Home production as a substitute to market consumption: Estimating the elasticity using houseprice shocks from the Great Recession

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Motivation

Analyses of *well-being* have relied on measures of income and spending.

- ▶ Becker's 1965 theory on the allocation of time: Home production.
- ▶ Time can be used to increase consumption beyond market spending (Aguiar & Hurst 2005).
- ▶ Share of home production in consumption bundle depends on *relative price of time*.
- ▶ Shift to home production when the price of time drops.

Shocks and Home Production

Home production can smooth consumption in response to shocks
in income (Hicks 2015):

- Home production and **retirement** (e.g. Aguiar & Hurst 2005).

- Home production and **unemployed** households (e.g. Guler &
  Taskin 2013).

- Home production and **health** (e.g. Halliday & Podor 2012).

- Home production and **wealth** (e.g. Kuehn 2015).

Identification strategies

- ▶ Transitory shocks in income.
    - ▶ *Monetary-* and *Time-budget*: substitution or time-endowment?
- ▶ Disputable instruments: lagged consumption (Rupert et al. 1995).
- ▶ Very specific subsample: EITC and single women (Gelber & Mitchell 2009).
- ▶ Permanent shocks in income: permanent income (Hicks 2015).
    - ▶ Identification from cross-sectional differences between poorer and richer persons.

Contribution

- **Intratemporal elasticity from within-person variation.**
- Causal identification:
    - Wealth-shocks only influence monetary-budget.
    - Large exogenous shock: *houseprices* in the Great Recession.
        - Consumption (Angrisani et al. 2014).
        - Home production (Kuehn 2015).
- Panel data with detailed consumption spending and time-use information of persons in US households (HRS/CAMS).
    - Consumption: *Retirement-Consumption "Puzzle"* literature.
    - Time-use: Burda & Hamermesh (2010); Aguiar et al. (2013).
    - Both, but imperfect: Ahn et al. (2008) (cross-section); Velarde & Herrmann (2014) (food).
    - Both: Colella & Van Soest (2013) (NL); Hicks (2015) (MEX).

HRS/CAMS

Health and Retirement Survey

- ▶ Representative 50+ population of the US.
- ▶ Longitudinal: 12 waves.
- ▶ 20,000 persons every two years (one wave).
- ▶ Detailed information on demographics, economic status, etc.

Consumption and Activities Mail Survey

- ▶ Supplementary study to HRS.
- ▶ Survey to subset of HRS respondents.
- ▶ Longitudinal: 4 waves (2005, 2007, 2009, 2011).
- ▶ 37 time-use categories, 39 spending categories.
- ▶ Information on both spouses within a household.

Definition of home production

Following Aguiar et al. (2013):

▶ House cleaning

▶ Washing, ironing or mending clothes (*Laundry*)

▶ Yard work or gardening (*Gardening*)

▶ Shopping or running errands (*Shopping*)

▶ Preparing meals and cleaning up afterwards (*Cooking*)

▶ Taking care of finances or investments, such as banking, paying bills, balancing the checkbook, doing taxes, etc. (*Financial Management*)

▶ Doing home improvements, including painting, redecorating, or making home repairs (*Home maintenance*)

▶ Working on, maintaining, or cleaning car(s) and vehicle(s) (*Vehicle maintenance*)

What can home production substitute?

"Home Production Substitutable Consumption":

- House cleaning $\iff$ Housekeeping services

- Laundry $\iff$ Housekeeping services, Washing/Drying machine

- Gardening $\iff$ Gardening services

- Shopping $\iff$ n.a.

- Cooking $\iff$ Dining out, Dishwasher

- Financial Management $\iff$ n.a.

- Home maintenance $\iff$ Homerepair services

- Vehicle maintenance $\iff$ Vehicle maintenance services

Consumption spending across Time ($/y)

	Wave 2005	Wave 2007	Wave 2009	Wave 2011
	Mean	Mean	Mean	Mean
Dining out	1,912	1,808	1,513	1,598
Housekeeping services	414	386	331	349
Gardening services	381	355	314	296
Homerepair services	1,347	1,465	1,068	1,006
Vehicle maintenance	649	614	618	598
Dishwasher	23	27	19	15
Washing/Drying machine	63	76	68	53
Substitutable consumption	4,788	4,730	3,931	3,915
Substitutable consumption excl. durables	4,703	4,627	3,844	3,847
Substitutable consumption incl. suppl. mat.	6,487	6,387	5,342	5,382
Total consumption	40,558	39,904	37,515	36,359

Home Production across Time (h/w)

	Wave 2005	**Wave 2007**	**Wave 2009**	**Wave 2011**
	Mean	Mean	Mean	Mean
House cleaning	4.7	4.8	4.7	4.8
Laundry	2.6	2.7	2.6	2.6
Gardening	2.2	2.2	2.3	2.2
Shopping	3.9	3.8	3.8	3.8
Cooking	6.4	6.3	6.3	6.2
Financial management	1.0	1.0	0.8	0.9
Home maintenance	1.0	0.8	0.7	0.7
Vehicle maintenance	0.4	0.3	0.3	0.4
Home production	22.2	21.8	21.5	21.6

Life-Cycle Model with Home Production and Wealth Shocks

$$U_\tau = max\, \mathbb{E}_\tau \left[\sum_{t=\tau}^{T} (1+\delta)^{\tau-t} u(c_{mt}, c_{nt}(h_{nt}), l_t) \psi(v_t) \right] \quad (1)$$

with

$$c_{nt}(h_{nt}) = g_t(h_{nt}) \quad (2)$$

subject to

$$h_{nt} = H - h_{mt} - l_t \quad (3)$$

$$A_{t+1} = (1+r)(\mathbb{E}_t[A_t] + (w_t \cdot (H - l_t - h_{nt})) + b_t - c_{mt}) \quad (4)$$

$$\mathbb{E}_t[A_t] = A_t + \xi_t \quad (5)$$

Euler Equations

Market consumption (e.g. Consumption spending):

$$u_{c_{mt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) =$$

$$\left(\frac{1+\delta}{1+r}\right) u_{c_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \epsilon_{t+1} \quad (6)$$

Market work (e.g. Labor supply):

$$u_{h_{mt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) =$$

$$- w_t \left(\frac{1+\delta}{1+r}\right) u_{h_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \epsilon_{t+1} \quad (7)$$

Home work (e.g. Home production):

$$u_{h_{nt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) =$$

$$w_t \left(\frac{1+\delta}{1+r}\right) u_{h_{nt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \epsilon_{t+1} \quad (8)$$

Parametric assumptions

Functional form:

$$u(c_{mt}, c_{nt}(h_{nt}), l_t) = c_{mt}^{\theta_{mt}} + c_{nt}(h_{nt})^{\theta_{nt}} + l_t^{\theta_{lt}} \qquad (9)$$

$$c_{nt}(h_{nt}) = g_t(h_{nt}) = \gamma_t h_{nt} \qquad (10)$$

Assumptions first-order approximation of Euler Equations:

▶ Time-constant r and δ reduce to a constant α.

▶

$$\theta_{jt+1} = X_{t+1} + \eta_j \qquad (11)$$

$$\psi_{t+1} = X_{t+1} + \eta_j \qquad (12)$$

$$\gamma_{t+1} = X_{t+1} + \eta_j \qquad (13)$$

$$w_t = X_{t+1} + \eta_j, j = m, n \qquad (14)$$

Empirical Euler Equations

Market consumption (e.g. Consumption spending):

$$\Delta ln(c_{imt+1}) = \Delta X_{it+1}\beta_c + \varepsilon_{ict+1} \qquad (15)$$

Market work (e.g. Labor supply):

$$\Delta ln(h_{imt+1}) = \Delta X_{it+1}\beta_m + \varepsilon_{imt+1} \qquad (16)$$

Home work (e.g. Home production):

$$\Delta ln(h_{int+1}) = \Delta X_{it+1}\beta_n + \varepsilon_{int+1} \qquad (17)$$

ε_{ijt+1} are distributed *iid* $N(0, \sigma_j)$ and capture random error of:

- ▶ Recursive process of the marginal utility of wealth (including shocks).
- ▶ Equations (11)-(14).
- ▶ Equations (15)-(17).

Estimating the Elasticity

Interested in $\frac{\Delta ln(h_{int+1})}{\Delta ln(c_{imt+1})}$:

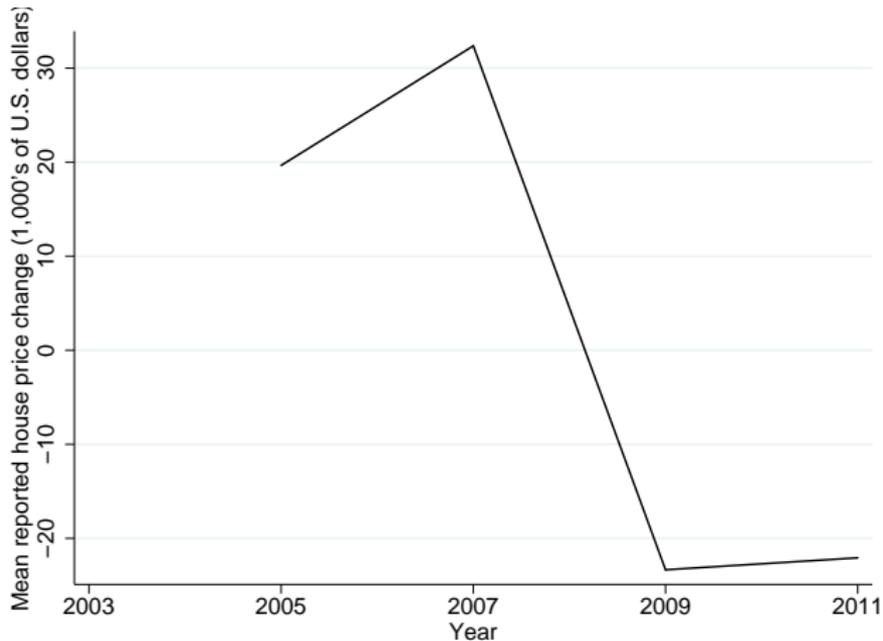- c_{imt+1}, h_{int+1}, (and h_{imt+1}) simultaneously determined.
- *Second-stage*:

$$\Delta ln(h_{int+1}) = \Delta X_{it+1}\beta_{n1} + \Delta ln(c_{imt+1})\beta_{n2} + \varepsilon_{int+1} \qquad (18)$$

- *First-stage*:

$$\Delta ln(c_{imt+1}) = \Delta X_{it+1}\beta_{c1} + D_{GR}\Delta ln(W_{it})\beta_{c2} + \varepsilon_{ict+1} \qquad (19)$$

- $D_{GR}\Delta ln(W_{it})$ shock to monetary-budget, not to time-budget.
- Keep $(w_t \cdot (H - l_t - h_{nt})) + b_t$ constant in Equation (4).

Identification: Houseprice changes

Estimation results

Second-stage	$\Delta ln(h_{int+1})$	
	Coeff.	S.E.
Elasticity		
$\Delta ln(c_{imt+1})$	-0.65*	0.37
First-stage	$\Delta ln(c_{imt+1})$	
	Coeff.	S.E.
Instrument		
$D_{GR}\Delta ln(W_{it})$	0.14**	0.06
Observations ($N \times T$)	2,500	
Hansens J statistic (p-value reported)	0.00	

Interpretation

- $\beta_{n2} = \frac{\Delta ln(h_{int+1})}{\Delta ln(c_{imt+1})} = -0.65$.
- Less than perfect substitute.
- Bigger than elasticity between food preparation and dining out found by Hicks (2015): -0.031 (endogeneity/food/25-80).
- Average effect: drop in consumption of 40 dollars (p/y) increases home production by about 7.6 hours (p/y): shadow wage $5.30.
- Reasonably lower than minimum wage in retirement (Ghez & Becker 1975).

Robustness

- ▶ Definitions of "home production substitutable consumption":
  - ▶ Excluding durables.
  - ▶ Including supplementary material.
- ▶ Equivalence scales of market consumption:
  - ▶ Full sharing.
  - ▶ Oxford equivalence scale.
  - ▶ OECD equivalence scale.
  - ▶ Square root equivalence scale.
- ▶ Single/couple household.
- ▶ Male/female respondents.

Heterogeneous elasticities

Elasticity primarily determined by:

- ▶ Drop in houseprice value.
- ▶ Relatively low houseprice value (absolute).
- ▶ Mortgage-free.
- ▶ Relatively high substitutable spending.
- ▶ Medium household income

Not by:

- ▶ Financial wealth.

Conclusion

- ▶ Decrease in market consumption after 'shocks'.
- ▶ Increase in home production after 'shocks'.
- ▶ Wealth shocks in the Great Recession avoid endogeneity problems.
- ▶ Small substitution effects ($\frac{\Delta ln(h_{int+1})}{\Delta ln(c_{imt+1})} = -0.65$).
- ▶ Small scope for substituting market consumption ($\approx 12\%$).
- ▶ Increases in home production primarily due to 'time-endowment'.
- ▶ Contrast to the high substitutability assumed in theoretical (macro) models (Campbell & Ludvigson 2001).