Do Couples Pool Their Income?
Evidence from Demand System Estimation for Germany

Martin Beznoska

School of Business & Economics
Discussion Paper

Economics

2019/3

Do Couples Pool Their Income?

Evidence from Demand System Estimation for Germany

Martin Beznoska*

February 18, 2019

Abstract

Whether couples pool their resources and behave like a unit or spend their income individually is crucial for social and tax policy. In this paper, I provide a test of the income pooling hypothesis using administrative cross-sectional survey data on expenditures and individual incomes of couple households in Germany. The test is performed within the Quadratic Almost Ideal Demand System (QUAIDS) framework, which allows for an endogenous expenditure budget and endogenous individual income contribution shares in an instrumental variables approach. Although the hypothesis is broadly rejected, there are significant differences regarding the marital status, the presence of at least one child in the household and whether the household is located in a former West or East German federal state. Married couples and couples with children are closer to the acceptance of the hypothesis than unmarried couples without children.

Keywords: Income Pooling, Intra-Household Allocation, Consumer Demand, QUAIDS

JEL Codes: D12, D13, H24, J12

Acknowledgement: I would like to thank Viktor Steiner, Tobias Hentze, Susanna Kochskämper, Judith Niehues, Jochen Pimpertz, Maximilian Stockhausen and participants of the microdata seminar at IW for helpful comments. Financial support by the Carl-Deilmann foundation (*C. D.-Stiftung*) through project 'Family Taxation in Germany' is gratefully acknowledged.

* German Economic Institute (IW), Konrad-Adenauer-Ufer 21, Cologne, Germany, beznoska@iwkoeln.de; *Research Associate* at Freie Universität Berlin, School of Business & Economics

1. Introduction

Income pooling within a couple household does not only have important implications for the consumer behavior and the intra-household labor supply allocation, but it also determines the needs and the equivalence scale of the household. These issues may have consequences for the design of social benefits and for poverty politics. But the presence or absence of income pooling is also relevant for income taxation. In Germany, married couples are treated as a single tax unit with joint assessment and the offsetting of income differences between spouses. This treatment implies perfect income pooling of the spouses and grants, in a progressive tax system, a lower average tax rate for the couple than individual tax assessment (in the presence of income differences between the spouses). In consequence, marginal tax rates are also shared within the couple, which would be optimal in case of income pooling and suboptimal related to an individual leisure-consumption decision.

The paper contributes new evidence on testing the income pooling hypothesis for Germany with survey data on household expenditures. Income pooling in the theoretical economic framework means that the household faces a single utility function which is maximized by its members. This so-called “unitary” model (Becker, 1991) implies that total household budget is the relevant determinant for the individual consumption in the household while the individual contribution shares to the household income do not matter. On this basis, I provide a test of the hypothesis within the framework of a Quadratic Almost Ideal Demand System (QUAIDS) (see Banks, Blundell and Lewbel, 1997) whether the demand on women’s clothing depends on women’s income share of total household income. Endogeneity issues of the household budget and women’s income contribution share are handled in an instrumental variables setting. Additionally, heterogeneity in the effects regarding marital status and the presence of children in the household, as well as between former East and West German federal states is also considered.

There is a vast empirical literature on testing the income pooling hypothesis with different approaches. Personally allocable consumption expenditures are rarely available in common household surveys, since expenditures are typically observed only on the household level except for clothing and footwear expenditures. These categories are often separately available for women, men and children in the data and can therefore be attributed to persons. Although clothing and footwear are only proxies for total individual consumption, a recent study, which exploits a data set of households from Bangladesh with detailed expenditures on the individual level, suggests that spending on clothing is the best predictor among all goods to identify the resource sharing rule within the household (see Bargain, Lacroix and Tiberti, 2018).

There is a class of papers that uses structural household consumption models to test the hypothesis with micro data. Browning et al. (1994) reject the unitary household model with Canadian survey data in a structural framework and identify a household sharing rule of resources. They find that personal expenditures is significantly affected by the share of income a spouse contributes to total household income. Browning and Chiappori (1998) test a series of theoretical assumptions within a structural demand system and find evidence for a collective household model for couples instead of the unitary one. Phipps and Burton (1998) test the pooling hypothesis in a demand system also with Canadian data and find mixed results for different expenditure data. Income pooling cannot be rejected e.g. for housing but on the other side, wives are more likely to spend their income on child care than husbands.

The study of Lundberg et al. (1997) belongs to a class of papers that uses a policy change as natural experiment. A child allowance was transferred to wives in the UK starting in 1977. The authors find strong evidence of a shift toward greater expenditures on women's and children's clothing due to the reform which is not in line with the pooling hypothesis. A more recent reform of child and working tax credits in 2003 in the UK was used by Fisher (2016) to analyze the effects on spending patterns. He finds significant positive effects on expenditures related to children. Ward-Batts (2008) combines a structural model with the exogenous variation of the UK reform in 1977 and confirms the findings of Lundberg et al. (1997).

Another line in the literature uses survey questions that are directly related to pooling in the household. Bonke and Uldall-Poulsen (2007) exploit Danish survey data and find that most couples fully or partly pool their income. They also show that the probability of income pooling depends on several household characteristics as e.g. the duration of marriage and the existence of children in the household. Bonke and Browning (2009) use the same data and report that two-thirds of couple households answers that they pool their resources. However, a small part of them indicates inconsistency if other answers are taken into account.

Finally, intra-household allocation of resources is also examined in experimental settings. Attanasio and Lechene (2002) use a welfare program designed as a field experiment in Mexico, which transferred money to mothers, to look at the outcomes of the correspondents. They find that women gained more influence in the decision-making process of the household due to the shift of resources. Beblo and Beninger (2017) use experimental data on 95 German couples and conclude that the hypothesis is rejected for more than a half of the couples, also noting that couples with higher household income and higher education are more likely to pool their resources.

Despite the highly relevant political debate in Germany, the evidence on income pooling of couples is small for the country and especially lacking of a structural approach. The paper at hand adds evidence from structural demand system estimation applied to pooled data of the income and consumption survey for Germany (*Einkommens- und Verbrauchsstichprobe, EVS*) for the years 2008 and 2013.

The paper is organized as follows: The methodological approach is provided in Section 2. Data and descriptives are presented in Section 3, followed by the empirical results in Section 4. Section 5 concludes.

2. Model and Empirical Strategy

Income pooling within a household means that the individual consumption of each member does not depend on the individual income contributions to the household budget. Therefore, a shift in the income contribution share should not alter individual consumption – given that the household budget stays constant. This is the case, for example, if one partner reduces working time for child care, which reduces his or her income, while the other partner increases working time to compensate the income reduction. Individual consumption measured as expenditures for goods and services solely consumed by one partner should not be affected by this shift in income contribution (given that preferences for the goods do not change). This general test is embedded in a structural household demand system, controlling for the total consumption budget, prices and taste shifters. Additionally, the model is extended to allow for endogeneity of the individual income contribution share and the budget.

2.1. The model

The structural framework for the test of the income pooling hypothesis is the Quadratic Almost Ideal Demand System (QUAIDS) (see Banks et al., 1997). The QUAIDS is often used in the literature to model consumer demand with household data and is based on price-independent generalized logarithmic (PIGLOG) preferences with Engel curves that are modeled as budget shares being a quadratic function of the log-budget.[1] It has the advantage of a flexible underlying utility function and allows imposing the restrictions of a consistent demand system like homogeneity and symmetry. For each $i = 1, \ldots, N$ goods and the corresponding budget shares w_i, the QUAIDS forms the following non-linear system of equations:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \, ln \, p_j + \beta_i \, ln \left[\frac{m}{a(p)}\right] + \frac{\lambda_i}{b(p)} \left\{ln \left[\frac{m}{a(p)}\right]\right\}^2 + u_i \qquad (1)$$

for $i = 1, .., N$ goods and $j = 1, .., N$ with consumption budget m, prices p_i and price indices

$$a(p) = \alpha_0 + \sum \alpha_i ln \, p_i + \frac{1}{2} \sum \sum \gamma_{ij} \, ln \, p_i \, ln \, p_j$$

$$b(p) = \prod p_i^{\beta_i}$$

The model allows computing budget and (un)compensated price elasticities, as well as cross-price elasticities between different good prices. Although the system is non-linear due to its price indices, it can be estimated easily using the method of the Iterated Linear Least Squares Estimator (ILLE) which imposes conditional linearity on the parameters (Blundell and Robin, 1999).[2] Further explanatory variables that account as taste shifters for household consumption like demographic characteristics can be added to the equations.

[1] Ward-Batts (2008) also uses the QUAIDS to test the income pooling hypothesis.
[2] The Stata routine „aidsills“ by Lecocq and Robin (2015), which implements the Blundell and Robin (1999) estimator, is used in this paper to estimate the QUAIDS model.

2.2. Application

The test of the income pooling hypothesis is performed with administrative household microdata containing consumption expenditures (see Section 3). The budget shares w_i in the QUAIDS model are calculated by dividing the expenditures of consumption good i by the total consumption budget within each household. Expenditures are in general observed on household level in the data and therefore not assignable to the individuals in a couple household. The only expenditure categories which allow the assignment to individuals in the household are those for clothing and footwear. These categories are observed for adults by gender (explicitly for persons aged 14 or older) and additionally for children. Although clothing and footwear categories are only proxies for total private consumption, a recent study, which exploits a data set of households from Bangladesh with detailed expenditures on the individual level, suggests that spending on clothing is the best predictor among all goods to identify a resource sharing rule within the household (see Bargain, Lacroix and Tiberti, 2018).

For the unambiguous assignment of the spending, the approach focuses on mixed-gender couple households with no further adults and uses the personal expenditures on clothing and footwear to test the hypothesis. To avoid a wrong assignment of clothing and footwear expenditures for older children in the household to the categories for adults, the sample is restricted to households with children aged below 14 (or without children). Using these categories as proxies for individual consumption is a limitation but a general approach in the literature as other personally assignable expenditures are typically not observed in classic consumption surveys (see e.g. Lundberg et al., 1997; Phipps and Burton, 1998; Ward-Batts, 2008).

Although the demand system can be modeled as detailed as the expenditure categories in the data allow, the underlying utility function with weakly separable preferences makes it possible to aggregate the single goods to commodity groups. This attribute is useful to keep the estimation feasible by reducing the number of price effects in the model because of the general problem with small variation in prices, which occurs in demand system estimation on pooled cross-sectional data. I use quarterly data from two survey years, 2008 and 2013, which leaves the price variation to eight points in time. The aggregation of single expenditure categories to commodity groups features the attribute of computing Stone-Lewbel prices for the groups to increase the variation in prices (Lewbel, 1989). With the assumption of constant expenditure shares within a commodity group (implying Cobb-Douglas preferences in the group), the prices of the single goods are weighted with their expenditure shares in the commodity group. Since these shares vary for every household, price variation increases with the use of Stone-Lewbel prices. However, the small variation over time remains a challenge for the estimation, especially if the commodity groups consist of only a few goods.

As the focus is on testing the income pooling hypothesis, there is no major objection to restrict the demand system to three commodity groups, which results in a three equations system: Women's clothing and footwear, men's clothing and footwear and a composite good that aggregates all other non-durable consumption. The budget m therefore contains the spending on non-durable consumption including the expenditures on clothing and footwear of both partners. The share of gross income contributed by the woman to the household gross income is introduced as s. Accordingly, the share of income contributed by the man to the household income is $1-s$. Income can thereby stem from different income sources, not only labor but also transfers, pension income, business income and so on. If income is pooled and individual consumption only depends on the household budget, commodity prices and taste shifters but not on the individual income contribution, then the parameter on s should not be significantly different from zero. The variable can be added to the system of equations (1) in the same way as taste shifters and other control variables x_k by entering equation (1) in:

$$\alpha_i = \alpha_{i,0} + \sum_k \alpha_{i,k} x_k + \alpha_{i,K+1} s \tag{2}$$

The hypothesis is obviously rejected if $\alpha_{women,K+1} \neq 0$ in the equation for women's clothing and footwear. But as the adding-up restriction of demand systems is imposed in the estimation ($\alpha_{women} + \alpha_{men} + \alpha_{composite} = 0$), this would in principle allow $\alpha_{women,K+1} = 0$, while $\alpha_{men,K+1}$ in the equation for men's clothing and footwear and $\alpha_{composite,K+1}$ in the composite good equation are different from zero. But this result would imply that household consumption patterns depend on the income contribution share of women, which would also reject the hypothesis and therefore has to be tested.

The demographic control variables consist of dummies for the number of children in the household, quartic polynomials of age of both partners, a dummy for marriage, dummies for agglomeration level of the place of residence, time dummies (quarter, year), dummies for the federal state and a dummy for owner-occupied housing.

2.3. Endogeneity

There are some potential sources of endogeneity in the model, which are addressed in an instrumental variables (IV) approach. A classic endogeneity issue in demand systems is related to the budget m, which stands in the denominator of the expenditure share on the left-hand side of the equations and also depends on the consumption preferences. The common solution for this issue can be implemented by using the disposable household income and its quadratic term as instruments in a Two-Stage Least Square (2SLS) type of estimator for a system of equations (see e.g. Blundell and Robin, 1999). The basic idea follows the augmented regression framework. In the first stage, budget m is regressed on the exogenous control variables x_k and the instruments. Then, the residuals of this regression are added to every equation in the system via (2) as additional control variables. Blundell and Robin (1999) show that under the assumption that the error term u_i of (1) can be orthogonally decomposed into the residuals from stage one and a white noise term, the augmented regression estimator is identical to the 2SLS estimator. Since the assumption of exogenous labor supply has to be somehow relaxed in the approach at hand, the disposable income is not an appropriate instrument. Instead, the gross wages of both partners are assumed to be exogenous and taken as instruments. The specific modeling will be discussed later.

All commodity prices are assumed to be exogenous. The small but existent time variation of the consumer prices used in the model stem from the years 2008 and 2013. There was a reform of the standard rate of value-added tax in Germany in 2009, which affected many commodities including the expenditures on clothing and footwear. The rate was increased by three percentage points from 16 to 19 percent, which can be seen as an exogenous variation in prices given an elastic supply curve.

Another potential endogenous regressor can be seen in the women's share of income contribution s, as the preferences for clothing and footwear and therefore the household consumption pattern as a whole could affect the labor supply decision of the couple. For example, if women with strong preferences for clothing and footwear work more compared to their partners than women with lower preferences for these goods, the coefficient on the share of income contribution would be upwards biased and reject the hypothesis although the household members pool their income. Thus, women's income contribution is endogenous to the labor supply allocation of both partners, which in turn can be endogenous to consumer preferences.[3] Another potential endogeneity issue stems from the matching of the couples. The preferences for clothing and footwear of partner A may influence the match with partner B, for example, because of partner B's income. This could also distort the test on income pooling as the considered couples may systematically vary in their unobserved characteristics (see Lundberg et al., 1997).

The standard approach in household demand analysis assumes separability between consumer demand and labor supply (e.g. Banks et al., 1997). This is also a useful assumption in the type of literature, which examines the identification of the sharing rule – the shares of resources that are jointly or privately consumed in the household (e.g. Browning, Chiaporri and Lewbel, 2013). Separability can be theoretically modeled as a two-stage budgeting process (Deaton and Muellbauer, 1980). At the first stage, the household labor supply decision is made, which determines leisure, non-durable and durable consumption of the household members (and savings, which are future consumption). At the second stage, non-durable consumption is allocated on goods and services. The separability assumption allows focusing on non-durable consumption and to treat the labor supply decision of the first stage as exogenous and independent. This assumption does not have to be relaxed in the analysis at hand to test the hypothesis. Total labor supply of the couple remains separable from consumption but the separability from the distribution of labor supply within the couple is relaxed. Therefore, it is needful to tackle the endogeneity issues linked to the share of gross income contributed by the woman s.

[3] A collective household labor supply model that also incorporates consumer demand is examined theoretically for example in Blundell, Chiaporri and Meghir (2005) and in Cherchye, De Rock and Vermeulen (2012), who extend the former and apply it empirically. Applications within the QUAIDS framework that focus on environmentally relevant consumer goods can be found in West and Williams (2004) and Beznoska (2014).

At the first stage, I estimate the two equations:

$$\begin{aligned} s &= \Phi^{11}X_1 + \Theta^{11}Z_1 + v_1 \\ \ln(m) &= \Phi^{21}X_1 + \Phi^{22}X_2 + \Theta^{21}Z_1 + \Theta^{22}Z_2 + v_2 \end{aligned} \tag{3}$$

where X_1 and X_2 are vector-subsets of the exogenous variables, which also enters the demand system at the second stage in (2). The vectors Z_1 and Z_2 are subsets of the instrumental variables (excluded in the demand system). Φ and Θ are parameter vectors.

In the first equation, women's contribution share s depends on the subset of control variables X_1 and the instruments Z_1. The instruments in Z_1 are dummies for the type of school graduation of the man and the woman, interaction terms between them, as well as dummies for the type of highest educational/vocational graduation of both partners and again their interactions. The idea here is that education is separable from the preferences for non-durable consumption and can be left out in the demand system. However, it influences the share of income contribution *ex-ante* by bargaining position of the partners in the household labor supply decision and is also assumed to be correlated with the match of couples apart from preferences for consumption. The vector-subset X_1 contains all exogenous variables of the demand system except for the marriage dummy, the dummies for the number of children and the dummy for owner-occupied housing. These variables are denoted as vector X_2 and only appear in the second equation. The reason is that they are assumed to be potentially endogenous to the share of income contribution e.g. via the tax benefits of joint assessment of married couples in Germany if the share is far away from 0.5, which is also part of the research question and will be further examined in the heterogeneity analysis. Therefore, vector X_2 only appears in the budget equation at the first stage as the variables are in principle important for attributes that influence the household income and ultimately the consumption budget.

The instruments in Z_2 are man's and woman's gross wages in logs, which are derived from the data on individual gross income and working time. The exogeneity assumption relies on exogenously determined gross hourly wages that are independent of the reported working time. Since firstly, many wages are negotiated by trade-unions in Germany and secondly, for those not working, a classic Heckman model (Heckman, 1979) is estimated separately for men and women to impute the wages, this assumption is not seen as crucial to instrument the budget.[4] The wages are left out of the first equation because women's income contribution share and the wages are all derived from the information on individual gross income, which creates a dependency by construction.

The two equations are overidentified as there are much more instruments than endogenous variables and can be estimated by seemingly unrelated regressions (SUR) to have efficiently estimated standard errors for the F-tests of the instruments. The first stage can then be linked to the second stage, which is the demand system, in an augmented regression framework like the one used in Blundell and Robin (1999). Thus, the predicted residuals from (3), $\hat{v}_1$ and $\hat{v}_2$, are included in (2) to account for the endogeneity of s and m. Tests on the exogeneity of s and m can be derived from the estimated coefficients on $\hat{v}_1$ and $\hat{v}_2$ in the demand system. This test on exogeneity is combined with a test for overidentifying restrictions and Shea's partial R^2 to further check for the validity of the instruments.

3. Data and Descriptives

The model is estimated with two pooled cross-sections of data from the income and consumption survey for Germany (*Einkommens- und Verbrauchsstichprobe, EVS*) for the years 2008 and 2013. This administrative data set is a representative sample of households in Germany containing detailed information on income and expenditures. Each survey year features about over 40,000 households. The households are observed for one quarter equally distributed over all four quarters and with quarterly income and expenditure information. While consumption expenditures are only reported at the household level, income information is available individually for every household member. Very rich households are not included in the data as it prevents households with a quarterly household net income of more than 18,000 euro per quarter to enter the sample. However, this should not have a great impact on the average marginal effects regarding a consumption analysis.

As already described in Section 2.2., I focus on the demand analysis of non-durable consumption and explicitly the expenditures for clothing and footwear expenditures, which

[4] See Appendix A for detailed results of the estimated Heckman model.

are observed for women and men separately. Expenditures on durables are manually classified and excluded from the budget m. The non-durable expenditures contain the categories food, drinks, tobacco, heating and electricity, mobility, articles of daily use, health expenditures, child care, spending for leisure activities and other smaller items. Housing expenditures are also included and can either be actually paid rents without heating and electricity costs or imputed rents for owner-occupied houses and flats. The imputed rents are calculated by the German Federal Statistical Office (Statistisches Bundesamt) and already implemented in the EVS data sets.

Price data is supplemented to the survey data with official consumer price indices provided by the German Federal Statistical Office. While most expenditure categories in the EVS data refer to the two-digit and the four-digit price indices, especially the categories for men's and women's clothing and footwear are on a more disaggregated level but without an exact match in the available price data. I therefore use available ten-digit prices as proxies for these categories.[5] The monthly price indices are averaged over the quarter to fit the quarterly expenditure data. Afterwards, household-specific Stone-Lewbel prices are constructed with the price data by weighting the prices with the respective expenditure shares for every commodity group to increase price variation (see Section 2.2. for details). There are eight points in time, which create price variation (quarterly data for two years). Additional regional price variation only comes from the prices for housing, which are differentiated available by federal states.

The standard sample of the analysis is restricted to mixed-gender couple households (who declare in the data to be a couple) with exactly two adult persons and optionally children below the age of 14. Additional criteria is the presence of income from occupation in the household from at least one partner. This restriction excludes the households from the analysis, which completely rely on transfer income. The reason is that these households could be systematically different in their preferences and consumption decision-making from households with at least one occupied partner. I end up with 29,461 households, 15,367 from the year 2008 and 14,094 from the year 2013.

[5] I use the prices for men's trousers and women's trousers as proxies for men's clothing and women's clothing, respectively. Revenue statistics for 2013 from data provider *Statista* suggest that expenditures for trousers are the most relevant expenditure group within clothing expenditures for men and women. For the price of men's footwear, I use the price category „classic or casual shoes for men". The respective price for women's footwear is called „pumps or casual shoes for women".

Table 3.1:
Sample descriptives

Variables	Mean	Standard Deviation
Budget	2,607.91	1,042.45
Budget (log)	7.80	0.37
Expenditures for the ***commodity groups***		
Women's clothing and footwear	77.31	84.96
Men's clothing and footwear	45.69	59.23
Composite good	2,484.91	992.21
Budget shares		
Women's clothing and footwear	0.029	0.027
Men's clothing and footwear	0.017	0.019
Composite good	0.954	0.038
Prices		
Women's clothing and footwear	100.03	3.74
Men's clothing and footwear	100.46	4.55
Composite good	102.65	4.07
Income		
Couple’s gross income	4,626.62	2,331.98
Women’s income contribution share	0.342	0.235
Selected control variables		
Women’s age	45.02	12.78
Men’s age	47.89	13.15
Married (dummy)	0.831	0.375
Children in household (dummy)	0.360	0.480
Number of children (below 14 years)	0.612	0.922
Owner occupied housing (dummy)	0.647	0.478
Women’s wage per hour (log)	2.63	0.56
Men’s wage per hour (log)	2.89	0.56

Number of observations: 29,461

Notes: Expenditures and income in euro per month.
Sources: EVS data 2008, 2013; own calculations.

A potential data issue for the estimation is the existence of zero expenditures in households. As in the single equation case, a large share of zeros of the dependent variables can result in a biased estimation that can be fixed with a censored regression model.[6] However, as the model at hand features only three commodity groups, of which the composite good has no zero consumption and clothing and footwear are pooled for both partners, the problem should be

[6] For the multiple equation case, see e.g. Shonkwiler and Yen (1999) who proposed an estimator for censored demand systems.

rather minor. In the important equations for clothing and footwear expenditures, the share of zeros is 6.9 percent for women, while it is 15.4 percent in the equation for men.

Table 3.1 shows the descriptives of the sample. The total budget of non-durable consumption expenditures is about 2,608 euro per month at the mean, which is 73.6 percent of total spending on consumption in the sample. The average gross income of the couple households is 4,627 euro per month, of which the women's contribution share is 34.2 percent.

A women's contribution share of zero is found in about ten percent of the households. In principle, this could only be a problem in the first stage of the 2SLS approach since s appears as a dependent variable there. But two issues speak against a different model: Firstly, a proportion of ten percent zeros is mostly not considered as harmful in the literature. Secondly, a tobit-type approach would be a problem for the implementation of the augmented regression since the residuals from stage one would be distributed differently from those of a linear model (because the predictions are always positive). However, since the households with a women's income contribution share of zero could systematically vary in their preferences for consumption, the model is also run solely with the sample, in which both partners work, to compare the estimated coefficients as a robustness check.

4. Results

The QUAIDS model is firstly estimated with the ILLE ignoring edogeneity issues regarding the women's income contribution share s and the budget m. The results are discussed and compared to those of the 2SLS implementation in the augmented regression setting, which is presented secondly. Parameters of interest are, besides the one for s, the price and budget elasticities for the demand system, which can be derived from the estimated parameters.

4.1. Results for the QUAIDS model without endogeneity

Table 4.1 shows the result for the demand system by using the ILLE ignoring endogeneity issues and imposing homogeneity in prices. While budget effects are highly significant in all three equations, the price effects are only significant in the equations for women's clothing and footwear and for the composite commodity group. Importantly, the coefficients for women's income contribution share are significant in all equations with a positive sign for women's clothing and footwear and a negative sign for both other commodity groups. The system-wide joint test of the coefficients is also highly significant with a chi-squared statistic of 211 (with two degrees of freedom because one equation has to be dropped). This result implies a rejection of the income pooling hypothesis because a higher income contribution share of the woman means a higher consumption of women's clothing and footwear and a lower consumption of men's for a given household budget.

Table 4.1:
Estimation results for the demand system without endogeneity

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.05732***	-0.01363	0.07095***
	(0.01477)	(0.01087)	(0.02082)
Price men's clothing and footwear (log)	0.03608**	0.00960	-0.04568**
	(0.01483)	(0.01092)	(0.02091)
Price composite good (log)	0.02124**	0.00402	-0.02526*
	(0.00949)	(0.00696)	(0.01340)
Budget (β)	0.07578***	0.03855***	-0.11433***
	(0.00457)	(0.00336)	(0.00644)
Budget squared (λ)	-0.00968***	-0.00483***	0.01451***
	(0.00071)	(0.00052)	(0.00100)
Women's income contribution share (α)	**0.00734*** **	**-0.00318*** **	**-0.00416*** **
	(0.00069)	(0.00051)	(0.00098)
One child (baseline category: no children)	-0.00994***	-0.00711***	0.01705***
	(0.00050)	(0.00037)	(0.00071)
Two children	-0.01300***	-0.00924***	0.02224***
	(0.00054)	(0.00039)	(0.00075)
Three children	-0.01520***	-0.01154***	0.02673***
	(0.00089)	(0.00066)	(0.00126)
Four or more children	-0.01978***	-0.01258***	0.03236***
	(0.00189)	(0.00139)	(0.00267)
Married	-0.00133***	-0.00068*	0.00201***
	(0.00047)	(0.00035)	(0.00066)
Owner-occupied housing	-0.00306***	-0.00222***	0.00527***
	(0.00036)	(0.00027)	(0.00051)
Constant	-0.00639	-0.00113	1.00752***
	(0.01881)	(0.01385)	(0.02652)
Polynomials for the age of both partners, dummies of German citizenship, dummies for the federal state, level of agglomeration, quarter and survey year	yes	yes	yes
N	29,461	29,461	29,461
R^2	0.0899	0.0633	0.1077
Test on joint significance of coefficients α, *Chi*²-statistic (*p*-value)	210.6 (0.000)		

Notes: Standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999). Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

To classify the quantity of the effect, it can be evaluated at the mean of the expenditure shares. A switchover from zero income contribution to being the sole income earner would increase the expenditures on women's clothing and footwear by 25 percent or nearly 20 euro per month. Simultaneously, consumption of men's clothing and footwear drops by about 19 percent and the composite good by 0.4 percent. So, the substitution happens mostly between the two private goods in this model.

Other control variables are left out in Table 4.1 but are included in all equations.[7] Importantly, the controls for the presence of children show consistent signs in a way that more children in the household reduce the private consumption of both partner. A hint on the differences in preferences between married couples and unmarried couples is the significant coefficient of the dummy for marriage. In this model, private consumption is lower for married couples but further heterogeneity has to be evaluated in Section 4.3.

Price and budget elasticities of the demand system can also be derived from the estimated parameters of Table 4.1.[8] They are presented in Table B.2 in the Appendix.

4.2. Results for the QUAIDS model with endogeneity

The model can be augmented by allowing for endogeneity of the women's income contribution share and the expenditure budget. Following the approach presented in Section 2.3., the two endogenous variables are regressed in a first-stage-SUR model on the instruments. The predicted residuals from the first stage are subsequently inserted in the QUAIDS model.

---

[7] See Appendix B for the complete estimation results.

[8] The formulas for the elasticities in the QUAIDS can be derived according to Banks et al. (1997) from the estimated parameters. The budget elasticities are obtained by $\eta_i = 1 + \frac{\mu_i}{w_i}$ where $\mu_i = \beta_i + \frac{2\lambda_i}{b(p)} \ln\left(\frac{m}{a(p)}\right)$ is the marginal effect with respect to a change in the budget. The uncompensated price elasticities can be calculated $\varepsilon_{ij}^{u} = \frac{\mu_{ij}}{w_i} - \delta_{ij}$ where $\mu_{ij} = \gamma_{ij} - \mu_i\left(\alpha_j + \sum_k \gamma_{jk} \ln p_k\right) - \frac{\lambda_i \beta_j}{b(p)}\left[\ln\left(\frac{m}{a(p)}\right)\right]^2$ is the marginal effect with respect to a change of price j and δ_{ij} is the Kronecker delta, which is 1 if $i = j$ and 0 otherwise. The compensated price elasticities can be derived via Slutsky equation $\varepsilon_{ij}^{c} = \varepsilon_{ij}^{u} + \eta_i w_j$.

Table 4.2:
Estimation results for the first-stage-SUR model

	Women's income contribution share		Budget (log)	
Price women's clothing and footwear (log)	-0.09397	(0.15151)	-0.47095**	(0.20033)
Price men's clothing and footwear (log)	-0.11896	(0.18736)	0.44190*	(0.24116)
Price composite good (log)	-0.10338	(0.08386)	-1.11874***	(0.14112)
Woman's wage per hour (log)			0.09807***	(0.00443)
Man's wage per hour (log)			0.16685***	(0.00550)
Baseline category: no school graduation (woman)				
Secondary school (woman)	-0.12914**	(0.06093)	-0.09877	(0.08152)
Intermediate school-leaving certificate (woman)	-0.05529	(0.05719)	-0.06303	(0.07982)
Specialized A-levels (woman)	-0.02523	(0.12907)	0.15650	(0.16109)
A-levels (woman)	0.06781	(0.07628)	0.05980	(0.10778)
Baseline category: no school graduation (man)				
Secondary school (man)	-0.02988	(0.05922)	-0.22989**	(0.09403)
Intermediate school-leaving certificate (man)	0.00585	(0.06255)	0.09669	(0.08541)
Specialized A-levels (man)	-0.11047*	(0.06222)	-0.08753	(0.10179)
A-levels (man)	0.06999	(0.09839)	0.07075	(0.10056)
Baseline category: no vocational training (woman)				
Vocational training (woman)	0.08099***	(0.01754)	0.02849	(0.01876)
Technician (woman)	0.05878**	(0.02763)	0.03308	(0.03511)
College (woman)	0.19446***	(0.03198)	0.16763***	(0.03739)
University (woman)	0.15551***	(0.02797)	0.09035***	(0.02936)
Baseline category: no vocational training (man)				
Vocational training (man)	-0.08976***	(0.01463)	0.02571	(0.01781)
Technician (man)	-0.09007***	(0.01838)	0.03341	(0.02383)
College (man)	-0.16177***	(0.01660)	0.12298***	(0.02484)
University (man)	-0.17348***	(0.02032)	0.06723**	(0.02973)
German citizenship (man)	-0.07858***	(0.01124)	0.05870***	(0.01315)
German citizenship (woman)	0.10291***	(0.00860)	0.11315***	(0.01215)
One child (baseline category: no children)			0.06780***	(0.00556)
Two children			0.14404***	(0.00578)
Three children			0.19817***	(0.00928)
Four or more children			0.24616***	(0.01955)
Married			-0.00360	(0.00557)
Owner-occupied housing			0.15158***	(0.00410)
Constant	3.91675***	(1.14284)	10.24911***	(1.56608)
Interaction terms between the type of school graduation of both partners and between the type of highest educational graduation of both partners	yes		yes	
N	29,461		29,461	
R^2	0.168		0.393	
F-statistic (*p*-value)	52.3 (0.000)		128.2 (0.000)	

Notes: Bootstrapped standard errors in parentheses. Significance levels *** p<0.01, ** p<0.05, *p<0.1.
Sources: EVS data 2008, 2013; own calculations.

The estimation results from the first stage are presented in Table 4.2. Since there are in total 48 dummies and interaction terms of the instruments *school graduation* and *highest educational/vocational graduation* of both partners, the table is shortened by leaving out the results for the interaction terms.[9] Most instrumental dummies are clearly significant, although an interpretation is not meaningful without the interaction effects. The wages,

[9] See Appendix C for the complete estimation results.

which only appear in the budget equation, are also strongly significant. The F-tests in both equations on joint significance of the instruments do not indicate a weak instruments problem. Additionally, *Shea's Partial R^2* (Shea, 1997) for the women's income contribution share s is about 0.086 suggesting a properly high correlation with the instruments.

Table 4.3:
Estimation results for the demand system with endogenous budget and endogenous women's income contribution share

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.06286***	-0.01739	0.08025***
	(0.01486)	(0.01093)	(0.02100)
Price men's clothing and footwear (log)	0.02060	-0.00086	-0.01974
	(0.01502)	(0.01107)	(0.02124)
Price composite good (log)	0.04226***	0.01825**	-0.06051***
	(0.00991)	(0.00726)	(0.01405)
Budget (β)	0.08318***	0.04370***	-0.12688***
	(0.00466)	(0.00343)	(0.00657)
Budget squared (λ)	-0.00972***	-0.00486***	0.01458***
	(0.00071)	(0.00052)	(0.00100)
Women's income contribution share (α)	**0.00506****	**-0.00702*****	**0.00196**
	(0.00236)	(0.00174)	(0.00333)
$\hat{\upsilon}_1$ - Women's income contribution share	0.00259	0.00425**	-0.00685**
	(0.00246)	(0.00181)	(0.00347)
$\hat{\upsilon}_2$ - Budget	-0.00895***	-0.00622***	0.01516***
	(0.00114)	(0.00084)	(0.00161)
One child (baseline category: no children)	-0.01019***	-0.00727***	0.01746***
	(0.00051)	(0.00037)	(0.00072)
Two children	-0.01386***	-0.00983***	0.02368***
	(0.00055)	(0.00040)	(0.00078)
Three children	-0.01653***	-0.01246***	0.02898***
	(0.00091)	(0.00067)	(0.00129)
Four or more children	-0.02137***	-0.01369***	0.03506***
	(0.00191)	(0.00141)	(0.00270)
Married	-0.00134***	-0.00067*	0.00201***
	(0.00047)	(0.00035)	(0.00067)
Owner-occupied housing	-0.00448***	-0.00320***	0.00768***
	(0.00041)	(0.00030)	(0.00058)
Constant	0.00690	0.01376	0.97934***
	(0.01974)	(0.01454)	(0.02789)
Polynomials for the age of both partners, dummies of German citizenship, dummies for the federal state, level of agglomeration, quarter and survey year	yes	yes	yes
N	29,461	29,461	29,461
Shea's partial R^2 between s and its instruments	0.086		
Test on joint significance of coefficients of $\hat{\upsilon}_1$, *Chi²*-statistic (*p*-value)	5.6 (0.060)		
Test on joint significance of coefficients of $\hat{\upsilon}_2$, *Chi²*-statistic (*p*-value)	89.3 (0.000)		
Test on joint significance of coefficients of α, *Chi²*-statistic (*p*-value)	28.3 (0.000)		

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999). Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

The test of the income pooling hypothesis in the demand system with endogenous regressors remains a significant rejection, although the effect of women's income contribution share on women's clothing and footwear consumption is smaller compared to the first model (Table 4.3). The direct effect from a shift in the contribution share from zero to one is now 17,4 percent more consumption compared to 25 percent in the first model but still significant at the 5 percent level. The coefficients are also still jointly significant at the 1 percent level in the system of equations. While the significant effect on the consumption of the composite good vanishes, the negative one on men's clothing and footwear becomes even more negative inducing a strong rival relationship between the two private goods.

However, the coefficients do not differ substantially from those of the first model. Accordingly, the test on exogeneity of women's income contribution share, which is the test on the joint significance of the included residuals, is only significantly rejected at the 10 percent level with a *p*-value of 0.06. A somewhat different picture shows the test on exogeneity of the budget, which is strongly rejected.

Table 4.4:
Estimated elasticities for the demand system with endogeneity

	Budget elasticity	Uncompensated price elasticity Change in the price of…			Compensated price elasticity Change in the price of…		
		(1)	(2)	(3)	(1)	(2)	(3)
Women's clothing and footwear (1)	1.718***	-2.729***	0.881*	0.130	-2.677***	0.911*	1.766***
	(0.035)	(0.495)	(0.501)	(0.317)	(0.495)	(0.501)	(0.324)
Men's clothing and footwear (2)	1.730***	-0.656	-0.876	-0.198	-0.604	-0.845	1.449***
	(0.049)	(0.618)	(0.625)	(0.396)	(0.618)	(0.625)	(0.405)
Composite good (3)	0.964***	0.067***	-0.030	-1.000***	0.096***	-0.013	-0.083***
	(0.002)	(0.022)	(0.022)	(0.014)	(0.022)	(0.022)	(0.014)

Notes: Standard errors in parentheses. Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed. Elasticities evaluated at sample means.
Sources: EVS data 2008, 2013; own calculations.

The corresponding elasticities are presented in Table 4.4, where the dependent variables (quantities of demand) can be found in the lines and the columns refer to the exogenous variables (the budget and the prices). The budget elasticities are highly significant in all equations indicating that the demand for clothing and footwear is budget elastic. They also vary significantly from those of the model without endogeneity (see Table B.2 in the Appendix). The compensated own-price elasticities are consistently negative for all commodity groups with a high own-price elasticity for women's footwear and clothing of -2.7. Because symmetry of price effects is not imposed in the estimation, the cross-price effects are mostly not symmetric and can therefore not be interpreted. The only confirmed substitutional relationship is found between the composite good and women's clothing and footwear. While the other cross-price effects show non-symmetric signs, they have in both cases only one significantly estimated effect with a positive sign indicating substitutional relationships.[10]

4.3. Heterogeneous effects for married couples and the presence of children

While the income pooling hypothesis is rejected by estimating one marginal effect for all couple households, there are still important questions open regarding the heterogeneity in the household context. To deal with these questions, the model will be extended with interaction effects for married status and the presence of children in the household. Additionally, differences in the effects between the former East and West German federal states are explored. The underlying model is the augmented regression from Section 4.2 which accounts for potential endogeneity and allows in principle adding interaction terms without estimating a different first-stage equation.[11]

[10] Symmetry cannot be rejected at the 10 percent level in this model. Imposing the restriction would give no significant cross-price relationship between both clothing and footwear commodity groups. Additionally, the compensated own-price effect for women's clothing and footwear would shrink to -2, while the one for men's clothing and footwear would rise to weakly significant -1.6.

[11] A different first-stage-SUR model is only estimated if the control variables are changed. For example, the dummies for the federal states had to be excluded in the interaction model with a dummy for East Germany. Therefore, this was also done in the first stage to have an equivalent specification.

Table 4.5:
Heterogeneous effects for married couples and the presence of children

	Dependent variables: Expenditure shares			
	Women's clothing and footwear	Men's clothing and footwear	Composite good	*Chi*²-statistic on system significance
Interaction with *Married* dummy				
Women's income contribution share ***s***	0.01200***	-0.00959***	-0.00241	55.1, 0.000
	(0.00287)	(0.00211)	(0.00405)	
Interaction effect: *Married* · ***s***	-0.00827***	0.00307**	0.00521*	22.0, 0.000
	(0.00194)	(0.00143)	(0.00274)	(combined effect)
Married	0.00219**	-0.00198***	-0.00021	19.0, 0.000
	(0.00095)	(0.00070)	(0.00135)	
Interactions with *Married* and *East Germany* dummies				
Women's income contribution share ***s***	0.01394***	-0.00762***	-0.00631	45.7, 0.000
	(0.00307)	(0.00226)	(0.00434)	
Interaction effect: *Married* · ***s***	-0.01146***	0.00060	0.01085***	21.2, 0.000
	(0.00227)	(0.00167)	(0.00321)	(combined effect)
Interaction effect: *East Germany* · ***s***	-0.00836**	-0.00744**	0.01581***	34.8, 0.000
	(0.00400)	(0.00295)	(0.00565)	(combined effect)
Int. effect: *East Germany* · *Married* · ***s***	0.01121***	0.00866***	-0.01987***	17.9, 0.000
	(0.00433)	(0.00319)	(0.00612)	(combined effect)
Married	0.00275**	-0.00152*	-0.00124	14.0, 0.001
	(0.00110)	(0.00081)	(0.00155)	
East Germany	0.00395**	0.00308**	-0.00703**	6.6, 0.037
	(0.00196)	(0.00144)	(0.00277)	
Int. effect: *East Germany* · *Married*	-0.00233	-0.00189	0.00423	2.1, 0.347
	(0.00209)	(0.00154)	(0.00295)	
Interaction with *At least one child in the household* dummy				
Women's income contribution share ***s***	0.00731***	-0.00656***	-0.00074	33.1, 0.000
	(0.00240)	(0.00177)	(0.00339)	
Interaction effect: *At least one child* · ***s***	-0.00712***	-0.00143	0.00855***	20.2, 0.000
	(0.00141)	(0.00104)	(0.00200)	(combined effect)
At least one child	-0.00768***	-0.00677***	0.01445***	218.8, 0.000
	(0.00071)	(0.00052)	(0.00100)	
Interactions with *Married* and *At least one child in the household* dummies				
Women's income contribution share ***s***	0.01385***	-0.01092***	-0.00293	63.9, 0.000
	(0.00305)	(0.00225)	(0.00431)	
Interaction effect: *At least one child* · ***s***	-0.01032**	0.00218	0.00814	10.3, 0.006
	(0.00431)	(0.00317)	(0.00608)	(combined effect)
Interaction effect: *Married* · ***s***	-0.00808***	0.00509***	0.00299	23.2, 0.000
	(0.00227)	(0.00167)	(0.00321)	(combined effect)
Int. effect: *At least one child* · *Married* · ***s***	0.00442	-0.00387	-0.00055	17.2, 0.000
	(0.00456)	(0.00336)	(0.00644)	(combined effect)
At least one child	-0.00729***	-0.01020***	0.01749***	53.8, 0.000
	(0.00194)	(0.00143)	(0.00274)	
Married	0.00167	-0.00372***	0.00205	26.9, 0.000
	(0.00117)	(0.00087)	(0.00166)	
Int. effect: *At least one child* · *Married*	-0.00050	0.00416***	-0.00366	9.1, 0.011
	(0.00203)	(0.00149)	(0.00286)	

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999). Significance levels *** $p<0.01$, ** $p<0.05$, *$p<0.1$. Homogeneity restriction is imposed. The right column contains p-values of the chi-squared test.
Sources: EVS data 2008, 2013; own calculations.

Four different interaction models are estimated with different specifications and presented in Table 4.5. The first model incorporates an interaction term for married couples allowing women's income contribution to have varying effects for married and unmarried couples. The effects on both "private" goods are significantly higher for unmarried couples. This result is confirmed with the system-wide chi-squared test which has a much higher statistic for unmarried couples (main coefficient), although the hypothesis remains rejected for married ones (main coefficient and interaction effect combined). Married couples are thus nearer to the theoretical construct of pooling.

Interestingly, there are substantial differences between the former East and West German federal states. The effect on women's clothing and footwear is smaller for unmarried couples in East Germany compared to West Germany, while the effect on men's clothing and footwear is much larger. Consequently, there is more substitution between the composite good and men's private good. The test signalizes a less strong rejection in the East. However, the status of marriage reduces the effects in both regions bringing about a low chi-squared statistic.

An effect similar compared to the one found for married couples appears in the model with an interaction term for the presence of at least one child in the household (below 14 years old). There is no effect left on women's clothing and footwear consumption but a high effect on men's. Without children the substitution happens almost exclusively between the private goods. But contrary to the model with a term for marriage, the expenditure shares of the private goods are both significantly lower with the presence of at least one child which indicates a large preference shift toward the composite commodity group. This is plausible because the expenditures on goods for children are contained in this group. However, it could be the case that all pure privately consumed goods for the adults are equally devaluated with the presence of children, which means there is still explanatory power to the test indicating substitution between men's consumption and the composite good dependent on women's income contribution. The chi-squared statistic has a similar low value as in the models with an interaction term for marriage.

The combination of marriage and the presence of at least one child confirms the found results. Interestingly, the constellation which is nearest to perfect income pooling according to the chi-squared test is an unmarried couple with at least one child. Though, this result is mainly driven by higher standard errors, as the differences between this case and the combination with marriage are not significant.

4.4. Robustness checks

A person's preference for clothing and footwear could depend on the occupational status in a way that expenditures could potentially be higher for occupied persons than for unemployed, or that they could be higher in higher paid jobs than in low income jobs. As the main specification of the model features couples with the presence of income from occupation in the household from at least one partner, this could be a factor in the hypothesis test. The instrumentation of the income contribution share should tackle the problem sufficiently as it only depends on educational backgrounds and not on actual occupational status in consequence. However, there could potentially be a correlation left between the preferences for clothing/footwear and unobserved factors regarding the occupational status because educational information is too broadly defined (e.g. not specifying the potential job positions).

Therefore, two robustness checks are done: Firstly, the sample is restricted to both partners having market income (and thus being occupied) and secondly to women's income contribution shares lying between 0.2 and 0.8, which gives both partners a significant contribution to the household budget. The first check should clarify the influence of a preference shift from (non-)occupation of a partner, while the second one should evaluate the situation in which both incomes are not too far different from each other.[12] The first stage remains in both checks the same as in the main specification to avoid selection effects in the coefficients of the instruments.

The results for the parameters α are presented in Table 4.6. For a better comparison with the initial parameters from the IV model of Table 4.3, these are repeated in the first rows. In the first robustness check with both partners having positive market income, the effect on women's clothing and footwear is smaller and insignificant while the one on men's expenditures is larger. In consequence, there is more substitution between men's consumption and the composite good, but a rejection of the hypothesis. This result is even stronger if the sample is restricted to s lying between 0.2 and 0.8. Since the average share of

[12] See Appendix D for detailed estimation results.

women’s income contribution is increasing going from the original model to the first and second robustness check, there is a possibly nonlinear effect on consumption pattern. For low values of s, there is a positive effect on women’s clothing and footwear consumption. For higher values, the effect becomes stronger for other goods contained in the composite good and lower for clothing and footwear. However, the rejection of the income pooling hypothesis persists in any case, since the negative relationship between women’s share and men’s private consumption holds.

Table 4.6:
Robustness checks: Different samples

	Dependent variables: Expenditure shares			
	Women's clothing and footwear	Men's clothing and footwear	Composite good	*Chi²*-statistic on system significance
Original effects (IV), *N* = 29,461				
Women's income contribution share (α)	0.00506**	-0.00702***	0.00196	28.9, 0.000
	(0.00236)	(0.00174)	(0.00333)	
$\hat{\upsilon}_1$	0.00259	0.00425**	-0.00685**	5.6, 0.060
	(0.00246)	(0.00181)	(0.00347)	
Sample restriction on both partners having positive market incomes, *N* = 19,322				
Women's income contribution share (α)	0.00405	-0.00981***	0.00576	26.6, 0.000
	(0.00304)	(0.00227)	(0.00433)	
$\hat{\upsilon}_1$	0.00346	0.00596**	-0.00942**	6.4, 0.040
	(0.00317)	(0.00237)	(0.00451)	
Sample restriction on s lying between 0.2 and 0.8, *N* = 19,257				
Women's income contribution share (α)	0.00299	-0.01245***	0.00946**	36.1, 0.000
	(0.00324)	(0.00233)	(0.00454)	
$\hat{\upsilon}_1$	0.00370	0.00668***	-0.01038**	8.1, 0.017
	(0.00327)	(0.00235)	(0.00459)	

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999). Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed. The right column contains p-values of the chi-squared test.
Sources: EVS data 2008, 2013; own calculations.

5. Conclusion

The validity of the income pooling hypothesis has important implications for social and tax policy as well as for inequality research. In this paper, I provide a test of the income pooling hypothesis using administrative cross-sectional survey data on German couple households. I use information on expenditures and individual incomes to test the hypothesis in a structural consumer demand system. While most expenditures are only observed at the household level in the survey, expenditures on clothing and footwear are separately available for women and men and can be taken as proxies for individual consumption within the couple household.

According to the hypothesis, household consumption decisions should only depend on the household budget, prices and taste shifters. The individual income contribution share should therefore have no effect on consumption patterns, which can be tested within the framework of a Quadratic Almost Ideal Demand System (QUAIDS). I expand the model by controlling for endogeneity of the expenditure budget and the individual income contribution shares in an instrumental variables approach. Additionally, heterogenous effects are evaluated according to household attributes.

Although the hypothesis is broadly rejected, which implies a relationship between individual income contribution and individual consumption, there are significant differences regarding the marital status, the presence of at least one child in the household and whether the household is located in a former West or East German federal state. Married couples and couples with children are more closely to the acceptance of the hypothesis than unmarried couples without children. Unmarried couples in a former East German federal states are closer to income pooling than in former West German states. A negative effect of women’s income contribution on men’s clothing and footwear consumption is confirmed in all specifications, which has a positive effect on women’s consumption and the composite good.

Since perfect income pooling is even rejected for married couples, this result has implications for income taxation. It justifies a limitation of joint assessment of couples, e.g. a limited offsetting of income differences between the spouses or different individual marginal tax rates in general. Additionally, tax and social policy should consider an equal treatment of couples with children regardless of the marital status because the differences in income pooling between these two family types are marginal.

References

Attanasio, O. and V. Lechene (2002): "Tests of Income Pooling in Household Decisions", *Review of Economic Dynamics*, 5, 720–748.

Banks, J., R. Blundell, and A. Lewbel (1997): "Quadratic Engel Curves and Consumer Demand", *The Review of Economics and Statistics*, 79, 527–539.

Bargain, O., G. Lacroix, and L. Tiberti (2018): "Validating the Collective Model of Household Consumption Using Direct Evidence on Sharing", Cahiers de recherche 1810, Centre de recherche sur les risques, les enjeux économiques, et les politiques publiques.

Beblo, M. and D. Beninger (2017): "Do Husbands and Wives Pool Their Incomes? A Couple Experiment", *Review of Economics of the Household*, 15, 779–805.

Becker, G. (1991): "*A Treatise on the Family*", enlarged edition, Harvard University Press, Cambridge.

Beznoska, M. (2014): "Estimating a Consumer Demand System of Energy, Mobility and Leisure: A Microdata Approach for Germany", *Discussion Papers* 2014/8, Free University Berlin, School of Business & Economics.

Blundell, R., and J.-M. Robin (1999): "Estimation in Large and Disaggregated Demand Systems: An Estimator for Conditionally Linear Systems", *Journal of Applied Econometrics*, 14, 209–232.

Blundell, R., P.-A. Chiappori, and C. Meghir (2005): "Collective Labor Supply with Children", *Journal of Political Economy*, 113, 1277–1306.

Bonke, J. and H. Uldall-Poulsen (2007): "Why Do Families Actually Pool their Income? Evidence from Denmark", *Review of Economics of the Household*, 5, 113–128.

Bonke, J. and M. Browning (2009): "Allocation of Expenditures within the Household: A New Danish survey", *Fiscal Studies*, 30, 461–481.

Browning, M. and P.-A. Chiappori (1998): "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests", *Econometrica*, 66, 1241–1278.

Browning, M., F. Bourguignon, P.-A. Chiappori, and V. Lechene (1994): "Incomes and Outcomes: A Structural Model of Intrahousehold Allocation", *Journal of Political Economy*, 102, 1067–1096.

Browning, M., P.-A. Chiappori, and A. Lewbel (2013): "Estimating Consumption Economies of Scale, Adult Equivalence Scales, and Household Bargaining Power", *Review of Economic Studies*, 80, 1267–1303.

Cherchye, L., B. De Rock, and F. Vermeulen (2012): "Married with Children: A Collective Labor Supply Model with Detailed Time Use and Intrahousehold Expenditure Information", *American Economic Review*, 102, 3377–3405.

Deaton, A. and J. Muellbauer (1980): *Economics and Consumer Behavior*, Cambridge University Press, New York.

Fisher, P. (2016): “British Tax Credit Simplification, the Intra-household Distribution of Income and Family Consumption”, *Oxford Economic Papers*, 68, 444–464.

Heckman, J. (1979): “Sample Selection Bias as a Specification Error”, *Econometrica*, 47, 153–161.

Lecocq, S. and J.-M. Robin (2015): “Estimating Almost-Ideal Demand Systems with Endogenous Regressors”, *Stata Journal*, 15, 554–573.

Lewbel, A. (1989): “Identification and Estimation of Equivalence Scales under Weak Separability”, *The Review of Economic Studies*, 56, 311–316.

Lundberg, S. J., R. A. Pollak, and T. J. Wales (1997): “Do Husbands and Wives Pool Their Resources? Evidence from the U.K. Child Benefit”, *Journal of Human Resources*, 32, 463–80.

Phipps, S. and P. Burton (1998): “What’s Mine is Yours? The Influence of Male and Female Incomes on Patterns of Household Expenditure”, *Economica*, 65, 599–613.

Shea, J. (1997): “Instrument Relevance in Multivariate Linear Models: A Simple Measure”, *Review of Economics and Statistics*, 79, 348–352.

Shonkwiler, J. S. and S. T. Yen (1999): “Two-Step Estimation of a Censored System of Equations”, *American Journal of Agricultural Economics*, 81, 972–982.

Ward-Batts, J. (2008): “Out of the Wallet and into the Purse: Using Micro Data to Test Income Pooling”, *Journal of Human Resources*, 43, 325–351.

West, S. and R. Williams (2004): “Estimates from a Consumer Demand System: Implications for the Incidence of Environmental Taxes”, *Journal of Environmental Economics and Management*, 47, 535–558.

Appendix A

The wages for women and men are used in the first stage of the instrumental variables approach. Since the wages are not observed for those that are not working, they have to be imputed to estimate the model on all observations in the sample. For this purpose, a classic Heckman model is estimated for women and men separately to impute wages for the missing cases. The underlying sample of couple households is the same as the one for the demand system estimation.

Table A.1:
Heckman model: Women

	Log Wage per hour		Work =1	
Age	0.06189***	(0.01211)	0.09793	(0.15118)
Age squared	-0.00050***	(0.00014)	-0.00448	(0.00550)
Age cubic			0.00011	(0.00009)
Age quartic			-0.00000**	(0.00000)
Partner's age			0.00562	(0.00759)
Partner's age squared			-0.00013*	(0.00007)
Baseline category: no vocational training				
Vocational training (2)	0.58934**	(0.24270)	0.15086*	(0.08512)
Technician (3)	0.65796**	(0.31513)	0.01815	(0.15085)
College (4)	0.43722	(0.30037)	0.81753***	(0.18008)
University (5)	0.08044	(0.29231)	0.37141***	(0.13057)
Interaction terms				
Interaction: Vocational training x age	-0.01201	(0.01260)		
Interaction: Technician x age	-0.01471	(0.01555)		
Interaction: College x age	-0.00087	(0.01519)		
Interaction: University x age	0.01970	(0.01483)		
Interaction: Vocational training x age squared	0.00005	(0.00015)		
Interaction: Technician x age squared	0.00011	(0.00018)		
Interaction: College x age squared	-0.00002	(0.00018)		
Interaction: University x age squared	-0.00022	(0.00017)		
Baseline category: partner has no vocational training				
Partner’s graduation: Vocational training (2)			-0.05971	(0.07541)
Partner’s graduation: Technician (3)			-0.04921	(0.10751)
Partner’s graduation: College (4)			0.04234	(0.10368)
Partner’s graduation: University (5)			0.12450	(0.11685)
Interaction terms				
Interaction educational graduation 2 (own) x 2 (partner)			0.24223**	(0.09498)
Interaction educational graduation 2 x 3			0.24185*	(0.12386)
Interaction educational graduation 2 x 4			0.13018	(0.12091)
Interaction educational graduation 2 x 5			-0.00339	(0.13454)
Interaction educational graduation 3 x 2			0.62338***	(0.16047)
Interaction educational graduation 3 x 3			0.57513***	(0.17778)
Interaction educational graduation 3 x 4			0.42714**	(0.17941)
Interaction educational graduation 3 x 5			0.30978	(0.18852)
Interaction educational graduation 4 x 2			0.03282	(0.19034)
Interaction educational graduation 4 x 3			0.14430	(0.21149)
Interaction educational graduation 4 x 4			-0.16620	(0.20127)
Interaction educational graduation 4 x 5			-0.31622	(0.21066)
Interaction educational graduation 5 x 2			0.21249	(0.14565)
Interaction educational graduation 5 x 3			0.28633*	(0.17237)
Interaction educational graduation 5 x 4			0.19310	(0.16231)
Interaction educational graduation 5 x 5			0.08174	(0.16619)
German citizenship	0.05153	(0.03356)	0.59728***	(0.04746)
Partner has German citizenship			-0.02569	(0.05573)
Married (baseline category: single)	-0.03672**	(0.01587)	-0.29201***	(0.03151)
Widowed	-0.06036	(0.07458)	-0.41168***	(0.11547)
Divorced	-0.06045**	(0.03027)	-0.13179**	(0.05932)
Permanently separated	-0.17778**	(0.07407)	0.29775*	(0.17948)
East Germany	-0.18964***	(0.03462)	0.23317***	(0.06077)

Baseline category: population < 5,000				
Population between 5,000 and 20,000	0.04916***	(0.01432)	0.03000	(0.02455)
Population between 20,000 and 100,000	0.05697***	(0.01488)	0.02177	(0.02566)
Population over 100,000	0.07945***	(0.01618)	0.03745	(0.02818)
Student	0.04225	(0.05127)	-1.66974***	(0.05905)
Civil servant	0.10634***	(0.01485)		
One child (baseline category: no children)			-0.63297***	(0.02797)
Two children			-0.79272***	(0.02925)
Three children			-1.26564***	(0.04592)
Four or more children			-1.47939***	(0.09707)
Constant	0.96547***	(0.23956)	-1.05446	(1.50307)
Dummies for the federal state, quarter and year	yes		yes	
Observations	31,260			
Selected	19,429			
Nonselected	11,831			
Lambda	-0.38597***	(0.02491)		

Notes: Standard errors in parentheses. Significance levels * p<0.10, ** p<0.05, *** p<0.01
Sources: EVS data 2008, 2013; own calculations.

Table A.2:
Heckman model: Men

	Log Wage per hour		Work =1	
Age	0.08111***	(0.01127)	1.45959***	(0.20562)
Age squared	-0.00087***	(0.00014)	-0.05801***	(0.00734)
Age cubic			0.00098***	(0.00011)
Age quartic			-0.00001***	(0.00000)
Partner's age			0.00879	(0.01003)
Partner's age squared			-0.00016	(0.00011)
Baseline category: no vocational training				
Vocational training (2)	0.60998***	(0.22967)	0.25738***	(0.08319)
Technician (3)	0.58928**	(0.28047)	0.11924	(0.12145)
College (4)	0.73314***	(0.25665)	0.65054***	(0.12519)
University (5)	0.16217	(0.26030)	0.48295***	(0.13400)
Interaction terms				
Interaction: Vocational training x age	-0.01227	(0.01166)		
Interaction: Technician x age	-0.00104	(0.01365)		
Interaction: College x age	-0.00430	(0.01276)		
Interaction: University x age	0.02412*	(0.01290)		
Interaction: Vocational training x age squared	0.00010	(0.00014)		
Interaction: Technician x age squared	-0.00006	(0.00016)		
Interaction: College x age squared	0.00005	(0.00015)		
Interaction: University x age squared	-0.00024	(0.00015)		
Baseline category: partner has no vocational training				
Partner’s graduation: Vocational training (2)			0.07127	(0.09212)
Partner’s graduation: Technician (3)			0.16231	(0.16752)
Partner’s graduation: College (4)			-0.04199	(0.16293)
Partner’s graduation: University (5)			0.23993*	(0.13764)
Interaction terms				
Interaction educational graduation 2 (own) x 2 (partner)			0.16175	(0.10458)
Interaction educational graduation 2 x 3			0.13729	(0.17883)
Interaction educational graduation 2 x 4			0.33672*	(0.17727)
Interaction educational graduation 2 x 5			-0.08784	(0.15557)
Interaction educational graduation 3 x 2			0.30183**	(0.13940)
Interaction educational graduation 3 x 3			0.22471	(0.19962)
Interaction educational graduation 3 x 4			0.46965**	(0.20546)
Interaction educational graduation 3 x 5			0.05474	(0.18783)
Interaction educational graduation 4 x 2			0.00523	(0.14366)
Interaction educational graduation 4 x 3			-0.13876	(0.20839)
Interaction educational graduation 4 x 4			0.24727	(0.20028)
Interaction educational graduation 4 x 5			-0.35416*	(0.18346)
Interaction educational graduation 5 x 2			0.12427	(0.15439)
Interaction educational graduation 5 x 3			0.12369	(0.21558)
Interaction educational graduation 5 x 4			0.31263	(0.20862)
Interaction educational graduation 5 x 5			-0.07990	(0.18355)
German citizenship	0.19657***	(0.02489)	0.44816***	(0.05983)
Partner has German citizenship			0.15327***	(0.05671)

Married (baseline category: single)	0.07515***	(0.01036)	0.13149***	(0.03523)
Widowed	-0.38595***	(0.11491)	-0.16545	(0.23720)
Divorced	-0.06948***	(0.02201)	-0.07127	(0.06066)
Permanently separated	0.03579	(0.05815)	0.05902	(0.15817)
East Germany	-0.24787***	(0.02556)	-0.02326	(0.07392)
Baseline category: population < 5,000				
Population between 5,000 and 20,000	0.03407***	(0.01038)	0.06368**	(0.02955)
Population between 20,000 and 100,000	0.03976***	(0.01084)	0.06067**	(0.03066)
Population over 100,000	0.03159***	(0.01178)	-0.01317	(0.03346)
Student	-0.64078***	(0.05072)	-1.98636***	(0.06914)
Civil servant	-0.05653***	(0.00960)		
One child (baseline category: no children)			-0.07814**	(0.03275)
Two children			-0.03939	(0.03484)
Three children			-0.21018***	(0.05655)
Four or more children			-0.35377***	(0.11213)
Constant	0.39361*	(0.22616)	-13.09894***	(2.09765)
Dummies for the federal state, quarter and year	yes		yes	
Observations	27,950			
Selected	22,012			
Nonselected	5,938			
Lambda	0.111***	(0.03559)		

Notes: Standard errors in parentheses. Significance levels * p<0.10, ** p<0.05, *** p<0.01
Sources: EVS data 2008, 2013; own calculations.

Appendix B

Table B.1:
Estimation results for the demand system without endogeneity

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.05732***	-0.01363	0.07095***
	(0.01477)	(0.01087)	(0.02082)
Price men's clothing and footwear (log)	0.03608**	0.00960	-0.04568**
	(0.01483)	(0.01092)	(0.02091)
Price composite good (log)	0.02124**	0.00402	-0.02526*
	(0.00949)	(0.00696)	(0.01340)
Budget (β)	0.07578***	0.03855***	-0.11433***
	(0.00457)	(0.00336)	(0.00644)
Budget squared (λ)	-0.00968***	-0.00483***	0.01451***
	(0.00071)	(0.00052)	(0.00100)
Woman's income contribution share (α)	0.00734***	-0.00318***	-0.00416***
	(0.00069)	(0.00051)	(0.00098)
One child (baseline category: no children)	-0.00994***	-0.00711***	0.01705***
	(0.00050)	(0.00037)	(0.00071)
Two children	-0.01300***	-0.00924***	0.02224***
	(0.00054)	(0.00039)	(0.00075)
Three children	-0.01520***	-0.01154***	0.02673***
	(0.00089)	(0.00066)	(0.00126)
Four or more children	-0.01978***	-0.01258***	0.03236***
	(0.00189)	(0.00139)	(0.00267)
Married	-0.00133***	-0.00068*	0.00201***
	(0.00047)	(0.00035)	(0.00066)
Woman's age	-0.00514***	-0.00056	0.00570**
	(0.00183)	(0.00135)	(0.00258)
Woman's age squared	0.00016***	0.00002	-0.00019**
	(0.00006)	(0.00004)	(0.00008)
Woman's age cubic	-0.00000***	-0.00000	0.00000**
	(0.00000)	(0.00000)	(0.00000)
Woman's age quartic	0.00000**	0.00000	-0.00000**
	(0.00000)	(0.00000)	(0.00000)
Man's age	-0.00311*	-0.00303**	0.00614**
	(0.00187)	(0.00138)	(0.00264)
Man's age squared	0.00007	0.00008*	-0.00015*
	(0.00006)	(0.00004)	(0.00008)
Man's age cubic	-0.00000	-0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
Man's age quartic	0.00000	0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
Man German citizenship	0.00004	0.00042	-0.00046
	(0.00093)	(0.00069)	(0.00131)
Woman German citizenship	0.00028	-0.00052	0.00024
	(0.00107)	(0.00078)	(0.00150)
Owner-occupied housing	-0.00306***	-0.00222***	0.00527***
	(0.00036)	(0.00027)	(0.00051)
Year 2013 (baseline category: year 2008)	0.00106***	0.00064**	-0.00170***
	(0.00040)	(0.00030)	(0.00057)
2nd quarter (baseline category: 1st quarter)	0.00264***	0.00059*	-0.00323***
	(0.00045)	(0.00033)	(0.00064)
3rd quarter	0.00074*	0.00005	-0.00079
	(0.00042)	(0.00031)	(0.00059)
4th quarter	0.00448***	0.00336***	-0.00784***
	(0.00050)	(0.00037)	(0.00070)
Constant	-0.00639	-0.00113	1.00752***
	(0.01881)	(0.01385)	(0.02652)
Dummies for the federal state and level of agglomeration	yes	yes	yes
N	29,461	29,461	29,461
R^2	0.0899	0.0633	0.1077
Test on joint significance of coefficients α, *Chi*²-statistic (*p*-value)	210.6 (0.000)		

Notes: Standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999).
Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

Table B.2:
Estimated elasticities for the demand system without endogeneity

	Budget elasticity	Uncompensated price elasticity Change in the price of…			Compensated price elasticity Change in the price of…		
		(1)	(2)	(3)	(1)	(2)	(3)
Women's clothing and footwear (1)	1.480***	-2.613***	1.355***	-0.223	-2.568***	1.381***	1.187***
	(0.017)	(0.493)	(0.495)	(0.312)	(0.493)	(0.495)	(0.314)
Men's clothing and footwear (2)	1.449***	-0.513	-0.325	-0.610	-0.470	-0.300	0.770**
	(0.025)	(0.615)	(0.619)	(0.391)	(0.615)	(0.618)	(0.392)
Composite good (3)	0.977***	0.060***	-0.055**	-0.982***	0.090***	-0.038*	-0.052***
	(0.001)	(0.022)	(0.022)	(0.014)	(0.022)	(0.022)	(0.014)

Notes: Standard errors in parentheses. Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed. Elasticities evaluated at sample means.
Sources: EVS data 2008, 2013; own calculations.

Appendix C

Table C.1:
Estimation results for the first-stage-SUR model

	Women's income contribution share		Budget (log)	
Price women's clothing and footwear (log)	-0.09397	(0.15151)	-0.47095**	(0.20033)
Price men's clothing and footwear (log)	-0.11896	(0.18736)	0.44190*	(0.24116)
Price composite good (log)	-0.10338	(0.08386)	-1.11874***	(0.14112)
Woman's wage per hour (log)			0.09807***	(0.00443)
Man's wage per hour (log)			0.16685***	(0.00550)
Baseline category: no school graduation (woman)				
Secondary school - 2 (woman)	-0.12914**	(0.06093)	-0.09877	(0.08152)
Intermediate school-leaving certificate - 3 (woman)	-0.05529	(0.05719)	-0.06303	(0.07982)
Specialized A-levels - 4 (woman)	-0.02523	(0.12907)	0.15650	(0.16109)
A-levels - 5 (woman)	0.06781	(0.07628)	0.05980	(0.10778)
Baseline category: no school graduation (man)				
Secondary school - 2 (man)	-0.02988	(0.05922)	-0.22989**	(0.09403)
Intermediate school-leaving certificate - 3 (man)	0.00585	(0.06255)	0.09669	(0.08541)
Specialized A-levels - 4 (man)	-0.11047*	(0.06222)	-0.08753	(0.10179)
A-levels - 5 (man)	0.06999	(0.09839)	0.07075	(0.10056)
Interaction terms				
Interaction school graduation 2 (woman) x 2 (man)	0.11408	(0.07257)	0.27040***	(0.10230)
Interaction school graduation 2 x 3	0.05802	(0.07531)	0.01217	(0.09491)
Interaction school graduation 2 x 4	0.19345***	(0.07487)	0.22595**	(0.11082)
Interaction school graduation 2 x 5	0.02046	(0.10630)	0.08718	(0.11150)
Interaction school graduation 3 x 2	0.09133	(0.06930)	0.28576***	(0.10082)
Interaction school graduation 3 x 3	0.03830	(0.06984)	-0.00030	(0.09306)
Interaction school graduation 3 x 4	0.16368**	(0.07133)	0.19490*	(0.10785)
Interaction school graduation 3 x 5	-0.01416	(0.10484)	0.06876	(0.10648)
Interaction school graduation 4 x 2	0.07404	(0.13437)	0.11269	(0.17509)
Interaction school graduation 4 x 3	0.03342	(0.13405)	-0.17472	(0.17186)
Interaction school graduation 4 x 4	0.14587	(0.13705)	-0.01775	(0.17641)
Interaction school graduation 4 x 5	-0.03525	(0.15763)	-0.14772	(0.17434)
Interaction school graduation 5 x 2	-0.00310	(0.08588)	0.21743*	(0.12486)
Interaction school graduation 5 x 3	-0.06187	(0.08671)	-0.06995	(0.12028)
Interaction school graduation 5 x 4	0.05013	(0.08982)	0.11226	(0.13084)
Interaction school graduation 5 x 5	-0.12409	(0.11674)	-0.03293	(0.12937)
Baseline category: no vocational training (woman)				
Vocational training - 2 (woman)	0.08099***	(0.01754)	0.02849	(0.01876)
Technician - 3 (woman)	0.05878**	(0.02763)	0.03308	(0.03511)
College - 4 (woman)	0.19446***	(0.03198)	0.16763***	(0.03739)
University - 5 (woman)	0.15551***	(0.02797)	0.09035***	(0.02936)
Baseline category: no vocational training (man)				
Vocational training - 2 (man)	-0.08976***	(0.01463)	0.02571	(0.01781)
Technician - 3 (man)	-0.09007***	(0.01838)	0.03341	(0.02383)
College - 4 (man)	-0.16177***	(0.01660)	0.12298***	(0.02484)
University - 5 (man)	-0.17348***	(0.02032)	0.06723**	(0.02973)
Interaction terms				
Interaction educational graduation 2 (woman) x 2 (man)	-0.00354	(0.01904)	0.01399	(0.02123)
Interaction educational graduation 2 x 3	-0.03986*	(0.02203)	0.01674	(0.02715)
Interaction educational graduation 2 x 4	-0.01750	(0.02030)	-0.03041	(0.02786)
Interaction educational graduation 2 x 5	-0.02003	(0.02363)	0.03759	(0.03333)
Interaction educational graduation 3 x 2	0.07631***	(0.02899)	0.02805	(0.03747)
Interaction educational graduation 3 x 3	0.05374*	(0.03087)	0.01438	(0.03962)
Interaction educational graduation 3 x 4	0.03996	(0.03029)	-0.05742	(0.04115)
Interaction educational graduation 3 x 5	0.04032	(0.03339)	0.03254	(0.04413)
Interaction educational graduation 4 x 2	-0.00915	(0.03372)	-0.07956**	(0.03910)
Interaction educational graduation 4 x 3	-0.02709	(0.03619)	-0.06006	(0.04291)
Interaction educational graduation 4 x 4	-0.03823	(0.03360)	-0.12953***	(0.04336)
Interaction educational graduation 4 x 5	-0.06811*	(0.03638)	-0.06740	(0.04617)
Interaction educational graduation 5 x 2	0.00973	(0.03002)	-0.02002	(0.03295)
Interaction educational graduation 5 x 3	-0.02336	(0.03252)	-0.01989	(0.03838)
Interaction educational graduation 5 x 4	0.02379	(0.03048)	-0.08430**	(0.03560)
Interaction educational graduation 5 x 5	-0.00101	(0.03229)	0.00871	(0.03848)
German citizenship (man)	-0.07858***	(0.01124)	0.05870***	(0.01315)
German citizenship (woman)	0.10291***	(0.00860)	0.11315***	(0.01215)
One child (baseline category: no children)			0.06780***	(0.00556)
Two children			0.14404***	(0.00578)
Three children			0.19817***	(0.00928)
Four or more children			0.24616***	(0.01955)
Married			-0.00360	(0.00557)

Woman's age	-0.11246***	(0.01478)	0.05120**	(0.02315)
Woman's age squared	0.00393***	(0.00048)	-0.00128*	(0.00076)
Woman's age cubic	-0.00006***	(0.00001)	0.00001	(0.00001)
Woman's age quartic	0.00000***	(0.00000)	-0.00000	(0.00000)
Man's age	-0.06456***	(0.01658)	0.05989***	(0.02244)
Man's age squared	0.00114**	(0.00052)	-0.00181**	(0.00071)
Man's age cubic	-0.00001	(0.00001)	0.00002**	(0.00001)
Man's age quartic	-0.00000	(0.00000)	-0.00000**	(0.00000)
Owner-occupied housing			0.15158***	(0.00410)
Constant	3.91675***	(1.14284)	10.24911***	(1.56608)
Dummies for the federal state and level of agglomeration	yes		yes	
N	29,461		29,461	
R^2	0.168		0.393	
F-statistic (*p*-value)	52.3 (0.000)		128.2 (0.000)	

Notes: Bootstrapped standard errors in parentheses. Significance levels *** p<0.01, ** p<0.05, *p<0.1.
Sources: EVS data 2008, 2013; own calculations.

Table C.2:
Estimation results for the demand system with endogenous budget and endogenous women's income contribution share

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.06286***	-0.01739	0.08025***
	(0.01486)	(0.01093)	(0.02100)
Price men's clothing and footwear (log)	0.02060	-0.00086	-0.01974
	(0.01502)	(0.01107)	(0.02124)
Price composite good (log)	0.04226***	0.01825**	-0.06051***
	(0.00991)	(0.00726)	(0.01405)
Budget (β)	0.08318***	0.04370***	-0.12688***
	(0.00466)	(0.00343)	(0.00657)
Budget squared (λ)	-0.00972***	-0.00486***	0.01458***
	(0.00071)	(0.00052)	(0.00100)
Women's income contribution share (α)	0.00506**	-0.00702***	0.00196
	(0.00236)	(0.00174)	(0.00333)
$\hat{\upsilon}_1$ - Women's income contribution share	0.00259	0.00425**	-0.00685**
	(0.00246)	(0.00181)	(0.00347)
$\hat{\upsilon}_2$ - Budget	-0.00895***	-0.00622***	0.01516***
	(0.00114)	(0.00084)	(0.00161)
One child (baseline category: no children)	-0.01019***	-0.00727***	0.01746***
	(0.00051)	(0.00037)	(0.00072)
Two children	-0.01386***	-0.00983***	0.02368***
	(0.00055)	(0.00040)	(0.00078)
Three children	-0.01653***	-0.01246***	0.02898***
	(0.00091)	(0.00067)	(0.00129)
Four or more children	-0.02137***	-0.01369***	0.03506***
	(0.00191)	(0.00141)	(0.00270)
Married	-0.00134***	-0.00067*	0.00201***
	(0.00047)	(0.00035)	(0.00067)
Woman's age	-0.00645***	-0.00165	0.00810***
	(0.00185)	(0.00136)	(0.00262)
Woman's age squared	0.00020***	0.00006	-0.00026***
	(0.00006)	(0.00004)	(0.00008)
Woman's age cubic	-0.00000***	-0.00000	0.00000***
	(0.00000)	(0.00000)	(0.00000)
Woman's age quartic	0.00000***	0.00000	-0.00000***
	(0.00000)	(0.00000)	(0.00000)
Man's age	-0.00432**	-0.00409***	0.00842***
	(0.00190)	(0.00140)	(0.00268)
Man's age squared	0.00010*	0.00010**	-0.00021**
	(0.00006)	(0.00004)	(0.00008)
Man's age cubic	-0.00000	-0.00000**	0.00000**
	(0.00000)	(0.00000)	(0.00000)
Man's age quartic	0.00000	0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
Man German citizenship	-0.00038	0.00037	0.00001
	(0.00097)	(0.00071)	(0.00137)

Woman German citizenship	-0.00065	-0.00138*	0.00204
	(0.00110)	(0.00081)	(0.00155)
Owner-occupied housing	-0.00448***	-0.00320***	0.00768***
	(0.00041)	(0.00030)	(0.00058)
Year 2013 (baseline category: year 2008)	0.00124***	0.00079***	-0.00202***
	(0.00040)	(0.00030)	(0.00057)
2nd quarter (baseline category: 1st quarter)	0.00275***	0.00068**	-0.00343***
	(0.00045)	(0.00033)	(0.00064)
3rd quarter	0.00027	-0.00026	-0.00002
	(0.00043)	(0.00031)	(0.00060)
4th quarter	0.00449***	0.00337***	-0.00786***
	(0.00050)	(0.00037)	(0.00070)
Constant	0.00690	0.01376	0.97934***
	(0.01974)	(0.01454)	(0.02789)
Dummies for the federal state and level of agglomeration	yes	yes	yes
N	29,461	29,461	29,461
Shea's partial R^2 between s and its instruments	0.086		
Test on joint significance of coefficients of $\hat{v}_1$, Chi^2-statistic (p-value)	5.6 (0.060)		
Test on joint significance of coefficients of $\hat{v}_2$, Chi^2-statistic (p-value)	89.3 (0.000)		
Test on joint significance of coefficients of α, Chi^2-statistic (p-value)	28.3 (0.000)		

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999).
Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

Appendix D

The robustness checks are two different sample restrictions to the IV model. Firstly, the sample is restricted to both partners having market income (Table D.1) and secondly to a women's income contribution share lying between 0.2 and 0.8, which gives both partners a significant contribution to the household budget (Table D.2). The first stage is in both cases estimated with the original sample (Table C.1).

Table D.1:
Robustness check: Sample restriction on both partners having positive market incomes

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.04482**	-0.01594	0.06076**
	(0.01897)	(0.01412)	(0.02697)
Price men's clothing and footwear (log)	0.00282	-0.00580	0.00298
	(0.01919)	(0.01432)	(0.02730)
Price composite good (log)	0.04201***	0.02174**	-0.06375***
	(0.01278)	(0.00948)	(0.01822)
Budget (β)	0.08109***	0.04334***	-0.12443***
	(0.00643)	(0.00479)	(0.00912)
Budget squared (λ)	-0.00940***	-0.00471***	0.01411***
	(0.00097)	(0.00073)	(0.00138)
Women's income contribution share (α)	0.00405	-0.00981***	0.00576
	(0.00304)	(0.00227)	(0.00433)
$\hat{v}_1$ - Women's income contribution share	0.00346	0.00596**	-0.00942**
	(0.00317)	(0.00237)	(0.00451)
$\hat{v}_2$ - Budget	-0.00908***	-0.00664***	0.01571***
	(0.00141)	(0.00105)	(0.00201)
One child (baseline category: no children)	-0.01017***	-0.00765***	0.01782***
	(0.00060)	(0.00045)	(0.00085)
Two children	-0.01383***	-0.01035***	0.02418***
	(0.00066)	(0.00049)	(0.00093)
Three children	-0.01738***	-0.01350***	0.03088***
	(0.00120)	(0.00090)	(0.00171)
Four or more children	-0.02008***	-0.01408***	0.03416***
	(0.00284)	(0.00212)	(0.00403)
Married	-0.00210***	-0.00082**	0.00292***
	(0.00056)	(0.00042)	(0.00080)
Woman's age	-0.00090	-0.00198	0.00289
	(0.00289)	(0.00215)	(0.00410)
Woman's age squared	0.00000	0.00006	-0.00007
	(0.00010)	(0.00007)	(0.00014)
Woman's age cubic	0.00000	-0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
Woman's age quartic	-0.00000	0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
Man's age	-0.00988***	-0.00492**	0.01479***
	(0.00294)	(0.00220)	(0.00418)
Man's age squared	0.00028***	0.00013*	-0.00042***
	(0.00010)	(0.00007)	(0.00014)
Man's age cubic	-0.00000***	-0.00000	0.00001***
	(0.00000)	(0.00000)	(0.00000)
Man's age quartic	0.00000**	0.00000	-0.00000**
	(0.00000)	(0.00000)	(0.00000)
Man German citizenship	-0.00012	0.00099	-0.00087
	(0.00136)	(0.00101)	(0.00193)
Woman German citizenship	-0.00034	-0.00069	0.00103
	(0.00147)	(0.00109)	(0.00208)
Owner-occupied housing	-0.00424***	-0.00316***	0.00740***
	(0.00052)	(0.00039)	(0.00074)
Year 2013 (baseline category: year 2008)	0.00194***	0.00091**	-0.00285***
	(0.00052)	(0.00039)	(0.00073)
2nd quarter (baseline category: 1st quarter)	0.00251***	0.00042	-0.00293***
	(0.00058)	(0.00043)	(0.00082)
3rd quarter	-0.00005	-0.00068*	0.00072

	(0.00054)	(0.00041)	(0.00077)
4th quarter	0.00421***	0.00318***	-0.00739***
	(0.00064)	(0.00048)	(0.00091)
Constant	0.01532	0.02760	0.95708***
	(0.02900)	(0.02163)	(0.04122)
Dummies for the federal state and level of agglomeration	yes	yes	yes
N	19,322	19,322	19,322

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999).
Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

Table D.2:
Robustness check: Sample restriction on *s* lying between 0.2 and 0.8

	Dependent variables: Expenditure shares		
	Women's clothing and footwear	Men's clothing and footwear	Composite good
Price women's clothing and footwear (log)	-0.06728***	-0.01747	0.08474***
	(0.01934)	(0.01389)	(0.02714)
Price men's clothing and footwear (log)	0.02090	-0.00524	-0.01566
	(0.01959)	(0.01410)	(0.02750)
Price composite good (log)	0.04637***	0.02270**	-0.06908***
	(0.01296)	(0.00927)	(0.01826)
Budget (β)	0.08930***	0.05029***	-0.13959***
	(0.00610)	(0.00439)	(0.00853)
Budget squared (λ)	-0.01036***	-0.00577***	0.01614***
	(0.00093)	(0.00067)	(0.00130)
Women's income contribution share (α)	0.00299	-0.01245***	0.00946**
	(0.00324)	(0.00233)	(0.00454)
$\hat{\upsilon}_1$ - Women's income contribution share	0.00370	0.00668***	-0.01038**
	(0.00327)	(0.00235)	(0.00459)
$\hat{\upsilon}_2$ - Budget	-0.01156***	-0.00765***	0.01920***
	(0.00150)	(0.00108)	(0.00210)
One child (baseline category: no children)	-0.01080***	-0.00802***	0.01882***
	(0.00064)	(0.00046)	(0.00089)
Two children	-0.01469***	-0.01093***	0.02562***
	(0.00073)	(0.00053)	(0.00103)
Three children	-0.02025***	-0.01475***	0.03500***
	(0.00156)	(0.00112)	(0.00219)
Four or more children	-0.02409***	-0.01501***	0.03910***
	(0.00374)	(0.00269)	(0.00524)
Married	-0.00166***	-0.00081**	0.00247***
	(0.00056)	(0.00040)	(0.00078)
Woman's age	-0.00705***	-0.00084	0.00789**
	(0.00244)	(0.00175)	(0.00342)
Woman's age squared	0.00021***	0.00003	-0.00024**
	(0.00008)	(0.00006)	(0.00011)
Woman's age cubic	-0.00000**	-0.00000	0.00000*
	(0.00000)	(0.00000)	(0.00000)
Woman's age quartic	0.00000**	0.00000	-0.00000*
	(0.00000)	(0.00000)	(0.00000)
Man's age	-0.00617**	-0.00495***	0.01113***
	(0.00249)	(0.00179)	(0.00349)
Man's age squared	0.00016**	0.00013**	-0.00030***
	(0.00008)	(0.00006)	(0.00011)
Man's age cubic	-0.00000*	-0.00000**	0.00000**
	(0.00000)	(0.00000)	(0.00000)
Man's age quartic	0.00000*	0.00000*	-0.00000**
	(0.00000)	(0.00000)	(0.00000)
Man German citizenship	0.00057	0.00091	-0.00149
	(0.00154)	(0.00111)	(0.00216)
Woman German citizenship	-0.00254*	-0.00172	0.00426**
	(0.00154)	(0.00111)	(0.00217)
Owner-occupied housing	-0.00514***	-0.00352***	0.00866***
	(0.00053)	(0.00038)	(0.00074)
Year 2013 (baseline category: year 2008)	0.00144***	0.00077**	-0.00221***
	(0.00053)	(0.00038)	(0.00074)
2nd quarter (baseline category: 1st quarter)	0.00257***	0.00027	-0.00284***

	(0.00059)	(0.00043)	(0.00083)
3rd quarter	-0.00052	-0.00090**	0.00142*
	(0.00056)	(0.00040)	(0.00078)
4th quarter	0.00454***	0.00314***	-0.00769***
	(0.00065)	(0.00047)	(0.00091)
Constant	0.02475	0.00674	0.96851***
	(0.02557)	(0.01839)	(0.03586)
Dummies for the federal state and level of agglomeration	yes	yes	yes
N	19,257	19,257	19,257

Notes: Adjusted standard errors in parentheses, asymptotic variance-covariance matrix according to Blundell and Robin (1999). Significance levels *** p<0.01, ** p<0.05, *p<0.1. Homogeneity restriction is imposed.
Sources: EVS data 2008, 2013; own calculations.

Diskussionsbeiträge - Fachbereich Wirtschaftswissenschaft - Freie Universität Berlin
Discussion Paper - School of Business and Economics - Freie Universität Berlin

2019 erschienen:

2019/1	WANGENHEIM, Jonas von English versus Vickrey Auctions with Loss Averse Bidders *Economics*
2019/2	GÖRLITZ, Katja; Merlin PENNY und Marcus TAMM The long-term effect of age at school entry on competencies in adulthood *Economics*