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Evidence from Repeated Cross-Section Data for Germany

Martin Beznoska
Viktor Steiner

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Martin Beznoska* , Viktor Steiner**

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Abstract

The life-cycle hypothesis implies that consumption would not decline at retirement. However, several studies found relevant declines in food consumption after retirement for the United States. Others concluded that this contradiction of the life-cycle hypothesis is solved by allowing for broader measures of consumption than food. Using repeated cross-section data for Germany, this paper analyzes the retirement consumption puzzle for the German case. For our broadest consumption measure, which includes the flow of durables' consumption, we find, on average, no significant consumption decline at retirement. This also holds if the potential endogeneity of indidual retirement is controlled for in instrumental variable regressions. We also find heterogeneity in retirement effects among birth cohorts, the level of household wealth, and the level of consumption, but these effects do not support the hypothesis that retirement is associated with a strong reduction of consumption among poorer households.

Keywords: Retirement consumption puzzle, life-cycle hypothesis, wealth effects, repeated cross-section data.
JEL Classification: D12, D91, H31, H55

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*German Institute for Economic Research (DIW Berlin), e-mail: mbeznoska@diw.de
**Free University of Berlin (FU Berlin), e-mail: viktor.steiner@fu-berlin.de

1 Introduction

The so-called retirement-consumption puzzle holds that the income reduction at the time of entering retirement leads to a drop in consumption (see, e.g., Hamermesh (1984), Banks, Blundell, and Tanner (1998), Bernheim, Skinner, and Weinberg (2001), Battistin, Brugiavini, Rettore, and Weber (2009)). This observation has been viewed to contradict the main implication of standard life-cycle models as developed by Modigliani and Brumberg (1954) and Friedman (1957)). Since these models imply, under specific assumptions, consumption smoothing over the lifecycle, expected income reductions should not lead to a coincidental decline in consumption.[1] The income reduction at the time of entering retirement seems likely to be expected, and rational consumers should therefore save in advance to be able to smooth consumption when moving from working life into retirement. Thus, a credible test of consumption smoothing as the main implication of the life-cycle model could be based on consumption and income changes at the time of retirement. The retirement-consumption puzzle is also of relevance for economic policies aimed at inducing households to save adequately for their retirement. For this purpose, subsidies or tax incentives for retirement savings have been introduced in several OECD countries (see, e.g., Attanasio, Banks, and Wakefield (2004), Börsch-Supan (2004)).

Empirical evidence on the retirement-consumption puzzle is mainly available for the U.S. and the U.K.,[2] two countries which rely much more heavily on funded private pension schemes than welfare states with a dominating public pension system, like Germany. We contribute to the literature by analyzing the retirement-consumption puzzle for Germany on the basis of the best available consumption and income data over the period 1993 to 2008, a period of substantial changes in the public pension system. Due to institutional factors Germany is a particularly interesting case for the analysis of the retirement-consumption puzzle. In contrast to the U.S., social security payments form the major component of retirement income for most households, and are closely linked to an employee's lifetime income. Furthermore, individual social security pensions are indexed to the growth rate of the average wage paid in the economy. Thus, employees should, in principle, know the extent of the decline in net income at retirement fairly accuratly. Although recent pension reforms reduced the income replacement ratio in the public pension system for younger birth cohorts and restricted access to early retirement also in Germany, these changes were introduced over fairly long phase-in periods, such that affected cohorts could adjust their savings and retirement behavior. The German case is also interesting

[1] The life-cycle model of Modigliani and Brumberg implies that the marginal utility of consumption rather than consumption per se is held constant over the lifecycle. For various reasons discussed in the literature, the marginal utility of consumption may vary over the lifecycle; see, e.g., Aguiar and Hurst (2005).

[2] See, e.g., Hamermesh (1984), Banks et al. (1998), Bernheim et al. (2001), Fisher, Johnson, Marchand, Smeeding, and BoyleTorrey (2008), Aguila, Attanasio, and Meghir (2011).

because savings and retirement behavior in East Germany changed dramatically in the wake of reunification, with substantial differences between the younger and older birth cohorts.

Our consumption measures are derived from representative consumption and income household surveys provided by the German National Statistical Office on a consistent basis every five years. Being derived from detailed expenditure accounts on a large number of consumption goods, these official consumption surveys provide much more accurate consumption and income information than contained in other household surveys for Germany.[3] These data also allow us to construct a much broader consumption measure, including the flow of consumption from non-durables, than in most previous studies. In contrast to some of the earlier studies which found significant reductions in food expenditures at the time of retirement, recent literature has looked at broader consumption measures than just food expenditures and found, consistent with the standard life-cycle model, no significant consumption drop (see, e.g., Fisher et al. (2008), Aguila et al. (2011)). For the great majority of households, expenditures on food constitute a relatively small share of household budgets, and the relevance of changes in specific expenditure components for testing the life-cycle model seems questionable.[4] Furthermore, it seems likely that the marginal utility of expenditures on food declines after retiring from work, and that food expenditures are partly substituted for home production (see, e.g., Aguiar and Hurst (2005)).

While our consumption and income data are not available as a panel, we observe several cross-sections and can control for differences across birth cohorts. These cohorts were affected differently by the various public pension reforms that took place in the observation period. Importantly, these pension reforms were introduced over a relatively long transition phase, so that older households had sufficient time to adjust their consumption and savings decisions. Another advantage of our data source is that it includes detailed wealth information, which allows us to control for the level of accumulated household wealth at the time of retirement.

In a first step, we estimate the change in various measures of consumption at retirement from repeated cross-section data by comparing the level of consumption before and after retirement for birth cohorts aged 52 to 67 in the period 1993-2008. This descriptive analysis, summarized in Section 4.1, confirms the result from previous literature that going from food expenditures to broader and more representative consumption measures reduces the decline in consumption at

[3] The German Socio-Economic Panel (SOEP), which was used by Schwerdt (2005) to investigate the retirement-consumption puzzle, does not contain regular consumption questions. Consumption in the SOEP can only indirectly be derived from recorded monthly household income and the monthly amount saved by the household. The monthly amount of savings is censored at zero, i.e. a household's dissaving is not recorded, which is a severe limitation when studying the retirement-consumption puzzle.

[4] The focus on this narrow consumption measure in earlier empirical studies was mainly motivated by the lack of broader consumption measures in household panel surveys, such as the PSID in the U.S.

retirement. For our preferred consumption measure, which includes the consumption flows from durables, the drop in net income at retirment is, on average, compensated for by a corresponding reduction in the level of wealth, with no change in consumption. Treating an individual's retirement status as exogenous to household consumption, and statistically controlling for other factors than retirement that may affect the change in consumption at the individual level, we find, on average, no significant decline of consumption at retirement for German households. These results also hold if the potential endogeneity of indidual retirement is controlled for in instrumental variable regressions, using the variation of changes in retirement regulations across age groups to construct instrumental variables. We also find heterogeneity in retirement effects among birth cohorts, the level of household wealth, and the level of consumption, but these effects do not support the hypothesis that retirement is associated with a strong reduction of consumption among poorer households.

2 Data

Our empirical analysis of the retirement-consumption puzzle is based on repeated cross-sections of German consumption survey data, the Income and Consumption Survey for Germany (*Einkommens- und Verbrauchsstichprobe*, EVS). This a representative sample of German households, which is provided every five years by the Federal Statistical Office. The EVS is the largest and most informative data source on consumption for Germany providing the base information for consumption in the national accounts and for constructing the official consumer price index (see Statistisches Bundesamt (2005)). The income information is available on the individual level, but consumption expenditures are only reported for the household. The scientific-use-files of the EVS provide a sample size of about 45,000 households in each survey year. The EVS contains detailed information on income and consumption expenditures, the level and composition of household wealth, as well as individual characteristics of all household members. Since the wave 1998, the information is reported quarterly while it was recorded on a yearly basis before. We use the EVS survey years 1993, 1998, 2003 and 2008 for the analysis described below.

Three different aggregates of consumption are considered in the analysis: food consumption, non-durable expenditures, and a specific consumption-flows aggregate. Food consumption consists of food, non-alcoholic drinks, alcoholic drinks, and tobacco. Expenditures on non-durable goods exclude all expenditures on non-frequently bought goods, such as purchases of cars, furniture and any kind of electronic equipment as well as rents. The consumption-flows aggregate includes, in addition to the non-durable aggregate, rents, imputed rents for owner-occupied housing and imputed expenditures on the service of cars owned by the household. We exclude

certain expenditures, especially fuel, because they are to a large extent work-related, and would therefore bias our results towards finding a decline in consumption following retirement. Because consumption expenditures are only available on the household level, they are equivalized by the square root of household size.

The change in the recording of expenditures from the whole year in 1993 to a quarter in subsequent years does not affect the measurement of income or expenditures on frequently bought non-durable goods, but may affect the reporting of expenditures on infrequently bought durable goods, in particular real property and cars. Since expenditures on housing and cars are a large share of households' consumption, which also vary over the lifecycle, their exclusion could severly bias the analysis of the relationship between consumption changes and retirement, as discussed in the introduction. On the other hand, simply including durable expenditures in the year they are made would not take into account that the services of these goods are consumed over their economic lifetime. We therefore include imputed rents for owner-occupied housing and the imputed value for owned cars as consumption flows in the observed period, instead of the non-frequently incurred expenditures for purchases and maintenance of these goods. Imputed rents for owner-occupied housing are included in our data base as computed by the Federal Statistical Office (see (Statistisches Bundesamt, 2005)). For the imputation of car expenditures we apply the market rental value approach to the measurement of services from durables (see Ruggles and Ruggles (1970), Katz (1983)). The prodecure is briefly described in Appendix A. To make 1993 comparable to the other years, when car purchases are observed four times more often than in the quarterly data at the level of the individual household, we set three out of four observed purchases to zero at random, as suggested by Bönke, Schröder, and Werdt (2010).

One important advantage of our data base is that it contains high-quality wealth information observed on the household level. Our wealth measure includes net housing wealth (gross housing wealth minus debts), which forms the largest part of wealth for the majority of households, and financial wealth, including deposits, stocks, bonds and life and pension insurance wealth. Social security wealth, i.e. entitlements to the pay-as-you-go public pensions system due to previous contributions, is not included here. As for consumption and income, we equivalize wealth by the square root of household size.

3 Empirical Methodology

In a first step, similarly to Fisher et al. (2008), we provide a descriptive account of consumption expenditures of people before and after retirement. In particular, we compare the average level of equivalized consumption of people when they are aged 58 to 62 years and not retired to

the average consumption level of people in the same birth cohort when they are aged 63 to 67 and retired. This analysis is performed for the three equivalized consumption measures defined above.[5]

The people in our sample were born between 1931 and 1945, with a large share of the older birth cohorts retiring within the observation period. Since, due to long-term unemployment and disability, early retirement well before the statutory retirement age of 65 is prevalent in Germany, we include people aged 58 years or older in our analysis, where a large fraction of the sample (about 90%) was not yet retired at the age of 58 but may already have been retired at 62 when this age cohort is observed 5 years later. We define a person as "retired" if she has no earnings from work and the social status is either *pensioner*, if previously employed in the private sector, or *civil servant pensioner*.

To account for differences in consumption and retirement behavior between birth cohorts, we also compare the average change in consumption before and after retirement in a given year within five-years birth cohorts. Since, at a given age, these cohorts are observed at different calendar years, the change in consumption can only be interpreted as a retirement effect in the absence of pure calendar time effects. Furthermore, the estimated retirement effect could also be confounded by other factors correlated with both consumption and retirement. As mentioned in the introduction, due to economic and institutional factors, consumption and retirement patterns in east and west Germany have evolved very differently in the wake of reunification. One important economic factor driving these differences is the much lower level of wealth in east Germany, especially among housholds in the older birth cohorts. We account for these differences in the descriptive analysis by calculating the average change in consumption within birth cohorts separately for the two regions.

Looking at the average change in consumption within birth cohorts and controling for regional effects, would allow us to identify the average effect of retirement on consumption only if there were no other factors affecting both retirement and consumption within birth cohorts. To statistically control for observed heterogeneity within birth cohorts, in addition to regional differences, in a second step we regress the logarithm of consumption on a retirement dummy variable, birth cohort and year dummies, and a couple of control variables. These include dummies for gender, nationality, marital status, children, and social status of the spouse (see Appendix B for the complete set of covariates).[6] The estimated coefficient of the retirement dummy measures the average effect of retirement on consumption, provided the retirement

[5]Relative consumption changes may be affected by the choice of a particular equivalence scale. In the regression analysis below, we control for changes in household composition over time.

[6]Since we control for household composition there would be no need to use equivalized consumption. We use equivalized consumption (as well as equivalized wealth) in the regressions to make estimation results comparable to the preceding descriptive analysis.

status can be treated as exogenous conditional on the set of control variables. Under this assumption, we can also estimate heterogeneous retirement effects by interacting the retirement dummy with birth cohorts and regional dummies.

Although the estimated retirement effect would still describe the association between consumption and retirement observed in the data, it could not be interpreted as causal if the retirement status was endogenous in the consumption equation, conditional on the set of included control variables. There are several reasons why the retirement status may be endogenous in the consumption equation, depending on which control variables are included in the regression equation. In particular, classical omitted variable bias may result if household wealth is not controlled for because it certainly affects consumption flows but is also likely to be correlated with the individual retirement status. On the other hand, simply treating wealth as exogenous in the consumption equation is also likely to bias the retirement effect due to shocks to permanent income prior to retirement. These shocks may induce positive or negative correlation between consumption flows and the level of wealth at retirement, and thus bias the retirement effect in either direction (for a more detailed discussion on this, see Bernheim et al. (2001)).

To account for the potential endogeneity of the retirement status, we estimate the consumption equation by Two-Stage Least Squares (2SLS). Similarly to Battistin et al. (2009), we use public pension eligibiltiy to instrument the potentially endogenous individual retirement status. The pension reform introduced in the 1990's reduced the income-replacement rate in the public pension system for younger birth cohorts and restricted access to early retirement. The reform was introduced over a fairly long phase-in period, such that the older birth cohorts were not affected by the reform, and its strongest impact was felt by younger birth cohorts in later years.[7] Thus, there should be sufficient exogenous variation in individual incentives to retire across birth cohorts to identify the endogenous retirement effect in the consumption equation. We instrument an individual's retirement status with age dummies (for each year between 59 and 67, with age 58 as base category) and their interactions with calender-time dummies (for observation years 1998, 2003, and 2008). The base category for these interaction terms refers to people aged 58-62 in 1993 and people aged 63-67 in 1998, i.e. people that should not have been affected by the pension reform introduced in the 1990's.

We also try to account for the potential endogeneity of the level of household wealth in the consumption equation. Since there seem to be no exogenous changes in institutional regulations affecting wealth accumualtion within our observation period to construct additional instrumental variables for the level of wealth, we follow the procedure suggested by Bernheim

[7] Note that people aged 63-67 in 1993 and 58-62 in 2008 are not included in our estimation sample due to the selection condition defined above. We report a robustness check with respect to this selection in Section 4.4 below.

et al. (2001) to eliminate that component from observed individual wealth which may be correlated with an individual's retirement status. This is done by regressing, in a first step, the amount of individual wealth on age dummies, dummies for an individual's employment status (including retirement), and a set of other control variables. We then calculate a standardized expected individual value of wealth from this regression, with age set at 60 years, a common employment status (dependent employment), and all other variables in the wealth equation set to their observed sample values. Thus, this standardized wealth measure does not depend on an individual's retirement status and age, but still varies according to other houshold characteristics. The wealth quartiles are then defined for this standardized wealth variable.

We also estimate the retirement effect on consumption conditional on the level of wealth. As discussed by, e.g., Bernheim et al. (2001) the consumption discontinuity may be the larger the smaller the accumulated level of wealth at retirement, something one would also expect on purely intuitive grounds. It therefore seems interesting to estimate heterogenous retirement effects conditional on the level of household wealth. Likewise, the retirement effect may also vary by the level of household consumption, which we will test by estimating the consumption function by quantile regression.

4 Results

4.1 Descriptive Analysis

In Table 1 we report average levels of food, non-durable consumption and consumption-flows before and after retirement as well as their percentage changes for the total population. Levels and changes of net income and wealth are also reported for comparison. All variables are measured in real equivalized euros. We report estimated population values obtained by weighting the individual sample observations by the household weight times the inverse of the equivalent scale, which we define as one over the square root of household size.[8] While average food consumption of retired people is 8.8% below the average amount observed of those not yet retired, there is no difference in non-durable consumption and the consumption-flow measure between the two groups despite the substantial differential in average net income of almost 16%. This seems consistent with recent research on the retirement-consumption puzzle which has shown that the significant decline in food consumption at retirement does not show up when broader consumption measures are analyzed. Of course, the differences in average consumption flows and incomes between the retired and those not yet retired provide only suggestive evidence

[8] This is a simple approximization of equivalent scales that weight each household member separately (see, e.g., Coulter, Cowell, and Jenkins (1992)), and should suffice for our purpose of normalizing consumption by household size.

for consumption smoothing because the two groups may differ by other factors correlated with both consumption and retirement.

One such factor is the level of household wealth. Table 1 shows that the equivalized stock of wealth of those retired, on average, falls short of the average stock of those not yet retired by 17%. Note that, although the relative difference in the stock of wealth between retired people and those not yet retired is similar to the relative difference in net incomes between the two groups, the difference in the average level of wealth between the two groups is much larger than the difference in the two groups' consumption levels. Thus, these average numbers cannot be interpreted as representing similar people before and after retirement. Other important factors may be related to regional differences and to differences across birth cohorts, as discussed above.

Table 1: Consumption, income and wealth levels before and after retirement - Pooled analysis

	Not retired	Retired	Change in %
Food consumption (per month)	242.56	221.31	-8.8 (0.66)
Non-durable consumption (per month)	871.01	871.06	0.0 (0.87)
Consumption flows (per month)	1,242.81	1,246.70	0.3 (0.71)
Net income (per month)	2,224.91	1,872.85	-15.8 (0.90)
Wealth (stock)	141,654	117,593	-17.0 (2.00)
No. of obs.	13,805	13,499	27,304

Notes: All consumption, income and wealth levels are weighted real equivalent values in euro and prices of 2003. The level is evaluated at the mean and equivalized by the square root of household size. The consumption flow measure contains non-work related non-durable consumption expenditures and imputed values for owner-occupied housing and cars (see Appendix A for the imputation methods). Clustered standard errors on the household level are in parentheses.

Source: Own calculations using the EVS data (1993, 1998, 2003 and 2008), scientific-use-files provided by the Federal Statistical Office.

In a first step, we account for the heterogeneity between the two groups by comparing the average change in consumption before and after retirement between East and West Germany and within birth cohorts, as described in the previous section.[9]

In Table 2, we differentiate between these two regions and between three birth cohorts, where we only consider our preferred consumption-flows measure. Not accounting for differences between birth cohorts in the pooled analysis shows that the result reported above for Germany as a whole is driven by the results for West Germany, whereas in East Germany a relatively small

[9]For this analysis we have to assume that there is no significant mobility of people shortly before and after retirement between the two regions. This assumption seems to be no strong violation of reality since the probability to migrate declines strongly with age (see e.g. Peukert and Smolny (2011) for the relationship between the probability to migrate and age in different German regions).

Table 2: Consumption, income and wealth levels before and after retirement by region and birth cohort

	West Germany			East Germany		
	Not retired	Retired	Change in %	Not retired	Retired	Change in %
Pooled Analysis						
Consumption flows (per month)	1,326.41	1,327.95	0.1 (0.71)	899.73	986.72	9.7 (1.26)
Net income (per month)	2,390.21	2,007.43	-16.0 (1.04)	1,546.51	1,442.26	-6.7 (1.27)
Wealth (stock)	164,659	139,370	-15.4 (2.15)	47,240	47,912	1.4 (4.38)
No. of obs.	10,811	9,757	20,568	2,994	3,742	6,736
Birth cohort 1931-35	**1993**	**1998**		**1993**	**1998**	
Consumption flows (per month)	1,239.14	1,269.49	2.4 (1.42)	823.22	919.07	11.6 (1.82)
Net income (per month)	2,319.44	1,931.73	-16.7 (1.68)	1,453.96	1,448.35	-0.4 (1.82)
Wealth (stock)	153,871	122,427	-20.4 (3.40)	36,359	34,877	-4.1 (6.95)
No. of obs.	3,004	2,833	5,837	1,076	1,402	2,478
Birth cohort 1936-40	**1998**	**2003**		**1998**	**2003**	
Consumption flows (per month)	1,360.93	1,343.41	-1.3 (1.48)	936.54	1,037.51	10.8 (2.34)
Net income (per month)	2,374.30	2,074.40	-12.6 (1.83)	1,616.19	1,505.94	-6.8 (2.34)
Wealth (stock)	166,307	141,329	-15.0 (3.56)	51,468	54,110	5.1 (7.97)
No. of obs.	4,239	3,583	7,822	1,002	1,199	2,201
Birth cohort 1941-45	**2003**	**2008**		**2003**	**2008**	
Consumption flows (per month)	1,363.60	1,362.14	-0.1 (1.43)	986.08	988.26	0.2 (2.00)
Net income (per month)	2,477.99	1,989.70	-19.7 (1.87)	1,620.88	1,342.25	-17.2 (2.78)
Wealth (stock)	172,694	152,606	-11.6 (4.17)	60,723	53,461	-12.0 (7.84)
No. of obs.	3,568	3,341	6,909	916	1,141	2,057

Notes: All consumption, income and wealth levels are weighted real equivalent values in euro and prices of 2003. The level is evaluated at the mean and equivalized by the square root of household size. The consumption flow measure contains non-work related non-durable consumption expenditures and imputed values for owner-occupied housing and cars (see Appendix A for the imputation methods). Clustered standard errors on the household level are in parentheses.

Source: Own calculations using the EVS data (1993, 1998, 2003 and 2008), scientific-use-files provided by the Federal Statistical Office.

average reduction in net income is associated with a higher average level of consumption flows and no significant change in average household wealth in the group of retired people. These regional differences can be explained by the rapid increase in earnings and public pensions in East Germany in the first few years after reunification (see Franz and Steiner (2000)), which dominated the subsequent large-scale increase in long-term unemployment and stagnation of earnings levels in East Germany over the whole observation period. While older birth cohorts of East Germans benefitted from these developments, they had a negative impact on income

and consumption levels of younger birth cohorts.

Looking at changes in consumption flows before and after retirement within birth cohorts, Table 2 shows no significant changes in West Germany for any of the birth cohorts, while in East Germany this is only true for the youngest birth cohort. For people born between 1941 and 1945, who were not yet retired in 2003 and retired in 2008, there is no significant change in consumption in both regions, and the change in both the level of net income and the stock of wealth is very similar in both regions. For the older East German birth cohorts, consumption flows (in real terms) after retirement increased, while real net incomes either remained constant (in the oldest cohort) or declinded only be about half as much as in the youngest cohort. These differences are related to the special regulations in the public pension system which were exceptionally favourable for the older birth cohorts in the East German transition process. The youngest age cohort could not take advantage of these special regulations anymore, and had to adjust their savings and retirement behavior to the new environment. There are also significant differences in the level of wealth both between birht cohorts in East Germany, and within birth cohorts between the two regions. In particular, within the youngest birth cohort the relative change in the level of wealth between the non-retired and retired is almost identical, although the stock of wealth among older people still differs substantially between East and West Germany.

4.2 Regression Results - Average Effects

The descriptive analysis in the previous section did not account for other factors potentially affecting consumption and retirement status within birth cohorts and region. Table 3 reports the results from regressions of the log of consumption flows on a retirement dummy, dummy variables for region, birth cohort and year, and a set of other variables which control for observed heterogeneity within birth cohorts. Definitions and means of these variables are documented in Appendix B.1. We report regression results for consumption functions with and without controling for the level of household wealth.

Column (1) of Table 3 shows OLS regression results of the consumption function with the individual retirement status treated as exogenous and without controling for the level of household wealth. Given the retirement status can be treated as exogenous conditional on the set of control variables, not including the level of household wealth, the estimated coefficient of the retirement dummy measures the average effect of retirement on consumption flows allowing for the adjustment of household wealth. For this specification we find that, on average, consumption flows are reduced by 0.5 percent at retirement, a small and insignificant effect. Comparing this estimate to the one obtained from the specification which includes wealth dum-

mies (column (3) in Table 3) shows that holding the level of wealth constant yields a small, but significant positive average retirment effect of about 1 percent.[10] Conditioning on the level of wealth takes into account that households with a relatively high level of accumulated wealth should, at a given age, also have a relatively high consumption level. As expected, the level of household wealth excerts a very strong effect on consumption flows; households in the highest wealth quartile consume, other things being equal, about 40 percent more than those in the lowest wealth quartile. Also, households' consumption in East Germany is almost 30 percent below the West German level, on average, even after controling for differences in the level households' wealth between the two regions. In contrast, estimated birth cohort effects on the level of consumption are relatively small in both the regression including the wealth dummies and the one without them. Note that year dummies are included in all regressions, and that birth-cohort and age effects are therefore not identified separately in these regressions.

As discussed in the methodology section, the exogeneity assumption concerning the retirement status in the consumption equation may be violated for various reasons. In column (2) of Table 3 we report results from an instrumental variable regression of the consumption function with the individual retirement status as treated as endogenous and without controling for the level of household wealth. The instrumental variables are age dummies and interactions between age and year dummies as defined in the methodology section. The instrumental variables are jointly highly significant in the first-stage regression of the individual retirement status which includes, except for the birth-cohort dummies, all other explantory variables in the consumption equation.[11] The point 2SLS estimate of the retirement coefficient is -1.4, almost three times the OLS estimate but also insignificant. The F-value for the instruments is about 450 and the Partial R^2 (Shea (1997)) is 0.09, suggesting that the correlation between the individual retirement status and the instruments is sufficiently strong to avoid the weak instrument problem. Still, the estimated standard error of the retirement coefficient increases substantially, and the lower bound of the 95%-confidence interval of the 2SLS estimate of the retirement coefficient is not too far apart from the OLS point estimate. Also, the Hausman-Wu test suggests that exogeneity of the individual retirement status cannot be rejected (p-value of 0.51). Thus, for the specification of the consumption equation with no controls for household wealth, there is no strong evidence that the OLS estimate of the retirement effect is inconsistent.

Column (4) of Table 3 shows 2SLS estimation results with the retirement status treated

[10] To allow for functional flexibility, we include three dummy variables indicating an individual's position in the respective quartile of the wealth distribution, with the lowest quartile defined as the base category.

[11] The first-stage regression is based on a linear probability model, which, under the conditional mean independence assumption, yields a consistent estimate of the individual retirement probability. The birth-cohort dummies are excluded from the first-stage regression, because there is no independent variation conditional on the included age dummies and the interactions between age and year dummies.

Table 3: Average retirement effects on consumption - Regression results

	No wealth controls		**With wealth controls**		
	OLS	2SLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)
Retirement	-0.5	-1.4	0.9	1.6	-1.4
	(0.41)	(1.37)	(0.38)	(1.29)	(1.37)
East	-39.5	-39.4	-26.8	-26.9	-36.5
	(0.49)	(0.51)	(0.53)	(0.54)	(1.06)
Birth cohort 1936-40	1.6	1.3	1.0	1.3	1.3
	(0.67)	(0.81)	(0.62)	(0.75)	(0.80)
Birth cohort 1941-45	2.1	1.4	1.4	1.9	1.3
	(1.01)	(1.40)	(0.95)	(1.31)	(1.40)
2nd wealth quartile			14.3	14.3	-0.4
			(0.57)	(0.57)	(0.91)
3rd wealth quartile			24.5	24.5	0.2
			(0.60)	(0.61)	(1.16)
4th wealth quartile			37.8	37.9	6.8
			(0.66)	(0.67)	(1.40)
Year dummies	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes
Constant	7.18	7.18	7.00	7.00	7.14
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)
R^2	0.27	-	0.35	-	-
Partial R^2 (Shea)	-	0.09	-	0.09	-
F-value of instruments	-	456.04	-	454.98	-
Hausman-Wu test (p-value)		0.505		0.592	-
No. of obs.	39,806	39,806	39,806	39,806	39,806

Notes: The dependent variable is the log of equivalized consumption flows. The consumption flow measure contains non-work related non-durable consumption expenditures and imputed values for owner-occupied housing and cars (see Appendix A for the imputation methods). The coefficient of the retirement dummy measured the average retirement effect on consumption in percent.
Clustered standard errors on the household level are in parentheses. The consumption and wealth values are equivalized by the square root of household size. Year dummies for 1998, 2003, 2008, with base year 1993. Other controls are nationality, marital status, gender, social status of spouse and quarter.

Source: Own calculations using the EVS data (1993, 1998, 2003 and 2008), scientific-use-files provided by the Federal Statistical Office.

as endogenous but the now included wealth dummies treated as exogenous, while column (5) treats them also as endogenous in the estimation. The estimated retirement effect in the former specification is not statistically significantly different from the OLS estimate with wealth dummies excluded. The Hausman-Wu test clearly suggests that the retirement status

can be treated as exogenous in the consumption equation, conditional on the level of household wealth. However, for the reasons discussed in the methodology section, wealth may also be endogenous in the consumption equation. The 2SLS estimation results reported in column (5) of Table 3 account for this potential endogeneity, where the instruments for the wealth dummies were constructed by standardizing wealth with respect to age and an individual's employment status as described at the end of the methodology section. This has very strong effects on the estimated coefficients of the wealth dummies, and the estimated retirement effect changes sign but remains insignificant. Interestingly, the estimated retirement effect in this specification does not differ from the one obtained in the 2SLS regression without wealth controls in column (2).

4.3 Heterogenous Retirement Effects

Estimated average retirement effects reported in the previous section may mask large differences between regions, birth cohorts, as well as poor and rich people. Table 4 shows OLS regression results for the specifications without and with wealth dummies. In addition to results for Germany as a whole, we also report estimation results allowing for heterogenous retirement effects by region, where the retirement dummy was interacted with the dummy for East Germany, birth-cohort dummies, and, depending on the specification, the wealth dummies. The same other control variables as in the regressions reported in Table 3, but without interactions with the retirement dummy, are included. To test the joint significance of the main and interaction effects, p-values are reported in parantheses below parameter estimates.

In the specification without wealth controls, the average retirement effect of -0.5% is the weighted average of the very small and insignificant estimated effect for West Germany and the highly significant point estimate of -2.8% for East Germany. In this specification, estimated retirement effects for the whole of Germany are only statistically significant for the oldest birth cohort, with a point estimate of -2.1%. In West Germany, we actually find no significant effect at all, whereas in East Germany relatively small negative but statistically significant retirement effects are also found for the younger birth cohort. These differences could be related to differences in the level of household wealth in the two regions.

OLS estimation results of retirement effects with wealth dummies included in the consumption equation are reported in the right-hand part of Table 4. Controlling for the level of wealth, which is assumed to be exogenous here, the average retirement effect estimated for West Germany turns positive and becomes significant in this specification, whereas there is little change for East Germany. Also, estimated retirement effects by birth cohorts in the specification with wealth controls are also positive and more significant for West Germany, whereas there is little change across birth cohorts in East Germany. Estimated retirement effects reported in the bot-

Table 4: Heterogenous retirement effects on consumption in % - OLS estimation results

	No wealth controls			With wealth controls		
	Germany	**West**	**East**	**Germany**	**West**	**East**
			Average effects			
	-0.5	0.1	-2.8	0.9	1.7	-2.1
(p-values)	(0.181)	(0.887)	(0.000)	(0.017)	(0.000)	(0.004)
			By birth cohorts			
1931-1935	-2.1	-1.3	-3.9	0.1	1.0	-3.1
	(0.007)	(0.163)	(0.005)	(0.862)	(0.246)	(0.029)
1936-1940	-0.1	0.6	-1.9	1.7	2.4	-0.7
	(0.900)	(0.404)	(0.107)	(0.005)	(0.001)	(0.569)
1941-1945	0.2	0.5	-2.9	0.6	1.4	-3.3
	(0.790)	(0.525)	(0.036)	(0.332)	(0.062)	(0.014)
R^2	0.27	0.17	0.18	0.35	0.27	0.22
				By wealth quartiles		
1 - Bottom				0.3	0.8	-3.2
				(0.711)	(0.343)	(0.017)
2 - 25% - 50%				0.5	1.1	-2.2
				(0.454)	(0.176)	(0.103)
3 - 50% - 75%				1.4	1.9	-2.2
				(0.041)	(0.014)	(0.093)
4 - Top				1.5	3.1	-1.0
				(0.049)	(0.001)	(0.493)
R^2				0.35	0.27	0.22
No. of obs.	39,806	30,025	9,781	39,806	30,025	9,781

Notes: The dependent variable is the log of equivalized consumption flows. The consumption flow measure contains non-work related non-durable consumption expenditures and imputed values for owner-occupied housing and cars (see Appendix A for the imputation methods). The coefficient of the retirement dummy measured the average retirement effect on consumption in percent. The p-values from clustered standard errors are in parentheses. The consumption and wealth values are equivalized by the square root of household size. Year dummies for 1998, 2003, 2008, with base year 1993. Other controls are nationality, marital status, gender, social status of spouse and quarter.

Source: Own calculations using the EVS data (1993, 1998, 2003 and 2008), scientific-use-files provided by the Federal Statistical Office.

tom part of Table 4 show that they do not differ significantly by wealth quartiles. In particular, these effects are positive for all quartiles in West Germany, and negative for all quartiles in East Germany, with only very small differences between quartiles within a region. Furthermore, in West Germany estimated retirement effects are only significant for the two highest wealth quartiles, and these postive effects are fairly small. In East Germany, the small negative retirement effecst are only statistically different from zero for the lower part of the wealth distribution.

This latter result could perhaps be explained by the relatively small amount of accumulated wealth in East Germany, which could severly restrict consumption smoothing opportunities.

The retirement effect on consumption flows could also vary by unobserved household characteristics. To account for these factors we estimate the consumption function by quantile regression which allows the regression coefficient of the retirement dummy to depend on the consumption quantile. Given our results from above, we treat the individual retirement status and household wealth as exogenous in the consumption equation here. Estimated retirement effects across consumption quantiles are plotted in the upper part of Figure 1 for the specification without wealth controls, and in the lower part for the specification with wealth controls. The graphs show, for each region, average retirement effects estimated for a given decile of the consumption distribution and the 95% confidence intervals of these estimates. The quantile regressions include the same control variables as the regressions in Table 3.

If household wealth is not controlled for, there is no significant retirement effect over the whole consumption distribution in West Germany. In contrast, consumption at retirement declines significantly with the level of consumption in East Gemany, although the estimated confidence bands become fairly large for higher deciles of the distribution. Controlling the level of household wealth in the quantile regression does not change the overall picture, although there is, in accordance with the estimation results in Table 4, a level shift in the retirement effect estimated for West Germany. The large drop in consumption of East German retirees at relatively high levels of consumption is consistent with the interpretation that the small amount of accumulated wealth among this group even restricts consumption smoothing possibilities.

4.4 Robustness Analysis

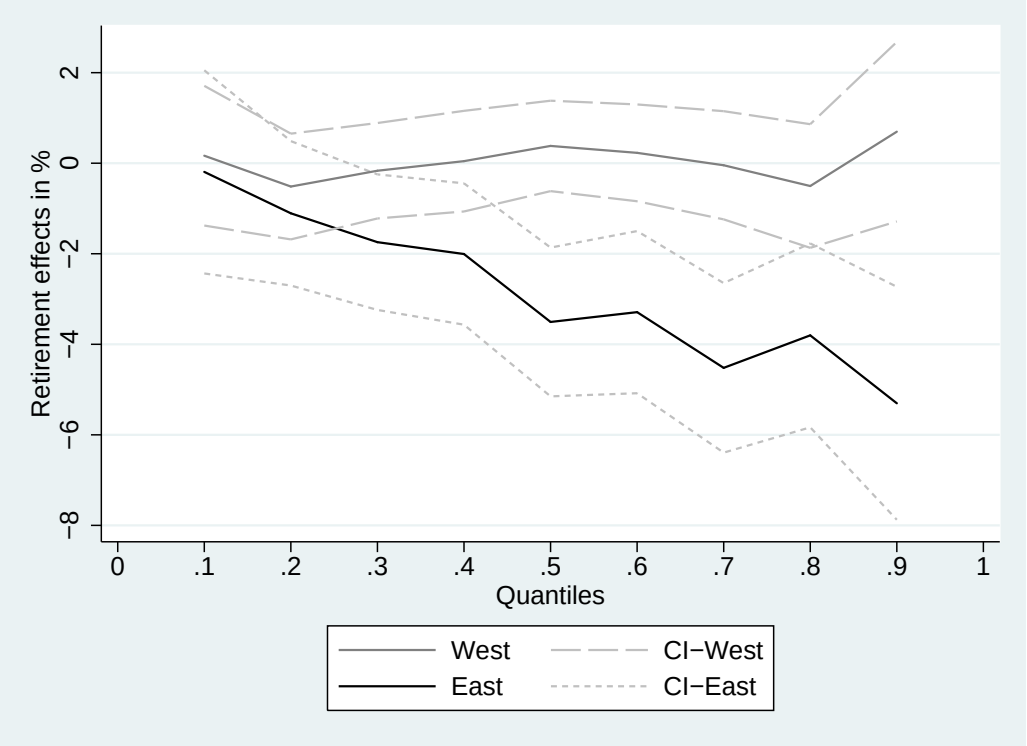
To check robustness of our estimation results, we have estimated alternative specification of the consumption function using different definitions of the consumption and retirement variables as well as the wealth variable. Estimation results for these alternative specifications are summarized in Table 5.

In the first specification, we use consumption on non-durables (excluding rents and imputed car expenditures) as an alternative consumption measure. The estimated retirement coefficient from an OLS regression in column (1) is virtually identical to the corresponding coefficient reported in the first column of Table 3.

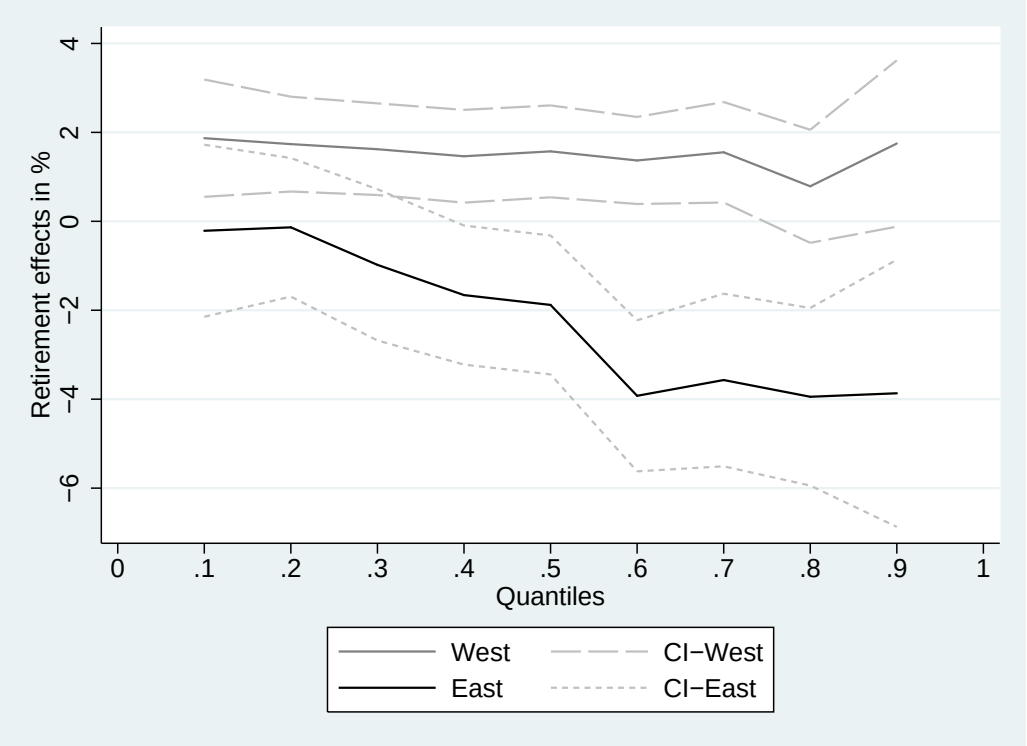
Next, we check what difference the use of food consumption instead of our preferred consumption flow measure would have on the estimated retirement effect. As mentioned in the introduction, most previous studies used food consumption to analyze the retirement-consumption puzzle, and we also found a large difference in food consumption between retired and non-retired

Figure 1: Retirement effects by consumption quantiles

(a) No wealth controls



(b) With wealth controls



Notes: The broken lines show 95% confidence bands (CI) of estimated quantile retirement effects with the same control variables as included in the regressions in Table 3.

Table 5: Regression results for alternative specifications of the consumption function

	Nondurables	Food consumption		Retired or non-employed		Age 56-65	Financial wealth
	OLS	OLS	2SLS	OLS	2SLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Retirement	-0.4	0.6	-5.5	-8.2	-2.2	-0.2	0.6
	(0.50)	(0.44)	(1.49)	(0.41)	(2.33)	(0.43)	(0.39)
East	-35.4	-14.6	-13.8	-39.0	-39.4	-39.7	-34.3
	(0.59)	(0.52)	(0.55)	(0.48)	(0.51)	(0.48)	(0.50)
Birth cohort 1936-40	2.6	2.8	0.6	0.4	1.4	0.8	1.1
	(0.82)	(0.73)	(0.88)	(0.65)	(0.76)	(0.64)	(0.65)
Birth cohort 1941-45	4.4	6.0	1.3	-1.0	1.6	0.6	1.4
	(1.24)	(1.09)	(1.52)	(0.96)	(1.35)	(1.00)	(0.98)
2nd wealth quartile							10.4
							(0.57)
3rd wealth quartile							17.8
							(0.60)
4th wealth quartile							27.4
							(0.66)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.88	5.50	5.51	7.21	7.19	7.20	7.06
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
R^2	0.22	0.14	-	0.27	-	0.28	0.32
Partial R^2 (Shea)	-	-	0.09	-	0.03	-	-
F-value of instruments	-	-	456.04	-	76.76	-	-
Hausman-Wu test (p-value)			0.00		0.01	-	-
No. of obs.	39,801	39,801	39,801	39,806	39,806	40,970	39,806

Notes: The dependent variable is the log of equivalized consumption flows. The consumption flow measure contains non-work related non-durable consumption expenditures and imputed values for owner-occupied housing and cars (see Appendix A for the imputation methods). The coefficient of the retirement dummy measured the average retirement effect on consumption in percent. Clustered standard errors on the household level are in parentheses. The consumption and wealth values are equivalized by the square root of household size. Year dummies for 1998, 2003, 2008, with base year 1993. Other controls are nationality, marital status, gender, social status of spouse and quarter.
Source: Own calculations using the EVS data (1993, 1998, 2003 and 2008), scientific-use-files provided by the Federal Statistical Office.

elderly people in the descriptive analysis of Section 4.1. Here, we estimate the consumption equation under the assumption of exogenous retirement status by OLS and also by 2SLS with the same instruments for retirement status as in our baseline specification in Table 3 above. Whereas the OLS estimate of the retirement coefficient is very small and statistically not significantly different from zero, the 2SLS estimator yields a fairly large negative and highly significant estimate of -5.5%.[12] The Hausman-Wu test clearly rejects exogeneity of the individual retirement status in this case. This may indicate that there is indeed some other factor wich is correlated with both food consumption and retirement, but much less so with our broader consumption-flow measure.

Estimation results in columns (4) and (5) of Table 5 refer to an alternative specification of the

[12]The insignificance of the retirement effect in this OLS regression is due to the inclusion of time dummies: not including time dummies would yield a significant point estimate of -1.6%.

retirement dummy where we include also non-employed people in the age group 58-67 years in our defintion of retirement. It could be argued that due to institutional regulations during most of our observation period unemployed people in this age group were effectively retired, and that the same could be assumed for people out-of-the-labor-force. On the other hand, retirement can probably be individually better planned than the event of unemployment, and the change on consumption may therefore differ between the two states, a point stressed by, inter alia, Banks et al. (1998) in their study of the retirement-consumption puzzle for the United Kingdom. The estimated OLS coefficient of this redefined retirement dummy indeed indicates a relatively large and highly significant negative retirement effect on consumption flows, with a point estimate is about -8%. However, the assumption of exogenous retirement status in this specification is strongly rejected by the Hausman-Wu test (p-value = 0.01). The negative point estimate (-2.2%) of the retirement effect from the 2SLS regression in this specification is smaller and imprecisely estimated. Due to the large standard error the estimated coefficient does actually not differ statistically significantly from the one estimated in our baseline specification. This large standard error suggests only a weak correlation of the instrumental variables and the individual retirement status in this specification. This is indeed indicated by the small value of the Parital R^2 of 0.03 despite a fairly large F-test for the instruments. That the instruments that worked reasonable well in our baseline specification are much weaker when retirement includes people who are not formally retired can be explained by the fact that the changes in institutional regulations we used to define our instrumental variables mainly affected formal retirement and not unemployment or non-participation in the labor market.

To further check the robustness of estimation results with respect to alternative definitions of the retirement status, in column (6), we have changed the age limit for inclusion in the sample to 56-65 years to account for early retirement, but this had very little effect on the estimated retirement coefficient.

Finally, in column (7) of Table 5 we report OLS regression results with the wealth dummies measuring a household's financial wealth instead of total net wealth. Here, the idea is that financial wealth is more liquid than housing wealth and can thus be easier used to smooth consumption after retirement (also see Bernheim et al. (2001)). Since the average retirement effect in this specification does not differ significantly from our baseline specification in Table 3, we conclude that the definition of the wealth variable does not affect our estimation results.

5 Conclusion

We have analyzed the retirement-consumption puzzle on the basis of repeated cross-section household data for Germany. This puzzle, which seems to contradict the main empirical im-

plication of the life-cycle hypothesis of consumption smoothing has mainly been investigated for the U.S. and the U.K., two countries which rely much more heavily on funded private pension schemes than welfare states with a dominating public pension system, like Germany. Using the best consumption and income data available for Germany, we have estimated the retirement effect on household consumption by comparing the level of consumption before and after retirement for birth cohorts aged of 52 to 67 in the period 1993-2008. These cohorts were affected differently by the various public pension reforms that took place in the observation period, and this provides important information we can use to identify the retirement effect on household consumption. Our data also allowed us to construct a much broader consumption measure, including the flow of consumption from non-durables, than in most previous studies. As shown in recent studies based on data for the U.S., using a broad and representative measure of household consumption is very important in investigating the retirement-consumption puzzle. In particular, these studies showed that the large drop in consumption at retirement found in earlier studies based on food consumption tends to disappear when a broad definition of consumption is used.

This general result is affirmed by our study for Germany as well. For our broadest consumption measure, which includes the flow of durables' consumption, we find that, on average, consumption does not decline significantly at retirement in OLS regressions with and without controls for household wealth. This also holds if the potential endogeneity of indidual retirement is controlled for in instrumental variable regressions. We also find heterogeneity in retirement effects among birth cohorts, the level of household wealth, and the level consumption, but these effects do not support the hypothesis that retirement is associated with a strong reduction of consumption among poorer households. For East German households at the bottom of the wealth distribution, we have found a significant negative retirement effect on consumption, which indicates that the relatively small amount of wealth accumulated by this group since unification severly restricts consumption smoothing opportunities for them. These results are robust to a number of specification checks.

Our results might also have implications for the question whether households save adequately for retirement to stabilize consumption levels. Not only was the average consumption decline after retirement fairly small across all birth cohorts analyzed in this paper, but also for the birth cohorts whose pension income was negatively affected by the public pension reforms which took place in our observation period. Furthermore, relatively poor households experienced only small declines in consumption after retirement.

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A Appendix - Imputation of Consumption Flows from Durables

The investment character of the consumption of the most relevant durable goods, namely owner-occupied housing and owned cars, is accounted for by including imputed values as consumption flows in the observed period, instead of the non-frequently appearing expenditures for purchases and maintenance of these goods.

For owner-occupied housing, the rents applied are computed by the Federal Statistical Office and provided with the data as follows: an average gross rent (excluding heating and maintenance) per square meter differentiated by federal states is applied to the reported size of the house or flat, and this is added to the reported expenditures for heating and maintenance (Statistisches Bundesamt, 2005).

Expenditures for car purchases form the most significant durable good related to the macroeconomic expenditures, except for housing expenditures. Here, we follow the "market rental value approach" for the measurement of services from durables. Firstly, a tobit-regression is estimated for households owning exactly one car with the reported expenditures for leasing as dependent variable and the disposable income and household characteristics as explanatory variables. Then, the unconditional value is predicted for each household owning at least one car assuming that 90% of the leasing rate is depreciation and 10% is interest payment. In case positive leasing payments are reported, they are used for the imputation. The depreciation is calibrated depending on the number of cars in the household and their characteristics (newly or second-hand bought). If the household reports expenditures for car purchases, 15% of this value is taken directly as depreciation for the first year (5% in case of second-hand purchase). Furthermore, if there are expenditures reported for preventive maintenance or spare parts then these are taken into account in calculating the depreciation.

B Appendix - Descriptives

Table B.1: Definition and means of variables in the consumption equation

Variable	Definition	Mean
Log consumption flows	in euros per month	7.12
Retired	Dummy	0.47
East	Dummy	0.25
Birth cohorts (Base category : birth cohort 1931-35)		0.29
Birth cohort 1936-40	Dummy	0.38
Birth cohort 1941-45	Dummy	0.33
Wealth quartiles (Base category: 1st quartile)		7,866 Euro
2nd quartile	Dummy	58,869 Euro
3rd quartile	Dummy	150,522 Euro
4th quartile	Dummy	380,292 Euro
Year dummies (Base category: 1993)		0.15
Year 1998	Dummy	0.36
Year 2003	Dummy	0.33
Year 2008	Dummy	0.16
Survey quarter (Base category: 1st quarter)		0.20
2nd quarter	Dummy	0.22
3rd quarter	Dummy	0.21
4ht quarter	Dummy	0.21
Nationality (Base category: non-German)	Dummy	0.99
Children in household	Dummy	0.09
Marital status (Base category: married)	Dummy	0.19
Gender (Base category: male)	Dummy	0.51
Social status of spouse		
(Base category: employed partner)		0.17
No partner in household	Dummy	0.17
Retired	Dummy	0.42
Non-employed	Dummy	0.20
Civil servant	Dummy	0.02
Self-employed	Dummy	0.02

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