

# **Estate division: Equal sharing, exchange motives, and Cinderella effects\***

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## **Abstract**

A large literature provides empirical tests of theoretical models of bequest motives. However, the previous studies rely either on survey data on parents' bequest intentions or on data from tax records, that commonly only cover bequests from the very wealthy and lack control variables to facilitate empirical tests of several bequest theories. Our contribution to this literature is that we use a population-wide administrative dataset covering data on realized inherited amounts for complete families (deceased parents and all their children), matched with an extensive set of economic and demographic variables. These data allow us to test three bequest models: altruism, exchange and evolutionary, by estimating the influence of child characteristics on differences in inherited amounts among siblings. Our findings are; first, children who are more likely to have provided services to the parent receive more than their siblings, as predicted by the exchange model. Second, daughters with children receive more than sons with children. This is consistent with the prediction of the evolutionary model, that larger investments should be directed to offspring who are certain to be genetically related. There are also Cinderella effects—that is adopted stepchildren receive less than siblings who are biological or children who are adopted by both parents—at work in some cases. Third, there is no correlation between the inherited amount and child's economic circumstances, measured as either permanent income, wealth, or education. This finding is inconsistent with the altruism model, which predicts that bequests should be compensatory.

Keywords: estate division, equal sharing, exchange motives, adopted children

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## 1 Introduction

This paper is about the determinants of parents' decisions regarding the allocation of bequests between their children. The objective is to test the relevance of both conventional and more unconventional explanations for parents' bequest decisions. We do this by studying the determinants of differences in inherited amounts among siblings.

We use a population-wide dataset from Sweden covering data on bequests and inheritances for complete families (deceased parents and all their children) during the 2002–2004 period, matched with an extensive set of individual economic and demographic variables from other administrative registers. By exploiting the within-family variation in the data, we estimate the influence of child characteristics on inherited amounts using models with family-fixed effects that effectively account for unobserved heterogeneity in preferences across families.

The questions we analyze include:

Do children who are worse off financially than their siblings receive larger bequests? This is the hypothesis of the altruism model of bequests, which assumes that parents use bequests to equalize consumption possibilities within the family (Barro, 1974; Becker, 1974). In macroeconomics, for example, the Ricardian equivalence predictions about fiscal policy inefficiency are based on the assumption of dynastic altruistic behavior.

Do children who have provided more services to the parent inherit larger amounts than their siblings do? This is the hypothesis of the exchange model of bequests (Bernheim et al., 1985; Cox, 1987). To the extent that services refer to informal care of the parent, unequal sharing on the basis of *quid pro quo* will work as a private insurance, compensating for the income losses from caregiving.

Do children who continue the family bloodline receive more than their siblings who do not? To the extent that this form of evolutionary motive (Cox, 2003; Hamilton et al., 2007) is important, it would manifest itself in larger bequests to genetic children than to non-biological children. Moreover, children who produce offspring (grandchildren of the deceased) should receive more than the siblings who do not produce offspring, and especially daughters since their offspring are more certain to be genetic descendants.

The above explanations are all based on the idea that parents (with more than one child) make unequal bequests. But, as the vast majority of parents divide, or intend to divide, their estates equally between their children, these explanations are commonly rejected in the literature. It should be noted already at this point that equal sharing is the default rule in the Swedish inheritance law. This is similar to the inheritance laws in most other European countries as well as in the United States (Angelini 2007; Pestieau 2003). It is apparent that equal sharing also is the common practice. In our data, 86 percent of the parents who pass away with a positive estate, more than one child and a will (which is needed to divide unequally) divide their estates equally among their children, even though they had the option to choose a different distribution.<sup>1</sup> This is consistent with what has been reported for other countries elsewhere in the literature (see Arrondel and Masson 2006, for a review).

It is important to learn about the degree at which bequests are typically divided unequally for an analysis of the evolution of wealth distribution.<sup>2</sup> But this is only a first step. It is, on a more general level, crucial to understand what determines the allocation decision in order to assess the normative implications of wealth inequality and consider potential policy interventions (Cremer and Pestieau 2006).

As far as we know, this is the first study of the determinants of differences in inherited amounts among siblings using population-wide administrative data that cover precise information on *realized* inherited amounts for complete families.

Our focus is not on the impact of child-level variables on the parent's decision to divide equally or unequally. This is because such an analysis is only informative about how the distribution of traits among children correlates with the allocation decision, and not on what grounds the parent favor or disfavor particular children.

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<sup>1</sup> The three year study period does not allow us to depict the trends in sharing patterns over time. This is not the objective of the paper either. Readers interested in this question are encouraged to consult Francesconi et al. (2015) for a study of the evolution of parents' sharing intentions in the U.S. during the period 1995-2010. For a matter of generalizability of the results, we should point out, that we have no reasons to believe that the three years of data (or put differently, the three cohorts of decedents) differ substantially from any other nearby year (or cohort).

<sup>2</sup> See De Nardi (2004) for a review of the literature regarding the relationship between bequests and wealth inequality and Elinder et al. (2016) for tests of the relationship, using the same data as the current study.

Instead, we provide more direct tests of the transfer theories by exploiting the uniqueness of our data, that is the information on inherited amounts for complete families, and estimate how differences in inherited amounts across siblings are related to differences in their characteristics. The identifying variation in these estimations comes from families with unequally divided bequests. This is unlike most previous studies that use the incidence of transfers as outcome, and thereby rely solely on variation induced by the small and particular subset of families in which the parent has disinherited at least one child (e.g. Dunn and Phillips, 1997; McGarry, 1999; Light and McGarry, 2004).

The results from our analysis are the following:

We find no evidence that the inherited amount is correlated with the child's permanent income. This finding is inconsistent with the altruism model of bequest.<sup>3</sup> To our knowledge, only Wilhelm (1996) provides tests of the compensatory nature of bequests using a similar approach. Based on estate tax return data on wealthy parents in the United States he, similarly to us, finds no evidence of compensatory division of bequests within families. We also take Wilhelm's work further and test for the impact of wealth and education but the relationships with the inherited amount are also in these cases statistically insignificant.

We find that children who are more likely to have provided services to the parent (because they lived close to the parent) benefit disproportionately from bequests. This is consistent with the predictions of the exchange model. There are no previous studies using our approach to test the predictions of the exchange model with respect to bequests.<sup>4</sup> In their seminal paper, Bernheim et al (1985) find that parents' bequeathable wealth has a significant positive effect on attention (measured as number of visits, or phone calls) supplied by the children. Light and McGarry (2004) report that among mothers who plan to leave unequal bequests, one fourth intends to exchange bequests for services provided by the children. Finally, Brown (2006) finds that

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<sup>3</sup> A number of studies find that *inter vivos* gifts are compensatory, suggesting that the altruism model works fairly well in explaining the motives behind this type of transfers (see, for example, McGarry and Schoeni, 1995; Dunn and Phillips, 1997; Hochguertel and Ohlsson, 2009, Halvorsen and Thoresen, 2011). However, the database used in this paper only contains data on taxable gifts from the deceased to the children during the ten years prior to the demise. Since we miss gifts made more than ten years ago and non-taxable gifts, which together are likely to constitute a large fraction of the total amount of gifts made, we focus on bequest at death (for which the data are complete).

<sup>4</sup> Hochguertel and Ohlsson (2009) use a similar approach to study the importance of the exchange motive for *inter vivos* gifts.

children who provide informal care to the parent, as compared to those who do not, are more likely to be included in the set of potential bequest recipients.

In order to investigate the relevance of the evolutionary explanations, we test for differences in inherited amounts between biological and adopted children within the same families. This strategy, as opposed to comparing transfers to biological children and non-adopted, non-biological children (e.g. stepchildren or foster children), is advantageous as it minimizes the influence of unobservable confounding factors, such as preferences, upbringing, etc.<sup>5</sup> It also limits the possibility that smaller transfers to non-biological children are the result of the parent expecting the child's biological parents to provide for him or her. Our results show that, among families with both biological and adopted children, adopted children receive almost 50 percent less than siblings who are the parent's biological children.

A closer look at the relationship, however, indicates that it is largely driven by disfavored adopted stepchildren of the deceased. Adopted children with two adoptive parents, on the other hand, do not receive less than siblings who are the biological children of the deceased. The finding that stepparents invest less in their (step)children than biological parents do is the reason for why we use the term Cinderella effect.<sup>6</sup> The crucial factor leading to a lower bequest for an adopted child, in other words, is whether the previously deceased parent was the child's biological parent.

Our finding agrees with previous studies that report that mothers with both biological and non-biological children (adopted or step) are more likely to *plan* unequal bequests (Light and McGarry, 2004), and that stepchildren are less likely to be included in the stepparent's will before the death (Francesconi et al., 2015).

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<sup>5</sup> Stepchildren and foster children are not legal heirs according to Swedish inheritance law. The deceased must either have adopted them or explicitly have included them as beneficiaries in a will or a life-insurance policy for them to be entitled to the deceased's property. This is commonly the case in inheritance laws in Europe as well as in the U.S.

<sup>6</sup> The Cinderella effect originates from evolutionary psychology and the finding that stepparents invest less in their (step)children than biological parents do (Cooper, 1976; Brenner, 1985) and also, that stepparents are disproportionately involved in child-abuse and mistreatment of their (step)children (see Daly and Wilson 2007, and references therein). Theoretical work on the optimal design of bequest taxes suggest the inheritance law should stipulate equal sharing in the presence of Cinderella effect (Cremer and Pestieau 2001).

Moreover, we find that daughters with children of their own receive more than sons with children. This is also in line with the predictions of evolutionary models, that larger investments should be directed to offspring who are certain to be genetically related.

The paper is structured as follows: In Section 2, we discuss the hypotheses and some empirical issues. Section 3 presents the data and the construction of the analysis sample. In Section 4, we report the results from the main analysis; that is, the determinants of differences in bequests among siblings. And, finally, Section 6 concludes. Two appendices provide additional descriptive statistics and estimation results.

## **2 Hypotheses and empirical issues**

### *2.1 Transfer motives*

Different motives for intentional transfers from parents to children have been proposed in the theoretical literature. We will here discuss altruism, exchange, and evolutionary motives.

The altruism model of bequests is based on the idea that the parent obtains utility from own consumption as well as from each of her children's utility levels (which depend on their lifetime consumption possibilities) (Barro, 1974; Becker, 1974). This implies that the higher the lifetime resources of the parent, the larger the transfer to all children. Another key prediction of the model is that bequeathed amounts from the parent are negatively correlated with child income. This is because the marginal utility of a transfer depends on the child's lifetime income. For parents with more than one child, this, so-called derivative condition, implies that the parent will make larger transfers to children with low income relative to the siblings (Cox, 1987). The compensating transfers will reduce the difference in lifetime consumption possibilities between low- and high-income siblings.

We test for the relevance of the altruism model by estimating the impact of child income on the inherited amount. The hypothesis is that children with lower incomes, relative to their siblings, should receive disproportionately larger inheritances. As noted above, the predictions regarding the connection between inheritance and income are based on permanent income. We will use the average of taxable labor income over the three years preceding the parent's demise as a proxy for the child's permanent income. We do not include the child's income in the year when the parent passes away, as it is unclear whether this is observable to all parents. One concern is that the three year average of income of persons who are, on average; in their early 50s may be

a poor proxy for permanent income.<sup>7</sup> As alternative measures of lifetime consumption possibilities, we use the child's wealth (average of net wealth over the three years preceding the demise) and level of education.

The exchange model assumes that the parent values services provided by the children, and more so than similar services provided in the market (Bernheim et al., 1985; Cox, 1987). Services may be attention paid to the parent, care, or assistance. The parent is assumed to pay for the services with transfers. Parents with higher resources will purchase more services and, consequently, make more and larger transfers. The price that the parent has to pay depends on the value of the child's time (i.e. the child's opportunity cost). This leads to the prediction that the parent is more likely to purchase services from children for whom the cost of time is low.<sup>8</sup> Transaction costs—in the form of travel or travel time costs—will also affect the purchase of services. Children, for whom these transaction costs are relatively low because they, for example, live closer to the parent, are more likely to be service providers and, consequently, more likely to be rewarded with larger transfers (see Hochguertel and Ohlsson, 2009, for a discussion).<sup>9</sup>

The prediction of the exchange model, that children who have provided relatively more services to the parent receive larger inheritances, is tested by comparing differences in inherited amounts between children who lived close to the parent prior to the demise and children who lived further away. The argument here is that services are more easily delivered when parents and children live geographically close (Cox and Rank 1992; Hochguertel and Ohlsson 2009). As a measure of geographic proximity, we use an indicator for whether the child and the parent resided in the same parish during the three years before the demise. The parish is the most disaggregated geographic identifier available in Swedish registers and ascertains that parents and children live no more than 20 kilometers from each other.<sup>10</sup> Another proxy for service

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<sup>7</sup> Ideally, we would like to calculate permanent income using income data from when the heirs were in their 40s, as suggested by, for instance, Nybom and Stuhler (2016), but unfortunately such data are not available to us.

<sup>8</sup> Unlike the altruistic model, the exchange model makes no clear predictions about the correlation between the inherited amount and the child's income. It only predicts that the probability of transfer is negatively related to child income, as a higher income implies a higher cost of the child's time and thus a higher price of services.

<sup>9</sup> We do not focus on the motives behind children's decision to provide services to their parents. Theoretical models commonly assume that children are purely selfish and provide services only because they anticipate bequests, as predicted by Becker's "rotten kids theorem" (Becker 1974, 1991; Cremer and Roeder 2017).

<sup>10</sup> At the time of the study period, Sweden had 2,200 parishes. The parishes are geographically distinguished, but vary in size. The vast majority are located in the southern Sweden and are small in geographic size, while the large

provision that we consider is the sex of the child. Studies consistently report that daughters are disproportionately more involved in the provision of parental care than sons (Coward and Dwyer, 1990; Stoller et al., 1992), due to the lower opportunity cost of their time (see e.g. Ettner, 1996).<sup>11</sup> Finding that daughters receive more than sons could, therefore, be explained by daughters being compensated for their relative more extensive service provision (Cox, 1987). Moreover, it is possible that care giving and attention are correlated with the child's marital status since single children are likely to have a lower opportunity cost of time than married or partnered children (Brown 2006). Finding that married children receive less than their unmarried siblings could, thus, be seen as support for the exchange model.

A more recent theory of parental transfers is based on reproductive biology and evolutionary psychology, and argues that transfers arise from an inherent desire of the parent to support the survival of his or her genes (Cox, 2003; Hamilton et al., 2007). Accordingly, parents will leave more and larger transfers to their biological children, who can pass on the genes, than to their non-biological children (i.e. adopted children or stepchildren). We will study the relevance of this prediction by testing for differences in inherited amounts between biological and adopted siblings. In Sweden, adopted children enjoy the same legal status in the bequest division as biological children. Finding that adopted children receive smaller inheritances than biological children would thus imply that parents act in accordance with the evolutionary model.

The evolutionary model further suggests that parents care about the long-term continuation of the family blood line and will thus favor children who produce descendants (i.e. grandchildren). This prediction, however, is somewhat less straightforward than the previous one since, on the one hand, parents may give larger amounts to children who have already produced children, and, on the other hand, parents give relatively large amounts to childless children to assist with the eventual cost of raising a child or simply to "motivate" them to produce grandchildren (Cox and Stark, 2005). To get closer to the theoretical prediction, we therefore extend the analyses to not only test for the impact of having children *per se*, but also for the interaction effect of

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parishes are located in the sparsely populated north. The average parish (including the northern ones) was 204 square kilometers (449,964 km<sup>2</sup>/2,200), implying that people live a maximum of 20 km from each other (the diagonal of the square). Excluding the north, about half of Sweden's geographic size (and 12 percent of the population), and a total of about 100 parishes yields an average sized parish of 107 km<sup>2</sup>, and a maximum distance of around 14 km.

<sup>11</sup> Recent theoretical work by Barigozzi et al. (2017) suggest that daughters are disproportionately involved in care for impaired parents because of social norms.

having children and being a woman. This follows from the reasoning and empirical observation in Cox (2003) that grandchildren by daughters are preferred over grandchildren by sons, as they are more certain to be genetic descendants.

## *2.2 Empirical issues*

A joint prediction of the transfer theories discussed above is that parents with more than one child will divide the bequest unequally between the children, if the children differ in characteristics and behaviors. Studying how child-level variables affect the parent's decision to divide equally or unequally would, however, only inform us about how the distribution of traits among children correlates with the parent's allocation decision, and not on what grounds the parent favors or disfavors particular children. Finding, for instance, that a greater income dispersion among the children is positively associated with the likelihood that the parent divides unequally could either imply that the parent gives more generously to children with low income (consistent with altruism) or more generously to the children with higher income (for example, to reward them for their past achievements).

We will instead provide more direct tests of the transfer theories by focusing on the distribution of bequests from the perspective of the child. More specifically, we test for how the inherited amount received by the child is affected by his or her economic and demographic traits.

Relating the inheritance of the child to his or her characteristics is not unproblematic. A simple cross-sectional regression is likely to produce biased estimates since the outcome is the result of preferences of the parent, which are unobservable and, presumably, correlated with the explanatory variables. For example, parents who desire a high level of consumption for their children may not only leave more generous bequests, but may also have invested heavily in the children's education. Since education is positively correlated with income, the coefficients estimate on child income is likely to be biased towards zero (McGarry 1999). Controlling for observable parent characteristics would only partly mitigate this bias. Moreover, since an inheritance by definition is only received at one point in time (as opposed to gifts, which could be received at several occasions), panel data methods cannot be employed to account for (time invariant) unobserved heterogeneity at the individual level.

We will instead exploit variation in inherited amounts and characteristics across children within the same families and estimate models with family-fixed effects.<sup>12</sup> The family-fixed effect will effectively control for time-invariant observed and unobserved factors that are common for all children within the same family, but differ across families, such as parent inequity aversion. Using within-family variation rather than between-family variation is also appealing, as it is consistent with the predictions of the transfer theories. The coefficient estimates for the child-level variables from family-fixed effects models represent deviations from the within-family mean and could, hence, be interpreted as the impact of the characteristic relative to the siblings without the characteristic.<sup>13</sup>

We use the actual inherited amount as outcome variable. The estimation strategy thus requires that the inherited amounts vary across children within the same family. If parents give equally to all children, there would be no correlation between the explanatory variable and the inheritance; any deviation would be random (McGarry and Schoeni, 1997). Consequently, we will rely on variation across families with unequally divided bequests.

In this respect, we differ from studies using survey data on bequest intentions to estimate the impact characteristics of the child will have on the probability that the child is (or will be) included in the parent's will (McGarry, 1999; Dunn and Phillips, 1997; Light and McGarry, 2004). These studies instead rely on variation from the particular sub-sample of families in which at least one child is not included in the set of bequest recipients (Menchik, 1980; Brown, 2006).<sup>14</sup> To the best of our knowledge, Wilhelm (1996) is the only study exploiting within-family variation in inherited amounts to test bequest motives. While Wilhelm reports convincing results that inheritances provide negligible compensation to children with low earnings, it is difficult to generalize the findings to other settings, as they are based on a sample drawn from the uppermost tail of the wealth distribution. The mean amount of inheritance in the sample is almost USD 250,000 (in 1982 dollars) which is more than 20 times larger the

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<sup>12</sup> Models using within-family variation (twins and siblings) have also been employed to study the returns to education, see, for instance, Ashenfelter and Krueger (1994) and Ashenfelter and Zimmerman (1997).

<sup>13</sup> In the case of two children, the model is reduced to a regression of the difference in incomes between child  $i$  and his/her sibling  $j$  on the similar difference with respect to the inherited amount. In the econometric specifications we account for family size by weighting the observation by the inverse of the total number of children in the child's family.

<sup>14</sup> To disinherit children without their approval is not legally possible in the vast majority of the European countries. A review by *The Economist* from 2009 shows that disinheriting children against their will is not legally possible in 26 of the (then) 27 EU countries (<http://www.economist.com/node/14644403>).

mean inheritance in our sample. The study is also limited in that it lacks variables capturing the elements of the exchange and evolutionary models.

### 3 Data and study population

This section briefly details the data used for the analyses. It also describes how we proceed to obtain the relevant analysis sample, which contains children of parents who divide their estates unequally among the children.

#### 3.1 The data

For the empirical analyses, we use the Belinda database, which covers information from the estates reports for all Swedes who passed away over the period 2002–2004 (around 90,000 observations per year). Elinder et al. (2014) describes the Belinda database more comprehensively. The database contains information on the deceased person's identity number, date of death, marital status, whether there is a will, the value of the estate at the time of death, as well as the bequest that is distributed between the heirs (including zeros).<sup>15</sup>

Of significance for our purpose, the database also contains the person identity numbers of the deceased's legal heirs and beneficiaries of wills, their relationship with the deceased, as well as information about the inheritances they receive from the deceased (including zeros). The data on bequests and inheritances come from the Swedish Tax Agency's *Inheritance Tax Register*, implying that errors from recall biases, underreporting, and non-response, which commonly couple other sources of data on intergenerational transfers, are of minor concern. The inheritance taxation integrated taxable gifts from the deceased to the heir during the previous ten years, and these gifts are therefore included in the database. Moreover, the database contains information on taxable insurances paid by the deceased with the heir as beneficiary. While the database does not cover all transfers in the form of gifts and insurance payments, we still believe that the data are valuable and we will use them in a sensitivity analysis.<sup>16</sup>

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<sup>15</sup> Assets and debts are in general valued at tax values and not at market values. For some assets, the tax values were, however, lower than the market values. The most important example is real estate. The tax value of this asset was supposed to be 75 percent of the market value. Any assets that were realized by the estate manager before the actual estate division were also valued at market prices.

<sup>16</sup> Gifts made more than ten years ago and non-taxable gifts (below the annual gift tax exemption level) are not included. Tax non-compliance might also be important. Non-taxable insurances are not included as well. Considerable amounts of insurances may have been transferred from deceased parents to heirs via arrangements that do not show up in the estate inventory reports. This is particularly true for insurance policies with premiums that have been paid for with money that has already been taxed. Some insurance policies, however, are tax-

Relevant demographic characteristics for the heirs and the deceased parents that do not appear in the estate reports are retrieved from Swedish administrative registers: *Birth Register* (for date of birth and sex), *Integrated Database for Labour Market Research* (for place of residence, marital status, and level of education), *Income and Wealth Registers* (personal income, net wealth), and are linked to the individuals using their person identity numbers.

The Belinda database does not contain information about the offspring of the deceased's children. We therefore use the *Multi-Generation Register*, which contains information on all parent-child relations in Sweden, to link the children with their offspring (i.e. the deceased's grandchildren). This data source also provides information on whether the child is a biological or adopted child of the deceased.

### 3.2 The analysis sample

We start out from the population of children heirs and their deceased parents in Sweden during the years 2002–2004; 455,544 and 201,581 individuals respectively. We hereafter use the term *family* to denote the parent-children entity. For our analysis, it is necessary to restrict the population in some dimensions. We impose six exclusion criteria. The first three naturally follow from our research questions, whereas the last three are needed in order to carry out the econometric analysis. The exclusions are made at the family level to assure that we keep all siblings within the family. The effects of the exclusion criteria on the sample size are summarized in Table A1 in Appendix A.

First, we exclude families with married or partnered decedents. This is because there is no, or only a partial, estate division and transfer to children when a married person passes away. There are similarly separate rules when a person leaves behind a cohabiting partner. Thus, we only include families for which a conventional estate division has taken place.

Second, we exclude families in which the parent passed away with no bequeathable wealth. This is because there are then no bequests to be transferred to the children.

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deferred. When an heir received the benefits from such a policy, the benefit amount was added to the inheritance amount when the inheritance tax due was calculated.

Third, we exclude families with only one child, since there is then no estate division between children. Each family in our sample therefore contains two or more children and one parent.

Fourth, we exclude families for which we lack information about the inheritance amount for one or more children. Without this information, we cannot calculate the degree of unequal sharing within the family or identify within-family variation in inheritances.

Fifth, we exclude families in which a Swedish person identity number is missing for one or more children. Without a person identity number, we cannot add data on covariates to the child.

Sixth, we exclude families for which register data on some economic and demographic variables are missing in the registers for one or more children. This is because the coefficients with respect to the covariates in our econometric specifications are identified only for families in which there is variation in the variable.

Taken together, these adjustments leave us with a study population consisting of 60,430 families with 167,429 children.

As described in the previous section our empirical analysis requires that there is variation in the inherited amounts within families implying that we should restrict the focus to families with unequally divided estates.

There are several different ways to define unequal division using our dataset. A first, fundamental, issue is, however, how one should think about decedents who have not written wills. Equal sharing of the estate between children is the legal default in Sweden if there is no written will. This is similar to the rules in other European countries and in the United States. The Swedish civil law, moreover, stipulates that half of the estate should be equally shared between the children even if there is a will. The other half of the estate can be freely bequeathed. A will is, therefore, a necessary, but not sufficient, criterion for unequal division of an estate.<sup>17</sup> Among the families in the study population, 8,156 (13.5 percent) have a will and 53,945 (86.5 percent)

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<sup>17</sup> We do not know when the wills in our data were written or their content. According to Ohlsson (2007), the wills can be of any type. Some stipulate unequal division, others stipulate that property received should be separate property. Some wills are recent others are old. Many written wills are mutual between spouses and concern the property rights of a surviving spouse.

do not have one.<sup>18</sup> One approach is to view the parent's decision not to write a will as a desire to divide the bequests equally between the children. We should then calculate the frequency of unequal division using all families. However, since our empirical strategy requires that the estate is unequally divided we consider only families with written wills, implicitly assuming that they are the only ones who have made conscious decisions whether or not to divide the bequests equally.

Regarding the classification of unequally divided estates, the most straightforward way would be to classify all deviations from exact equal division as unequal division. However, the issue with such an "exact" definition is that it classifies all differences in inheritance amounts among the children, also those resulting from rounding of amounts and cases in which it has been practically difficult to divide the assets so that the children receive equal amounts, as unequal division. Therefore, we consider a less restrictive definition, used in Wilhelm, 1996, which classifies the estate as unequally divided if any child receives an inheritance that deviates more than  $\pm 2$  percent from mean inheritance calculated across all children within the family. A two percent deviation from the within-family mean in our sample corresponds to, on average, 3,256 SEK (1,662 SEK) for families with (without) wills.<sup>19</sup>

Table 1 reports the incidence of unequal division according to the two definitions. The first column reports the incidence for families with wills, which are the focus subjects. If we consider the "exact" definition, the incidence of unequal division is around 15.9 percent. The " $\pm 2$  percent"-definition yields an incidence that is slightly lower: 14.3 percent.

What could explain the discrepancy in incidences produced by the two definitions? A closer look at the families that divide unequally according to the exact definition but equally according to the " $\pm 2$  percent"-definition can tell us something. First, we note that, for one third of the cases, rounding of amounts seems to be responsible for the discrepancy: the difference between the min and max inheritances within these families is less than 2 SEK. Moreover, the mean (median) of the difference between the min and max inheritance is 1,500 SEK (500 SEK),

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<sup>18</sup> This number contrasts the estimates of the incidence of wills in the United States where approximately 40-50 percent of the population, and as many as two thirds of those older than 70 years, have a will (Rossi and Rossi, 1990; Lee, 2000; Goetting and Martin, 2001; Schwartz, 1993; McGranahan, 2006).

<sup>19</sup> Tomes (1988) defines unequal division as when the difference between the maximum and the minimum inheritance exceeds 25 percent of the within-family mean.

which corresponds to less than one percent of the total bequest to the children. This suggests that the discrepancy in incidence (for cases where it is not rounding) is due to practical difficulties of distributing amounts equally rather the parents favoring/disfavoring one child over the other(s). We, therefore, consider the “± 2 percent”-definition as the most preferable one. Consequently, restricting the study population to families with wills stipulating unequal division yields an analysis sample consisting of 3,220 children heirs (of 1,166 families). In robustness tests, we also consider children of families that divide unequally according to the “exact” definition.

For a matter of completeness, we report (in parentheses) the incidences of unequal division also for all families, including those without wills (of whom some may have an explicit preference for equal division). The incidence of unequal sharing is, naturally, lower in this group: 3.3 percent and 2.4 percent according to the “exact” and “± 2 percent” definitions, respectively.

Table 1: Incidence of unequal division of estates among children

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Definition of equal division:

Exact	
Incidence, %	16.0 (3.3)
Number of heirs	3,599
Number of decedents/families	1,303
± 2 %	
Incidence, %	14.3 (2.4)
Number of heirs	1,166
Number of decedents/families	3,220

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How well does the incidence of unequal division in our data correspond with the incidence in other countries? The incidence in data on *actual* bequest distributions from the United States (Menchik 1980, 1988; Judge and Hrdy 1992; Wilhelm 1996; Behrman and Rosenzweig 2004;

Norton and Taylor Jr 2005)<sup>20</sup> and France (Arrondel et al. 1997) ranges between 8 and 30 percent, which is in the same ballpark as ours.<sup>21</sup> The incidence in our data also accords well with the incidence in survey data on parents *intended* division of bequests from the United States (Dunn and Phillips 1997; McGarry and Schoeni 1997; McGarry 1999; Light and McGarry 2004) and Japan (Horioka 2009), which ranges between 8 and 22 percent.

In appendix A, we report estimates for the relationship between parent characteristics (estate size, age, gender, marital status, education level, marital status, number of children) as well as child characteristics and the likelihood of unequal division. These estimates display a pattern that accords well with the findings reported in previous studies implying that our analysis sample is not inherently different from the samples used in the earlier literature.

We now continue to the tests of the transfer theories that exploits differences in inherited amounts among siblings.

#### **4 Empirical analysis**

This section presents an analysis of the determinants of variation in inherited amounts among siblings. The analysis is based on children of families with unequally divided bequests (according to the “ $\pm 2$  percent”-definition described in Section 4); in total 3,220 children of 1,166 families. We start by presenting descriptive statistics for the key variables. We then report estimation results from transfer models with family-fixed effects and, finally, we assess the robustness of the main findings.

##### *4.1 Summary statistics for key variables*

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<sup>20</sup> Tomes (1981, 1988) are the exceptions, finding unequal division in 51–79 percent of the estates by using a combination of probate records from Cleveland, US. However, Menchik (1988), who found an incidence of unequal division of 12–16 percent for the same time and place, has questioned Tome’s findings.

<sup>21</sup> A priori, one may expect the incidence of unequal division to be lower in Sweden than in the U.S. because Swedish parents are not allowed to completely disinherit their children. Children are always allowed to their statutory shares which is half of what they would have received in the absence of a will, or put differently, the parent has testamentary freedom over half of the property. However, parents are free to divide unequally between the children down to the restriction. Erixson and Ohlsson (2015) investigate whether decedents are restricted in their choices by the legislation of statutory shares using the same data as in the current paper. Their findings suggests that the law affects the distribution decisions of only about one percent of the decedents.

To get a sense of the magnitudes of the empirical estimates, we report, in Table 2, descriptive statistics (means and for continuous variables, also standard deviations, reported in parentheses) for the outcome (inheritance amount) and for the explanatory variables.

For each variable, we, moreover, report the incidence of variation at the family level. This is to show for what fraction of families we identify the coefficients on the explanatory variables. Continuous variables, beside the incidence of variation, are accompanied by the coefficient of variation (reported in brackets).

All children have received inheritance. The mean inheritance (before transfers taxes were paid) amounts to slightly more than SEK 137,500. The incidence of within-family variation in the variable is 100 percent. This follows from the fact that the sample contains only those families with unequally divided bequests. Moreover, the coefficient of variation indicates that a great deal of inequality results from unequal inheritances to children within the same family.

The mean permanent income is around SEK 245,000 per year. Moreover, we see that the mean wealth is slightly more than more than one million SEK, which is more than seven times larger than the mean inheritance. In all families, there are differences between the children in income and in wealth (within-family variation is 100 percent) implying that all families will contribute to the identification of the coefficients on the variables. Moreover, we see that almost one third of the children have university education and that the within-family variation is around 41 percent.

Regarding the variables relating to the exchange model, we note, first, that there are somewhat fewer women than men among the children. The within-family variation, however, indicates that a majority of the families contain both women (daughters) and men (sons). We also see that about one fourth of the children resided in the same parish as the parent prior to the demise and that eleven percent are daughters living in the same parish as the parent. At the family-level, the incidence of variation with respect to these two variables is above 45 and 26 percent, respectively. Moreover, a slight majority (53 percent) of the children are married and for 60 percent of the families there is a mix of married and unmarried children. Finally, the incidence of the interaction between living in the same parish as the parent and being married is almost 13 percent (with a within-family variation of 28 percent).

The variables related to the evolutionary model are reported in the bottom panel of the table. We see that slightly more than 2.7 percent of the children are adopted and the identifying variation comes from the 4.5 percent of the families that has a mix of adopted and biological children.<sup>22</sup>

Finally, we note that 82 percent of the children have at least one child of their own (within-family variation is 36 percent) and that almost 42 percent of the sample consists of women with children, together producing an average within-family variation of almost 65 percent.

Table 2: Sample characteristics of children of families with unequally divided estates.

Level:	Child (mean (st. dev.))	Family (% variation [cv])
Outcome		
Inheritance, SEK	137,588 (239,704)	100 [0.70]
Altruism model		
Permanent income, SEK	245,222 (211,287)	100 [0.46]
Wealth, SEK	1,009,999 (3,592,046)	100 [4.11]
University education, percent	32.7	41.1
Exchange model		
Daughter, percent	48.4	67.6
Same parish, percent	25.5	45.3
Same parish*daughter, percent	11.4	26.2
Married, percent	53.4	60.2
Same parish*married, percent	12.8	28.3
Evolutionary model		
Has children, percent	82.1	36.4
Has children*daughter, percent	41.8	64.8
Adopted, percent	2.7	4.5
Number of children (families)	3,220	(1,166)

#### 4.2 The determinants of within-family differences in inherited amounts

We exploit variation across siblings and estimate models with family-fixed effects to test for the impact of child attributes on inherited amounts. The basic specification is of the following form:

<sup>22</sup> In 2002, the beginning of the study period, 1.5 percent of all Swedes had at least one adoptive parent.

$$Y_{it} = \alpha + \beta X_{it} + \gamma_f + \epsilon_{it}$$

where  $Y_{it}$  is the inherited amount, in SEK 100,000, received by child  $i$  of family  $f$ .<sup>23</sup>  $X_{it}$  is a vector of the child characteristics displayed in Table 2, and  $\gamma_f$  is a family-fixed effect that varies across families, but is common to all children within the same family. The fixed effect does not only control for unobserved heterogeneity at the family level, but also for observable parent characteristics. The parameter of interest is  $\beta$  and it measures how the transfer received by child  $i$  is related to her characteristics, relative to the within-family average. In addition to the variables in Table 2, we augment the model with age fixed effects. This is to account for the possibility that historical division norms that are based on the children's age, such as primo and lineal geniture, may influence parents' distribution decision. To account for the possibility that the parent's bequest behavior is correlated with family size, we weight the observations by the inverse of the number of children in the family.<sup>24</sup>

The regression results are reported in Table 3. Each bequest theory is first tested individually using separate regressions for each child characteristic that is related to the theory, and then, finally, all the three theories are tested jointly in one regression including all children characteristics.

Starting with the altruism model, in column 1, we see that the coefficient estimate on the permanent income variable is negative, but not statistically different from zero at conventional levels. This corresponds with the results in Wilhelm (1996) and could be seen as proof against the altruism model's prediction regarding perfect equalization, which requires a statistically significant negative one-to-one relationship between income and inheritance amount. One possible explanation for the absence of a link is that the three-year average of (current) income is a poor proxy for permanent income (McGarry 1999). We therefore consider the child's wealth as an additional proxy for her lifetime consumption possibilities. Assuming that wealth is a valid proxy, the altruism model predicts that parents will transfer more to children who are relatively less well off in terms of wealth, implying that we would expect a negative coefficient if the theory holds up. The coefficient estimate (column 2) is, however, similarly to that on

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<sup>23</sup> We have also considered a version of the econometric specification in which the inherited amounts enter in logarithmic form rather than in levels. The results in Table 3 are robust to this change in functional form.

<sup>24</sup> The estimates reported below are robust to the exclusion of age controls and family weights.

income, statistically insignificant at conventional levels. One may think that education is a better proxy for permanent income than a three year average of (current) income and thus, that siblings with relatively high education should receive less than those with comparably low education, if bequests are compensatory. However, we find that education is, if anything, positively related with the inherited amount, a finding that also speaks against the altruism model (see column 3). When we control for income, wealth and education simultaneously (column 4) we see that the coefficients on income and wealth, are as previously statistically insignificant, whereas the coefficient on education remains positive and significant at the 10 percent level. However, when we control for other characteristics that are likely to determine the relative inherited amount (column 14), the relationship with respect to education disappears. Taken together, the results are inconsistent with the prediction of the altruism model that bequests are compensatory.<sup>25</sup>

Concerning the test of the exchange model, we see that the coefficient estimate on the indicator for being daughter (column 5) is positive and statistically significant, implying that daughters receive more than sons. While this result is in line with the hypothesis that daughters are more engaged in service provision and compensated accordingly, it is also consistent with the predictions of Wedgwood (1928) and Blinder (1973) that parents have preferences for daughters over sons. Moreover, we see that children living in the same parish as the parent receive more than their siblings living further away (column 6).<sup>26</sup> This is consistent with the prediction of the exchange model, that parents purchase more services (with bequests) from children for whom the cost of provision is relatively low. Relating the point estimate to the mean inheritance yields that, a child living in the same parish as the parent receives 14 percent more than the sibling(s). In column 7, we report the results from a specification with controls for being daughter, living in the same parish as the parent as well as interaction between the two characteristics. The coefficient estimate on the latter variable is statistically insignificant, implying that daughters living in the same parish as the parent do not receive larger inheritances than sons living in the same parish as the parent. This suggests that parents do not discriminate

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<sup>25</sup> Income and wealth are measure at individual level. To account for the possibility that the parent's transfer decision is based on household resources we tested for the impact of income and wealth interacted with marital status. However, this does not affect the main conclusion, that bequest are not compensatory.

<sup>26</sup> We have also considered the two wider definitions of geographical proximity; municipality and county, and these yield similar results as parish.

with respect to sex but rather, that they compensate for service provision, as indicated by the positive and statistically coefficient on *Same parish* in columns 7 and 14.

We do not find any evidence that married children (who are less likely to be service providers because of their relatively higher time cost) receive less than their never married or divorced siblings (column 8). However, we do find that the interaction between being married and living in the same parish as the parent is negative and statistically significant, a finding that appears to be robust (see column 14) and could be viewed as further support for the exchange model.

We now turn to the tests of the evolutionary model of bequests. We find no evidence that children who have children of their own receive more or less than their siblings without children of their own (columns 10, 11, and 14). This suggests that parents neither use bequest to encourage childless children to reproduce or to reward children that have already produced grandchildren. We see, however, that the interaction between being daughter and having children is positive and statistically significant ( $p < 0.05$ ), implying that daughters with children receive more than sons with children (see columns 11 and 14). This corresponds with the evolutionary model, predicting that parents care about the continuation of the bloodline and favor the offspring of daughters, as these are certain to be genetic descendants (Cox, 2003). The implied percentage difference in inheritance amount relative to that of brothers with children is almost 22 percent.

Further support for parents' bequest behavior being governed by evolutionary motives is found in column 12, displaying that adopted children receive substantially less than siblings who are the parent's biological children. A comparison of the point estimate and the average inheritance implies a 57 percent difference in amounts. However, the indicator in column 12 makes no distinction between adopted children with one or two adoptive parents, it only conditions on the child being adopted by the current deceased parent, from whom the bequest is received. As noted in Section 4.1, 2.8 percent of the children in our sample are adopted. However, 2 percent of the children (71 percent of the adopted children) are adopted only by the current deceased parent.<sup>27</sup> While it is possible that some of these children have been adopted by single parents, it is more likely that they are stepchildren who have been adopted by a stepparent. To study more

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<sup>27</sup> These statistics differ somewhat from those for the overall population. In 2002, one third of all adopted children in Sweden had only one adoptive parent.

carefully whether the adopted effect is driven by adopted stepchildren being disfavored (relative to their siblings) by their adoptive stepparents, we substitute the previous adopted indicator with two new variables for adopted status: one indicator indicating whether the child is adopted by both parents and one indicator indicating whether the child is adopted *only* by the parent from whom the bequest is received. The results from this specification is reported in column 13. It can be seen that adopted children with two adoptive parents do not receive differently from their siblings who are the parent's biological children: the coefficient estimate is, though negative, statistically insignificant. However, the indicator for being adopted only by the giving parent is negative and statistically significant at the five percent level suggesting that adopted stepchildren receive less than the siblings. This finding holds also in the specification with all additional controls (column 14) and suggests that the adopted effect is largely driven by families in which adopted stepparents disfavor their adopted stepchildren. There is, in other words, a Cinderella effect. This finding is consistent with the findings in Light and McGarry (2004) and Francesconi et al. (2015).

Taken together, the results in Table 3 provide little support for the altruism model but some support for the exchange model and the evolutionary model. In the following section, we assess the robustness of these findings.

Table 3: The determinants of within-family variation in inherited amounts

Transfer model:	Altruism				Exchange					Evolutionary			Joint	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Permanent income	-0.011 (0.021)			-0.039 (0.025)										-0.021 (0.025)
Wealth		0.003 (0.004)		0.004 (0.004)										0.004 (0.004)
University education			0.166* (0.097)	0.190* (0.098)										0.156 (0.097)
Daughter, indicator					0.242*** (0.065)		0.242*** (0.076)						-0.082 (0.167)	-0.138 (0.170)
Same parish, indicator						0.313*** (0.088)	0.306** (0.123)		0.490*** (0.133)					0.482*** (0.161)
Same parish*daughter, indicator							0.043 (0.159)							0.065 (0.157)
Married, indicator								0.011 (0.068)	0.103 (0.078)					0.122 (0.083)
Same parish*married, indicator									-0.339** (0.169)					-0.361** (0.166)
Has children, indicator										-0.002 (0.100)	-0.186 (0.130)			-0.207 (0.128)
Has children*daughter, indicator											0.391** (0.182)			0.431** (0.179)
Adopted by giving parent, indicator												-0.809** (0.342)		
Adopted by two parents, indicator													-0.350 (0.508)	-0.284 (0.502)
Adopted by giving parent only, indicator													-0.945** (0.410)	-0.868** (0.370)
$R^2$	0.828	0.829	0.829	0.830	0.830	0.830	0.831	0.828	0.830	0.828	0.830	0.829	0.829	0.835

Note: The models are estimated using children of parents who have divided the estate unequally according to the “± 2 percent” definition described in Section 3, in total 3,220 individuals. The models controls for age. Observations are weighted by family size. Monetary variables are in SEK 100,000. The mean inheritance in the sample amounts to SEK 137,588. Robust standard errors in parentheses. \* significant at the 10 percent level, \*\* significant at the 5 percent level, \*\*\* significant at the 1 percent level.

### 4.3 Sensitivity analyses

We have done some sensitivity analyses with respect to the estimates in Table 3, which are reported in Table C1 in Appendix C and briefly described below.

Children of widowed descents (77 percent in our sample) typically receive two inheritances: one from the currently deceased (widowed) parent and one from the previously deceased parent. This is because, when a married person in Sweden passes away the estate is transferred to the surviving spouse and, if the spouses have common children; the children receive the inheritance from the first deceased parent when the second parent passes away. The focus of the main analysis in the previous section is on the decisions of currently deceased parent. However, it is possible that the children who are disfavored (favored) by the currently deceased parent have been favored (disfavored) by the previously deceased parent. For example, a disfavored stepchild may receive a disproportionately larger inheritance from the previously deceased (biological) parent and hence, that the child receives similarly to the siblings if we consider the total inheritance amount instead. In column 1, we report estimates from a regression with the total inheritance amount as dependent variable. It can be noted that these estimates are akin to the main estimates in terms of sign and statistical significance suggesting that it is not the case that disfavored (favored) children receive disproportionately more (less) from the previously deceased parent.<sup>28</sup>

One concern with the interpretation of the positive impact of living in the same parish as the parent as compensation for services is that the location choice of the child may be due to the child's own needs of services from the parent, rather than by the needs of the parent. To investigate this more carefully we test for whether characteristics of the child that indicate needs of assistance influence the inherited amount. The first characteristic we consider is the child's health status. The conjecture is that children in poor health receive larger inheritance than the siblings. The child is assumed to be in poor health if he or she has been hospitalized for any cause and/or has had any (insured) sick leave during the three years prior to the demise.<sup>29</sup> The

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<sup>28</sup> We do not have any information on when the adoption took place or information about the initial biological parent, for which the stepparent substitutes. Thus, we cannot rule out the possibility that the adopted stepchild is disfavored by the stepparent because he/she has received transfers from the initial biological parent.

<sup>29</sup> Data on hospitalization episodes are collected from the Swedish National Patient Register and data on sick leave are collected from the Integrated Database for Labour Market Research. 39 percent of the children have been hospitalized and/or have had sick leave during the three years prior to the parent's demise.

second characteristic is unemployment. We define unemployment based on whether child has received any unemployment benefits during the three years prior to the demise and the conjecture is that unemployment is associated with financial strain, which is compensated for with larger inheritance (Cox 1990).<sup>30</sup> The third characteristic we consider is whether the child has children and it should be seen as a proxy for the child's need of childcare. In column 2 we report results an estimation including each characteristic separately as well as interactions between the three characteristics and the indicator for living in the same parish as the parent. The indicator unemployment is statistically insignificant at conventional levels. The indicator for the presence of children is statistically significant and negative as in the main specification (Table 3, column 14), suggesting that the, potential, need of childcare does not translate into larger inheritance. Similarly, the indicator for poor health is statistically significant and negative, suggesting that parents, if anything give less to children in poor health. Regarding the interactions between the needs indicators and same parish, neither of them turns out statistically significant and, reassuringly, the indicator for same parish remains statistically significant and positive. Taken together, these results strengthen our conclusion that the relationship between location choice of the child and the inheritance amount is due to exchange motives.

As an alternative way to evaluate the robustness of the impact of location on the inheritance amount as support for the exchange motive we test for whether the relationship is stronger if the parent has had poor health prior to the demise, and thus has been more likely to require informal care from the children. We use three proxies for informal care needs, constructed using data from the Swedish National Patient Register and the Cause of Death Register, to test this hypothesis. The first one is an indicator variable for whether the parent has suffered from dementia (which is often referred to as the disease that requires most informal care, e.g. Wimo et al. 2007) during the three years prior to the demise.<sup>31</sup> The second one is an indicator variable for whether the parent has suffered from a stroke (which is also informal care intensive disease, e.g. Albrecht et al. 2016) at any time during the three years prior to the demise.<sup>32</sup> Finally, the

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<sup>30</sup> Information on unemployment benefits is retrieved from the Integrated Database for Labour Market Research. 13 percent of the children have received unemployment benefits at any point during the three years prior to the parent's demise.

<sup>31</sup> We define the parent as having had dementia if he/she has been hospitalized for dementia (primary or contributing diagnosis), at any point during the three years prior to the demise, or passed away from dementia (primary or contributing cause of death). 21 percent of the parents have suffered from dementia.

<sup>32</sup> We define the parent as having had stroke if he/she has been hospitalized for stroke (primary or contributing diagnosis), at any point during the three years prior to the demise. 10 percent of the parents have suffered from at least one stroke.

third proxy, is an indicator variable for whether the parent has had any surgery (which is commonly associated with need of informal care), for any cause, during the three years prior to the demise.<sup>33</sup> The empirical test is conducted by regressing the empirical specification used in Section 4.3 augmented with interaction terms between the informal care need indicators and the indicator for living in the same parish as the parent (the informal care need indicators are captured by the family fixed effects). A positive and statistically significant coefficient on the interaction terms implies that the difference in inheritance amounts between siblings living and not living in the same parish is larger if the parent has had larger health related care needs and should be seen as support for the hypothesis. The results are reported in column 3 and we can see that the interaction between parent having had dementia and the same parish is statistically significant ( $p < 0.10$ ). The interactions with respect to stroke and surgery are positive as well, though statistically insignificant. Taken together these findings indicates that informal care provided by the children is compensated for with larger inheritance, in line with the findings in Brown (2006).

In columns 4 and 5, we have redone the analysis separately on a sample excluding families with deceased who have given gifts (to at least one child) during the ten years before death (column 4), and a sample excluding families with deceased who have transferred wealth through insurance to at least one child (column 5). This is to test whether the main results are driven by decedents who, potentially, already have achieved their desired compensation during life, through gifts, or at death, through insurances (rather than through bequests).<sup>34</sup> Neither of these sensitivity checks alters the estimates substantially, with the exception that in the no-insurance sample, the coefficient on the married indicator is statistically significant at the 10 percent level and the having children indicator is statistically insignificant. The latter coefficient is, however, of the same order of magnitude and has the same sign as the corresponding main estimate.

In column 6, we redo the analysis on children from families with unequally divided bequests according to the “exact” definition. The estimates are largely consistent with the main estimates.

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<sup>33</sup> The Patient Register reports separately whether an individual has had a surgery. 37 percent of the parents have had at least one surgery during the three years prior to the demise.

<sup>34</sup> A similar test with respect to gifts is reported in Wilhelm (1996).

The last sensitivity check is that we consider a different model specification in the tradition of Mundlak (1978). The model includes the same child characteristics as previously, but rather than explicitly controlling for family-fixed effects, we include as additional regressors the parent-level variables that entered the probability models for unequal division, as well as child characteristics that are averaged over all children in the respective family (and hence do not vary across children within the same family). By conditioning on parent characteristics and child means, we capture within-variation at the family level and could thus interpret the coefficients on the child characteristics as in the family-fixed effects regressions. The results with respect to the child-level variables are reported in column 7 and these display a similar pattern as the main estimates, suggesting that the main estimates are robust to this change in model specification.<sup>35</sup>

## 6 Concluding discussion

A large literature provides empirical tests of the theoretical models of bequest motives. However, the previous studies rely either on survey data on parents' bequest intentions, focusing on the particular subset of families in which the parent will disinherit at least one child, or on data from tax records, that commonly only cover bequests from the very wealthy and lack control variables to facilitate empirical tests of several bequest theories.

Our contribution to this literature is that we use a population-wide dataset covering individual-level data on *realized* inherited amounts for complete families (deceased parents and all their children), matched with an extensive set of economic and demographic variables from administrative registers. These data allow us to test three bequest models: altruism, exchange and evolutionary, by estimating the influence of child characteristics on differences in inherited amounts within families. To the best of our knowledge, we are the first to test the importance of more than one bequest motive by exploiting within-family variation in inherited amounts.

We do not find any support for the altruism model: there is no correlation between the inherited amount and child's economic circumstances, measured either as permanent income, wealth, or education. This is in line with the general finding in the earlier literature that bequests do not tend to be compensatory (e.g. Wilhelm 1996; Dunn and Phillips 1997). These findings suggest

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<sup>35</sup> The coefficient estimates on the parent variables and the family means are available from the authors on request.

that government efforts to reach intergenerational redistribution are unlikely to be counteracted by bequests (as opposed to the prediction of the Ricardian equivalence proposition).

We do find, however, that in families with unequally distributed estates, children who are more likely to have provided services to the parent (because they lived close to the parent) receive larger bequests than their siblings. This could be interpreted as if, at least for some parents, transfers are motivated by exchange.

A large share of the population in most Western countries is involved in caregiving for an older parent, experiencing lost labor income, pensions and other work related benefits. Because of increasing longevity and life expectancy, the number of elderly persons with chronic health conditions who are in need of caregiving by their adult children is expected to increase even further, one may expect to see exchange motivated bequests to grow in importance.

We also find some support for the evolutionary model in the data. First, daughters with children receive more than sons with children, implying that parents have preferences for descendants that are more certain to be genetic. Second, adopted stepchildren receive less than siblings who are the biological children of both parents or adopted by both parents. This is consistent with the predictions of models from evolutionary psychology. The fact that the effect is largely driven by disfavored adopted stepchildren of the deceased indicates that bequest decisions are influenced by so-called Cinderella effects.

An increase in incidence of divorce, remarriage, repartnering and cohabitation has led to an evolvment of new, more heterogeneous family arrangements with both biological and non-biological children (Lundberg and Pollak, 2007; Stevenson and Wolfers, 2007). To the extent that these patterns will continue one may expect unequal division of estates to become more common.

It should be noted that our focus is on the determinants of parents' decisions regarding the allocation of bequests *at death* and not the allocation of gifts during life. It is possible that some parents already have achieved their desired compensation during life, through *inter vivos* gifts. Although our sensitivity tests indicate that such compensation has not been achieved with reported taxable gifts we cannot assess the relative importance of unreported and non-taxable gifts. An ideal, complete account would, however, not only consider monetary gifts, but also

gifts in terms of time, social networks and other parental resources, which seem to matter a lot for inequality in success across children (Björklund et al. 2013).

We should also emphasize that this analysis is based on families where the parent has decided to divide the estate unequally among the children. We cannot, therefore, say anything about the bequest motives for parents who divide their estates equally.

While there is no feasible strategy to test the bequest motives of these parents, there are at least three possible reasons for why equal division of their bequests reflects a deliberate choice rather than the bequests being “accidental”.

First, the estate allocation is public information and the children can directly see how their shares compare with their siblings’ and thereby, might interpret this as if they are loved more or less than their siblings. If parents care about their reputation after death, equal treatment may be considered the most desirable outcome (Lundholm and Ohlsson, 2000; Bernheim and Severinov, 2003).

Second, parents may choose equal treatment because the alternative, unequal division, could lead to jealousy and conflicts among the children, and ultimately, a breakdown of the family as a social entity (Menchik, 1988 and Wilhelm, 1996).

Third, parents might distribute their estates equally because it is less costly and requires less effort and, therefore, may be more rational than other distributive principles (Elster 1989). The parent does not have to collect and compare information on the financial status of the children and the parent does not have to value the services provided by the children.

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## Appendix A. Additional data description.

Table A1. Exclusion criteria and study population

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Initial number of children (deceased parents/families)	455,544 (201,581)
Exclusion criteria:	
(1) Non exit households	182,297 (78,967)
(2) One child	59,918 (59,918)
(3) No bequeathable wealth	82,738 (34,284)
(4) One or more children missing inheritance info	1,913 (901)
(5) One or more children missing person identity number	9,438 (3,143)
(6) One or more children missing register data	46,553 (16,941)
Fulfills any of (1) – (6)	288,115 (141,151)
Study population	167,429 (60,430)

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## Appendix B. The determinants of unequal division of bequests

In this appendix, we present estimates of the factors influencing the parent's decision to divide the bequest unequally. The motivation for this is twofold. First, it allows one to evaluate how families with unequally divided bequest compares with families with equally divided bequests. Second, it allows one to evaluate to what extent our sample is comparable to the samples used in previous studies. For a matter of completeness, we report estimates both for all families, including those without wills (to acknowledge that there is no difference between splitting equally with a will and splitting equally without a will) and for families with wills (who are the focus of our main analysis).

Practically, we estimate linear probability models with the dependent variable being an indicator variable for whether the bequest is unequally divided, as defined by any child receiving outside  $\pm 2$  percent of the within-family mean.<sup>36</sup>

The explanatory variables entering the estimations are intended to capture the parent's taste or ability to divide unequally, and are the same that commonly appear in previous studies: the deceased's estate, income, age, gender, marital status, level of education, and number of children.

We also include a set of variables capturing children characteristics. The coefficients on these child level variables should indicate whether the parent's decision to divide equally or unequally is in line with the transfer theories (altruism, exchange, evolutionary). However, it should be noted that the coefficients only are informative about how the distribution of traits the among children correlates with the allocation decision, and not on what grounds the parent favor or disfavor particular children (which is the most direct test of the theories, and the focus of the main analysis).

The coefficient of variation (cv) with respect to the children's income and wealth are intended to capture whether the transfer decision is affected by economic inequality between the

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<sup>36</sup> We have also considered a non-linear *Probit* model. This is to account for the possibility that the estimated coefficients from the linear model may imply probabilities outside the unit interval. The coefficient estimates from the Probit model are similar to the linear probability estimates in terms of sign and statistical significance. Also, the implied marginal effects are quantitatively similar to the estimates from the linear model.

children, in line with the altruism model.<sup>37</sup> We, moreover, consider education as an alternative measure of economic status. Practically, we include two indicator variables, one for whether at least one child in the family has university education and one for whether there is both children with and without university education.

The variables associated with the exchange model are four indicators indicating: first, whether there is at least one daughter in the family, second, the presence of both sons and daughters, third, whether there is at least one child residing in the same parish as the parent, and fourth, whether there is a mix of children residing and not residing in the same parish as the parent.

The variables associated with the evolutionary model include indicators for: whether there is at least one adopted child in the family, whether there is a mix of adopted and biological children, whether at least one of the children has children of her own (i.e. grandchildren of the deceased), and whether there is a mix of children who have and do not have children of their own.

The regression results are reported in Table B1 and may be summarized as follows: among all families, the likelihood of unequal sharing of bequest between children is increasing with the size of the estate. Judge and Hrdy (1992), Table 8, find the same result. However, among families with wills (column 2), there is no such relationship. Likewise, parent income is also positively associated with the decision to divide unequally in the full sample but not among those with wills. The latter finding corresponds with that in Light and McGarry (2004). Similarly to Light and McGarry, we also find that older parents are more likely to divide unequally than younger parents. Women, compared to men, are less likely to divide unequally. This is consistent with the results in Wilhelm (1996). Marital status seems to explain unequal division only among decedents with wills. In that sample, widows/widowers are less likely to divide unequally than divorced decedents and deceased parents who have never married. In both study groups, the distribution decision is unaffected by the deceased's level of education. Moreover, the decision to divide unequally appears to be positively associated with the number of children, though at a decreasing rate.

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<sup>37</sup> The coefficient of variation (cv) is obtained by dividing the standard deviation of the within-family (sibling) mean with the within-family (sibling) mean. For cases where the cv is undefined, because the within-family (sibling) mean is zero, it has been replaced with value zero.

Regarding the child-level variables, we see that a higher inter-sibling dispersion in permanent income and in wealth is associated with a higher likelihood of unequal division. This is consistent with the prediction of the altruism model and, is also in accordance with the results in McGarry (1999) and Light and McGarry (2004). Having at least one child with university education reduces the likelihood of unequal division among families with wills (but not in full sample) whereas having a mix of children with and without university education increases it. The latter finding could be considered in line with the results for income and wealth. Having one or more daughters is negatively associated with unequal division (though, the relationship is only statistically significant for families with wills) whereas the indicator for having both daughters and sons (as opposed to having only sons or daughters) is positive (and statistically significant in for families with wills); indicating that parents may have preferences for one sex over the other. Moreover, having children in the same parish (< 20 km away) reduces the likelihood of unequal division in the full sample but not among families with wills. In addition, having a mix of children living and not living in the same parish is positively associated with the outcome in the full sample but not among families with wills. Having adopted children increases the likelihood of unequal division in the full population. Moreover, in line with previous tests of the evolutionary model (Light and McGarry, 2004; Francesconi et al., 2015), we find that having both biological and adopted children increases the likelihood of the outcome among parents with wills. Having grandchildren reduces the likelihood of unequal division, but having a mix of children with and without children of their own increases it. This result is line with Light and McGarry (2004).

Table B1: The determinants of unequal division of estate among children.

	All families	Families with wills
	(1)	(2)
<i>Parent characteristics</i>		
Estate	0.002*** (0.000)	-0.000 (0.000)
Income	0.009*** (0.002)	-0.001 (0.005)
Age, years	0.000*** (0.000)	0.002*** (0.000)
Woman, indicator	-0.003** (0.002)	-0.026*** (0.009)
Widow/widower, indicator	-0.001 (0.002)	-0.063*** (0.013)
Upper secondary or post graduate education, indicator	0.001 (0.004)	-0.008 (0.013)
Number of children (reference: 2 children)	0.006***	0.039***
3 children, indicator	(0.002)	(0.010)
4+ children, indicator	0.001 (0.002)	0.041*** (0.014)
<i>Child characteristics</i>		
Altruism model		
Permanent income, cv	0.016*** (0.002)	0.066*** (0.013)
Wealth, cv	0.000 (0.000)	0.000* (0.000)
University education, indicator	-0.002 (0.002)	-0.039*** (0.011)
Mix of university and no university education, indicator	0.003 (0.002)	0.020** (0.010)
Exchange model		
Daughter, indicator	-0.001 (0.002)	-0.025** (0.012)
Mix of daughters and sons, indicator	0.002 (0.002)	0.021** (0.010)
Children in same parish as parent, indicator	-0.004** (0.002)	0.001 (0.015)
Mix of children in and not in same parish as parent, indicator	0.005** (0.002)	0.035** (0.016)
Evolutionary model		
Adopted children, indicator	0.043*** (0.015)	0.016 (0.036)
Mix of biological and adopted children, indicator	-0.011 (0.017)	0.136*** (0.050)
Children having children, indicator	-0.005 (0.004)	-0.053* (0.028)
Mix of children with and without children, indicator	0.007*** (0.001)	0.037*** (0.009)
Dep. variable mean	0.024	0.143
R <sup>2</sup>	0.012	0.029
No of observations	60,430	8,156

Note: Monetary variables are reported in SEK 100,000. The model specification also includes controls for the deceased's year of death. Education refers to the highest achieved level. Permanent income (wealth) is given by the average of taxable employment income (net worth) over the three years preceding death. cv refers to the within-family coefficient of variation. Robust standard errors in parentheses. \* significant at the 10 percent level, \*\* significant at the 5 percent level, \*\*\* significant at the 1 percent level.

**Appendix C. Additional estimations, the determinants of unequal amounts**

Table C1: The determinants of within-family variation in inherited amounts, sensitivity analyses.

	Total inheritance amount	Controls for child needs	Impact of parent's informal care needs	No gifts in family	No insurance in family	Unequal sharing: Exact	Mundlak model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Permanent income	-0.007 (0.027)	-0.022 (0.025)	-0.020 (0.024)	-0.018 (0.026)	-0.018 (0.025)	-0.021 (0.025)	-0.019 (0.034)
Wealth	0.003 (0.004)	0.004 (0.004)	0.003 (0.004)	0.003 (0.004)	0.002 (0.003)	0.004 (0.004)	0.003 (0.007)
University education	0.178 (0.112)	0.158 (0.098)	0.157 (0.097)	0.108 (0.099)	0.121 (0.096)	0.156 (0.097)	0.183* (0.104)
Daughter	-0.102 (0.200)	-0.128 (0.173)	-0.139 (0.170)	-0.147 (0.178)	-0.025 (0.170)	-0.138 (0.170)	-0.120 (0.173)
Same parish, indicator	0.634*** (0.182)	0.595*** (0.197)	0.319* (0.186)	0.486*** (0.167)	0.598*** (0.129)	0.482*** (0.161)	0.515*** (0.187)
Same parish*daughter	0.033 (0.198)	0.076 (0.164)	0.069 (0.159)	0.088 (0.157)	-0.084 (0.144)	0.065 (0.157)	-0.231* (0.134)
Married	0.256** (0.128)	0.099 (0.087)	0.127 (0.083)	0.124 (0.080)	0.136* (0.080)	0.122 (0.083)	0.140 (0.087)
Same parish*married	-0.488** (0.197)	-0.277 (0.178)	-0.399** (0.166)	-0.424** (0.171)	-0.412*** (0.158)	-0.361** (0.166)	0.007 (0.171)
Has children	-0.353** (0.160)	-0.135 (0.143)	-0.208 (0.128)	-0.242* (0.133)	-0.144 (0.132)	-0.207 (0.128)	-0.377** (0.189)
Has children*daughter	0.560** (0.220)	0.431** (0.179)	0.439** (0.179)	0.388** (0.189)	0.316* (0.182)	0.431** (0.179)	0.450** (0.185)
Adopted by two parents	0.758 (0.980)	-0.232 (0.498)	-0.268 (0.494)	-0.239 (0.421)	-0.478 (0.500)	-0.284 (0.502)	-0.175 (0.442)
Adopted by giving parent only	-0.847** (0.373)	-0.871** (0.374)	-0.859** (0.365)	-0.994** (0.387)	-0.935** (0.379)	-0.868** (0.370)	-0.788** (0.316)
Poor health		-0.153* (0.080)					
Poor health*same parish		0.163 (0.157)					
Unemployed		0.071 (0.118)					
Unemployed*same parish		-0.087 (0.207)					
Has children*same parish		-0.278 (0.216)					
Parent dementia*same parish			0.455* (0.241)				
Parent stroke*same parish			0.170 (0.253)				
Parent surgery*same parish			0.198 (0.172)				
Number of observations	3,220	3,220	3,220	2,982	3,030	3,586	3,220
Mean of inheritance	1.806	1.377	1.377	1.314	1.311	1.448	1.377
R <sup>2</sup>	0.794	0.835	0.835	0.823	0.829	0.835	0.673

Note: The models control for age fixed effects. Observations are weighted by family size. Monetary variables are in SEK 100,000. Robust standard errors in parentheses. \* significant at the 10 percent level, \*\* significant at the 5 percent level, \*\*\* significant at the 1 percent level.