Supplement to ”How Does Consumption Respond to a Transitory Income Shock? Reconciling Natural Experiments and Semi-Structural Estimations”

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Appendix A The BPP estimator in the literature

The BPP estimator has been adapted, extended, and put to use in diverse fields, and I provide a few examples for each. In household finance studies, Kaufmann and Pistaferri (2009) generalize the BPP method to account for advance information of consumers; Casado (2011) implements the BPP estimator in a database of Spanish households; Blundell, Low, and Preston (2013) adapt it to the use of cross-sectional data and to a more general income process; Hryshko (2014) allows for a correlation between the transitory and permanent shocks; Etheridge (2015) uses the BPP estimator to disentangle rival specifications of income; Bayer and Juessen (2015) apply it to estimate the response of happiness to transitory and permanent income shocks; Ghosh (2016) extends the BPP method to exploit both the second and third moments of log-income and log-consumption growth.

In labor, Ortigueira and Siassi (2013) and Heathcote, Storesletten, and Violante (2014) use the BPP estimates as a benchmark against which they compare their simulation results; Blundell, Pistaferri, and Saporta-Eksten (2016) allow for endogenous labor supply and estimate its elasticity to transitory and permanent wage shocks; Blundell, Pistaferri, and Saporta-Eksten (2018) estimate the elasticity of hours spent with children to transitory and permanent wage shocks.

In development, Attanasio, Meghir, and Mommaerts (2015) compare the elasticity of consumption to transitory and permanent income shocks at the village level and at the individual level, to assess the importance of within-village insurance mechanisms. Santaeulàlia-Llopis and Zheng (2018) measure the evolution of the elasticity of consumption to transitory and permanent income shocks during the period of large and sustained GDP growth in China.

In housing, Carlos Hatchondo, Martinez, and Sànchez (2015) compare the consumption elasticities simulated from a model with mortgage default to the BPP estimates. Hedlund, Karahan, Mitman, and Ozkan (2017) use the BPP estimator to measure the elasticity of consumption to a change in house prices, among subgroups of households with different leverage ratios.

Appendix B Common extensions of the life-cycle model

Possibly binding borrowing constraint I allow for the presence of a tighter borrowing limit than the natural one, so that some households might become constrained. This gives rise to a new term in the first order condition:

$$u'(c_{i,t}R_{i,t,t+1}^{1/\rho}) = E_t[u'(c_{i,t+1})]R_{i,t,t+1} + \lambda_{i,t}R_{i,t,t+1}^{-1},$$

with $\lambda_{i,t}$ the multiplier on the borrowing constraint. It is zero when the constraint does not bind and strictly positive when it does. Constrained households would like to move resources from the future to the present, to smooth their expected marginal utility, but because they cannot borrow, the marginal utility of their current consumption remains above the expected marginal utility of their future consumption. I apply $u'(.)^{-1}$ to each side, and expand the right-hand side around the point where $\lambda_{i,t} = 0$. Expected future consumption is:

$$E_t[c_{i,t+1}] = c_{i,t}R_{i,t,t+1}^{1/\rho} + \varphi_{i,t} + \underbrace{\sum_{s=0}^{\infty} \frac{\lambda_{i,t}R_{i,t,t+1}^{-1}}{s!}((u')^{-1})^s(E_t[u'(c_{i,t+1})])}_{\text{correlates with past income shocks}}.$$

The presence of a possibly binding borrowing constraint contributes to expected consumption growth: a household that wants to borrow but cannot is forced to move more resources to the future than it wants to, and it experiences a higher expected consumption growth. Whether a household wants to borrow or not depends on its current level of assets, which is determined by the shocks it has received in the past. The contribution of the borrowing constraint to expected consumption growth thus correlates with the realizations of past income shocks.

Non-separable durable consumption Although the standard model presented in the first section does not explicitly model the presence of durable consumption, the results would be unchanged if the household had also access to a durable good but derived utility from the nondurable and durable goods in additively separable ways. I now let the household have access to a durable good c^D whose past consumption interacts with the utility derived from current nondurable consumption c: the utility of period t is $u(c_{i,t})u(c^D_{i,t-1})^{\alpha_1}...u(c^D_{i,t-s})^{\alpha_s}$. The first order condition becomes:

$$u'(c_{i,t}R^{1/\rho}_{i,t,t+1}) = E_t[u'(c_{i,t+1})]\left(\frac{u(c^D_{i,t})}{u(c^D_{i,t-1})}\right)^{\alpha_1}...\left(\frac{u(c^D_{i,t-s+1})}{u(c^D_{i,t-s})}\right)^{\alpha_s}$$

A household chooses its current and future consumption so that the marginal utility of its current consumption equals the expected marginal utility of its future consumption, but the marginal utility is now weighted by the utility derived from the durable goods bought in the past. With this particular utility function, when a household increases its stock of durables, it can also allocate relatively more nondurable consumption to the present than to the future because it anticipates that it will derive utility in the future from the durables it is currently buying. Expected future consumption is:

$$E_t[c_{i,t+1}] = c_{i,t}R^{1/\rho}_{i,t,t+1}\underbrace{\left(\frac{u(c^D_{i,t})}{u(c^D_{i,t-1})}\right)^{\alpha_1/\rho}...\left(\frac{u(c^D_{i,t-l+1})}{u(c^D_{i,t-l})}\right)^{\alpha_s/\rho}}_{\text{correlates with past income shocks}} + \varphi_{i,t}.$$

The fact that the marginal utility of current consumption depends on past durable consumption changes the weight put on current versus future consumption, and this new weight is not deterministic but depends on past durable consumption, which is influenced by the income shocks received in the past.

Habit persistence I now incorporate habit persistence: the household does not derive utility from its current consumption only, but from a weighted sum of its current consumption and of its recent consumption growth: $u_{i,t} = u((1-h)c_{i,t} + h(c_{i,t} - c_{i,t-1})) = u(c_{i,t} - hc_{i,t-1})$, with h the weight measuring the strength of habit formation. The first order condition is:

$$\begin{aligned} u'((c_{i,t} - hc_{i,t-1})R^{1/\rho}_{i,t,t+1}) - \frac{h}{(1+r)}E_t[u'((c_{i,t+1} - hc_{i,t}))] \\ = E_t[u'((c_{t+1} - hc_{i,t})) - \frac{h}{(1+r)}u'((c_{i,t+2} - hc_{i,t+1})R^{-1/\rho}_{i,t+1,t+2})], \end{aligned}$$

with $R_{i,t,t+s} = (\beta(1+r))^s e^{\delta_{t+s}z_{i,t+s}-\delta_t z_{i,t}}$. A household anticipates that increasing its current consumption will reduce its future utility and raise the marginal utility of its future consumption, which is why the marginal utility of current consumption incorporates the fraction $h/(1+r)$ of expected future marginal utility. Rearranging, this expression becomes:

$$\begin{aligned} &u'((c_{i,t} - hc_{i,t-1})R_{i,t,t+1}^{1/\rho}) \\ &= \underbrace{\left(1+\frac{h}{(1+r)}\right)E_t[u'((c_{i,t+1} - hc_{i,t})R_{i,t+1,t+2}^{1/\rho}) - \frac{h}{(1+r)}E_t[u'((c_{i,t+2} - hc_{i,t+1})R_{i,t+1,t+2}^{-1/\rho})]}_{H_{i,t}(h)}, \end{aligned}$$

where I denote $H_{i,t}$ the right-hand side. I apply $u'(.)^{-1}$ to each side, and take an exact expansion around the point where $h = 0$. Eventually, expected future consumption is:

$$\begin{aligned} E_t[c_{i,t+1}] = {} & c_{i,t}R_{i,t,t+1}^{1/\rho} + \varphi_{i,t} \\ & \underbrace{+\sum_{s=1}^{\infty}\frac{h^s}{s!}\left(\left(\frac{d^s(c_{i,t} - hc_{i,t-1})R_{i,t,t+1}^{1/\rho}}{dh^s}\right)_{h=0} + \frac{1}{\rho}\left(\frac{d^s H_{i,t}}{dh^s}\right)_{h=0} H_{i,t}(0)^{-(1+\rho)/\rho}\right)}_{\text{correlates with past shocks}} \end{aligned}$$

An additional term emerges that depends on past consumption, current consumption, and the expected distribution of future consumption. The three depend on past shocks, so the additional term is likely to correlate with past shocks.

Appendix C Log-consumption growth in BPP

I follow the derivation presented in Blundell, Low, and Preston (2013), to which BPP refer as being the detailed version of their own derivation. To ease the reading, I drop the household index i. The authors begin with the Euler equation:

$$E_t[u'(c_{t+1})] = u'(c_t e^{R_{t,t+1}^{1/\rho}})$$

Inside the expectation operator, they apply an exact Taylor expansion of $u'(c_{t+1})$ around $v_{t+1} = ln(c_{t+1}) - ln(c_t R_{t,t+1}^{1/\rho}) = 0$, which means they take an approximation at the point where future consumption equals current consumption in all states of the world, regardless of the shocks that occur. The authors obtain that there exists a $\tilde{c}$, between $c_t R_{t,t+1}^{1/\rho}$ and c_{t+1} such that, with my notations (this expression corresponds to the unnumbered equation at the top of page 31 in Blundell, Low, and Preston (2013)):

$$E_t[\Delta ln(c_{t+1})] = ln(R_{t,t+1}^{1/\rho}) + \frac{1}{2}\frac{u'(c_t R_{t,t+1}^{1/\rho})}{c_t R_{t,t+1}^{1/\rho} u''(c_t R_{t,t+1}^{1/\rho})} E_t[\frac{\tilde{c}u'''(\tilde{c}) + \tilde{c}u''(\tilde{c})}{u'(c_t R_{t,t+1}^{1/\rho})} v_{t+1}^2].$$

They decompose the expected value of $E_t[\Delta ln(c_{t+1})]$ into the sum of $\Delta ln(c_{t+1})$ and an innovation that I denote w_{t+1}:

$$\Delta ln(c_{t+1}) = ln(R_{t,t+1}^{1/\rho}) + \frac{1}{2}\underbrace{\frac{u'(c_t R_{t,t+1}^{1/\rho})}{c_t R_{t,t+1}^{1/\rho} u''(c_t R_{t,t+1}^{1/\rho})}}_{\gamma(c_t R_{t,t+1}^{1/\rho})} E_t[\underbrace{\frac{\tilde{c}u'''(\tilde{c}) + \tilde{c}u''(\tilde{c})}{u'(c_t R_{t,t+1}^{1/\rho})}}_{\beta(\tilde{c}, c_t R_{t,t+1}^{1/\rho})} v_{t+1}^2] + w_{t+1}$$

Now, because they assimilate v_{t+1} and w_{t+1}, the term $\gamma(c_t R_{t,t+1}^{1/\rho}) \times E_t[\beta(\tilde{c}, c_t R_{t,t+1}^{1/\rho}) v_{t+1}^2]$, which is a $\mathcal{O}(E_t[v_{t+1}^2])$, is also a $\mathcal{O}(E_t[w_{t+1}^2])$. They obtain:[1]

$$\Delta ln(c_{t+1}^{BPP}) = ln(R_{t,t+1}^{1/\rho}) + \mathcal{O}(E_t[w_{t+1}^2]) + w_{t+1}.$$

When no such assimilation is made it is written as:

$$\begin{aligned}
\Delta ln(c_{t+1}) &= ln(R_{t,t+1}^{1/\rho}) + \mathcal{O}(E_t[v_{t+1}^2]) + w_{t+1} \\
\Delta ln(c_{t+1}) &= ln(R_{t,t+1}^{1/\rho}) + \underbrace{\mathcal{O}(E_t[(w_{t+1} + E_t[ln(1 + \frac{\varphi_t + \xi_{t+1}}{R_{t,t+1}^{1/\rho}})])^2])}_{\neq \mathcal{O}(E_t[w_{t+1}^2])} + w_{t+1}
\end{aligned}$$

The trend of log-consumption growth is not deterministic in this case, because the term $\mathcal{O}(E_t[(w_{t+1} + E_t[ln(1 + \frac{\varphi_t + \xi_{t+1}}{R_{t,t+1}^{1/\rho}})])^2])$ depends on the level of assets of the household. Note that the same random walk expression could be obtained without having to assimilate v_{t+1} and w_{t+1}, by taking an approximation of the identity $ln(c_{i,t+1}) = ln(c_{i,t} R_{i,t,t+1}^{1/\rho}) - \frac{1}{\rho} ln(1 + \frac{u'(c_{i,t+1}) - u'(c_{i,t} R_{i,t,t+1}^{1/\rho})}{u'(c_{i,t} R_{i,t,t+1}^{1/\rho})})$ around $u'(c_{i,t+1}) = u'(c_{i,t} R_{i,t,t+1}^{1/\rho})$, as is done to derive the log-linearized Euler equation. To express w_{t+1} as a function of the income innovations, the authors plug their expression of log-consumption growth in the intertemporal budget constraint, approximate both sides of the intertemporal budget

[1] Although the approximation they consider implies that $\Delta ln(c_{t+1}^{BPP}) = ln(R_{t,t+1}^{1/\rho}) + \mathcal{O}(E_t[w_{t+1}^2]) + w_{t+1}$, the authors do not restrict the value of the trend and simply impose $\Delta ln(c_{t+1}^{BPP}) = \Gamma + \mathcal{O}(E_t[w_{t+1}^2]) + w_{t+1}$, stating that Γ is identical across households thus deterministic.

constraint, and take a first difference:[2]

$$\mathscr{O}(E_t[w_{t+1}^2]) + w_{t+1} = \varepsilon_{t+1}\phi_t^{\varepsilon} + \eta_{t+1}\phi_t^{\eta} + \mathscr{O}((\varepsilon_{t+1}, \eta_{t+1})^2)$$

Using their expression of log-consumption growth, they additionally obtain that $\mathscr{O}(E_t[w_{t+1}^2]) = \mathscr{O}(\varepsilon_{t+1}^2, \eta_{t+1}^2)$, which gives that the innovation to log-consumption growth is w_{t+1} is linear in the income shocks when income shocks are small (when $\mathscr{O}((\varepsilon_{t+1}, \eta_{t+1})^2)$ is small).

Appendix D Robustness

D.1 Higher-order moments

Table 1: Moments of the distribution of ε

	$\theta E[\varepsilon_{i,t}^2]$	$\theta E[\varepsilon_{i,t}^3]$	$\theta E[\varepsilon_{i,t}^4]$	$\theta E[\varepsilon_{i,t}^5]$	$\theta E[\varepsilon_{i,t}^6]$	$\theta E[\varepsilon_{i,t}^7]$	$\theta E[\varepsilon_{i,t}^8]$
Mom.	0.0057	−0.0008	0.0037	−0.0029	0.0098	−0.0249	0.0624
	(0.0013)	(0.0013)	(0.0020)	(0.0041)	(0.0087)	(0.0244)	(0.0639)
Obs.	8,958	8,958	8,958	8,958	8,958	8,958	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. This table reports the value of moments that are proportional to those of the distribution of ε by a factor θ. A moment $\theta E[\varepsilon_{i,t}^s]$ is computed as $cov(\Delta ln(\tilde{y}_{i,t}^s), \Delta ln(\tilde{y}_{i,t+2}))$, among the household-year observations (i,t) for which the estimating moment is observed.

[2] Blundell, Low, and Preston (2013) have an additional term π in the right-hand side that captures the innovation to an aggregate component of income, but BPP do not include it and only have idiosyncratic income shocks.

D.2 Demographic characteristics

Table 2: Elasticity ϕ^{ε} - Alternative sets of detrending variables

Detrending	Baseline	- Fixed char.	- Empl.	- Fam dum.	Only year
ϕ^{ε}	0.539	0.526	0.546	0.521	0.437
	(0.274)	(0.260)	(0.303)	(0.276)	(0.401)
Obs.	8,958	8,958	8,958	8,958	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of nondurable consumption to a transitory shock on net income when log-income and log-consumption are detrended with different sets of demographics: with the baseline set; excluding dummies for year-of-birth, education, and race, and their interactions with the year and cohort dummies; excluding dummies for whether the male head is employed or unemployed and for whether there is an extra income recipient in the household who is not the head or its spouse, and their interactions with the year and cohort dummies; excluding dummies for family size, number of children, and whether the household has an outside dependent children, and their interactions with the year and cohort dummies; including only year dummies. The second line reports the number of household-years for which the estimating moment is observed.

Table 3: Elasticity ϕ^{ε} - Alternative periods of the dummies in the set of detrending variables

Detrend	Baseline	+ D. $_{t-1}$	+ D. $_{t-1,t-2}$	+ D. & Int. $_{t-1}$	+ first/last year
ϕ^{ε}	0.539	0.594	0.617	0.618	0.537
	(0.274)	(0.250)	(0.337)	(0.243)	(0.273)
Obs.	8,958	7,600	6,349	7,600	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of nondurable consumption to a transitory shock on net income when log-income and log-consumption are detrended with different sets of demographics: the baseline set; adding the values of the demographic characteristics at the last period; adding the values of the demographic characteristics at the last period and two periods ago; adding the values of the demographic characteristics at the last period and interactions between these past demographic characteristics and past year dummies; adding dummies for whether it is the first time that positive earnings are observed, except for the first year of the sample, or the last time that they are observed, except for the last year of the sample, with the reason for this control being that Daly, Hryshko, and Manovskii (2016) show that income shocks are more volatile at the beginning or at the end of an earnings spell. The second line reports the number of household-years for which the estimating moment is observed.

Table 4: Elasticity ϕ^{ε} - Alternative demographic interactions

Interactions	Year + coh.	Year	Cohort	Education	Year + coh. + edu.
ϕ^{ε}	0.539	0.425	0.512	0.436	0.538
	(0.274)	(0.299)	(0.274)	(0.300)	(0.273)
Obs.	8,958	8,958	8,958	8,958	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of nondurable consumption to a transitory shock on net income when log-income and log-consumption are detrended with different interactions dummies. The second line reports the number of household-years for which the estimating moment is observed.

Table 5: Elasticity ϕ^{ε} - Alternative clusters

Cluster level	Household	Coh. $\times$ edu.	Year $\times$ edu.
ϕ^{ε}	0.539	0.539	0.539
	(0.274)	(0.274)	(0.185)
Num. of clusters	1,561	119	27
Obs.	8,958	8,958	8,958

Note: Standard errors in parentheses are adjusted for heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of nondurable consumption to a transitory shock on net income and estimates of their standard errors allowing for arbitrary correlation within a household, within households with the same level of education and the same year-of-birth, and within households with the same level of education observed on the same year. The second line reports the number of clusters within which arbitrary correlation is allowed. The third line reports the number of household-years for which the estimating moment is observed.

Table 6: Elasticity ϕ^{ε} and MPC lower bound $\underline{MPC}^{\varepsilon}$ - Alternative measures of consumption

	Nondur.	Food	Total	Total + edu. + health
ϕ^{ε}	0.539	0.314	0.624	0.634
	(0.274)	(0.234)	(0.328)	(0.333)
$\underline{MPC}^{\varepsilon}$	0.319	0.061	0.489	0.537
	(0.135)	(0.037)	(0.210)	(0.233)
Obs.	8,958	8,973	8,958	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of consumption to a transitory shock on net income when consumption is measured as nondurable consumption, food consumption, total consumption (the sum of nondurable and durable expenditures), and the sum of total consumption plus expenditures on education and health. The second line reports the number of household-years for which the estimating moment is observed.

Table 7: Elasticity ϕ^{ε} and MPC lower bound $\underline{MPC}^{\varepsilon}$ - Alternative measures of income

	Net income (earn.+trans.-tax.)	Gross income (earn.+trans.)	Gross income before trans. (earn.)
ϕ^{ε}	0.539	0.469	0.099
	(0.274)	(0.250)	(0.198)
$\underline{MPC}^{\varepsilon}$	0445	0.348	0.082
	(0.229)	(0.185)	(0.165)
Obs.	8,958	8,959	8,637

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first line of this table reports GMM estimates of the average elasticity of nondurable consumption to a transitory shock on net income, gross income, and gross income before transfers. The second line reports the number of household-years for which the estimating moment is observed.

D.3 Long-run response

Table 8: MPC lower bounds out of a change in the total net present value of income for current and future consumption

	Current cons.: c_t	Future cons.: c_{t+1}	Long-run: $c_t + \frac{1}{1+r}c_{t+1}$
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.3)$	0.344	−0.262	0.074
	(0.175)	(0.230)	(0.118)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.4)$	0.319	−0.075	0.241
	(0.162)	(0.144)	(0.120)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.5)$	0.298	0.024	0.323
	(0.152)	(0.106)	(0.142)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.6)$	0.280	0.081	0.364
	(0.142)	(0.090)	(0.157)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.7)$	0.264	0.116	0.383
	(0.134)	(0.084)	(0.165)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.8)$	0.249	0.138	0.391
	(0.127)	(0.082)	(0.169)
$\underline{MPC}^{\varepsilon\ total}$ $(\theta = 0.9)$	0.237	0.151	0.392
	(0.120)	(0.081)	(0.170)
Obs.	8,958	8,958	8,958

Note: Standard errors in parentheses are adjusted for arbitrary within-household correlations and heteroskedasticity. The first seventh lines report lower bounds for the MPCs out of the net present value change in total income caused by a transitory shock for different values of θ. The eighth line reports the number of household-years for which the estimating moments are observed.

Conditional on the value of θ, it is possible to identify the average elasticity of consumption to a past transitory shock, denoted $\phi^{\varepsilon L1}$, by using jointly the covariance between current log-consumption growth and future log-income growth at $t+1$ and the covariance between current log-consumption growth and future log-income growth at

$t+2$:[3]

$$\begin{cases} \hat{\phi}^{\varepsilon} & = \frac{cov(\Delta ln(\tilde{c}_{i,t}),\Delta ln(\tilde{y}_{i,t+2}))}{cov(\Delta ln(\tilde{y}_{i,t}),\Delta ln(\tilde{y}_{i,t+2}))} \\ \hat{\phi}^{\varepsilon L1}-\hat{\phi}^{\varepsilon} & = \frac{cov(\Delta ln(\tilde{c}_{i,t}),\Delta ln(\tilde{y}_{i,t+1}))-((1-\theta)/\theta)cov(\Delta ln(\tilde{c}_{i,t}),\Delta ln(\tilde{y}_{i,t+2}))}{cov(\Delta ln(\tilde{y}_{i,t-1}),\Delta ln(\tilde{y}_{i,t+1}))} \end{cases}$$

Then, the relation between the MPC out of the total net present value change in income caused by a past transitory shock, denoted MPC^{L1}, and the elasticity of consumption to a past transitory shock is: $MPC^{L1}_{i,t}=\frac{c_{i,t}}{(1+r)y_{i,t-1}+\theta y_{i,t}}\phi^{\varepsilon L1}_{i,t}$. If individual elasticies are constant in the sample or covary positively with the ratio of consumption over income, I can measure a lower bound for the average MPC in the sample:

$$\underline{MPC}^{L1}=E[\frac{c_{i,t}}{(1+r)y_{i,t-1}+\theta y_{i,t}}]\phi^{\varepsilon L1}\leq E[\frac{c_{i,t}}{(1+r)y_{i,t-1}+\theta y_{i,t}}\phi^{\varepsilon L1}_{i,t}]=MPC^{L1}$$

Table 8 presents the estimation results. The MPC of future consumption out of the total net present value change in income caused by a current transitory shock is precisely estimated only for $\theta \geq 0.8$, making it difficult to draw conclusions about how consumption evolves more than a year after the transitory shock realized. Also, the point estimates vary substantially with the value of θ. For values of $\theta \leq 0.6$, the point estimate of the MPC is negative, [4] which could suggest an overshooting phenomena: a household increases its consumption above what it would have consumed otherwise when it receives the shock but it overshoots, so it then decreases its consumption below what it would have consumed otherwise at the next period. For values of $\theta \geq 0.7$, the MPC of future consumption is positive but smaller than the MPC of current consumption: a household increases its consumption more at the moment when it receives the shock than at subsequent periods. This is the qualitative pattern predicted by the standard life-cycle model. The long-run MPC over the two years following the shock is more precisely estimated. It is statistically significant for all values of $\theta \geq 0.6$. As a lower value of θ implies a higher MPC of current consumption but a lower MPC of future consumption, the long-run MPC, the sum of the current and of the future MPC, varies less with θ than the MPC of future consumption does.

[3]In practice, to avoid losing observations, I make the additional assumption that $var(\varepsilon_{i,t})=var(\varepsilon_{i,t-1})$ and use $cov(\Delta ln(\tilde{y}_{i,t}),\Delta ln(\tilde{y}_{i,t+2}))$ instead of $cov(\Delta ln(\tilde{y}_{i,t-1}),\Delta ln(\tilde{y}_{i,t+1}))$ in the denominator of the expression of $\hat{\phi}^{\varepsilon L1}-\hat{\phi}^{\varepsilon}$. Thus, I do not have to drop households for which $\Delta ln(\tilde{y}_{i,t-1})$ is not observed. Results are similar but less precise if I use $cov(\Delta ln(\tilde{y}_{i,t-1}),\Delta ln(\tilde{y}_{i,t+1}))$.

[4]Indeed, when θ is small, the second term in the expression of the elasticity difference becomes larger than the first, and the elasticity to a past transitory shock must be negative to rationalize the observed values of $cov(\Delta ln(\tilde{c}_t),-\Delta ln(\tilde{y}_{t+2}))$ and $cov(\Delta ln(\tilde{c}_t),-\Delta ln(\tilde{y}_{t+1}))$.

Appendix E Elasticity of consumption to permanent and transitory income shocks

To derive expressions of the elasticities of consumption to a permanent and to a transitory shock, I iterate forward on the expression of consumption growth between t and $t+1$. I obtain that expected consumption growth between t and any future period $t+s$ is a weighted sum of current and future expected precautionary growth:

$$E_t[c_{t+s}] = c_t R_{t,t+s}^{1/\rho} + \sum_{k=1}^{s} E_t[\varphi_{t+k-1}] R_{t+k,t+s}^{1/\rho}.$$

With this expression, I substitute for $E_t[c_{t+s}]$ in the intertemporal budget constraint, which states that total expected future consumption equals current assets plus total expected income. Rearranging, I obtain the following equilibrium relationship satisfied by consumption at period t, where $l_{t,0} = (\sum_{s=0}^{T-t} \frac{R_{t,t+s}^{1/\rho}}{(1+r)^s})^{-1}$ measures an intertemporal weight put on consumption at period t relative to other periods:

$$c_t = \frac{1}{l_{t,0}} \Bigg(\underbrace{(1+r)a_t + \sum_{s=0}^{T-t} \frac{E_t[y_{t+s}]}{(1+r)^s}}_{\substack{\text{lifetime expected resources} \\ W_t}} - \underbrace{\sum_{s=1}^{T-t} \frac{l_{t,s} E_t[\varphi_{t+s-1}]}{(1+r)^s}}_{\substack{\text{lifetime expected precautionary growth} \\ PG_t}} \Bigg).$$

The elasticities of consumption to a permanent and to a transitory income shock are the percentage changes in consumption caused by each type of shock:

$$\phi^{\eta}_{net.inc.} = \frac{(dW_{i,t}/d\eta_{i,t}) - (dPG_{i,t}/d\eta_{i,t})}{W_{i,t} - PG_{i,t}} = \frac{\sum_{s=0}^{T-t} \frac{E_t[y_{t+s}]}{(1+r)^s} - \overbrace{(dPG_{i,t}/d\eta_{i,t})}^{(1)}}{(1+r)a_t + \sum_{s=0}^{T-t} \frac{E_t[y_{t+s}]}{(1+r)^s} - \underbrace{PG_{i,t}}_{(2)>0}} \neq \phi^{\eta\ BPS}_{net.inc.},$$

$$\phi^{\varepsilon}_{net.inc.} = \frac{(dW_{i,t}/d\varepsilon_{i,t}) - (dPG_{i,t}/d\varepsilon_{i,t})}{W_{i,t} - PG_{i,t}} = \frac{y_t - \overbrace{(dPG_{i,t}/d\varepsilon_{i,t})}^{(1)<0}}{(1+r)a_t + \sum_{s=0}^{T-t} \frac{E_t[y_{t+s}]}{(1+r)^s} - \underbrace{PG_{i,t}}_{(2)>0}} > \phi^{\varepsilon\ BPS}_{net.inc.}.$$

Thus, precautionary behavior has two effects on the consumption elasticities. First, denoted (1), the response of lifetime expected precautionary consumption growth to a shock modifies the change in consumption caused by the shock. In the case of a permanent shock, the response of lifetime expected precautionary consumption is undetermined, so the sign of (1) is unknown. In the case of a transitory shock, the theorem proved in Section 2 implies that a transitory income shock reduces current and future expected precautionary growth, so it must reduce lifetime expected precautionary growth: $\frac{dPG_{i,t}}{d\varepsilon_{i,t}} < 0$ and the sign of (1) is negative. As the shock relaxes the need for precautionary saving, a household responds more to a transitory shock than it would in the absence of uncertainty. Second, denoted (2), precautionary saving reduces the initial level of consumption of a household everything else being equal. This raises the elasticity of consumption further: everything else being equal, a household that faces uncertainty consumes less than it would otherwise, so a given change in consumption corresponds to a larger percentage change in consumption than it would in the absence of uncertainty.

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