Household Financial Decision-Making Models: Which to Choose for Experimental Investigation

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Abstract. The paper offers a comparison of household financial decision-making models considering a household as one of the initial economic units, understanding the decision-making process and utility function perception of which is influential for the conception of the integrate economic development of a society. Paper provides a brief description of the most applicable within-household decision-making models, namely unitary, bargaining, and collective ones, denoting the pros and cons of their employment for experimental investigation by stating the appropriateness conditions, which are as follows: the ability to include more than two members considering their own preferences, various possible scope of modelled decisions, and framework allowing for empirical research. Regarding previous research, the collective model with Pareto weights appears to be the one, which justifies the conditions set.

Keywords: Household, Financial Decision-Making Models, Utility Function

JEL classification: *D10, D70, G50*

1 Introduction

A household is an initial economic unit at the microeconomic level, which makes its financial decisions under constraints and in turn influence other economic units both on the microeconomic and macroeconomic levels. The utility of the household, which in theory has to be maximized by its rational members, has been and still is the one of the issues of a great interest for the researchers (Becker, 1991; Neuwirth, Haider, 2004; Bertocchi et al., 2014; Chiappori et al., 2015; Saelens, 2019, and others). As decision-making process within households is in the sphere of concern for policy makers on the government level (Le Cacheux, 2005; Himmelweit et al., 2013) and practically all products and services suppliers, modelling of that process is helpful and virtually inevitable for understanding the preferences and sharing of resources in potentially conflicting within-household relations.

Initially the majority of the economists starting with Becker (1991, originally published in 1981) rested on the assumption that financial decision making within households in traditional microeconomics analysis is based on *unitary* utility function[1] meaning that members have unitary preferences. However, not all of the researchers agreed with the previous assumption and the *non-cooperative* approach appeared, according to which the individual preferences are different and each of the household members maximizes his/her own utility function. As non-cooperative procedures typically lead to inefficient outcomes, a *cooperative* approach was introduced with a restriction of the Pareto efficient household decision making. Such an approach with Pareto efficient household decisions (when no other feasible choice is likely to being preferred by all household members) is also referred to as *collective* one (Browning et al., 2011). However, as it is visible from the divergence of the models' classifications in different sources given below, there is still no agreed structure proposed in the literature[2].

The *aim* of the research is to extract the decision-making model of the household suitable for applying in experimental investigation of financial decision making[3] based on the previous research studies (Becker, 1991; Neuwirth, Haider, 2004; Bertocchi et al., 2014; Browning et al., 2011; Chiappori et al., 2015). Experimental investigations are made using experimental methods in order to testify theoretical predictions by gathering empirical evidence in laboratories (Friedman, Sunder, 1994; Nikiforakis, 2010).

For the purpose of our research we make a *hypothesis* that collective models are the more suitable for applying in experimental investigation of financial decision making in sense of their framework, scope of the decisions that can be modelled, and empirical research application. Thus, the *research question* is whether the collective model is the most suitable financial decision-making model for experimental verifying the theoretical predictions about the financial decision making within households.

The paper proceeds as follows: section 2 contains literature review on the household decision-making models including unitary, bargaining and collective ones; section 3 describes the methodology adopted to make a choice of the proper model for experimental investigation of the financial decision making within households; section 4 presents the main results; section 5 suggests discussion; section 6 concludes.

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[1] In the context of the research, we assume that decision making within household has its model, and the utility function represents not the model itself, but the preferences of the members within the decision-making model. The paper is focused on the model selection remaining the utility function derivation as the purpose for further research.

[2] Le Cacheux pointed out, that 'A large number of empirical studies has emphasized the limits of the usual model. However, the new models are scattered and no theoretical framework has clearly taken over'; and by usual model Le Cacheux meant a model, when households are treated '… as if they were individuals' (Le Cacheux, 2005, p. 1).

[3] We apply financial decision making of the household as made by the individual members grouped together according to the behaviour of other members. The sphere of such decisions may include, for example, income spending on goods consumed privately or household public goods, as well as the time to contribute to that income or time spent in domestic production (Himmelweit et al., 2013).

2   Literature Review on Household Decision-Making Models

In the literature concerning decision process on resources allocation within households the majority of authors starts with describing the models of the household decision making with their advantages and disadvantages in general and particularly regarding the issues of further research (Woolley, 1990; Becker, 1991; Mattila-Wiro, 1999; Browning et al., 2011; Bertocchi et al., 2014; Chiappori, Mazzocco, 2017; Saelens, 2019).

According to the existing literature, there is no common agreed structure of the models constructed during the last decades. In earlier literature authors, for example, divided the models of decision making at within-household level into cooperative, non-cooperative, institutional, and transaction cost approaches[4] (Woolley, 1990). Chiappori et al. (1993) divided models into unitary and collective, in their turn collective were split in two other broad types as cooperation and non-cooperation[5] ones. Le Cacheux (2005) described unitary or 'usual' model in the traditional approach of household decision making, but do not include it into the typology of the within-household decision models, consisting from two main categories, namely cooperative and non-cooperative bargaining models, and in its turn cooperative ones consist of Nash-equilibrium bargaining rule and predetermined sharing rule. Mattila-Wiro (1999) divided the models into unitary and collective as well, and after split collective into cooperative, bargaining and non-cooperative. Also, the author made a comparison of the different models including important characteristics, as the number of members and utility functions, etc. (Table 1).

Table 1. A comparison of the main features of the various economic models.

	Consumer theory	Becker's model	Efficient cooperative models	Bargaining models	Non-cooperative models
Number of members	One individual (one consumer) with own egoistic preferences	Two individuals with own preferences, one individual has altruistic preferences	Two individuals with own preferences	Two individuals with own preferences	Two individuals with own preferences

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[4] In turn, the cooperative models were divided to marriage market model, Nash-bargaining model and Pareto optimal agreement model. Institutional approach was suggested for modelling intra-household income allocation determined by the shares of market and household production within household. Transaction cost approach was focused on organizing production within the household and the nature of the marriage contract.

[5] In the scheme of the household models authors showed that cooperation models include Pareto optimal modes, which in turn include Nash bargaining models, which finally include unitary model (Chiappori et al., 1993, p. 10).

Number of utility functions	One utility function	One utility function	Two utility functions	Two utility functions	Two utility functions
Utility	Utility depends on the consumption of market goods	Utility is derived from the consumption of basic commodities	Utility depends on the members' own consumption	Utility depends on the individual consumption plus the consumption of household public goods	Utility depends on the individual consumption plus the consumption of household public goods
Intra-household behaviour	No conflicts, individual maximizes own utility function	Member's own preferences cause conflicts which are resolved through the altruistic behaviour of one household member	There is no assumption about intra-household behaviour, decisions made are Pareto efficient, the sharing rule divides the resources between household members	Bargaining process through cooperative game, solution depends on the bargaining power of each participant, the result is Pareto efficient	Household has separate gender-specific economies, there is income transfers between wife and husband, bargaining is described by non-cooperative game, not all equilibria are Pareto optimal
Threat point				Outside option, divorce	Non-cooperative equilibrium within marriage from which bargaining proceeds, equilibrium is based on traditional gender roles and specialization to contain tasks

Source: Mattila-Wiro (1999)

In the recent research on economics of the family Browning et al. (2011) distinguished such models as unitary, non-cooperative, cooperative with the collective approach (concluding bargaining models), and collective models. Himmelweit et al. (2013) divided the models in three broad categories, namely unitary models, bargaining (including cooperative and non-cooperative), and collective (as a generalization of cooperative models). The similar division of the static household decision models had

Chiappori and Mazzocco (2017) distinguishing between unitary, Nash-bargaining and collective models.

To the purpose of our paper, we follow the common classification of models suggested in the recent literature (Himmelweit et al., 2013; Chiappori, Mazzocco, 2017) consisting from the three main groups given below[6]. We briefly outline them as to make the main ideas and differences clear.

2.1 Unitary Models

The unitary model was the pioneering one created for economic modelling of collective decisions using the tools of rational choice theory initially intended for the analysis of decision making at an individual level (Backer, 1991, originally published in 1981). According to such a model, households make decision on income spending by maximizing a single members' *utility function* subject to the single common budget constraint (representing the common income of all the household members) under the notion of income pooling. The notion means that there is no difference, who contributes what amount into the budget as this does not influence on how the budget is spent.

Arguable assumption of the model is the identical preferences for all members, which is in a conflict with methodological individualism. Another problematic assumption relates to the household head making potentially altruistic decisions for the household members. There is no rational grounds for the statement, that actually the household head is the person, who is both altruistic and having enough authority as to convince the others in making the best decisions in their interests. In addition, income-pooling assumption creates evidence from the empirical front saying, that reallocation of the income (in the form of non-labour income) from one member to another does not influence on the household expenditure composition. However, empirical studies show that there is a difference in who brings income for how it is spent (Himmelweit et al., 2013).

2.2 Bargaining Models

Bargaining models do not have the limitations, which are typical for the unitary models as their assumptions correspond better to sociological insights about intra-household power (Himmelweit et al., 2013). These models are based on game theory to show the bargaining by members of the household whose preferences differ (Lundberg, Pollak, 1993; Manser, Brown, 1980; McElroy, Horney, 1981; Pollak, 2005). The bargaining models featured in the two versions. First version is a *cooperative model*, where each of the family members has own utility function and negotiate with other members to achieve Pareto efficient outcome. This Pareto efficient outcome is defined as a situation in which one member cannot achieve greater utility without reducing the utility of

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[6] We tend to dividing the models into two broad categories, namely unitary and collective, and then classifying the collective models according to the main characteristics (similar to Chiappori et al. 1993; Mattila-Wiro, 1999). Such a categorisation, thus, is not the aim of the paper given, and remains as one of the directions for further research.

another member, when the resources remain constant. To reach efficient cooperative outcome as a key assumption, long-term relationship between household members is used to reduce short-term gains from game (Donni, Ponthieux, 2011).

Situation of the bargaining cooperative model is shown in the Fig. 1, which represents Pareto-efficient allocations of a couple. Those allocations should be viewed as the frontier of the set of all combinations of utility achievable by household members under a given budget constraint. On vertical axis we can find utility of woman, and on horizontal one the utility of man. The area beneath the frontier and to the left of it contains the possible variants of utility levels for the partners of all eventual outcomes, while the frontier from W to M shows the Pareto-efficient outcomes that could be reached by bargaining. There are many such outcomes, which differ in favouring one or another member of the household. As we can see, combinations near W-point are more favourable for the woman and those near M-point are more auspicious for the men. As each household member has a relative bargaining power, the final bargaining outcome depends on such power.
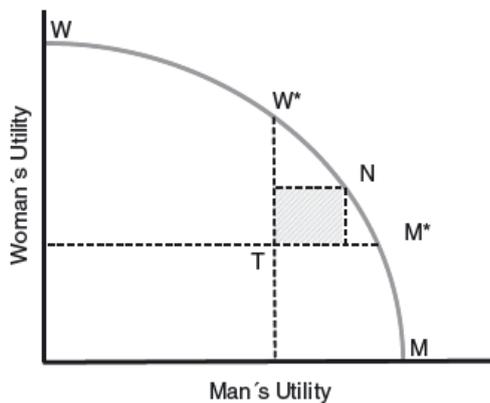

Fig. 1. A household's utility in a *bargaining* model (see Himmelweit et al., 2013).

The point of intersection T in the Fig. 1 represents the *threat point*[7], which expresses the utility gained by each individual in case of the cooperation collapse. The woman will not agree to outcomes below M* as this outcome will make her worse than threat point. On the opposite side, the man will not be satisfied with the combinations, located on the left from W*. Then between W* and M* lies Pareto-efficient bargaining outcome. The outcome at the point N, which lies on the frontier that maximizes the product of the two partners' gains in the utility terms over the threat point, is called Nash bargaining solution (Apps, Rees, 2007). How good will be the outcome at N, depends on the bargaining power of each member according to the threat point T. The equilibrium shifts along the frontier due to decline in the bargaining power of one member and increasing power of the other one (Donni, Ponthieux, 2011).

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[7] Also known as disagreement point or breakdown position.

In bargaining model shown, two different types of the threat point are in place. First one is divorce, which represents the household dissolution. The second one is the situation, when the household members stay together without cooperation, which refers to the non-cooperative game theory (Himmelweit et al., 2013).

2.3 Collective Models

This type of models was developed in order to tackle with the shortcomings of the unitary and bargaining models, and assume the Pareto efficient outcome of the decision making within households. Collective models are the most general from the models of household decision making, considering Pareto efficiency as the only assumption made concerning the minimum expression of the desire of living in a couple, which Chiappori called a *collective rationality* (Chiappori, 1988). According to Browning et al. (2011), collective models also have to rely on the assumption of existence of the *decision process* in the household; also, collective models include cooperative bargaining models and unitary models as special cases. Those models account for individuals *caring behaviour* and may include *more than two decision makers*. They may include *financial decision making* on household production, taxes and spending on private and public household goods as well as the labour time and participation on the labour market (Himmelweit et al., 2013).

The existence of collective-rationality theoretical assumption of the models allows for representing of any outcome of a household decision making as the result of maximizing a function, which is a *weighted sum of the household members' utility functions* subject to the total budget constraint. Those Pareto weights combine individual utility functions and represent the respective power of each household member over the outcome of the decision-making process. Fig. 2 presents the same couple's household utility possibility frontier, as in the example of bargaining model depicted in Fig. 1. Point A, as the point of tangency of the Pareto weights line, is relatively higher for man, which gives the better outcome for man, than B; and in turn, outcome B is better for the woman, than A.

One of the useful features of collective models is that they can allow for any factor not influencing individual preferences of the household members affecting the outcome of the model by changing the Pareto weights. Those may be factors, which enter the household budget constraint, switching the range of probable outcomes, such as wage rates, goods prices, as well as individual or household non-labour income. At the same time, the factors of influence on the Pareto weights may be *distributional* [8] ones, which do not influence preferences of household or the variables having impact on the household budget constrain. When they change, the frontier on the Fig. 2 remain unchanged, but there will be a shift in the relative power of the household members, influencing the relative weight of the members' individual utility function in the form of the tangents slope in Fig. 2. This will result in the change of the Pareto-efficient

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[8] McElroy and Horney (1981) refer to those factors as 'extra-household environmental parameters'.

outcome of the household decision making[9] (Himmelweit et al., 2013). Such distributional factors may include some individual characteristics of the members of the household as their age and human capital[10]. Also, they may include some legal and welfare rules (e.g., laws pertaining to marriage, divorce, abortion, right to be protected from domestic violence, property rights, etc.) as well as sociological or cultural characteristics including partners' social background or gender role attitudes, and even national customs (Browning et al., 2011; Donni, Ponthieux, 2011).
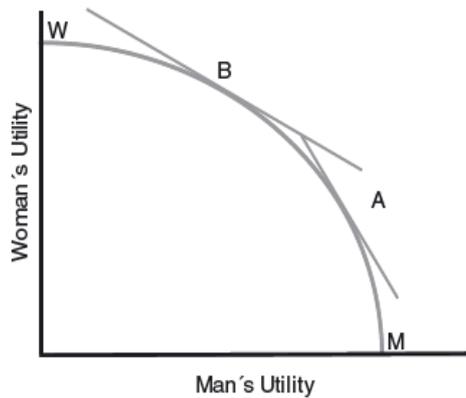

Fig. 2. A household's utility in a *collective* model (see Himmelweit et al., 2013).

Except of Pareto weights there is another concept for measuring decision-making powers within households, which rely on using the *sharing rule*[11] reflecting the power of each partner, that may depend on the variables describing household environment. In case of sharing rule implementation, the decision-making process can be decomposed into two phases: (1) the income is shared between the two household members according to the sharing rule; (2) each member maximizes his/her utility under the budget constraint determined in the phase (1) by the sharing[12] (Donni,

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[9] Donni and Ponthieux (2011) explain that '… if two distribution factors affect the demand for any good in identical ways, we can then conclude that their impact on the equilibrium on the efficiency frontier must be the same. In addition, any other demand for goods must be affected in the same way by the two distribution factors in question'. The aforementioned explanation of the theoretical model properties allows for the conclusion of the model testability on empirical data.

[10] However, Donni and Ponthieux (2011) classify age along with education and sex as *preference factors,* i.e. the variables, which tend to alter individual preferences in case of an individual or household with several members.

[11] The conditions for applying the sharing rule are egoistic preferences and no public goods involved, so that economic interactions within the family are minimal and members live side by side, but consume independently (Browning et al., 2011, p. 167).

[12] Although Donni and Ponthieux (2011) pointed out that '… the sharing rule concept has become so popular that some see it as a cornerstone of research on collective models', there is no common

Ponthieux, 2011). Browning et al. (2011) emphasize that in the aforementioned context the efficiency relates solely to the phase (2), because the allocation will be efficient provided the utility maximization by the household member, whatever the sharing rule of the collective part of the process (1), entailing bargaining, formal rules or others, is.

3   Methodology

As the research gives theoretical grounds for further investigation, we use the general research methods such as comparison, analysis and synthesis, induction and deduction for investigating the main features of different approaches to decision-making models and utility functions of the households. We analyse the models used nowadays as theoretical basis for decision making at the household level, compare their characteristics with required for the purpose of experimental investigation of the financial decision making within households and select an appropriate model[13].

 For the purpose of our research we review the literature as to analyse the existing models of financial decision making within households that meet certain conditions. The first condition is that model may include more than two members of the household as we suppose that modern households usually consists of more than two members having their own preferences. With the first condition implementation we support the statement of methodological individualism, which was a motivation for Chiappori's research saying that "Modelling a group (even if reduced to two participants) as if it were a single individual, hence, should be seen as a mere holistic deviation" (Chiappori, 1989, p. 3). Thus, we suppose that within the household the preferences of each member matters. The second condition regards the scope of the decisions which can be modelled (i.e. consumption, spending, income, or time allocation), as there is a lack of evidence and data concerning within-household decision making and it is vital to have a choice in selection of data for the model. The third condition is that the model has a framework allowing for empirical research.

 According to the aim of the paper, the question of choosing the appropriate household financial decision-making model with utility functions of the household members leads us to the brief analysis of the main models' shortcomings. Then we make a choice and ground it on the basis of literature review and the conditions stated.

4   Results

We briefly outline the shortcomings of the models in the same order as they are described in the literature review.

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approach to its determination and 'the terminology is not completely tied down' (Browning et al., 2011, p. 128).

[13] Similar methodological approach to household decision models, although without choosing one for further research, is presented in Mattila-Wiro (1999), Le Cacheux (2005), Himmelweit et al. (2013).

The unitary model based on the unitary utility function of the household and decisions are supposed to be made by the household as a unit, which is seen to be far from reality, and separate interests and preferences of the household members are to be considering. The assumption of constant preferences is also quite arguable, as individual members' preferences cannot assume to be constant (Grossbard-Shechtman, 1999). Within unitary model, the household remains a 'black box', as the intra-household choices are independent of which member receives resources or consumes goods (Le Cacheux, 2005). Therefore, the framework does not address such issues as the allocation of resources within the household and obviously does not allow taking the effects of distributional factors (e.g. social or fiscal policy implementation) into account.

Bargaining models mostly rely on the framework of two household members with their specific utility functions, and the models require a specific setting: a threat point for each member has to be defined describing the utility level, which he/she may reach in the case of disagreement. If the threat point is outside the Pareto set, there will be no agreement between the household members since at least one of them would lose (Browning et al., 2011).

Collective models' framework mostly consists of two utility functions with application of Pareto weights or sharing rule conditions. One of the collective models' shortcomings relates to the caring preferences meaning household members' concern for each other. Thus, collective models with caring preferences are seen as potentially invalidating a sharing rule interpretation in case of caring not about the level of utility, but the way of how it is achieved. Another point in critics is that in collective models the efficient outcomes are only achievable on cooperative basis, which lack may be seen as a reason of many inefficient empirical outcomes in developed and developing countries. Gender norms, e.g. in division of unpaid labour or domestic violence, are often reported as causes of the lack in such a cooperation. Another criticism is from the empirical front saying that sharing rule is difficult to estimate (Himmelweit et al., 2013).

Despite aforementioned disadvantages of the collective models, Donni and Ponthieux (2011) argue that recently appeared collective approach plays a prominent role in household economics. Unlike bargaining models, collective ones do not require *a priori* specified threat points as to test the influence of distributional factors, which can be directly determined from the outcomes of household decision making (Himmelweit et al., 2013).

According to Browning et al. (2011, p. 127), for the collective model, which depends on the Pareto weights, the household utility function can be defined as:

$$u^h\big(Q, q, \mu(P, p, x, z)\big) = \max_{q^a, q^b}\{\mu(P, p, x, z)u^a(Q, q^a, q^b) + u^b(Q, q^a, q^b)\}$$
$$\text{subject to } q^a + q^b = q \qquad (1)$$

where u^h stands for household utility; Q – public goods; q – private goods; P – market prices for public goods; p – market prices for private goods; x – household total expenditures; z – distribution factors; $\mu(P, p, x, z)$ – Pareto weight.

Browning et al. pointed out that implementation of the household utility function of the collective model, which depends on the Pareto weights, '… makes analysis using a collective model almost as easy as using a unitary model which is an important consideration when considering non-unitary alternatives' (Browning et al., 2011, p. 128).

Based on the analysis of the earlier and recent literature concerning the within-household decision making, we assume that collective model, which depends on the Pareto weights[14], has the most appropriate framework for the purpose of experimental investigation of financial decision making within the household. The characteristics, that fit our requirements, are as follows: the collective model may include more than two decision makers, covers the large scope of the household decisions including spending, income or time allocation, etc., and do not require a particular bargaining framework to be specified, thus being more open to empirical application. In spite of the fact that at the present stage of the research it is not quite clear, which factors will be included to the model, we assume applying collective model with Pareto weights and several utility functions: one for each household member.

5   Discussion

The topic of the paper is quite actual nowadays as both public and private sector decision makers on the higher and lower levels are interested in the household decision-making process. The models we describe are used now for policy implementation testing at the governmental level, as well as for testing of supply and demand matching for the business. The expectations from the model application then consist of reflecting the behaviour of the households in the way appropriate for making accurate predictions. Although all three main types of the decision-making models on the household level are implemented nowadays (Himmelweit et al., 2013), there is expanding opinion of the specialists that '… multi-person households cannot be accurately characterised by the aggregation assumptions that are inherent in the unitary model. A direct comparison of the unitary and collective model firmly establishes the collective model as the go-to approach to analyse observed behaviour of multi-person households' (Saelens, 2019). Also, in recent studies authors mention that new generation of models open a new direction for further research considering the dynamic nature of decision-making processes within households (Donni, Ponthieux, 2011).

The investigation of the literature on the household decision making showed that in spite of the bulk of the research on the topic, there is still much room for both theoretical and empirical improvements and developments. The aforementioned inconsistency of the theory needs to be tackled. The other main development direction is related to the data availability. We agree with Himmelweit et al. (2013) pointing out that given the importance the policymakers and other interests place on economic and quantitative evidence of decision making within households, it is incumbent on those who have

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[14] This kind of collective model in contradiction to the model with sharing rule allows avoiding aforementioned shortcomings of the latter one.

influence on data collection to understand and overcome the data limitations for making more extensive use of those models feasible in the nearest future. Donni and Ponthieux (2011) emphasized, that 'Over the past dozen years, the empirical studies performed on the basis of these improvements have made significant contributions, yet remain hindered by the complexity of models and the availability of relevant data'. Understanding the circumstances, under which the financial decisions are made within the household, and over which resources, is crucial for implementing the policies affecting the intra-households resource allocation and finally to opening the 'black box' of the intra-household financial relations.

6   Conclusion

We analyse the more frequently used theoretical models for household decision making along with their advantages and disadvantages as to choose one appropriate for experimental investigation of the financial decision making within household. We set three main conditions for the model, which are as follows: model may include more than two decision makers; allow for a wide scope of the decisions that can be modelled; allow for empirical implementation. On the basis of the literature review and the conditions set, the collective model with Pareto weights appears to be the more appropriate for the purpose of further research.

As the extension of the paper it is planned to select appropriate database[15] for empirical implementation of the chosen model in two steps. Firstly, we plan to determine the scope of the decisions, which will be modelled according to the data available. Secondly, we will create a model and check it according to the data. Thus, we plan to check the theoretical modes described in the paper with real data. Then we will design an experiment as to verify whether the theory coincide with the data obtained in a laboratory.

Although we have already extracted the model for the research, we may still re-estimate its appropriateness according to the scope of the decisions available for modelling, and the time horizon of the research. As we extract theoretical model for testing it on experimental data, we concentrate our attention on static models according to Mazzocco (2007) and Chiappori, Mazzocco (2017), as it is appropriate approach for the purpose of our ongoing research. In future we plan to extend the scope of the research as to include household intertemporal behaviour peculiarities, and consequently to apply some of the dynamic models, which allow for including time and generation changes (Chiappori, Mazzocco, 2017). Although the dynamic models are not in the list of the most applicable ones in the literature on the topic nowadays, we assume that the future belongs actually to those more complicated and thus more precise models.

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[15] Now we are considering and exploring the data from the Household Financial and Consumption Survey as to verify the possibility of modelling the financial decision making within households in Slovakia. Information on the Survey is available at the webpage of the National Bank of Slovakia in the part of Household Finance and Consumption Network [14].

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