches the observed level of consumption in 2007:Q4, and that implies empirically plausible marginal propensities to consume (MPCs) out of assets and permanent income. Then, we show model predicted consumption in 2011:Q2 under different expectations for income and asset values. We find that for reasonable parameter values, the decline in assets can explain 1/3 of the gap between actual and potential consumption, while declines in permanent income expectations can easily explain the other 2/3 of the gap.

Figure 16 Real Consumption Expenditures with and without the Great Recession



Model

Define C_t as consumption expenditures at time t (where time is measured in quarters).

Households maximize

1) $$\sum_{t=t_0}^{\infty} \beta^t \ln(C_t)$$

subject to the following asset accumulation equation,

2) $$A_{t+1} = (1+r)A_t + Y_t - C_t, \qquad A_{T+1} \geq 0$$

A_{t_0} given, and given income expectations. To avoid the additional complication of dealing with uncertainty, we assume that individuals are certain of future income. However, we allow them to revise their perceived income process if they make a mistake.

The solution to the consumer's problem is:

3) $$C_t = (1-\beta)(\tilde{Y}_t + A_t)$$

where

4) $$\tilde{Y}_t = \sum_{\tau=t}^{\infty} (1/(1+r))^{\tau-t} Y_\tau$$

is the present value of future labor income.

We compute $\tilde{Y}_t$ by assuming that consumers observe income up to 2011:Q2 and that from that point on, income expectations for the next year are those measured in the most recent Michigan Survey of Consumers, but then revert to long run income growth afterwards.

Mathematically, we can write this as

$$Y_{t+k} = (1+g_M)^k Y_t, \; k \leq 4$$

$$Y_{t+k} = (1+g) Y_{t+k-1}, \; k > 4$$

where Y_t is disposable income, g_M is the perceived real income growth for the next year in the 2010:Q4 (the most recent release of this variable suggests even more pessimism on consumer's part than in 2010:Q4) Michigan Survey of Consumers, while g is the average growth rate of income over the last 40 years. Putting these equations together yields

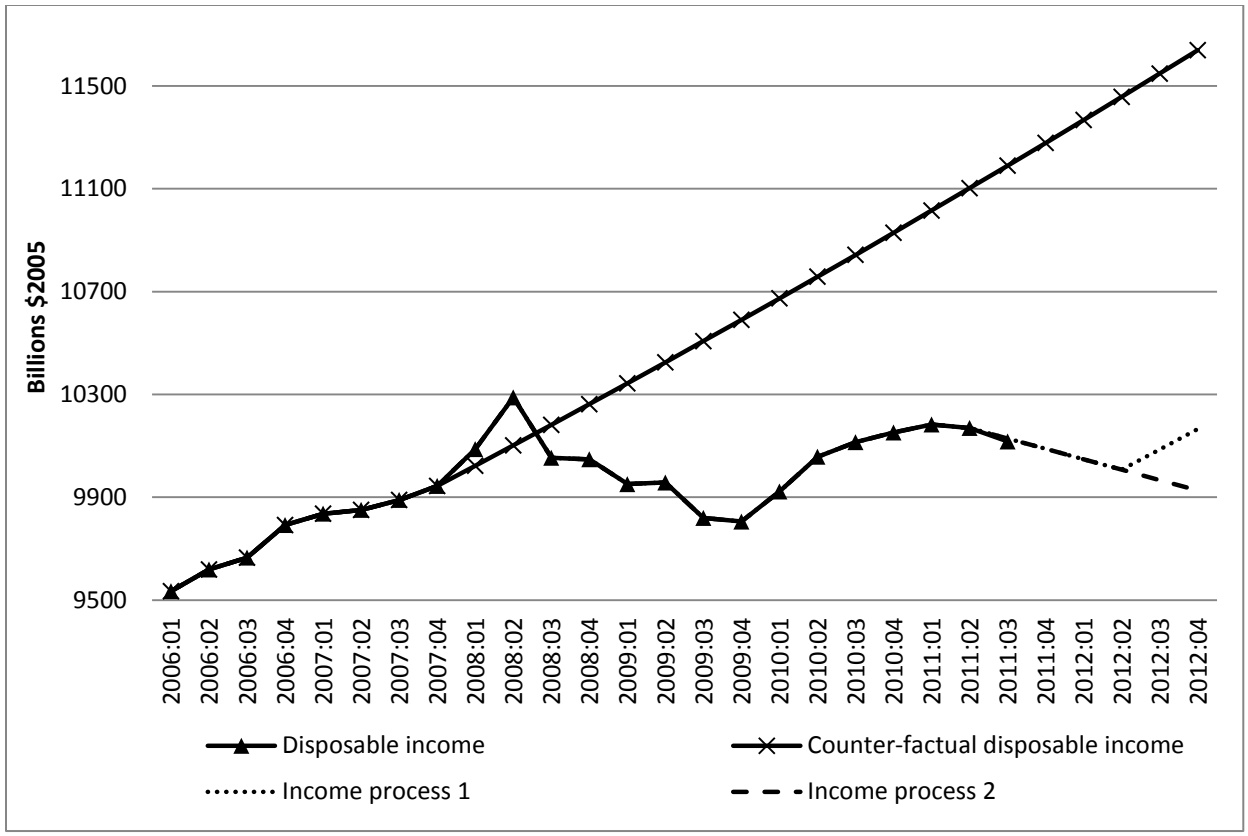
5)
$$\begin{aligned}
\tilde{Y}_t &= \sum_{\tau=t}^{\infty} (1/(1+r))^{\tau-t} Y_\tau \\
&= Y_t(1+(1+g_M)/(1+r)+((1+g_M)/(1+r))^2 \\
&\quad +((1+g_M)/(1+r))^3+((1+g_M)/(1+r))^4 \\
&\quad \times[1+(1+g)/(1+r)+((1+g)/(1+r))^2+\ldots] \\
&= Y_t(1+(1+g_M)/(1+r)+((1+g_M)/(1+r))^2 \\
&\quad +((1+g_M)/(1+r))^3+((1+g_M)/(1+r))^4 \tfrac{(1+r)}{(r-g)}).
\end{aligned}$$

We call the income process above income process 1. Then, to show the importance of low expected income growth, we consider a more pessimistic scenario, which we call income process 2, in which rather than reverting back to a long-run expected growth after four quarters, pessimism about income growth persists on forever. When this is the case,

6) $$\tilde{Y}_t = \sum_{\tau=t}^{\infty} (1/(1+r))^{\tau-t} Y_\tau$$
$$= Y_t(\tfrac{(1+r)}{(r-g_M)}).$$

Figure 17 reports four different lines for the time path of real disposable income since the beginning of 2007. The top crossed line shows counterfactual disposable income level, had it continued to grow at its historical average rate of 3.2% from 2007:Q4 on. The triangle line shows realized disposable income up to 2011:Q2. The dashed line begins with realized disposable income in 2011:Q2. It then tacks on the expected level of disposable income using expectation data from the Michigan Survey of Consumers for all periods thereafter. This corresponds to income process 2. The dotted line begins in 2012:Q2, assuming that income grows according to the Michigan Survey of Consumers between 2011:Q2 and 2012:Q4, and then grows at its historical rate afterwards. It corresponds to income process 1.

Figure 17. Disposable income and assumed income processes



Calibration

The three key moments we wish to match are the marginal propensity to consume (MPC) out of assets, the MPC out of permanent income, and the level of consumption in 2007:Q4.

Most estimates of the MPC out of assets are around .01-.05 and most estimates of the MPC out of permanent income are around .5-1. We assume the MPC out of assets is .03 per year. We use per capita income growth for the individual's decision problem. Thus we set $g = .032 - .014 = .018$ (average disposable income growth over the 1967:4 to 2007:4 period less population growth of those age 16+ over the same time period). We pick *r* and β to match the MPC out of assets and the level of consumption in 2007:Q4. Thus we match

$$\frac{\partial C_t}{\partial A_t} = (1-\beta) = .03$$

$$C_{2007:Q4} = (1-\beta)[Y_{2007:Q4}\frac{1+r}{r-g} + A_{2007:Q4}]$$

Where $C_{2007:Q4}$ = \$9,312.6 billion (at an annualized rate), $Y_{2007:Q4}$ = \$9,944 billion (annualized), and $A_{2007:Q4}$ = \$69,139 billion.

The unit of time in this analysis is a quarter, although so far we have been discussing all calibrations at annualized rates. We convert annual growth rates to quarterly ones, using the formula $(1+g)^{(1/4)}-1$ when taking the quarterly growth rate for g. For dollar amounts, we divide by 4. After converting everything to quarterly rates, we use the above two equations to solve for β and r. Table 1 presents all variables at quarterly and annualized rates. At annualized rates, β = .97 and r=.060.This gives a quarterly MPC out of permanent income equal to

$$\frac{\partial C_t}{\partial Y_t} = (1-\beta)[(1+r)/(r-g)] = .730$$

which is consistent with the evidence in the literature.

Over the last 40 years annual population growth for those aged 16+ is 1.4%, which we define as *p*. We assume this rate of population growth continues on into the future. Income growth in the individual's decision problem is in per capita terms. We then account for aggregate growth at the end by adjusting up disposable income by 1.4% at an annual rate.

Table 1: Model Parameters	Annual	Quarterly
Exogenously set		
g_M	-0.016	-0.0040
Population growth	0.014	0.0035
g	0.018	0.0045
MPC out of assets	0.03	0.0074

$Y_{2007:Q4}$	9,944	2486
$C_{2007:Q5}$	9,313	2,328
$A_{2007:Q4}$	69,139	69,139
Endogenously determined		
β	0.97	0.993
r	0.060	0.015
Implied MPC out of income		0.730

Results

Table 2 explains our key findings. All quarterly numbers in this section are annualized; i.e., they are the quarterly numbers multiplied by 4. Consumption expenditures in 2011:Q2 were $9.379 trillion. Had they grown at average rates from 2007:Q4 on, they would have been at $10.472 trillion in 2011:Q2, which is 10% higher than it is today. This difference of $1.069 trillion, line 3 of the table, is the shortfall we seek to explain with the model. Figure 16 depicts this shortfall graphically.

Table 2: Results

Realized consumption level 2011:Q2	9379
Predicted consumption level 2011:Q2 given information in 2007:Q4	10472
Consumption loss	1093
Consumption loss due to asset value decline	
Asset value decline	9746
Predicted consumption decline due to asset price decline	289
Consumption loss given disposable income decline	
Income process 1	917
Income process 1 and lower short-term interest rate	710
Income process 2	4038
Consumption loss given both asset and income declines	
Income process 1	1206
Income process 1 and lower short-term interest rate	999
Income process 2	4328

Note: All amounts in Billions of dollars

Lines 5 and 6 in Table 2 study the effects of the decline in asset prices. Net worth fell $9.746 trillion in real terms over this time period. Given a quarterly MPC of .0074, we predict a ($9.746 trillion)X(.0074)X4 = $.289 trillion fall in consumption, at an annualized rate.

The following lines in the table predict the consumption fall due to various permanent income scenarios. To perform this computation, we first put ourselves in 2007:Q4 and predict $\tilde{Y}$ as of 2011:Q2, had income grown steadily at its long-run historical average. Second, we calculate $\tilde{Y}$ given realized income in 2007:Q4 and the two income processes that we have described previously. To be clear, taking into account population growth rates, we calculate $\tilde{Y}_{2011:Q2}$, given information set from 2007:Q4 = $\tilde{Y}_{2007:Q4} = Y_{2007:Q4} \frac{1+r}{r-g}((1+p)(1+g))^{14}$, where 14 is the number of quarters between 2007:Q2 and 2011:Q4.

Once we calculate the loss in $\tilde{Y}$ under different income and interest rate scenarios, we use the model to calculate the resulting consumption loss. The consumption loss associated with income process 1 is \$0.917 trillion, which is reasonably close to the observed consumption loss. This computation is sensitive to the time path of the interest rate as well. The baseline calibration yields a yearly interest rate of 6%. In the lower short term interest rate scenario we assume that over the first year the yearly interest rate is 3% and then reverts back to 6%. In this case, income is less heavily discounted, hence its present value is higher and the implied consumption drop is \$710 billion rather than \$917 billion. Unsurprisingly, the very pessimistic income expectation scenario considered in Income process 2, generates a huge consumption loss of \$4.038 trillion, which is almost 4 times larger than the consumption shortfall we wish to explain.

Because our model predicts that consumption is linear in resources (assets and the present value of future income), we can add up losses from assets and income. Note that the predicted consumption decline given the asset fall plus the predicted decline given income process 1 of \$1.206 trillion lines up almost exactly with what is in the data.

Conclusions

This article documents key facts about aggregate consumption and its subcomponents and looks at the behavior of important determinants of consumption over the cycle, such as consumption is consumer's expectations about their future income, and changes in the consumers' wealth positions due to changes in house prices and stock valuation. We performed a simple computation to determine whether the observed drop in consumption can be explained by the observed drops in wealth and income expectations.

In the context of a simple permanent income model, we find that the negative wealth effect (coming from decreased stock market valuation and housing prices) and decreased consumer's income expectations were big factors in determining the observed consumption drop. In fact, we find that in this model the observed drops in wealth and income expectations can explain the observed drop in consumption in its entirety, depending on what is assumed about future income growth going forward, beyond the time horizon covered by the Michigan Survey of Consumers data set.

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