Home Production as a Substitute for Market Consumption: Reactions of Time-Use to Shocks in Housing Wealth *

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Abstract

Shocks to income and wealth decrease the households monetary budget available. As a consequence, households respond by decreasing consumption spending. Income shocks, such as unexpected unemployment and retirement, also increase the time-budget available in addition to decreasing the monetary budget available. Some research has suggested that the additional time available enables households to substitute home production for purchased goods and services, effectively increasing their well-being beyond what a measure of spending would indicate. We aim to expand on this research by using data on time-use with data on categories of spending. We use wealth shocks in house values induced by the Great Recession to infer the extent to which households adjusted home production in response to decreasing market consumption possibilities. For people whose time-budget did not change and who were affected by the shock, we find that a 1% decrease in consumption that can be substituted for by home production increases the time spent in home production activities by about 0.6%. This implies that a part of the decreased market consumption possibilities can be replaced by home production to mitigate the consequences for well-being.

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1 Introduction

The assessment of economic preparation for retirement has relied on measures of income and wealth (Boskin & Shoven, 1987; Haveman et al., 2006, 2007; Crawford & O'Dea, 2012; Knoef et al., 2013; De Bresser & Knoef, 2014), and in some cases on measures of consumption (Engen et al., 1999; Scholz et al., 2006; Hurd & Rohwedder, 2008, 2011; Binswanger & Schunk, 2012). The canonical Life-Cycle Hypothesis (LCH) predicts that individuals allocate their resources in order to smooth the marginal utility of consumption over their life-time. To obtain smoothing of consumption over life-time, rational forward-looking individuals will save during the working life so to maintain a smooth level of consumption at retirement by dissaving. Using a life-cycle model Scholz et al. (2006) find that about 80% of Americans are saving sufficiently to smooth their marginal utility of consumption over the life-cycle. Hurd & Rohwedder (2011) find a similar result of the adequacy of preparation for retirement.

While none of these studies consider home production in their assessments, a couple of strands of related literature have raised the issue and showed that home production plays a role when people experience a change in their work status. The first literature is concerned with changes in spending and time use around retirement and the second is concerned with changes in spending and time use in response to unemployment. A number of studies have noted and investigated a sizeable drop in household spending at retirement. This phenomenon of sharply declining consumption at retirement has been called the *retirement consumption puzzle* as it is in contrast with the predictions of the LCH. Such drops in consumption expenditures at retirement are found by, among others, Mariger (1987); Robb & Burbidge (1989); Banks et al. (1998); Bernheim et al. (2001); Miniaci et al. (2003); Battistin et al. (2009). Other studies argue that the drop in consumption expenditures at retirement is not in contrast with the LCH. Hurd & Rohwedder (2003, 2006); Ameriks et al. (2007); Borella et al. (2011); Hurd

& Rohwedder (2013) argue that the drop in consumption is anticipated and therefore not inconsistent with rational forward-looking individuals per se. On the other hand, retirement may be an unanticipated shock (due to a health shock or layoffs) as suggested by Smith (2006); Haider & Stephens (2007); Barrett & Brzozowski (2012). Such unexpected retirement may explain the drop in consumption that is empirically observed while being consistent with the LCH. For an excellent overview of the literature regarding the reconciliation of consumption drops within the LCM, see Hurst (2008) and Attanasio & Weber (2010).

One of the main conclusions of Hurst (2008) is that a large heterogeneity is found in spending changes at retirement across different categories of consumption. Especially food expenditures are found to fall sharply relative to other consumption components at retirement (Aguila et al., 2011; Hurd & Rohwedder, 2013; Velarde & Herrmann, 2014). Aguiar & Hurst (2005) explain this phenomenon by showing that retired persons use their additionally available time to maintain well-being by substituting home production (e.g., cooking) for purchased goods and services (e.g., dining out). Stancanelli & Van Soest (2012) show that the act of retirement increases time spent in home production. Hence, it is crucial to differentiate between expenditures and consumption and to augment the standard life-cycle model with home production in order to explain that the expenditure drops observed at retirement are not inconsistent with the LCH (Hurst, 2008).

The idea of introducing home produced good in the utility function was introduced by Becker (1965) and further developed by Gronau (1977). In dynamic equilibrium, an individual maximizes within period utility by equating marginal utilities to price ratios, where the price of time depends on labor market opportunities. Following retirement as total spending declines, budget shares will change as predicted by Engle curves; to the extent that some uses of time are complements or substitutes for each type of

purchased consumption good, those uses of time will also change.

The subsequent literature has pursued the implications of home production further. Baxter & Jermann (1999); Apps & Rees (2005); Aguiar & Hurst (2005); Dotsey et al. (2010); Rogerson & Wallenius (2013) incorporate home production in a standard life-cycle model in which the home produced goods are substitutable with market goods. Dotsey et al. (2010) show that this model can account for the observed patterns in consumption and time-use over the life-cycle. According to the model, households allocate more time to home production and leisure as they reduce working hours toward retirement. This is because the opportunity cost of home production and leisure declines in retirement, because there is no longer a tradeoff with working hours. As a consequence, home production of goods substitutes for consumption of market goods; this explains the drop in expenditures observed at retirement.

Taking into account the willingness to substitute home production for market consumption also improves explanation of the aggregate fluctuations observed at the macro level (Benhabib et al., 1991; Greenwood & Hercowitz, 1991). The time households devote to home production fluctuates over the business cycle, implying that households may shift away from market work to home production in recessional times. Unemployed workers choose lower levels of market goods consumption than they would if employed, but they can keep well-being constant as they have more time to produce at home (Hall, 2009; Karabarbounis, 2014). Ahn et al. (2008) find that home production is higher in households with unemployed individuals than in those with employed individuals. Similarly, Brzozowski & Lu (2006), explicitly focusing on food consumption and production, find that home production is higher in households with retired individuals.

Although these results are an indication of substitution effects between market consumption and time-use, they cannot be interpreted as being causal; Ahn et al. (2008) and Brzozowski & Lu (2006)

are only able to analyze time-use in a cross-sectional setting. However, using longitudinal data, Velarde & Herrmann (2014) find substantial substitution effects between food expenditures and food-related time-use at retirement. This result extends to individuals who are non-working (not in the labor force) or unemployed. Such effects are also found by Colella & Van Soest (2013) focusing on home production in general. Burda & Hamermesh (2010) find evidence that individuals generally offset market hours with home production during times of high cyclical unemployment. Aguiar et al. (2013) show that individuals who lost working hours during the Great Recession reallocated a substantial part of their available time to home production and/or increased leisure time. They find that about 30% of lost working hours were absorbed by home production during the Great Recession. Such substitution between market work and home production may mitigate the effects of recessions on well-being, the drop in which may not be as large as the drop in market hours. However, Aguiar et al. (2013) do not study the substitution effects between market consumption and home production as they do not have data on spending (Burda & Hamermesh, 2010; Aguiar et al., 2013). Analyzing the effect of the Great Recession, Griffith et al. (2014) find that households lowered food spending by increased shopping effort. They, however, do not have any explicit information about time-use.

We expand on the research discussed above by using data that has information on both time-use and spending such as Colella & Van Soest (2013); Velarde & Herrmann (2014). Compared to Colella & Van Soest (2013); Velarde & Herrmann (2014) we explicitly try to find the degree of substitution between consumption spending and home production. Since spending on market consumption and home production is endogenous, we use the wealth shocks induced by the Great Recession to infer the degree to which households are able to use time to offset partially the market consumption possibilities losses. More particularly, we use the the drop in house prices as an exogenous negative wealth shock that de-

creased the monetary budget (Angrisani et al., 2013) but not the time budget. Angrisani et al. (2013) exploit regional heterogeneity in house price drops due to the Great Recession to infer a causal relationship between wealth and consumption. They find substantial decreases in consumption due to the drop in housing wealth due to the Great Recession. Substitution effects between consumption spending and time-use is, however, neglected in this study. Nevertheless, it is important to gain insight into the degree to which consumption can be replaced by home production as this may mitigate the effects of shocks on well-being.

The remainder of the paper is organized as follows. Section 2 describes the HRS and CAMS data used in the paper. Descriptive statistics of time-use and consumption spending are presented in Section 3. To analyze home production formally, Section 4 presents a simple life-cycle model with home production. The functional form and the empirical model are dervied in Section 5 and Section 6 respectively. The results of the empirical model are shown in Section 7. Section 8 provides a discussion. Conclusions regarding the substitutability of market consumption and home production can be found in Section 9.

2 Data

The data for our empirical analyses come from the Health and Retirement Study (HRS), a longitudinal survey that is representative of the U.S. population over the age of 50 and their spouses. The HRS conducts core interviews of about 20,000 persons every two years. In addition the HRS conducts supplementary studies to cover specific topics beyond those covered in the core surveys. The time-use data we use in this paper were collected as part of such a supplementary study, the Consumption and Activities Mail Survey (CAMS).

Health and Retirement Study Core interviews

The first wave of the HRS was fielded in 1992. It interviewed people born between 1931 and 1941 and their spouses, irrespective of age. The HRS re-interviews respondents every second year. Additional cohorts have been added so that beginning with the 1998-wave the HRS is representative of the entire population over the age of 50. The HRS collects detailed information on the health, labor force participation, economic circumstances, and social well-being of respondents. The survey dedicates considerable time to elicit income and wealth information, providing a complete inventory of the financial situation of households. In this study we use demographic and asset and income data from the HRS core waves spanning the years 2002 through 2010.

Consumption and Activities Mail Survey

The CAMS survey aims to obtain detailed measures of time-use and total annual household spending on a subset of HRS respondents. These measures are merged to the data collected on the same households in the HRS core interviews. The CAMS surveys are conducted in the HRS off-years, that is, in odd-numbered years.

The first wave of CAMS was collected in 2001 and it has been collected every two years since. Questionnaires are sent out in late September or early October. Most questionnaires are returned in October and November. CAMS thus obtains a snap-shot of time-use observed in the fall of the CAMS survey year. In the first wave, 5,000 households were chosen at random from the entire pool of households who participated in the HRS 2000 core interview. Only one person per household was chosen. About 3,800 HRS households responded, so CAMS 2001 was a survey of the time-use of 3,800 respondents and the total household spending of the 3,800 households in which these respondents live. Starting in the third wave of CAMS, both respondents in a couple household were asked to complete the time-use section,

so that the number of respondent-level observations on time use in each wave was larger for the waves from 2005 and onwards.

Respondents were asked about a total of 31 time-use categories in wave 1; wave 2 added two more categories; wave 4 added 4 additional categories. Thus, since CAMS 2007 the questionnaire elicits 37 time-use categories, as shown in Appendix A. Of particular interest for this study are the CAMS time-use categories related to home production:

- House cleaning
- Washing, ironing or mending clothes
- Yard work or gardening
- Shopping or running errands
- Preparing meals and cleaning up afterwards
- Taking care of finances or investments, such as banking, paying bills, balancing the checkbook, doing taxes, etc.
- Doing home improvements, including painting, redecorating, or making home repairs
- Working on, maintaining, or cleaning car(s) and vehicle(s)

For most activities respondents are asked how many hours they spent on this activity last week. For less frequent categories they were asked how many hours they spent on these activities last month. Hurd & Rohwedder (2008) provide a detailed overview of the time-use section of CAMS, its design features and structure, and descriptive statistics. A detailed comparison of time-use as recorded in CAMS with that recorded in the American Time Use Survey (ATUS) shows summary statistics that are fairly close

across the two surveys, despite a number of differences in design and methodology (Hurd & Rohwedder, 2007).

In this paper we use data from CAMS 2005, 2007, 2009 and 2011, each wave containing between about 5,300 and 6,500 respondent-level observations on time-use that we merge with HRS core data. Combining the data from the HRS core and the CAMS provides us with data that are unique in that we observe demographics, economic status, time-use and spending for the same individuals and their households in panel.

3 Descriptive statistics

3.1 Time-use

Table 1 shows the time spent in home production activities per wave by persons aged 51-80. These activities can be used as a substitute for the market bought goods and services shown in Table 2. The aggregate of home production activities shows that a non-negligible part of the weekly available time is spent on home production and that virtually all persons engage in some form of home production.

Most of the home production is devoted to the cooking of meals. Together with the house cleaning, this accounts for about half of total time spent in home production. More than 80% of the persons in the data spend some time on these two home production activities. About 90% of the people engage in shopping activities although the average time spent in this activity is somewhat smaller than the time spent in house cleaning and cooking. Unlike activities such as house cleaning, cooking and doing the laundry, it is harder to buy the service for shopping on the market which may explain the relatively high percentage of persons engaging in this activity. Approximately half of the people engage in gardening and maintenance of the home and vehicles but the amount of time spent in these activities are fairly

small. More than 80% of the people spend time on managing their finances, but the amount of time spent in this activity is only about an hour per week.

Despite the fact that a non-negligible part of the weekly available time is devoted to home production activities on average, there is a lot of variation around this average as the standard deviations of most activities are about the same size as the averages (or even bigger). However, the variation across waves is only marginal. This might suggest that people do not adjust their time-use in home production that much during the course of the business cycle.

3.2 Consumption

Table 2 shows the household spending on consumption that can be substituted for by home production. The waves prior to the Great Recession show that spending is on average more substantial than in the waves after the Great Recession. This is consistent with the consumption drops found by Angrisani et al. (2013).

Substitutable consumption is about 11-12% of total consumption spending and is consistent across waves. This makes the substitutable consumption spending a non-negligible part of total consumption spending. The biggest component of the substitutable consumption spending consists of dining out expenditures. This expenditure could be well substituted for by home production in the form of cooking. Standard deviations of the spending categories are relatively big compared to the mean. The relative size of the standard deviation compared to the mean is much smaller for the total of consumption spending. This suggest that there is especially large heterogeneity in consumption spending that could be substituted for by home production activities. We observe that virtually all households have expenditures that could be substituted for by home production although the percentage of households with spending on substitutable consumption decreased in later waves.

Table 1: Time-use in home production activities

	Wave 2005				Wave 2007				Wave 2009				Wave 2011			
	Mean	S.D.	% Total	% Respondents	Mean	S.D.	% Total	% Respondents	Mean	S.D.	% Total	% Respondents	Mean	S.D.	% Total	% Respondents
House cleaning	4.7	6.3	21.2	80.8	4.8	7.1	22.0	82.1	4.7	6.1	21.9	83.0	4.8	6.5	22.2	83.3
Laundry	2.6	3.7	11.7	72.9	2.7	4.7	12.4	72.9	2.6	3.7	12.1	73.9	2.6	4.0	12.0	72.8
Gardening	2.2	4.9	9.9	50.4	2.2	4.2	10.1	52.4	2.3	4.5	10.7	51.9	2.2	4.7	9.3	49.4
Shopping	3.9	4.9	17.6	88.5	3.8	4.7	17.4	87.4	3.8	4.5	17.7	89.1	3.8	4.2	17.6	88.1
Cooking	6.4	6.9	28.8	85.8	6.3	7.2	28.9	85.9	6.3	6.6	29.3	86.7	6.2	6.6	28.7	86.2
Financial management	1.0	2.1	4.5	85.6	1.0	2.0	4.6	83.5	0.8	1.4	3.7	83.4	0.9	1.6	4.2	83.3
Home maintenance	1.0	3.0	4.5	45.8	0.8	2.0	3.7	44.2	0.7	2.5	3.3	40.1	0.7	2.2	3.2	39.2
Vehicle maintenance	0.4	0.9	1.8	52.1	0.3	0.7	1.8	51.7	0.3	0.9	1.4	48.5	0.4	1.1	1.9	48.6
Home production	22.2	19.4	100	98.5	21.8	21.1	100	98.1	21.5	17.7	100	97.9	21.6	20.1	100	98.4

Table 2: Household level consumption spending

	Wave 2005				Wave 2007				Wave 2009				Wave 2011			
	Mean	S.D.	% Total	% Households	Mean	S.D.	% Total	% Households	Mean	S.D.	% Total	% Households	Mean	S.D.	% Total	% Households
Dining out	1,912	3,530	4.7	85.0	1,808	2,912	4.5	84.5	1,513	2,096	4.0	83.9	1,598	2,443	4.4	81.2
Housekeeping services	414	1,194	1.0	49.3	386	1,054	1.0	49.5	331	984	1.0	45.2	349	1,014	1.0	43.4
Gardening services	381	1,371	1.0	34.2	355	1,179	1.0	33.8	314	833	1.0	35.6	296	854	0.8	33.5
Homerepair services	1,347	3,923	3.3	49.8	1,465	6,515	3.7	48.5	1,068	2,829	2.8	48.4	1,006	3,534	2.8	43.2
Vehicle maintenance	649	875	1.6	83.0	614	804	1.5	81.6	618	809	1.6	80.4	598	833	1.6	78.2
Dishwasher	23	115	0.0	4.4	27	127	0.0	5.0	19	105	0.0	3.6	15	91	0.0	3.5
Washing/Drying machine	63	250	0.0	8.7	76	293	0.0	9.7	68	278	0.0	9.2	53	232	0.0	8.3
Substitutable consumption	4,788	6,633	11.8	96	4,730	8,253	11.9	95	3,931	4,748	10.5	95	3,915	5,557	10.8	94
Substitutable consumption excl. durables	4,703	6,590	11.6	96	4,627	8,201	11.6	95	3,844	4,700	10.2	95	3,847	5,515	10.6	93
Substitutable consumption incl. suppl. mat.	6,487	8,069	16.0	99	6,387	9,878	16.0	99	5,342	5,795	14.2	99	5,382	7,071	14.8	98
Total consumption	40,558	29,427	100	100	39,904	29,268	100	100	37,515	25,778	100	100	36,359	26,086	100	100

Together, Table 1 and Table 2 give some idea on the scope of substituting market purchases for home production activities. To capture the possible substitution effects between the two more formally, we present a life-cycle model with home production in the next section.

4 Model

4.1 A simple Life-Cycle Model

The standard model to analyze consumption over the life-cycle is the life-cycle model that expresses utility over the remainder of the life-cycle as a function of consumption and leisure. Households maximize

$$U_\tau = max \mathrm{E}_\tau \left[\sum_{t=\tau}^{T} (1+\rho)^{\tau-t} u(c_t, l_t) \psi(v_t) \right] \tag{1}$$

where c_t and l_t denote consumption and leisure in time period t, respectively. ρ is the discount factor and T the time horizon of the household. v_t are the personal- and household characteristics that influence utility directly known as taste-shifters (e.g. age, household size, number of children).

Households maximize Equation 1 under the budget constraint that

$$A_{t+1} = (1+r)(A_t + (w_t \cdot (H - l_t)) + b_t - c_t) \tag{2}$$

where A_t is the amount of assets at time t, r is a constant real interest rate, w_t is the (after-tax) wage rate, H the time-endowment and b_t are benefits (e.g. unemployment, social security and other unearned non-asset income).

An extension introduces leisure interacting with the one good in the instantaneous utility function so as to allow for home production, and/or complementarity or substitutability between time and that

good (Laitner & Silverman, 2005). However, following retirement leisure is fixed so that this version of the extended model reverts to the simple version. Therefore home-production needs to be incorporated explicitly in the life-cycle model.

4.2 A simple Life-Cycle Model with Home Production

Since we are particularly interested in time-use, it is important to incorporate household production (Becker, 1965; Gronau, 1977; Apps & Rees, 1997, 2005) in the simple life-cycle model . This introduces home produced goods c_{nt} next to the classical market consumption c_{mt} and leisure l_t (Rupert et al., 2000) which yields the following utility function

$$U_\tau = max\mathrm{E}_\tau \left[\sum_{t=\tau}^{T} (1+\rho)^{\tau-t} u(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) \right] \tag{3}$$

with $c_{nt}(h_{nt}) = g_t(h_{nt})$ being the home production function with time spent in home production h_{nt}. For simplicity, we assume that the home production function is strictly concave in one variable input,[1] namely the time spent in home production. The budget constraint becomes

$$A_{t+1} = (1+r)(A_t + (w_t \cdot (H - l_t - h_{nt})) + b_t - c_{mt}) \tag{4}$$

Solving equation 3 subject to equation 4 gives the following Euler Equations of marginal utility with respect to c_{mt} (consumption of market goods), h_{nt} (home production) and $h_{mt} = H - l_t - h_{nt}$ (market production).

$$u_{c_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = \left(\frac{1+r}{1+\delta} \right) E_t \left[u_{c_{mt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) \right] \tag{5}$$

[1] Relaxing this assumption would give $c_{nt}(h_{nt}) = g_t(x_t, h_{nt})$ with x_t as market purchased inputs used in home production. Working with this relaxed assumption would give an additional expenditure term in the budget constraint.

$$u_{h_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = -w_t \left(\frac{1+r}{1+\delta}\right) E_t \left[u_{h_{mt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right] \tag{6}$$

$$u_{h_{nt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) = w_t \left(\frac{1+r}{1+\delta}\right) E_t \left[u_{h_{nt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right] \tag{7}$$

where $\left(\frac{1+r}{1+\delta}\right) E_t \left[u_{c_{mt+1}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1})\right]$ captures the marginal utility of wealth. In other words, the optimal level of consumption of market goods is where the marginal utility of consumption of market goods equals the marginal utility of wealth (taking into account a fixed interest rate and discount factor). The marginal utility of wealth takes into account all future expectations. Similarly, the marginal utility of market production and home production depend on the marginal utility of wealth as well as the wage rate. A higher wage rate, however, increases the marginal utility of market production and decreases the marginal utility of home production for which the wage rate is an opportunity cost. The model predicts that the marginal utility of market production and home production is equal across different activities.

Expressions 5 and 7 imply that market consumption and home production are functions of the individual's current characteristics that determine the wage as well as all relevant information about other periods, including future periods. To see this, introducing an expectation error ε_{t+1} allows us to rewrite the Euler Equations into

$$u_{c_{mt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) = \left(\frac{1+\delta}{1+r}\right) u_{c_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \varepsilon_{t+1} \tag{8}$$

$$u_{h_{mt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) = -w_t \left(\frac{1+\delta}{1+r}\right) u_{h_{mt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \varepsilon_{t+1} \tag{9}$$

$$u_{h_{nt}}(c_{mt+1}, c_{nt+1}(h_{nt+1}), l_{t+1})\psi(v_{t+1}) = w_t \left(\frac{1+\delta}{1+r}\right) u_{h_{nt}}(c_{mt}, c_{nt}(h_{nt}), l_t)\psi(v_t) + \varepsilon_{t+1} \tag{10}$$

where ε_{t+1} is uncorrelated with all the information available at time t. The rewritten expressions explicitly show the recursive nature of the marginal utility of wealth in which only an unanticipated shock (ε_{t+1}) can result into a deviation from the optimal path. This implies that the marginal utility of wealth at time t is a function of (in our case) a constant representing the ratio between the interest rate and the discount rate as well as a term that captures the individual specific effects (e.g. fixed effects) and a random error that reflects the expectational error up to the current period. We use these facts to derive our empirical model later.

4.3 A simple Life-Cycle Model with Home Production and Wealth Shocks

Since we are explicitly interested in how a wealth shock affects home production through its effect on the budget constraint, we add a stochastic component to the deterministic life-cycle budget contraint in Equation 4.

$$A_{t+1} = (1+r)(\mathrm{E}_t[A_t] + (w_t \cdot (H - l_t - h_{nt})) + b_t - c_{mt}) \tag{11}$$

with

$$\mathrm{E}_t[A_t] = A_t + \xi_t \tag{12}$$

where ξ_t yields a random term that captures a shock in the value of wealth available at time t (A_t). We assume $\mathrm{E}_t[\xi_t] = 0$ in the marginal utility of wealth. A shock at time t ($[\xi_t] \neq 0$) is captured by the error term ε_{t+1} in Equations 8-10.

A negative shock ($\xi_t < 0$) causes the monetary budget available at time $t+1$ (A_{t+1}) to decrease. This means that the decreased monetary budget has consequences for h_{mt+1}, h_{nt+1}, l_{t+1}, c_{mt+1} and c_{nt+1} in reoptimizing utility from the remaining life-time. As a result of the wealth shock, individuals may react by 1) only reducing market consumption (c_{mt}), 2) only increasing market work (h_{mt}) at the expense of leisure (l_t), 3) switching from market consumption (c_{mt}) to non-market consumption (c_{nt}) (e.g. home production) or a combination of these options.

Option 1) is most likely to have the most substantial effects on well-being while option 2) may not be possible (e.g. people working full-time, hours constraints by employers, retirees, unemployment, disability,). This suggests that option 3) would be a favorable option to mitigate the consequences of a negative wealth shock on well-being. Especially for those individuals that are unable to adjust their market hours (h_{mt}). The shift from market produced to home produced consumption goods would imply an increase in the total time spent in home production activities (h_{nt}).

5 A functional form to derive the empirical model

For simplicity, the functional form representation of preferences for market consumption, home consumption and labor is an additive utility function such that preferences are additively separable.[2] A similar simple functional form of the utility function was used by Rupert et al. (2000) and Gortz (2006). More sophisticated functional forms are used in Benhabib et al. (1991), Greenwood & Hercowitz (1991), Fang & Zhu (2012), Dotsey et al. (2010), Rogerson & Wallenius (2013) and Karabarbounis (2014). These papers use a Cobb-Douglas period utility function as a CES parameterization of the utility func-

[2]We assume additively separable preferences in this framework to keep the derivation of our empirical model tractable. In practice, it is likely that the marginal utility of consumption does depend on home production, for example.

tion with home production.[3] Alessie & De Ree (2008), for example, allow for a functional form that distinguishes between husband's and wife's home production.

As we only intend to derive our empirical model from the life-cycle model with home production, it suffices to use the following simple functional form of the utility function as used by Gortz (2006) where consumption, labor supply and home production are summed over spouses (e.g. joint decision-making).[4]

$$u(c_{mt}, c_{nt}(h_{nt}), l_t) = c_{mt}^{\theta_{mt}} + c_{nt}(h_{nt})^{\theta_{nt}} + l_t^{\theta_{lt}} \tag{15}$$

with θ_{mt}, θ_{nt} and θ_{lt} being the preference parameters for market goods, home production and leisure such that $\theta_{mt} + \theta_{nt} + \theta_{lt} = 1$. Productivity in home production $c_{nt}(h_{nt}) = g_t(h_{nt})$ is assumed to have constant economies of scale but is assumed to be different over time[5] ($c_{nt}(h_{nt}) = g_t(h_{nt}) = \gamma_t h_{nt}$ with γ_t being a positive parameter). Inserting the derivative of Equation 15 with respect to market consumption, market production and home consumption into the Euler Equation (Equation 5-7) and using $H - l_t - h_{nt}$ gives the following first-order approximations of the Euler Equations of market consumption, market

[3] This parameterization looks as follows.

$$u(c_{mt}, c_{nt}(h_{nt}), l_t) = \frac{\left(c_t^{1-b} l_t^b\right)^{1-\phi} - 1}{1-\phi} \tag{13}$$

with

$$c_t = \left((1-a)c_{mt}^{\rho} + a c_{nt}^{\rho}\right)^{1/\rho} \tag{14}$$

Here, ρ is the willingness to substitute between market consumption and home production. ϕ is the willingness to substitute leisure and consumption. A consequence of this specification in relation to our specification is that the marginal utility of consumption (either market or home produced) depends on the amount of leisure as well and vice versa.

[4] Deriving the empirical model from using the Cobb-Douglas period utility function as a functional form would result in a reduced form model with extra parameters a, b, ϕ, ρ and marginal utility of consumption that depends on leisure and vice versa.

[5] In this way, productivity does not increase nor decrease with the number of hours of home production supplied, but can increase or decrease over time because of, for example, aging or shocks in health. The assumption of constant economies of scale has no constraining consequences for our empirical model, but allows us to neatly write down the derivation of the empirical model.

production and home production given that the solution is interior.[6]

$$\theta_{mt} c_{mt}^{(\theta_{mt}-1)} \psi(v_t) = \left(\frac{1+r}{1+\delta}\right) E_t \left[\theta_{mt+1} c_{mt+1}^{(\theta_{mt+1}-1)} \psi(v_{t+1})\right] \tag{16}$$

$$\theta_{lt} h_{mt}^{(\theta_{lt}-1)} \psi(v_t) = -w_t \left(\frac{1+r}{1+\delta}\right) E_t \left[\theta_{lt+1} h_{mt+1}^{(\theta_{lt+1}-1)} \psi(v_{t+1})\right] \tag{17}$$

$$\theta_{nt} \gamma_t h_{nt}^{(\theta_{nt}-1)} \psi(v_t) = w_t \left(\frac{1+r}{1+\delta}\right) E_t \left[\theta_{nt+1} \gamma_{t+1} h_{nt+1}^{(\theta_{nt+1}-1)} \psi(v_{t+1})\right] \tag{18}$$

The first-order approximation of Equation 16-18 gives

$$ln(\theta_{mt}) + (\theta_{mt}-1) ln(c_{mt}) + ln(\psi(v_t)) =$$

$$ln(1+r) - ln(1+\delta) + E_t \left[ln(\theta_{mt+1}) + (\theta_{mt+1}-1) ln(c_{mt+1}) + ln(\psi(v_{t+1}))\right] \tag{19}$$

$$ln(\theta_{lt}) + (\theta_{lt}-1) ln(h_{mt}) + ln(\psi(v_t)) =$$

$$-ln(w_t) + ln(1+r) - ln(1+\delta) + E_t \left[ln(\theta_{lt+1}) + (\theta_{lt+1}-1) ln(h_{mt+1}) + ln(\psi(v_{t+1}))\right] \tag{20}$$

$$ln(\gamma_t) + ln(\theta_{nt}) + (\theta_{nt}-1) ln(h_{nt}) + ln(\psi(v_t)) =$$

$$ln(w_t) + ln(1+r) - ln(1+\delta) + E_t \left[ln(\gamma_{t+1}) + ln(\theta_{nt+1}) + (\theta_{nt+1}-1) ln(h_{nt+1}) + ln(\psi(v_{t+1}))\right] \tag{21}$$

[6] To allow for corner solutions, such as people in retirement without labor supply ($h_{mt} = 0$), equations 16-18 can be adjusted by multiplying the righthandside with $e^{(-\pi R_t)}$ (Gortz, 2007). $R_t = 1$ if a person is retired and zero otherwise. π is the degree to which a person adjusts the marginal utility of market production and home production. $\pi > 0$ is assumed such that $0 < e^{(-\pi R_t)} < 1$ if a person is retired meaning that the marginal utility of market production and home production does not have to equal the marginal wage rate times the marginal utility of wealth as would be in interior solutions.

Using 8-10 this yields[7]

$$\Delta ln(c_{mt+1}) = \frac{1}{\Delta(\theta_{mt+1}-1)}\left(ln(1+r) - ln(1+\delta) + \Delta ln(\theta_{mt+1}) + \Delta ln(\psi(v_{t+1}))\right) + \varepsilon_{t+1} \tag{22}$$

$$\Delta ln(h_{mt+1}) =$$

$$\frac{1}{\Delta(\theta_{mt+1}-1)}\left(-ln(w_t) + ln(1+r) - ln(1+\delta) + \Delta ln(\theta_{mt+1}) + \Delta ln(\psi(v_{t+1}))\right) + \varepsilon_{t+1} \tag{23}$$

$$\Delta ln(h_{nt+1}) =$$

$$\frac{1}{\Delta(\theta_{nt+1}-1)}\left(ln(w_t) - \Delta ln(\gamma_{t+1}) + ln(1+r) - ln(1+\delta) + \Delta ln(\theta_{nt+1}) + \Delta ln(\psi(v_{t+1}))\right) + \varepsilon_{t+1} \tag{24}$$

Here, we assume that that the time-constant interest rate (r) and discount rate (δ) reduce to a constant α.

$$\alpha = ln(1+r) - ln(1+\delta) \tag{25}$$

Furthermore, we assume that θ_{mt+1} and θ_{nt+1} (the time-varying preference parameters of consumption and home production respectively) can be approximated by a set of individual- and household specific characteristics (captured in the vector X_{t+1}) such as age, gender, marital status, household structure, educational status, health and unobserved characteristics captured in η_m and η_n respectively. As η_j represents individual fixed effects, the combination of $X_{t+1} + \eta_j$ and ε_{t+1} capture the marginal utility of wealth.

[7] Explicitly allowing for retirement as a corner solution would add an extra term $\pi \Delta R_{t+1}$ to equations 23 and 24.

As $\psi(v_{t+1})$ are the personal- and household characteristics that affect utility directly, it is captured by the vector X_{t+1} (observed heterogeneity) and η_j (unobserved heterogeneity).

γ_{t+1} is a time-varying parameter that represents the productivity of home production and is likely to be captured by the vector X_{t+1} and the individual specific effects as well.

Since the life-cycle model only applies to non-corner solutions, w_t should be positive. To incorporate corner solutions as well in the model,[8] we do not use w_t but we use the life-cycle wage profile which can be approximated by the variables in vector X_{t+1} and the individual specific effects in stead (see for example Kalwij & Alessie (2007); Casanova (2013); Knoef & Been (2014)). This wage profile also includes the expected wages over the remainder of the life-cycle.

The fixed effects parameters capture the unobserved heterogeneity in the marginal utility of wealth, unobserved heterogeneity in preferences and unobserved heterogeneity in potential wages (only η_n).

$$\theta_{jt+1} = X_{t+1} + \eta_j \tag{26}$$

$$\psi_{t+1} = X_{t+1} + \eta_j \tag{27}$$

$$\gamma_{t+1} = X_{t+1} + \eta_j \tag{28}$$

$$w_t = X_{t+1} + \eta_j, j = m, n \tag{29}$$

Summarizing, X_{it} captures the effects of individual- and household characteristics such as age on preferences, potential wages and the marginal utility of wealth. Taking aforementioned assumptions into account, equation 22 to 24 reduce to the following empirical first-differences specifications for household i. Note that the constant (α) and the individual fixed effects (η_m and η_n) cancel out in a first-differences specification.

[8] Which is important to study retirees.

$$\Delta ln(c_{imt+1}) = \beta_c \Delta X_{it+1} + \varepsilon_{ict+1} \tag{30}$$

$$\Delta ln(h_{imt+1}) = \beta_m \Delta X_{it+1} + \varepsilon_{imt+1} \tag{31}$$

$$\Delta ln(h_{int+1}) = \beta_n \Delta X_{it+1} + \varepsilon_{int+1} \tag{32}$$

The error terms $\varepsilon_{ijt+1}, j = c,m,n$ are distributed *iid* $N(0,\sigma_j)$. These error terms capture the random error of the recursive process of the marginal utility of wealth (including possible shocks in wealth), the random error in equations 30-32 as well as the random error of vector X_{it} capturing preferences and potential wages (the latter only for $j = m,n$).

6 Empirical model

6.1 Estimating the Elasticity in Home Production and Market Consumption

The Life-Cycle Model with Home Production and Wealth Shocks in Section 4.3 indicated that negative wealth shocks decrease the monetary budget available and therefore the parameters in optimizing utility of the remaining life-time. If individuals are unable to adjust their market hours, a wealth shock decreases market consumption. We use this fact in estimating the substitution effect between home production and market consumption. Individuals may increase their home production as a response to the decrease in market consumption in order to mitigate the consequences of the wealth shock on their well-being. Ideally, we are interested in β_{n2} which forms the elasticity of substitution between home production and market consumption:

$$\Delta ln(h_{int+1}) = \beta_{n1}\Delta X_{it+1} + \beta_{n2} ln(c_{imt+1}) + \varepsilon_{int+1} \tag{33}$$

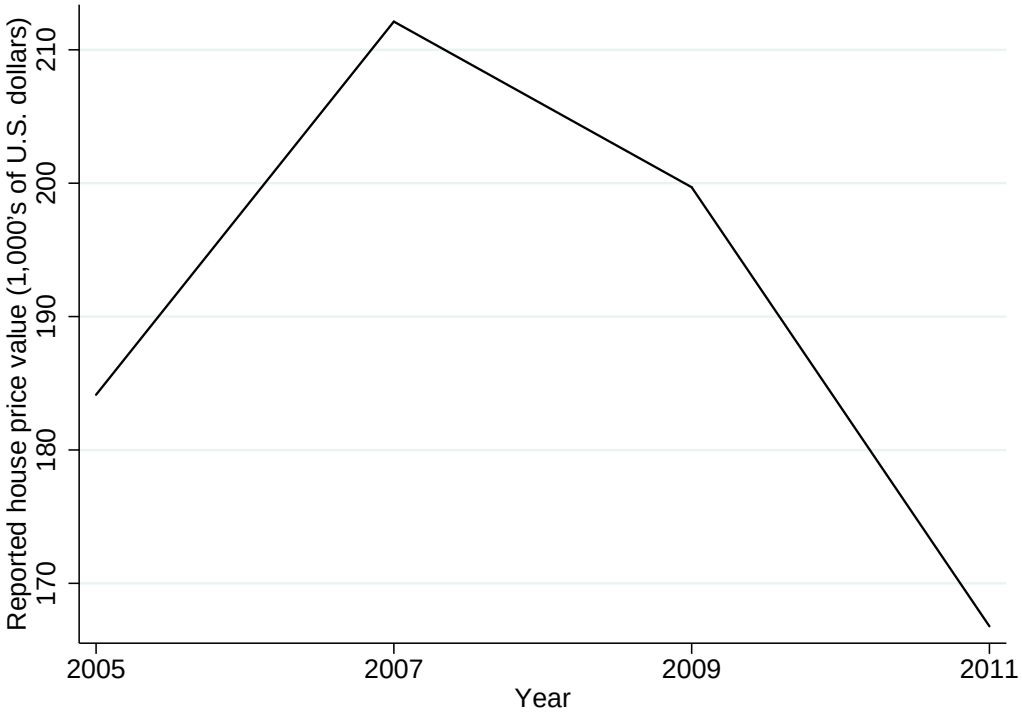
Since home production and market consumption are endogenously determined, as shown in Equations 30-32, estimates of β_{n2} would be biased. Hence, we need a *valid* and *relevant* instrument for market consumption. As we measure home production by time-use in home production activities and market consumption by spending, we need an instrument that unexpectedly affects the monetary budget available but not the time budget available. This excludes shocks in retirement, unemployment and health as they are often related to changes in both the monetary and the time budget. A shock in wealth, however, only affects the monetary budget while time-use is only affected through decreases market consumption possibilities. Therefore, we can use the unexpected change in (the log of) house prices due to the Great Recession ($D_{GR}\Delta ln(W_{it})$) as an exclusion restriction in the first-stage equation that represents ξ_t in Equation 12:

$$\Delta ln(c_{imt+1}) = \beta_{c1}\Delta X_{it+1} + \beta_{c2} D_{GR}\Delta ln(W_{it}) + \varepsilon_{ict+1} \tag{34}$$

The average reported house prices over the CAMS waves are reported in Figure 1. The house price drop from 2007 to 2009 is likely to be unexpected and persistent. The change in the reported house price from 2007-2009 by the respondent is used as the instrument in the IV regression since it only influences the life-time (monetary) budget constraint but not the time-budget. Since, the shock may also have effects on unemployment, we only consider retired persons in our analysis.

To make sure that the wealth shock decreases the monetary budget and therefore market consumption, we want to keep the terms $(w_t \cdot (H - l_t - h_{nt})) + b_t$ in Equation 11 fixed. This means that individuals

Figure 1: Reported house prices development



Source: HRS.

do not experience a change in their time budget available for home production by increasing or decreasing (e.g. becoming unemployed, disabled or retired) market work hours ($H - l_t - h_{nt}$). Neither do individuals experience a change in non-market, non-wealth income such as social security benefits (b_t). Therefore, we estimate Equation 33 and 34 on a subsample of persons fully retired at time t and $t+1$ ensuring that $\Delta h_{mt} = 0$ (e.g. remaining fully retired)[9] and $\Delta b_t = 0$ (e.g. no changes in recipience of UI, DI or SS benefits).

For these retirees, the mechanism is most tractable. A shock in wealth decreases the monetary budget and, since the time-budget does not change, decreases market consumption possibilities. However, these retirees can substitute leisure for time spent in home production to mitigate the effects on well-being which allows us to infer a causal relationship between market consumption spending and time-use in home production.

6.2 Reduced form specification

We define h_{nt} as the sum of time-use in Homecleaning, Laundry, Gardening, Shopping, Cooking, Financial Management, Home improvements, Car improvements. c_{mt} is defined as the sum of money spent on market goods that could potentially be substituted for by home production. These spending categories include Vehicle maintenance, Dishwasher, Wash and drying machine, Home repair services, Housekeeping services, Gardening services, Dining out.

To estimate Equations 33 and 34, we let X_{it} consist of age, age squared (to allow for non-linear effects of age), household transitions (from single to couple or couple to single), household size (increasing or decreasing), health status (improving or deteriorating) and the wave of the CAMS data.

As an instrument for $D_{GR}\Delta ln(W_{it})$ we use the self-reported change in (the log of) housing wealth in

[9] This basically makes Equation 31 redundant and reduces the analysis to Equations 30 and 31.

the period 2007-2009. Angrisani et al. (2013) showed that the drop in house prices decreased spending on market goods and services.

Equations 33 and 34 are regressed on the sample of people who are able to experience $\xi_t \neq 0$ and for whom this has consequences on the monetary budget, e.g. homeowners. We only include homeowners that did not buy or sell a house from period t to $t+1$.

7 Estimation results

Table 3 shows the estimated coefficients of the effect of the log of consumption (β_{c2}) on the log of time-use in home production activities (β_{n2}) using the houseprice drop in the Great Recession to infer a causal relationship between β_{c2} and (β_{n2}). β_{n2} can be interpreted as the elasticity between consumption that can be substituted for by home production and home production. Equation 33 is estimated for 8 different groups based on gender, marital status and individual versus household level. Included control variables are changes in age, age squared, health, single/couple household, household size and wave.

The results indicate that the estimated elasticity is not significant for most groups. However, we do find a significantly negative elasticity between consumption and home production if we estimate Equation 33 for the whole sample and for the subsample of couples. The negative elasticity implies that a 1% decrease in consumption spending increases the time spent in home production by 0.58% and 0.72% for the two aforementioned groups respectively. Home production is therefore found to be a (less than perfect) substitute for market consumption.

For the whole sample (including the regression restrictions) the average consumption spending on home production substitutable goods and services is 3,926 dollars per year. The average number of hours spent in home production is 22.5 hours per week. The elasticity implies that, on average, a

drop in consumption spending of 39 dollars (per year) on home production substitutable market goods and services increases home production activities by about 8 minutes per week (about 6.8 hours per year). This seems like a strong reaction to a small decline in consumption possibilities. However, home production substitutable consumption is strongly and positively correlated with total consumption with a correlation coefficient (ρ) of 0.62 for this sample.[10] So, a decline in home production substitutable market consumption goes hand in hand with a decline in total consumption which might make the need for increased home production more urgent.

The insignificant elasticity found in the other 6 groups does not mean that the effect does not exist, but it might be a consequence of the fairly small number of observations. Despite the fact that we did not find significant results for separate regressions for men and women, the effect we find for couple households may be a compositional gender effect. For our restricted subsample, the main respondent in single households is a woman in 76% of the cases. This is only 55% in couple households implying that the stronger response might be an effect of measuring more men in the couple households and so the stronger effect may be due to males in couple households. Using this in the restriction of the subsample, however, leaves us with too few observations for a reliable IV regression.

[10] $H_0 : \rho = 0$ with $p - value = 0.00$.

Table 3: Regression results substitutability consumption spending and home production[a]

	Single[b]									Couple[c]												All[d]		
	Male			**Female**			**All**			**Male**			**Female**			**All**			**Household**					
	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.
Retired	-1.19	14.59	208	-0.42	0.55	687	-0.47	0.62	895	-1.72	1.08	670	-0.43	0.35	809	-0.72*	0.44	1,479				-0.58*	0.33	2,467
Retired, 65+	-0.18	0.50	186	-0.54	0.58	622	-0.50	0.51	808	-1.62	1.00	603	-0.46	0.36	647	-0.71	0.44	1,250				-0.57*	0.31	2,144

[a] Time-use in Home Production includes: Housecleaning, Laundry, Gardening, Shopping, Cooking, Financial Management, Home improvements, Car improvements.Consumption spending includes spending on: Vehicle maintenance, Dishwasher, Wash and drying machine, Home repair services, Housekeeping services, Gardening services, Dining out. Time-use in Home Production and Consumption spending are transformed using the inverse hyperbolic sine transformation. Changes in Time-use in Home Production and Consumption spending are trimmed for the top and bottom 1 percent of the sample in each survey wave. The sample of for the estimation consists of persons aged 51-80, who own a house, who have not moved since the previous period and who have been fully retired since the previous period. All regressions control for changes in age, age squared, health, single/couple household, household size and wave. Standard errors reported are robust to heteroskedasticity.

[b] Time-use of respondents (male or female) without a spouse.

[c] Time-use of respondents (male or female) with a spouse (male or female). *All* refers to all male and female respondents with a spouse. *Household* refers to the household sum of time-use of the respondent and its spouse.

[d] Time-use of all respondents (male or female, single or couple).

All regressions in Table 3 use the estimation restriction that persons are aged 65+, have a constant time-budget (e.g. retired) and own a home. For explanations, see Section 6. To see the importance of these restrictions for the results we present several estimation results for the total sample of persons aged 51-80 with different estimation restrictions.

Table 4 shows that estimating Equations 33 and 34 for the whole sample of homeowners (aged 51-80) does not reveal a significant effects of a the wealth shock on consumption. Neither does it reveal a significant effect of consumption on home production. This may be explained by the fact that the gross of these people do not experience the wealth shock as a shock to the monetary budget since they are able to adjust their labor supply. On the other hand, this sample also includes the persons whose time-budget actually changed due to the wealth shock (persons becoming unemployed, or retiring) which makes the instrument invalid. Focussing on a sample in which persons do not experience changes in their time-budget because they are full retired or fully out of the labor force, we do find significant effects for both relationships. First of all, a drop of 1% in the houseprice value (in 1,000's) during the Great Recession reduces spending on consumption that can be substituted for by home production with 0.15%. For comparison, Angrisani et al. (2013) find a change of about 0.41% in spending on the total of consumption. Secondly, we find that a 1% decrease in spending on consumption that can be substituted for by home production gives a 0.58% increase in time-use in home production activities. Restricting the sample to persons aged 65+ or to persons who did not observe an increase in their houseprice value during the Great Recession gives results that are highly comparable.

Table 4: Regression results with different regression constraints[a]

	First-stage		Second-stage		
	β_{c2}	$\sigma^2_{\beta_{c2}}$	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.
Homeowners	0.06	0.05	-0.68	0.78	5,121
Homeowners, constant time-budget	0.15***	0.06	-0.58*	0.33	2,467
Homeowners, constant time-budget, 65+	0.17***	0.06	-0.57*	0.31	2,144
Homeowners, constant time-budget, drop only	0.15**	0.06	-0.54*	0.33	2,226

[a] Time-use in Home Production includes: Housecleaning, Laundry, Gardening, Shopping, Cooking, Financial Management, Home improvements, Car improvements. Consumption spending includes spending on: Vehicle maintenance, Dishwasher, Wash and drying machine, Home repair services, Housekeeping services, Gardening services, Dining out. Time-use in Home Production and Consumption spending are transformed using the inverse hyperbolic sine transformation. Changes in Time-use in Home Production and Consumption spending are trimmed for the top and bottom 1 percent of the sample in each survey wave. The sample of for the estimation consists of persons aged 51-80, who own a house, who have not moved since the previous period and who have been fully retired since the previous period. All regressions control for changes in age, age squared, health, single/couple household, household size and wave. Standard errors reported are robust to heteroskedasticity.

Table 5 indicates that the results are also robust to different consumption spending definitions. Consumption excluding durables excludes the expenditures on a dishwasher and a washing and/or drying machine. Consumption including supplementary material includes expenditures on home repair supplements, housekeeping supplements and gardening supplements. Regressions are estimated on the whole sample of persons aged 65+ with a constant time-budget and owning a home.

Table 5: Regression results with different definitions of consumption spending

	First-stage		Second-stage		
	β_{c2}	$\sigma^2_{\beta_{c2}}$	β_{n2}	$\sigma^2_{\beta_{n2}}$	Obs.
Consumption	0.15***	0.06	-0.58*	0.33	2,467
Consumption excluding durables	0.14**	0.06	-0.64*	0.37	2,467
Consumption including supplementary material	0.15**	0.06	-0.56**	0.27	2,471

8 Discussion

Whether we find substitution effects between market consumption and home production depends on the subsample analyzed. This may be due to a small-sample. For the subsamples for which we do find significant and substantial substitution effects between market consumption and home production, we find that results are highly robust to different market consumption definitions and to different definitions of people whose monetary budget is affected without the time budget being affected. To find these effects, we show that it is important to keep the time budget constant.

Other subsamples for which we do not find substitution effects may also indicate a fairly small scope for substitution between market consumption and home production. Although time spent in home production is non-negligible on a weekly basis (both in terms of the number of hours and the percentage of people engaging in the activity), the variation over time is fairly small despite relatively high standard deviations in time spent in the home production categories. This suggests that most of the heterogeneity in home production is cross-sectional and largely invariant to a business cycle effect.

The heterogeneity in market consumption spending is both cross-sectional and over time. Market

consumption spending seems to respond more strongly to the business cycle than home production. In line with home production, the standard deviation of money spent on home production substitutable consumption (such as dining out, housekeeping, gardening, home- and vehicle maintenance) is fairly large while, on average, the total spending on these categories is relatively small compared to total market consumption spending. Therefore, the scope to substitute home production substitutable market consumption by home production may be small on average.

9 Conclusion

Decreased market consumption possibilities can partially be replaced by home production to mitigate the consequences for well-being. This is both relevant for the consequences of facing shocks in wealth, health and employment and the retirement decision. The increased time-budget at retirement may explain the drop in market consumption often observed when retiring. Conventional retirement savings adequacy measures do not take into account the time-budget available for retirees and may, therefore, underestimate the adequacy of retirement savings.

T.B.W.

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