

Koulovatianos, Christos; Schröder, Carsten; Schmidt, Ulrich

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## Non-market time and household well-being

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**WORKING**

**PAPERS**

Christos Koulovatianos  
Carsten Schröder  
Ulrich Schmidt

Non-Market Time and Household Well-Being

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# Non-Market Time and Household Well-Being

Christos Koulovatianos<sup>a,\*</sup>, Carsten Schröder<sup>b</sup>, Ulrich Schmidt<sup>c</sup>

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## Abstract

A distinguishing feature among households is whether adult members work or not, since the employment status affects a household's available time for home activities. Using a survey method in two countries, Belgium and Germany, we provide household incomes that retain the level of well-being across different family types, distinguished by family size and employment status of adults. Our tests support that specialization in home production and childcare-time costs are important determinants of household well-being. Estimates of child costs relative to an adult are higher for households that are time-constrained (all adults in the household work), and also higher for poorer households.

Keywords: household production, child costs, childcare, survey method

JEL Classification: D13, J22, C42, D31, I31

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<sup>0</sup> <sup>a</sup> Department of Economics, University of Vienna

<sup>b</sup> Department of Economics, Free University of Berlin

<sup>c</sup> Department of Financial Economics, University of Hannover

\* Corresponding author, Department of Economics, Univ. of Vienna, Hohenstaufengasse 9, A-1010 Vienna, Austria. E-mail: christos.koulovatianos@univie.ac.at, Tel: +43-1-427737426, Fax: +43-1-42779374. Financial support from the TMR network "Living Standards, Inequality and Taxation," contract No ERBFMRXCT980248, is gratefully acknowledged. Koulovatianos thanks the Leventis foundation and the RTN project on "The Economics of Ageing in Europe" for financial support. Schmidt acknowledges financial support from the Deutsche Forschungsgemeinschaft, contract No Schm1396/1-1.

# 1. Introduction

Since the seminal contribution of Becker (1965) on the economics of household production, time spent for producing “commodities at home” has received remarkable attention. Many studies suggest treatments of the time input in household production functions in order to address questions about labor supply, marriage decisions, inequality, social security or population aging.

Applied studies using econometric or calibration approaches to issues that involve home production rely upon information from consumer-expenditure, labor-supply, or time-use surveys. However, numerous unobservable factors driving home production choices make it difficult to elicit unambiguous conclusions about preference and home-production primitives from the currently available databases through simple consumer-behavior and rationality principles. So, applied scholars are obliged to make explicit assumptions, for example, on the behavior of household members, or on the structure of utility and production functions. Both the qualitative and, especially, the quantitative properties of the ex-post orderings of household well-being due to household choices in applied models, are often sensitive to prior assumptions. Especially for multi-person families, there is no consensus on which assumptions to use. In this case, additional assumptions are needed for an intra-household allocation mechanism.<sup>1</sup>

Developing ways to obtain direct empirical estimates of household incomes that preserve the level of well-being across different family types, distinguished by family size and employment status of adults, can provide key information for evaluating the appropriateness of candidate assumptions in applied research of home economics, since the employment status

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<sup>1</sup> For example, approaches vary from Becker’s model of cooperative family collective choice to bargaining models with individual utility maximizers within the household. See Pollak (2002) for further details and guidance to the literature.

affects a household's available time for home activities. We provide such estimates through a survey approach, and test implications of core assumptions behind the mechanics of home production and intra-household allocations of time and other goods.

In our survey we ask questions as: "which family-income level can make a household with one employed and one unemployed adult with two children achieve the same well-being as a household with an unemployed single childless adult and a monthly family income of \$1,000, according to your opinion? What income do you suggest if in the previous question both adults were unemployed? And what if both adults were employed?" The answers to these questions are direct assessments of "*equivalent incomes*:" incomes that make the well-being of households with different demographic composition and employment patterns equal. The information contained in equivalent incomes enables us to study the role of different time constraints for household production or leisure activities for welfare comparisons.<sup>2</sup>

The pattern of such a profile of equivalent incomes may also depend on the underlying level of well-being. In our survey, we identify and fix three different levels of well-being, by providing each of our subjects with three specific income levels, "*reference incomes*," for an unemployed single childless adult (our "*reference household type*").

Using this survey method, we collect data from Belgium and Germany. Our database is essentially non-parametric, with the sole exception that we pre-specify a set of hypothetical household types and reference incomes that are related to the bottom-, middle-, and upper quintile of the personal-income distribution of single adults in these two countries. For this reason, the equivalent incomes that we obtain can provide information about inter-household orderings of well-being stemming from actual consumer-expenditure and time-allocation choices by households, at least in the way these are perceived by our respondents.

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<sup>2</sup> A similar type of survey was also used by Koulovatianos, Schröder and Schmidt (2005), to study the sharing potential of multi-person households at different levels of well-being.

Thus, the implications of a wide range of consumer-behavior models can be re-examined after adding the information we provide.

If individuals simply value leisure and consume only final market goods, the stated equivalent incomes for family types with more employed members should be higher. This could be a plain compensation in terms of final goods for the loss of leisure time or for the disutility of effort. If, in addition, time is an input to household production, then more time spent in the market has more complex implications for well-being. Individuals might need to “outsource,” i.e. to buy final goods as substitutes for goods that they could have produced at home, or they might need to reduce leisure.

The decision whether to buy a final good in the market or to produce a substitute good at home, depends on several unobservable factors. Apart from the preferences over the final good itself, important are also the preferences over the type of activity, the preferences over the effort involved, the efficiency of the household production activity and effort, that may also depend on the existing stock of durable household equipment, the possibility to produce some different goods at the same time (joint production), among others.

For example, the only observables behind the decision of a single childless adult to cook or to dine in a restaurant are the prices of meals at restaurants, the prices of food ingredients and cooking equipment, the personal income and maybe some other socioeconomic variables (such as gender, age, occupational status or education). Simple arguments of revealed preference based on this limited set of observables, without strong assumptions on several important unobservable primitives of home production, such as the nature of a home-production function, are unable to explain the choices.

The involvement of non-market time constraints into household well-being is further difficult to evaluate in multi-person households. Apart from the fact that there is sharing

potential for final consumption goods (joint consumption), there is also a sharing potential for the consumption of home-production activities. For example, two adults might enjoy cooking together more. More importantly, the time input in home production can be an input to two activities, for example one can cook and take care of children at the same time (joint production). Or, it might take about the same time to cook for four people as it would take to cook for two (economies of scale).

Since Becker's (1965) work, the literature is full of such examples, and also very rich in proposed household allocation mechanisms and models. An important breakthrough has been made since the introduction and utilization of time-use survey data. Time-use surveys provide information about the chosen allocation of time, which is a significant extension to the information set available to researchers of home economics. In recent work by Gronau and Hamermesh (2001) and (2003), some cross-country empirical regularities about time allocations are striking. First, childcare is an important part of the time budget and this activity is rather time-intensive. Second, more educated (and richer) households work less at home and their home production activities are more goods-intensive than these of the less educated (poorer).

Such empirical facts have motivated scholars to follow specific modeling directions and to rethink their assumptions about the intra-household time allocation mechanisms. In particular, Apps and Rees (2002) have used a model where adults engage into a type of within-household Ricardian trade and specialization according to comparative advantage in order to re-evaluate the costs of children when childcare is included. They utilize information from both time-use survey data and consumer expenditures. Our findings support the direction of some of their assumptions on the intra-household time allocation mechanism.

Tests using our data support that, (i) specialization in home/market activities is a plausi-

ble time allocation mechanism in two-adult households, (ii) childcare influences significantly the overall household level of well-being, and (iii) richer households have an advantage in dealing with decreases in their non-market time endowment. Consistently with these three observations, our estimates of child costs relative to an adult are higher for households that are time-constrained (all adults in the household work), and also higher for poorer households. Our results can also serve as a step for improving both econometric approaches as this of Apps and Rees (2002) and for calibration approaches to models studying the economics of different family types, as these of Aiyagari, Greenwood and Güner (2000) and Greenwood, Güner and Knowles (2000) on marriage decisions, and Greenwood, Seshadri and Yorukoglu (2005) on female labor supply.

In Section 2 we explain our method and samples. In Section 3 we provide the averages of equivalent incomes and we discuss their direct implications. In Section 4 we analyze specific hypotheses and empirical facts from time survey data in the literature about home production and intra-household time allocations and examine whether our results are consistent with these hypotheses. In Section 5 we provide our estimates for children costs relative to an adult and we compare them with these of Apps and Rees (2002). In Section 6 we suggest extensions and we conclude with Section 7.

## **2. Survey structure and samples**

Our survey consists of three sections, all appearing in the appendix. In the first section we give information to the respondents about the topic in question and we explain the task they must perform. In the second section we ask our respondents to state some of their personal characteristics that could possibly influence their judgements about the role of the household time allocations for well-being.



The third section contains the core questions of our survey. We provide our subjects with a table of 20 entries, each corresponding to a family type distinguished according to three dimensions, namely, (i) the number of adults, (ii) the number of children in the household, and, (iii) the employment status of adults. Moving downwards within each column of the table, we increase the number of children (from zero to three children). Moving within rows from left to right, we increase the number of adults, from one to two adults, and we also vary the employment status of these adults between unemployed and full-time employed. Denoting an unemployed adult by “U” and an employed adult by “E,” the sequence from left to right is, U, E, UU, EU, EE. Each child is denoted by “C,” so, EUCCC is a household with two adults, one employed and one unemployed, and three children. We tell our respondents to consider that adults are individuals of age 35 to 55, and that children are of age 7 to 11.

In the first entry of the table we provide the after-tax monthly income of a reference household, an unemployed single childless adult. All the remaining 19 entries are empty, and our subjects are asked to fill them in with *after-tax* monthly *family* incomes that bring all households to the same level of well-being as this of the reference household. We provide our subjects with two more tables of the same structure, with the sole difference that the reference income of the reference household is different. The three levels are defined as follows: the lowest reference income is the absolute poverty line (defined by the social-security benefit for single-childless adults in both Belgium and Germany, about 500 Euros) and we add increments of three poverty lines for each next income category (that defines a level of well-being). Our selection of reference-income increments matches approximately the bottom-, middle-, and top income-distribution quintile in both countries.<sup>3</sup>

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<sup>3</sup> Both Belgium and Germany had similar per-capita incomes and personal-income distributions at the time of sampling. The social-security benefit for an unemployed single childless adult was 523 Euros in Belgium in 2002 (see the database “MISSOC (Mutual Information System on Social Protection in the Member States of the European Union)” provided by EUROSTAT). According to the Regulation of Compensation Rules and to the 12<sup>th</sup> Book of the Social Welfare Code in Germany (Regelsatzverordnung (2004) and Sozialgeset-

Our samples consist of 149 respondents in Belgium and 164 in Germany. The questionnaire appeared on the internet and was advertised through web newsletters in both countries. Each respondent got a participation compensation of 5 Euros. The Belgian sample was collected in April 2002, whereas the German sample in February 2005. Table 1 presents a breakdown of the sample statistics for both countries.

The gender distribution of Germany is biased towards having more male respondents. In both countries, most respondents come from the age bracket of 20-40 years old and they are highly educated. These biases might be explained by the structure of internet users.<sup>4</sup> In a previous paper with similar welfare-evaluation questions (see Koulovatianos, Schröder and Schmidt (2005)), we have found no compelling evidence that personal characteristics or the survey medium (written vs. internet) bias the resulting estimates of equivalent incomes. Therefore, possible sampling biases are not expected to be a burden in eliciting credible information about the inter-household comparisons of well-being.<sup>5</sup>

### 3. Equivalent-income profiles

Table 2 gives a comprehensive summary of our results, by presenting the sample means of the stated equivalent incomes. An immediate observation is that respondents always compensate households for their loss in non-market time endowment or for their labor-market effort. This

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zbuch - SGBXII (2004)), the unemployment benefit for a single childless adult was between 282-297 Euros in Germany in 2004. According to the Law of Housing Benefits (Wohngeldgesetz (2004) - paragraph 2) compensations for housing vary according to personal and family characteristics. A plausible estimate for single-adult housing in 2004 is 200 Euros. Therefore, the total 2004 benefits in Germany were about 500 Euros. We interpret this total amount as the poverty line.

<sup>4</sup> For example, according to the annual publication of the Elections Research Group in Germany for year 2004 (Forschungsgruppe Wahlen (2004)), most internet users are male (about 58%), highly educated and people above the age 50 are under-represented.

<sup>5</sup> See also section 4.2, p. 989 in Koulovatianos, Schröder and Schmidt (2005) for evidence that even the levels of well-being of respondents do not influence significantly their evaluations of income needs of hypothetical households with welfare different from this of the respondents. This finding also supports that the use of a “small” sample of respondents is not a burden for estimating equivalent incomes. A “small” sample of respondents that provide reliable information about many hypothetical households is able to generate a large number of observations that is appropriate for statistical inference.

is a plausible result, consistent with predictions by any documented theory of the value of time, at least to our knowledge.

A set of comparisons and tests can reveal some sources of responsiveness of the stated time compensations. Table 3 shows the change in equivalent incomes varying the time endowment of hypothetical households by changing the employment status of one adult in each case. So, the first four columns of Table 3 state the difference in equivalent incomes in single-adult households when the adult moves, exogenously, from the condition of being unemployed to this of being employed. Moving from left to right, each column adds one child in the household. The following group of four columns shows the compensations for households with two adults of types UU and EU, i.e. when the number of employees in the household raises from zero to one employee. Finally, the last four columns present compensations for switching from household types with adults EU to EE, namely, the case of shifting from a “traditional household” of one employee to a “non-traditional household” with both adults employed.<sup>6</sup>

All welfare-preserving compensations appearing in Table 3 are statistically significant differences of the relevant averages stated in Table 2.<sup>7</sup> All these numbers contain important information about reservation wages or about determinants behind early-retirement decisions. We remind that in both Belgium and Germany, the total monthly social-security benefit for unemployed single childless adults was about 500 Euros in the years we conducted our survey, which is also interpreted as the German poverty line. Our lowest reference in-

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<sup>6</sup> We borrow the terms “traditional” and “non-traditional” household from Apps and Rees (2002). We do not present the comparison of household types with two adults being EE and UU, as these do not add more insights to the observations that we make below. Moreover, these comparisons can be obtained directly from Table 3.

<sup>7</sup> As each respondent provides subjective evaluations for all types of households and income levels, all values are reported by the same group of individuals. Since these equivalent incomes are not independent, we have performed pairwise t-tests of difference of means. All compensations stated in Table 3 (the numbers outside the brackets), are significantly different from zero at the 99% confidence level and these t-tests are not reported in Table 3, but they can be provided by the authors upon request.

come is also 500 Euros, so the average stated compensation for the single-childless adult for the living standard at the poverty line implies that the monthly reservation wage in Belgium is about 803 Euros. In Germany, with a similar logic, the reservation wage should be about 903 Euros.

With respect to early retirement decisions, our estimates in Table 3 can be closely linked with threshold wage and pension differentials that drive certain labor groups from particular family types out of the labor market. This subject, the threshold differential of wage-pension income flows for retirement decisions has received a lot of attention, especially in Europe, in light of the trends in the skill premium since the beginning of the 1990's. In particular, the reported upwards trend in the skill premium and, in many cases the drop in the absolute wage of the low-skill workers, has been considered to be the key explanation to an increase in the early-retirement decisions trend in both Europe and in the US.<sup>8</sup> Yet, it is difficult to obtain estimates of the threshold differential of wage-pension income flows for retirement decisions. So, our study may shed some light on this matter.

#### **4. Using our survey to test hypotheses motivated by time-use survey data**

Several scholars have studied the role of time in home production by combining consumption expenditure data with data from time-use surveys. Time-use questionnaires elicit the time allocation of respondents among market and non-market activities.<sup>9</sup> They reveal the nature of non-market activities and also allow to understand the linkage of activity types with observed demands for specific market goods.<sup>10</sup> Gronau and Hamermesh (2001) present time-

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<sup>8</sup> For a comprehensive picture of early-retirement trends in Europe and the US, see Herbertsson and Orszag (2003, Table 1, p. 2).

<sup>9</sup> Time-use surveys first appeared in Bloch (1973) and Gronau (1976), while a book summarizing recent results on time use is Hamermesh and Pfann (2005).

<sup>10</sup> See, for example, Gronau and Hamermesh (2003) for a very comprehensive study in Israel and the US, and especially Table 1 and the Appendix, where the authors suggest explicit connections between activities

use data across six countries and provide several facts about time use and activity diversity across educational levels.<sup>11</sup> To the extent that such facts are consistent across countries, the theory of home production choices is called for comprehensive explanations.

Time-use data add important features of home production activities that are unobserved in consumer-expenditure and labor surveys. Yet, although time-use data enrich the dimensions of information input in applied models, available information is still inadequate to specify irrefutable assumptions that are necessary for modeling consumer, home-production, and labor-supply choices. However, combined with our results, assumptions and models can be double-checked. In this section we present tests revealing that our database is consistent with several plausible assumptions made in the literature, or transparent from the descriptive statistics of time-use surveys. Three of the working hypotheses that are stressed in studies motivated by time-use surveys, are consistent with our results. In particular, our results support that, (a) household setups that yield a Ricardian-trade specialization type of equilibrium between the two adults are rather plausible, (b) childcare is an important household activity with strong implications for inter-household comparisons of well-being, and (c) richer households can substitute more easily home-produced goods with market final goods, and/or, their home production time and effort must be more efficient compared to the poor. We explain each of these points in the subsections below.

## 4.1 Specialization in the household

The ‘neoclassical’ approach to multi-person household consumer/labor supply theory has been based on the idea that even multi-person households have a single objective. There has been a significant and early literature departing from the ‘neoclassical’ approach and

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and demanded market goods.

<sup>11</sup>Another recent study providing similar observations from three countries is Ichino and Galdeano (2005).

studying the possibilities of bargaining or exchange of incomes for market goods and time between adults in the household. One can distinguish two main strands of literature.

In the first strand, originated by Manser and Brown (1980) and McElroy and Horney (1981), and receiving a comprehensive theoretical treatment by Chiappori (1988) and Browning and Chiappori (1998), the Nash-bargaining aspect of collective-decision households has been set. Specialization results from non-cooperative games between adults in the household. This strand of literature is thoroughly examined at a very general theoretical and methodological level. Chiappori (1988) and Browning and Chiappori (1998) point out that the assumption of efficiency of collective decisions guarantees that models giving parametric structure to estimations based on goods quantities, work time, and price data, can be rationalized by the data, in the sense that revealed preferences are consistent with feasibility of collective choices. A distinct feature of this literature is that it has not been extended to include any household production.

The second strand of literature, parallelly developed, extends the collective approach to household production. It suggests a within-household Ricardian-trade type of home-production model, where adults specialize in market and non-market production activities according to comparative advantage. This literature was originated by Apps (1981, 1982), Apps and Jones (1986) and continued in a number of applications by Apps and Rees (1988, 1996, 1997, 1999, 2002). In all these papers, the working hypothesis is that there can be gains from trade of home-production inputs between the two adults. Apps (2002), surveys this work, stating explicitly that a number of assumptions are needed in order that the model specification be tractable, especially for the sharing rules and the household production functions. Apps (2002, p. 28-29) emphasizes that time-use survey data have expanded the information of household production unobservables (at least, they provide the input decisions

and the range of home-production activities), and helped to test for the plausibility of some assumptions. Yet, she states that a considerable set of assumptions, with a questionmark on their testability, is still unavoidable. A main reason is that home-production outputs are unobservable, or, at least, difficult to measure. Is our database appropriate to help?

It is plausible to think that EU family types possess possibilities to trade activity types and time within the household, so that they can benefit from specialization. In other words, the welfare-retaining compensations for switching exogenously from UU to EU should be small, given that the unemployed adult can specialize in carrying out the biggest load of home-production activities. On the contrary, such a specialization advantage will be lost when switching from EU to EE, because of the extreme narrowing in the ability to produce at home. Therefore, compensations for such a change in the employment status should be high. Of course, the latter reasoning holds for switching from U to E types of households.

In Table 4, we present comparisons of time-loss compensations for cases where family types switch to a setting where there can be specialization (from UU to EU) with compensations for cases where family types switch to settings where they cannot specialize (from EU to EE and from U to E). If specialization is important, then compensations for switching to a setting where there cannot be specialization, should be higher than in cases of switching to settings where specialization is possible.

In the first column of Table 4, we present differences of time-loss compensations for childless adult households taken from Table 3. For example, in the first column of Table 4, for the reference income of 2000 Euros for Belgium, the number 138.39 is the difference between 609.80 from the entry of the column " $n_C = 0$ " of the category "EE-EU" in Table 3 for Belgium ( $y_r = 2000$ ), and 471.41, from the corresponding entry in the category "EU-UU" of Table 3. Underneath each entry of Table 4, we provide, in brackets, the p-value of pairwise

t-tests of differences of means.

All differences in the first column of Table 4 are both positive and significant at the 5% level, indicating that time loss compensations are higher when the specialization ability of the household worsens (switching from UU to EU retains the ability to specialize, but this is not true when switching from EU to EE). On the contrary, the second column of Table 4, compares time-loss compensations for switching to cases without an ability to specialize (i.e. a comparison of the case of switching from U to E and EU to EE). Except from the highest reference income for Germany, all these differences are insignificant, supporting that our respondents take into account the effects of specialization. Our conclusions are reconfirmed by the comparisons of the third column of Table 4, (the comparison between switching from U to E and from UU to EU).

Table 4 is restricted to examining childless households only. When children are present, adults can also specialize with respect to a very important home activity, childcare. For this reason, we present distinct observations and tests for families with children in the section that focuses on childcare, right below.

## **4.2 The importance of childcare**

In Gronau and Hamermesh (2003 - Tables 2a and 2b), it is transparent that time devoted to childcare is an important part of the population-wide home-time allocation, in all six countries they study. Similar, but even stronger, is the message from the more detailed work on United States and Israel by Gronau and Hamermesh (2001) who link up types of activities with activity-specific market-good expenditures. They come up with goods/time intensities for each activity, in a similar fashion to observing realized capital/labor ratios across production activities. Besides sleep, in both US and Israeli databases, childcare is the second time-intensive activity after “leisure” (see Gronau and Hamermesh (2001 - Table



1 and their appendix)).<sup>12</sup> Apps and Rees (2002) stress the importance of childcare based on an Australian time use survey and provide an analysis for re-examining child costs after including considerations about childcare time.

Is our survey able to provide information about the implications of childcare for inter-household comparisons of well-being? Our respondents are not required to state any cost of particular activities (such as childcare), but to state the welfare-retaining aggregate incomes for a range of family types, employment status and levels of well-being. But the generality of our data is not a burden. If time devoted to childcare matters for the overall choices of a household, then compensations for losses of non-market time endowments should depend on the presence of children. In Table 3, the numbers appearing in brackets are the p-values of pairwise t-tests of equality of means for testing whether these compensations are increasing when additional children are present in the family. So, brackets under averages are the p-value for the comparison of the average above the p-value and the average in the entry next to it on the left.

In Table 3 we can see that, in both countries, for all levels of well-being, time-loss compensations increase in the presence of additional children, in cases where all adults work full time (E versus U and EE versus EU). In connection with the previous subsection, the absence of specialization possibilities in family types E and EE and the fact that childcare is time-intensive, contribute to an increasing aggregate-budget compensation pattern due to the need for childcare time.

In the case of inter-household comparisons between families with adults of type UU and EU, time-loss compensations do not exhibit an increasing pattern in the presence of more children. Specialization possibilities in EU allow the non-working partner to devote more

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<sup>12</sup>Sleep is assumed to have infinite time intensity in Gronau and Hemermesh (2003). For an extensive study on the cross-country empirical facts and the economics of sleep see Biddle and Hamermesh (1990).

time for childcare, and the household does not incur a higher loss in well-being due to the presence of more children.

This test that we present in Table 3 advocates the importance of childcare. In the cases where the time budget is suppressed to the maximum possible (all adults work in the market), each additional child increases the opportunity cost of time at home. The result of the analysis of time-use surveys by Gronau and Hamermesh (2003), that childcare is time-intensive is a good match with our findings. At the same time, it might take about the same time to take care of two children as it takes for one, i.e. childcare is subject to joint production.

As the early analysis by Pollak and Wachter (1975) indicates, joint production drives (observable) consumer demands for intermediate goods to be dependent on preferences over unobservable final home production goods. They provide some ideas for tackling this problem so that the estimation through a demand system becomes possible. So far, there are no applied studies, at least to our knowledge, that deal empirically with the joint-production aspect of childcare. Combined with our data, econometric or calibrated models can possibly help to build this extension that seems to be crucial. In fact, using an applied model to replicate our findings, could shed light on the popular hypothesis that parents may derive non-negligible utility from time with their children.<sup>13</sup> An important dimension of this extension is that childcare is both expensive to buy in the markets and also market childcare may not be treated as a perfect substitute to childcare by parents.

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<sup>13</sup>See, for example, the conclusions of Hallberg and Klevmarken (2003 - p. 223), who study time allocation data in Finland.

### 4.3 Richer households suffer relatively less from non-market time-endowment losses

Several facts are transparent about the time allocation of rich and poor (in particular, the less and the more educated) from the extensive work by Bloch (1973), Gronau (1976), (1977), (1980) and (1997), and in the more detailed papers by Gronau and Hamermesh (2001) and (2003). Specifically, households with more educated adults, (a) spend more time for childcare, (b) devote less time for home production, and, (c) their home-production activities are more goods-intensive.

The last two empirical observations lead to the plausible hypothesis that the richer households are more able to substitute home-produced goods with market final goods. Following the example of cooking at home, poor unemployed single adults might dine less in restaurants than richer unemployed single adults. The need for a shift in the outsourcing decision for food by the poorer might be higher than this by the richer, when their non-market time endowment decreases. At the same time, the home production time and effort of the rich must be more efficient compared to the poor, due to the fact that the richer may own a wider range and better quality of home-production durables. The empirical fact that, historically, the poorer have had less durable goods is supported by the findings of Day (1992, Table 8, p. 319), and it is a major result in the analysis of Greenwood, Seshadri and Yorukoglu (2005). If this hypothesis is correct, then non-market time-endowment losses are more easily borne by the rich compared to the poor. The time-loss compensations must be a lower fraction of the income of the rich compared to the corresponding fraction for the poor.

In order to compare the relative strength of this effect of income on time-allocation choices, we divide the profiles of equivalent incomes for each level of well-being by the corresponding reference income of the unemployed single childless adult (the reference household).

The ratio of the *equivalent income* of a household type by the *reference income* of the reference household gives its “*equivalence scale*.” The example above about dining in restaurants and the empirical facts about the goods-intensity of home-production activities of the rich, advocate that equivalence scales of poorer households with employed adults should be higher compared to these of the richer.

In Table 5 we present the averages of equivalence scales in both countries. It is transparent that equivalence scales fall with income. In our previous work (see Koulovatianos, Schröder and Schmidt (2005)), we have found that richer households exhibit a higher ability to share consumption goods. This finding is an indication that higher incomes lead households to choose a bundle of consumables that contain a higher intra-household sharing ability on the aggregate. The property that equivalence scales fall as the reference income increases can be attributed to both (i) different sharing abilities between rich and poor in multi-person households, and, (ii) to a different ability of rich to cope with time losses. For example, in the case of childless adults who are employed, equivalence scales drop as the reference income increases, revealing that the second effect is also applicable. We test these two effects in the section that follows, where we utilize all available information in our database for estimating child costs, while controlling for each effect of demographics and time-endowment variation across households.

## **5. Estimates of child costs relative to an adult**

A key goal of scholars who are interested in assessing household well being is to evaluate children costs relative to an adult. Child-cost estimates are crucial, for example, in the evaluation of reservation wages and labor participation, tax policies and social security towards various family types, marriage markets, etc. In this section we provide a range of estimates

for child costs from our data.

So far, our database has revealed that several important aspects affect resource- and time allocations in households. In particular, our analysis has supported that, (i) specialization in home/market activities is present in two-adult households, (ii) childcare has a significant impact on the overall household level of well-being, and (iii) living standards affect the time allocation towards ‘outsourcing’ home-produced goods with market substitutes. In order to come up with a sensible estimate of relative child costs, these three aspects of inter-household comparisons should be controlled for.

We build on the logic of Banks and Johnson (1994), who suggest a formalization for measuring household economies of scale. To capture the main idea, consider a case of comparisons among childless families. Using the formula,

$$Equivalence\ Scale = n_A^\theta ,$$

with  $n_A$  being the number of adults in the household,  $\theta$  can be seen as a “catch-all” parameter, controlling for economies of scale in both household consumption and production. It would be expected that  $\theta$  takes values between 0 and 1. Of course, the lower the estimate of parameter  $\theta$ , the higher the economies of scale.

Including families with children, assessing the cost of children as a fraction of the costs of an adult, after controlling for the sharing potential of household goods, should be captured by parameter  $\alpha$  in,

$$Equivalence\ Scale = (n_A + \alpha \cdot n_C)^\theta ,$$

where  $n_C$  is the number of children. In Koulovatianos, Schröder and Schmidt (2005) we found that both parameters,  $\theta$  and  $\alpha$ , fall as the living standard, captured by the reference income, increases.

We extend this approach to including the costs of non-market time-endowment losses by specifying a regression as follows,

$$ES_{i,y} = \left( n_A + \alpha_y \cdot n_C + \beta_y \cdot n_E \right)^{\theta_y} + b_y \cdot PERSONAL_i + e_{i,y} . \quad (1)$$

By  $ES_{i,y}$  we denote respondent “ $i$ ’s” stated equivalence scale corresponding to reference income “ $y$ .” The variable  $n_A$  is the number of adults,  $n_C$  is the number of children, and  $n_E$  is the number of employed adults in the household. So,  $n_A$ ,  $n_E$ , and  $n_C$  define the household type. As in the Banks-Johnson (1994) specification, parameter  $\theta_y$  captures and controls for economies of scale in household consumption and production at reference income  $y$ . Parameter  $\beta_y$  is the time-endowment-loss compensation relative to the cost of an unemployed adult, after controlling for household economies of scale, at a certain level of well-being. Parameter  $\alpha_y$  then gives the costs of children relative to an unemployed adult, after controlling for household economies of scale and time-loss compensations at reference income  $y$ .

$PERSONAL_i$  is a set of conditioning variables that comprise the personal characteristics of respondent  $i$ , listed in Table 1. Finally,  $e_{i,y}$  is the error term.

By running a separate regression for each reference income,  $y$ , we control for the impact of the level of well-being on equivalence scales. This strategy controls for aspect (iii) mentioned above, that living standards seem to affect the sharing potential and time allocation of households. In particular, if the impact of non-market time-endowment variations on equivalence scales is lower for the rich than for the poor, then the estimator  $\hat{\beta}_y$  should be lower as the reference income increases. The columns “Spec. 1” in Tables 6a and 6b show that this is the case. Moreover, as in Koulovatianos, Schröder and Schmidt (2005), the estimators  $\hat{\alpha}_y$  and  $\hat{\theta}_y$  fall with reference income as well.<sup>14</sup>

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<sup>14</sup>This property, that the rich exhibit a higher ability to share (the richer have a lower  $\hat{\theta}_y$ ), has received recent theoretical attention and empirical support. In particular, Donaldson and Pendakur (2004) suggest

Yet, the specification given by (1) does not disentangle the comparative impact of aspects (i) and (ii) mentioned above, namely, the specialization hypothesis and the importance of childcare in inter-household comparisons. For example, parameter  $\beta_y$  might contain time-loss compensations for time otherwise channeled to childcare. In this case, estimates of  $\alpha_y$  based on (1) may bias child costs downwards. For this reason, we suggest three additional alternative specifications that also serve as a sensitivity analysis for the estimators of  $\alpha_y$  provided by specification (1).

We introduce two dummy variables that allow to disentangle the impact of specialization and childcare costs. First, we use a dummy variable that takes the value of one whenever all adults in the household are employed, denoted as “ $D_F$ ,” to capture the concept of full time-endowment loss. So,  $D_F$  distinguishes the single-employed-adult households (with children or not) and the two-adult households with both adults working, from all other family types that have more available time. As childcare is time-intensive, children costs should be higher in these time-constrained family types. On the contrary, in two-adult households with only one employed, it is possible that the unemployed adult undertakes childcare, saving part of this cost for the household. To test this hypothesis, we introduce another dummy variable, “ $D_{EU}$ ,” that takes the value one if the household type has two adults, one employed and one unemployed ( $EU$ ). Thus, in the regression,

$$ES_{i,y} = \left( n_A + \alpha_y \cdot n_C + \beta_y \cdot n_E + \gamma_y \cdot n_C \cdot D_{EU} + \delta_y \cdot n_C \cdot D_F \right)^{\theta_y} + b_y \cdot PERSONAL_i + e_{i,y} . \quad (2)$$

the new parameter,  $\delta_y$ , can capture the extra children costs borne by families with all adults

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that demand systems characterized by a property they name “Generalized Equivalence Scale Exactness (GESE)” outperform previous demand systems and provide evidence that equivalence scales fall with rising income in Canada. Donaldson and Pendakur (2005) introduce a new property for demand systems, “Generalized Absolute Equivalence Scale Exactness (GAESE),” according to which scales can fall with income if households face fixed costs of family-type characteristics, and they provide new evidence from Canada that this is, indeed, the case.

being fully employed, and is expected to be positive and significant, whereas parameter  $\gamma_y$  is expected to be zero (insignificant). In Tables 6a and 6b, the results of the regression specification given by (2) are presented in columns “Spec. 2.” Indeed,  $\gamma_y$  is insignificant in all cases, whereas  $\delta_y$  is positive and significant, with the sole exception of Belgium for the highest reference income.

We modify the specification given by (2), in order to control for specialization in home activities other than childcare, using,

$$ES_{i,y} = \left( n_A + \alpha_y \cdot n_C + \gamma_y \cdot n_C \cdot D_{EU} + \delta_y \cdot n_C \cdot D_F + \zeta_y \cdot n_A \cdot D_{EU} + \eta_y \cdot n_A \cdot D_F \right)^{\theta_y} + b_y \cdot PERSONAL_i + e_{i,y} \quad (3)$$

If there is significant specialization in the household, this specification given by (3) should also imply that  $\zeta_y$  is smaller than  $\eta_y$ , providing a different set of controlling variables for estimating child costs. Tables 6a and 6b show (columns “Spec. 3”) that this is the case.

Last, extending the sensitivity analysis, to distinguish among all household types, using two extra dummies, “ $D_E$ ” corresponding to single-adult households where the adult is employed, and “ $D_{EE}$ ,” corresponding to two-adult households, both working. This is given by specification,

$$ES_{i,y} = \left( n_A + \alpha_y \cdot n_C + \gamma_y \cdot n_C \cdot D_{EU} + \zeta_y \cdot n_A \cdot D_{EU} + \varphi_y \cdot n_C \cdot D_E + \chi_y \cdot n_C \cdot D_{EE} + \psi_y \cdot n_A \cdot D_E + \omega_y \cdot n_A \cdot D_{EE} \right)^{\theta_y} + b_y \cdot PERSONAL_i + e_{i,y}. \quad (4)$$

Consistently with our previous findings about the specialization hypothesis, the estimates of (4) in Tables 6a and 6b reveal that, generally,  $\zeta_y$  is smaller than  $\psi_y$  and  $\omega_y$ . Again, children are more costly in households where all adults are employed.



In Tables 6a and 6b all reported estimates are controlled for the respondents' personal characteristics. However, we do not report the estimates of the vector  $b_y$ . Although the inclusion of personal characteristics adds some explanatory power to the regressions (it increases  $\bar{R}^2$ ), it does not alter the levels of the reported estimates. We found no personal characteristic that is either robust or preserving its sign across all reference incomes for each specification.<sup>15</sup>

Tables 6a and 6b provide the opportunity to derive children costs from all coefficients that are linked with the presence of children in the household, and to have a direct assessment of relative children costs from our survey. In Table 7 we present a summary of the ranges of children costs that result from specification 4, given that this controls for specialization effects, both with respect to childcare and with respect to all other home activities. In particular, we present estimates for two-adult households, EU versus EE households, in order to compare our results with these of Apps and Rees (2002). Two important findings conveyed by Table 7, are that relative child costs fall as the reference income increases and that relative child costs are higher in EE family types compared to EU.

To our knowledge, Apps and Rees (2002) is the only study that takes specialization in home production activities and time for childcare seriously into account for estimating child costs. We have argued that our respondents must capture these two aspects of household economics, and all our results support that this direction of modeling is both plausible and promising. In Table 7 we also state the Apps and Rees (2002) estimates. In Apps and Rees (2002, see p. 645), the sum of childcare purchased goods, home production for children *and* childcare time costs, sums to about 78% to 98% of the total consumption of an adult male. These numbers are higher compared to ours. This difference must be due to the particular assumptions on sharing rules and on the nature of the home-production

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<sup>15</sup>The estimates of personal characteristics can be provided by the authors upon request.

functions that Apps and Rees (2002) make in order to allow for a ‘smooth’ estimation process through a demand system that also matches time-use data. The additional hypotheses of joint production possibilities and scale economies with respect to childcare time, must be a plausible direction to follow and a natural extension of the analysis of Apps and Rees (2002).

## 6. Suggested extensions

As we stressed in the introduction, our study was motivated by the fact that all theories of home production decisions and labor supply have to rely upon strong assumptions in order to deal with unobservables. Our analysis supports two hypotheses, this of specialization in home production and of the importance of childcare-time costs as key determinants of household well-being, as suggested by Apps and Rees (2002). Our estimates can provide a ‘roadmap’ of the equilibrium inter-household rankings of well-being due to consumer-expenditure and time-allocation household choices. Demand systems, as this of Apps and Rees (2002) that model childcare explicitly can be tested to fit data obtained by surveys like ours.

But the use of econometric demand systems is not the only available approach for tackling household economics and labor-supply behavior. There is a strand of studies that incorporate richer economics behind consumer behavior, stressing lifetime utility maximization and permanent-income considerations in order to derive consumer choice can benefit from our data. Papers as this of Aiyagari, Greenwood and Güner (2000), Greenwood, Güner and Knowles (2000) and Greenwood, Seshadri and Yorukoglu (2005), look at marriage decisions, social security or the long-run development of labor-supply (especially female-labor participation). Such studies with dynamic households stress the savings plans of households as well. Reduced-form econometric models are difficult to derive from such simulated models, and a calibration methodology is used instead. As we give reference monthly-income flows

to our respondents, our subjects may not rule out savings plans and life-cycle considerations. Therefore, the model specification of dynamic models can also be guided by fitting our results. Finally, our evidence that richer households can cope more easily with non-market time-endowment losses can initiate a new working hypothesis for future research.

## **7. Conclusion**

We implemented a survey method for estimating the link between household well-being and non-market time endowments across different family types. Our database from two countries, Belgium and Germany, enabled the testing of two important hypotheses in the literature, that specialization in home production and childcare-time costs are important determinants of household well-being. These have been the working hypotheses in Apps and Rees (2002), and our study implies that they are both plausible. In addition, we find that rich households can deal more easily with decreases in non-market time endowments, possibly due to their higher comparative ability to outsource home-produced goods with market substitutes. We provided estimates of child costs relative to an adult as functions of household characteristics at different levels of well-being. These estimates suggest that relative child costs are higher for households that are time-constrained (all adults in the household work), and also higher for poorer households.

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**Table 1** Personal characteristics of respondents

	<b>Belgium</b>		<b>Germany</b>	
	<b>N=149</b>		<b>N=164</b>	
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>
<i>Gender</i>				
Female	69	46.3	56	34.1
Male	80	53.7	108	65.9
<i>Partner</i>				
Yes	109	73.2	69	42.1
No	40	26.8	95	57.9
<i>Children</i>				
None	80	53.7	140	85.4
One	17	11.4	18	11.0
Two	31	20.8	5	3.0
More than two	21	14.1	1	0.6
<i>Siblings</i>				
None	1	0.7	30	18.3
One	10	6.7	51	31.1
Two	69	46.3	57	34.8
More than two	69	46.3	26	15.8
<i>Age</i>				
< 20 years	1	0.7	0	0.0
20 - 40 years	108	72.5	147	89.6
> 40 years	40	26.8	17	10.4
<i>Education</i>				
Unfinished education	0	0.0	1	0.6
Element. school	1	0.7	1	0.6
Second. school	10	6.7	3	1.8
Special German second. School	---	---	2	1.2
German second. School	---	---	98	59.8
Techn. school or university	138	92.6	59	36.0
<i>Occupational group</i>				
Social-sec. rec. or unemployed	1	0.7	1	0.6
Blue-collar worker	3	2.0	1	0.6
White-collar worker	118	79.2	45	27.4
Civil servant	11	7.4	8	4.8
Pupil. student. trainee	12	8.1	102	62.4
Self-employed	2	1.3	5	3.0
Pensioner	2	1.3	1	0.6
Housewife. houseman	0	0.0	1	0.6
<i>Own working time</i>				
Not working	3	2.0	27	16.5
Working irregularly	6	4.0	63	38.4
Working 1/2 day	3	2.0	25	15.2
Working 1/1 day	137	91.9	49	29.9
<i>Working time of partner</i>				
Not working	51	34.2	117	71.3
Working irregularly	0	0.0	6	3.7
Working 1/2 day	17	11.4	12	7.3
Working 1/1 day	81	54.4	29	17.7
<i>After-tax household income</i>				
$y_p < 1.75P$	4	2.7	64	39.0
$1.75P \leq y_p < 3.25P$	36	24.2	46	28.0
$3.25P \leq y_p < 4.75P$	28	18.8	24	14.6
$4.75P \leq y_p < 6.25P$	41	27.5	18	11.0
$y_p \geq 6.25P$	40	26.8	12	7.4
P denotes social assistance for a single adult in Germany.				

		Belgium					Germany				
$y_r$	$n_C$	$U$	$E$	$UU$	$EU$	$EE$	$U$	$E$	$UU$	$EU$	$EE$
500	0	---	803.32 (283.72)	879.09 (167.96)	1140.23 (381.13)	1449.90 (649.49)	---	903.35 (274.28)	977.13 (239.26)	1314.33 (423.94)	1715.85 (675.60)
	1	758.39 (115.42)	1089.87 (302.61)	1133.76 (244.15)	1392.82 (412.36)	1765.00 (692.57)	802.13 (107.68)	1227.90 (327.42)	1266.10 (263.54)	1603.96 (459.85)	2070.58 (706.86)
	2	970.10 (205.03)	1327.68 (372.66)	1350.70 (326.94)	1614.36 (456.35)	2014.80 (767.28)	1073.41 (212.00)	1498.63 (408.61)	1522.38 (351.98)	1866.16 (538.59)	2371.19 (780.65)
	3	1179.53 (302.97)	1560.97 (485.72)	1570.64 (426.72)	1826.44 (514.85)	2255.50 (871.67)	1323.05 (340.17)	1758.69 (525.04)	1747.35 (448.87)	2102.74 (664.92)	2645.58 (901.80)
2000	0	---	2621.88 (790.28)	3096.64 (626.80)	3568.05 (1086.58)	4177.85 (1772.04)	---	2829.57 (864.22)	3227.29 (731.23)	3856.16 (1142.04)	4718.60 (1883.90)
	1	2467.38 (363.37)	3159.60 (955.76)	3542.42 (870.52)	4044.43 (1288.47)	4744.43 (1921.62)	2460.37 (466.36)	3308.08 (1060.67)	3628.81 (1001.92)	4287.35 (1403.20)	5249.54 (2162.35)
	2	2862.82 (666.55)	3604.30 (1185.43)	3937.18 (1174.46)	4452.08 (1549.54)	5201.48 (2130.13)	2812.20 (720.87)	3700.30 (1256.43)	3960.06 (1167.62)	4622.41 (1531.01)	5660.76 (2324.10)
	3	3249.53 (961.85)	4049.66 (1504.08)	4336.51 (1548.11)	4893.29 (1977.06)	5681.74 (2470.90)	3149.39 (1005.43)	4066.74 (1499.60)	4297.53 (1491.29)	4969.21 (1782.48)	6092.07 (2601.97)
3500	0	---	4283.39 (1235.57)	5105.30 (1176.13)	5813.52 (1981.00)	6678.19 (3006.96)	---	4540.70 (1155.56)	5277.44 (1180.56)	6135.82 (1688.72)	7432.32 (2817.54)
	1	4098.99 (624.99)	4992.32 (1548.88)	5694.90 (1568.60)	6402.89 (2267.53)	7386.41 (3325.74)	3980.95 (403.09)	5104.73 (1321.38)	5752.10 (1393.85)	6695.43 (1944.78)	8077.59 (3056.46)
	2	4641.85 (1165.87)	5588.02 (1961.23)	6274.87 (2063.58)	6971.11 (2627.66)	8035.91 (3703.14)	4410.34 (809.10)	5576.07 (1572.40)	6175.15 (1641.99)	7141.49 (2213.22)	8592.84 (3309.74)
	3	5189.40 (1732.17)	6210.97 (2536.31)	6852.95 (2600.86)	7575.50 (3138.81)	8704.66 (4203.96)	4815.52 (1212.58)	6028.02 (1881.82)	6594.02 (1990.75)	7582.62 (2527.53)	9100.91 (3578.12)

Average equivalent incomes. Standard deviations in parentheses.  $n_C$  denotes the number of children;  $y_r$  denotes the level of reference income; each  $U$  denotes an unemployed adult, each  $E$  denotes an employed adult.



	<i>E - U</i>				<i>EU - UU</i>				<i>EE - EU</i>			
$y_r$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$
<i>Belgium</i>												
500	303.32	331.48	357.58	381.44	261.14	259.06	263.66	255.81	309.66	372.18	400.44	429.06
		[0.02]	[0.00]	[0.02]		[0.29]	[0.29]	[0.40]		[0.00]	[0.09]	[0.01]
2000	621.88	692.21	741.48	800.13	471.41	502.01	514.90	556.78	609.80	700.00	749.40	788.46
		[0.03]	[0.01]	[0.00]		[0.11]	[0.09]	[0.08]		[0.00]	[0.00]	[0.00]
3500	783.39	893.32	946.17	1021.58	708.22	707.99	696.24	722.55	864.66	983.52	1064.80	1129.16
		[0.00]	[0.02]	[0.01]		[0.46]	[0.41]	[0.35]		[0.00]	[0.00]	[0.00]
<i>Germany</i>												
500	403.35	425.76	428.26	435.64	338.41	340.91	347.44	360.27	400.30	463.57	501.37	537.96
		[0.01]	[0.38]	[0.12]		[0.34]	[0.15]	[0.14]		[0.00]	[0.00]	[0.00]
2000	829.57	847.71	888.11	917.35	643.51	676.22	681.25	691.80	847.80	944.51	1019.45	1102.74
		[0.23]	[0.00]	[0.00]		[0.00]	[0.20]	[0.10]		[0.00]	[0.00]	[0.00]
3500	1040.70	1123.78	1165.73	1212.50	858.38	943.32	966.34	988.60	1296.49	1382.16	1451.34	1518.29
		[0.00]	[0.00]	[0.00]		[0.00]	[0.02]	[0.03]		[0.00]	[0.00]	[0.00]
Note. Income increments for employees; pairwise t test of means; p values in brackets. $y_r$ denotes the reference income; $n_C$ denotes the number of children.												

**Table 3** – Average stated employment compensations

**Table 4** – Tests for the specialization hypothesis

$y_r$	(EE-EU) - (EU-UU)	(E-U) - (EE-EU)	(E-U) - (EU-UU)
Belgium			
500	48.52 [0.04]	-6.34 [0.75]	42.18 [0.00]
2000	138.39 [0.00]	12.08 [0.76]	150.47 [0.00]
3500	156.44 [0.03]	-81.28 [0.16]	75.17 [0.10]
Germany			
500	61.89 [0.01]	3.05 [0.90]	64.94 [0.00]
2000	204.30 [0.00]	-18.23 [0.76]	186.07 [0.00]
3500	438.11 [0.00]	-255.79 [0.00]	182.32 [0.00]
Notes. $y_r$ denotes the level of reference income. Pairwise two-tailed t-tests. p values appearing in parentheses.			

**Table 5** – Average equivalence scales

		<i>Belgium</i>			<i>Germany</i>		
	$n_C$	$y_r = 500$	$y_r = 2000$	$y_r = 3500$	$y_r = 500$	$y_r = 2000$	$y_r = 3500$
<i>U</i>	<i>1</i>	1.517 (0.231)	1.233 (0.182)	1.171 (0.178)	1.604 (0.215)	1.226 (0.226)	1.139 (0.115)
	<i>2</i>	1.940 (0.410)	1.431 (0.334)	1.326 (0.333)	2.141 (0.421)	1.402 (0.355)	1.262 (0.231)
	<i>3</i>	2.359 (0.606)	1.624 (0.481)	1.482 (0.495)	2.646 (0.679)	1.572 (0.499)	1.379 (0.347)
<i>E</i>	<i>0</i>	1.607 (0.567)	1.311 (0.395)	1.224 (0.353)	1.807 (0.553)	1.428 (0.475)	1.319 (0.427)
	<i>1</i>	2.180 (0.605)	1.579 (0.478)	1.427 (0.442)	2.456 (0.655)	1.668 (0.567)	1.481 (0.470)
	<i>2</i>	2.655 (0.745)	1.801 (0.593)	1.597 (0.560)	2.997 (0.815)	1.865 (0.662)	1.618 (0.536)
	<i>3</i>	3.122 (0.971)	2.024 (0.752)	1.774 (0.725)	3.517 (1.045)	2.050 (0.780)	1.749 (0.618)
<i>UU</i>	<i>0</i>	1.758 (0.336)	1.548 (0.313)	1.459 (0.336)	1.954 (0.476)	1.614 (0.365)	1.513 (0.336)
	<i>1</i>	2.268 (0.488)	1.771 (0.435)	1.627 (0.448)	2.532 (0.524)	1.816 (0.500)	1.650 (0.397)
	<i>2</i>	2.701 (0.654)	1.968 (0.587)	1.793 (0.590)	3.045 (0.700)	1.982 (0.583)	1.772 (0.468)
	<i>3</i>	3.141 (0.853)	2.167 (0.774)	1.958 (0.743)	3.495 (0.893)	2.151 (0.744)	1.893 (0.568)
<i>EU</i>	<i>0</i>	2.280 (0.762)	1.784 (0.543)	1.661 (0.566)	2.631 (0.853)	1.953 (0.608)	1.776 (0.554)
	<i>1</i>	2.786 (0.825)	2.021 (0.644)	1.830 (0.648)	3.214 (0.923)	2.171 (0.731)	1.937 (0.620)
	<i>2</i>	3.229 (0.913)	2.225 (0.775)	1.992 (0.751)	3.740 (1.079)	2.340 (0.795)	2.065 (0.692)
	<i>3</i>	3.653 (1.030)	2.446 (0.989)	2.164 (0.897)	4.215 (1.333)	2.514 (0.918)	2.193 (0.777)
<i>EE</i>	<i>0</i>	2.900 (1.299)	2.089 (0.886)	1.908 (0.859)	3.432 (1.358)	2.394 (1.020)	2.169 (0.970)
	<i>1</i>	3.530 (1.385)	2.372 (0.961)	2.110 (0.950)	4.141 (1.420)	2.660 (1.148)	2.355 (1.028)
	<i>2</i>	4.030 (1.535)	2.600 (1.065)	2.296 (1.058)	4.742 (1.568)	2.866 (1.225)	2.503 (1.094)
	<i>3</i>	4.511 (1.743)	2.840 (1.236)	2.487 (1.201)	5.291 (1.809)	3.082 (1.357)	2.650 (1.164)

Notes. Average equivalence scales. Standard deviations in parentheses.  $n_C$  denotes the number of children.  $v_r$  denotes the level of reference income.

Belgium													
$y_r$		$y_r = 500$				$y_r = 2000$				$y_r = 3500$			
		Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2	Spec. 3	Spec. 4
$\alpha_y$	$n_C$	0.67*** (0.03)	0.59*** (0.03)	0.57*** (0.03)	0.59*** (0.03)	0.44*** (0.03)	0.37*** (0.03)	0.35*** (0.03)	0.36*** (0.03)	0.39*** (0.03)	0.34*** (0.03)	0.32*** (0.03)	0.33*** (0.03)
$\beta_y$	$n_E$	0.91*** (0.05)	0.75*** (0.06)			0.64*** (0.05)	0.51*** (0.06)			0.57*** (0.05)	0.48*** (0.06)		
$\gamma_y$	$n_C \cdot D_{EU}$		-0.03 (0.04)	0.03 (0.05)	0.06 (0.06)		0.01 (0.05)	0.08 (0.06)	0.13* (0.07)		-0.01 (0.05)	0.05 (0.07)	0.10 (0.08)
$\delta_y$	$n_C \cdot D_F$		0.11*** (0.04)	0.11*** (0.04)			0.11*** (0.04)	0.11*** (0.04)			0.07 (0.05)	0.07 (0.05)	
$\zeta_y$	$n_A \cdot D_{EU}$			0.30*** (0.04)	0.32*** (0.05)			0.17*** (0.03)	0.18*** (0.05)			0.16*** (0.05)	0.18*** (0.06)
$\eta_y$	$n_A \cdot D_F$			0.74*** (0.06)				0.51*** (0.05)				0.48*** (0.06)	
$\phi_y$	$n_C \cdot D_E$				0.10** (0.05)				0.10** (0.05)				0.07 (0.06)
$\chi_y$	$n_C \cdot D_{EE}$				0.20** (0.09)				0.24** (0.11)				0.22* (0.12)
$\psi_y$	$n_A \cdot D_E$				0.75*** (0.06)				0.48*** (0.07)				0.42*** (0.08)
$\omega_y$	$n_A \cdot D_{EE}$				0.77*** (0.06)				0.51*** (0.08)				0.49*** (0.09)
$\theta_y$		0.85*** (0.02)	0.88*** (0.02)	0.88*** (0.02)	0.85*** (0.02)	0.68*** (0.02)	0.69*** (0.02)	0.70*** (0.02)	0.66*** (0.03)	0.63*** (0.02)	0.64*** (0.02)	0.64*** (0.02)	0.59*** (0.03)
$\overline{R}^2$		0.44	0.44	0.44	0.44	0.32	0.32	0.32	0.33	0.31	0.31	0.31	0.31

Notes: Regressions for each reference income in Belgium. Endogenous variable: equivalence scales stated by respondents taking a childless unemployed single adult as the reference household. Number of observations: 2831. White's heteroskedasticity correction for covariance matrix; standard errors in parentheses; \*\*\* denotes significance at the 1 percent level; \*\* denotes significance at the 5 percent level; \* denotes significance at the 10 percent level; all other coefficients are insignificant.

**Table 6a** Regressions for estimating child costs and economies of scale in home production/consumption in Belgium

Germany													
$y_r$		$y_r = 500$				$y_r = 2000$				$y_r = 3500$			
		Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2	Spec. 3	Spec. 4
$\alpha_y$	$n_C$	0.64*** (0.03)	0.57*** (0.03)	0.55*** (0.03)	0.58*** (0.03)	0.36*** (0.02)	0.32*** (0.02)	0.30*** (0.02)	0.30*** (0.02)	0.26*** (0.02)	0.23*** (0.02)	0.21*** (0.02)	0.19*** (0.02)
$\beta_y$	$n_E$	0.95*** (0.04)	0.82*** (0.05)			0.77*** (0.05)	0.66*** (0.06)			0.68*** (0.04)	0.59*** (0.05)		
$\gamma_y$	$n_C \cdot D_{EU}$		-0.03 (0.04)	0.02 (0.05)	0.05 (0.05)		-0.04 (0.04)	0.03 (0.05)	0.07 (0.06)		-0.03 (0.04)	0.07 (0.05)	0.18*** (0.07)
$\delta_y$	$n_C \cdot D_F$		0.08*** (0.03)	0.08** (0.03)			0.07* (0.04)	0.07* (0.04)			0.06* (0.03)	0.06* (0.03)	
$\zeta_y$	$n_A \cdot D_{EU}$			0.34*** (0.04)	0.37*** (0.04)			0.24*** (0.04)	0.27*** (0.05)			0.18*** (0.04)	0.21*** (0.05)
$\eta_y$	$n_A \cdot D_F$			0.81*** (0.05)				0.66*** (0.05)				0.58*** (0.05)	
$\phi_y$	$n_C \cdot D_E$				0.09** (0.04)				0.07 (0.05)				0.12*** (0.04)
$\chi_y$	$n_C \cdot D_{EE}$				0.18** (0.07)				0.20** (0.09)				0.30*** (0.11)
$\psi_y$	$n_A \cdot D_E$				0.80*** (0.06)				0.62*** (0.07)				0.40*** (0.07)
$\omega_y$	$n_A \cdot D_{EE}$				0.86*** (0.07)				0.70*** (0.08)				0.71*** (0.10)
$\theta_y$		0.93*** (0.02)	0.96*** (0.02)	0.96*** (0.02)	0.92*** (0.02)	0.72*** (0.02)	0.74*** (0.02)	0.75*** (0.02)	0.70*** (0.02)	0.66*** (0.01)	0.68*** (0.02)	0.68*** (0.02)	0.58*** (0.02)
$\overline{R}^2$		0.53	0.53	0.53	0.53	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37

Notes: Regressions for each reference income in Germany. Endogenous variable: equivalence scales stated by respondents taking a childless unemployed single adult as the reference household. Number of observations: 3116. White's heteroskedasticity correction for covariance matrix; standard errors in parentheses; \*\*\* denotes significance at the 1 percent level; \*\* denotes significance at the 5 percent level; \* denotes significance at the 10 percent level; all other coefficients are insignificant.

**Table 6b** Regressions for estimating child costs and economies of scale in home production/consumption in Germany

y <sub>r</sub>	Spec. 4				Apps & Rees (2002)	
	Belgium		Germany			
	EU	EE	EU	EE	EU (average income)	EE (average income)
poor (500)	0.59	0.79	0.58	0.76	0.24-0.40 <sup>a</sup> 0.82-0.98 <sup>b</sup>	0.53-0.69 <sup>a</sup> 0.78-0.91 <sup>b</sup>
middle (2000)	0.36	0.60	0.30	0.50		
rich (3500)	0.33	0.55	0.37	0.49		
Notes. y <sub>r</sub> is the level of reference income. <sup>a</sup> denotes a model specification without considering domestic production and parental childcare. <sup>b</sup> denotes a model specification considering domestic production and parental childcare.						

**Table 7** Child costs relative to an adult in EU vs. EE households

# Appendix

## Questionnaire

### 1. Purpose of the survey

In general, different household types may have different income needs in order to attain a given living standard. These needs (measured in income amounts) may depend on the number of adults and children living in the household. Furthermore, household needs may vary with respect to the occupational status of the adults (unemployed or full-time employed) since this, for example, might affect the time adults can spend for cooking or educating their children. Therefore, the following question arises:

*Given the income of a specific household type (reference household), what is the income for another household type (differing with respect to the number of children and/or adults and/or number of employees) that allows this household to reach an identical living standard as the reference household?*

Since there does not exist an objective correct answer, we would like to know your subjective attitude towards this question.

### 2. Personal characteristics

We would like to ask you to state several of your own personal characteristics. Please mark the correct answer categories. Your answers will be treated confidentially and only for the stated research purpose.

- |   |  |
|---|--|
| 1) Please state your gender:                              | <input type="checkbox"/> male            |
|   | <input type="checkbox"/> female          |
| 2) Are you living together with a partner?                | <input type="checkbox"/> yes             |
|   | <input type="checkbox"/> no              |
| 2a) In the case that you answered question 2) with “yes:” |  |
| Is your partner working                                   | <input type="checkbox"/> not at all      |
|   | <input type="checkbox"/> half a day      |
|   | <input type="checkbox"/> whole day       |
|   | <input type="checkbox"/> irregularly?    |
| 3) How many children are living in your household?        | <input type="checkbox"/> 0               |
|   | <input type="checkbox"/> 1               |
|   | <input type="checkbox"/> 2               |
|   | <input type="checkbox"/> 3 or more       |
| 4) What is your <b>family after-tax income</b> per month? | <input type="checkbox"/> below 1.75P     |
|   | <input type="checkbox"/> 1.75P – 3.25P   |
|   | <input type="checkbox"/> 3.25P – 4.75P   |
|   | <input type="checkbox"/> 4.75P – 6.25P   |
|   | <input type="checkbox"/> 6.25P and above |

5) Are you

- ☐ social-security recipient,
- ☐ unemployed,
- ☐ blue-collar worker,
- ☐ white-collar worker,
- ☐ civil servant,
- ☐ pupil, student, or trainee,
- ☐ self-employed,
- ☐ pensioner,
- ☐ houseman or - wife?

6) Are you working

- ☐ not at all
- ☐ half a day
- ☐ whole day
- ☐ irregularly?

7) Please state your education level:

- ☐ no degree
- ☐ elementary school
- ☐ secondary school
- ☐ Mittlere Reife
- ☐ German secondary
- ☐ Technical school or university

8) Please state the number of siblings you lived together in a household during your childhood?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3 or more

9) Please mark the correct age category you belong to:

- ☐ below 20 years
- ☐ 20 – 40 years
- ☐ 40 years and older

### 3. Income evaluation

In the tables below you shall evaluate three different situations. The situations differ by the pre-specified monthly net income (including all social transfers) of an unemployed and childless single-adult household. Now consider, for each situation separately, that the size and composition of the households change according to the table.

Below, we give you an example of such a table. Please take some time to familiarize yourself with the structure of the table.



	1 adult, unemployed	1 adult, full-time employee	2 adults, both unemployed	2 adults, 1 unemployed, 1 full-time employee	2 adults, both full-time employees
0 children	Reference income				
1 child					
2 children					
3 children					

Within a given table, all household types should attain an identical living standard. You are asked to fill in the gaps putting the after-tax family income that you believe brings the households that differ with respect to the numbers of children, adults, and employees, to the same living standard as the one of the single-childless-unemployed-adult household.

Please complete the following three tables. Assume for your assessment that adults are between 35 and 55 and children between 7 and 11 years old.

(In the actual survey, three tables are provided, with the same structure as above, each for a different reference income for the single-childless-unemployed-adult household in increasing order).