
The Child as a Family Asset? The Modelling of the Family' Economic Loss in Case of Premature Child Death

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Abstract:

Purpose: EU policy investing in children involves a social assessment of the high value of household spending on having and bringing up children. Therefore, the question arises as to what loss the household as investor will bear in the event of the child's death, and what the economic value of the child. The research questions are as follows: How to assess the economic importance, economic value of a child in a household? What factors influence this economic value? Is it necessary to model it in time?

Design/Methodology/Approach: We present the loss suffered by a household as a result of a child's death, based on selected economic theories and concepts for estimating human life and goods, assuming the child is a good of a given value. We build the model using financial mathematics, discounted cash flow calculations, annuity calculations, as well as social elements and intergenerational transfers.

Findings: The obtained results indicate the high economic value of the child for the current, but also - and even the most - the future economic situation of the household. The compensatory awards in liability cases do not cover even the expenses incurred for the lost asset. It may lead to financial instability of individual and externalisation of loss, especially when it comes to support during old age.

Practical Implications: The modelling concept could determine the minimum economic and ethical value of the child from the point of view of the household and allow evaluation in the financial decisions and loss compensation instruments areas, such as life insurance, liability claims or the systemic policy of supporting fertility and investing in children.

Originality/Value: The study offers an in-depth insight into modelling of the household financial loss and valuation of the child.

Keywords: Economic loss, family behaviour, household finance management, child value.

JEL codes: D14; G50, J17.

Paper type: Research study.

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1. Introduction

In 2018, in the EU-28, 29.2% of private households were households with children, which is decreased by more than 2 percentage points from 2008 (Eurostat, 2019). EU policy is aimed at supporting investment in children - in terms of the fertility rate and further of improvement of the economic conditions of children living, as for example, Commission Recommendation of 2013 Investing in children breaking the cycle of disadvantage (EU, 2013 and OECD, 2011). It implies the social and economic importance and high value assigned for household expenditures for having and raising children. Premature death of a child causes a loss for the whole society, which is analyzed from an economic point of view in researches on the statistical value of life, which apply mostly willingness to pay or willingness to accept approaches, discussed in theoretical underpinnings. These methods are often used when public safety, including work and investment in transport or environment investment are considered.

Premature death of a child hurts also the household which over a certain period of time made investment in child. The emotional aspect of loss in child's death case is obvious, but the economic aspect is not always evident, outside some costs such as funeral costs. In practice, the valuation attempt is performed in two areas:

- claims in tort liability against those responsible for the premature child's death;
- life insurance when the policy covers the child's life.

In both areas it is necessary to make a loss assessment, either by relatives or by institutions such as a court or insurer. In practice, as mentioned, these decisions are often not based on the financial analysis of the loss. In life insurance cases, the valuation is done by "rule of thumb" or "ability" to pay a specified premium. In tort law, the dilemma arises while the legal framework grants often relatives a claim for immaterial loss such as pain and harm rather than for the economic loss.

Based on the review of rulings and system solutions in the area of child's death claims we identified huge differences in the valuation of the child or the loss of the household (parents) caused by the child's death. For example the case of parents in Poland who filed a claim for compensation - formulated as for non-economic loss - of PLN 1 million (c.a. EUR 239,808) per parent for the death of a 4-year-old child caused by a falling tree in the city park. The court of first instance found the claim excessive and awarded PLN 0.3 million (c.a. EUR 71.942). However, the court of the second instance changed the judgment, considering that it was still an excessive amount ("grossly overvalued"), and the appropriate amount was set as PLN 0.16 million (c.a. EUR 38.369) per parent. We also observe a huge variation in the valuation in other markets. For example, in Germany, the non-economic loss resulting from a child's death case is estimated by the judiciary at the range of EUR 5,000 to 20,000. For example in the case of LG Bochum against LG Bochum, Urt.

29/10/2015 - I-2 O 574/12, the parents of the deceased boy received EUR 20.000 each. Some Italian courts also apply their own internal guidelines in the event of compensation for the death of a relative by setting ranges of values. As reported by Ponzanelli and Baroni (2010), the court in Milan established for the case of pain and suffering of one parent resulting from the death of a son compensation from 106.376 to 212.752 euros.

Also when examining the Tables or guidelines used in some EU countries rarely refers to fatal cases, the amounts indicated in them (often as the basic, requiring consideration of individual circumstances), it should be pointed out that they also deviate significantly from the values set in the article. For example, in Belgium, Tables Indicatieve tabel van forfaitaire schadevergoedingen bij Verkeersongevallen introduced as supporting case-law guide indicates the basis amount - however for non-economic loss - EUR 12.500 in case of death of the child living together with parents and EUR 5.000 if living separately.

The different research models and systemic solutions in US and some European countries focused on non-economic loss (pain and suffering) in the context of value of life have been discussed in (Kwiecień, 2015), where also the other model was proposed, next developed in Jędrzychowska and Kwiecień (2019).

Recognizing these problems the authors propose an approach for modelling economic loss suffered by the household in the case of a child's premature death. The authors assume that it should indicate the minimum values considered in individual and systemic decisions. Non-economic loss such as pain, suffering and harm could or should increase this basis.

The aim of the article is therefore to present a model that combines theories related to the valuation of life and the principles of financial calculations. The approved model is based on a specified, rising annuity (in other researches has been used a model of increasing actuarial annuity (Jędrzychowska, 2017)). The presented calculations illustrate the value of the household loss related to the death of the child and show the size of this loss depending on the moment when death occurs. Knowledge about the components and the size of the loss is necessary to properly manage the risk of its occurrence.

The theoretical considerations are illustrated with examples based on social and economic factors occurring in Poland. The study used data from household budgets in Poland, as well as a study of the time spent by family members in Poland on individual household work. Hourly rates for types of work and their growth dynamics are also taken from reports of the Central Statistical Office in Poland. The time range of data is 2006-2016 (not all reports are published every year). The discounting rate was determined based on the level of the maximum technical rate in Poland for the years 2006-2016 based on the Communications of the Polish

Financial Supervision Authority regarding the amount of the maximum technical rate for the years 2006-2016.

The proposed method (model) combines elements of financial mathematics (discounted cash flow account and annuity account) and social elements – the roles of individual members of the household are taken into account. Each time, in the calculations, a distinction was made for the value of the loss depending on the biological structure of the household.

The article has been divided into four parts. Initially, the theoretical foundations of the problem are presented. Then in the second section discusses the concepts of calculating losses and the economic background of Poland for this valuation. The third subsection gives a numerical illustration. At the end, reference is made to other studies, conclusions are drawn, and further areas of relevant research indicated.

2. The Theoretical Underpinnings

The authors' model combines and implements methods from the theory of value such as cost of production, willingness to pay and utility theory. Cost of production is conceived according to the classical theory of economics (Murphy, 2006), which states that the value of a good is equal to the cost of its production. Willingness to pay (WTP) is used in statistical life valuation (Blomquist, 1981; Knieser, Viscusi and Ziliak, 2013; Viscusi, 2003) through the prism of expenditure; investments that a person is willing to pay to avoid an undesirable event, for additional safety. The WTP approach is used to measure the statistical value of life (VSL), involved mainly in the analysis of projects affecting the risk of death.

Research indicates there is considerable controversy in comparison with the valuation of the value of life as such (Freeman, 2003; MacLean, 1990). This WTP method is modified by the authors to take into account the expenditure that a household is willing to pay in order to have a child, which also indicates value simply as the costs that parents are willing to take on. This is related to expected benefits and utility theory from the psychological school of economics (the so-called "Austrian school", which includes E. B. de Condillac and C. Menger) (Stankiewicz, 2000). This theory presents an individualized value, and the usefulness is determined by the ability of a good to satisfy the specific needs of an entity (the investor). Indeed, the assumption that a child is a specific kind of good – a long-term asset that causes the flow of well-being and has a certain value – was the basis of Becker's fertility model (1960). The concept of the valuation whole loss model is based on the aforementioned economic methods, according to the period or component of the loss:

- a) expenditures incurred by the child until death (cost of production);
- b) the loss of expected benefits in the future (the utility);
- c) planned expenditures (willingness to pay).

Our approach takes into account research on the valuation of goods, including the value of human life (in this instance, the value of the child), among others Hofflander (1966), Schultz (1961) and Becker (1975), Leimer *et al.* (1999), Letablier *et al.* (2009) in addition to overviews and more sociological studies such as Zelizer (1994). In these studies, both economic (cost of production, utility theory, etc.) and non-economic (hedonic damages, willingness to pay or accept, etc.) aspects of value are considered; however, this is more often from the point of view of society than of the individual household.

The household perspective is however analyzed in the area of forensic economy, by involving economic approach to claims and loss valuation. Ireland and Ward (1994) applied investment approach to valuing the child's life, the expenditures have been estimated by Ward (1989) and then extended by Ireland (1990). Their works have practical implications in connection with the US system of liability claims and awards, which more often than in Europe relies on the use of economic theories and expertises. The broader conceptualization of the cost of children we found in Folbre (2008), expanding the conventional picture of the circular flow of exchanges between households and businesses to the movement of economic resources (money and time) among men and women, to children, and back again. She indicates also importance of energy, time and money spent on children for market economy, which move back to the macro approach in part. The utility as the valuation factor has been involved in Baum and Rodgers (2018) calculating the present value of lost household production in wrongful death cases (deceased mothers, not children).

In the Polish market, there is no research in this area in terms of micro, individual loss from the point of view of the household and personal finances. It should be noted that research on the so-called statistical value of life (VSL) – and therefore in the macro-social approach in which VSL was measured for Poland by means of willingness to pay or willingness to accept (Giergiczny, 2006a; 2016) and in the study on the valuation of an additional year of life (Valuation of Life Year Gained (VOLY) as part of the European Commission project NEEDS – was carried out in Poland in 2004-2006.

A single questionnaire was implemented in 8 countries participating in the project. The project was implemented in Poland, the Czech Republic, Hungary, France, the UK, Switzerland, Spain and Denmark. In Poland, the survey covered 150 residents of Warsaw (Markiewicz, 2007). WTP is also used in cyclical studies of the costs of road accidents and collisions based on the capital and restitution method, called Pandora, developed in the 1990s derived from the recommendations of the European Commission. Up to now, it is based on basic components of accident costs such as costs of treatment and rehabilitation, costs of lost production and reduced costs (Road and Bridge Research Institute, 2015). In this project, mainly the macro perspective is calculated, some internal costs are considered only in part on the basis of claims paid by insurance companies and granted from perpetrators in criminal trials (the same point of view is in Smith, 1997). But this provides only a picture of

the compensation amounts paid, rather than an assessment of their adequacy in meeting actual household loss. However, this study captures the problem of road accident victims very widely. This motivated us to make a broad analysis of the financial consequences for the household. Hence our idea of valuing the work done for the child and the work done by the child.

In this article, the authors consider only the first two components of the model (a, b), that constitute economic loss:

- actual losses – financial and non-financial – in the form of expenditures incurred by the child until death (cost of production);
- lost benefits – as reasonably expected in the future (the utility).

The calculations of planned expenditures (c), which due to death will not be made by the household, are omitted. This component is discussed in another work of the authors (Jędrzychowska and Kwiecień, 2019), allowing for a determination of the non-economic part of the loss and complementing the model of the whole loss valuation.

3. Valuation of Economic Loss Components

This section will discuss the economic loss of a household in the event of a child's death as identified in the introduction:

- a) expenditures incurred by the child until death (cost of production);
- b) the loss of expected benefits in the future (the utility).

These components of economic loss are described using two elements each:

- (a) expenditures by:
 - financial expenses of the child;
 - household members' own work for the child.
- (b) loss of expected benefits that the household could reasonably – in legal and social(moral) terms – expect from the child, but which, due to the child's death, will not be received from:
 - the child's own housework;
 - lost care (support) in old age.

Research on intergenerational transfers indicates several models on which these transfers are based. One of them is the "exchange model". In this model, the transfers are in a form of investment made by parents, who predict that they will need support in their old age. Parents incur the current costs of investing in their children, for example in the form of expenditure on education, health, housing, loans, and raise funds for the future (promise of inheritance) so that their children will behave altruistically in the future (Coall and Hertwig, 2010). So we have to deal

with the exchange between a self-affecting parent and his child. The second model is "reciprocity". Reciprocity usually refers to a long-term exchange. Adult children feel obliged to help their parents who have previously supported them, and use mainly transfers of time, help and care as a form of debt repayment (Leopold and Raab, 2011). The parent wants his child to provide certain services to him in exchange for current or future transfers. For this reason, we cannot overlook the aspect of lost care in old age (in the case of death of a child), because according to the theory of intergenerational flows, this help is inscribed in the thinking of children and parents.

Financial support from parents is only to a small extent dependent on the income of children and parents. The resource of wealth or the income of the donor do not matter to his willingness to give money to his children. If a parent wants to provide support for the future, he must bear the cost (Laferrere and Wolff, 2006). However, the richness of parents will have a significant impact on the form of transfers. If transfers can take place both in the form of services (time) and money, parents will be more willing to offer financial support when their income is high and services when their income is low. In connection with the barrack of access to data on households in relation to childcare, but taking into account additionally the income of parents, we omit this aspect. We used average values, both expenses and work performed for the child.

Intangible transfers are a form of exchange based on the principles of solidarity and reciprocity. Their immaterial type is usually represented by care and so-called activity that builds interpersonal relationships as joint exits, visits, phone calls and the like. Practical help can take the form of even help at home when a person is ill or infirm. The family is also a source of transfers in the form of advice or emotional support in difficult moments. Intangible transfers, relatively stronger than cash donations, affect the formation of bonds between family members, which results from their personal nature.

Nowadays, families change in nature and characteristics. There is a departure from the formalized nature of relationships, individualistic attitudes become more common, expectations of a relationship with another person are changing, the number of children in the family decreases and the relationships persist. Bengston (2001) suggests that the changes taking place in families will result in intra-intergenerational transfers within the family becoming more important. There are three reasons for this:

- 1) increasing life expectancy, which means that the number of years of life shared by parents and children will increase;
- 2) the growing role of grandparents and grandmothers and other relatives in the implementation of the family function;
- 3) strength and durability of intergenerational solidarity (Bengston, 2001).

In our opinion, it should also include social changes such as migration and the disappearance of multigenerational families, and against this background the growing role of financial support (Krzyżanowski, 2013; Abas *et al.* 2009). Studies show importance of remittances received from migration for minimizing economic risk and overcoming capital constraints (Chant and Radcliffe 1992; Stark and Taylor 1991) and even well-being (Adhikari, 2011).

The calculations below are based on an increasing annuity. All values are in the Polish currency, the authors wish to indicate that the exchange rate was 4.17 PLN to the euro (December 2019).

3.1 Expenditures of Household on Child

This section will indicate the costs that the family incurred for the child until his death. The economic value of a child's life was determined for particular moments in its life, as a combination of two components. The real loss (the value of expenses incurred up until the child's death) determined in this way could be the base for determining the amount of compensation including financial expenses and unpaid work performed by the household members for the child. The second component has a specific economic value, which does not detract from the fact that the performance free of charge.

3.1.1 Financial Expenses

In order to estimate this value, it is necessary to calculate what part of its total expenses the household spends on the child. The difference between total household expenses (two adults) with a certain number of children (i) and a two-person household with no children, divided by the number of children method for calculation cost of a child in a household with two adults (formula 1) (Jędrzychowska, Pietrzyk and Rokita, 2018):

$$AVCC_i = \frac{C_{Ci} - C_C}{i} \quad (1)$$

where i is the number of children in the household, C_C is the total expenses of a couple household without children, C_{Ci} is the total expenses of a couple household with i children, and $AVCC_i$ is an average variable cost of a child in a household with two adults and i children.

This method assumes that the variable cost of each child in the household is on the same level. The average cost of a child depends on the biological type of the household i.e., on the number of children in a household with two adults. But it is based on the assumption of the same variable cost of each child, relative to the cost of maintaining two adults without children. In this part of analysis we used the report *Household Budgets Survey in 2006* (and the subsequent reports for the years 2006-

2017) published by the Central Statistical Office in Poland (2006a). From this report were obtained the following values for the monthly average costs of a child in particular types of family household (Table 1). Due to the fact that the calculation was based on assumptions of the value of money in time, the average monthly growth rate of these values was also determined. Table 1 contains the average monthly net income per person in household. It was considered that the cost values obtained should be scaled proportionally to the income of a given household by the ratio between its income and the estimated average income. This is based on the assumption that expenditures on a child depend on the wealth of the household. The impact of wealth on financial expenses per child and work for the child was mentioned in the section on inter-generational flows (section 2 of the article).

Table 1. *The monthly costs of a child in a household by biological type of household*

	Household composition - number of kids		
	With one child	With two children	With three or more children
Average net income per capita	175.78 EUR	107.70 EUR	20.85 EUR
Monthly cost of one child	149.35 EUR	96.52 EUR	27.93 EUR
Average monthly growth rate of the child's cost	0.50%	0.72%	1.66%

Source: *Own calculation based on the "Household Budgets Survey in 2006" and subsequent reports up until 2016.*

It should be noted that the rate of increase in expenses for children in families with three or more children is high. This may be due to the fact that programmes supporting families with more children have been introduced in Poland. These are local programmes, e.g. a large family card, or nationwide programmes, e.g. 500+ programme (which provides an additional PLN 500 equivalent to about EUR 120, which the family receives for the second and each subsequent child).

Table 2. *The present value of expenses incurred by a child, depending on the type of family and the moment of the child's death (in EUR)*

Household	with one child	with two children	with three or more children
Age of the child at the time of death	Value of expenditures incurred up until death	Value of expenditures incurred up until death	Value of expenditures incurred up until death
0	0.00	0.00	0.00
5	11,257.84	7,800.72	3,072.88
10	28,303.28	21,103.29	11,835.44
15	53,464.60	43,094.64	35,970.54
20	89,934.34	78,720.31	101,511.87

Source: *Own calculation based on the Household Budgets Survey in 2006 and subsequent reports up until 2016.*

3.1.2 Non-financial Expenditures on Child

Undoubtedly, the expenditures on children are not only directly financial, but also the household members' own work for the benefit of the child, which mean giving up leisure time or professional activity. These works include cooking, cleaning, shopping, transport to school and additional classes, doing homework with children, talking, taking care during diseases, etc. There is no doubt that this work has real economic value, as could be replaced by external services. In order to make a valuation of the parents' work for the child, we used the report of the CSO's *Time Use Survey 2013* (CSO, 2013), a study containing information on the average time spent performing daily activities by a person in Poland. Some of this activities can be considered as related to childcare (Table 3). So, if in the second numerical example we consider a child aged 20, we assume that the household work for him is at the same level as in the last 3 years, like the one from the age of 17.

Because some of the activities (such as food processing, work relating to the preparation and maintenance of clothes or shopping) are performed for all members of the household, we included information of a number of household members in our calculations. The received values of time in these categories were divided by the number of household members. However, time dedicated only to child (eg., childcare and transport to school) was shared only by the children who are part of the household. Table 3 contains the categories of work for the child selected from this report and their duration (in minutes) each day. These are values for a family with one child.

Table 3. Time (in minutes per day) to perform activities related to raising a child

	Two adults with a child			
	of 6 years old	of 17 years old	of 6 years old	of 17 years old
	Women		Man	
Food processing	105	118	26	30
Work related to maintaining order	49	51	25	36
Work related to the preparation and maintenance of clothing	16	20	1	1
Shopping and use of services	27	32	17	20
Childcare	201	38	92	18
Commuting relating to looking after children	15	8	7	4

Source: Own work based on the *Time Use Survey 2013*.

The values given in Table 3 illustrate the fact of the mother's greater involvement in caring for the child. Of course, it is worth analysing this behavioural phenomenon also in the financial aspect as it does, for example, Scott *et al.* (2017). Based on market rates and the duration of work, we have valued the work of parents for the child. For this purpose we found the pay rates per working hour for employees of relevant professions. As before, CSO reports were used, this time from the study

Structure of wages and salaries by occupation in October 2006 (CSO, 2006B) and subsequent reports up until 2016 (reports are issued every two years). So we looked for analogies with work market. Therefore:

- work relating to order and to the preparation and maintenance of clothes, as well as shopping and using services, can be treated in the same way as cleaning tasks, which is why they were given a valuation in the category of “household aids and cleaners” (average hourly rate: PLN 10,10 = EUR 2,42 monthly increase rate 0.0045);
- work associated with food processing was valued according to “cooks” (average hourly rate: PLN 14,68 = EUR 3,52 monthly increase rate 0.0096);
- childcare according to “child carers and teaching assistants” (average hourly rate: PLN 12,40 = EUR 2,97 monthly increase rate 0.0038);
- the commuting to school according to the category “drivers of passenger vehicles” (average hourly rate: PLN 13,71 = EUR 3,29, monthly increase rate 0.00316).

Based on these assumptions, the value corresponding to “cost of child” at the time of child’s death was set. Similarly to the case of child expenses, this value shifts according to the age at which the child dies, in order to take into account the fact that part of the work for the child has already been done (therefore the results of a job have been lost). We valued only the work actually performed for the child, the following values were obtained (Table 4).

Table 4. *Value of the household’s work for the child before the death of the child (for selected age of child at time of death) (in EUR)*

Age of the child at the time of death		0	5	10	15	20
Women	with one child	0.00	30,000.42	59,546.21	100,183.86	144,690.16
	with two children	0.00	16,920.95	35,471.35	62,547.57	92,422.98
	with three or more children	0.00	12,048.93	25,926.87	46,680.64	69,646.48
Men	with one child	0.00	12,707.53	24,414.44	39,489.59	55,595.64
	with two children	0.00	6,973.17	14,075.08	23,780.41	34,214.43
	with three or more children	0.00	4,896.54	10,130.53	17,467.85	25,376.26

Source: *Own calculation based on Structure of wages and salaries by occupation in October 2006 and subsequent reports up until 2016.*

3.2 Lost Benefits of the Household

The extent of economic damage is also determined by *lucrum cessans*. This part of loss is calculated for assessment of cash flow, which in fact are lost benefits that the

household could have expected from “investing” in having a child. These are primarily:

- lost child labour input into the household;
- lost care (support) in old age.

The scope of these benefits depends on many individual circumstances, as well as cultural and environmental factors that are beyond the scope of consideration. Instead, the authors will try to model a certain “typical” situation. Children in traditional society were useful not only “here and now”, but also in the future, because they were a safeguard in their old age for their parents. With the emergence of pension systems (especially capital), this role of children has decreased. However, it cannot be considered that it ceased to exist. First of all family ties (the exchange model and the reciprocity model) still make children obliged to care for their parents during their old age. Secondly in view of the current demographic situation (small fertility, an aging population), these pension systems, which are in part based on an intergenerational exchange, do not provide good protection in old age.

3.2.1 Child’s Services Performed on Behalf of Household

In this part, for the child’s contribution for its household, we also used the CSO *Time Use Survey 2013* report (CSO, 2013). This report takes into account the time spent by children on housework in two age groups in 10-14 and 15-17. The calculations therefore include only those years; the age ranges below 10 years and above 17 years received the value 0. It is important to understand that the valuation relates to the loss, i.e., if the child dies at the age of 0, the household loses all its future child’s contributions from 10 to 17 years of age. For this reason, we assumed that the child’s death at 18, 19 and 20 does not result in a loss to the household of the child’s housework, because it is assumed that, by the end of 17 years, it was included in household’s work. Table 5 shows the value of a child’s lost work calculated according to the child’s age at time of death.

Table 5. *The value of a child’s work calculated for age at time of death (in EUR)*

Child’s age at the time of death	0	1	2	3	4
Value of the child’s work	6,753.64	6,962.30	7,177.42	7,399.18	7,627.79
Child’s age at time of death	5	6	7	8	9
Value of the child’s work	7,863.47	8,106.43	8,356.89	8,615.1	8,881.28
Child’s age at time of death	10	11	12	13	14
Value of the child’s work	9,155.68	8,257.94	7,380.85	6,523.93	5,686.72
Child’s age at time of death	15	16	17		
Value of the child’s work	4,868.77	3,849.18	2,853.04		

Source: *Own work based on the Time Use Survey 2013.*

Also in this case the composition of the household has impact of value. It should be taken into account that, in a household with one child (i.e., a couple household), the household receives two-thirds of that value, because one third of the child’s

housework is for his or her own benefit. Analogue, for a couple household with two children it is three-quarters, and for three children is four-fifths, etc.

3.2.2 Lost Support During the Old Age

To estimate this component the information on the average life expectancy of an x-year old was taken from the Life Tables for Poland 2016. These values were compared - for women and men apart - with the average life expectancy at full health. This value was determined for Poland at 59.1 years for men and 63.4 years for women (according to Eurostat). On this basis we have the life expectancy and health status (in months), and thus the need for care for x-year-olds parents (Table 6).

Table 6. *Average life expectancy in months - in health and without health*

Age	Men		Women	
	Average life expectancy (months)			
	in full health	without full health	in full health	without full health
20	470	184	520	229
25	410	187	460	230
30	350	190	400	230
35	290	194	340	232
40	230	198	280	233
45	170	204	220	236
50	110	213	160	240

Source: Own work based on data from Eurostat.

For calculation was made the assumption that following a deterioration in health, a person needs one hour of care from its closest family member for the first 5 years, three hours of care and help during the next 5 years of health deterioration, five hours in the next five years, and after 15 years of progressive deterioration in health, 10 hours of support is required. The assumption regarding the need for care in old age is one of many that appear in the literature. This is where "stepped" growth was adopted, but you can also use the solutions appearing in the literature (Shin and Kim, 2018). This support does not have to be a form of care or medical activities at once, but it concerns help in everyday life, eg., help in transport, shopping or cleaning. The hourly rate was based on the average hourly rate estimated in the CSO's *Structure of wages and salaries by occupations in October 2006* report (CSO, 2006b and subsequent reports up until 2016). The rate for the category "healthcare and social assistance" was adopted in the calculations. The initial gross hourly wage amounts to PLN 20,67 = EUR 4,96, and the monthly growth rate is 0.002869.

Table 7. *The present value of care costs in case of loss of health (in EUR)*

Parent's age at the time of the child's death	The present value of care costs	
	Men	Women
20	101,934.23	162,681.40
25	103,989.56	164,025.41

30	107,280.59	170,760.51
35	112,946.30	175,877.83
40	117,377.54	179,719.85
45	125,498.42	181,065.39
50	136,963.81	183,296.86

Source: Own calculation based on the Structure of wages and salaries by occupation in October 2006 and subsequent reports up until 2016.

In loss adjusting and next management process different sources of loss compensation should be considered such as social security benefits depending on national legal system (Smith *et al.*, 1999), such as care insurance or medical savings accounts. In this article the authors however do not consider the sources of compensation and household risk management techniques.

The source of financing old age care can, of course, be the system of social or commercial insurance. Analysing the Polish market, one should emphasize the deficiencies of the state system (for example, a long period of waiting for benefits or the availability of some services in unpaid form only for people with the lowest financial status). On the other hand, the private system in Poland is still in the development phase, and with premiums that are relatively high in old age for such risks (medical treatment, long-term care) in the face of a low replacement rate (in Poland it is currently around 40%), allows the assessment that private insurance is unavailable to many people of retirement age. Therefore, very often tangible or financial support from children is expected.

4. Numerical Examples and Discussion

In this part two numerical examples will be presented. The values of damage related to the loss of a child will be determined in them. Each time, the dynamic of the individual elements of the loss is shown. The significance of the biological family type for the loss valuation will also be shown.

4.1 Example 1

The first example concerns the situation of a young couple. The married couple is the wife aged 20 and the husband aged 25. Two options will be considered. Option 1, the deceased child was 0 years old (death at delivery), and Option 2, the child was five years old. The considerations will be divided into three cases relating to the number of children in the household (i.e., the biological type of the household). The calculated values of damages relating to the death of a child are presented in Tables 8-10. Established value is the total loss for a household. The loss value was divided into four components:

1. financial expenses incurred for a child;
2. work done for the child;

3. child's work lost due to the death of a child;
4. lost care for old age.

Table 8. Value of household loss due to the death of a child – 1 child in household, calculated for example 1 (in EUR)

components	1.	2.	3.	4.	total
0 years old	0.00	0.00	4,502.43	289,670.96	294,173.38
%	0,00%	0,00%	1,53%	98,47%	
components	1.	2.	3.	4.	total
5 years old	56,974.11	30,000.42	5,242.32	289,670.96	381,887.79
%	14,92%	7,86%	1,37%	75,85%	

Source: Own calculations.

Table 9. Value of household loss due to the death of a child – 2 children in household, calculated for example 1 (in EUR)

components	1.	2.	3.	4.	total
0 years old	0.00	0.00	5,065.23	144,835.5	149,900.7
%	0.00%	0.00%	3.38%	96.62%	
components	1.	2.	3.	4.	total
5 years old	7,800.73	23,894.11	5,897.6	144,835.5	182,427.91
%	4.28%	13.10%	3.23%	79.39%	

Source: Own calculations.

Table 10. Value of household loss due to the death of a child – 3 children in household, calculated for example 1 (in EUR)

components	1.	2.	3.	4.	total
0 years old	0.00	0.00	5,402.91	96,556.99	101,959.89
%	0.00%	0.00%	5.30%	94.70%	
components	1.	2.	3.	4.	total
5 years old	3,072.88	16,945.46	6,290.78	96,556.99	122,866.10
%	2.50%	13.79%	5.12%	78.59%	

Source: Own calculations.

The total value of household losses for the only child who dies at the age of 0 is approximately EUR 300,000. If the child dies in 5 years, the value is 380,000 EUR. In the case of a 0 year old, the cost of production (sum of components 1 and 2) is 0 PLN. This is due to the fact that calculations omit the costs incurred during pregnancy, as well as costs related to psychological consultations and treatment of trauma after losing a child. In the case of a 5-year-old, the family already invested in child - financial (component 1) and non-financial elements (components 2-4). As can be seen in Tables 9 and 10 due to the large number of children in the family, the valuation of the old child, in families with a large number of children is smaller. For example, for a child in a family with three children who dies after few years, it is one-third of the value for only one child, it is about 102,000 EUR. It should be noted that component (4) representing the cost of care in old age is the highest. Only the

parents' age affects this value. And also the number of children in the household affects this value. In the case of only one child who dies after birth, it is 98% of the total loss (Table 8). In an analogous situation for the only child who dies at the age of five, the significance of this amount decreases (expenses for the child have already been incurred) and amount to 76% of the total loss.

In addition, in the case of the death of a young child, the greater part of the damage is associated with loss of benefits and support from the child than with expenses. That is why it is so important to emphasize that the calculation includes the social function of the child - the obligation to cover the costs of living for the benefit of parents.

4.2 Example 2

The second example concerns older spouses (the woman is 45 and the man 50). At the same time, the child is also older (options considered: 10, 15, 20 years old). As in example 1, this example considers the influence of the biological family type on the amount of loss (Tables 11-13). The same loss components were used (as in example 1).

Table 11. Value of household loss due to the death of a child – 1 child in household, calculated for example 2 (in EUR)

components	1.	2.	3.	4.	total
10 years old	28,303.29	83,960.65	6,103.79	318,029.19	436,396.91
%	6.49%	19.24%	1.40%	72.88%	
components	1.	2.	3.	4.	total
15 years old	53464,6	139673,44	3245,85	318029,19	514413,08
%	10,39%	27,15%	0,63%	61,82%	
components	1.	2.	3.	4.	total
20 years old	89934,35	200285,79	0.00	318029,19	608249,32
%	14,79%	32,93%	0,00%	52,29%	

Source: Own calculations.

Table 12. Value of household loss due to the death of a child – 2 children in household, calculated for example 2 (in EUR)

components	1.	2.	3.	4.	total
10 years old	21,103.29	49,546.43	6,866.76	159,014.60	236,531.08
%	8.92%	20.95%	2.90%	67.23%	
components	1.	2.	3.	4.	total
15 years old	43,094.64	86,327.97	3,651.58	159,014.60	292,088.78
%	14.75%	29.56%	1.25%	54.44%	
components	1.	2.	3.	4.	total
20 years old	78,720.31	126,637.40	0.00	159,014.60	364,372.31
%	21.60%	34.75%	0.00%	43.64%	

Source: Own calculations.

Table 13. Value of household loss due to the death of a child – 3 children in household, calculated for example 2 (in EUR)

components	1.	2.	3.	4.	total
10 years old	11,835.45	36,057.40	7,324.55	106,009.73	161,227.12
%	7.34%	22.36%	4.54%	65.75%	
components	1.	2.	3.	4.	total
15 years old	35,970.54	64,148.48	3,895.01	106,009.73	210,023.76
%	17.13%	30.54%	1.85%	50.48%	
components	1.	2.	3.	4.	total
20 years old	101,511.87	95,022.74	0.00	106,009.73	302,544.34
%	33.55%	31.41%	0.00%	35.04%	

Source: Own calculations.

This example teases that the value of loss increases with the age of the child. Thus, the expenditures incurred on this child (components 1 and 2), up to the moment of his death, are higher. Of course, an older child means that both parents are older. And this means that the value of the capital equivalent to lost care is higher (component 4). This is related to the age of the parents and not directly to the child's age. Example 2 assumes that parents are 25 years older than the parents in example 1. This value is higher because this care will be needed sooner than for young parents. In example 1 this component was for both parents around EUR 290,000 and in the second example it is around EUR 320,000.

In example 1 the total loss in the case of the only child is (in EUR) about 300 thousand (0 years old) or about 380 thousand (5 years old), and now (example 2) is 440 thousand (10 years old), 510 thousand (15 years old) or 610 thousand (20 years old). The values received for families with more children are, of course, lower. Results are presented in Tables 12 and 13.

In both examples, the least significant component is lost child's work for the household (component 3). However, it should be remembered that this non-financial loss is very important in agricultural and large families. This can be eg care for younger siblings or help with house and agricultural work.

5. Conclusions

The above analysis does not exhaust the subject. The valuation of a child for a household was based on the concept of investment in a good of a certain value, and expected profits and direct cost of production. The authors focused on expenditures for a child. It is obvious that their level depends on many factors, including household wealth, as well as social attitudes regarding the scope of expenses, including education and the period of supporting the child. Interrupting this "production" process means that we are dealing with real loss, economic in nature. But due to research goal of the economic loss valuation, the interruption of the

production process can not determine the end point. It is necessary to take into account *lucrum cessans* - lost benefits.

The calculations in the part of numerical examples show that this part of the damage is the most important in household financial situation. The largest share in total loss value is the lost benefits in the form of expected care in old age, and we should be aware that longer life expectancies will make this value grow still greater. It should be considered as most important future risk which need to be managed. Especially in the context of the analysis of the pension gap, taking into account both the earned income and the increased amounts (the risk of infirmity). The calculations also illustrate that the significant value of future damage causes that one should not forget the value of money in time and the real increase in the values considered, this is important when thinking about a life insurance contract for the longer term.

The presented calculations show that for a death situation (at birth) of the only child in the family, the loss is about EUR 294,000 (Table 8). In the case of the death of an only child at 5, due to the expenditures already incurred and the closer (by 5 years) moment of the point from which parents require the care, this amount increases to EUR 382,000 (Table 1). If the child is older at the time of death, e.g. 10, the loss rises to the level of EUR 436,000 (Table 9). Of course, in the situation of families with a large number of children, the loss is smaller, due to the assumptions regarding the division of work done for children and the sharing of care by the children of parents in old age.

Returning to the assessment of the values (for Poland) described in the introduction derived from the judicial awards or the guidelines, it should be noted that:

- in the case of the death of a child at the age of 5 - only the cost of production is EUR 86.974,53 for only one child;
- in case of child's death at the age 15 or 20 it is respectively EUR 193.138,04 and EUR 290.220,14.

For Western European countries these values will be much higher. We should notice that for example the average annual wage in Germany (net values) is over 4 times higher, in 2014 according to Eurostat data EUR 36.269,23 than in Poland EUR 8.278,27, the average one-hour salary for nurse in Germany is 30 EUR in Poland only 10 EUR, for rehabilitant in Germany is 19 EUR in Poland only 6.5 EUR. That obviously increases expenditures on children and old-age care costs.

Thus, the compensatory awards for parents in the range of EUR 20.000-38.000 even doubled as for each parent do not cover even the expenses incurred for the lost good. Clearly it would be perceived as unfair and violating the basic principle of full compensation of damage when comparing with the damage to property (as a damaged car) when just the good's price is considered. But what is even more important it may lead to financial instability of individual and externalisation of loss,

especially when it comes to support during old age. The expected benefits and contribution of a child to the functioning of a household can also be an important argument within the systemic policy of supporting fertility and investing in children.

Due to the fact that the damage does not only relate to the loss of expenses incurred (care and upbringing costs lost), as well as the loss of future benefits (care in old age), in the model it is necessary to use the principles related to the time value of money. As it has been indicated, the loss of expected benefits matters most in the total amount of damage.

In conclusion, we would like to refer to other studies which could be considered as relevant to the problem of valuation of the loss related to the death of a household member. Giergiczny (2006b; 2016), mentioned in the introduction, relies (like us) on GUS data. However, he uses the reports for the year 2002. These data complement the reports of the National Labor Inspectorate for the period 2001-2003. The value determined in the method described by Giergiczny as hedonic (de facto based on the analysis of the method of accepting a higher work risk, willingness to accept) is close to the lower amount recommended by the European Commission (1-2 million euro) in the analysis of improving the quality of the environment and safety in transport (OECD, 2009). Giergiczny (2016, p. 410) estimated the VSL for Poland as PLN 2.55 million to PLN 4.74 million, i.e. the equivalent of EUR 612.000 to EUR 1.137.000. The values obtained differ significantly from those we obtained in this study. But this is due to the profile of the person whose life was valued. Giergiczny valued the life of an adult generating income and making a contribution of his work to society, but we have to remember that these calculations as incorporating willingness to accept or willingness to pay approach, refer to a non-economic loss, however they are considered from a different point of view (social attitudes to human value).

Apart from strictly scientific research, periodic reports of the Adam Smith Centre on the cost of raising a child can also be invoked as related to valuation of the examined issue of economic loss. Studies prepared by the Centre are also based on GUS data. Their methodology is similar to that presented by us. In these studies, the attention is focused only on the part related to the expenses (in our study this is a1 – and in the whole model including planned expenditures also c1).

Reports omit the household work for the child, the child's work for the household and do not take into account the loss of expected care in old age. According to the Adam Smith Centre report, in 2018, the cost of raising one child up to 18 years of age is around PLN 190-210.000 (approximately EUR 50.000), while two children is PLN 350-385.000 (approximately EUR 90.000) (Kajetanowicz *et. al.*, 2018). The amounts received are lower than those quoted following Giergiczny and lower than ours because, as mentioned, this research focuses on financial expenses only.

Comparing our results to others, one cannot fail to mention the study of the Road and Bridge Safety Inspectorate (IBDiM), described as based in Pandora's method in the introduction. This study captures the problem in the macro scale and was for us an inspiration only for a detailed analysis of the child's death problem in the micro scale, i.e. in a single family. However to compare we could indicate that the unit cost of fatality in Pandora is calculated among others. This unit cost is composed of administrative costs of operating units (police, fire brigade etc.) and emergency medical services (ambulance, medical helicopter), medical expenses for the deceased within 30 days after the accident, administrative costs related to autopsy, and also costs of a funeral grant, costs of the judiciary, prison, benefits for relatives paid under social insurance, and compensation for the families of the deceased under liability and personal insurance. It takes also loss of productivity resulting from the deaths of road accident victims employers' losses.

In Pandora's study for 2014 the total unit cost of a fatal injury is estimated as PLN 1.910.000 = EUR 458.034 of which the share of individual losses suffered by the family is assessed as 30%, while 70% is the state budget's loss, the external social burden. Therefore, it could be considered that the statistical loss covering expenditure only, including incurred costs, is not less than PLN 573.000 = EUR 137.410 in the case of one fatality (IBDiM, 2015). It has to be underlined as in the introduction, that only real costs are considered in Pandora, based on market data.

Finally, the authors wish to emphasize that a lot of assumptions have been made in this paper, which indicate further research directions.

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