Bargaining over parental leave - implications of the biological clock

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Abstract: Following the increasing amount of attention centred on gender equality in recent years, this thesis continues the study of parental leave division; this is a topic which is thought to have implications for gender equality on several dimensions. Specifically, we investigate if the threat of female infertility; the "biological clock", affects the division of parental leave between parents. We hypothesise that a woman's bargaining power relative to her spouse decreases as she approaches an infertile age. In a theoretical framework, we analyse the division of parental leave through a Nash cooperative bargaining game. We then perform an empirical analysis to investigate if our hypothesis obtains support in data. In the theoretical framework, we conclude that a decrease in the mother's bargaining power relative to the father should result in her taking a larger share of total parental leave. However, we are not able to empirically support the hypothesis that the female biological clock affects the bargaining outcome negatively as she approaches an infertile age.

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1. Introduction

Gender equality is a subject that has been receiving an increasing amount of attention worldwide. In Sweden, the government has set goals regarding gender equality, declaring that women and men should have equal power in shaping society and their own lives (Government Offices of Sweden, 2015). In striving towards accomplishing this policy objective, the importance of an equal distribution of unpaid housework and provision of care has been emphasised.

A distinct case of unpaid housework and care distribution is the division of parental leave between two spouses. As of today, women in Sweden spend more time in unpaid household work than men, and the unequal distribution tend to arise when a couple has children (Evertsson and Nermo, 2007; Van der Lippe and Siegers, 1994). Research has shown that there are negative aspects of an unequal distribution of responsibility in unpaid housework. For example, being responsible for a large share of the household work in parallel with the ordinary market work could lead to impaired health for women due to the large amount of total work (Angelov, Johansson and Lindahl, 2013). There have also been indications of that an unequal share of household work induced by parental leave tends to continue and lead to an even more skewed division of household work in the future (Ahrne and Roman, 1997). Additionally, there is empirical support of positive effects for both the father and the child in spending time together, implying positive consequences of an equal sharing of parental leave (Sarkadi, et al., 2008). There are thereby strong reasons to address the importance of an equal division of parental leave. In order to enable and promote an equal division, the main causes of the division need to be understood. This is important for policymaking in terms of promoting gender equality, and for further development of the parental insurance system.

This thesis aims to further explore what factors affect the division of parental leave. Previous research has focused on the effect of social policies, such as "the Daddy months" and the Equality bonus (Swedish Social Insurance Agency, 2012; Swedish Social Insurance Agency, 2014). Attention has also centred on how parents' characteristics, e.g. age, education level and income, correlate with the division of parental leave. We want to extend this research by incorporating possible implications of biological differences between genders, more specifically the female "biological clock". This entails an analysis of whether the threat of female infertility affects the division of parental leave.

We will begin this thesis by reviewing previous empirical work in order to establish what factors appear to explain the dynamics of the division of parental leave. In addition to an empirical overview, we will review theoretical models of the division of household work to investigate how the mechanism of dividing household work has been modelled by previous researchers. We will thereafter derive the hypothesis of the biological clock, which we believe to have explanatory power to the division of parental leave. After adding this to a theoretical framework, we will conduct an empirical analysis to test whether there is evidence to support our hypothesis. We will conclude by discussing our results and analysing its implications.

2. Previous research

2.1. Background and empirical evidence

Looking at the division of parental leave from a European perspective, women have traditionally had the main responsibility for child care, according to a report from Eurofound (2015). In a EU directive from 2010 (Council Directive 2010/18/EU) that entitles workers to a leave period of at least four months after childbirth, parental leave is considered important for enabling equal opportunities for men and women. Several reforms and new legislation for a more gender equal take-up of leave was enacted after this directive was transposed. The structure of provisions and incentive schemes regarding parental leave differ between the member countries, giving parents disparate levels of allowed length compensation in connection with the take-up. The European trend regarding take-up of leave among fathers is reported to be increasing in general, but there is still a large gap compared to mothers' take-up.

Eurofound identifies several factors that appear to influence the outcome regarding fathers' take-up of leave. These factors include the characteristic of the available schemes, information about the available leave, to what extent child-care facilities are available and if there is a fear of labour market isolation associated with parental leave. The explanatory factors are reported to be complex, but include the spouses' amount of financial compensation, education level, if they live in a rural or urban area, as well as type of employment sector. In cases where the father has a

higher level of education, lives in a larger city and works in the public sector, there is a higher probability of him taking a larger share of parental leave.

Haas and Rostgaard (2011) state that the Nordic countries are particularly well-advanced in terms of gender equality, which also applies to the division of child care and market work in households. Several Nordic countries were pioneers in paid maternity and paternity leave.

In all Nordic countries, research has been done in order to better understand what individual characteristics increase the probability of a gender equal take-up of parental leave (Bloksgaard and Rostgaard, 2014; Salmi and Lammi-Taskula, 2014; Björk-Eydal and Gíslason, 2014; Brandth and Kvande, 2014). Summarising the results, the probability of a gender equal division of parental leave is more likely if the mother and/or the father:

- Are younger compared to older
- Have higher education compared to only having secondary education
- Have high incomes compared to low incomes
- Work in the public sector compared to working in the private sector

Taking a closer look at Sweden, the Swedish Social Insurance Agency (SSIA) has investigated how parents' characteristics affect the division of parental leave (SSIA, 2013a). What makes this study distinctive is that the analysis includes both individual characteristics' effect on the division of parental leave as well as couple characteristics'; that is how the parents' characteristics in relation to each other affect the division of parental leave. The result from the study of couple characteristics shows that an equal division of parental leave is more likely if the parents:

• Are approximately of the same age. A larger age gap than five years has a negative effect, and the largest inequality arises when the mother is the older one. Additionally, the study of individual characteristics shows that if the mother and/or the father are 40 years old or more, the probability of an equal sharing decreases compared to parents who are between 20-39 years old.

• Have the same level of education. More importantly, the probability of an equal sharing decreases substantially if the father has a higher level of education than the mother. The mother being more educated than the father does not seem to induce equal sharing at all.

• Are both born in Sweden. Parents who are both born in a foreign country share parental leave less equally, as does couples where the father is born abroad and the mother is born in Sweden. This is not the case however when the father is born in Sweden and the mother abroad.

• Both work in the public sector. The division of parental leave will also be almost as equal if the father works in the public sector and the mother in the private sector.

• Have approximately an equally large pensionable income. Additionally, if the mother earns 60-79 percent of the total household pensionable income, the couple is likely to continue sharing parental leave equally, while if the father earns 60-79 percent of the total household pensionable income, the probability of equal sharing decreases dramatically. This result holds regardless of the level of the household's income. The results differ greatly depending on the income gap. For example, if the mother earns more than 80 percent of the household's average pensionable income, the probability of an equal sharing again decreases substantially. The consequence however is not that the father takes the largest share of parental leave; instead the mother takes on average 90 percent of the total parental leave days.[1]

Even though these couple characteristics explain variation in the division of parental leave, the single most important factor is reported by SSIA (2013a) to be gender. This becomes evident especially when looking at income. A plausible reason for a woman taking a larger share of parental leave is if the man has a higher income, as it would be more economically beneficial for the household. However, the result from the SSIA study indicates that income differences is not the root cause of unequal sharing, as mothers who earn more than 80 percent of the household pensionable income on average take out a substantially larger part of parental leave than fathers. Based on the study, the report concludes that the woman's status and access to resources are of

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[1] The majority of the women in this group earns a maximum of SEK 17 000 per month, which means that the father has a maximum pensionable income of SEK 4 000 per month.

importance for an equal division of parental leave. Consequently, strengthening the woman's status seems important in order to achieve greater gender equality in parental leave, according to SSIA.

2.2. Literature review of the household decision-making models

There are different types of theoretical models that illustrate the mechanisms behind the division of time and resources between spouses in a household. As we will analyse the division of parental leave through a theoretical perspective in this thesis, theories of household behaviour and decision-making will be of importance to us. There are three main modelling frameworks in the literature of household behaviour; the unitary model, the cooperative model and the non-cooperative model.

The theoretic framework of the unitary model is built upon the work by Samuelson (1956) and Becker (1981). Samuelson describes the family through his consensus model, arguing that the family acts as if it was maximising its joint utility function. Becker claims that altruism dominates family behaviour, and that the dynamics of family behaviour in other words is characterised by striving towards what is best for the household as an entity. The unitary model thereby regards the household as one single utility-maximising unit in which the spouses agree on the division of time and resources according to what is effective from the household perspective. The income of both spouses are pooled, and the household is subject to a common income and time constraint.

Criticism has afterwards been directed towards the unitary model. Chiappori (1992) argues that the assumptions of the unitary model contradict the basic assumptions of neoclassical microeconomic analysis, namely that individuals should be seen as having their own separate preferences, and not to be part of an aggregate collective decision-making unit. Chiappori also states that, in viewing the household as a single utility-maximising unit, the internal household decision-making process is ignored, as the household is regarded as a "black box".

In light of the critique towards the unitary model, the cooperative model of the household decision-making process is emphasised. Manser and Brown (1980) and McElroy and Horney (1981) advocate the cooperative model by analysing the household decision-making through a bargaining problem. They argue that putting household behaviour in a bargaining perspective permits

inclusion of problem solving regarding the decision-making and allocation of resources within the household. The intra-household behaviour resembles the two-person bargaining problem that Nash introduced for modelling bargaining interactions (Katz, 1997). A two-person bargaining situation involves two individuals with the opportunity to collaborate for mutual benefit in more than one way (Nash, 1950). Intra-household bargaining was developed from this theory, and it refers to negotiations that occur between members of a household in order to make decisions about the household.

The cooperative model allows for two separate utility functions for the spouses in the household. The equilibrium outcome in the household decision-making is reached through negotiation between the spouses, and is assumed to be Pareto efficient from the household point of view. If the spouses do not manage to reach a Pareto efficient equilibrium, in other words in a lack of a cooperative solution, there will be a divorce. The utility functions of the spouses in the cooperative model are made up of consumption of goods and leisure time (Manser and Brown, 1980 and Chiappori, 1992). Apps and Rees (1996) add household production to the cooperative model, addressing the importance of including this component in the theoretical framework since household work would otherwise incorrectly be regarded as leisure time. Another feature of the cooperative model is income pooling, implying that the private incomes are consolidated and then bargained over for personal use (Agarwal, 1997).

The spouses both gain from marriage as long as their utility within the marriage do not fall below what is known as the threat point. The threat point is described by Manser and Brown as the utility that an individual receives in case the bargaining should fail, i.e. the utility in the divorced state. The threat point is equal to bargaining power, since it represents the degree of independence one spouse has from the other.

Later, a non-cooperative model was developed by Lundberg and Pollak (1994). In this model, the assumptions of a Pareto efficient outcome was relaxed, and the distribution of time and resources within the household was modelled as a non-cooperative game. Since the game is non-cooperative, it does not assume costless enforceable contracts. Another difference compared to the cooperative

model is that the outcome in the non-cooperative model of household decision-making is not divorce, but instead a non-cooperative equilibrium, which is not necessarily Pareto efficient.

3. Research focus

3.1. Limitation of scope

We have chosen to limit the scope of this thesis to the Nordic countries, that is: Sweden, Norway, Denmark, Iceland and Finland. The sample data we have retrieved reflect the Norwegian population, and we believe it could be extended to all the Nordic countries, considering that the countries share similar cultural[2] characteristics (Ronen and Shenkar, 1985). Additionally, all five countries rank among the highest on the Global Gender Gap Index (World Economic Forum, 2014) and are known to have progressive parental leave policies.

3.2. Deduction of hypothesis

As previously stated, research indicates that reasons for an unequal division between genders are subject to factors that are solely related to gender in itself. There are a substantial amount of norms and social expectations surrounding gender and what kind of roles that are assigned to women and men respectively. But what has been neglected in previous research is the biological difference between genders, which constitutes a difference that has little to do with norms. In terms of having children, the obvious difference regarding fertility is an example of a biological difference that is particularly interesting when it comes to the division of parental leave.

Looking over a human's total expected lifetime, a woman is fertile a shorter period of time than a man. More specifically, a woman's fertility will have declined substantially by the time she is around 40 years of age, while men in their 70s and even 80s can father children (Virtala, et al., 2011). Although fertility is genetic and individual for every woman, statistics show that it will begin to decrease significantly from around the age of 32, and much faster after the age of 37. In addition, the finding from the SSIA study (2013a) that a larger inequality in parental leave division

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[2] Countries can be clustered according to similarities on certain cultural dimensions. These dimensions typically measure work goals, values, needs, and job attitudes.

arises when the mother is the older one, is an empirical result that could indicate a connection between the biological clock and the division of parental leave.

The biological clock can be viewed as a threat of infertility that is present for the woman but not for the man. As the woman becomes older and approaches an age where infertility is a major risk, her bargaining power in relation to her husband could thereby decrease. The decrease in bargaining power is a consequence of the woman's reduced ability to thrive outside the marriage, [3] as a divorce would mean that she would need to find a new spouse to reproduce with. This would relate to what in previous research has been described as the threat point, i.e. the utility of divorce. Thus, if the woman is approaching an infertile age, she becomes more dependent on her husband, and her threat point decreases.

In addition to the case of a decreased threat point due to lower utility in the divorced state, another consequence of the biological clock might be that a mother's bargaining power is influenced by other, more subtle, effects. For example, if the mother is approaching an infertile age, she might attach more importance to having a child. Because she wants a child the most out of the two spouses, she might feel obliged to take on a large share of parental leave herself, and will then lose bargaining power. Her feeling of obligation can be regarded as intra-relational pressure. There could also be gender-related norms affecting the bargaining power of the mother. An example is that, when a woman becomes a mother later in life, there may be societal pressure on her to take a large share of parental leave. There exist traditional stereotypes of women and what defines womanhood; some of which are that womanhood is defined by reproduction. Women who are involuntarily childless have traditionally been viewed as desperate and unfulfilled (Franklin, 1997; Pfeffer, 1987; Woollett 1991 cited in Letherby, 2002, p.10), while women who are voluntarily childless have been seen as selfish, deviant and unfeminine (Smith, 1996; Gillespie, 2000 cited in Letherby, 2002, p.10). This stereotypical view might be applicable to the case of women having children later in life, both voluntarily and involuntarily. As a consequence of the norm, when older women do procreate they might feel the need to overcompensate in order to prove that they are good mothers, and possess "womanly features". This need to overcompensate could show itself in the mother taking a larger share parental leave than the father.

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[3] We regard being married and being in a committed relationship as interchangeable in this thesis.

Thus, there are potentially several effects from the biological clock that could result in the mother taking a larger part of parental leave. Our hypothesis is thus:

- The female biological clock affects the bargaining outcome negatively as the female approaches an infertile age

If the hypothesis is correct, a decrease in bargaining power will result in women taking a larger share of parental leave as they approach an infertile age. We will as previously stated approach the investigation of our research question in two ways; both through a theoretical framework and through an empirical analysis.

4. Theoretical framework

4.1. The model

The model which best captures the dynamics of the household decision-making process depends on the nature of the specific household decision-making that is to be illustrated. We want to use a model that illustrates as simple as possible the particular case of decision-making that concerns the division of parental leave between two spouses. We regard the Nash cooperative bargaining model as the most suitable one in our case, due to the following arguments:

- In accordance with Chen and Woolley and (2001), it can be argued that cooperation is reasonable to assume because of the long-term, repeated action-character of the behaviour within marriage. In a marriage where a child is about to be born, it is more likely that the spouses have had time to build up this cooperative-like behaviour, since it is probable that the spouses have spent a considerable amount of time with each other before having a child.

- The decision of parental leave can be considered to be a comparatively big decision for the household that might have large implications on future work opportunities and career lives for the spouses, and for the well-being of the child. It is thus reasonable to assume that the equilibrium outcome will be Pareto efficient for the household as a whole.

- We argue that a certain degree of selflessness is reasonable to assume, since it regards a marriage and a child. Hence, the spouses should not only care about their own utility, but try to maximise the utility of the entire household.

- To assume income pooling, which is a feature of the cooperative model, is credible in our case since sharing income might be more motivated when one of the spouses is unable to work due to the take-up of parental leave, and thereby sacrifices part of his/her private income (or full income in case of unpaid leave) to take care of the mutual child.

- The cooperative model also assumes that in case the spouses do not cooperate, they will divorce. One could question whether this is a reasonable assumption to make, but in accordance with previous argument, parental leave is a big decision with possibly large future implications. Thus, it does not seem unreasonable to assume that if the parents despite efforts cannot reach an agreement, they will divorce.

In the cooperative household model, it is the threat point that drives the outcome (Katz, 1997). What determines the equality or inequality of bargaining power is the relative threat points of the individuals in the bargaining process; that is, which bargainer has more to lose. When the concept of bargaining power is applied to intra-household bargaining, an individual's bargaining power and threat point are defined by one's ability to survive and thrive outside the family.

A wide range of factors could determine a person's bargaining power (Agarwal, 1997), some quantifiable, such as economic assets, and others which are not, such as external support systems, or social norms and institutions. Inequalities in bargaining power rise due to unequal access to strong fall-back positions. When an individual within the household has, for example, less economic or social capital relative other individuals within the household, a situation is created where different individuals within the household have more or less bargaining power. Having less bargaining power in turn leads to less influence over household decision-making, such as allocation of resources.

Players' socioeconomic characteristics are generally indicators of future income, which in turn are expected to influence bargaining power. This concept was used in a study of bargaining over temporary parental leave conducted by Amilon (2007), and we consider it applicable to our case of parental leave as well since the dynamics of the threat point is similar. The relationship between bargaining power and future income can be explained by the fact that a high future income implies higher utility in a potential future divorce, indicating a strong threat point. As an example, a higher level of education can be expected to have a positive effect on future income. Therefore, having a higher education will improve a player's threat point and thereby bargaining power. The age of the parent is also expected to influence bargaining power, as age can be viewed as a proxy for labour market experience. Therefore, a higher age is expected to influence the individual's bargaining power positively.

4.2. Setting up the model

In the first section, we will illustrate the hypothesised effect from the biological clock on the threat point through a basic Nash cooperative bargaining model. We base our framework on the one used by Amilon (2007), who models the division of temporary parental leave through a non-cooperative bargaining game. We use similar utility functions as Amilon, but apply them to a cooperative rather than a non-cooperative bargaining game. We later extend the model as done by Katz (1997) in order to incorporate the intra-relational pressure and norm-related factors that could potentially affect the outcome division of parental leave.

4.2.1. A Nash Cooperative Bargaining Model of parental leave

We assume that there are two rational players, a mother and father who together constitute the household, and which both have individual preferences. The individual utility functions constitute the total utility of the household in line with the cooperative model framework. The players maximise the utility of the household through a bargaining game in which the resource allocation between the spouses is decided. We hence assume that the household's resource allocation varies systematically with individual players' bargaining power.

In accordance with our hypothesis, we want to analyse if the division of parental leave is affected by a mother's proximity to an infertile age and thus decreasing bargaining power. In families and households, child care can be considered a public good, which the two players of a household

(mother and father) must produce in order to consume. Thus, parental leave is viewed as a household public good, produced with the time of the parents as the only input. We assume that both parents have the same productivity in providing the public good, i.e. they are equally good at taking care of the child.

The players' utility is composed of consumption of the household public good and consumption of private goods. In other cooperative models, the private goods have consisted of market goods and leisure (Apps and Rees, 1997; Aronsson and Daunfelt, 2001). In our model, we replace the leisure-component with pursuit of a satisfying career. The reason we want to include pursuit of a career instead of leisure in the private utility is that, in modelling the case of parental leave, the trade-off is made between market work and parental leave, rather than between market work and leisure as in other household models. Time spent pursuing a career is part of the utility since a long absence from the labour market due to parental leave can be regarded as a possible impediment to future satisfactory job opportunities. Since work is such a large part of most people's lives, the satisfaction they derive from work is likely to be a major determinant of their overall utility levels (Brown and McIntosh, 1998).

Players receive the same utility from the public good regardless of who takes care of the child, as we make the simplifying assumption that players have the same preferences for child care. In addition to assuming equal preferences for child care, we also assume that preferences for market work is the same. In reality preferences naturally differ amongst individuals, but we make this assumption since preferences is not the explanatory factor of interest in our analysis.

The utility that stem from private consumption depends on how much time a player spends in parental leave, as production of the public good results in less time spent in market work, thereby resulting in a reduction of individual utility. Thus, the time the mother spends at home with the child represents a private disutility for her, while representing a utility for the father, since it enables him to spend that time pursuing his career. Therefore, both spouses want their children to be taken care of, but each of them receive more utility from laying the production of the household good on the other.

The utility functions of the players are as follows:

$$U_m = u(private\ goods\ consumption_m) + g(public\ good\ consumption_m)$$
$$U_f = u(private\ goods\ consumption_f) + g(public\ good\ consumption_f)$$

i = (m)other, (f)ather

In its most basic form, the Nash cooperative bargaining solution can be written as:

$$Z = (u_m(x_m) - v_m(b_m)) * (u_f(x_f) - v_f(b_f))$$

where u_i is the utility of each household member, x_i is a vector of consumption of goods; v_i is the indirect utility level achievable by each member outside of the household; and b_i is a vector of parameters which influence this indirect utility level, such as future income. Z represents the total utility of the household, which the two players try to maximise. The expression within brackets represent the gains from cooperating, since it equals the difference between the utility received within the marriage and outside the marriage.

To define the threat point, we consider what constitutes utility in the divorced state. Fertility can be regarded as a physical asset. Monetary assets are a component of the utility, as the player in the divorced state can consume what he/she produces and thereby receive full utility from the private income. This makes bargaining power dependent on both monetary- and physical assets. Thus, we define the threat point as:

$$b_i = expected\ future\ monetary\ assets + physical\ assets$$

where expected future monetary assets is a function of current income, education level, age and labour market sector (Amilon, 2007). The physical asset represents the biological clock. In order for the spouses to cooperate and continue to be married as opposed to divorce, the utility of this threat point has to be lower than the utility of being married:

$$U_i(x_i) > V_i(b_i)$$

4.2.2. Solving the model

By taking parental leave, a spouse provides the household public good. This prevents the spouse from consuming part of her/his private good; pursuing a satisfying career. We thus model parental leave as a cost. We let x_i represent this cost, or disutility, that each parent experiences from taking parental leave. In order to clearly show the implications that the magnitude of this cost has on the threat point, we simply let the utility of the spouses be reversely expressed as $-x_i$:

$$u_m = -x_m \qquad u_f = -x_f$$

The household utility function Z can in accordance with the Nash cooperative bargaining solution thus be written as:

$$Z = (-x_m - b_m)(-x_f - b_f)$$

We assume that $x_m + x_f = 1$ since the public good always has to be provided by one of the spouses. The father's utility can thereby be expressed as: $u_f = -x_f \leftrightarrow u_f = -(1 - x_m)$

By this, the expression of the household utility becomes:

$$Z = (-x_m - b_m)(-(1 - x_m) - b_f)$$

Since the spouses maximise the utility of the household, we take the first order condition of the household utility function with respect to x_m in order to solve the model. This yields the following results:

$$\frac{\partial Z}{\partial x_m} = -(-1 - x_m) - b_f) + (-x_m - b_f) =$$

$$= 1 - 2x_m + b_f - b_m = 0$$

$$x_m = \frac{1 + b_f - b_m}{2}$$

In words, the larger the mother's threat point b_m, the smaller will her cost x_m be, hence she will spend less time in parental leave. Consequently, she will spend more time pursuing a satisfying career, and receive greater private utility. If on the other hand the father's threat point b_f increases, the mother will take more parental leave and receive less private utility.

4.2.3. Extending the model

In this section, we want to incorporate the more subtle effects of the biological clock on the female bargaining power, such as effects from intra-relational pressure and norms regarding womanhood.

Cooperative bargaining models assume that both players' gains to cooperation carry equal weight in the determination of resource allocation. This fact is discussed and criticised by Katz (1997). She argues that members of the household bargain for resources to be allocated to their own advantage. To reach their preferred outcome, they will use their relative strengths within the relationship - beyond the power they receive from the relative strength of their threat point. As an example, some people are harder bargainers than others, making them more able to influence the household decision-making process. This means that household members may not have the same abilities to convert the difference between their inside and outside options (utility from marriage in contrast to divorce) into bargaining power. Another example of relative strengths is the way decision-making roles are determined by prevailing social norms. In some countries for example, there are norms insinuating that men have the final say in household decisions. This implies that, although an individual may have a strong threat point in a bargaining situation, he/she might not be able to utilise it properly due to personal characteristics or social norms.

Thus, it may not be correct to attribute an equal ability to utilise bargaining power in household decision-making. This factor can according to Katz be accounted for in the cooperative bargaining model by parameterising the gains to cooperation expressions:

$$Z = (u_m(x_m) - v_m(b_m))^\alpha * \left(u_f(x_f) - v_f(b_f)\right)^{1-\alpha}$$

where α captures the relative weight of the female partner in the decision-making process. This relative weight captures differences in exercising bargaining power.

The application of relative weights is of value in modelling our hypothesis since women approaching an age of infertility might have less ability to utilise bargaining power within the marriage. For example, an older woman might have an inferior ability to exercise her bargaining power due to intra-relational pressure or pressures from gender related social norms. A lower ability to utilise bargaining power results in a lower relative weight attached to the spouse in the bargaining process. This extension of the model thereby captures the more subtle effects from the biological clock on the outcome division of parental leave.

5. Empirical analysis

The theoretical framework we have provided shows that decreasing the strength of a mother's threat point will lead to her taking up a larger share of parental leave:

$$x_m = \frac{1 + b_f - b_m}{2}$$

The extension of the model also incorporates an effect from intra-relational pressure and norms. However, the model does not explain an important part of our hypothesis; that it is a woman's proximity to an infertile age that is the reason for her decreased bargaining power. Thus, we conduct an empirical analysis to see if there is empirical support for the hypothesis.

5.1. Data presentation

In order to test our hypothesis empirically, we have performed an OLS regression on the cross-sectional data set at hand. We have used cross-sectional survey data from the Norwegian Social Science Data Services (Nordic Institute of Women's Studies and Gender Research & Work Research Institute, 2014)[4]. The sample was randomly drawn from the Norwegian population and

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[4] Previous studies of parental leave have used register data or combinations of register data and survey data (SSIA, 2013b; Salmi and Lammi-Taskula, 2007; Norwegian Labour and Welfare Administration, 2009). Information regarding paid benefits has been collected through register data, which has been complemented by survey data to gather additional information of the take-up of leave.

includes individuals aged between 18 and 79. The gross sample consists of 6044 individuals and the net sample 2805, implying a response rate of 46.4 %. The data was collected by sending out self-completion forms, 3700 by post and 2344 electronically. The purpose of the survey was to gain knowledge of attitudes and practice of gender equality among residents. The parts significant to us in testing our hypothesis are variables describing the respondents' caretaking of children along with personal characteristics such as age, background and work.

We have excluded observations from the data set containing missing values on our dependent variable, which is the take-up of parental leave. Since we are interested in the division between parental leave and market work for two-person households, we have also excluded single, widowed or separated, retirees and students from the sample. We have also omitted observations containing answers that seem highly unlikely, such as females having their last child at an age above 60 or at the age of 12 and below. After excluding observations that were inapplicable to our analysis, the final sample contained 358 observations. The number of observations are unfortunately heavily reduced since the data survey has not been specifically targeted to couples with children.

5.2. Working method

Since we want to analyse the outcome division of parental leave between spouses, our dependent variable consists of the number of weeks the mother has taken divided by the number of weeks that the spouses have taken in total, where the number of weeks are a sum of both paid and unpaid leave. The dependent variable is thereby a quota describing the division between the spouses, more specifically the mothers' share of total parental leave. The parental leave period refers to when the couple's youngest child was born, since the data-set only contains information on parental leave regarding the most recently born child.

The independent variable that we use in order to estimate the potential effect of the biological clock on bargaining power is the mother's age when giving birth to her youngest child. To calculate this age, we have used the answers to the question of how old her youngest child is and subtracted this number from the mother's age. Thereby, our independent variable consists of the mother's age when her youngest child was born.

In choosing control variables, we want to control for factors that are likely to affect the division of parental leave and bargaining power other than the independent variable reflecting our hypothesised effect.

We have used gap measurements for the control variables, which thereby represent the difference between the mothers' and fathers' level in background characteristics. In the study conducted by SSIA (2013b), it was found that the parents' characteristics in relation to each other have implications for the division of parental leave. We argue that gap measurements are especially relevant in the setting of bargaining, where the spouses' relative power determines the outcome in the bargaining process.

To begin with, factors that are relevant to control for are personal characteristics that indicate level of future income (Amilon, 2007), since future income is a component of the threat point and hence bargaining power, which is unrelated to our hypothesis. Indicators of future income are as previously stated current income, age, education and labour market sector. We thereby use the difference between the father and the mother in income, age and education level, as well as an indicator variable of labour market sector, as control variables.

In addition, we want to exclude the effect of preferences, since preferences for child care should naturally also affect the division of parental leave between spouses. If we do not control for this, there is a risk of omitted variable bias when estimating the parameters, since there might be common sets of preferences for groups of respondents with similar characteristics. The level of education could reflect preferences and attitudes to work and future career to some extent. Another measure that might capture preferences of the spouses is the job sector that the individual is working in. Amilon argues that an individual who works in the public sector, which has traditionally had a larger share of females than the private sector, might on average have stronger preferences for taking care of children than individuals working in the private sector. Individuals in the public sector might also have a larger take-up of parental leave as they are less likely to be "punished" for taking parental leave. This is due to the fact that it might be seen as less deviant behaviour in the public sector, which is female-dominated. This is thereby an additional reason for controlling for labour market sector.

5.3. Descriptive statistics

This section consists provides an overview of the data in our sample. A table of descriptive statistics along with information of the generated variables can be seen below.

Variable	Obs.	Mean	Std. Dev.	Min	Max
moth_share	358	0.8427	0.1915	0	1
age_birth	358	31.4749	4.9170	20	57
age_birth_exp	358	1014.777	333.0633	400	3249
inc_gap	358	1.0698	1.5333	−5	5
edu_gap	358	−0.0894	0.8487	−3	3
moth_public	358	0.5	0.5007	0	1
father_public	358	0.3184	0.4665	0	1
age_gap	358	2.5754	4.6597	−11	38

The dependent variable, which measures the mother's share of total parental leave, has a mean value of 0.84. This implies that women take on average 84% of total parental leave. It is thereby clear that, as expected, the mothers in our data set are on average taking a substantially larger share of parental leave than the fathers.

In collecting the data, income was rated on an interval scale of 1 to 7, where 1 represents an income under NOK 100 000 and 7 represents an income of NOK 600 000 or more.[5] Education was rated on an interval scale of 1 and 4, where 1 means that the respondent's highest education level is 10 years of elementary school and 4 represents a highest education of more than four years at university level.[6] The age of the respondents is measured in number of years. The variables that specify which sector the mother or father works in are indicator variables, implying that they take the value of 1 or 0 depending on if the respondent works in the public sector or the private.

5.4. The regression model

The final regression model used is:

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[5] 2 = income of NOK 100.000 – 199.999, 3 = income of NOK 200.000 – 299.999, 4 = income of NOK 300.000 – 399.999, 5 = income of NOK 400.000 – 499.999, 6 = income of NOK 500.000 – 599.999
[6] 2 = continuing education (general, vocational training or other), 3 = university education up to four years

moth_share = ß$_0$+ ß$_1$age_birth + ß$_2$age_birth_exp + ß$_3$ inc_gap + ß$_4$ edu_gap + ß$_5$ moth_public + ß$_6$ father_public + ß$_7$ age gap + $\boldsymbol{\varepsilon}$

where the control variables are income gap, education gap and age gap between the two parents, as well as two indicator variables indicating if the mother and father work in the public or private sector. The variables representing the gap between the spouses is generated by taking the father's value and subtracting the mother's. In other words, a high value on income gap implies that the father has a substantially higher income than the mother, which should increase the mother's share of parental leave according to the theory of expected future income.

The independent variable is the mother's age the last time she gave birth. This is the key independent variable of interest in our test of whether the age of the mother affects the dependent variable; mother's share of total parental leave. We have also included the independent variable in squared form (variable name age_birth_exp) to analyse if there is any exponential effect on the dependent variable. This allows the marginal effect of the mother's age on share of parental leave to vary with the mother's age. The marginal effect is of interest due to the fact that the bargaining power effect of the biological clock should increase as the mother approaches infertile age in accordance with our hypothesis.

5.5. Data problems

An important and positive attribute of our dataset is that it is possible to analyse the spouses in relation to each other, since it contains information of the respondent and the respondent's partner. This is an important feature since the relational aspects are significant when testing for differences in bargaining power. Another positive attribute is that we have a measure of parental leave that includes both paid and unpaid leave. We thereby get a full measure of the actual leave taken, since using only a measure of registered paid out parental insurance would be misrepresentative in the way that actual leave taken can differ from paid leave, as established by SSIA (2013b).

Although there are positive aspects of our dataset, it has several limitations. A superior dataset in testing our hypothesis would be the one used in Social Insurance Report 2013:9 (SSIA, 2013b). These data were, in contrast to ours, collected with the specific intention of analysing parental leave and what factors affect the probability of an equal take-up among parents in Sweden,

implying a larger amount of observations and more relevant variables. The dataset also contains register data of paid parental leave, which reduces risk for measurement error. Unfortunately we were not able to acquire this dataset from SSIA. In continuing this section, we will list the limitations of the dataset at hand.

The dependent variable represents the division of parental leave, but since the data collection is not targeted specifically to couples with children, many respondents become irrelevant to us, resulting in observations with missing answers on key variables. The number of observations that we were able to use are therefore heavily reduced, which impairs the significance and generality of our results.

Another deficiency is that we do not have a measure for income at the time of childbirth. We therefore have to use the current income gap between the spouses as an approximation for the income gap at time of the child's birth. This is a flawed approximation, since a skewed division of parental leave could lead to a subsequently larger income gap, leading to a problem with reverse causality in our regression model. Also, income levels of the spouses could have changed significantly since the last child was born. In order to mitigate this deficiency, we have excluded couples from the sample where the youngest child is older than 10 years old and hence where there is a large time gap between current income and the income when the child was born.

The measure of the mother's age when giving birth only measures the division of parental leave for the youngest child, and does not contain information regarding possible earlier children. This lack of information due to the character of our dataset might affect our analysis, since the number of children a woman has had might affect the power balance between spouses and possibly our hypothesised effect of the biological clock as well. There is also the possibility that previously taken amount of parental leave for earlier children might affect subsequent division of parental leave, which is an effect that will not be captured by our model. Further, as it is likely that some mothers were not primigravida, why a situation could be created where parents use "saved" parental leave days from their older children, which would also generate fallible results.

Further, the dataset is based on survey data and not on register data. Information based on register data, which has been used in other studies (SSIA, 2013a; Salmi and Lammi-Taskula, 2007; Norwegian Labour and Welfare Administration, 2009) is more likely to have a higher degree of accuracy regarding paid leave and background characteristics. However, survey data is necessary to gather information in terms of unpaid leave and other attributes of the parents, of which there are no registered data, as in SSIA report 2013:9 (SSIA, 2013b). However, in using survey data, there is a significant risk for measurement error. Our dependent variable is likely to be subject to measurement error, since the estimation of number of weeks in parental leave might be difficult to remember in exact terms, especially if a long time has passed. The independent variables on the other hand, seem less likely to be subject to measurement error, since it is easier to have more exact knowledge of your education level, income and which labour market sector you work in. If the measurement error in the dependent variable is uncorrelated with the independent variables (Wooldridge, 2009, p.316), the estimations of the coefficients are unbiased and consistent. In our case, the estimation of the number of weeks of parental leave taken should not be correlated with our independent variables since in that case, people would make better/worse estimations depending on the gap in income, education etc. compared to the spouse, which seems unlikely. Also, we can think of no reason for why the error term and the measurement error should be correlated, hence the effect of measurement error in our case would simply mean a higher variance in the error term.

Additionally, there is a high probability of correlation between the independent variables in our model. For instance, education level difference should be correlated with income gap since a higher level of education is likely to result in a higher income. A high level of multicollinearity implies (Wooldridge, 2009, p.96) a smaller part of unique explanatory power of each independent variable, which will increase the standard errors of the estimates and decrease the statistical significance level.

Lastly, we have many observations with missing data in our data set. We do not consider it likely that the data is missing in a non-random fashion, since the couples excluded are the ones without children and which do not work. We can think of no reason why some group of individuals would

avoid answering a certain question in a systematic manner. Hence, the missing data should not have any negative effect on our estimates, except for reducing our number of observations.

5.6. The regression and results

In summarising the dependent variable that measures the mother's share of total parental leave, its mean value is 0.84, implying that women take on average 84% of total parental leave. It is thereby clear that, as expected, the mothers in our data set are on average taking a substantially larger share of parental leave than the fathers.

As established, we want to analyse if there is an effect of a mother's age when having her last child on the division of parental leave. Specifically, indications of this effect should imply a positive coefficient on our independent variable since that would illustrate an increase in the mothers' share of parental leave as she gets older. If the effect is increasing as the mother gets older, the coefficient on the squared form of our independent variable should be positive.

The results from our first regression can be seen in the table below:

Source	SS	df	MS
Model	0.5500	7	0.0786
Residual	12.5370	350	0.0358
Total	13.0869	357	0.0367

Number of obs	=	358
$F(7, 350)$	=	2.19
Prob > F	=	0.0343
R-squared	=	0.0420
Adj R-squared	=	0.0229
Root MSE	=	0.18926

moth_share	Coef.	Std. Err.	t	P>|t|
age_birth	−0.0102	0.0140	−0.73	0.465
age_birth_exp	0.000115	0.000206	0.56	0.576
inc_gap	0.0177	0.00704	2.51	0.013
edu_gap	−0.0133	0.0128	−1.04	0.299
moth_public	0.00274	0.0208	0.13	0.895
father_public	−0.0334	0.0227	−1.48	0.141
age_gap	0.00218	0.00220	0.99	0.323
_cons	1.032	0.236	4.37	0.000

The coefficient on age_birth is -0.0102, meaning that an increase in mother's age by 1 year leads to an on average percentage point decrease by 1.02 in the mother's share of parental leave in absence of an exponential effect. The sign of the coefficient is the opposite from what our hypothesis should predict, and the standard error is large relative to the coefficient value. In addition, the p-value of the coefficient is 0.465, implying that the effect is not statistically significant at any relevant level.

The quadratic variable has a very small coefficient (0.000115), indicating that there is practically no exponential effect from the mother's age on the mother's share of parental leave. Furthermore, the standard error of the coefficient is high relative to the coefficient value, and the p-value is 0.576, meaning that the null-hypothesis that the coefficient is zero cannot be rejected at any relevant significant level, implying low statistical significance. The R-squared in our model is also low, indicating that the share of mother's parental leave is not explained that much by our model.

In order to improve the regression model, we want to distinguish the effect of a mother's age when giving birth depending on if the mother is in the younger or older segment of our sample. The reason for this is that, in accordance with our hypothesis, the effect of the biological clock should be strongest for old mothers. We will thereby be able to even further isolate possible differences between mothers near and far from an infertile age. We chose to make the distinction between old and young mothers in the sample at the age 32. The first reason for this is that 32 is approximately the mean age of women giving birth in our sample, creating a natural division between "younger" and "older" mothers. The second reason is that, although fertility is genetic and individual for every woman, statistics show that it will begin decreasing significantly from around the age of 32, and much faster after the age of 37 (Virtala, et al., 2011).

We create an indicator variable corresponding to if the mother is old or young, called old_mother. The variable takes the value 1 if a mother is above 33 years old, and it has the following characteristics:

Variable	Obs.	Mean	Std. Dev.	Min	Max
old_mother	358	0.3715	0.4839	0	1

The new regression model, including interaction terms with the old_mother indicator variable thus becomes:

moth_share = β_0 + $\delta_0$old_mother + $\beta_1$age_birth + **$\delta_1$age_birth*old_mother** + $\beta_2$age_birth_exp + **$\delta_2$age_birth_exp*old_mother** + β_3 inc_gap + β_4 edu_gap + β_5 moth_public + β_6 father_public + β_7 age gap + ε

The variable that interacts the indicator variable for old/young mother with our independent variable age_birth is called old_birth in the regression table. The variable interacting the indicator variable and the quadratic form of the independent variable is called old_birth_exp in the regression table.

This regression generated the following results:

Source	SS	df	MS
Model	0.6449	10	0.0645
Residual	12.4420	347	0.0359
Total	13.0869	357	0.0367

Number of obs	= 358
$F(10, 347)$	= 1.81
Prob > F	= 0.0596
R-squared	= 0.0493
Adj R-squared	= 0.0219
Root MSE	= 0.18936

moth_share	Coef.	Std. Err.	t	P>|t|
age_birth	0.0081	0.0731	0.11	0.912
old_mother	1.4342	1.3230	1.08	0.279
old_birth	-0.0738	0.0845	-0.87	0.383
age_birth_exp	-0.00015	0.0013	-0.11	0.911
old_birth_exp	0.0009	0.0014	0.65	0.516
inc_gap	0.0172	0.0071	2.42	0.016
edu_gap	-0.0105	0.0130	-0.81	0.419
moth_public	0.0048	0.0209	0.23	0.817
father_public	-0.0341	0.0227	-1.50	0.134
age_gap	0.0021	0.0022	0.95	0.343
_cons	0.7295	1.0000	0.73	0.466

The coefficients of the variables, including those with the interacting indicator, have large standard errors relative to the coefficient values and very large p-values, indicating low statistical significance. The R-squared in our model is also low, indicating that the share of mothers' parental leave can still not be explained very much by our regression model. A robust version of the same regression as above can be found in the appendix. The coefficients in the robust regression do still not indicate an effect of the biological clock on bargaining power, as the estimated coefficients are not statistically significant at any relevant level.

To test if there is any difference in the effect from the mother's age on the mother's share of parental leave between the two groups (old and young mothers) we perform an F-test on the coefficients including the indicator variable.

$$H_0: \delta_1 = 0, \delta_2 = 0$$

$F(2, 347)$	=	1.13
$\text{Prob} > F$	=	0.3233

This tests whether the coefficients on the variables old_birth and old_birth_exp are equal to zero. The F-value in this test is 0.3233, indicating that the null-hypothesis that there is no difference in the effect of our independent variable between the two groups cannot be rejected at any relevant significance level.

6. Discussion

The regressions indicate that there is no statistically significant effect from a mother's age when giving birth on her share of parental leave. The unequal distribution of parental leave between the genders appear to be rather constant and not dependent on mother's age. There is thereby no empirical evidence to support our hypothesis that the female biological clock has implications for her bargaining power in the marriage.

There are several potential reasons for the lack of empirical evidence to support or hypothesis. The most prominent one is that the biological clock simply does not have any notable effect on a

woman's bargaining power in terms of parental leave. Or, if there is an effect, it might be subtle or weak and difficult to find empirical evidence of. In that case, the conclusion that follows is that the threat of infertility does not appear to have a substantial effect on the division of parental leave. This would imply that our hypothesis is false. Following this conclusion, the threat of infertility as a potential cause of unequal parental leave division should be given less attention in the search for the main reasons behind parental leave division. In other words, other research areas could be explored in the pursuit of enabling and promoting a more gender equal division.

On the other hand, there may be technical and data related issues behind why the hypothesis could not be proven. Because of the limitations of our empirical analysis it is difficult to draw significant conclusions regarding the effect of the biological clock on bargaining power. The lack of statistically significant estimates are likely due to earlier stated data problems, such as a low number of observations, leading to a small sample variation in the independent variables (Wooldridge, 2009, p.95). There is also a high probability of multicollinearity among the independent variables, creating even larger standard errors because of the low unique explanatory power in each independent variable. The testing of our hypothesis could be improved by a larger data set more suitable for testing our specific hypothesis, such as the one used by SSIA (2013b). The fact that we do not see any empirical evidence of our hypothesis could thereby be a consequence of these limitations.

There is also a possibility that the regression model suffers from omitted variable bias because of factors that are likely to affect the outcome division of parental leave but that are difficult to control for. These factors are for instance preferences, but also personality characteristics of the spouses. A high-ranked job with a high income might be an indicator of personal characteristics, such as self-confidence, leading to a strong bargaining position in addition to a strong threat point.

However, the choice of theoretical framework might also be a reason for why we do not see evidence of our hypothesis in the data. The cooperative intra-household model we have used to illustrate the mechanism between bargaining power and the amount of time spent in parental leave could in itself have flaws. First off, the model is a very simplified version of the real dynamics within a household. Reality is much more complicated as relationships and behaviour tend to be

distinct and different from couple to couple. An issue is also whether using the cooperative model adequately illustrates the underlying mechanisms of the division of parental leave. In work similar to ours, the division of temporary parental leave was modelled non-cooperatively (Amilon, 2007), which potentially could illustrate the dynamics of parental leave division more accurately.

In addition, the assumptions upon which we have built our theoretical framework might not be representative of how the spouses actually perceive parental leave. To model parental leave as a cost is a strong assumption in itself, which might be unrealistic. Our theoretically modelled hypothesis might thus be a poor illustration of reality, with a lack of statistically significant results as consequence. Furthermore, we have assumed that the public good is produced with the time of the parents as the only input. In reality, day care and nannies are available to parents and will affect the amount of parental leave they take.

Due to these potential issues, we advise the reader against drawing conclusions regarding what implications the biological clock has on the division of parental leave. Still, we argue that even though our study is not able to show a correlation between the biological clock and parental leave division, it should be taken into consideration that a bargaining power asymmetry between a mother and father might arise due to the biological clock.

7. Conclusion

In our thesis, we have analysed the division of parental leave through a bargaining perspective. Our hypothesis was that the female biological clock should decrease a woman's bargaining power negatively in the division of parental leave, as she approaches an infertile age. To illustrate this, we have used Nash bargaining theory, more specifically, a cooperative model of intra-household behaviour. We then tested the hypothesis empirically through an OLS regression on a Norwegian dataset, in which we found no evidence to support our hypothesis. The lack of empirical evidence is possibly due to issues with the data used in the regression analysis, since we could not generate statistically significant results. Also, the reason could be theory based in the sense that the biological clock does not decrease female bargaining power at all, or that our theoretical framework is not representative of the underlying dynamics of the division of parental leave.

The lack of empirical evidence of an effect from the biological clock on the power balance between the spouses – the unequal distribution is quite constant and not dependent on mother's age – might indicate that the most important explanation for inequality is due to norms related to gender (SSIA, 2013a). Future research that could be done to produce more significant results is to use a data set more compatible to address our specific hypothesis, thereby including more observations. In addition, a continued problematisation and analysis regarding social norms could potentially contribute to explaining the dynamics of the division of parental leave.

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Appendix

Robust version of the second regression.

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Linear regression                              Number of obs    =     358
                                               F(10,347)        =    3.05
                                               Prob > F         =   0.0010
                                               R-squared        =   0.0493
                                               Root MSE         =   0.18936
```

moth_share	Coef.	Std. Err.	t	P>|t|
age_birth	0.0081	0.0806	0.10	0.921
old_mother	1.4342	1.4044	1.02	0.308
old_birth	−0.0738	0.0900	−0.82	0.413
age_birth_exp	−0.0002	0.0014	−0.10	0.917
old_birth_exp	0.0009	0.0015	0.62	0.538
inc_gap	0.0172	0.0079	2.18	0.030
edu_gap	−0.0105	0.0134	−0.78	0.434
moth_public	0.0048	0.0220	0.22	0.826
father_public	−0.0341	0.0232	−1.47	0.142
age_gap	0.0021	0.0023	0.92	0.361
_cons	0.7295	1.1357	0.64	0.521