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.

- 'Time' can be used to increase consumption beyond market spending (Aguiar & Hurst 2005).
- 'Time' can be a considerable endowment in low-income households.
- Becker's 1965 theory of the allocation of time.

A theory of the allocation of time (Becker 1965)

- Consumption 'produced' by two inputs
  - Market expenditures.
  - Time.
- *Money-intensive* versus *Time-intensive goods*.
- Composition of consumption bundle depends on *relative price of time*.
- Shift in composition when the price of time changes.

Augmenting the standard classical model (Gronau, 1977)

$$max_{c_{mt}, h_{mt}, h_{nt}} u(c_m, c_n(h_n), l) \tag{1}$$

with *home production function*

$$c_n(h_n) = g(h_n) \tag{2}$$

subject to a time- and monetary budget

$$H = h_m + h_n + l \tag{3}$$

$$c_m = w \cdot (H - l - h_n) + b \tag{4}$$

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.

Main 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. 2015).
    - Home production (Kuehn 2015).

Minor contribution

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 $\Longleftrightarrow$ Housekeeping services
- Laundry $\Longleftrightarrow$ Housekeeping services, Washing/Drying machine
- Gardening $\Longleftrightarrow$ Gardening services
- Shopping $\Longleftrightarrow$ n.a.
- Cooking $\Longleftrightarrow$ Dining out, Dishwasher
- Financial Management $\Longleftrightarrow$ n.a.
- Home maintenance $\Longleftrightarrow$ Homerepair services
- Vehicle maintenance $\Longleftrightarrow$ Vehicle maintenance services

Consumption spending across Time ($/y)

	Wave 2005	Wave 2007	Wave 2009	Wave 2011
	Mean	Mean	Mean	Mean
Dining out	1,795	1,761	1,472	1,683
Housekeeping services	432	390	291	296
Gardening services	486	429	348	363
Homerepair services	1,403	1,412	1,176	1,059
Vehicle maintenance	632	558	556	545
Dishwasher	21	82	18	18
Washing/Drying machine	71	82	69	45
Substitutable consumption	4,841	4,656	3,930	4,009
Substitutable consumption excl. durables	4,749	4,549	3,843	3,946
Substitutable consumption incl. suppl. mat.	6,540	6,266	5,320	5,402
Total consumption	40,120	38,856	36,122	35,348

Home Production across Time (h/w)

	Wave 2005	Wave 2007	Wave 2009	Wave 2011
	Mean	Mean	Mean	Mean
House cleaning	4.5	5.2	5.0	4.8
Laundry	2.7	2.6	2.8	2.6
Gardening	2.7	3.0	2.9	3.0
Shopping	4.1	3.9	4.0	4.0
Cooking	7.0	7.0	6.8	7.1
Financial management	0.9	1.0	0.8	0.9
Home maintenance	1.0	0.9	0.7	0.7
Vehicle maintenance	0.3	0.4	0.4	0.4
Home production	23.1	23.9	23.4	23.3

Life-Cycle Model with Home Production and Wealth Shocks

$$U_\tau = max_{c_{mt}, h_{mt}, h_{nt}} \mathbb{E}_\tau \left[\sum_{t=\tau}^{T} (1+\delta)^{\tau - t} u(c_{mt}, c_{nt}(h_{nt}), l_t) \psi(v_t) \right] \tag{5}$$

with

$$c_{nt}(h_{nt}) = g_t(h_{nt}) \tag{6}$$

$$c_{mt} = \{c^s_{mt}, c^{ns}_{mt}\} \tag{7}$$

subject to

$$h_{nt} = H - h_{mt} - l_t \tag{8}$$

$$A_{t+1} = (1+r)(\mathbb{E}_t[A_t] + (w_t \cdot (H - l_t - h_{nt})) + b_t - c_{mt}) \tag{9}$$

$$\mathbb{E}_t[A_t] = A_t + \xi_t \tag{10}$$

Theoretical predictions

$$u_{c_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = \left(\frac{1+r}{1+\delta}\right)\mathbb{E}_t\left[u_{c_{mt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right] \tag{11}$$

$$u_{h_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = -w_t\left(\frac{1+r}{1+\delta}\right)\mathbb{E}_t\left[u_{h_{mt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right] \tag{12}$$

$$u_{h_{nt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = w_t\left(\frac{1+r}{1+\delta}\right)\mathbb{E}_t\left[u_{h_{nt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right] \tag{13}$$

Empirical model

Estimating the elasticity:

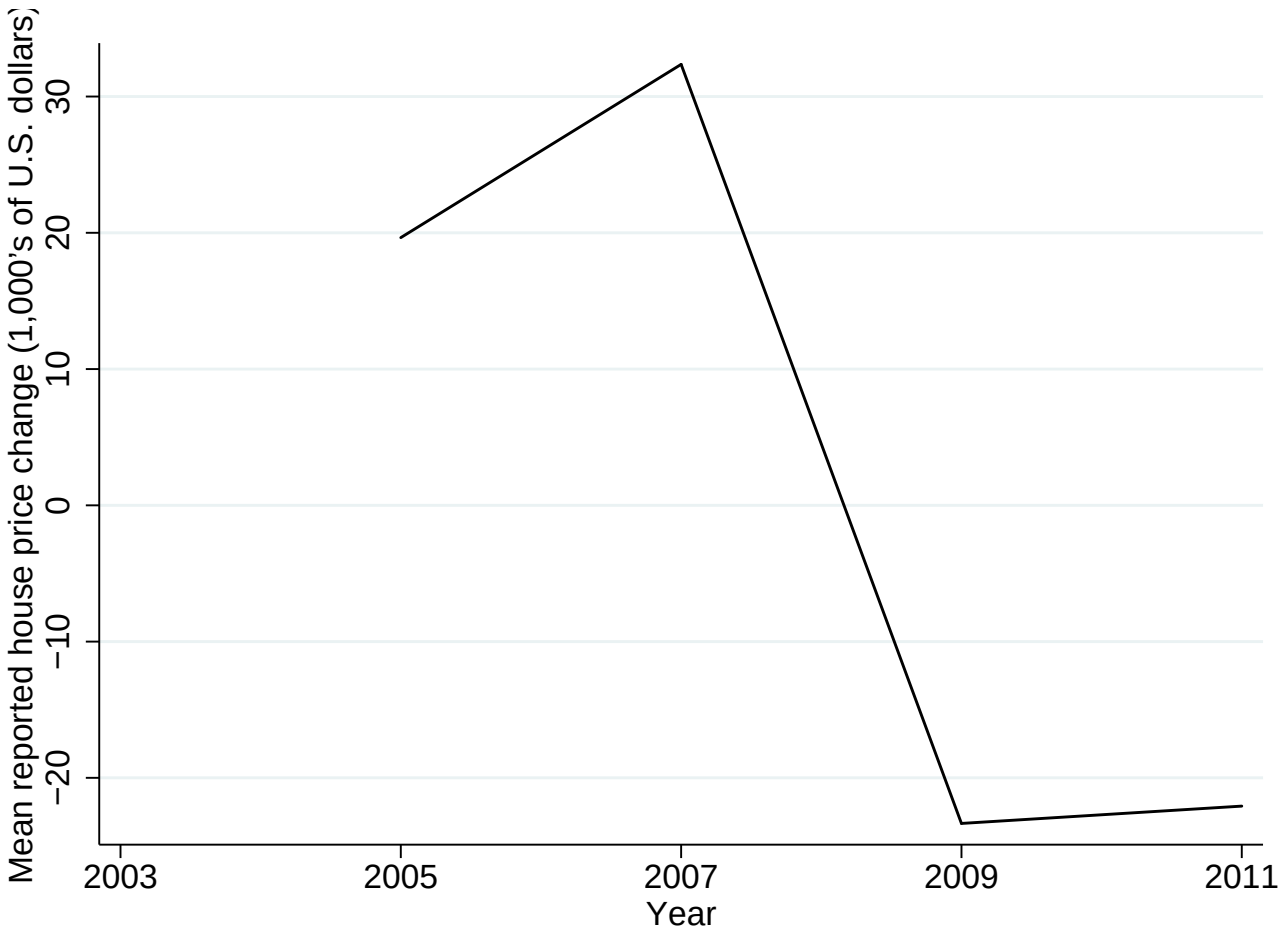
$$\Delta ln(h_{int+1}) = \Delta X_{it+1}\beta_{n1} + \Delta ln(c^s_{imt+1})\beta_{n2} + \varepsilon_{int+1} \tag{14}$$

where $\beta_{n2} = \frac{\Delta h_{nt+1}}{\Delta c^s_{mt+1}}$, using

$$\Delta ln(c^s_{imt+1}) = \Delta X_{it+1}\beta_{c1} + D_{GR}\Delta ln(W_{it})\beta_{c2} + \varepsilon_{ict+1} \tag{15}$$

Keeping $(w_t \cdot (H - l_t - h_{nt})) + b_t$ constant.

Identification: Houseprice changes



Instrument: Validity & Relevance

Validity:

$$h_{nt} = H - h_{mt} - l_t \tag{16}$$

$$A_{t+1} = (1 + r)(\mathbb{E}_t[A_t] + (w_t \cdot (H - l_t - h_{nt})) + b_t - c_{mt}) \tag{17}$$

Relevance:

- General: Case et al. (2005; 2013), Carroll et al. (2011).
- Older households: Campbell & Cocco (2007).
- Great Recession: Angrisani et al. (2015), Christelis et al. (2015).

Estimation results

Second-stage	$\Delta ln(h_{int+1})$	
	Coeff.	S.E.
Elasticity		
$\Delta ln(c^s_{imt+1})$	-0.65*	0.37
First-stage	$\Delta ln(c^s_{imt+1})$	
	Coeff.	S.E.
Instrument		
$D_{GR}\Delta ln(W_{it})$	0.14**	0.06
F-statistic	5.6	
Observations ($N \times T$)	2,500	

Interpretation

- $\beta_{n2} = \frac{\Delta ln(h_{int+1})}{\Delta ln(c_{imt+1})} = -0.65$.
- Less than perfect substitute.
- Bigger than elasticity found by Hicks (2015): -0.03 (endogeneity/food).
- 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 to different definitions

Definition	First-stage		Second-stage		
	β_{c2}	$\sigma^2_{\beta_{c2}}$	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.
$ln(c^s_{imt+1})$	0.14**	0.06	-0.65*	0.37	2,500
$ln(c^s_{imt+1})$ excl. durables	0.12**	0.06	-0.71*	0.44	2,500
$ln(c^s_{imt+1})$ incl. suppl. material	0.14**	0.06	-0.61**	0.31	2,504
$ln(c^s_{imt+1})$ dining out only	0.30***	0.11	-0.29*	0.17	2,489
$ln(c^s_{imt+1})$ excl. homerepair services	0.12**	0.06	-0.74*	0.45	2,491
$ln(c^s_{imt+1})$ excl. homerepair/gardening services	0.12**	0.06	-0.74*	0.45	2,490

Heterogeneous elasticities

Elasticity primarily determined by:

- Drop in houseprice value.
- Relatively low houseprice value (absolute).
- Mortgage-free.
- Medium household income.
- **Relatively high substitutable spending.**
- **Relatively low home production level**.

Not by:

- Financial wealth.
- Indebtedness.

Lower bound

	h_n		c_m^s	
	Mean	S.E.	Mean	S.E.
Non-retired	19.8	0.26	5,177.5	103.4
Retired	23.2	0.23	3,747.8	64.0
Δ	3.4***	0.35	-1,429.7***	115.3
Non-retired men	16.1	0.29	6,013.6	175.9
Retired men	19.1	0.23	3,992.8	96.3
Δ	3.0***	0.50	-2,020.7***	194.9
Non-retired women	22.6	0.39	4,540.6	122.1
Retired women	25.2	0.28	3,624.5	83.0
Δ	2.6***	0.47	-916.0***	143.1
Non-retired <65	19.4	0.27	5,247.1	133.6
Retired <65	23.6	0.47	3,766.0	126.9
Δ	4.2***	0.51	-1,481.1***	199.2
Non-retired 65+	20.6	0.55	5,029.1	153.8
Retired 65+	23.0	0.27	3,740.8	73.9
Δ	2.4***	0.58	-1,288.3***	158.6

Conclusion

- 'Small' substitution effects ($\frac{\Delta ln(h_{int+1})}{\Delta ln(c^s_{imt+1})} = -0.65$).
- Small scope for substituting c^s_{mt} ($\approx 12\%$).
- High substitutability assumed in theoretical (macro) models (Campbell & Ludvigson 2001).
- Estimates are credible lower bound.

Importance for pensions

- Income and spending drop at retirement (*Retirement-Consumption Puzzle* literature).
- Drop in well-being likely to be smaller:
  - Substitute c^s_{mt} for c_{nt}.
  - Considerably more non-work time available ($h_{mt} = 0$).
- Need for Pension Adequacy measures that go beyond income and spending.