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Non-Market Household Time and the Cost of Children

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Abstract

A distinguishing feature among households is whether adult members work or not, since the occupational status of adults affects their 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 occupational status of adults. Our tests support that 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). Moreover, we find supportive evidence for the hypothesis that, in two-adult households, there is a potential for within-household welfare gains from specialization in market- vs. domestic activities, especially childcare.

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

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

1. Introduction

In his survey of the role of children in understanding the economic behavior of households, Browning (1992, p. 1470-1) noted:

> "*Every aspect of household economic behavior is significantly correlated with the presence of children in the household. [...] children [...] do play a central role in understanding all facets of household economic behavior.*"

A particular feature about the presence of children in a household is that they must be raised by adults. So, childcare, the upbringing of children, is, unavoidably, a part of the set of home-produced goods that require to invest considerable time and effort. Yet, the occupational status of adults influences the total available time for home activities. As childcare is one of the most time-intensive home activities, non-trivial childcare-time costs may be present as well.[1] So, a reasonable question to raise is, "do households with working adults face higher children costs?" In this study we focus on evaluating the link-up between the occupational status of adults and the costs of children households face. Our study focuses on estimating the tradeoff between non-market-time losses and the family income required to keep a household at the same level of well-being, as before the time loss. A particular hypothesis we test is: "is the time/money tradeoff higher in households with children vs. families with no children?" Moreover, we estimate child costs relative to an adult in families with working adults vs. families with non-working adults.

In order to come up with estimates of the time/money tradeoff faced by different family types, it is crucial to obtain household *equivalent incomes*, i.e. disposable family incomes that make the well-being of households with different demographic composition and occupational

[1] See Gronau and Hamermesh (2006) on the time intensity of several home activities.

status equal. We obtain equivalent incomes directly through a survey instrument. In our survey we ask questions as: "which family-income level can make a household with one working and one non-working adult with two children achieve the same well-being as a household with a non-working 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 non-working? And what if both adults were working?" The set of equivalent incomes we obtain, enables us to calculate welfare-preserving time-loss compensations across family types with the same demographic composition but different occupational status.

For given variations of the occupational status of adults, we obtain estimates of average rates of substitution between time and money, that best capture the intensity of the tradeoff between time and money in different family types. We focus on two broad types of non-market time-endowment loss in families: (i) time losses where the occupational-status variation of adults leads to a state where all adults in the household work full time, and (ii) time losses where households of two non-working adults become a household of one working and one non-working adult. For both types of time loss, (i) and (ii) above, we compare rates of substitution between time and money in households with children vs. households without children.

We conduct this survey in two countries, Belgium and Germany, and find evidence that the time/money tradeoff increases in the presence of at least one child in all cases of a time-loss type given by (i) above. In fact, for type-(i) time losses we find that, in most cases, the time/money tradeoff increases in the presence of each additional child. In particular, for two-adult households, when the time loss leads to two full-time working adults, the time-money tradeoff increases in the presence of each additional child *in all cases*. On the contrary, for type-(ii) time losses the effect of the presence of children on the time/money tradeoff faced

by two-adult households is either insignificant or slightly positive. We also estimate child costs relative to an adult, after controlling for household economies of scale in consumption along the dimension of household size. Consistently with our results above, we find that child costs are higher in time-constrained families.

Our results point out promising directions to be followed in the field of family- and labor economics. First, childcare seems to be a very important determinant of household choices and well-being, and our results indicate that theoretical models should be stressing childcare-time costs explicitly. Second, our results indicate that households with one non-working and one working adult may exploit an ability to obtain welfare gains through the specialization of one adult in domestic activities (such as childcare) and of the other adult in market activities. To our knowledge, Apps and Rees (2002) is the only existing study addressing these two modeling directions explicitly.

The reason we have chosen a survey instrument of direct questions is the difficulties faced by studies that use theoretical models in order to elicit similar information from available data. Existing studies that pursue the estimation (and explanation) of child costs and equivalent incomes of households, face the particular difficulty that the set of prices of home activities as well as the quantities of domestic inputs and outputs is not completely available (a subset of unobservables is difficult to obtain). A considerable effort to collect data on the domestic input "allocation of time on home activities" is time-use surveys.[2] But even if all

[2] However, a connection between time allocated to home activities and the intermediate market goods used in home production is still not provided by the data. We quote Gronau and Hamermesh (2006, p.3) on this issue:

> "*Regrettably, no single data set anywhere in the world meets the ideal: information from time budgets on how household members spend all their time [...] and records of the same households' purchases of goods and services.*"

Nevertheless, time-use surveys are a very useful piece of information that first appeared in Bloch (1973) and Gronau (1976), while a book summarizing recent results on time use is Hamermesh and Pfann (2005). Moreover, Gronau and Hamermesh (2001) present time-use data across six countries and provide several facts about time use and activity diversity across educational levels. Examples of studies that utilize time-use

inputs to domestic production were available, the household-production technologies remain unspecified. And in the plausible case where time devoted to childcare generates direct utility, even if household-production technologies with tractable properties (e.g., constant returns to scale) are assumed, the overall level of domestic output is unknown.[3] This means that, for a given utility function it is not possible to compute the price of domestic output, so the price vector for computing equivalent incomes is not completely available. Thus, it is difficult to establish that estimates of equivalent income/expenditure functions and child costs that are deduced from theoretical models are unbiased.[4] So, a central contribution of our study is that we suggest a way to estimate equivalent incomes directly.

Our survey can provide a useful piece of new information in addition to this of databases on consumption expenditures (and prices), labor supply (and wages), and time use. The new database we provide is not intended to *substitute for* the use of models or other databases in labor studies, or studies in family economics. Typically, models suggest mechanisms of rational choice that can explain observed choices, but always imply an ordering of well-being across households (driven by indirect utility functions) that is unobservable. Our survey elicits such an ordering of well-being and matching this ordering can serve as a criterion for specifying more reliable models. In this way databases from our survey can serve as a useful step, a *complement* to both econometric-demand system approaches and to calibration approaches to applied issues in these fields. Another important aspect is that hypotheses underlying the building of theoretical models that are not testable a-priori can be tested using data from our survey.

data in their analyses include Apps and Rees (2002) and Kerkhofs and Kooreman (2003).

[3] Home-production technologies with constant returns to scale is a simplifying direction pointed out early on by Pollak and Wachter (1975) in cases where there is not "joint production," i.e. when work at home does *not* generate direct utility.

[4] We are indebted to an anonymous referee for elucidating this point to us.

In Section 2 we explain the structure of our survey and our samples. In Section 3 we analyze the time/money tradeoffs faced in different family types with emphasis on a comparison of families with children vs. families without children. In Section 4 we provide estimates of child costs relative to an adult in families with different non-market time endowments, while in Section 5 we suggest applications and extensions. Section 6 summarizes our conclusions.

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 are asked to perform. In the second section we ask our respondents to state some of their personal characteristics that could possibly be related to their assessments of the role of 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 occupational 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 occupational status of these adults between non-working and working full time.[5] Denoting a non-working adult by "N" and a full-time working adult by "W," the sequence

[5] The terms "working" and "non-working" indicate whether individuals work *full-time in the market* or not. So, even if an individual is putting effort in home activities it is called, by convention, "non-working." On another note, in a previous version of this paper (see Koulovatianos, Schröder and Schmidt (2005b)) we have used the English terms "Employed" for "Working" and "Unemployed" for "Non-working." As we explain below, we have not conducted our survey in English-speaking countries. Had we done so, the English term "unemployed" might have given a negative signal to respondents and might have biased the results. So, we have avoided using the term "Unemployed" in this version of the paper. In conducting the survey in Germany and Belgium for this paper, we used the equivalent of "non-working" ("nicht-erwerbstätig" in German and "niet werkend" in Dutch). We are indebted to Martin Browning for raising this objection for

from left to right is, "N, W, NN, WN, WW." Each child is denoted by "C," so, "WNCCC" is a household with two adults, one working and one non-working, 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, a non-working 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.[6]

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 was offered the right to participate in a lottery with expected payoff equal to 5 Euros. The Belgian sample was collected in April 2002, whereas the German sample in

the English term that we used in the previous version of the paper.

[6] 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 Eurpean Union)" provided by EUROSTAT). According to the Regulation of Compensation Rules and to the 12^{th} Book of the Social Welfare Code in Germany (Regelsatzverordnung (2004) and Sozialgesetzbuch - 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.

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.[7] In a previous paper with similar welfare-evaluation questions (see Koulovatianos, Schröder and Schmidt (2005a)), 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.[8]

3. Equivalent-income profiles and the tradeoff between time and money in families with children

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 is a plausible result, consistent with predictions by any documented theory of the value of time, at least to our knowledge. In this section we present some information that can be

[7] 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. Couper (2000), discusses four sources of error in web-based surveys: (i) coverage error (a mismatch between the target population and the frame population), (ii) sampling error (non-representativeness within the frame population), (iii) nonresponse error (unwillingness or inability to respond), and (iv) measurement error (arising from low motivation of respondents to put the required effort or imperfections of the presentation means of the survey). Errors (ii) to (iv) arise also in non-web-based surveys and they can be minimized through careful survey design and efficient advertisement of the survey and by offering appropriate participation incentives.

[8] See also section 4.2, p. 989 in Koulovatianos, Schröder and Schmidt (2005a) 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.

conveyed directly from equivalent-income profiles and we test the hypothesis that families with children face a stronger tradeoff between time and money.

3.1 The tradeoff between time and money across different family types

Figures 1.a and 1.b depict the information given in Table 2. The horizontal axis of each graph captures the dimension of a household's available time endowment. In particular, the value "1" on the horizontal axis represents the case where all adults in the household are non-working. The value "0" on the horizontal axis represents the case where all adults in the household work full time. In the case of two-adult households where one adult is working and the other is non-working, the corresponding value on the horizontal axis is "0.5." Each dot (also represented by the symbols "■, ♦, ▲, •" to distinguish among family types with a different number of children) gives an average equivalent income, one for each case of household characteristics, taken from Table 2.

For example, consider the entry "WN, $y_r = 500$, $n_C = 2$" for Belgium in Table 2. This gives an average equivalent income of 1614.35 Euros for a couple with two children where one adult is working and the other is not working, for the reference income of 500 Euros. This entry is displayed by the triangle "▲" which is in the middle of the line named "2 children" on the graph "Couples, poor (500 Euros)" in Figure 1.a.

For any given family type presented in Figures 1.a and 1.b the average equivalent incomes that correspond to a reduction in available non-market time are connected by a solid line. The fact that all solid lines in Figures 1.a and 1.b are downward sloping implies that, in both countries, for any given family type, a decrease in available non-market time always requires a positive income compensation. The slope of each solid line can be interpreted as a rate of substitution between non-market time endowments and household disposable

income, capturing and quantifying the trade-off between time and money for each family type. Yet, some remarks must be made about these estimated rates of substitution.

First, the slopes of the solid lines in Figure 1 should not be interpreted as estimated rates of substitution between consumption expenditures and leisure implied by indifference curves of structural household utility functions. Instead, the time/money tradeoff estimated by the slopes of the solid lines of Figure 1 originates from *household indirect utility functions*. This distinction should be emphasized, since our questions pertain evaluations of relationships between incomes, non-market time endowments and household well-being, contingent upon potential real-life choices made by hypothetical households. The questionnaire leaves the respondent free to think about potential chosen consumer baskets, even education decisions for children, for a given economic environment, prices and quality of goods in a certain location.[9] So, if, for example, the price vector changes, the estimates of rates of substitution between time and money should change as well. A second remark is that Figure 1 does not, and cannot, provide information about *marginal* rates of substitution between time endowments and incomes.

The way each graph is structured in Figure 1 enables to visualize a key aspect of our study, namely welfare-preserving compensations of each additional child for a given number and occupational status of adults in a household. By fixing a non-market time endow-

[9] Of course, we anticipate that respondents project some of the choices that they would make themselves under the hypothetical conditions given by our questionnaire. The sole proviso for eliciting credible information through these questionnaires is that respondents are rational and well-informed, the basic assumption underlying rational-choice models. We speculate that respondents are "well-trained" experts in making reasonable assessments, since they have been planning on their overall budget allocations, often keeping their home balance sheets, routinely in their everyday lives. A typical source of doubt about the efficiency of our approach comes from the fact that respondents examine hypothetical household setups that typically differ from their own and often from the history of household setups they have belonged to in the past. In Koulovatianos, Schröder and Schmidt (2005a, p. 989), where we have used a similar survey instrument to estimate household economies of scale, we have tested the ability of respondents to provide comparisons among family types with living standards different from their own, and we have found that respondents perform this task satisfactorily well.

ment (a choice of values 0, 1, or 0.5 -whenever 0.5 is applicable- on the horizontal axis) and projecting a line upwards, welfare-preserving compensations for each additional child can be distinguished on each graph of Figure 1. This can be done by comparing the distances between consecutive dots (average equivalent incomes) at any given non-market time endowment.

3.2 The time/money tradeoff in families with children

Do rates of substitution between non-market time and money differ in the presence of children for a given number of adults in a household? A way to visualize an answer to this question is to compare the slope of the solid line of a childless household with this of all other households in each graph of Figure 1. In Figure 1, dashed curves are the equivalent-income functions of the childless households, appearing at the bottom of each graph, shifted in a (piecewise) parallel way.

Figure 1 shows that the solid lines are steeper than the dashed lines for all families with one adult and children. This indicates that the rate of substitution between available non-market time and disposable family income is higher in single-adult households with children, compared to single-childless adult households. This pattern can be seen in both countries, and at all levels of well-being. In brief, for single adult households, the time/money tradeoff becomes stronger in the presence of children.

The pattern of time/money tradeoffs in families with children vs. families without children is more subtle in two-adult households. In particular, the shifts in time/money tradeoffs when children are added to single-adult families are the same in two-adult families only when the non-market time loss pertains a transition from a "WN" household type to a "WW" household type. When the non-market time loss pertains a transition from "NN" household types to "WN" household types, the dashed lines are close, hardly distinguishable from

the solid lines in some cases. This is an indication that when two-adult households with two non-working adults shift to a "traditional" household type ("WN"),[10] the time/money tradeoff is unaffected by the presence of children.

Table 3 presents significance tests for the time/money-tradeoff patterns that can be seen in Figure 1. Each entry of Table 3 is a welfare-preserving time-loss compensation. The symbols "$W-N$", "$WN-NN$" and "$WW-WN$" denote the three types of time loss. For example, all entries under "$WW-WN$" refer to time-loss compensations that pertain a two-adult household that switches from an occupational status "WN" to the status "WW." Each entry under a given type of time loss pertains a household type with a given number of children. For example, the entry under "$WW-WN$" with "$n_C = 2$" gives the compensation for a two-adult household with two children that switches from "WN" to "WW". For each such compensation we state the sample mean, median, and standard error. To see the link-up between Tables 2 and 3, the entry "$WW-WN$, $y_r = 500$, $n_C = 2$" in Table 3a (where the mean is equal to 400.44) is the difference between the entries "WW, $y_r = 500$, $n_C = 2$" (=2014.79) and "WN, $y_r = 500$, $n_C = 2$" (=1614.35), for Belgium in Table 2.

It is transparent that entries of Table 3 (sample means) capture slopes of solid lines in Figure 1. To test the statistical significance of differences in slopes whenever children are added to a household, it suffices to compare entries of Table 3 for families with different numbers of children. For each level of well-being in Table 3, at the bottom and in-between each two consecutive columns of descriptive statistics, appears a Wilcoxon signed-ranks test statistic and its p-value. The fact that a Wilcoxon test statistic appears in-between two particular columns indicates that it tests differences in the data of these two columns. So,

[10]The term "traditional household" was coined by Apps and Rees (1999, 2002), in their analyses of taxation of couples and childcare time costs. In Apps and Rees (2002, p. 624) the "traditional household" consists of a full-time working adult and an adult "[...] usually a female [...]", who "[...] works hardly at all outside the home [...]". We emphasize that in our questionnaire we do not assign genders to hypothetical adult members for "WN" household types (or any other households).

these Wilcoxon tests pertain the change in compensations for time losses in households that differ by the presence of one child. Notice that this is a *stronger* test than comparing the slopes of solid lines vs. slopes of dashed lines in Figure 1. The Wilcoxon tests in Table 3 compare time-loss compensations for each *additional* child between two family types. The reason we have used Wilcoxon signed-ranks tests and not pairwise t-tests is that normality is not guaranteed for the errors of the sample means, as this can be seen by the descriptive statistics presented in Table 3.[11] Since the observations appearing in entries of Table 3 are not independent (they come from the same sample of respondents and the same survey) the Wilcoxon tests we present in Table 3 take the differences in time-loss compensations *stated by each individual* and test them against a 0-value null hypothesis.

The results of the Wilcoxon signed ranks tests reveal a striking pattern of time/money tradeoffs in different family types. For time losses that stem from the occupational-status variations "$W - N$" and "$WW - WN$," in all cases and in both countries, the time/money tradeoff becomes stronger in the presence of the first child. This is consistent with the picture seen in Figure 1, based on the comparison between the slopes of solid lines named "1 child" and the slopes of dashed lines for all time losses corresponding to "$W - N$" and "$WW - WN$," and for all levels of well-being. In fact, Table 3 shows that in most cases and in both countries, the time/money tradeoff becomes stronger in the presence of each additional child, beyond the first child, for these time losses.

On the contrary, time/money tradeoffs corresponding to time losses that stem from the occupational-status variation "$WN - NN$," barely change by the presence of children. As it can be seen in Table 3, for time-loss types "$WN - NN$," in Belgium it is only two out of nine cases where additional children mildly affect this tradeoff, whereas in Germany the

[11] In a previous version of this paper, Koulovatianos, Schröder and Schmidt (2005b, Table 3), we also presented pairwise t-tests and the results are in accordance with the results of Wilcoxon tests presented in the current version.

corresponding tradeoffs are mildly affected in about half of the cases. These results reconfirm the message given by the comparison between solid lines and dashed lines in Figure 1.

To summarize our results so far, we have found evidence that the time/money tradeoff increases in the presence of at least one child in all cases where the occupational-status variation of adults leads to a state where all adults work full time (either "$W - N$" or "$WW - WN$" time-loss types). In particular, for these types of time loss, the presence of each additional child makes the time/money tradeoff stronger. With respect to the time loss borne when households of two non-working adults ("NN") become "traditional" ("WN"), the effect of the presence of children on the time/money tradeoff faced by these households is either insignificant or slightly positive. Most interestingly in two-adult households that face the time-loss type "$WW - WN$," the tests of Table 3 indicate that the time-money tradeoff increases in the presence of each additional child *in all cases*.

These results suggest that all time-constrained households bear higher children costs. The only exception is the "traditional household type" ("WN"), where welfare-preserving compensations for children seem to be about the same as in household types "NN."

One plausible explanation for our results can be provided by the time component of child costs (childcare-time costs). In particular, according to Gronau and Hamermesh (2006, p. 5, Table 1), based on US and Israeli data, besides sleep, childcare is the second most time-intensive activity after leisure.[12] 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.

If childcare is time-intensive, then, in the presence of children, the time-loss compensations needed when the time loss leads to low non-market time endowments is likely to be

[12]Sleep is assumed to have infinite time intensity in Gronau and Hemermesh (2006). For an extensive study on the cross-country empirical facts and the economics of sleep see Biddle and Hamermesh (1990).

higher. Such high time-loss compensations could arise because time-constrained parents may need to "outsource" for childcare services, i.e. to buy childcare services from the market. For our finding that time-loss compensations increase in the presence of each additional child, the fact that an adult can take care of more than one children at the same time (economies of scale in the domestic production of childcare) could offer an explanation. The cost of outsourcing in the market for childcare activities would rise with the number of children.

A consistent conjecture can be made for our finding that, in two-adult households, when the time loss leads to a "traditional" household type ("$WN - NN$"), the time-loss compensations are not affected by the presence of children. In the case of traditional households, "outsourcing" for childcare services may not be as necessary, as childcare-time costs may be borne by the non-working adult who specializes in home activities. Specialization possibilities in "WN" family types allow the non-working partner to devote more time for childcare, and the household does not incur a higher loss in well-being due to the presence of more children.

So far we have tested hypotheses that address the comparison of time/money tradeoffs in households with children vs. families without children *qualitatively*. Our database enables us to move to a second step without the use of a prior theory to address the data: to estimate child costs relative to an adult after controlling for some important effects, such as household economies of scale in consumption in multi-member families.[13] In fact, the analysis of the present section serves as a guide for specifying the regressions of the section that follows, that undertakes the estimation of child costs. The goals of the section that follows are two:

[13]Yet, we must stress that a quantitative analysis of child costs without theory is far from complete. Without a theoretical model, estimates of child costs cannot be *explained* adequately. Such a connection of our database with a theoretical model is beyond the scope of our present analysis. Nevertheless, our database enables to *measure* child costs without providing a rigorous explanation of the results. What is important about the analysis that follows is the distinction of child costs in time-constrained vs. non-time constrained households.

(i) to address child costs *quantitatively* and to distinguish child costs in time-constrained households vs. non-time-constrained households, and (ii) to test whether the results of the present section are robust to controlling for other aspects that influence household choices, such as household economies of scale in consumption.

4. Estimates of child costs relative to an adult

In order to estimate child costs relative to an adult it is important to control for economies of scale in household consumption/production along the dimension of household size. Household economies of scale might stem from the potential that members of multi-person households have, for example, to share within-household public goods.

The requirement that child costs are estimated relative to an adult, necessitates the use of ratios of equivalent incomes. We build on the logic of Banks and Johnson (1994), who suggest a formalization for measuring household economies of scale and children costs relative to an adult from equivalent-income ratios.[14] Banks and Johnson (1994) use the formula,

$$EIR = \left(n_A + \alpha \cdot n_C\right)^{\theta} \ ,$$

with EIR being the equivalent-income ratios, n_A being the number of adults in the household, n_C being the number of children, α being the cost of a child relative to an adult, while θ can be seen as a "catch-all" parameter, controlling for economies of scale in both household consumption and production. It would be expected that θ takes values between 0 and 1. Of course, the lower the estimate of parameter θ, the higher the economies of scale.

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

[14]Equivalent-income ratios are called "relative equivalence scales." This term usually appears in literatures where equivalent incomes of different families are not distinguished according to the occupational status of adults.

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

By $EIR_{i,y}$ we denote respondent "*i's*" stated equivalent income divided by the reference income. The reference income is the income, "*y*," of the non-working single childless adult. So, the costs of children we estimate are relative to a non-working adult. The variable n_A is the number of adults, n_C is the number of children, and n_W is the number of working adults in the household. So, n_A, n_W, and n_C define the household type. As in the Banks-Johnson (1994) specification, parameter θ_y captures and controls for economies of scale in household consumption and production at reference income y. Parameter β_y is the time-loss compensation relative to the cost of a non-working adult, after controlling for household economies of scale at reference income y. Parameter α_y then gives the costs of children relative to a non-working 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.

In Koulovatianos, Schröder and Schmidt (2005a, p. 974, Table 2), in regressions using the specification $EIR = (n_A + \alpha \cdot n_C)^{\theta}$, we found that both parameters, θ and α, fall as the living standard, captured by the reference income, increases. This means that at a higher level of well-being (higher reference income), the within-household sharing potential is higher, and equivalent-income ratios and children costs relative to an adult are lower. For this reason, we allow all coefficients (i.e., α_y, β_y,θ_y, and b_y, here, and all other coefficients introduced in other regression specifications below), to vary with reference income, y. Thus, we run a separate regression for each reference income in order to control for the effects of well-being on equivalent-income ratios.

The regression results of specification (1) can be found in the columns "Spec. 1" in Tables 4a and 4b. In both countries and for all reference incomes, we can see that α_y is lower than β_y. This means that, relative to a non-working adult, the time-loss compensation of an adult for full-time work is greater than the cost of a child. Moreover, as in Koulovatianos, Schröder and Schmidt (2005a), the estimators $\hat{\alpha}_y$ and $\hat{\theta}_y$ fall with reference income as well.[15]

In the previous section we provided evidence that time-loss compensations are higher in the presence of children, in the cases where the time-loss types lead the household to an occupational status where all adults work (i.e., when households become "W" or "WW"). If such an effect is present and robust, the specification given by (1) does not allow to distinguish it in the evaluation of child costs. For this reason, we introduce a new regression specification that extends (1), given by,

$$\begin{aligned} ES_{i,y} &= \left(n_A + \alpha_y \cdot n_C + \beta_y \cdot n_W + \gamma_y \cdot n_C \cdot D_{WN} + \delta_y \cdot n_C \cdot D_F\right)^{\theta_y} + \\ &\quad + b_y \cdot PERSONAL_i + e_{i,y} \ . \end{aligned} \tag{2}$$

The difference between (2) and (1) is that we have introduced two dummy variables, "D_{WN}" and "D_F," that interact with n_C, i.e. with the presence of children. The dummy D_F takes the value 1 if it refers to household types "W" and "WW," i.e. households where all adults work full time (notice that the symbol we have chosen, "D_F," captures the concept of *full* time-endowment loss). If the coefficient δ_y (on $n_C \cdot D_F$) is positive and significant, then children costs should be higher in these (highly) time-constrained family types. On the contrary, in

[15]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 that demand systems characterized by a property they name "Generalized Equivalence Scale Exactness (GESE)" outperform previous demand systems and provide evidence that equivalence scales (EIR's) fall with rising income in Canada. Donaldson and Pendakur (2006) 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.

the previous section we found evidence consistent with the hypothesis that in "traditional" two-adult households, "WN," it is possible that the non-working adult undertakes childcare, saving part of this cost for the household. In order to test this hypothesis after controlling for all other effects, we introduce the dummy variable "D_{WN}," that takes the value 1 if the family type is "WN." So, if the coefficient γ_y (on $n_C \cdot D_{WN}$) is not different from 0, then this would be supportive evidence that in "traditional" households childcare-time costs can be borne by the non-working adult who may specialize in child-related home activities. In Tables 4a and 4b, the results of the regression specification given by (2) are presented in columns "Spec. 2." Indeed, γ_y is insignificant in all cases, whereas δ_y is positive and significant, with the sole exception of Belgium for the highest reference income.

The regression results of specification (2) suggest that the specialization potential for childcare in household types "WN" leads to gains in terms of well-being in these household types. It is plausible to think that "WN" family types possess specialization potential for more home activity types than childcare.[16] This specialization advantage of "WN" may not be present when switching from "WN" to "WW" (or from "N" to "W"), because of the narrowing in the ability to produce at home. We modify the specification given by (2), in order to control for specialization in home activities other than childcare, using,

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

If there is significant specialization in the household, this specification given by (3) should

[16] A strand of literature 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 (2003), provides a survey of this line of work.

also imply that ζ_y is smaller than η_y, providing a different set of controlling variables for estimating child costs. Tables 4a and 4b 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_W" corresponding to single-adult households where the adult is working, and "D_{WW}," corresponding to two-adult households, both working. This is given by specification,

$$\begin{aligned} ES_{i,y} \;=\; & \big(n_A + \alpha_y \cdot n_C + \gamma_y \cdot n_C \cdot D_{WN} + \zeta_y \cdot n_A \cdot D_{WN} + \varphi_y \cdot n_C \cdot D_W + \chi_y \cdot n_C \cdot D_{WW} + \\ & + \psi_y \cdot n_A \cdot D_W + \omega_y \cdot n_A \cdot D_{WW}\big)^{\theta_y} + b_y \cdot PERSONAL_i + e_{i,y}. \end{aligned} \tag{4}$$

Consistently with our previous findings about the specialization hypothesis, the estimates of (4) in Tables 4a and 4b (columns "Spec. 4") reveal that, generally, ζ_y is smaller than ψ_y and ω_y. Again, children are more costly in households where all adults are working.

In Tables 4a and 4b 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.[17]

Tables 4a and 4b 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 5 we present a summary of the ranges of children costs that are taken from the columns "Spec. 4" of Table 4, given that this regression specification controls for specialization effects, both with respect to childcare and

[17]The estimates of personal characteristics can be provided by the authors upon request.

with respect to all other home activities. In particular, we present estimates for two-adult households, "WN" versus "WW" households, in order to compare our results with these of Apps and Rees (2002). Two important findings conveyed by Table 5 are that relative child costs are higher in "WW" family types compared to "WN," and that relative child costs fall as reference income increases.

In Table 5 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 may be due to the particular assumptions on sharing rules and on the nature of the home-production 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).

5. Suggested extensions

The available micro-level databases that scholars in labor and family economics use, consist of three parts: (i) consumption-expenditure data and prices, (ii) labor-supply data and wages, and (iii) time-use survey data. Studies that rely upon theoretical models in order to estimate household-production functions, labor-supply decisions, child costs and equivalent-income functions often face identification problems. A typical example is the identification of a household-production function. With information limited to data (i)-(iii) above, quantities and prices of home-produced commodities must be inferred implicitly by a model. Since early on, Pollak and Wachter (1975) have stressed the strong restrictions required in order

to separate implicit commodity prices from household preferences, household-production technologies and market prices. In particular, the Pollak and Wachter (1975) restrictions include that household-production technologies exhibit constant returns to scale and that there is no joint production. Little progress has been made since the Pollak-Wachter (1975) critique. For example, Gronau (1977) suggested that home commodities and market goods are perfect substitutes. But as Gronau (2006, p.10) notes,

> *"The 'price' Gronau [(1977)] had to pay for attaining identification of the home production function was giving up on the estimation of [...] the utility component associated with work at home. This shortcoming seems particularly disturbing in the case of childcare."*

Graham and Green (1984) and Kerkhofs and Kooreman (2003) suggest some solutions to the restrictions pointed out by Pollak and Wachter (1975), that allow for the identification of household production functions, but they impose other restrictions. Such identification problems pertain both the estimation of econometric demand systems and the calibration approach of macroeconomists, as Gronau (2006) explains in detail.[18]

We must emphasize that the database we provide is not intended to substitute for the use of models or other databases in labor studies. The role of our survey is that it can provide *a useful piece of information* (direct estimates of household equivalent incomes), in addition to this of databases (i)-(iii) above, so as to facilitate the specification of models that aim at explaining several issues in family- and labor economics. One new promising direction of research is studies using matching models such as these of Aiyagari, Greenwood and Güner (2000), Greenwood, Güner and Knowles (2000) and Greenwood, Seshadri and Yorukoglu

[18]Such studies include, Benhabib et al. (1991), Greenwood and Hercowitz (1991), Greenwood et al. (1995), McGrattan et al. (1997), Einarsson and Marquis (1997), Ingram et al. (1997), Perli (1998), Parente et al. (2000), Campbell and Ludvingson (2001), Gomme et al. (2001), Gollin et al. (2004) and others.

(2005), that look at marriage decisions, social security or the long-run development of labor-supply (especially female-labor participation). Our study's survey can be particularly useful for this line of work, as we provide equivalent incomes for a wide variety of household types and at different levels of well-being.

6. Conclusion

We implemented a survey method that can provide direct estimates of equivalent incomes (welfare-preserving disposable family incomes) among different family types that also vary according to the available non-market time of adults in a household. One can distinguish two broad types of non-market time-endowment loss in families: (i) time losses where the occupational-status variation of adults leads to a state where all adults in the household work full time, and (ii) time losses where households of two non-working adults become a household of one working and one non-working adult ("traditional household"). Welfare-preserving compensations for such time losses capture rates of substitution between time and money, the time/money tradeoff faced by different family types. We conducted this survey in two countries, Belgium and Germany, and, for both types of time loss, (i) and (ii) above, we compared the time/money tradeoff, in households with children vs. households without children. We found evidence that the time/money tradeoff increases in the presence of at least one child in all cases of a time-loss type given by (i) above. On the contrary, for type-(ii) time losses the effect of the presence of children on the time/money tradeoff faced by two-adult households is either insignificant or slightly positive. Interestingly, in two-adult households, in all cases where the time loss leads to two full-time working adults, the time-money tradeoff increases in the presence of each additional child. We provided estimates of child costs relative to an adult as functions of household characteristics after

controlling for household economies of scale in consumption along the dimension of household size. These estimates suggest that relative child costs are higher for households that are time-constrained (all adults in the household work). Moreover, we found evidence for the potential for welfare gains from specialization in childcare vs. market activities in two-adult households. We argued that modeling childcare explicitly in theoretical models and the potential for specialization in domestic vs. market activities in two-adult households (two working hypotheses in Apps and Rees (2002)) are plausible and also a promising direction for future research. We have also suggested ways to combine our survey data with other available databases and existing methodologies in applied research on labor and family economics.

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Table 1 Personal characteristics of respondents

	Belgium		**Germany**	
	N=149		**N=164**	
	N	**%**	**N**	**%**
Gender				
Female	69	46.3	56	34.1
Male	80	53.7	108	65.9
Partner				
Yes	109	73.2	69	42.1
No	40	26.8	95	57.9
Children				
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
Siblings				
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
Age				
< 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
Education				
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
Occupational group				
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
Own working time				
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
Working time of partner				
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
After-tax household income				
$y\_p < 1.75P$	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 the social-assistance benefit for a single adult.				

Table 2 – Average stated equivalent incomes (values in Euros)

		Belgium					*Germany*				
y_r	n_C	*N*	*W*	*NN*	*WN*	*WW*	*N*	*W*	*NN*	*WN*	*WW*
500	*0*	---	803.34 (23.24)	879.09 (13.76)	1140.21 (31.23)	1449.88 (53.21)	---	903.35 (21.66)	977.13 (18.63)	1314.33 (33.50)	1715.85 (53.18)
	1	758.37 (9.45)	1089.86 (24.79)	1133.79 (20.00)	1392.81 (33.78)	1765.01 (56.74)	802.13 (8.43)	1227.90 (25.65)	1266.10 (20.52)	1603.96 (36.27)	2070.58 (55.63)
	2	970.12 (16.80)	1327.70 (30.53)	1350.72 (26.78)	1614.35 (37.39)	2014.79 (62.86)	1073.41 (16.59)	1498.63 (31.90)	1522.38 (27.41)	1866.16 (4.36)	2371.19 (61.40)
	3	1179.53 (24.82)	1560.98 (39.79)	1570.64 (34.96)	1826.42 (42.18)	2255.48 (71.41)	1323.05 (26.58)	1758.69 (40.93)	1747.35 (34.96)	2102.74 (52.20)	2645.58 (70.85)
2000	*0*	---	2621.05 (64.76)	3096.03 (51.36)	3567.15 (89.02)	4177.36 (145.19)	---	2829.57 (67.48)	3227.29 (57.10)	3856.16 (89.18)	4718.60 (147.11)
	1	2465.65 (29.81)	3158.14 (78.34)	3541.10 (71.35)	4042.99 (105.57)	4743.60 (157.43)	2460.37 (36.42)	3308.08 (82.82)	3628.81 (78.24)	4287.35 (109.57)	5249.54 (168.85)
	2	2861.60 (54.66)	3602.28 (97.20)	3935.85 (96.26)	4450.42 (127.00)	5200.36 (174.53)	2812.20 (56.29)	3700.30 (98.11)	3960.06 (91.18)	4622.41 (119.55)	5660.76 (181.48)
	3	3248.36 (78.86)	4048.30 (123.27)	4334.96 (126.87)	4891.62 (162.00)	5680.31 (202.46)	3149.39 (78.51)	4066.74 (117.10)	4297.53 (116.45)	4969.21 (139.19)	6092.07 (203.18)
3500	*0*	---	4283.06 (101.23)	5106.26 (96.35)	5814.46 (162.29)	6676.81 (246.29)	---	4540.70 (94.02)	5277.44 (92.51)	6135.82 (139.01)	7432.32 (228.72)
	1	4098.56 (51.18)	4992.76 (126.82)	5695.85 (128.51)	6403.61 (185.71)	7385.56 (272.41)	3980.95 (31.45)	5104.73 (105.89)	5752.10 (108.92)	6695.43 (157.54)	8077.59 (246.22)
	2	4642.07 (95.51)	5588.97 (160.52)	6275.42 (169.05)	6972.32 (215.22)	8035.56 (303.25)	4410.34 (63.10)	5576.07 (124.63)	6175.15 (128.12)	7141.49 (177.50)	8592.84 (265.15)
	3	5188.36 (141.92)	6210.34 (207.81)	6852.39 (203.06)	7574.81 (257.13)	8705.11 (344.42)	4815.52 (94.54)	6028.02 (148.12)	6594.02 (155.18)	7582.62 (201.16)	9100.91 (285.35)

Average equivalent incomes. Standard errors in parentheses (sample standard deviation divided by the square root of the number of observations). n_C denotes the number of children; y_r denotes the level of reference income; each *N* denotes a non-working adult, each *W* denotes a (full-time) working adult.

	Occupational - status variation	***W - N***				***WN - NN***				***WW - WN***			
y_r		$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$
500	*Mean*	303.34	331.49	357.58	381.45	261.11	259.02	263.63	255.78	309.67	372.20	400.44	429.07
	Median	250.00	250.00	275.00	300.00	150.00	150.00	150.00	150.00	200.00	250.00	250.00	300.00
	Std.error	(23.24)	(22.72)	(24.56)	(28.07)	(24.57)	(25.26)	(26.27)	(23.50)	(28.30)	(31.17)	(34.94)	(39.73)
	Wilcoxon	3.53***		4.53***	2.78***	0.50		0.77	0.39	5.41***		3.18***	4.01***
	p-value	[0.00]		[0.00]	[0.01]	[0.62]		[0.44]	[0.70]	[0.00]		[0.00]	[0.00]
2000	*Mean*	621.05	692.49	740.68	799.94	471.11	501.89	514.56	556.66	610.21	700.61	749.95	788.68
	Median	400.00	500.00	500.00	500.00	250.00	250.00	250.00	250.00	300.00	500.00	500.00	500.00
	Std.error	(64.76)	(70.41)	(75.30)	(81.77)	(61.94)	(66.32)	(69.99)	(84.01)	(68.70)	(70.32)	(73.10)	(74.60)
	Wilcoxon	4.31***		4.00***	5.13***	1.93*		0.73	2.69***	6.20***		4.31***	4.52***
	p-value	[0.00]		[0.00]	[0.00]	[0.05]		[0.46]	[0.01]	[0.00]		[0.00]	[0.00]
3500	*Mean*	783.06	894.19	946.90	1021.98	708.19	707.77	696.90	722.42	862.36	981.95	1063.24	1130.31
	Median	500.00	500.00	500.00	500.00	300.00	300.00	300.00	300.00	500.00	500.00	500.00	600.00
	Std.error	(101.23)	(105.82)	(110.61)	(118.70)	(107.56)	(106.56)	(105.83)	(109.54)	(107.45)	(116.76)	(126.65)	(132.15)
	Wilcoxon	6.40***		4.25***	3.90***	0.76		0.94	0.28	5.67***		5.16***	5.15***
	p-value	[0.00]		[0.00]	[0.00]	[0.45]		[0.34]	[0.78]	[0.00]		[0.00]	[0.00]

Notes. y_r denotes the reference income; n_C denotes the number of children. Standard errors are given by the sample standard deviation divided by the square root of the number of observations. *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level; all other test statistics are insignificant.

Table 3a – Stated time-loss compensations (Belgium)

	Occupational - status variation	***W - N***				***WN - NN***				***WW - WN***			
y_r		$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$	$n_C=0$	$n_C=1$	$n_C=2$	$n_C=3$
500	*Mean*	403.35	425.76	425.21	435.64	337.20	337.87	343.78	355.47	401.52	466.62	505.03	542.83
	Median	312.50	350.00	350.00	350.00	250.00	250.00	250.00	250.00	250.00	300.00	325.00	350.00
	Std.error	(21.66)	(22.95)	(25.48)	(28.12)	(24.85)	(26.26)	(28.15)	(34.20)	(29.06)	(29.59)	(31.95)	(34.91)
	Wilcoxon	2.26**		0.64	1.24	0.97		0.91	0.67	7.01***		5.14***	4.92***
	p-value	[0.02]		[0.52]	[0.21]	[0.33]		[0.36]	[0.50]	[0.00]		[0.00]	[0.00]
2000	*Mean*	829.57	847.71	888.11	917.35	628.87	658.54	662.35	671.68	862.44	962.20	1038.35	1122.87
	Median	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	575.00	625.00	750.00
	Std.error	(67.48)	(68.75)	(73.09)	(78.28)	(59.94)	(63.23)	(64.58)	(65.14)	(86.14)	(91.39)	(97.50)	(105.26)
	Wilcoxon	4.22***		4.03***	3.36***	2.96***		1.23	1.83*	7.27***		5.68***	5.88***
	p-value	[0.00]		[0.00]	[0.00]	[0.00]		[0.22]	[0.07]	[0.00]		[0.00]	[0.00]
3500	*Mean*	1040.70	1123.78	1165.73	1212.50	858.38	943.32	966.34	988.60	1296.49	1382.16	1451.34	1518.29
	Median	500.00	700.00	725.00	750.00	500.00	500.00	500.00	500.00	875.00	1000.00	1000.00	1000.00
	Std.error	(94.02)	(100.14)	(105.44)	(110.51)	(85.63)	(94.53)	(97.95)	(101.58)	(131.09)	(135.11)	(139.05)	(142.21)
	Wilcoxon	5.24***		3.97***	4.93***	3.97***		2.28**	2.70***	5.78***		5.44***	4.57***
	p-value	[0.00]		[0.00]	[0.00]	[0.00]		[0.02]	[0.01]	[0.00]		[0.00]	[0.00]

Notes. y_r denotes the reference income; n_C denotes the number of children. Standard errors are given by the sample standard deviation divided by the square root of the number of observations. *** denotes significance at the 1 percent level; ** denotes significance at the 5 percent level; * denotes significance at the 10 percent level; all other test statistics are insignificant.

Table 3b – Stated time-loss compensations (Germany)

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**
α_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)
β_y	n_W	0.91*** (0.05)	0.75*** (0.06)			0.64*** (0.05)	0.51*** (0.06)			0.57*** (0.05)	0.48*** (0.06)		
γ_y	$n_C \cdot D_{WN}$		-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)
δ_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)	
ζ_y	$n_A \cdot D_{WN}$			0.30*** (0.04)	0.32*** (0.05)			0.17*** (0.03)	0.18*** (0.05)			0.16*** (0.05)	0.18*** (0.06)
η_y	$n_A \cdot D_F$			0.74*** (0.06)				0.51*** (0.05)				0.48*** (0.06)	
φ_y	$n_C \cdot D_W$				0.10** (0.05)				0.10** (0.05)				0.07 (0.06)
χ_y	$n_C \cdot D_{WW}$				0.20** (0.09)				0.24** (0.11)				0.22* (0.12)
ψ_y	$n_A \cdot D_W$				0.75*** (0.06)				0.48*** (0.07)				0.42*** (0.08)
ω_y	$n_A \cdot D_{WW}$				0.77*** (0.06)				0.51*** (0.08)				0.49*** (0.09)
θ_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 non-working 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 4a 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**
α_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)
β_y	n_W	0.95*** (0.04)	0.82*** (0.05)			0.77*** (0.05)	0.66*** (0.06)			0.68*** (0.04)	0.59*** (0.05)		
γ_y	$n_C \cdot D_{WN}$		-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)
δ_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)	
ζ_y	$n_A \cdot D_{WN}$			0.34*** (0.04)	0.37*** (0.04)			0.24*** (0.04)	0.27*** (0.05)			0.18*** (0.04)	0.21*** (0.05)
η_y	$n_A \cdot D_F$			0.81*** (0.05)				0.66*** (0.05)				0.58*** (0.05)	
φ_y	$n_C \cdot D_W$				0.09** (0.04)				0.07 (0.05)				0.12*** (0.04)
χ_y	$n_C \cdot D_{WW}$				0.18** (0.07)				0.20** (0.09)				0.30*** (0.11)
ψ_y	$n_A \cdot D_W$				0.80*** (0.06)				0.62*** (0.07)				0.40*** (0.07)
ω_y	$n_A \cdot D_{WW}$				0.86*** (0.07)				0.70*** (0.08)				0.71*** (0.10)
θ_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 non-working 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 4b Regressions for estimating child costs and economies of scale in home production/consumption in Germany

y_r	Spec. 4				Apps & Rees (2002)	
	Belgium		Germany			
	WN	*WW*	*WN*	*WW*	*WN* (average income)	*WW* (average income)
poor (500)	0.59	0.79	0.58	0.76	0.24-0.40[a] 0.82-0.98[b]	0.53-0.69[a] 0.78-0.91[b]
middle (2000)	0.36	0.60	0.30	0.50		
rich (3500)	0.33	0.55	0.37	0.49		
Notes. y_r is the level of reference income. [a] denotes a model specification without considering domestic production and parental childcare. [b] denotes a model specification considering domestic production and parental childcare.						

Table 5 Child costs relative to an adult in *WN* vs. *WW* households

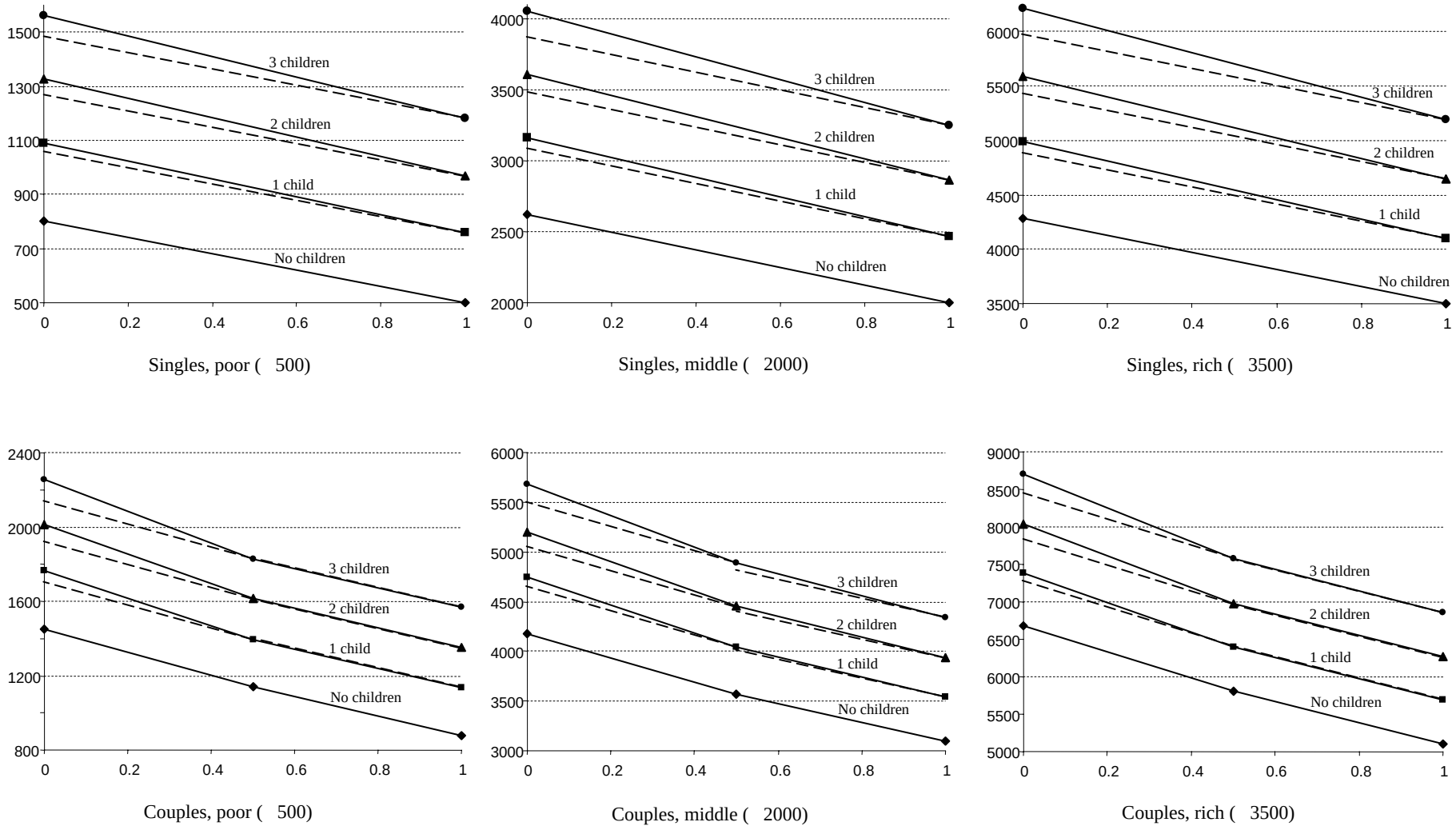

Figure 1.a (Belgium) Equivalent incomes as functions of non-market time endowments

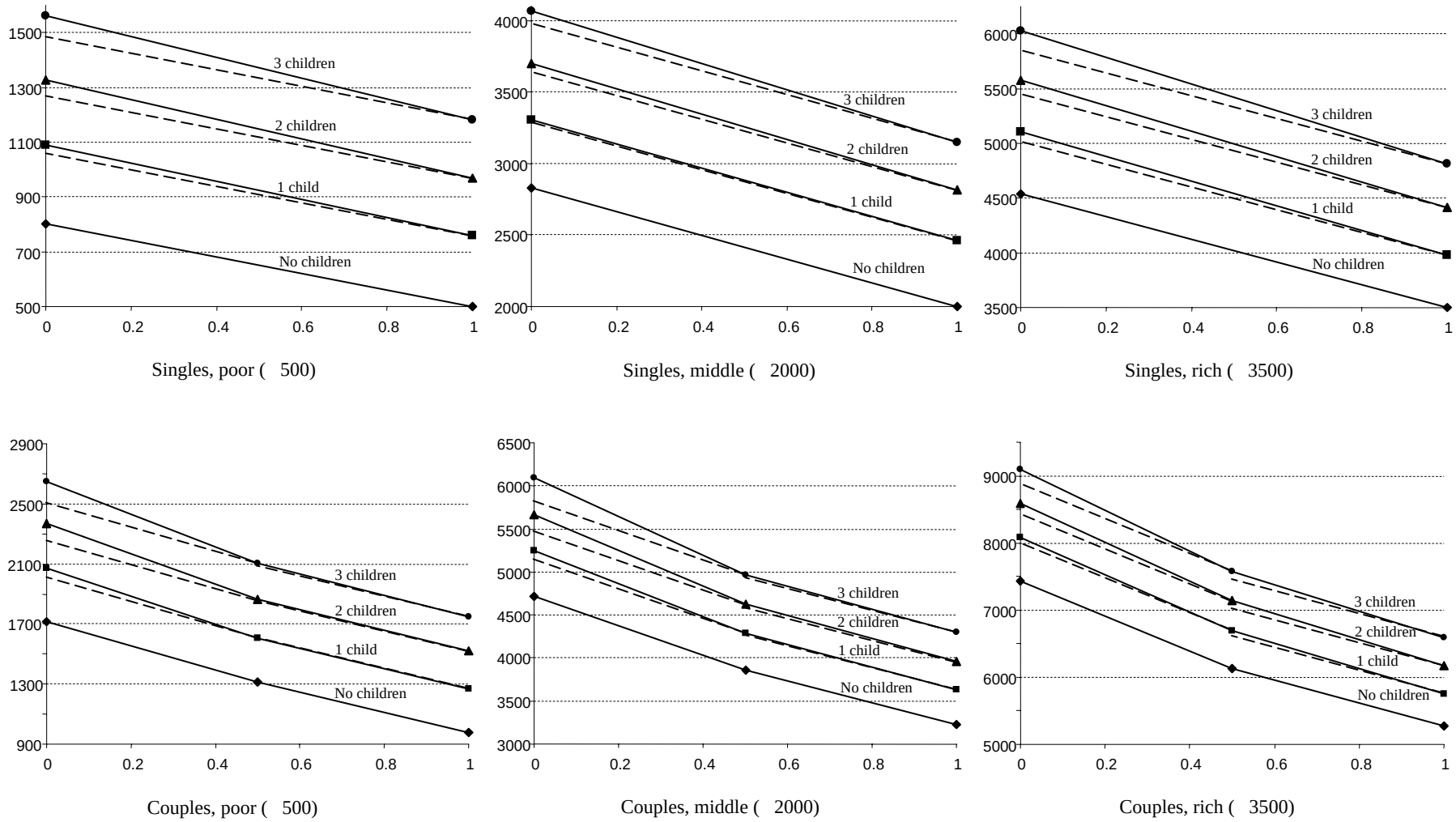

Figure 1.b (Germany) Equivalent incomes as functions of non-market time endowments.
Note to Figure 1: Dashed curves are the equivalent-income functions of the childless households, appearing at the bottom of each graph, shifted in a (piecewise) parallel way in order to stress the change in the rate of substitution between income and time due to the presence of children.

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 (non-working or working full time) since this might affect, for example, 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 working adults) that allows this household to reach an identical living standard as the reference household?

Since there does not exist an objectively correct answer, we would like to know your subjective assessment of this question.

2. Personal characteristics

We would like to ask you to state some of your own personal characteristics. Please mark the boxes that apply to you. Your answers will be treated confidentially and only for the stated research purpose.

1) Please state your gender:
- ☐ male
- ☐ female

2) Are you living together with a partner?
- ☐ yes
- ☐ no

2a) In case your answer to question 2) is "yes:"
Is your partner working
- ☐ not at all
- ☐ half a day
- ☐ whole day
- ☐ irregularly?

3) How many children are living in your household?
- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3 or more

4) What is your **family after-tax income** per month?
- ☐ below 1.75P*
- ☐ 1.75P – 3.25P
- ☐ 3.25P – 4.75P
- ☐ 4.75P – 6.25P
- ☐ 6.25P and above

* Note to researcher: *P* is the "poverty line" in a country as explained in the section explaining the survey structure.

5) Are you

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

6) Are you working

- ☐ not at all
- ☐ part-time
- ☐ full-time
- ☐ irregularly?

7) Please state your education level:

- ☐ no degree
- ☐ elementary school
- ☐ secondary school
- ☐ technical school or university

8) Please state the number of siblings you lived together with 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. These situations differ by the pre-specified after-tax monthly income (including all social transfers) of a household consisting of a non-working childless single adult. 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, non-working	1 adult, working full time	2 adults, both non-working	2 adults, 1 non-working, 1 working full time	2 adults, both working full time
0 children	Reference income				
1 child					
2 children					
3 children					

Within a given table, all household types should attain the same 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 working adults, to the same living standard as the one of the non-working single-childless adult.

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 non-working single-childless adult in increasing order).