Income Distribution Statistics and Shared Residence

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Income Distribution Statistics and Shared Residence

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Preface

This paper was initially presented at the 36th General Conference of the International Association for Research in Income and Wealth (IARIW). The conference took place in Oslo, Norway, 23–27 August 2021.

The paper has been prepared by Johan Lindberg, Hans Heggemann and Fredrik Carlsson at Statistics Sweden.

Statistics Sweden, September 2021

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Abstract

The aim of this paper is to analyse the financial situation of families in which the parents live apart, using the equivalised disposable income of the household as the variable of analysis. To enable identifying children who live more or less equally with each parent (often referred to as shared residence), a logistic regression model is used. We will also present an alternative equivalence scale, which takes account of the needs of both households in the case of shared residence.

The Swedish official income statistics provide the basis for describing the financial situation of individuals and households in Sweden. A group of households with a financial situation that is difficult to accurately estimate is parents who live apart.

The income statistics are based on data from administrative registers. The household composition is based on a dwelling concept, whereby a household consists of the people registered in the same dwelling. Because it is not possible to be registered in multiple dwellings, there is no information on the extent to which children of separated parents live with each parent. In the statistics, children of separated parents are included in the household where they are registered according to administrative data. That parent is assumed to bear the entire cost for the child, thus resulting in an overestimation of that cost for the parent with whom the child lives and, conversely, an underestimation of the cost for the other parent.

The report describes quality problems in the statistics regarding the financial situation of separated parents. Furthermore, a model is used to estimate the financial situation of these parents and their children, with the cost of the children being evenly distributed between the households when residence is shared.

The results show that around 144 000 children had shared residence in Sweden in 2017. These children were registered in 92 000 households, and had their actual residence in almost 172 000 households when considering shared residence.

When shared residence is taken into account; that is, when households with children living full time are reclassified as having shared residence, the median economic standard (equivalised disposable income) of such households increases by around 10 percent. Conversely, the economic standard of households to which children with shared residence are added decreases by approximately 30 percent.

The impact on total income inequality is relatively small. Based on the entire population, the Gini coefficient decreases by 0.001, from 0.322 to 0.321. The percentile ratios P95/P05 and P80/P20 decrease by 0.03 and 0.02, respectively, down from 5.21 to 5.18 and 2.21 to 2.19. The at-risk-of-poverty rate decreases from 14.9 percent to 14.6 percent.

Introduction

This paper addresses the issue in income distribution statistics with measuring the economic standard (equivalised disposable income) for families in which the parents live apart.

Approximately one in four children in Sweden has parents who have separated or have never lived together (Statistics Sweden 2014a). The living conditions for these families are hard to adequately measure in income distribution surveys. At the same time, single-parent families, especially single women, are often of interest from a policy perspective due to their elevated risk of experiencing economic hardship.

Living arrangements for families with parents living apart varies considerably between different families in Sweden, and have changed over time. Parents living apart may have their children living with them most or all of the time, or part of the time, or the children may live more or less equally with both parents, often referred to as shared residence.[1]

According to different surveys, shared residence has become more common in Sweden in recent years. Approximately one third of children whose parents do not live together live alternately with each parent, often every other week. This is a sharp increase compared to the 1980s, when only a few percent of children with separated parents had this kind of arrangement.[2]

However, there is no information on the extent to which the children actually live with each parent in the sources on which the statistics are based. The Swedish income distribution survey is a total population survey based entirely on administrative data, primarily from the Swedish Tax Agency. The household composition is based on a dwelling concept, whereby a household consists of the people registered in the same dwelling. There is no available administrative data, for instance, on the prevalence of shared residence. Hence, the children are considered to be living in the household where they are registered in the national population register, most often with their mother.

When measuring the economic standard of families in which the parents no longer live together, certain quality issues arise. These are

[1] This report focuses on children with shared residence, as it is in this group that the greatest measurement error occurs, combined with them making up the largest group of children of separated parents. However, it is important to note that there are also measurement problems for children with other living arrangements; these ought thus not to be as significant as for children with shared residence.

[2] According to the report *Different families live in different ways* (Statistics Sweden, 2014a) about 35 percent of children of parents not living together had shared residence. The same kind of statistics can also be found in the Swedish EU-SILC. According to EU-SILC, approximately 28 percent of the children had shared residence. These differences can thus be attributed to differences in survey design.

essentially attributable to the children being included in just one of the households and, consequently, having a direct impact on the economic standard of that household. At the same time, the economic standard of the other parent is unaffected.

Income distribution surveys tend to disregard the existence of shared residence and, in so doing, the fact that the parents tend to share the burden of support for the child. Rather, the entire economic burden is assigned to one household, thus resulting in an underestimation of the economic standard of one parent (often the mother) and, conversely, an overestimation of the economic standard of the other.[3]

Instead, when residence is shared, it can be assumed that there would be a reduction in the burden of support for the parent with whom the child is registered and, conversely, an increase for the other parent. The extent of this change for each parent can be debated, as certain costs are fixed, such as the need for larger accommodation as well as double sets of numerous items, such as clothes. However, the non-fixed costs would certainly be lower for the parent with whom the child is registered, as it can be assumed that the expenses would be reduced more or less proportionately to the time spent with the other parent. Nevertheless, due to the fixed costs borne by both households, it can be assumed that shared residence increases the total cost of the child.

Swedish legislation obliges both parents to assume responsibility for providing for their children; that is, to attend to the child financially. In cases where a child lives with just one parent, the other parent (with whom the child does not live) is obliged to pay child support. If the child has shared residence, neither parent is required to pay child support as they are both considered to bear their part of the burden.

Income transfers between households is generally absent from administrative data, and this is also the case for child support. Child support is regular transfers that the parents have arranged between themselves. The alternative is maintenance support, which is administrated by the Swedish Social Insurance Agency, and is thus available in administrative data. However, maintenance support is only used when the parents cannot come to an agreement by themselves, and it is therefore not a comprehensive source of income transfers between parents.

In the official income distribution statistics, adjustments are made regarding both positive and negative transfers of child support by using

[3] See for example the report Continuous parenthood: about responsibilities, economy and cooperation for the sake of the child (Swedish Government Official Report 2011) for a thorough discussion on quality issues in income distribution statistics regarding children with shared residence.

a model to simulate these transfers, from the parent with whom the child does not live, to the one with whom the child is registered. This model, to some extent, also considers shared residence, by lowering the total simulated child support in the population by the proportion of shared residence.[4] However, it does not adjust for the altered economic burden borne by parents of children with shared residence.

A recent Swedish paper (Björklund 2020) raised concerns as to whether the inability to properly measure the economic standard of different types of households, with regard to shared residence, may have resulted in an overestimation of inequality between households in the statistics. In particular, the economic standard of children living with one adult lagged behind that of other children during the period 1995–2017, while at the same time shared residence has become increasingly common in Sweden.

Another Swedish study (Fransson et al. 2017) finds that children with shared residence largely tend to have living conditions on a par with children who live with two custodial parents in the same household. Furthermore, the study finds that children living with only one custodial parent have poorer living conditions than their peers in households with two custodial parents and those with shared residence. This held true in particular for economic and material conditions. The analysis was based on the Swedish Living Conditions Survey (ULF) and the Living Conditions Survey of Children (Child-ULF), with questions covering aspects such as having a room of their own, cash margin and the ability to buy the same things as friends.

The aim of this paper is to analyse the economic situation of families in which the parents live apart, using the equivalised disposable income of the household as the variable of analysis. To enable identifying families and children with shared residence, a logistic regression model is used. We will also present an alternative equivalence scale, which takes into account the needs of both parents when residence is shared.

The rest of this paper is structured as follows. The following methodology section consists of a review of different methods that can be used to simulate the existence of shared residence, after which a model is introduced for estimating an alternative economic standard for both the affected children and their households. Finally, results are presented followed by a discussion of the potential implications of these results for the official income distribution statistics.

[4] See Quality of the statistics (SCB 2020) for detailed information about the model used for simulating child support.

Methodology

This section presents the methodology used in this paper to estimate the economic standard of households with children that have shared residence. This process consists of different steps, the first one being to identify the children, and thus the affected households, with shared residence.

To enable estimating an alternative economic standard for the households concerned, the following procedure is used.

1. Identify children and households with shared residence.
2. If applicable, reclassify the household type.
3. Apply an alternative equivalence scale, with households with shared residence being assigned alternative weights due to changes in needs.
4. Distribute the child's own income between the two households.
5. Estimate an alternative economic standard, whereby the economic standard of the child equals the average of the parents' economic standard.

Below is a detailed review of these steps. In step 1 (the very essence of the method, in which children with shared residence are identified), an evaluation is performed of different methods used to determine which children should be classified as having shared residence. The different methods all have their benefits and drawbacks, and generate partly different results, both in terms of the classification of shared residence as well as its impact on income distribution.

Children with shared residence

As described earlier, no administrative data is available on the extent to which children actually live with each parent. Available information is instead based on sample surveys on housing and family living arrangements. By combining data from sample surveys with data from administrative registers, a model to classify shared residence can be generated.

In this paper, we will use a model developed by Statistics Sweden as part of work with the micro simulation model FASIT (Distributional Analysis System for Income and Transfers)[5]. The model is based on a logistic regression, in which the probability of a child having shared residence is estimated. By using these probabilities, children can then be classified as having shared residence. This procedure can be performed with different approaches, each generating partially different results.

[5] See The Economic Standard for Households and Individuals with Shared Residence – Simulated Results in FASIT (Statistics Sweden 2014b) for further information.

Below is a brief review of the regression model used to estimate probabilities of shared residence. This is followed by an evaluation of four different approaches to identifying children with shared residence, based on the results of the regression model. The benefits and drawbacks of each approach are discussed, after which one of the approaches is selected for further use in the subsequent result section.

Probability of shared residence

The model is based on children 0–19 years who are registered in Sweden and have both their parents registered in Sweden. These children can be categorised as follows: registered at the same address as both parents, not registered at the same address as either parent, or having the same address as just one of the parents. Shared residence can only exist in the third category, which is also the category that we will use as input in the regression model.

However, to enable classifying shared residence, administrative data alone is not sufficient input to the model. At the end of 2012 and the beginning of 2013, Statistics Sweden conducted a survey on behalf of the Ministry of Health and Social Affairs.

The survey, *Different families live in different ways*, was sent to the parents, who lived apart, of 15 000 randomly selected children. Both parents were given the opportunity to participate in the survey. The purpose was to see how the parents had solved housing issues and finances for their child. In total, answers representing 8 787 children were received, either from the mother, the father or from both. Responses from the survey were combined with administrative data in order to create the logistic model used in this paper. The model has been evaluated with recent data from the Swedish EU-SILC, without seeing any need for adjustment at this stage.

A logistic model, which is the result from a logistic regression, is particularly useful when only two outcomes are possible, in this case the existence of shared residence. The model is applied to the population of children who are only registered with one parent, and estimates the probability of shared residence for each of these children.

The model, described below, has shared residence as the dependent variable (S) and consists of 26 significant independent variables. The independent variables, which include variables both of a demographic nature as well as different kinds of income variables, refer to both the parents and the child.[6]

[6] See appendix 1 for a full list of the independent variables included in the model.

$$log\frac{P(S)}{1-P(S)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_{26} X_{26} + \varepsilon \qquad \varepsilon \sim N(0, \sigma)$$

The outcome is an estimate of the probability for each child of having shared residence. Each child in the population is assigned a probability between zero and one. By using these probabilities, the total number of children with shared residence can be estimated, as well as which of these children should be included in that category.

Methods to classify shared residence

The following four methods to classify children with shared residence have been evaluated.

In Method 1, a uniformly distributed random number is generated between zero and one for each child. Children with an estimated probability of shared residence greater than the random number are classified as having shared residence. That way, the total number of children, as well as the specific children with shared residence, are identified. The use of generated random numbers adds unpredictability, or uncertainty, to the estimation. The uncertainty is that different children, and the total number of children classified as having shared residence, will vary each time new randomised numbers are generated.

The procedure can be compared to using a sample in a survey. Each sample can be skewed, resulting in biased estimates, while the average result from many samples is expected to estimate the true value; that is, the estimator is expected to be unbiased.

This means that each set of random numbers can be viewed as one possible result of many, whereby the average result from numerous iterations will have the same characteristics as the population on which the model is based. It also means that one specific result does not have to be representative of the original population.

In Method 2, the total number of children is estimated in the same way as in Method 1; that is, the total number of children refers to the sum of the children whose probability of shared residence is greater than the randomly generated number. The difference compared to Method 1 is how children with shared residence are classified. In Method 2, children with the highest probability of shared residence are selected. This method will, in large, generate the same children each time; that is, those with the highest probability of shared residence (however, the total number of children depends on the randomly generated numbers). This, in turn, means that the results will vary less between different iterations, since these largely will be based on the same children, resulting in a lower variance, or margin of error, in the estimate. This is good granted that the logistic model accurately describes reality. Should this not be the case, the risk of biased results is evident, since the

children selected will have a strong correlation with the independent variables in the model.

In Method 3, the total number of children with shared residence equals the sum of probabilities of all the children included in the model; that is, children who are only registered with one parent. Children are classified by selecting those with the highest positive difference between the probability and the randomised number. One advantage of the method is that the number of children with shared residence is kept constant, while classification of these children is performed in a randomised manner. The method should result in some variability as to who is classified as having shared residence, although this can be assumed to be somewhat smaller compared to Method 1 in particular, since the number of children in alternative 3 is kept constant.

Finally, in Method 4, the total number of children with shared residence is generated in the same way as in Method 3; that is, by summing the probabilities for each child. Then, the children with the highest probability of shared residence are selected, i.e. the procedure is the same as in Method 2. This method is entirely dependent on the result of the logistic model and contains no randomised steps. The advantage of this method is that, since the method is not based on a random variable, no additional uncertainty is included in the estimation of the population parameters. The disadvantage, as previously pointed out, is that the results rely entirely on the logistic model used to generate probabilities for shared residence.

Table 1 below contains a summary of the four methods, with the advantages and disadvantages of each method.

Table 1. Summary of methods used to estimate shared residence

	Method 1	Method 2	Method 3	Method 4
Classification of children with shared residence	Probability of shared residence > randomised number.	The children with the highest probability.	The children with the greatest positive difference between the probability and the randomised number.	The children with the highest probability.
Total number of children with shared residence	The sum of the children with a probability of shared residence > randomised number.	The sum of the children with a probability of shared residence > randomised number.	Total sum of probabilities.	Total sum of probabilities.
Advantages	Stochastic, generates unbiased estimates.	Partly stochastic. Should generate less variance in the estimates compared to Method 1.	Partly stochastic. Should generate less variance in the estimates compared to Method 1.	Generates no variance, as the method does not contain any stochastic elements.
Disadvantages	Generates greater uncertainty. Single iterations of randomised numbers may be skewed, resulting in biased estimates.	Risk of systematic errors if the underlying model is skewed. Single iterations of randomised numbers may be skewed, resulting in biased estimates.	Generates greater uncertainty. Single iterations of randomised numbers may be skewed, resulting in biased estimates.	Risk of systematic errors if the underlying model is skewed.

As described below, the different methods generate slightly different results as well as differences in the size of the margin of error for each point estimate. Important aspects when choosing the method is that it should be as precise as possible, but also robust, and it should generate unbiased estimates.

Evaluation of methods

In this section, an evaluation is performed of the four methods presented above. The evaluation forms the basis for choosing one of these methods for further analysis.

In order to evaluate the four methods, we use data from the Swedish EU-SILC, which includes questions regarding the actual living situation of children. Granted that we have this data for a subset of all children, an evaluation can be performed of how well each method estimates the true value of this subset.

The evaluation is based on how well the different methods manage to estimate the parameters below in relation to the results based on the EU-SILC data.

- The percentage of children with the correct classification.
- The percentage of children with shared residence.
- Mean and median value of equivalised disposable income.
- The percentage of children at risk of poverty.

EU-SILC data

The target population in the EU-SILC differs in some respects from the target population examined in this report. In the EU-SILC, the target population is households in Sweden, while the target population in this report is children with shared residence. Therefore, the EU-SILC data needs to be adjusted to the purpose of this paper in order to be used in the evaluation.

To obtain a sufficiently large reference data set, data from three years is used – 2016, 2017 and 2018. This data contains a total of 753 children living only with one biological parent (unweighted). Of these, 660 children fulfil the necessary conditions; that is, that the parents do not live together according to the national population register, and that both parents must be registered in Sweden.

The main source of the independent variables is the Income and Tax Register. When performing this analysis, income data for 2018 was not yet available. Therefore, it is assumed that children with shared residence in 2016 and 2018 also had shared residence in 2017. By making this assumption, in the analysis we can use independent variables from 2017 only.

For children classified as having shared residence, an adjusted disposable income has been calculated. The adjusted disposable income

equals the average of the equivalised disposable income for the two households.

The methods using a stochastic variable to classify children with shared residence have used averages from 1 000 iterations of random numbers in the evaluation. This means that the evaluation refers to how well the methods work on average and not in an individual case.

Results from evaluation

This section presents results from the evaluation of the four methods in terms of how well they manage to estimate the predetermined parameters.

Table 2 shows point estimates and margins of error for the predetermined parameters, based on the different methods as well as EU-SILC data for reference.

Table 2. Evaluation of the methods used to estimate shared residence

	ULF/ SILC	Method 1	Method 2	Method 3	Method 4
Correct classification (%)	–	68.6	75.4	68.6	75.3
Children with shared residence (%)	37.2	37.2	35.5	37.1	35.6
Margin of error (%)	–	± 3.1	± 2.4	± 1.2	± 0.0
Children at risk of poverty (%)	3.6	4.0	2.9	4.0	2.9
Margin of error (%)	–	± 2.0	± 0.2	± 2.0	± 0.0
Mean value, economic standard (SEK thousands)	307.4	306.2	307.2	306.1	307.2
Margin of error (SEK thousands)	–	± 11.8	± 2.4	± 11.9	± 0
Median value, economic standard (SEK thousands)	271.5	275.2	274.7	275.1	274.8
Margin of error (SEK thousands)	–	± 7.8	± 0.7	± 7.6	± 0

If we look at the percentage of children that are classified correctly, alternatives 2 and 4 do best, both having 75 percent of the children with the correct status, compared to just under 70 percent for the other methods. Regarding the percentage of children with shared residence, intuitively Methods 1 and 2 ought to give the same results, while the same should apply to Methods 3 and 4, since they use the same approach to estimate the total number of children with shared residence. However, as shown in table 3, this is not the case, as Methods 1 and 3 come closer to the result based on EU-SILC, while Methods 2 and 4 have a somewhat poorer performance. The reason for this is that, even though Methods 1 and 2, as well as Methods 3 and 4, respectively, use the same approach for estimating the total number of children with shared residence, different children were selected. These children have

different weights which, in turn, affect the total number of children classified as having shared residence.

Besides the point estimates, the size of the margin of error is of interest. As seen, Method 1 has by far the largest margin of error, while Method 4 is at the other end of the spectrum – not generating any margin of error at all.

We continue by looking at how well the various methods estimate the economic parameters. As can be seen, there are no particular differences in the point estimates of the mean and median values. On the other hand, the margins of error differ fairly much between the methods. Methods 1 and 3 perform worse with relatively large margins of error, while Method 2 clearly performs better. In the absence of stochastic elements, Method 4 has no variance at all.

A central indicator in income distribution statistics is the at-risk-of-poverty rate. As shown, the point estimates of the at-risk-of-poverty rate for Methods 1 and 3 are slightly high compared to the benchmark, while the opposite is the case for Methods 2 and 4. Again, Methods 1 and 3 generate relatively large margins of error, with 95 percent of the outcomes being in the interval 2–6 percent. On the other hand, Methods 2 and 4 will significantly underestimate the true value.

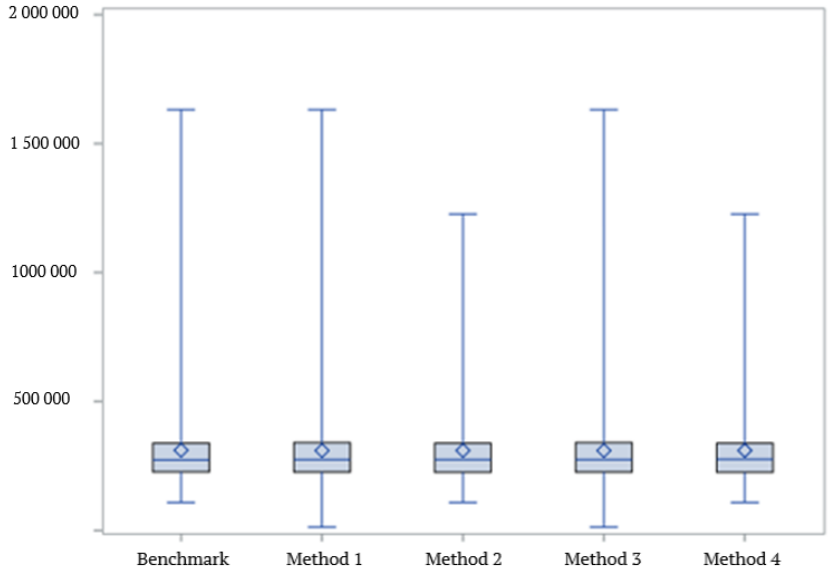
Methods 2 and 4 underestimate the at-risk-of-poverty rate because these methods rely to a greater extent on the logistic model when classifying children with shared residence. The model assigns significant weight to independent variables regarding the parents' income, alongside other variables that affect the household income. This results in children in high-income households being more likely to be classified as having shared residence.

On the other hand, when Methods 1 and 3 are used, a greater distribution of income among parents is obtained. One effect of this is that more children in low-income households are classified as having shared residence, resulting in a slight overestimation of the at-risk-of-poverty rate with these methods.

The chart below shows the distribution of equivalised disposable income in the reference material as well as in data generated by each method.

Based on the results above, it is not evident which method should be applied in the further analysis, as there are advantages and disadvantages with all the methods.

Figure 1. Distribution of equivalised disposable income by method, SEK



When it comes to estimating the total number of children with shared residence, all methods give roughly equivalent results. Owing to this, we choose to proceed with the approach used in Methods 3 and 4; that is, the sum of probabilities. This approach has the appealing feature that it estimates the same number of children each time, unlike when randomised numbers are used, with a different number of children being estimated for each new generation of randomised numbers.

When it comes to determining which children are to be classified as having shared residence, the methods will classify different children, thus having an impact on the economic indicators. Since no method is significantly better than the others, we choose to proceed with the method that generates the smallest margin of error; that is, children with the highest probability of shared residence. One obvious disadvantage in this approach is, as shown in table 2, that we are very likely to underestimate the at-risk-of-poverty rate for children with shared residence.

All things considered, Method 4 will be used in the further analysis in this paper.

Household type

By using Method 4, approximately 144 000 children are estimated to have shared residence. These children are registered in 92 000 households, and actually live in almost 172 000 households when shared residence is taken into account.

In this paper, we consider households with children who have shared residence to be regular households with children, i.e. as if the children were registered in both of the households. This results in the reclassification of some households in terms of household type; that is,

households that originally have no registered children but which, after adjustments will have at least one child with shared residence, will be classified as households with children. The implication of this is that the total number of households without children decreases, while households with children increases.

The transition matrix below shows the distribution of the households affected by shared residence in terms of household type before and after the adjustments are made.

Table 3. Transition matrix, distribution of household type in terms of shared residence, percent

Adjusted household type/ Unadjusted household type	Single with children 0–19 years	Cohabiting with children 0–19 years	Other households with children 0–19 years
Single without children	25.1	–	–
Single with children 0–19 years	35.6	–	–
Single with children 20– years	1.0	–	–
Cohabiting without children	–	5.7	–
Cohabiting with children 0–19 years	–	21.4	–
Cohabiting with children 20–years	–	0.9	–
Other hh. without children	–	–	2.9
Other hh. with children 0–19 years	–	–	6.0
Other hh. with children 20– years	–	–	0.3

We will not introduce any new household types, e.g. households with children with shared residence, as it would be difficult to classify households with children both full time and with shared residence. However, children with shared residence will be treated as a separate group.

Equivalence scale

Statistics Sweden uses a national equivalence scale in the calculation of equivalised disposable income. The scale is based on estimates made on the Swedish HBS and which are thus adapted to Swedish conditions. The scale assigns a value of 1 to the household head, 0.51 to the spouse/partner of the household head, 0.6 to other adults, 0.52 to the first child 0–19 years old, and 0.42 to other children 0–19 years old.

In this paper, we assume that households with shared residence share the costs of the child, since the child spends approximately equal time with both parents. Translated to equivalence scales, this implies that each household bares half the weight of children with shared residence, corresponding to 0.26 for the first child with shared residence and 0.21 for subsequent children.

However, it is reasonable to assume that the total cost of a child with shared residence increases, as certain costs are fixed for both parents, such as the need for larger accommodation as well as double sets of numerous items, such as clothes. Results show, for example, that children with shared residence in Sweden usually have their own room in both homes (Statistics Sweden 2014a). In light of this, the weight of children with shared residence ought to be higher than that of children living in just one household.

We use the same estimates of costs for children that were used when the Swedish equivalence scale was developed. In these calculations, the cost of living for the first child makes up 29 percent of the total cost of the child, while the corresponding share for subsequent children is, on average, 17 percent. This corresponds to a weight of 0.15 (0.52 * 0.29) for the first child and 0.07 (0.42 * 0.17) for subsequent children.

These calculations also include items for clothes, shoes and leisure activities which, together, represent other double costs incurred by both parents. In the calculations, these items represent 17 percent of the total cost for the first child and 19 percent for subsequent children, corresponding to weights of 0.09 (0.52 * 0.17) and 0.08 (0.42 * 0.19) respectively.

Overall, this means that, for shared residence, the equivalent weight of the first child is increased from 0.52 to 0.76 (0.52 + 0.15 + 0.09) and for subsequent children from 0.42 to 0.57 (0.42 + 0.07 + 0.08). As each household is assumed to bear half the cost of the child, the total burden of each household will be 0.38 for the first child and 0.28 (rounded) for subsequent children. Consequently, we introduce two additional categories in the equivalence scale – First child with shared residence and Subsequent children with shared residence, as seen below in Table 4.

Table 4. Modified equivalence scale with regard to shared residence

	Weight
One adult (single household)	1.00
Cohabiting without children	1.51
Additional adult, 20– years	0.60
First child 0–19 years	0.52
Subsequent children 0–19 years	0.42
First child with shared residence 0–19 years	0.38
Subsequent children with shared residence 0–19 years	0.28

However, the composition of households, and thus the assigning of weights, can be somewhat intricate when children with shared residence are introduced. The table below shows various combinations of households with associated weights for the children.

Table 5. Equivalised weight for children in different housing situations

	Weight per child	Household sum
0 full time, 1 child with shared residence	0.38	0.38
0 full time, 2 children with shared residence	0.38+0.28	0.66
1 child full time	0.52	0.52
1 child full time, 1 child with shared residence	0.52+0.28	0.80
1 child full time, 2 children with shared residence	0.52+0.28+0.28	1.08
2 children full time, 0 children with shared residence	0.52+0.42	0.94
2 children full time, 1 child with shared residence	0.52+0.42+0.28	1.22
2 children full time, 2 children with shared residence	0.52+0.42+0.28+0.28	1.50

Children with shared residence may have different weights in the two households, depending on the existence of other children and the living arrangements of these children. For instance, in the presence of two children in a household, one full time and one with shared residence, the child with shared residence receives a weight of 0.28. If there are no other children present in the other household, the child with shared residence in this household receives the weight 0.38.

Children's own income

Some children have incomes of their own, especially income from capital, but also earned income, which in some cases may suffice to significantly affect the disposable income of the household. In this paper, these incomes will be shared equally between the two households. The effect of this is that households with registered children with shared residence have their income reduced somewhat, while the opposite is the case for households that only have children with shared residence.

Adjusted economic standard

It can be assumed that children with shared residence are affected by the financial situation of both households. Hence, the equivalised income for children with shared residence will be calculated as the average of the equivalised disposable income of both households. Consequently, the equivalised disposable income for children with shared residence will not equal the equivalised income of either parent.

Results

In this section, results are presented of the effects of introducing shared residence for children with separated parents. The results will be based on the model described in the previous section. In order to classify children with shared residence, Method 4 will be used.

The results depend on how the different adjustments described in the previous section affect certain groups. In total, four adjustments are made in order to take shared residence into account. These are a) possible change of household type, b) the change in burden of support (equivalence scale), c) the distribution of the child's own income between the households, and d) the child's economic standard as the average of the two households.

The change in burden of support as well as the distribution of the child's own income between the households have a direct impact on the economic standard of the household. The allocation of the average economic standard of the two households to the child with shared residence only affects the child, without any implications for the economic standard of other household members. Lastly, the reclassification of some of the households with shared residence, as seen in table 3, will only have an effect on the overall statistics by household type, thus having no impact on the specific household.

Households directly affected by shared residence

As seen previously in table 3, approximately 172 000 households are affected by shared residence. Of those, around 92 000 have at least one child who is reclassified from living full time with one parent, to dividing their time between both parents. 80 000 of these households are affected by the reclassification from a child only being registered with one parent, to one with shared residence (referred to as group A below), while almost 12 000 households also have at least one child with shared residence added to the household (group C).

Group B, consisting of almost 80 000 households, then refers to households to which children with shared residence are added; that is, no children previously living in these households are affected by shared residence. These three groups of households are mutually exclusive.

This implies that households in group A will see their burden of support decrease, while the opposite is the case for households in group B. Households in group C, on the other hand, can be affected in both ways, with the total effect depending of the number of children going in each direction.

The tables below show the overall economic impact of these three groups of households when comparing the median income before and after adjustments are made for shared residence.

All in all, households in group A are, not surprisingly, financially affected to a lesser extent by the adjustments than households in group B. This is because the equivalised weight of the child with shared residence is reduced less in these households than it is increased for the other parent; that is, households in group B. At the same time, the median value decreases for households in group C, due to the same rationale as above. It is also notable that households with single parents experience the greatest impact in all groups.

Table 6. Group A, equivalised disposable income for households with children 0–19 years old being reclassified as having shared residence

	Number of households	Median value	Median value, adjusted	Change in percent
All households	80 341	202 824	225 804	11.3
Single with children	54 428	185 166	209 084	12.9
Single women with children	39 604	176 657	199 042	12.7
Single men with children	14 824	209 243	237 059	13.3
Cohabiting with children	19 517	247 298	267 314	8.1
Other hh. with children	6 396	239 956	257 478	7.3

Table 7. Group B, equivalised disposable income for households having children 0–19 years old with shared residence added to the household

	Number of households	Median value	Median value, adjusted	Change in percent
All households	79 585	317 559	224 212	-29.4
Single with children	47 353	313 787	205 464	-34.5
Single women with children	12 778	300 915	194 594	-35.3
Single men with children	34 575	318 435	209 765	-34.1
Cohabiting with children	24 002	328 648	258 313	-21.4
Other hh. with children	8 230	312 816	250 143	-20.0

Table 8. Group C, equivalised disposable income for households with children 0–19 years old being reclassified as having shared residence, as well as having children with shared residence added to the household

	Number of households	Median value	Median value, adjusted	Change in percent
All households	11 904	246 135	224 936	-8.6
Single with children	5 307	211 205	191 027	-9.6
Single women with children	2 703	197 323	178 487	-9.5
Single men with children	2 604	224 921	203 806	-9.4
Cohabiting with children	5 389	274 479	251 693	-8.3
Other hh. with children	1 208	266 838	248 069	-7.0

Effects on the household statistics

For many types of household, there are no or small changes in the economic standard when adjustments are made due to children with shared residence. This is because the majority of the households do not have children with shared residence, and are thus unaffected by the adjustments. Figure 2 below shows the change in the economic standard for the household types that mainly, directly or indirectly, are affected by the adjustments.

The figure shows the relative difference (the ratio) between the adjusted and the unadjusted estimates, expressed in percent, for the median values of economic standard. A value above 100 means that the adjusted economic standard is higher than the unadjusted standard, meaning that the unadjusted value is underestimated. Conversely, a value below 100 implies that the unadjusted value is overestimated.

As shown, the unadjusted values for single people with children is underestimated throughout the period, while the opposite is the case for both single people and cohabitants without children (age group 30–49 years old). The ratio for cohabitants with children is at 100 throughout the period, indicating that the economic standard for this group is (on average) more or less unaffected by shared residence.

The main reason for why the adjusted incomes of households without children are lower than the unadjusted incomes, is that households reclassified from not having children to having children (with shared residence) have higher equivalised disposable income than the remaining households. This is not surprising, partly due to the design of the model simulating shared residence (in which income is an important variable), but also because it can be assumed that these households to a greater extent have more robust finances than their counterparts without children.

It is also apparent that the over- and underestimation of the unadjusted values have increased throughout the period for single people, both with and without children.

Figure 2. The effect of shared residence on different types of household

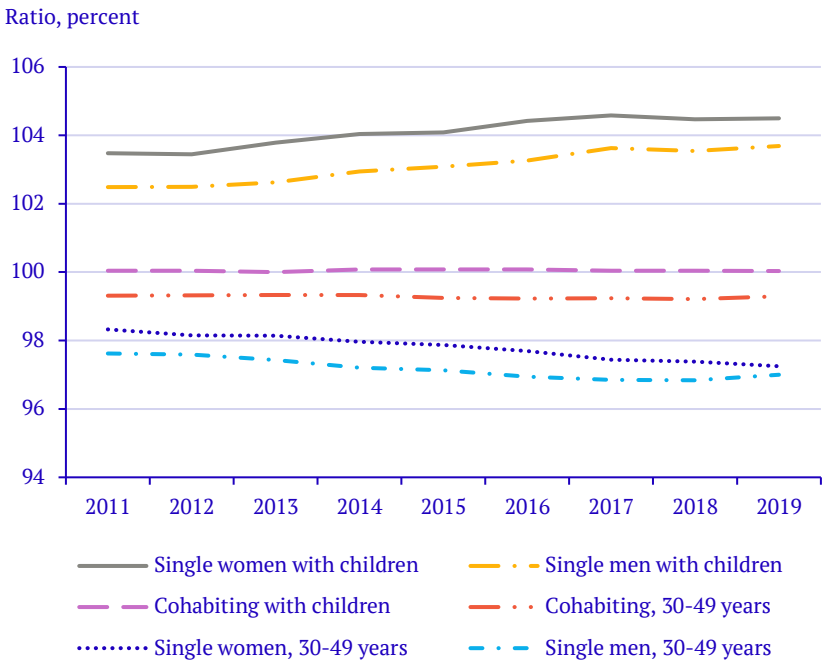
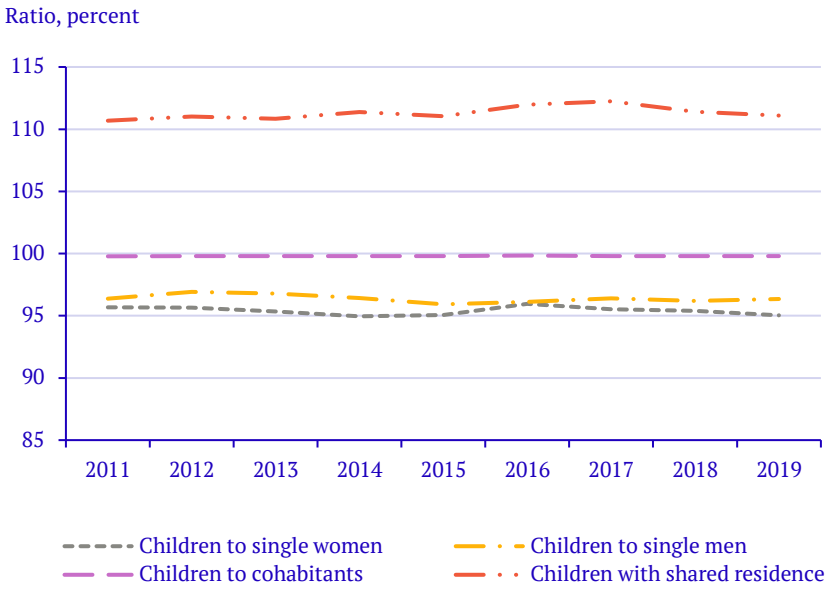


Figure 3 shows the ratios between the adjusted and the unadjusted median values of the economic standard for children. By default, the category Children with shared residence does not exist in the unadjusted statistics; hence, these children are included in the other categories (Children to single women, Children to single men and Children to cohabitants). However, to enable explicitly showing how children with shared residence are affected by the adjustments, their unadjusted estimates are plotted against their adjusted estimates and shown in the diagram as Children with shared residence.

Figure 3. The effect of shared residence on children in different types of households



As shown, the median economic standard is underestimated by more than 10 percent for children with shared residence when this is not taken into account. Conversely, the unadjusted value for children in single households is overestimated by approximately 4 percent throughout the period.

Shared residence is more common in families with high income (Statistics Sweden 2014a), which is also apparent in the design of the logistic model. By using Method 4, in which children with the highest probability of having shared residence are chosen (this also applies to Method 2) and without any other stochastic elements, income distribution becomes relatively compact for children with shared residence (as shown figure 1). Because of this, the at-risk-of-poverty rate for children with shared residence is significantly lower than that of children in other types of households (see table 9 below).

The total number of children at risk of poverty decreases by almost 20 000 when shared residence is taken into account, corresponding to just under 1 percentage point, from 19.1 to 18.2 percent. The at-risk-of-poverty rate decreases by nearly 12 percentage points for the children classified as having shared residence, corresponding to 17 000 children.

Table 9. The at-risk-of-poverty rate by type of household in 2017

	Unadjusted	Adjusted
Single women with children	38.3	34.2
Single men with children	22.6	18.9
Cohabiting with children	9.9	9.7
All children 0–19 years old	19.1	18.2
Children to single women	45.9	50.7
Children to single men	25.3	30.5
Children to cohabitants	12.8	13.0
Children with shared residence	18.7	6.9

Both single men and women with children have a lower at-risk-of-poverty rate after the adjustments. The difference between the adjusted and the unadjusted rate is amplified the more children there are in the household. This is also the case for cohabitants with children.

Effect on overall income distribution

There are only small effects on overall distribution of income when the statistics are adjusted for shared residence. The mean and median income decreases due to the increased burden of support in the population as a whole owing to the changes made in the equivalence scale. One consequence of the lower median income is that relative income poverty is reduced (except for the 40 percent poverty line).

The Gini Coefficient is affected slightly, with a decrease of 0.001, from 0.322 to 0.321 in 2017. This result is also robust over time, with the difference between the adjusted and unadjusted Gini Coefficient being constant throughout the period.

From the percentile ratios, it appears that the adjustments have a somewhat compressing effect on the tails of the income distribution, and in particular the top incomes.

Table 10. The effect of shared residence on the distribution of equivalised disposable income in 2017

	Unadjusted	Adjusted	Change (adjusted – unadjusted)
Median value, SEK	248 425	247 807	-618
Mean value, SEK	296 717	296 000	-717
Gini coefficient	0.322	0.321	-0.001
Below 40% of the median value, %	3.8	3.8	0.0
Below 50% of the median value, %	8.1	7.9	-0.1
Below 60% of the median value, %	14.9	14.6	-0.3
Below 70% of the median value, %	23.2	22.9	-0.3
Above 200% of the median value, %	7.0	7.0	0.0
P80/P20	2.21	2.19	-0.02
P90/P10	3.36	3.34	-0.02
P95/P05	5.21	5.18	-0.03
P05/P50	0.43	0.43	0.00
P10/P50	0.53	0.54	0.00
P20/P50	0.66	0.66	0.00
P80/P50	1.46	1.45	-0.01
P90/P50	1.79	1.79	-0.01
P95/P50	2.25	2.24	-0.01
P99/P50	4.68	4.66	-0.03

Concluding remarks

The aim of this paper has been to highlight quality issues in the income distribution statistics with the increasingly common concept of shared residence for children with separated parents, as well as to propose a methodology to address these issues.

As demonstrated, the impact on overall income distribution is fairly minor. However, when looking at specific types of households, the effect is quite significant. It is also worth noting that we have only looked at the effect of shared residence in this paper, although it can also be assumed that other types of living arrangements for the children have a financial impact on both households, beyond direct income transfers between the parents.

As a quality-enhancing measure, we see advantages in including the concept of shared residence in the statistics, as it would enhance the relevance of the statistics in the analysis of the financial situation of different types of household. Especially since it is conceivable that shared residence will become more common in the future, and thus have an increasing impact on the statistics.

However, when introducing a model into the production of the statistics, it must be considered that the model has to be evaluated, and possibly revised, at certain intervals. In this case, that would imply a need to conduct surveys on both the actual living arrangements of children of separated parents, as well as their financial situation.

Another aspect to consider when making changes in the statistics is comparability over time. Whenever changes are made in the equivalence scales or new types of households for children are introduced, time series will be affected. Such changes must be handled with great care in order to reduce any potential negative impact for users of the statistics.

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Appendix 1

A logistic model is used to estimate the probability of each child not living with both its parents of having shared residence. Shared residence is the dependent variable (S) and the model consists of 26 significant independent variables. Every child in the population is assigned a probability between zero and one. By using these probabilities, the total number of children with shared residence can be estimated, as well as which of these children should be included in that category.

$$log\frac{P(S)}{1-P(S)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_{26} X_{26} + \varepsilon \qquad \varepsilon \sim N(0, \sigma)$$

β_0=-0.0898 Intercept

β_1= 3.5539 X_1= Maintenance support with shared residence

β_2=-2.6180 X_2= Maintenance support

β_3=-2.0613 X_3= Parents live in different counties

β_4=-1.9193 X_4= Child under 2 years old

β_5=-0.5076 X_5= Father under 30 years old

β_6=-0.3085 X_6= Father 49–64 years old

β_7=-0.8401 X_7= Father 65 years or older

β_8= 0.6028 X_8= Mother under 30 years old

β_9= 0.3627 X_9= Mother 30–38 years old

β_{10}=-0.3953 X_{10}= Mother 49–64 years old

β_{11}=-0.7157 X_{11}= Assessed income from mother < SEK 124 300

β_{12}=-0.4456 X_{12}= Assessed income from mother SEK 124 300–232 399

β_{13}=-0.3340 X_{13}= Assessed income from father < SEK 124 300

β_{14}=-0.2256 X_{14}= Assessed income from father SEK 124 300–232 399

β_{15}=-0.5259 X_{15}= Assessed income from father ⩾ SEK 379 700

β_{16}= 0.3255 X_{16}= Assessed income from parents ⩾ SEK 379 700

β_{17}=-0.5259 X_{17}= Foreign born father

β_{18}=-0.3209 X_{18}= Foreign born mother

β_{19}=-0.4792 X_{19}= Mother having sickness and activity compensation

β_{20}=-0.4456 X_{20}= Father having social assistance

β_{21}= 0.2900 X_{21}= Mother having business income

β_{22}=-0.2899 X_{22}= Father having sickness compensation

β_{23}= 0.2610 X_{23}= Mother having study grants

β_{24}= 0.2451 X_{24}= Father being single parent (household type)

β_{25}= 0.2070 X_{25}= Mother being single parent (household type)

β_{26}= 0.1707 X_{26}= At least one child is a boy

* Assessed income is total income from employment and business minus the general deduction.

In order to calculate the probability (P) of shared residence (V) of child (i) the following equation is used.

$$P(V_i) = \frac{e^{\beta_0+\beta_1 x_{1i}+\beta_2 x_{2i}+\cdots+\beta_{26} x_{26i}}}{1 + e^{\beta_0+\beta_1 x_{1i}+\beta_2 x_{2i}+\cdots+\beta_{26} x_{26i}}}$$

Appendix 2

Table A2.1 Step by step effect when estimating adjusted economic standard, median value, SEK thousands

	Unadjusted	Household type	Equivalence scale	Children's income	Total adjustments (incl. average of the parents)
All persons	**248.4**	**248.4**	**247.8**	**247.8**	**247.8**
All persons 20- years	**256.6**	**256.6**	**255.3**	**255.3**	**255.3**
Women living alone	172.4	171.0	171.0	171.0	171.0
20-29 years	192.1	191.8	191.8	191.8	191.8
30-49 years	251.9	245.3	245.3	245.3	245.3
50-64 years	246.5	246.3	246.3	246.3	246.3
65-79 years	161.5	161.5	161.5	161.5	161.5
80- years	151.9	151.9	151.9	151.9	151.9
Men living alone	220.3	214.6	214.6	214.6	214.6
20-29 years	212.9	212.4	212.4	212.4	212.4
30-49 years	266.0	257.6	257.6	257.6	257.6
50-64 years	257.2	254.3	254.3	254.3	254.3
65-79 years	179.5	179.5	179.5	179.5	179.5
80- years	169.2	169.2	169.2	169.2	169.2
Single women with children	166.2	171.2	173.9	173.8	173.8
1 child	182.1	184.8	186.1	186.0	186.0
2 children	160.0	168.0	172.2	172.1	172.1
3+ children	131.1	135.5	138.7	138.6	138.6
Single men with children	201.7	239.1	208.8	209.1	209.1
1 child	215.4	241.6	221.4	221.6	221.6
2 children	189.9	242.0	201.3	201.6	201.6
3+ children	154.4	201.1	167.0	167.3	167.3
Cohabiting without children	306.7	305.5	305.5	305.5	305.5
20-29 years	307.4	307.0	307.0	307.0	307.0
30-49 years	364.8	361.8	361.8	361.8	361.8
50-64 years	376.3	376.1	376.1	376.1	376.1
65-79 years	258.3	258.3	258.3	258.3	258.3
80- years	198.9	198.9	198.9	198.9	198.9
Cohabiting with children	257.4	258.6	257.5	257.5	257.5
1 child	282.3	283.2	282.6	282.6	282.6
2 children	257.4	258.9	258.2	258.2	258.2
3+ children	207.8	212.6	210.6	210.6	210.6
All persons 0–19 years	**227.1**	**227.1**	**228.4**	**228.3**	**228.5**
Children to single parents	161.9	153.7	153.9	153.9	153.9
Children to single women	154.6	147.4	147.7	147.6	147.6
Children to single men	193.3	186.6	186.2	186.2	186.2
Children to cohabiting	244.6	244.5	244.1	244.1	244.1
Children other households	205.6	203.5	203.1	203.1	203.1
Children with shared residence	200.6	200.6	222.5	221.7	225.2

Table A2.2 Step by step effect when estimating adjusted economic standard, at-risk-of-poverty rate, percent

	Unadjusted	Household type	Equivalence scale	Children's income	Total adjustments (incl. average of the parents)
All persons	**14.9**	**14.9**	**14.7**	**14.7**	**14.6**
All persons 20- years	**13.6**	**13.6**	**13.5**	**13.5**	**13.5**
Women living alone	30.7	31.1	30.7	30.7	30.7
20-29 years	30.1	30.2	30.0	30.0	30.0
30-49 years	21.1	22.9	22.8	22.8	22.8
50-64 years	23.2	23.2	23.1	23.1	23.1
65-79 years	30.7	30.7	30.2	30.2	30.2
80- years	43.5	43.5	42.7	42.7	42.7
Men living alone	24.6	25.4	25.3	25.3	25.3
20-29 years	30.3	30.5	30.4	30.4	30.4
30-49 years	20.8	23.1	23.1	23.1	23.1
50-64 years	24.6	25.1	25.0	25.0	25.0
65-79 years	24.2	24.2	23.9	23.8	23.9
80- years	24.2	24.2	23.8	23.8	23.8
Single women with children	38.3	36.0	34.2	34.2	34.2
1 child	30.2	29.4	28.8	28.8	28.8
2 children	40.6	35.8	33.0	33.0	33.0
3+ children	67.0	61.9	58.4	58.5	58.5
Single men with children	22.6	15.9	19.0	18.9	18.9
1 child	19.0	14.9	16.4	16.4	16.4
2 children	24.2	14.4	18.5	18.4	18.4
3+ children	45.9	27.9	37.5	37.1	37.1
Cohabiting without children	4.7	4.8	4.7	4.7	4.7
20-29 years	5.5	5.6	5.6	5.6	5.6
30-49 years	5.0	5.3	5.2	5.2	5.2
50-64 years	3.6	3.6	3.6	3.6	3.6
65-79 years	4.5	4.5	4.4	4.4	4.4
80- years	8.4	8.4	8.2	8.2	8.2
Cohabiting with children	9.9	9.7	9.7	9.7	9.7
1 child	6.9	7.0	7.0	7.0	7.0
2 children	7.6	7.5	7.5	7.5	7.5
3+ children	21.8	20.4	20.5	20.5	20.5
All persons 0–19 years	**19.1**	**19.1**	**18.4**	**18.4**	**18.2**
Children to single parents	41.2	47.0	46.7	46.7	46.7
Children to single women	45.9	51.2	50.7	50.7	50.7
Children to single men	25.3	30.5	30.5	30.5	30.5
Children to cohabiting	12.8	13.0	13.0	13.0	13.0
Children other households	24.8	25.6	25.5	25.5	25.5
Children with shared residence	18.7	18.7	9.3	9.5	6.9

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