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Meet the Parents? The Causal Effect of Family Size on the Geographic Distance between Adult Children and Older Parents*

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Abstract

An emerging question in demographic economics is whether there is a link between family size and the geographic distance between adult children and elderly parents. Given current population trends, understanding how different configurations of family size and sibship influence patterns of child-parent proximity is vitally important, as it impacts on issues such as intergenerational care and everyday mobility. It may be the case, for example, that larger families enable the responsibility of care for older parents to be shared among more siblings, possibly decreasing individual involvement and relaxing constraints on geographic mobility. However, there is no causal evidence to date on this issue. This study is the first attempt to estimate the causal effect of sibship size on the geographic distance between older parents and adult children by using a large administrative data set from Sweden. We find a positive association between sibship size and child-parent geographic distance. However, when we use multiple births and sibship sex composition as instruments for family size, we do not find any evidence that the observed positive relationship represents a causal effect. Given that family sizes are continuing to fall in many developed countries, our findings suggest that the trend towards smaller families will not necessarily result in adult children being more constrained in terms of their geographic location decisions, at least in countries with extensive state-provision of elderly care.

Keywords: Family size, child-parent geographic proximity.

JEL Classification: J10, C10.

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I. Introduction

During the last few decades of the 20th century, virtually every industrialized country has witnessed demographic changes that have dramatically reshaped family structures. One of the most important trends has been a change in the population structure by age due to the increased life expectancy of the average individual. At the same time, there has been a significant decline in the number of families having a second or third child, and a shift from the, previously dominant, two-child or three-child models of the family towards single-child ("beanpole") families. The ageing of the population and the growing trend towards one-child families place many adult children in an unprecedented situation with respect to parent-care activities. Indeed, more and more adult children are likely to be caught in a "demographic double bind" (Treas, 1979): they are increasingly likely to have at least one parent who survives into old age and to have fewer siblings with whom to share care-giving responsibilities. What are the likely implications of these demographic trends for the geographic mobility of younger generation family members? Geographic proximity is likely to affect the amount of care provided to the elderly, thus, with life expectancy increasing and fewer siblings around to share the care of elderly parents, can we expect people to be constrained in their location decisions over their life-cycle because of familial obligations? Further, will this have additional consequences for labor mobility and individuals' earnings potential? Is the growing trend towards one-child families in many developed countries likely to be a major obstacle to geographic mobility in the 21st century? Despite the enormous policy implications, these are questions we know very little about. An answer to these questions firstly requires a thorough understanding of whether different configurations of family size and sibship influence the mobility patterns of young adults.

This study's principal contribution is to attempt, for the first time, to measure the causal effect of sibship size on the geographic distance between older parents and adult children. To this end, we use data based on a 35 percent random sample of cohorts born in Sweden from 1945-1960. By means of a population register, biological siblings and parents are matched to the individuals in the random sample. A unique feature of our dataset is the possibility of using information in the Swedish censuses to identify the geographic location of all individuals in the sample. Using the geographic coordinates of the main town or village in each parish, together with household identifiers, we calculate the approximate distance between children and their parents in 1990. This distance measure combined with detailed information about family size, birth order and sibship sex composition allows us to comprehensively study the relationship between family structure and the geographic mobility of adult children. To isolate the causal effect of family size on child-parent geographic proximity, we use plausible quasi-experimental variation in family size resulting from the birth of multiples and preferences for a mixed-sex sibship.

Theories of why family size might affect the geographic mobility of younger generation family members come from a variety of sources across different disciplines. Economists have recently started to investigate how intergenerational links that require younger generations to support the elderly and family structure interact in affecting adult children's mobility patterns. On the one hand, a small family may involve shorter distances to parents, since there are fewer siblings around who could help when necessary. On the other hand, a large family may enable the responsibility for caregiving to be shared among more siblings, possibly decreasing individual involvement and resulting in greater mobility. Thus, the size of the family might increase adult children's mobility, since more siblings may share the caring for elderly parents and, therefore, may be less constrained in their location choices (Rainer and Siedler, 2009). Human geographers have also argued that children with a large number of siblings may not feel as great a need to live close to their parents. One hypothesized reason for this is the reduced supply of parental resources available to children in larger families (Shelton and Grundy, 2000).

To begin to shed some light on these issues, we first conduct simple ordinary least squares regressions of child-parent geographic distance on family size. Our baseline regression, which only includes children's birth year and gender as controls, reveals a positive and statistically significant relationship between family size and child-parent geographic distance. Controlling for parents' characteristics does not alter the significance and magnitude of the coefficient on family size. In a second step, we investigate whether the relationship between family size and child-parent proximity is non-linear. Using dummy variables for different family sizes, the estimates reveal some interesting family location patterns: the average child-parent distance increases non-linearly with family size. In a third step, we examine whether birth order effects are responsible for the observed relationship between family size and child-parent proximity. The rationale for this is as follows: suppose the average distance from parents is smaller (respectively, larger) for children of low birth order. This increases (respectively, reduces) the average child-parent distance in large families. Thus, estimates that exclude birth order controls might underestimate (respectively, overestimate) the true association between family size and child-parent proximity. When we include birth order controls, we find an even stronger relationship between family size and geographic distance. As for birth order effects, separate regressions for different family sizes show that the geographic distance from parents decreases in children's birth order.

Having established this, we examine whether the observed positive relationship between family size and child-parent geographic distance is causal, or whether it is a reflection of unobserved family and neighborhood background characteristics. Some scepticism regarding a causal interpretation arises from the recent literature on the intergenerational transmission of attitudes and preferences. For example, there is growing evidence that risk attitudes are transmitted from one generation to the next (Dohmen et al., 2006), and it is also well understood that individuals' willingness to take risks and their mobility behavior is positively correlated (Jaeger et al., 2007). Thus, if a significant correlation between parents' risk attitudes and family size exists, and if such attitudes are transmitted from one generation to the next, then a positive link between family size and child-parent geographic distance might not be causal. To the best of our knowledge, this study represents the first attempt to isolate the causal effect of sibship size on child-parent proximity by using quasi-experimental variation due to twin births and parental preferences for a mixed-sex sibship. Consistent with previous research (Black et al., 2005; Angrist et al., 2006), we find a positive and significant influence of multiple births on family size, indicating that a multiple birth increases completed family size by around 0.8 children. Moreover, we also find that mothers with two children of the same sex have a greater probability of having a third child than mothers with a daughter and a son. While this empirical relationship is weaker than the exogenous variation in family size resulting from a multiple birth, the empirical tests also point to a strong instrument. When exploring the causal effect of family size on mobility by using sibling sex composition and multiple births as exogenous sources of variation for family size, we do not find any evidence that the positive relationship represents a causal effect. The estimates drop considerably in magnitude, and some of the effects even become negative. Given that family sizes are continuing to fall in many developed countries, our findings suggest that the trend towards smaller families will not necessarily result in adult children being more constrained in terms of their geographic location decisions, at least not in Sweden. In fact, as we shall see in Section V, Sweden is a country characterized by explicit legal state obligations for elderly care, and has a population that also believes the state rather than the family should be responsible for care provision. Therefore, our results showing that sibship size is not causally related to child-parent proximity should be interpreted within this particular institutional setting.

On the methodological side, our results highlight the importance of accounting for potential problems of omitted variable bias when investigating the relationship between family structure and adult children's location decisions.

The remainder of this paper is organized as follows. Section II reviews the related empirical literature. Section III describes the data and provides descriptive statistics. Section IV presents the results of our empirical analysis and checks for robustness. Section V discusses possible explanations for our findings. Finally, Section VI concludes.

II. Related Literature

This paper contributes to the existing empirical literature that uses multiple births and sibship sex composition to estimate causal effects of family size, previously mainly on human capital outcome variables.

Since the quantity-quality fertility model was first proposed by Gary Becker and his associates (Becker, 1960; Becker and Lewis, 1973; Becker and Tomes, 1976), there has been a long tradition of looking at whether family size makes an important input into the production of child quality. Rosenzweig and Wolpin (1980) were the first to use multiple births to estimate the causal effect of family size on human capital variables. However, their finding that an increase in fertility reduces child quality has been questioned because of inadequate sample sizes and lack of birth order controls. Black et al. (2005) also use twins to estimate the effect of family size on education. Using Norwegian administrative data, they find no evidence of a negative effect of family size on human capital. The same finding is also at the heart of a recent study by Angrist et al. (2006), which combines sibship sex composition and twins identification strategies using Israeli census data.[1] Finally, Black et al. (2009) examine the effect of family size on IQ scores of young men. While instrumental variables estimates using twins imply a negative effect of family size on IQ scores, results using sex composition as an instrument reveal no significant adverse effect of family size.

This study extends the aforementioned literature by looking beyond human capital outcomes. To the best of our knowledge, our work is the first to address the question of whether family size affects the spatial proximity between older parents and adult children. Understanding how different configurations of family size and sibship affect patterns of child-parent proximity is a topic of great concern, not least because it impacts on issues such as intergenerational care (Couch et al., 1999; Pezzin et al., 2006), the strength of family ties (Shelton and Grundy, 2000; Hank, 2007; Ermisch, 2009), and everyday mobility

[1] Angrist and Evans (1989) pioneered the use of sibling sex composition as an exogenous source of variation for family size. More recent papers that also use the sex composition of siblings as an instrument include, for example, Butcher and Case (1994), Goux and Maurin (2005) and Conley and Glauber (2006).

(Konrad et al., 2002; Rainer and Siedler, 2009). What we currently know about the relationship between family structure and child-parent spatial proximity is limited and inconclusive. Examining socio-demographic factors associated with variations in child-parent distance, Shelton and Grundy (2000) find a significant negative association between the number of siblings and proximity to parents. Both Konrad et al. (2002) and Rainer and Siedler (2009) compare adult children from two-child families with only children to examine whether the presence of a sibling and birth order are related to patterns of child-parent proximity. While all three studies begin to shed light on the relationship between family environment and the geographic distance between older parents and adult children, none of the findings can be interpreted as causal. Family size reflects parents' past fertility choices and hence may be related to unobservable parental characteristics that affect their children's location decisions. This study deals with the issue of causality by using quasi-experimental variation in family size resulting from the birth of multiples and sibship sex composition.

III. Data

The data, a 35 percent random sample of cohorts born in Sweden from 1945-1960, originates from registers administrated by Statistics Sweden. By means of a population register, siblings (both full and half biological) and biological parents are matched to the individuals in the random sample. A unique feature of the data is that through information in the censuses, we can identify the geographic location of all these individuals. The censuses contain information on the parish and municipality in which the individuals lived. Moreover, there is also an indicator for the household to which the individual belongs, which makes it possible to identify cases of co-residence between adult children and their parents.

Using the geographic co-ordinates of the main town/village in each parish in 1990, we calculate the approximate distance in kilometers, as the crow flies, between children and their parents. In 1990, the number of parishes in Sweden was 2,563, with a population ranging from 2 to 56,714 inhabitants. The median parish population was 968.

Our measure of geographic distance will be imprecise, for several reasons. Firstly, we do not have exact information on the distance between children and parents who live in the same parish. We do know whether they co-reside in the same household, in which case they will be assigned a zero distance. In case they do not live in the same household, but in the same parish, we assign, for each parish, a distance that is half of the minimum distance between any other child-parent pair not living in the same parish. Secondly, parishes vary a lot in geographic area, and using the co-ordinates of a parish will be more precise for smaller parishes than larger ones.

We restrict the data to families in which all siblings were born from 1945-1960, and only to full biological siblings. Children with half biological siblings are dropped from the sample. In the censuses it is also possible to track down which individuals lived together in the same household. In each census, we know whether an individual lives with his/her biological parents or not, and we use this information to identify non-intact families. If at some point one or more of the siblings in a family live with only one biological parent, we consider this a family breakup.[2] We exclude these families from our analysis and focus only on the family size and birth order effects in intact families. We also drop families that experienced the death of a child.

The data also contain information on completed education. For the parents, this information is based on the 1970 census, whereas for the children and their siblings, education is reported in the education register from 2003. The level of education is translated into years of schooling according to the years normally required to complete the degree.[3]

Our main outcome of interest is the geographic distance, measured in kilometers, between adult children and their mothers, in 1990. The children are aged 30-45 in this year, and for the majority of the individuals we should capture the location they choose after completing their studies. When constructing the data set a trade-off emerges: on the one hand, we want to measure distance at a stage when individuals have entered the labour market, on the other hand, we cannot observe them too late because then their parents are likely to be deceased and we cannot observe the distance. For the 1945-1960 cohorts, concentrating on the distance from their mothers in 1990, implies that we loose 11.4 percent of the sample whose mothers were already dead in 1990.

Table 1 presents the descriptive statistics of our sample. On average, the adult children

[2]To this end, we use the censuses conducted in 1960, 1965, 1970, 1975, 1980, 1985 and 1990. Naturally, children may live with none of the parents once they have reached adulthood, but this is not coded as a family breakup. However, if at least one biological child has never lived with the parents, it is considered to be a non-intact family.

[3]The information in the 2003 education register has been translated into years of education in the following way: 7 for (old) primary school, 9 for (new) compulsory school, 9.5 for (old) post-primary school (realskola), 10 for less than two years of high school (or incomplete high school), 11 for short high school, 12 for long high school, 13 for less than two years of post-secondary education, 14 for short university, 15 for three years of university, 16 for four years of university, 17 for five or more years of undergraduate university studies (including magister), 18 for a lower graduate degree (licentiate), and 20 for a PhD. For the parental schooling variable, years are assigned as follows: 7 for (old) primary school, 9 for new compulsory school or old post-primary school, 11 for short high school, 12 for three-year high school, 14 for short university, 15 for three years of university and 19 for a lower graduate degree (licentiate) or a PhD.

in the sample live 71 km away from their mothers. 31 percent of the individuals actually live in the same parish as their mother, and 2 percent live in the same household. Mothers are born on average in 1924, fathers in 1921. (Mothers observed have to be alive in 1990, but not fathers; 20 percent of the fathers were dead in 1990). In the sample, the average length of education is 12 years, and for mothers and fathers, the length of schooling is 8.28 and 8.95 years, respectively. The average child belongs to a family with 2.48 children, and 13 percent of the children are only children.[4] Moving on to Table 2, reporting the number of children in families of different sizes, we see that most children grow up in families with two or three children; about 45 percent of the children grow up in two-child families. Families with five or more children are rare. Finally, in our instrumental variable analysis, we use the event of twin births as an instrument for family size. Twins are identified in the data as full biological siblings born in the same month and year. In the sample of intact families used in this paper, we have 3341 twins.

IV. Findings

As outlined in the introduction, there are several potential mechanisms that may introduce an association between family structure and geographic mobility. We mentioned, for example, that the size of the sibship could increase mobility, since more siblings may share care responsibilities for elderly parents and therefore may be less constrained in their location choice. There is also the potential for birth-order effects that predict higher mobility for early-born siblings compared to later-borns, either because earlier-born siblings have a first-mover advantage through which they can influence the behavior of later-borns, or because later-born siblings are emotionally closer to their parents and more informed about the needs of the ageing parents. To begin to shed some light on how geographic mobility varies by sibship size and birth order, in the following we present some ordinary least squares regression results.

A. Sibship Size and Child-Parent Proximity

In Table 3 we present results from regressions of distance from mother on family size, based on our sample of children from intact families. The regressions can be represented by the following equation:

$$d_{ij} = \beta_0 + \beta_1 FAMILYSIZE_j + \gamma' x_{ij} + \varepsilon_{ij}, \tag{1}$$

[4]Note that because of our sample restrictions the numbers presented here do not represent national averages.

where d_{ij} represents the child-mother geographic distance measure for adult child i from family j, $FAMILYSIZE_j$ indicates the total number of children in family j, the vector x_{ij} contains exogenous covariates, and ε_{ij} represents the disturbance term. Controls included in the vector x_{ij} are dummies for the child's birth year, gender, the mother's and the father's age, and the mother's and the father's years of schooling. Some regressions also include controls for the child's own schooling, birth order and the mother's home municipality. The effects on geographic mobility that are not observed by the researcher, captured by ε_{ij}, may include factors such as adult children's and their parents' preferences and risk attitudes. The key parameter of interest – the effect of family size on child-mother geographic distance – is the coefficient β_1. Estimates of β_1 will tell us whether having one more sibling is associated with a higher average geographic distance between adult children and their parents. We also run similar regressions where the linear variable $FAMILYSIZE_j$ is exchanged for dummy variables for each family size.

In the first two columns of Table 3 only birth year effects and a gender dummy are included in the regressions, and in the following columns further controls are added. The first column in Table 3 shows that entering family size as a linear regressor, one more child in the family increases the average distance from the mother by 4.52 km. The third column shows that this coefficient is robust to the inclusion of further demographic controls.

Next, we look at whether the relationship between sibship size and child-parent proximity is non-linear. Using dummy variables for different family sizes, the estimates in Table 3 reveal some interesting family location patterns. In particular, the average child-parent distance appears to be a non-linearly increasing function of sibship size: the more siblings there are, the longer the average distance from the mother. Consider, for example, the results presented in the fourth column of Table 3. The estimated coefficients suggest that in families with two children, the average distance from the mother is 8.88 km longer compared to the distance between an only child and her mother. Moving on to families with four and five children, the estimated coefficients represent average distances of 15.09 and 21.57 km respectively. This non-linear and increasing relationship between family size and child-parent distance holds for families with up to seven children, after which there are very few of the larger families.

In the fifth and sixth column of Table 3, we include controls for the mother's municipality in 1990. The reason for this is twofold: firstly, our distance measure varies in quality by region, and secondly, family size might vary by region in a non-random fashion. For example, if family size is larger in rural areas, and mobility is higher for children in rural areas for labor market (or other) reasons, our estimation strategy will capture a spurious correlation between family structure and geographic mobility unless we control for region-specific effects. Including municipality controls, we observe that the coefficients are reduced in magnitude, but still remain statistically significant.

One possible explanation for the observed link between sibship size and the distance between adult children and elderly parents is birth order effects. To observe this, suppose that the average distance from parents is smaller (respectively, larger) for children of low birth order. This would increase (respectively, reduce) the average child-parent distance in large families. Thus, estimates that exclude birth order controls might underestimate (respectively, overestimate) the true association between family size and child-parent proximity.[5] When we include birth order controls in the last four columns of Table 3, we find that the relationship between family size and geographic distance remains. Thus, the link between family size and child-parent geographic distance appears not to be driven by birth order effects.

The estimation results in Table 3 do not include controls for the child's own education. Location choice and education are likely to be closely linked, but it is unclear in what way. Choice of location could be the consequence of a certain type of education, but location and education can also be regarded as a joint decision: job opportunities for many types of education are restricted to certain geographic areas, and this is known at the time the education choice is made. In Table 4, we present results, corresponding to those in Table 3, also controlling for own education. The results on family size remain stable. Overall, we therefore conclude that sibship size is positively associated with the geographic distance between adult children and their older parents.

B. Birth Order and Child-Parent Proximity

Moving on to study the effect of birth order on mobility, we regress distance from mother on birth order separately for different family sizes. The results are outlined in Table 5, and, although many of the coefficients are not statistically significant, they point towards mobility decreasing in birth order. Later-born siblings locate closer to their parents, which is in line with the hypothesis that early-born siblings have a first-mover advantage and are less constrained in their location choice than younger siblings.[6] Again, in Table 5 we

[5] Related to this, Black et al. (2005) show that family size effects on children's education are mostly driven by birth order effects. High birth order children emerge with lower education, which lowers the average for large families, and once controlling for birth order in a regression of education on family size, the effect of family size is negligible.

[6] We omit results for families with more than nine children, for which there are very few observations.

have omitted the control for children's own education. When adding this control, as in Table 6, it is clear that for birth order effects, education plays a crucial role. We no longer find that distance decreases in birth order for the most common family sizes.

To interpret these findings, we conclude from the previous literature (see, e.g., Black et al. 2005) that higher birth order implies lower education, and now we also know from our results that higher birth order implies more restricted geographic mobility, unconditional on education. The nature of the education and location decision-making process, however, makes it difficult to extrapolate which mechanisms are at stake. On the one hand, if children are responsive to their parents' care needs and younger siblings know that they will carry the burden of care giving, the incentive to invest in higher education might be lower if the return to education is low in their home region. In this case, it is the location constraint that determines the birth order effects for educational outcomes. On the other hand, high birth order can be associated with lower educational outcomes for other reasons, and in this case the birth order effects on mobility that we found in Table 5 are spuriously driven by educational choices. Recent research on education and mobility reports a positive causal effect of the length of compulsory years of schooling on regional geographic mobility (Machin et al., 2008). This finding speaks in favor of including adult children's years of schooling as a control variable in our regressions in order to net out the mobility effect that is due to higher education. Thus, in the following regressions, we always control for adult children's years of schooling.

C. Using Twin Births and Sibship Sex Composition as Instruments for Family Size

We now examine whether the observed positive relationship between family size and child-parent geographic distance is causal, or whether it is a reflection of unobserved family background characteristics. There are many reasons to lead us to believe that family size and child-parent geographic distance are correlated but not necessarily causally related. For example, families are traditionally larger in rural areas, and urbanization makes it likely that many children will leave the countryside for cities. Some scepticism regarding a causal interpretation also arises from the recent literature on the intergenerational transmission of preferences and attitudes. For example, there is growing evidence that attitudes towards risk are transmitted from one generation to the next (Dohmen et al., 2006), and it is also well understood that individuals' willingness to take risks and their mobility behavior is positively correlated (Jaeger et al., 2007). Thus, if a significant correlation between parents' risk attitudes and family size exists, and if such attitudes are transmitted from one generation to the next, then a positive link between family size and child-parent geographic distance might not be causal. To the best of our knowledge, this study represents the first attempt to isolate the causal effect of sibship size on child-parent proximity. To do so, we use two sources of quasi-experimental variation in family size in an instrumental-variables (IV) approach: the unplanned event of a multiple birth (see, e.g., Rosenzweig and Wolpin, 1980; Angrist and Evans, 1998) and sibship sex composition (Angrist and Evans, 1998; Angrist et al., 2006). The latter instrument relies on the assumption that parents with children of the same sex are more likely to have another child than parents with both daughters and sons. Our rich data set allows us to identify twin births and sibling sex composition and, thus, to estimate the causal effect of family size on the geographic distance between adult children and their mothers.

Multiple Births as an Instrument for Family Size.—The main idea is that the birth of multiples is unplanned and provides a source of exogenous variation in family size (i.e., parents end up with more children than anticipated). It is reasonable to assume that the "surprise" increase in family size is unlikely to be correlated with parents' unobservable characteristics which is a first requirement for a multiple birth to be a valid instrument for family size (Rosenzweig and Wolpin, 1980; Angrist and Evans, 1998; Black et al., 2005; Angrist et al., 2006). Note that we use a dataset with multiple births among cohorts born from 1945-1960, i.e., before fertility techniques (e.g., IVF or ICSI), which increase the likelihood of multiple births, became available.

We aim to estimate the impact of family size on the distance between adult children and elderly parents by two-stage least squares (2SLS), treating family size as endogenous and the other explanatory variables as exogenous. The estimation strategy consists of the following two equations:

$$d_{ij} = \beta_0 + \beta_1 FAMILYSIZE_j + \gamma' x_{ij} + \varepsilon_{ij}, \tag{2}$$

$$FAMILYSIZE_j = \alpha_0 + \alpha_1 TWINS_j + \lambda' x_{ij} + \mu_{ij} \tag{3}$$

with the variables d_{ij}, $FAMILYSIZE_j$ and x_{ij} as defined above. The first instrumental variable candidate $TWINS_j$ equals one if the nth birth of family j is a multiple birth (twins or triplets), and is equal to zero if the nth birth is a singleton birth, with $n = 2$ or $n = 3$. Equation (3) represents the first stage of the 2SLS procedure and equation (2) denotes the second stage with the variable $FAMILYSIZE_j$ representing predicted values from the first stage.

Note that we restrict the sample to families with two (or three) and more children when using multiple births as an instrument for family size. Importantly, we estimate

2SLS regressions only for adult children born before the multiple birth in the family (Black et al., 2005; Angrist et al., 2006). Estimations for the $n = 2$ case, therefore, only include first-born children, whereas the $n = 3$ regressions include both first- and second-born children. This sample restriction will increase the likelihood of a comparison between adult children from families with similar preferences for family size at the nth birth. In addition, it helps us to avoid the potential problem that families with more children are more likely to experience a twin birth.

Panel A of Table 7 presents the results for first-born children in families with two or more children, the instrument being a multiple birth at the second birth. The OLS estimate in the first column indicates that the positive association between family size and child-mother geographic distance also holds for this particular sample. Thus, we are not working with a sample here that looks very different from the random sample. Next, the second column shows a strong first stage, with a very high F-statistic. Quantitatively, this indicates that a multiple birth increases completed family size by about 0.8, which is consistent with previous research (Black et al., 2005; Angrist et al., 2006). Finally, the IV estimate of 0.91 (5.01) reveals that a multiple birth at a parity of two or higher does not affect the geographic distance between first-born children and their mothers. Thus, even though our instrument is very strong, it suggests that there is no causal relationship between sibship size and the geographic distance between adult children and elderly parents. Panel B paints a similar picture when we use multiple births at third birth as an instrument: even though the first stage is strong, the random event of a multiple birth does not impact the geographic mobility in the family.

One major concern with the use of multiple births as an instrument for family size is that families that experience this event are different from other families, simply because of the multiple birth. The existence of twins in the family not only affects the family size, but might also have a direct impact on other outcomes, and an indirect effect on child outcomes by altering parental investments in children. In this case, the instrument is invalid. In this particular application, we do not have any prior whether and how a flawed instrument would affect the results.

Sibship Sex Composition as an Instrument for Family Size.— Next, we use children's sex composition as an alternative source of exogenous variation in family size. Using two different IV strategies helps researchers to address some concerns regarding the external validity of any given instrumental variable estimate. As outlined by Angrist et al. (2006), the combined evidence of two different instrumental variables has several advantages. Firstly, both instruments may be subject to omitted variable bias. For instance, twin rates vary by maternal characteristics such as age at birth, and a multiple birth might influence child spacing, i.e., the age difference between siblings. Instrumental variable estimates based on parental preferences for sibling sex composition are unlikely to be affected by these issues. A comparison of both IV estimates, therefore, provides a meaningful specification check.

The rationale for using same sex composition of children as an instrumental variable is that parents of same sex children are more likely to have another child than families with a daughter and a son (Butcher and Case, 1994; Angrist and Evans, 1998). The instrument $SAMESEX_j$ (used in equation (3) instead of $TWINS_j$) is a dichotomous variable equal to one if in family j both the first-born and second-born child are of the same sex, and zero otherwise. In an alternative set-up, the variable indicates same sex of the three first-born children. Also, in this case the sample is adjusted to include only first- (first and second-) born children in families with two (three) or more children. These particular samples are also similar to the random sample in terms of the OLS estimate. The first stage of the same sex instrument, shown in column 2 of the first panel of Table 8, demonstrates that this instrument does indeed affect family size (bear in mind, however, that the coefficient 0.06 is much smaller than those of the $TWINS_j$ indicator, as expected). However, moving on to the reduced form estimate, there is no indication that this has an effect on the geographic distance between adult children and their mothers. This holds in both panels of the table where same sex of first two or first three siblings is used as an instrument, respectively.

Discussion of IV Estimates.— Our analysis of the effect of family size on geographic distance between adult children and their ageing mothers does not indicate that a causal relationship is present. The results from both instrumental variable strategies suggest that OLS estimates overstate the positive relationship between family size and child-parent geographic distance. It is, however, possible that the hypothesized effect is present in some subgroups of the population. For example, it could be the case that young adults in rural regions are more likely to face the trade-off between moving to a more prosperous urban area and staying close to the family, whereas children growing up in urban areas already have job opportunities close by, and do not see the need to relocate. To investigate if there is any heterogeneity in the sample in this respect, we have split the sample by urban and rural regions, urban being the counties surrounding the three major cities in Sweden: Stockholm, Gothenborg and Malmö, and rural corresponding to the rest of the country. These regressions do not alter the picture, we find no significant effect of family size on geographic distance between adult children and their ageing mothers.[7] Another type of heterogeneity that we investigate is the age of the mother. The idea is that the link between family structure and care giving might be more pronounced in families with relatively old mothers. In non-reported regressions, we split our sample by the median age of mothers, but our previous conclusion remains unchanged: there is no effect of sibship size on child-parent geographic distance. We have also run our regressions separately by gender, without detecting any differences along this dimension.

Another reason why we fail to detect a causal effect could be the choice of specification: we are using a continuous outcome measure of distance, and might not capture that location decisions may vary in a non-linear fashion. In non-reported regressions, we, therefore, also estimate linear probability models with binary outcomes indicating whether the child and mother live in the same parish or same municipality. These regression results confirm our previous findings.

One limitation of our analysis is that we do not have an instrument that identifies the shift from being an only child to a child with a sibling, which is potentially the most important difference in terms of family size. It might be that the existence of siblings is what matters and not necessarily how many. Unfortunately, we do not have an instrument for this variation in family size, and cannot investigate whether a causal effect is present in the lower part of the family size distribution.[8]

V. Discussion

We now move on to try to understand why there is no effect of family size on child-parent geographic distance. Previous research points to considerable cross-national differences in the role of both formal and informal care systems for the support of older persons. For example, Davey et al. (2005: S281) point out: "Policies in the United States place primary responsibility on the contributions of family, with formal services often playing a supplemental role. In some countries, notably Sweden and the other Scandinavian countries, formal services are more likely to have a primary role in providing care." Similarly, Shea et al. (2003) argue that Sweden's well-developed system of care is designed to support older people in need without placing too high demands on the family. Against this background, we focus on how differences in formal care services across countries are

[7] These results are not presented in the paper but available from the authors upon request.

[8] Bedard and Deschênes (2004) use the sex of the first child as an exogenous variation for family break-up in order to investigate the causal effect of marital dissolution on mother's economic status. However, in our context, the sex of the first child is unlikely to be a valid instrument for family size because there might be a direct effect of gender on adult children's location decisions.

mirrored by people's perception about caring responsibilities for the elderly. Our data set comes from Sweden, a country with widespread public provision of elderly care and explicit legal state responsibilities towards adults with care needs. We hypothesize that publicly provided care and welfare state policies in Sweden might reduce the role of the family in care giving for the elderly, and therefore the number of siblings does not matter for geographic location decisions. To shed further light on this argument, we present some descriptive evidence based on the Survey of Health, Ageing and Retirement in Europe (SHARE), a multidisciplinary and cross-national household panel data set. Starting in 2004, SHARE interviewed more than 40,000 individuals in 11 European countries, asking questions about a wide range of social and family networks, opinions, health and socio-economic characteristics. European countries differ considerably in the extent to which they provide state care provision and rely on informal care provision. These differences are likely to be related to cultural and historical differences as well as to individuals' attitudes about the role of the family in providing support and care to elderly persons. We measure respondents' attitudes towards the caring responsibility for the elderly based on the following questions: "In your opinion, who - the family or the state - should bear the responsibility for each of the following...". We use answers from the following three areas: "Financial support for older persons who are in need?", "Help with household chores for older persons who are in need such as help with cleaning, washing?" and "Personal care for older persons who are in need such as nursing or help with bathing or dressing?". The answers can be given on a scale from 1 to 5, which correspond to "totally family", "mainly family", "both equally", "mainly state" and "totally state". We group the first two and the last two answer categories together to capture whether respondents think that it is mainly the responsibility of the family or the responsibility of the state to support older persons.

Next, we divide the European countries into three broad categories with respect to the extent of family obligations, legal requirements and state provision of elderly care (Miller and Warman, 1996). These are:

- Individual Autonomy: Countries where family members have no legal obligations to provide or pay for elderly care. At the same time, care responsibilities of the state are well defined and explicit. In Sweden, for example, the 1956 Municipality Social Services Act assigns local authorities the primary responsibility for care provision for the elderly. In the SHARE data set, the two countries that fall into this category are Denmark and Sweden.

- Legal Obligations in Nuclear Families: Family obligations are mainly defined with respect to the nuclear family, i.e. between partners and between parents and children. In these countries, adult children have legal maintenance responsibilities towards their parents. Countries with legal obligations in nuclear families that are surveyed in the SHARE data in 2004 are Austria, Belgium, Greece, France, Luxembourg and the Netherlands.

- Legal Obligations in Extended Families: Countries where the extended family plays a more important role in providing support. This includes legal obligations between family members to provide financial support to each other and these family obligations are embedded into a broader context, including grandparents, uncles and aunts. SHARE countries that fall into this category are Italy and Spain.

This categorization allows us to develop some initial suggestive evidence on whether expectations regarding family obligations differ across countries and whether they are in line with the nature and extent of state welfare activities. In Table 9 we present descriptive evidence on respondents' attitudes towards caring for the elderly, separately for the three regime types. It is clear that respondents from countries characterized by individual autonomy are more likely to answer that the state should be responsible, rather than the family. For example, 44 percent of respondents in the Autonomy Regime (Denmark and Sweden) think that it is the responsibility of the state to help elderly persons with household chores, compared to 21 percent in countries with legal obligations in extended families. Moreover, nearly 50 percent of respondents in the 'Autonomy countries' indicate that the state should provide personal care for older persons who are in need such as nursing or help with dressing, compared to 24 percent of individuals living in a country with legal obligations in extended families. This could potentially explain why sibship size and geographic mobility is causally unrelated in Sweden: care is publicly provided, and it is also commonly believed that it should be provided by the state rather than by the family.

VI. Conclusion

Our research is motivated by two recent fertility and demographic trends in the western world: on the one hand, fewer children are being born and more and more children are growing up in smaller families. On the other hand, we are seeing increased longevity and, hence, the need for elderly care is increasing. What are the likely implications of these trends for the geographic mobility of younger generation family members?

In this paper, we estimate the causal effect of family size on the geographic distance between mothers and adult children. Our empirical analysis is based on register data from Sweden. We find a a small positive relationship between family size and the geographic distance between adult children and their elderly mothers in cross-section estimations. Keeping in mind that the number of children in a family is not exogenous, but, for example, reflects parental preferences that might be correlated with our outcome measure, we take our analysis one step further by introducing an instrumental variables approach. We use multiple births and sibling sex composition as exogenous variation for family size. These approaches are appealing because they control for unobserved heterogeneity across individuals that potentially confound simple cross-sectional estimates. The instrumental variable estimates indicate that there is no positive effect of family size on child-parent geographic distance. Our findings suggest that the recent trend towards smaller families in many developed countries will not necessarily result in adult children to be more constrained in terms of their geographic location decisions, at least not in Sweden.

Moving on to explain our results, we use an alternative data source to look at attitudes towards elderly care in different countries. We find that in Sweden, the attitudes are in favor of the state taking major responsibility for the care. This suggestive evidence could potentially explain why we do not find a causal relationship between family size and child-parent geographic proximity: if the family plays a small role in caring for the elderly, the younger generation will not be constrained in their location decisions. An interesting roadmap for future research is, therefore, to compare countries with different institutions and attitudes, to see if in countries where the family plays a crucial role in taking care of the elderly, family structure has a more significant impact on the geographic distance between generations.

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Table 1

Summary statistics

Variable	Mean	Std. Dev.
Distance to mother in 1990	70.65	141.39
Same parish in 1990	0.31	0.46
Same household in 1990	0.02	0.14
Birth year	1952.29	4.26
Birth year mother	1924.19	5.78
Birth year father	1920.94	6.43
Years of schooling	12.02	2.53
Mother's years of schooling	8.28	2.11
Father's years of schooling	8.95	2.67
Family size	2.48	1.04
Only child	0.13	0.34
Father dead in 1990	0.20	0.40
Female	0.50	0.50
Observations	301,677	

Table 2

Number of children in families of different size

Family size	Freq.	Percent
1	39,551	13.11
2	138,638	45.96
3	82,145	27.23
4	28,865	9.57
5	8,570	2.84
6	2,624	0.87
7	820	0.27
8	348	0.12
9	66	0.02
10+	50	0.02
Total	301,677	100

Table 3

The effect of family size on child-mother geographic distance in 1990

	No demographic controls		Demographic controls				Demographic controls and birth order controls			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Nr of children	4.52		4.91		1.87		6.36		3.26	
	(0.35)**		(0.35)**		(0.30)**		(0.42)**		(0.38)**	
2 children		11.08		8.88		7.69		10.54		9.21
		(0.76)**		(0.77)**		(0.74)**		(0.84)**		(0.81)**
3 children		16.23		13.57		9.54		16.40		12.08
		(0.89)**		(0.89)**		(0.84)**		(1.03)**		(0.99)**
4 children		16.01		15.09		7.62		19.28		11.43
		(1.31)**		(1.29)**		(1.19)**		(1.51)**		(1.41)**
5 children		18.86		21.57		9.27		26.78		13.99
		(2.49)**		(2.46)**		(2.19)**		(2.75)**		(2.45)**
6 children		25.48		29.41		11.64		36.93		18.61
		(5.15)**		(5.05)**		(4.25)**		(5.33)**		(4.52)**
7 children		39.16		45.54		19.44		53.35		26.72
		(11.22)**		(11.13)**		(8.26)*		(11.36)**		(8.59)**
8 children		8.99		15.26		-7.48		24.50		1.30
		(13.67)		(13.74)		(11.03)		(15.09)		(11.96)
9 children		21.48		34.33		19.11		45.55		29.95
		(30.18)		(30.21)		(18.71)		(30.79)		(18.42)
10 children		-14.65		-8.18		5.20		6.50		19.30
		(19.58)		(21.15)		(24.66)		(25.46)		(28.89)
2nd child							-2.33	-3.38	-1.53	-3.08
							(0.63)**	(0.64)**	(0.61)*	(0.63)**
3rd child							-4.90	-5.14	-3.88	-4.52
							(1.08)**	(1.08)**	(1.04)**	(1.06)**
4th child							-10.30	-8.37	-9.99	-7.72
							(1.82)**	(1.84)**	(1.77)**	(1.81)**

5th child							-9.65	-9.30	-11.05	-8.41
							(3.31)**	(3.41)**	(3.27)**	(3.39)*
6th child							-16.87	-18.90	-20.22	-17.96
							(6.02)**	(6.03)**	(5.90)**	(6.04)**
7th child							-9.58	-10.55	-14.43	-10.16
							(14.17)	(13.12)	(13.14)	(13.21)
8th child							-44.13	-20.96	-41.08	-20.87
							(14.94)**	(14.35)	(14.93)**	(14.69)
9th child							-50.74	-24.00	-29.37	-23.80
							(31.05)	(37.05)	(34.44)	(37.44)
10th child							-96.86	-43.78	-55.86	-42.41
							(6.38)**	(26.86)	(9.36)**	(26.87)
Municipality controls					yes	yes			yes	yes
Observations	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677
R-squared	0.00	0.00	0.02	0.02	0.10	0.10	0.02	0.02	0.10	0.10

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.
All regressions include additional controls for gender and birth year of the child. Columns 3-10 also include years of schooling and age of both parents.

Table 4

The effect of family size on child-mother geographic distance in 1990
Including controls for own education

	No demographic controls		Demographic controls				Demographic controls and birth order controls			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Nr of children	7.02		6.98		3.80		7.172		3.984	
	(0.34)**		(0.34)**		(0.29)**		(0.410)**		(0.367)**	
2 children		9.99		8.88		7.63		8.45		7.14
		(0.74)**		(0.75)**		(0.72)**		(0.82)**		(0.79)**
3 children		17.15		15.81		11.52		15.16		10.71
		(0.86)**		(0.87)**		(0.82)**		(1.01)**		(0.96)**
4 children		21.38		20.47		12.50		20.41		12.23
		(1.25)**		(1.25)**		(1.15)**		(1.46)**		(1.37)**
5 children		29.72		29.87		17.10		30.48		17.41
		(2.37)**		(2.38)**		(2.12)**		(2.66)**		(2.38)**
6 children		38.89		39.30		21.24		41.75		23.32
		(4.90)**		(4.89)**		(4.15)**		(5.19)**		(4.44)**
7 children		54.51		55.66		29.24		58.36		31.62
		(10.86)**		(10.89)**		(8.19)**		(11.06)**		(8.45)**
8 children		27.49		28.71		5.64		32.73		9.41
		(12.66)*		(12.84)*		(10.48)		(14.11)*		(11.29)
9 children		48.67		51.72		36.28		55.97		40.40
		(27.09)		(27.23)		(15.87)*		(28.00)*		(15.90)*
10 children		-3.78		-3.80		7.98		2.14		13.74
		(17.75)		(18.98)		(23.17)		(23.08)		(26.98)
2nd child							1.177	0.90	1.800	1.00
							(0.619)	(0.64)	(0.603)**	(0.63)
3rd child							0.930	1.12	1.658	1.46
							(1.064)	(1.07)	(1.028)	(1.05)
4th child							-2.599	-1.69	-2.646	-1.32
							(1.791)	(1.81)	(1.750)	(1.79)
5th child							-1.261	-3.29	-2.829	-2.64

							(3.245)	(3.38)	(3.213)	(3.36)
6th child							-6.955	-11.54	-10.306	-10.88
							(5.835)	(5.89)*	(5.730)	(5.90)
7th child							-1.251	-4.61	-5.987	-4.45
							(14.072)	(12.85)	(13.087)	(12.94)
8th child							-33.172	-13.24	-30.100	-13.49
							(14.134)*	(13.59)	(14.365)*	(13.95)
9th child							-32.073	-4.55	-11.410	-5.30
							(31.107)	(36.52)	(33.835)	(36.90)
10th child							-85.423	-22.36	-45.782	-22.04
							(7.930)**	(25.67)	(12.617)**	(25.70)
Municipality controls					yes	yes			yes	yes
Observations	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677	301,677
R-squared	0.06	0.06	0.06	0.06	0.13	0.13	0.06	0.06	0.13	0.13

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.
All regressions include additional controls for years of schooling, gender and birth year of the child. Columns 3-10 also include years of schooling and age of both parents.

Table 5

The effect of birth order on geographic mobility, estimated by family size

Dependent variable: Child-mother distance in 1990, km

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2nd child	-3.25	-1.95	-4.39	-9.40	-0.35	-13.98	27.88
	(0.84)**	(1.29)	(2.60)	(5.69)	(10.89)	(25.45)	(40.99)
3rd child		-2.41	-5.91	-3.01	7.49	3.75	-69.43
		(1.78)	(3.22)	(7.14)	(14.03)	(28.25)	(32.86)*
4th child			-10.01	-0.49	35.56	-64.31	-138.99
			(4.09)*	(8.14)	(18.37)	(41.90)	(57.04)*
5th child				-5.02	35.63	-42.79	-123.15
				(9.71)	(20.29)	(46.03)	(69.27)
6th child					34.46	-71.88	-168.73
					(23.93)	(53.63)	(73.78)*
7th child						-75.20	-187.02
						(63.55)	(88.97)*
8th child							-216.19
							(100.50)*
Municipality controls	yes	yes	yes	yes	yes	yes	yes
Observations	138,638	82,145	28,865	8,570	2,624	820	348
R-squared							

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.

All regressions include additional controls for gender and birth year of the child and years of schooling and age of both parents.

Table 6

The effect of birth order on geographic mobility, estimated by family size
Including controls for own education
Dependent variable: Child-mother distance in 1990, km

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2nd child	1.17	1.62	-0.21	-5.68	3.57	-7.53	32.27
	(0.83)	(1.27)	(2.59)	(5.61)	(10.85)	(26.21)	(41.25)
3rd child		4.11	0.88	1.74	12.62	12.48	-65.72
		(1.75)*	(3.19)	(7.04)	(14.07)	(28.49)	(30.78)*
4th child			-0.55	5.62	44.07	-52.82	-134.03
			(4.03)	(7.97)	(18.42)*	(41.49)	(53.71)*
5th child				3.44	44.24	-35.02	-116.37
				(9.47)	(20.33)*	(45.68)	(65.52)
6th child					46.59	-56.33	-161.84
					(23.71)	(52.05)	(69.35)*
7th child						-60.76	-180.70
						(61.31)	(84.47)*
8th child							-205.38
							(93.55)*
Municipality controls	yes	yes	yes	yes	yes	yes	yes
Observations	138,638	82,145	28,865	8,570	2624	820	348
R-squared							

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.
All regressions include additional controls for years of schooling, gender and birth year of the child and years of schooling and age of both parents.

Table 7

The causal effect of family size on child-mother geographic distance in 1990

	(1) OLS	(2) 1st stage	(3) Reduced form	(4) IV
	A. Regressions for first-born children in families with two or more children			
Family size	3.62 (0.61)**			0.91 (5.01)
Twins at second birth		0.81 (0.02)**	0.73 (4.04)	
Observations	106,075	106,075	106,075	106,075
R-squared	0.14	0.11	0.14	
F-test: Twins		2519.91		
	B. Regressions for first and second-born children in families with three or more children			
Family size	2.32 (0.90)**			-0.62 (6.15)
Twins at third birth		0.87 (0.02)**	-0.54 (5.34)	
Observations	73,843	73,843	73,843	73,843
R-squared	0.15	0.09	0.15	
F-test: Twins		1388.11		

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.
All regressions include controls for years of schooling, gender and birth year of the child, years of schooling and age of both parents, and home municipality of mother.

Table 8

The causal effect of family size on child-mother geographic distance in 1990

	(1) OLS	(2) 1st stage	(3) Reduced form	(4) IV
	A. Regressions based on first-born children in families with two or more children			
Family size	3.62			-1.75
	(0.61)**			(13.04)
Same sex sib 1 & 2		0.06	-0.11	
		(0.004)**	(0.84)	
Observations	106,075	106,075	106,075	106,075
R-squared	0.14	0.10	0.14	0.14
F test: Same sex		209.85		
	B. Regressions based on first and second-born children in families with three or more children			
Family size	2.32			-6.69
	(0.90)**			(31.61)
Same sex sib 1, 2 & 3		0.05	-0.32	
		(0.01)**	(1.49)	
Observations	73,847	73,847	73,847	73,847
R-squared	0.15	0.07	0.15	
F test: Same sex		29.46		

Notes: Robust standard errors in parentheses are clustered on families. * significant at 5%; ** significant at 1% level.
All regressions include controls for years of schooling, gender and birth year of the child, years of schooling and age of both parents, and home municipality of mother.

Table 9

Differences in People's Perception about Family vs. State Responsibility in Old Age, by 'Regimes'

	(1) Extended Family Countries	**(2) Nuclear Family Countries**	**(3) Autonomy States**
Financial support for older persons who are in need?			
Family	0.21	0.12	0.10
Both Equally	0.40	0.37	0.22
State	0.39	0.51	0.68
Help with household chores for older persons?			
Family	0.37	0.29	0.27
Both Equally	0.42	0.42	0.29
State	0.21	0.29	0.44
Personal care for older persons who are in need such as nursing or help with bathing or dressing?			
Family	0.31	0.19	0.29
Both Equally	0.45	0.43	0.22
State	0.24	0.38	0.49

Note: Family and state include (totally or mainly). Own calculations from SHARE.