Response of Consumption to Income Shocks

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Random-Walk Hypothesis

- Consumption Euler equation with uncertainty:

$$U'(C_t) = \beta(1+r)E_t[U'(C_{t+1})]$$

- with $\beta(1+r) = 1$:

$$U'(C_t) = E_t[U'(C_{t+1})]$$

- Marginal utility is a martingale:
  - Best current predictor of tomorrow's marginal utility is today's marginal utility

Random-Walk Hypothesis

- Suppose marginal utility is linear (i.e., quadratic utility):

$$C_t = E_t C_{t+1}$$

- Consumption a martingale!!

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- Suppose marginal utility is linear (i.e., quadratic utility):

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- Consumption a martingale!!
- This is Robert Hall's (1978) random walk hypothesis
  - Very controversial at the time
  - Seems "obvious" today

    (Are we too conditioned by our models?)

Random Walk Hypothesis

$$E_t C_{t+1} = C_t$$
$$C_{t+1} = C_t + \epsilon_{t+1}$$

where $\epsilon_{t+1} = C_{t+1} - E_t C_{t+1}$

- Two important properties of ϵ_{t+1}:
  - Since it is an expectations error, it is uncorrelated with information known at time t or earlier
  - It is proportional to the innovation to the consumer's present value of life-time income ("permanent income" for short)

Random Walk Hypothesis

- Infinite horizon case:

$$C_t = \frac{r}{1+r}\left(A_t + \sum_{j=0}^{\infty}(1+r)^{-j}E_t Y_{t+j}\right)$$

$$\Delta C_{t+1} = \epsilon_{t+1} = \frac{r}{1+r}\sum_{j=0}^{\infty}(1+r)^{-j}\Delta E_{t+1} Y_{t+1+j}$$

where $\Delta E_{t+1} Y_{t+1+j} = E_{t+1} Y_{t+1+j} - E_t Y_{t+1+j}$

Empirical Implications

- Response to anticipated changes in income: Zero
- Response to transitory unanticipated change in income: Small
  - Marginal propensity to consume
  - Something like 2-5% per year
- Response to permanent unanticipated change in income: Large
  - 1% permanent increase in income raises “permanent income” by 1% (ignoring assets) and should therefore raise consumption by 1%

Early Tests

- Random walk hypothesis implies that consumption growth should be unpredictable. I.e., unforecastable using lagged variables
- Suggests following regression test:

$$\Delta C_{t+1} = \alpha + \mathbf{X}_t \beta + \epsilon_{t+1}$$

  where $\mathbf{X}_t$ is a set of regressors known at time t and the test is $\beta = 0$

- Hall (1978) performed tests along these lines:
  - Failed to reject for lagged values of income and consumption
  - Rejected using lagged value of stock market
  - Interpreted results in favor of hypothesis

Campbell and Mankiw (1989)

- Rejections in early tests hard to interpret
    - Are they economically meaningful?
    - Even very accurate models can be rejected with enough data
- Useful to have a specific alternative hypothesis
- Two types of consumers:
    - Fraction λ are "hand-to-mouth", i.e., consume their income
    - Fraction $1 - \lambda$ are rational PIH consumers

Campbell and Mankiw (1989)

- Implies

$$\Delta C_t = \lambda \Delta Y_t + (1-\lambda)\epsilon_t$$

  i.e., consumption growth is a weighted average of income growth and growth in permanent income

- Important complication:
  - ΔY_t and ϵ_t are likely correlated. Why?

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- Important complication:
  - ΔY_t and ϵ_t are likely correlated. Why?
  - Recall that ϵ_t denotes innovations to permanent income
  - Changes in current income likely correlated with innovations to permanent income

An IV Approach

$$\Delta C_t = \lambda \Delta Y_t + (1 - \lambda)\epsilon_t$$

- Can we think of instruments that will work in this case?

  (Hint: Error term is an expectation error)

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- Can we think of instruments that will work in this case?
  (Hint: Error term is an expectation error)
- Any variable know at time $t - 1$ works as an instrument
- Since ϵ_t is an expectation error, it is orthogonal to all variables known at time $t - 1$ or earlier
- So, we can use lags of anything as instruments
  (Wow, lots of possible instruments)

Additional Complications

- Consumption homoskedastic in logs rather than levels
  - Regression in levels would suffer from heteroskedasticity
  - Campbell-Mankiw take logs (i.e., log-linear approximation)
  - Alternative to divide through by, e.g., C_{t-1}
- C_t is a time average over a quarter
  - Even if C_t were a random walk, time averaging would imply serial correlation of changes (Working, 1960)
  - Campbell and Mankiw (1989) lag instruments by 2 periods to avoid this

Table 1 UNITED STATES 1953–1986
$\Delta c_y = \mu + \lambda \Delta y_t$

Row	Instruments	First-stage regressions: Δc equation	First-stage regressions: Δy equation	λ estimate (s.e.)	*Test of restrictions*
1	None (OLS)	—	—	0.316 (0.040)	—
2	$\Delta y_{t-2}, \ldots, \Delta y_{t-4}$	−0.005 (0.500)	0.009 (0.239)	0.417 (0.235)	−0.022 (0.944)
3	$\Delta y_{t-2}, \ldots, \Delta y_{t-6}$	0.017 (0.209)	0.026 (0.137)	0.506 (0.176)	−0.034 (0.961)
4	$\Delta c_{t-2}, \ldots, \Delta c_{t-4}$	0.024 (0.101)	0.045 (0.028)	0.419 (0.161)	−0.009 (0.409)
5	$\Delta c_{t-2}, \ldots, \Delta c_{t-6}$	0.081 (0.007)	0.079 (0.007)	0.523 (0.131)	−0.016 (0.572)
6	$\Delta i_{t-2}, \ldots, \Delta i_{t-4}$	0.061 (0.010)	0.028 (0.082)	0.698 (0.235)	−0.016 (0.660)
7	$\Delta i_{t-2}, \ldots, \Delta i_{t-6}$	0.102 (0.002)	0.082 (0.006)	0.584 (0.137)	−0.025 (0.781)
8	$\Delta y_{t-2}, \ldots, \Delta y_{t-4}$, $\Delta c_{t-2}, \ldots, \Delta c_{t-4}$, $c_{t-2} - y_{t-2}$	0.007 (0.341)	0.068 (0.024)	0.351 (0.119)	−0.033 (0.840)
9	$\Delta y_{t-2}, \ldots, \Delta y_{t-4}$ $\Delta c_{t-2}, \ldots, \Delta c_{t-4}$, $\Delta i_{t-2}, \ldots, \Delta i_{t-4}$, $c_{t-2} - y_{t-2}$	0.078 (0.026)	0.093 (0.013)	0.469 (0.106)	−0.029 (0.705)

Note: The columns labeled "First-stage regressions" report the adjusted R^2 for the OLS regressions of the two variables on the instruments; in parentheses is the p-value for the null that all the coefficients except the constant are zero. The column labeled "λ estimate" reports the IV estimate of λ and, in parentheses, its standard error. The column labeled "Test of restrictions" reports the adjusted R^2 of the OLS regression of the residual on the instruments; in parenthesis is the p-value for the null that all the coefficients are zero.

Source: Campbell and Mankiw (1989)

Main Takeaways

- Estimate λ of roughly 0.5
- Strongly reject $\lambda = 0$ (random walk hypothesis)
- Lagged income growth weak instruments
- Lagged consumption growth much stronger instruments
  - Consumption seems to encode information about future income growth
- This type of rejection of random walk hypothesis is often referred to as “excess sensitivity”

Limitations of Macro-Data Tests

- Few observations
- Difficult to find variables with much predictive power for income
- Rely on strong assumption that ϵ_t is only a expectations error
  - If not true, hard to find a valid instrument
- Rely on strong aggregation assumptions
  (see, e.g., Attanasio and Weber, 1993, 1995)

Tests Using Micro Data

Large literature has analyzed anticipated changes in income at the household level:

- Wilcox (1989): Preannounced increases in social security benefits
- Parker (1999): Reaching Social Security payroll cap
- Souleles (1999): Receipt of tax refund
- Souleles (2002): Reagan tax cuts
- Johnson, Parker, Souleles (2006): 2001 tax rebate
- Parker, Souleles, Johnson, McClelland (2013): 2008 tax rebate
- Hsieh (2003) and Kueng (2015): Alaska Permanent Fund payments

Anticipated or Unanticipated

- All these income changes are pre-announced
- But many were (likely) not very salient to households
    - I received 2008 in the mail and was pleasantly surprised
- Does it matter whether consumers knew?

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  - I received 2008 in the mail and was pleasantly surprised
- Does it matter whether consumers knew?
- If transitory, probably not that much
  - Don't affect permanent income much
  - MPC out of transitory income shock should be very small
- If persistent (Wilcox 89, Souleles 02) matters more

Parker-Souleles-Johnson-McClelland 2013

- Economic Stimulus Act of February 2008
- $100 billion of tax rebates to 130 million US tax filers
  - Single filers received $300-$600
    (max of $300 and tax liability up to $600)
  - Couples received $600-$1200
  - Fazed out for incomes above $75,000 ($150,000 for couples)

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- Timing of dispersement based on last two digits of SSN
  (effectively random)
- Compare spending of households that received payment
  at different dates

Table 1—The Timing of the Economic Stimulus Payments of 2008

Payments by electronic funds transfer		*Payments by mailed check*	
Last two digits of taxpayer SSN	Date ESP funds transferred to account by	Last two digits of taxpayer SSN	Date check to be received by
00–20	May 2	00–09	May 16
21–75	May 9	10–18	May 23
76–99	May 16	19–25	May 30
		26–38	June 6
		39–51	June 13
		52–63	June 20
		64–75	June 27
		76–87	July 4
		88–99	July 11

Source: Internal Revenue Service (http://www.irs.gov/newsroom/article/0,,id=180247,00.html).

Source: Parker et al. (2013)

Nature of Income Shock

- Should be anticipated (program highly publicized)
  - Consumption response should be a lower bound on response of an unanticipated income change
  - Some of the effect may have occurred upon announcement
- Totally transitory

DATA

- Main data source: Consumer Expenditure Survey
- Households surveyed 4 times with 3 month intervals about spending over past 3 months
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- Households surveyed 4 times with 3 month intervals about spending over past 3 months
- New households added each month
- Authors worked with BLS to add questions about receipt of stimulus payments
  - Did they receive stimulus payment?
  - When did they receive it?
  - How much did they receive?

Empirical Specification

$$C_{i,t+1} - C_{i,t} = \sum_s \beta_{0s} \times month_{s,i} + \beta_1' X_{i,t} + \beta_2 ESP_{i,t+1} + u_{i,t+1}$$

- Dependent variable: 3-month change in consumption
- Independent variable of interest: $ESP_{i,t+1}$

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  - Soaks up all aggregate effects
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  - Identification comes from cross section
    Comparison of those that get ESP at time $t+1$ and those that don't

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  - Identification comes from cross section
    Comparison of those that get *ESP* at time $t+1$ and those that don't
- $X_{i,t}$ to soak up some variation from error term

TABLE 2—THE CONTEMPORANEOUS RESPONSE OF EXPENDITURES TO ESP RECEIPT AMONG ALL HOUSEHOLDS

	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS
Panel A. Dollar change in spending								
ESP	0.016	0.079	0.121	0.516				
	(0.027)	(0.046)	(0.055)	(0.179)				
I(*ESP*)					10.9	74.8	121.5	494.5
					(31.7)	(56.6)	(67.2)	(207.2)

	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS	Food 2SLS	Strictly nondurables 2SLS	Nondurable spending 2SLS	All CE goods and services 2SLS
	Panel B. Percent change in spending				*Panel C. Dollar change in spending*			
ESP					0.012	0.079	0.128	0.523
					(0.033)	(0.060)	(0.071)	(0.219)
I(*ESP*)	0.69	1.74	2.09	3.24				
	(1.27)	(0.96)	(0.94)	(1.17)				

Notes: All regressions also include a full set of month dummies, age, change in the number of adults, and change in the number of children following equation (1). Reported standard errors are adjusted for arbitrary within-household correlations and heteroskedasticity. The coefficients in panel B are multiplied by 100 so as to report a percent change. The last four columns report results from 2SLS regressions where the indicator variable for ESP receipt and the other regressors are used as instruments for the amount of the ESP. All regressions use 17,478 observations except for the first two columns of panel B which have only 17,427 and 17,475, respectively.

Source: Parker et al. (2013)

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    (if high income people did relatively well or badly in this period)

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- 2nd set of results use $I(ESP > 0)$

  (i.e., only whether household received ESP, not how much)

Table 2—The Contemporaneous Response of Expenditures to ESP Receipt among All Households

	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS
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  (i.e., only whether household received ESP, not how much)
- Panel C uses 2SLS with $I(ESP > 0)$ as an instrument for $ESP_{i,t+1}$
  - First stage: $ESP_{i,t+1}$ on $I(ESP > 0)$
  - Reduced form: $C_{i,t+1} - C_{i,t}$ on $I(ESP > 0)$
  - IV is ratio of these two

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- Three approaches:
  - Control for receipt of payment
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Table 3—The Response to ESP Receipt among Households Receiving Payments

	Dollar change in		Percent change in		Dollar change in	
	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending 2SLS	All CE goods and services 2SLS
Panel A. Sample of all households ($N = 17{,}478$)						
ESP	0.117	0.507			0.123	0.509
	(0.060)	(0.196)			(0.081)	(0.253)
$I(ESP)$			2.63	3.97		
			(1.07)	(1.34)		
$I(ESP_{i,t} > 0 \text{ for any } t)_i$	9.58	21.21	−0.88	−1.17	8.23	20.77
	(36.07)	(104.00)	(0.50)	(0.63)	(38.79)	(112.18)
Panel B. Sample of households receiving ESPs ($N = 11{,}239$)						
ESP	0.185	0.683			0.252	0.866
	(0.066)	(0.219)			(0.103)	(0.329)
$I(ESP)$			3.91	5.63		
			(1.33)	(1.69)		
Panel C. Sample of households receiving only on-time ESPs ($N = 10{,}488$)						
ESP	0.214	0.590			0.308	0.911
	(0.070)	(0.217)			(0.112)	(0.342)
$I(ESP)$			4.52	6.05		
			(1.50)	(1.89)		

Source: Parker et al. (2013)

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  (again, correlated with income)
- Three approaches:
  - Control for receipt of payment
  - Only households that received payment
  - Only households that reported receiving payment on time
- Most of later results with this last sample
- Results significant, but standard errors not trivial

Longer-Term Impact

- Do effects reverse or build over time?
  - Add lagged term to regression

TABLE 5—THE LONGER-RUN RESPONSE OF EXPENDITURES TO ESP RECEIPT

	Dollar change in		Percent change in		Dollar change in	
	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending 2SLS	All CE goods and services 2SLS
ESP_{t+1} or $I(ESP_{t+1})$	0.201	0.517	3.92	4.96	0.254	0.757
	(0.067)	(0.211)	(1.55)	(1.96)	(0.110)	(0.360)
ESP_t or $I(\mathrm{ESP}_t)$	−0.054	−0.288	−1.23	−2.22	−0.097	−0.278
	(0.080)	(0.214)	(1.50)	(1.92)	(0.113)	(0.330)
Implied spending effect in second three-month period	0.146	0.230	NA	NA	0.156	0.479
	(0.104)	(0.303)			(0.177)	(0.568)
Implied cumulative fraction of rebate spent over both three-month periods	0.347	0.747	NA	NA	0.410	1.235
	(0.155)	(0.477)			(0.273)	(0.892)

Notes: All regressions also include the change in the number of adults, the change in the number of children, the age of the household, and a full set of month dummies. The sample includes only households receiving only on-time ESPs. Standard errors are adjusted for arbitrary within-household correlations and heteroskedasticity. The coefficients in the second triplet of columns are multiplied by 100 so as to report a percent change. The final triplet of columns reports results from 2SLS regressions where $I(ESP)$ and the other regressors are used as instruments for ESP. The number of observations for all regressions is 10,488.

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- Growth slightly negative in next quarter
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- Do effects reverse or build over time?
  - Add lagged term to regression
- Growth slightly negative in next quarter
- But level still above control group
- Point estimate thus suggests higher spending persists and longer term impact bigger than short-term impact
- Standard errors large

What Did They Spend It On?

Table 7—The Propensity to Spend on Subcategories of Expenditures

	Panel A. Food			*Panel B. Additional categories in strictly nondurables*			
Dependent variable:	Food at home	Food away from home	Alcoholic beverages	Utilities, household operations	Personal care and misc.	Gas, motor fuel, public transportation	Tobacco products
Coefficient on ESP	0.050	0.025	0.011	0.059	0.083	0.027	0.007
Standard error	(0.032)	(0.033)	(0.007)	(0.027)	(0.049)	(0.039)	(0.009)
Implied share of increase in nondurable spending	0.16	0.08	0.04	0.19	0.27	0.09	0.02
Share of avg. spending on subcategory	0.23	0.11	0.01	0.23	0.04	0.16	0.01

	Panel C. Additional categories in nondurables			*Panel D. Additional categories in total CE spending*			
Dollar change in spending on:	Apparel	Health	Reading	Housing (incl. furnishings)	Entertainment	Education	Transportation
Coefficient on ESP	0.022	0.025	−0.001	0.099	0.077	−0.100	0.527
Standard error	(0.021)	(0.048)	(0.003)	(0.092)	(0.099)	(0.042)	(0.269)
Implied share of increase in:							
Nondurable spending	0.07	0.08	0.00				
Durable spending				0.16	0.13	−0.17	0.87

What Did They Spend It On?

Panel E. Subcategories of transportation

Dollar change in spending on:	New vehicle purchases	Used vehicle purchases	Other vehicle purchases	Maintenance and repairs	Other, insurance fees, etc.
Coefficient on ESP	0.357	0.123	0.011	0.009	0.027
Standard error	(0.204)	(0.149)	(0.054)	(0.028)	(0.024)
Implied share of increase in durable spending					
	0.59	0.20	0.02	0.01	0.04
Share of average durable spending					
	0.07	0.06	0.01	0.04	0.09

Source: Parker et al. (2013)

What Did They Spend It On?

- For non-durables: alcohol, personal care, tobacco, apparel
- For durables: cars

What Did They Spend It On?

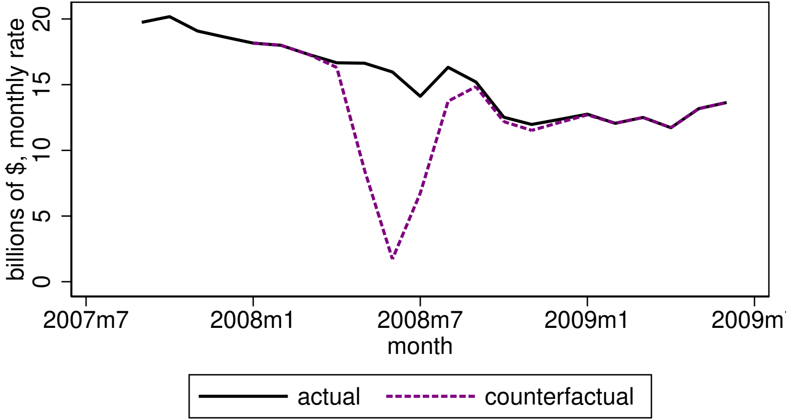
- For non-durables: alcohol, personal care, tobacco, apparel
- For durables: cars
- Large effect on cars suggests ESP provided down payment for debt-financed cars (alleviated liquidity constraints)
- Possible reversal for cars:
  - Did it move everyone forward a few months (no reversal)?
  - Or did those that didn't buy immediately, spend it on something else and become liquidity constrained again (subsequent reversal)?

Is the Magnitude Plausible?

- It has become common to view an MPC of 0.25-0.30 as a reasonable target in theoretical work on consumption
- But are the magnitudes of the effects in Parker et al. (2013) plausible?
- Orchard, Ramey, and Wieland (2023) argue effects including durables are not
- First pass: What would New Motor Vehicle spending have been absent the stimulus checks
  - Based on earlier work by Sahm, Shapiro, and Slemrod (2012)
  - "Partial equilibrium" counterfactual (everything else equal)

Is the Magnitude Plausible?

Figure 1. Expenditures on New Motor Vehicles: Actual vs. Counterfactual



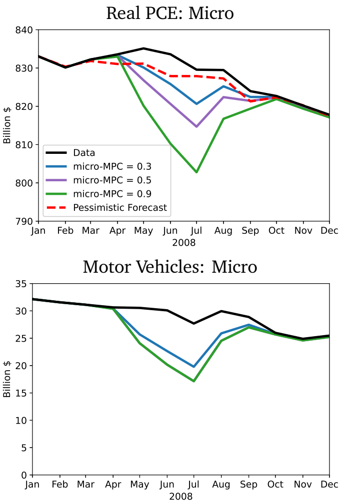
Note. Based on Sahm, Shapiro, and Slemrod calculations applied to revised data.
Source: Orchard, Ramey, Wieland (2023)

Worse in Standard New Keynesian Model

- Build a standard two-agent New Keynesian model
  - PIH agent and hand-to-mouth agent
- Counterfactual even more extreme
- Dominant GE force: Keynesian multiplier

Is the Magnitude Plausible?

Figure 4. Counterfactual Real Consumption Expenditures: Baseline Model



Source: Orchard, Ramey, Wieland (2023). This is total motor vehicles, not new motor vehicles.

Two Possible Reasons

- General equilibrium dampening
  - Parker et al. (2013) only estimate relative effects
  - Perhaps control group was affected
  - Higher demand for cars may have raised the price of cars
- Problems with specification / estimator (two-way fixed effects)
  - Causal effect is dynamics (rise and fall).
    Specification must take that into account, or else it is misspecified
  - In the presence of heterogeneous treatment effects,
    two-way fixed effects can have problems
    (e.g., Sun and Abraham 2020, Borusyak, Jaravel, Spiess, 2022)
  - Households have low consumption in period before they report a rebate

Dynamic Causal Effect

$$C_{i,t+1} - C_{i,t} = \sum_s \beta_{0s} \times month_{s,i} + \beta_1' X_{i,t} + \beta_2 ESP_{i,t+1} + u_{i,t+1}$$

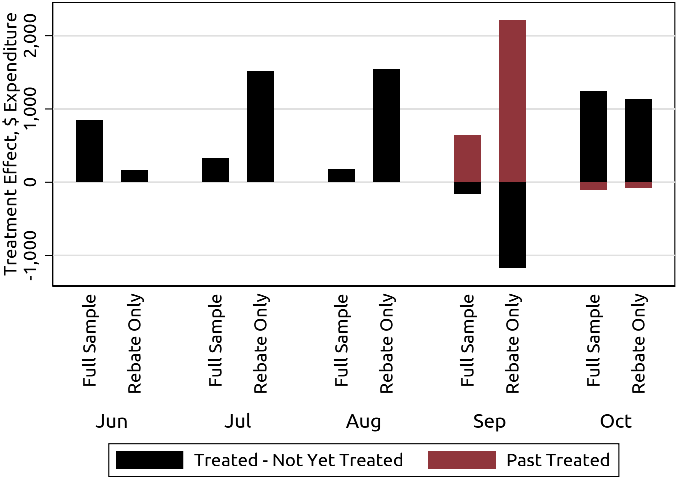
- Suppose true causal effect is dynamics: Consumption rises, then falls
- If specification is not dynamic (i.e., no lags), some "control" observations will be experiencing post-treatment fall in consumption
- This will "contaminate" the controls
- Adding lagged treatment "fixes" this problem (as Parker et al. (2013) do in their Table 5)

Forbidden Comparisons

- Critiques of two-way fixed effect regressions focus on the use of always-treated / earlier-treated units as controls
- Basic idea: If treatment effect ($Y_{i,t}(1) - Y_{i,t}(0)$) is different at different times, always-treated / earlier-treated units will not be valid controls
- But potential outcome if untreated ($Y_{i,t}(0)$) may also vary over time. Not clear this issue is less important
- Diff-in-Diff and TWFE are fundamentally parametric.
    - Hard to say anything without some assumptions
    - Whether a given assumption (about $Y_{i,t}(1) - Y_{i,t}(0)$ or $Y_{i,t}(0)$) is problematic will depend on setting

Heterogeneous Treatment

Figure 6. TWFE Coefficients in the Full and Rebate Only Samples By Month



Source: Orchard, Ramey, Wieland (2023). Black bars are recipients versus not-yet or never treated. Red bars are recipients versus previously treated.

Lower Lagged Consumption

Table 4. Negative effect of future rebate receipt on current expenditure

	Full Sample (1)	Rebate Recipients Only (2)
Lead Rebate Indicator	-866.5^{***}	-562.0^{*}
	(289.5)	(335.9)
Rebate Indicator	-383.4	246.1
	(303.8)	(377.8)
Observations	16,962	10,076

Notes: The dependent variable is the Level of PCE. Regressions include interview (time) fixed effects, and household level controls for age, change in number of adults, and change in number of children.Standard errors, in parentheses, are clustered at the household level: $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Source: Orchard, Ramey, Wieland (2023). Anticipation effect? Recall bias?

Different Estimates

Panel B: Rebate Recipients Only				
	Homogeneous Treatment Effect		Heterogeneous Treatment Effect	
	(1)	(2)	(3)	(4)
Rebate Indicator	811.07**	544.36	633.99	355.01
	(323.27)	(344.12)	(406.07)	(500.40)
Lag Rebate Indicator		−481.50	−203.34	−345.32
		(374.61)	(325.30)	(361.87)
Lag Total Expenditure				−0.29***
				(0.02)
Lag Motor Vehicle				−0.71***
				(0.03)
Implied 3-month MPC	0.87	0.58	0.67	0.37
Implied 6-month MPC		0.63	1.14	0.06
6-Month MPC S.E.		(0.93)	(1.08)	(1.19)
Income Decile FE	No	No	No	Yes
Observations	10,076	10,076	10,076	10,076

Notes: The dependent variable is the change in Personal Consumption Expenditure (PCE). Regressions include interview (time) fixed effects, and household level controls for age, change in number of adults, and change in number of children. Standard errors for the 6-month MPC are estimated via Delta-method. The rebate coefficients in columns (3) and (4) are the weighted average of the interaction between rebate cohort and the (lagged) rebate indicator with weights computed following Sun and Abraham (2021). Standard errors, in parentheses, are clustered at the household level: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Orchard, Ramey, Wieland (2023).

Zero on Everything Other than Motor Vehicles

Table 5. Household Spending Response to Rebate by Subcategory

	Full Sample		Rebate Only Sample	
	Motor Vehicles (1)	Other PCE (2)	Motor Vehicles (3)	Other PCE (4)
Rebate Indicator	308.41***	−20.28	286.72*	68.29
	(114.69)	(145.54)	(173.35)	(460.16)
Lag Rebate Indicator	129.58	−181.36	138.07	−483.39
	(94.72)	(133.82)	(120.18)	(343.67)
Lag Total Expenditure	0.02***	−0.28***	0.02***	−0.32***
	(0.01)	(0.03)	(0.01)	(0.02)
Lag Motor Vehicle	−1.04***	0.30***	−1.04***	0.33***
	(0.01)	(0.03)	(0.01)	(0.03)
Implied 3-month MPC	0.33	-0.02	0.30	0.07
Income Decile FE	Yes	Yes	Yes	Yes
Observations	16,962	16,962	10,076	10,076

Source: Orchard, Ramey, Wieland (2023).

Hsieh (2003)

- Parker (1999) and Souleles (1999) find that households respond to predictable changes in income
  - Parker (1999): Households hitting SS tax limit
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  2. Too small and irregular for households to plan for
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  1. Failure of "LC-PIH"
  2. Too small and irregular for households to plan for
     (but why does that mean spend as opposed to save)
- Browning and Collado (2001) study large predictable seasonal variation in earnings in Spain and find no response of consumption

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- Payments are large and predictable
- Finds no response of consumption to these payments
- In contrast, finds that Alaskan household are excessively sensitive to income tax rebates
- Concludes: Households will behave according to "LC-PIH" when it comes to large and regular payments

The Alaska Permanent Fund

- Created in 1976
- 25% of states governement's oil royalties go to fund
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- Subject to eligibility, every resident gets the same amount
  - Amount equal to $payment_t \times familysize_h$
- Over sample period, payments varied from low of \$331 in 1984 to high of \$1,964 in 2000
- Good for testing "LC-PIH":
  - Payments are large and predictable
  - Application in March. Dispersement in October. Amount set in September. But estimated by newspapers before that.

Data

- Main data source: Consumer expenditure survey
- Aggregates observations to household level
- Drops households in student housing, lacking family size, age of head of household, or food expenditures. Also drops movers.
- Total number of observations: about 800

TABLE 1—SAMPLE STATISTICS

	Alaska		Other 49 states	
	Mean	Standard deviation	Mean	Standard deviation
Monthly consumption (July–September)				
Nondurable consumption	1,107	(998)	792	(656)
Food and alcohol	412	(221)	310	(211)
Apparel and services	109	(139)	83	(119)
Entertainment and personal care	161	(744)	83	(358)
Durable consumption	713	(1,178)	528	(1,097)
Monthly Consumption (October–December)				
Nondurable consumption	1,109	(646)	802	(601)
Food and alcohol	396	(210)	296	(197)
Apparel and services	140	(186)	103	(147)
Entertainment and personal care	142	(208)	83	(236)
Durable consumption	643	(962)	512	(996)
Family size	2.7	(1.5)	2.6	(1.5)
Age	42.1	(13.3)	48.9	(17.6)
Pretax family income (monthly)	2,898	(2,341)	2,068	(2,169)
Alaska dividend fund income (per family)	2,048	(1,310)		
Number of observations	806		56,801	

Notes: All nominal values were converted to 1982–1984 dollars. Alaska dividend fund income is for observations from 1984–2000.

Source: Hsieh (2003)

Excess Sensitivity Test

$$\log\left(\frac{C_{th}^{IV}}{C_{th}^{III}}\right) = \alpha_1 \frac{PFD_t \times familysize_h}{Familyincome_h} + z_{th}'\alpha_2 + \epsilon_{th}$$

- C_{th}^{IV} is non-durable consumption of household h in quarter IV
- PFD_t is Permanent Fund payout per person in year t
- z_h contains constant, change in # adults, # children, 2nd order polynomial in age of household head
- α_1 measures elasticity of household consumption with respect to increase in income due to Permanent Fund payments

TABLE 2—RESPONSE OF CONSUMPTION TO ALASKA PFD

	dlog(*Nondurable consumption*)			dlog(*Durable consumption*)		
	(1)	(2)	(3)	(4)	(5)	(6)
$\dfrac{PFD_t \times Family\ Size_h}{Family\ Income_h}$	0.0002	−0.0167	−0.0034	−0.1659	−0.1741	−0.1488
	(0.0324)	(0.0336)	(0.0328)	(0.0878)	(0.0916)	(0.0890)
Controls for:						
Family size	No	No	Yes	No	No	Yes
Year dummies	No	Yes	No	No	Yes	No
Number of observations	806	806	806	806	806	806

Notes: Dependent variable is $\log(C_{IV}/C_{III})$. Standard errors are in parentheses. All regressions are ordinary least squares (OLS) and include a quadratic in age and changes in the number of children and adults in the household.

Source: Hsieh (2003)

No Excess Sensitivity for Non-Durables

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- Typical shock 20%. Response 0.004 percent or 4 cents.

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- Perhaps seasonal pattern is different for households of different size
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- Baseline elasticity for non-durable consumption 0.0002 (s.e. 0.0324)
- Typical shock 20%. Response 0.004 percent or 4 cents.
- Baseline estimated from variation across years and across family size
- Perhaps seasonal pattern is different for households of different size
  - 3rd column controls for family size (only uses variation across time)
- But perhaps seasonal pattern varied over time
  - 2nd column controls for time effects (only uses variation in family size)

Negative Sensitivity for Durables

- Elasticity for durables negative and significant: -0.166 (0.088)
- Suggests households purchase durables in 3rd quarter, before payments are made
- This is consistent with theory, since this is when payment amount becomes known

What Do They Do With Money?

- CEX only asks about income and assets in 1st and 4th interview
- Not possible to see what each household does with payments
- But survey starting dates random throughout year
- Can construct estimates for representative Alaskan family

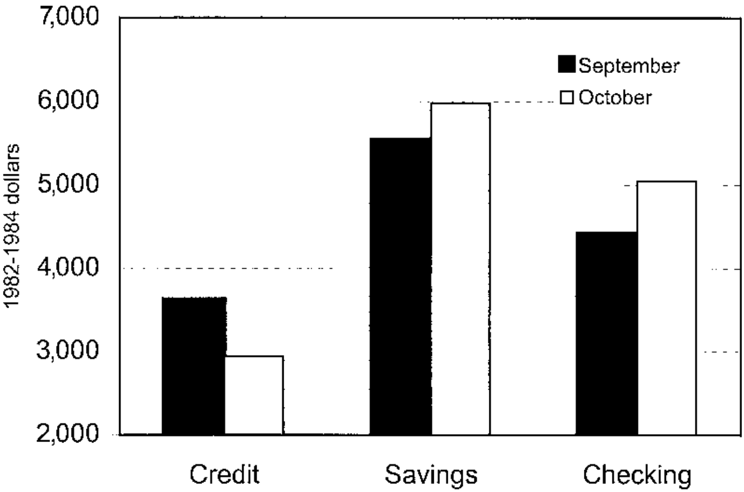

FIGURE 1. AVERAGE CONSUMER DEBT AND BALANCES IN SAVINGS AND CHECKING ACCOUNTS (ALASKA RESIDENTS)

Source: Hsieh (2003) – Credit down by $680, savings and checking up by $440 and $640, respectively. Average received from Fund: $2,000.

Why Are Results So Different from Previous Literature?

- Perhaps Alaskan households less liquidity constrained
  - But they are substantially younger ...
  - And results hold for those with low income
- Perhaps due to size and visibility of payments
- Check this by considering response to income tax receipts (as in Souleles 1999)

Table 6—Response of Nondurable Consumption to Income Tax Refunds and PFD

	dlog(*Nondurable consumption*)	
	$\log(C_{II}/C_I)$	$\log(C_{IV}/C_{III})$
$\dfrac{PFD_t \times Family\ Size_h}{Family\ Income_h}$	—	0.0032 (0.0562)
$\dfrac{Income\ tax\ refund_h}{Family\ Income_h}$	0.2831 (0.1140)	—
Number of observations	369	369

Notes: Dependent variable is $\log(C_{II}/C_I)$ in the first column and $\log(C_{IV}/C_{III})$ in the second column. Standard errors are in parentheses. All regressions are OLS and include a quadratic in age and changes in the number of children and adults in the household.

Source: Hsieh (2003)

Hsieh (2003): Conclusion

- Households display excess sensitivity to small, unpredictable, hard to predict changes in income
  - Consistent with Parker (1999), Souleles (1999), Johnson-Parker-Souleles (2006), Parker et al. (2013)

Hsieh (2003): Conclusion

- Households display excess sensitivity to small, unpredictable, hard to predict changes in income
  - Consistent with Parker (1999), Souleles (1999), Johnson-Parker-Souleles (2006), Parker et al. (2013)
- Households do not display excess sensitivity to large, predictable, highly visible changes in income
  - Consistent with Paxson (1992), Browning and Collado (2001)

KUENG (2015)

Revisits Hsieh's (2003) analysis and gets very different results

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- Normalizes dividend payments by total expenditure as opposed to current total family pre-tax income
  - This makes a big difference
  - Lots of measurement error in family income variable
  - Attenuation bias

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- Normalizes dividend payments by total expenditure as opposed to current total family pre-tax income
  - This makes a big difference
  - Lots of measurement error in family income variable
  - Attenuation bias
- Extends sample by 12 years and uses non-Alaskans as control group
  - Much more variation in dividend payments
  - Control group also improves precision

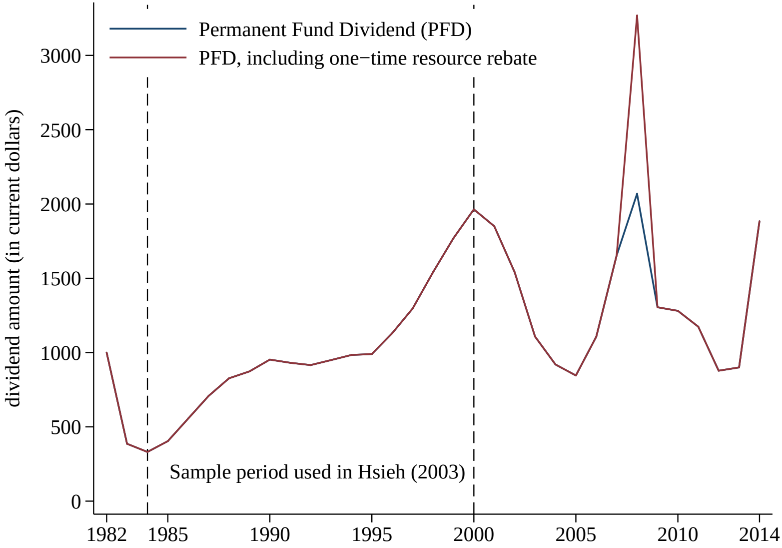

Figure 2 – Alaska Permanent Fund Dividend per person, 1982-2014 (nominal amount)

Source: Kueng (2015)

Specification

$$\log c_{i,t} - \log c_{i,t-1} = \alpha_1 \frac{PFD_t \times familysize_i}{y_i} + \alpha_2' z_{i,t} + \epsilon_{i,t}$$

- y_i is either total expenditures or pre-tax total income
- $z_{i,t}$ is a vector of controls that may include fixed effects

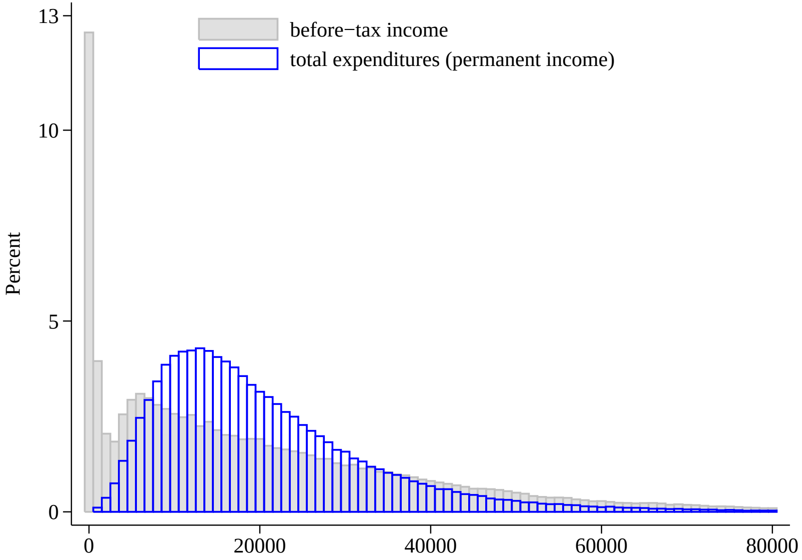

Figure 1 – Distribution of annual before-tax family income and total annualized expenditures

Source: Kueng (2015)

Table 2: Spending excess sensitivity tests using the Permanent Fund Dividend

Dep. var.: $\Delta\ln(c_{it})$, nondurables and services	*Alaskans only*					*All households*			
	Hsieh's specification								
	Hsieh (2003)	replication and extension	normalize w/ total expend.	control for aggr. effects	more sample selection	using rest of U.S. as contol	control for all main effects	attenuation factor	IV curr inc w/ perm inc
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A: Sample 1980-2001									
PFD x family size x Alaska / before-tax income	-0.003	-0.003							0.052**
	(0.033)	(0.005)							(0.025)
PFD x family size x Alaska / total expenditures			0.123	0.124	0.126	0.090**	0.091**	**0.107****	
			(0.086)	(0.112)	(0.127)	(0.036)	(0.036)	(0.043)	
Number of observations (rounded)	806	800	800	800	600	315200	315200	315200	281500
Number of Alaskan obs. (rounded)	806	800	800	800	600	4300	4300	4300	3800
Number of clusters (rounded)	--	0	800	800	600	117000	117000	117000	103400
Number of Alaskan CUs (rounded)	806	800	800	800	600	1700	1700	1700	1500
R-squared	N/A	0.009	0.013	0.038	0.044	0.009	0.009	0.009	0.010
F-statistic for current and lagged dividend									
B: Sample 1980-2013									
PFD x family size x Alaska / before-tax income		-0.001							0.076***
		(0.004)							(0.023)
PFD x family size x Alaska / total expenditures			0.116*	0.134*	0.125	0.113***	0.113***	**0.136*****	
			(0.060)	(0.077)	(0.087)	(0.027)	(0.027)	(0.032)	
Number of observations (rounded)		1400	1400	1400	1000	559400	559400	559400	458000
Number of Alaskan obs. (rounded)		1400	1400	1400	1000	7100	7100	7100	5900
Number of clusters (rounded)		0	1400	1400	1000	206200	206200	206200	166000
Number of Alaskan CUs (rounded)		1400	1400	1400	1000	2800	2800	2800	2300
R-squared		0.004	0.007	0.032	0.039	0.007	0.007	0.007	0.009
- Other household characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES
- Family size	YES	YES	YES	YES	YES	YES	YES	YES	YES
- Period FEs				YES	YES	YES	YES	YES	YES
- Alaska FE						YES	YES	YES	YES
- Inverse total expenditures							YES	YES	YES

Notes: To maintain confidentiality, sample sizes in columns (2)-(10) are rounded to the nearest hundred. Columns (1)-(5) use only Alaskan households. For comparison, columns (3)-(4) use the same smaller sample as in columns (1)-(2) that excludes households with zero self-reported family income. Other household characteristics include quarterly changes in the number of children, adults, and seniors, and a quadratic in the age of the reference person. Robust standard errors in parentheses are clustered at the household level in columns (3)-(9), thereby adjusting for arbitrary within-household correlations and heteroskedasticity; OLS standard errors are used in columns (1) and (2).

Source: Kueng (2015)

Kueng (2015) – Main Results

- Normalizing by total expenditures dramatically changes results
- Results similar for extended sample (more significant without time FE)

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- Normalizing by total expenditures dramatically changes results
- Results similar for extended sample (more significant without time FE)
- Using non-Alaskans as a control group improves precision (Why?)
- Column 8 takes into account that on average only 83 cents per dollar of PFD is received in the form of cash income (some is garnished, also college fund, etc.)

Excess Sensitivity over the Life-Cycle

Up until now:

- Excess sensitivity of consumption to predictable movements in income

Another type of potential excess sensitivity:

- Consumption seems to track income over the life-cycle

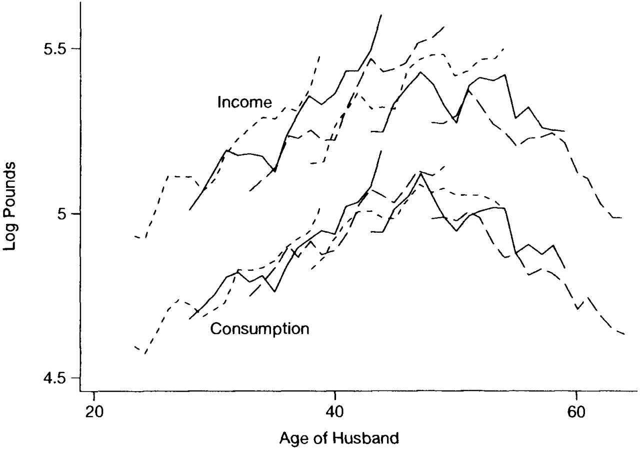


FIGURE 1. CONSUMPTION AND INCOME OVER THE LIFE CYCLE

Note: Connected solid, solid and dashed lines represent different cohorts.

Source: Attanasio and Browning (1995). Data are from the UK Family Expenditure Survey.

Life-Cycle Consumption Needs

- Consumption needs may vary over the life-cycle
- Most obvious source of such variation is family size and composition
- Attanasio and Browning (1995) regress cohort-year averages of consumption on cohort-year averages of:
  - Number of children
  - Number of adults
  - Log of family size
  - Dummy for at least one child

  Then plot residual consumption

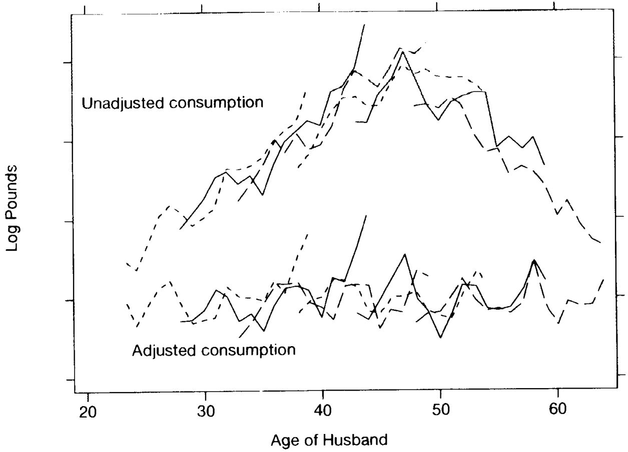


FIGURE 2. UNADJUSTED AND ADJUSTED CONSUMPTION OVER THE LIFE CYCLE

Note: Connected solid, solid and dashed lines represent different cohorts.

Source: Attanasio and Browning (1995). Data are from the UK Family Expenditure Survey.

Family Size and Age

- Interpretation not clear
  - Does family size cause differences in consumption over life-cycle?
  - Or is it simply possible to predict age with family size variables used by Attanasio and Browning?
- More informative to see if people of the same age that have different family size have different levels of consumption

Gourinchas and Parker (2002)

- Estimate age profile of consumption and income using U.S. data from the Consumer Expenditure Survey

- Household-level regression:

$$\log \tilde{C}_i = f_i \pi_1 + a_i \pi_2 + b_i \pi_3 + \mathcal{U}_i \pi_4 + \text{Ret}_i \pi_5 + \epsilon_i$$

  - f_i: family size dummies; a_i: age dummies
  - b_i: cohort dummies; $\mathcal{U}_i$: unemployment rate
  - Ret_i: dummy for retired

- Control for family size at household level and conditional on age
  - Do people of the same age with different family size have different levels of consumption

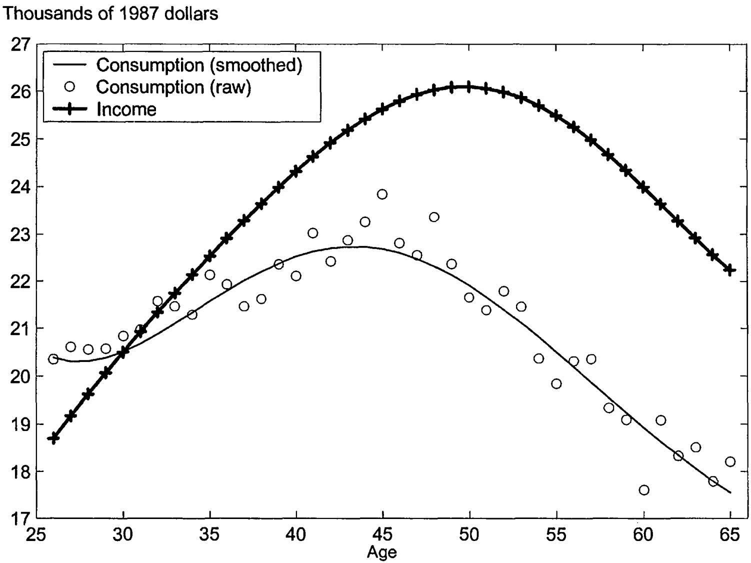


FIGURE 2.—Household consumption and income over the life cycle.

Source: Gourinchas-Parker (2002). Takes out cohort effects. Family size held constant over life-cycle.

Age-Time-Cohort

- Gourinchas and Parker allow for age effects and cohort effects but not time effects

$$\log \tilde{C}_i = f_i \pi_1 + a_i \pi_2 + b_i \pi_3 + \mathcal{U}_i \pi_4 + \text{Ret}_i \pi_5 + \epsilon_i$$

- All three types of effects may be important:
  - Age: income, productivity, preference vary with age
  - Cohort: Later cohorts richer, more educated, etc. at a given age
  - Time: Business cycles may affect consumption
- "Annoying identity": $T - A = C$
- Can't control for all three!

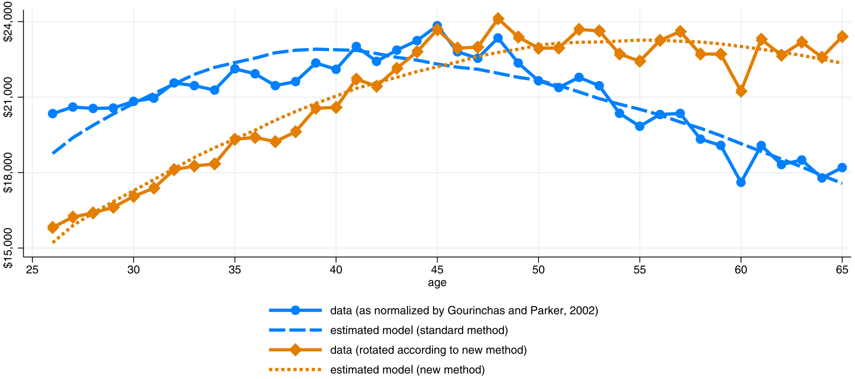
Age-Time-Cohort

- Gourinchas and Parker use unemployment to proxy for time effect:

$$\log \tilde{C}_i = f_i\pi_1 + a_i\pi_2 + b_i\pi_3 + \mathcal{U}_i\pi_4 + \mathrm{Ret}_i\pi_5 + \epsilon_i$$

- Schulhofer-Wohl (2018) shows that it is the slope of the consumption profile that is unidentified
- True consumption profile may have different trend (e.g., more upward sloping)
- Proposes a method to pick trend and concludes that consumption profile IS more upward sloping

Alternative Slopes of Consumption Profile



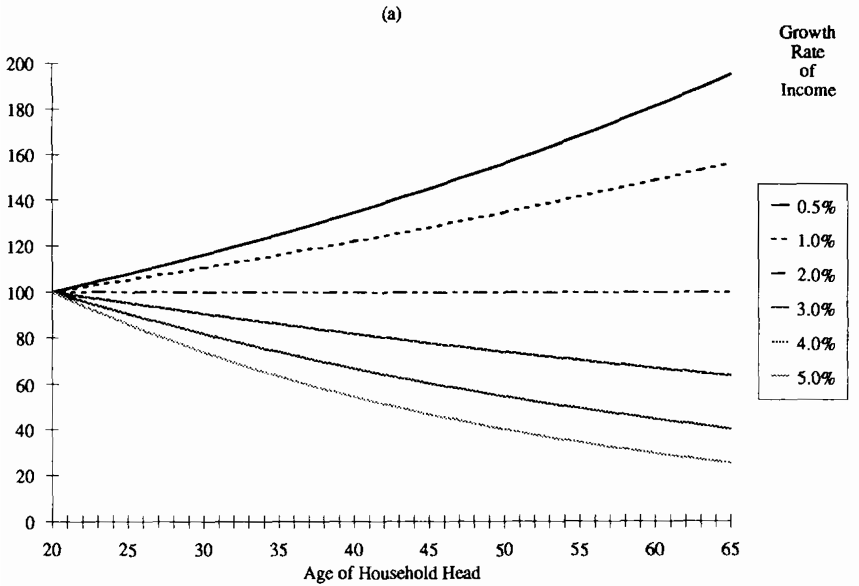
Source: Schulhofer-Wohl (2018).

Carroll and Summers (1991)

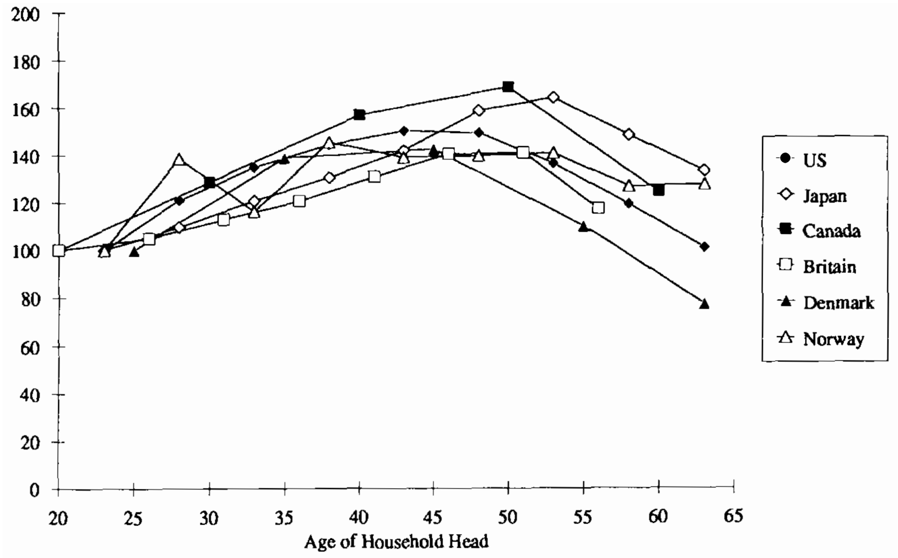
- PIH/LCH predicts that fast growing countries should have very different age-consumption profiles at a point in time than slow growing countries. (How should they differ?)

Carroll and Summers (1991)

- PIH/LCH predicts that fast growing countries should have very different age-consumption profiles at a point in time than slow growing countries. (How should they differ?)
- In a fast growing country, young have much higher life-time resources than old
- In a slow growing country, less so.
- Age-consumption profile should be more downward sloping in fast growing countries than slow growing
  (Relies imperfect sharing of income across generations within families)



Source: Carroll and Summers (1991). Households desire 2% consumption growth.
Point in time consumption profile.



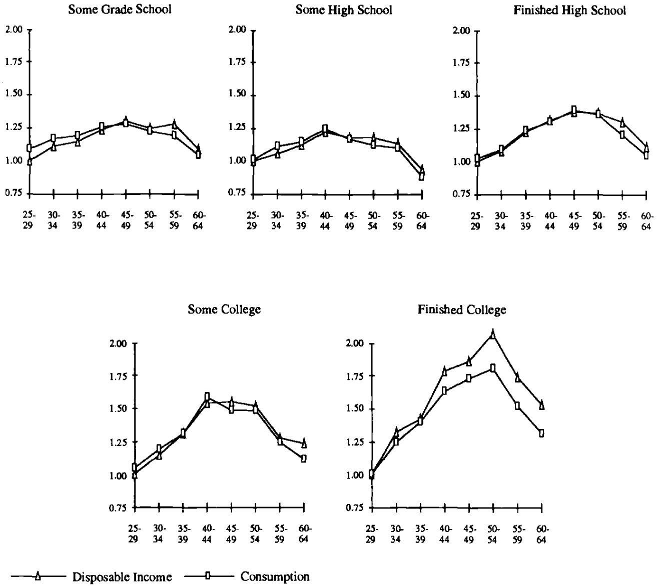
Source: Carroll and Summers (1991). Consumption profiles from the mid 1980s.

Carroll and Summers (1991)

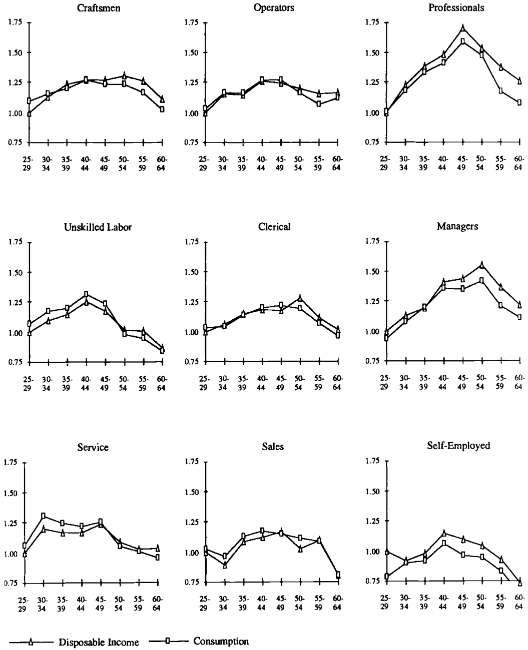
- Growth in per capita GNP from 1960-1985:
  - Japan: 5.2%
  - U.S.: 2.1%
- Yet Japan has a steeper consumption profile than US!!
- What about family transfers?

Carroll and Summers (1991)

- Perhaps there is some common cause of income growth and consumption growth across countries
- But what if we look across education groups or occupations within a country?
- Education groups and occupations with steeper income profiles should borrow more early in life according to PIH/LCH



Source: Carroll and Summers (1991). Data from the US CES.



Source: Carroll and Summers (1991). Data from the US CES.