When do kinsmen really help? Examination of the cohort and parity specific kin effects on fertility behaviour. Case of the Bejsce parish register reconstitution study, 18th-20th centuries, Poland.

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ABSTRACT

Present study aims at investigation of the parity specific effect of kin help on the transition between births among natural and controlled fertility birth cohorts of Bejsce parish. The hypothesis states that kin help should be of particular importance in case of higher order births. Thus, kin effects understood as reduction in the costs of childbearing (direct childcare, provision of the resources) or nutritional effects should be of particular importance at higher parities.

The analyses are based on the multilevel hazard models of parity transition with kin effects represented by time constant and time varying covariates. The data used for the estimation of the models comes from the reconstitution of the registers from Bejsce parish located in the south central Poland. The reconstitution covers the period between 1730 and 1968.

The results suggest that there was a strong kin effect especially at higher parities. These effects were mostly associated with the presence of non generative relatives (grandparents). The analyses reveal only weak differences in the kin effect between natural and controlled fertility regimes.

INTRODUCTION

In traditional agricultural societies the family life was strongly influenced by the extended kinship network that determined economic and social well being of the household (Laslett 1988). Broad system of kinship and multigenerational nature of traditional family was frequently a safety net against uncertainty associated with agricultural production and various unforeseen events. In the economic system of agriculture, kinship network provided a substantial increase in certainty about future by diversification of risk among between family (Kohler and Hammel 2001). This paper explores one of the aspects of the kin influence on family life, namely the influence on the rates of reproduction within households.

Many studies concerning traditional populations shown that the existence of kin networks strongly enhances reproductive performance of individuals by providing them with additional childcare or material resources (Burnstein et al. 1994, Dunbar and Spoors 1995, Hill and Hurtado 1996, Sear et al. 2003, Tymicki 2004). A theoretical framework that explains ultimate causes of such kin oriented altruism is related to kin selection theory. This theory predicts that individual actions should be oriented toward enhancement of the reproduction of close relatives (Grafen 1984).

The theory of kin selection originates in the work of Hamilton (1964). Basic evolutionary reasoning states that each organism during its life strives for optimal allocation of the resources in order to maximise lifetime reproductive success. The fact that human life span consist of reproductive ages (15-49) and non-reproductive ages (childhood and post menopausal period) creates an opportunity to distribute the investments between self reproduction *(direct investments)* and reproduction of the relatives *(indirect investments)*. Therefore, an overall lifetime reproductive performance of an individual could be divided between *direct reproductive effort* (own reproduction) and an *indirect reproductive effort* (help towards genetically related individuals).

The role of the indirect reproduction as a potential explanation of altruistic behaviour has been neglected until already mentioned work of Hamilton who pointed out that organisms could contribute to genetic pool of the population also by investing in reproduction of relatives. In the light of this theory, such a genetic contribution stands for the main reason why genetically related organisms reveal altruistic behaviour towards each other.

Hence, the kin selection framework provides a natural point of reference for the analysis of the kin influence on individual reproductive performance. However, any applications of this framework to any historical or traditional population have to be very cautious. This is due to the fact that the kin oriented altruistic behaviour should be considered as a product of evolutionary process. Therefore it cannot be assumed that there is an evolutionary force, which selects traits associated with the kin oriented altruism in the studied population. The fields of interest are short term social and demographic consequences of kin oriented help, rather than the long-run evolutionary consequences of such behaviour. Moreover, one have to be fully aware that the altruistic behaviour towards relatives are not merely ‘genetically programmed’ but are enhanced and maintained by the social norms and the rules of reciprocity (Gintis et al. 2003).

Already mentioned studies investigated the kin effects on female reproductive behaviour (Sear et al. 2003, Tymicki 2004). The results have shown that there was a strong influence of selected kin groups on the rates of progression to next birth which resulted in higher completed fertility. However, these investigations were not concerned with the birth order which might be considered as a simplification, since it is unrealistic to assume that the kin help had an equal effect over the whole life span of the recipient. It is more plausible to assume that the intensity of the kin effect on the reproduction had a different effect with respect to the parity of the recipient. Therefore, present analysis focuses on the hypothesis that kin help had a different effect with respect to the parity.

The differential effect of kin effect over individual reproductive life-span should manifest through the positive relationship between presence of the various kin groups and increased proportion of higher order births. This reasoning is based on the assumption that help provided by kinsmen should lower costs associated with childbearing and thus facilitate achieving of higher completed fertility. This argument is based on the economic analysis of demand and supply for children (Becker, 1998; Becker and Barro, 1988; Easterlin and Crimmins, 1985). Within this framework, growing costs of children are one of the main factors that reduce demand for children and thus causing reduction of completed fertility. Therefore any reduction in costs should stimulate demand for children and therefore lead to higher fertility. From this perspective, those households which receive help from the kin groups should exhibit higher fertility due to the reduction in the costs of children. This reduction in costs could be associated with direct childcare (time spend on helping behaviour), provision of resources (both for mother and child) and improving nutritional status of the children.

It has to be noted that the forms of help and their effect on the reproductive behaviour could have different meaning in the context of controlled and natural fertility regimes. In the latter case, help should primarily concern provision of nutritional resources both to the mother and a child, whereas among controlled fertility groups help should reduce alternative costs of having children like foregone wages or time costs. Moreover, the kin effect in the case of both fertility regimes should be of particular importance for transition to above-average birth orders. That is, the kin effect should be significant in the case of birth orders that exceed average for a given population or cohort. This implies that individuals receiving help from their families achieved above average reproductive success in their groups which converges with above mentioned evolutionary reasoning. In order to understand these relationships we have to throw some light on the pathways of the kin influence on female reproduction.

Pathways of the kin influence on reproduction

As described extensively elsewhere (Crognier 2003, Crognier et al. 2001, Tymicki 2004), in order to account for the positive relation between kin oriented help and reproductive success of the recipient, both components of reproductive success have to be considered; the number of produced offspring and the number of surviving offspring. The hypothesis concerning the kin effect on the reproduction assumes that this effect operates through both components. Kin help understood as a provision of the resources on the one hand increases survival of the new-born children and on the other hand, due to lower costs of additional child, leads to higher completed fertility. These two ways, from the theoretical point of view, constitute an exhaustive list of potential influences; kinsmen can contribute both to increased offspring survival or facilitate progression to the next birth.

The kin effects on the number of surviving offspring or survival of a new born infant were investigated in many studies (Beise and Voland 2002, Sear et al. 2003, Sear et al. 2000, Tymicki 2004). The relation between presence of kinsmen and the risk of transition to next birth, with few exceptions was not of a particular interest of demographers so far (Sear et al. 2003, Tymicki 2004). These studies were primarily interested in the overall effect of kin on the rates if transition to subsequent birth, whereas this study tries to focus on the distribution of the kin effects over the individual life span of the recipient. As noted earlier, using the demand-supply framework it can be shown that kin help lower the costs of childbearing and promote higher completed fertility. However it has to be noted that there could be different pathways of the kin influence on reproductive behaviour in pre-transitional and post-transitional cohorts (populations).

In all human populations, the pace of conceptions and deliveries is regulated by the set of factors known as proximate mechanisms(Bongaarts 1978). These factors like duration of the lactation, post partum ammenorhea, irregularities in the menstrual cycle (higher frequency of anovulatry cycles) and coital frequency were responsible for the probability of transition between successive births and thus lifetime reproductive outcome. Although these factors are present in all human populations they were of particular importance among natural fertility populations i.e. populations with no form of deliberate fertility control. Therefore, the possible pathways of the kin influence on the reproductive rates of women among natural fertility populations are associated with the provision of resources and reduction of workload. Improvement in the nutritional status of woman thanks to kin's help might lead to better biological condition and thus to shorter birth intervals and higher transition risks (Cumming et al. 1994, Ford and Huffman 1993, John 1993, Mosley 1979, Pebley et al. 1991). On the other hand, kin support might reduce woman's workload, which in turn could increase the amount of time spent in the household and possibly affect her reproductive behaviour. However it might be difficult to capture these effects and separate them from physiological rhythm of reproduction in natural fertility populations. As shown by Sear and colleagues (2003) we cannot rule out the kin effects on the rates of reproduction in populations without deliberate fertility control. Although it could be argued that these effects might be much stronger in the populations in which fertility was a controlled process and families were limiting their reproductive behaviour consciously (Easterlin and Crimmins 1985, Gallowayet al. 1994, Tymicki, 2004).

If we consider above mentioned theory from the perspective of the kin effects we may suppose that a shift in the demand-supply schedule might create a possibility for kinsmen to affect the fertility rates of their relatives. In the pre-transitional period (natural fertility) members of the kin group contributed mostly to reproductive behaviour of the relatives by increasing the infant's survival and nutritional status of the mother. In the post transitional period however, kinsmen could lower the costs associated with childbearing and thus led to higher fertility of their relatives. Existing evidence suggest that this could have been associated both with the provision of resources to the recipient's household and childcare (Turke 1988, Weisner and Gallimore 1977). On the one hand provision of the resources lowered the costs of children and on the other hand childcare was helpful because of changes in the opportunities structure for parents.

Heterogeneity and fertility

Heterogeneity with respect to individual fecundability is one of the major problems in the research focused on the correlates of reproductive behaviour in traditional or historical populations with natural fertility levels. The issue of heterogeneity basically refers to underlying differences between women in the levels of their fecundability (Larsen and Vaupel 1993). Some women might be more fertile due to the factors that we cannot observe directly, like better health status or genetic endowment. Therefore, the unobserved heterogeneity might obscure true relationships between studied variables and cause severe difficulties to isolate proper causal relationships between them (Vaupel and Yashin 1985). For that reason, it is necessary to control for heterogeneity in the models of the kin effect on reproduction.

The problem of heterogeneity is not the only one that might obscure true relationships between kin effects and reproductive rates. We have to be aware of the fact that phenotypic and environmental effects that might trigger positive relation between presence of the kin and reproductive rates (Sear et al. 2003). For instance, due to intergenerational inheritance of fertility, woman from big families (which means presence of may potential helpers) might have many offspring but this do not necessarily means that there were any form of kin oriented help within families. For that reason we apply methodology that minimises potential heterogeneity and confounding phenotypic or environmental effects.

The groups of potential kin helpers

In the present study we use identical definition of the kin groups as in the previous study (Tymicki 2004). The first group consists of woman’s older children, also called *helpers at the nest*. Older children are considered to relieve mother from burden associated with childbearing and thus enhance mother's reproduction. The analysis of the influence of *helpers at the nest* on mother’s fertility has proven this effect to be significant (Bereczkei 1998, Crognier et al. 2001, Hill and Hurtado 1996), although in some cases results have been quite ambiguous (Sear et al. 2003). Generally it could be assumed that the presence of older children indeed enhances woman's parity transition risk, although there is differential effect with respect to the sex of helpers.

The second group of potential helpers, called *out of the nest* helpers, consists of individuals who terminated their reproductive span (woman's mother and mother in law). This group can include also other kinsmen, like woman's sisters and brothers (*mother's kin helpers*), husband's brothers and sisters and husband's and wife's grandfathers. Although some of these individuals are still able to reproduce (for instance woman's siblings) but this not necessarily have to exclude them from the group potential helpers.

The effect of grandparents could be divided between the effect of *reproductive* and *post-reproductive helpers*. This effect of *reproductive helpers* is rather straightforward since presence of young and reproductive grandmother inhibits reproductive performance of a daughter. This is due to the fact that young grandmother prefers to contribute to her own reproduction rather to the reproduction of her daughter. Moreover, young mother might be expected to contribute to the reproductive effort of the young grandmother rather to her own. Quite opposite effect could be attributed to the presence of *post-reproductive* (non-reproductive) grandmother. Females who terminated their reproduction are able to devote their time and resources into helping behaviour towards relatives. The relationship between presences of post-reproductive females in the household and reproductive behaviour has been widely analysed as a grandmother hypothesis (Beise and Voland 2002).

The magnitude of the grandparent's effect could be reinforced by the economic system and rules of inheritance among polish peasant families. Usually, newly married moved to the husband's parents farm and were dependent up to the moment when parents passed the farm to the son (Kopczynski 1998, Stys 1959). Depending on the inheritance system, oldest or youngest son usually became a head of the family after death of the father. Therefore, the development of his own family was strictly related to the economic independence, which was attained after father's death. These explanations could be useful in the case of the hypothesis concerning positive relationship between absence of paternal grandfather and higher completed fertility.

Some studies have found the group of *out of the nest* helpers to be an important source of help provided for mothers among traditional hunter gatherers(Hill and Hurtado 1996, Sear et al. 2003). It could be assumed that the help provided by this group is associated both with provision of the resource and direct childcare. For instance, woman's male siblings and grandfathers would be rather concerned with provision of goods and grandmothers with direct childcare. However, especially women in post reproductive stage turned out to be an important group, which affects survival of children, and thus leads to higher fertility.

DATA

The study site

Present analysis of kin effects on reproductive outcomes of females are based on the data coming from the reconstitution of registers from Bejsce parish located in south-central Poland. This reconstitution study was initiated by the Institute of Anthropology, Polish Academy of Science, in the year 1965 under the supervision of Professor Edmund Piasecki. The research team aimed at collecting demographic and anthropometric data using techniques of parish registers reconstitution. For the study site, the researchers have chosen Bejsce parish located in south central part of Poland (100 kilometres Northeast from Cracow). The search criteria restricted possible choices to big, rural parishes, located on fertile soils, with a long and continuous settlement history, and well preserved parish registers from the seventeenths to twentieth centuries. The Bejsce parish fulfilled each of these criteria and moreover, was homogeneous with respect to nationality and religion of inhabitants. Also it was not exposed to any dramatic depressions like wars or plague. The whole parish was founded in the year 1313, and throughout all its history has relied on the agricultural production. Unfortunately the information on the size of owned land was missing or incomplete and thus could not be included into database. For that reason it was also impossible to reconstruct any information about socio-economic status (SES) of inhabitants. Due to data collection obstacles, researchers finally decided to reconstruct only data, which allowed tracing demographic history of the whole population and particular families covering the period from 1690 to 1968. These data were published and described in a monograph book by Piasecki (1990). The research team reconstructed the books of baptisms, burials and marriages and linked obtained data into one database containing around 40 thousands of cases. These data allowed reconstructing families and genealogies for the whole period under investigation. The estimates of data accuracy show that the registers were rather complete from 1740 onwards (Piasecki 1990). Therefore, present analyses were conducted only for cohorts born after the year 1740). As already mentioned, inhabitants of the parish were quite homogenous with respect to the social status which at least partially compensate lack of the information on the SES. The majority of population was small landholders or leased the land from the manor house. Only the minority (around 5% to 10%) was landless and worked as a hired labour force.

Shortcomings of reconstitution data

Although parish register data offer an interesting research material, they are not free from some limitations. One of the main issues concerning the use of parish registers reconstitution databases is the problem of selectivity. There are two major sources of the distortions that might lead to selectivity of the data. Firstly, parish registers were not run in a very strict way. Thus, not all individuals had the same chance of being registered. Secondly, the selectivity of the data might be caused by migration, which was not recorded (for detailed description of shortcomings of parish reconstitution data see: (Kasakoff and Adams 1995, Saito 1996, Voland 2000). In the case of the Bejsce database, these problems are fortunately a minor concern since, as noted earlier, the parish books were run in a quite strict way after the year 1740 due to introduction of the civil laws (connected with the tax system) which forced accuracy in entering the records into the registers. Secondly, migration in Bejsce parish could be divided between temporal and permanent process. The temporal migration was associated with labour migration of young boys and girls (around age of 14 to 18). This process do not constitute a major problem since after this period they returned home and stayed in the parish for the rest of their lives. The permanent migration of individuals or whole families was rather rare (less than 3% of the total database) and could not have any impact on the quality of the data (Piasecki 1990). Another aspect, the in-migration to parish, once again do not stands for major problem due to its' low rate (around 1% of total database).

Sample selection and preparation

The construction of the database in order to analyse the parity specific kin effects was guided by requirements of multilevel event history analysis. This analysis of the intensity of transition to next birth with respect to kin variables and parity was designed to capture the differential kin effect in the cohorts experiencing natural and controlled fertility. Therefore it was necessary to distinguish between women who gave birth in these two different reproductive regimes. In the Bejsce parish the onset of transition from natural to controlled fertility appeared at the beginning of 20th century. The cohorts that had been born before the year 1900 experienced relatively high fertility with the total fertility rate (hereafter TFR) around 5.5 to 6.0. The cohorts that had been born after 1900 were characterised by significantly lower TFR ranging from 4.0 for the birth cohort 1900-1920 to 3.0 for birth cohort 1941-1960. Thus the year 1900 has been chosen to be a threshold between natural and controlled fertility. In order to account for differential kin effects in these two groups a dummy variable was created indicating whether a woman belongs to natural fertility or controlled fertility cohort. Therefore, model for each birth was calculated separately for natural and controlled fertility birth cohorts.

The models for natural fertility birth cohorts were calculated for transition from 1st birth to 2nd birth and up to 10th birth and higher (calculated jointly for transition 9-10 and higher). For the controlled fertility birth cohorts models were calculated for transition from 1st to 2nd birth and up to 5th birth (jointly for transitions to 5th birth and higher). The samples sizes are presented in the TABLE 1.

[TABLE 1 ABOUT HERE]

As could be noticed, the transition to first birth has been excluded from the analysis. There were two reasons for exclusion of the first parity transition. Firstly, transition to first birth and transition to higher order births involve different duration. In the case of this model the basic duration is *number months since last birth*. This basic duration could be essentially this same for all parity transitions higher than transition to first birth. The second reason, which is of theoretical nature, argues that it is plausible to assume that there is a difference between a set of correlates responsible for transition to first birth and transition to higher order parities. It is known that transition to first birth in historical populations, to large extent, was determined by the transition to first marriage (Goody 1983, Livi-Bacci 1999). First marriage was closely followed by first birth and therefore it could be assumed that there was a different set of determinants responsible for entering into first marriage that we do not account in our models.

The hazard model consists of basic duration, which is transition to subsequent birth, a set of the variables responsible for the kin effect and a set of the control variables. The most of the kin effect on the risk of parity transition, are captured by the following time varying covariates: (i) presence of the *helpers at the nest* (male and female siblings of an index child older at least 10 years), (ii) presence of maternal grandmother in reproductive age vs. presence of maternal grandmother in post reproductive age, (iii) presence of maternal grandfather, (iv) presence of paternal grandmother and grandfather. The only kin variable represented by time constant covariate is the presence of mother's younger sisters and brothers.

Secondly, the group of control variables, which may be responsible for delayed or faster transition to next birth: (i) whether previous birth was multiple or single, (ii) age of mother at previous birth, (iii) fate of the previous child (whether previous child died within 1 year after birth). Among these variables age of mother at previous birth is of particular importance since it could influence inter-birth intervals and therefore completed fertility.

The individuals in the analysis were censored in the following cases: (i) death, (ii) lost to follow up (presumably migration), (iii) reaching limit of the reproductive age (45 years old), (iv) lack of next parity transition, (v) the birth interval longer than 72 months. In the last case it could be assumed that the birth interval lasting more than 72 months was related to some irregularities in reproductive functions caused probably by sterility or missed birth (compare similar assumption in Sear et al. 2003).

The other censoring events do not influence studied sample in a significant way. As already mentioned, the process of migration applies to marginal fraction of the sample. Reaching the age of 45 and death of individual constitutes a case of natural censoring and does not influence the sample structure and size. Censoring due to lack transition to subsequent birth could be caused by volitional stopping of reproduction (in the case of controlled fertility cohorts) or reaching the limit of reproductive age or the last case which is interval lasting longer than 72 months.

METHODS

The multilevel event history approach was applied in order to model the risk of transition to next birth with respect to kin effects as the major explanatory variables. Event history models are quite useful when we want to account for the time dependency and for the fact of censoring in the data. Moreover recently produced software allows to account for unobserved heterogeneity (Lillard and Panis 2000). The mathematical representation of the transition rate in the multilevel model containing unobserved heterogeneity could be given by following formula:

$$\ln \mu_{ij}(t) = y(t) + \sum_{k} \beta_{jk} x_{ijk} + \sum_{k'} \gamma_{k'} v_{jk'} + u_{ij} + \delta_{i} \qquad (1)$$

where; μ_{ij} is the intensity, *(t)* stands for basic duration, here time since last birth. Thus the whole term $\mu_{ij}(t)$ refers to the rate of occurrence of an event at time t (the birth of jth infant) for the ith woman. The component $y(t)$ captures the baseline hazard (i.e. the effect of duration on the intensity of studied event). The x_k represents kth time constant covariate specific to the child level with β as the respective regression parameter. The $\gamma_{k'}$ represents the k'th covariate on the mother's specific level. Two last parameters are responsible for unobserved heterogeneity, u_{ij} refer to child level heterogeneity and δ_j refer to mother specific heterogeneity factor[1].

In comparison to the previous study (Tymicki 2004) there was no need to calculate multilevel model since each model has been calculated separately with respect to given birth. In the previous analyses it was necessary to build a multilevel model since all parity transitions for each woman were merged into one database. Therefore, it required a hierarchical structure of the database since one woman could contribute several children to the analysis.

On the other hand, as mentioned above in the theory section, the main source of distortions in the model is unobserved differences in fecundability between women and phenotypic and environmental confounds. That was the reason to include mother specific heterogeneity factor and set of time varying and time constant covariates that characterise the groups of mother kinsmen.

As already discussed in the previous section each model has been calculated separately for birth cohort exhibiting natural and controlled fertility. This distinction was based on the TFR presented earlier in this paper. In order to estimate the multilevel hazard regression model of the influence of kin variables on transition to subsequent parities the aML software has been used (Lillard and Panis 2000).

RESULTS

The models of the parity specific kin effects were calculated with respect to the fertility regime i.e. natural vs. controlled fertility and therefore presented in two separate tables (compare TABLE 2 and TABLE 3). Generally, the results reveal similar pattern as shown in earlier analyses (Tymicki 2004). The kin influences on the risk of transition between successive births are much stronger and clearer in the case of the natural fertility birth cohorts than in the case of controlled fertility cohorts.

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[1] Assumed that the heterogeneity parameter δ_j is normally distributed.

The results for the natural fertility birth cohorts are presented in the TABLE 2. Both for women born before and after the turn of the 20th century there is no effect of their male or female siblings. That is, the number of woman's brothers or sisters did not influence her risk of transition between parities.

Also the absence of younger siblings of an index child (so called *helpers at the nest*) has rather reverse effect than expected (Murphy and Knudsen 2002). However this relationship has an intuitive explanation: women who did not have any children prior to the index child run a higher risk of experiencing next birth.

[TABLE 2 ABOUT HERE]

On average, women from natural fertility birth cohorts, who did not have any younger children at least 10 years older than the index child, revealed around 40 per cent higher risk of transition to 6th birth and higher. Thus, we may wonder whether the presence of young caretakers had any positive influence in the case of parity specific transition risks.

The results suggest that there is a positive effect of absence of reproductive grandmother at each of studied birth transitions. The woman whose mother was alive and still reproductive had lower risk of progression to subsequent birth. On the other hand, reproductive women whose mother has died had, on average, 25 per cent lower risk transition to next birth at each of parity. This effect is particularly profound in the case of the highest parities (transition to 9th birth and higher). Those woman whose mothers aged 45 and higher, were dead had almost 70 per cent lower risk of transition to 9th birth and higher. Similar pattern could be noticed in the case of the influence of maternal grandfather and paternal grandmother. Absence of mother's father and father's mother decreases the risk of transition to higher order births, although these effects are much weaker than in the latter case. On the contrary, the absence of paternal grandfather seems to enhance the risk of transition at each of the parities.

In the case of women who entered the motherhood during the controlled fertility regime, i.e. after the turn of the 20th century, the patterns of the kin influence are similar as in the case of natural fertility birth cohorts. The results are presented in the TABLE 3. Again, the most important effect could be attributed to the effect of grandparents. Absence of maternal grandmother, aged 45 and more, decrease chances for transition at each of the parities. This effect is also present in the case of maternal grandfather and paternal grandparents although is much less clear.

[TABLE 3 ABOUT HERE]

As in the case of natural fertility birth cohorts there is no parity specific effect of the helpers at the nest. There is also a positive effect of the absence of mother's younger sisters or brothers at given parity transition. Generally, the patterns of the kin influence in the case of controlled fertility birth cohorts are much less clear which might be due to lower number of cases under analysis.

The effects of included control variables are similar in the case of both models. There is practically no effect of twin births on subsequent parity transition. In the case of the natural fertility cohorts the twin births have rather inhibiting effect on the transition to subsequent conception. This effect is much less clear in the case of controlled fertility birth cohorts, which might be an effect of some spurious effects due to insufficient number of cases.

The estimated effect of mother's age reveals quite predictable pattern. Both for natural and controlled fertility birth cohorts of woman from Bejsce parish exhibit decreasing risk of parity transition with age.

There is also a significant replacement effect at lower parities. Women who have lost their previous child experience higher transition risks in comparison with woman whose child survived first 12 months of life. This effect is particularly strong in the case of death of first or second child (transition 1-2 and 2-3).

DISCUSSION

The present paper aimed at the analysis of the parity specific kin effects among the women from the population of Bejsce parish. The analyses of the parity specific kin effect were designed in order to answer the question about the relative importance of help provided by closest kin across individual reproductive history. The results reveal only a weak support for the original hypothesis that kin help should be of crucial importance at higher parities.

Generally, the results overlap with the findings of the previous analyses of the effect of closest kin on the transition to next birth without regard to parity (Tymicki 2004). Surprisingly, selected groups of family members did not have an effect on the increased risk of transition to higher birth orders. An exception here is the group of so called *non-generative helpers* (grandparents). The most spectacular is the effect of maternal grandmother, both in the case of natural and controlled fertility birth cohorts. Absence of maternal grandmother decreases the risk of transition to 10th birth by 70 per cent in comparison to those women whose mother was still alive (among natural fertility cohorts). It has to be noted that absence of maternal grandmother decreases the risk of each parity transition, on average, by 30 per cent.

Interestingly, there is also a significant effect of maternal grandfather at higher parities. Absence of mother's father decreases chances of transition beyond 7th birth by 30 per cent (on average). The overall shape of the effect of maternal parents on the transition to subsequent births shows that this effect was rather constant across individual reproductive history, in the case of maternal grandmother. Contrary to this, the effect of maternal grandfather was concentrated at higher order births. This might be evidence for a direct help obtained by mother from the wife's parents, which possibly enabled the couple to attain higher number of births.

The shape of the parity-specific effect of maternal grandmothers, who were below the age of 45, seems to be quite opposite to the previously described effects. The absence of reproductive grandmother rather increased the risk of transition at each of the parities[2]. This however might be explained by the fact daughters of those women who became grandmother relatively early, below age of 45, started own reproduction early and therefore progressed to higher parities slower than the reference category. This effect is present both among natural and controlled fertility cohorts.

Another worth mentioning effect is associated with presence of paternal grandparents among natural fertility birth cohorts. The shape of the relationship between presence of paternal grandmother and the risk of transition to subsequent parities is mixed. Absence of husband's mother (paternal grandmother) increases the risk of transition to parity 2 and 3 and decreases the risk at higher parities. On the other hand, absence of husband's father (paternal grandfather) increases the risk of transition at each of the parities. As already noted, such an effect could be attributed to the economics and the inheritance system among Polish peasant families. Therefore, the positive relation between the absence of paternal grandfather and higher risk of transition to subsequent birth could be partially explained by the economic foundations of the peasant family formation process.

Similar explanation could be assumed in the case of the effect of paternal grandmother at lower parities. Moreover the results reveal a positive relation between presence of husband's mother and transition to higher parities. This was probably related to the fact

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[2] Extremely high results for the parity transition to 10th birth and higher is probably due to insufficient number of cases under analysis and therefore should be interpreted very cautiously.

that non-reproductive paternal grandmother could be still used as a caretaker for the children in the household.

As could be noticed, these effects are absent among controlled fertility birth cohorts, which was a result of increasing importance of other than agriculture sources of income. Although the process of industrialisation progressed much slowly in Poland than in the rest of Western European countries finally it led to the changes in the family formation process.

As already noted, on the basis of the current and past results theoretically predicted positive effect of the *helpers at the nest* could be questioned. The obtained results rather suggest the opposite conclusion. Presence of children at least 10 years older than the index child inhibits rather than promotes reproductive performance of mother. Certainly, the possibility that those children were helpful in the household cannot be completely ruled out. However on the basis of the current data and analysis this effect cannot be isolated in a satisfactory way. The only significant pattern prove that presence of older children in the household inhibited transition to higher order births by purely demographic effect of lower parity progression ratios.

There is also no effect of mother’s siblings, which could be a sing of weak support between the family members. Of course there might be some flows of goods and services between household of siblings but apparently it did not have any effect on the rates of reproduction.

Present analysis is by no means exhaustive and leaves lots of room for further investigations. Since the working database is a pure register of demographic events we cannot rule out the possibility that more detailed data would bring more comprehensive and consistent results. As shown by other anthropological studies investigating kin effects, the use of small but richer databases or narrower focus of the analysis might bring the results, which converge with the theoretical predictions (Bereczkei 1998, Turke 1988, Weisner and Gallimore 1977). Moreover, presented models did not aim to reveal causal relationships between analysed variables, but rather to show interdependence between presence of kin and rates of reproduction.

Since, at present, there is no suitable benchmark for presented analysis obtained results cannot be compared. However, analyses based on existing parish register reconstitution data from other countries might bring comparable results. Therefore, it seems highly desirable to conduct a comparative analysis using other sources of parish data. This might involve other methods like estimation of parity specific birth probabilities or parity transition ratios with respect to described kin variables. This might bring some new evidence that at least some kin variables had a profound effect on the rates of reproduction in historical European populations. Therefore, presented study is just a first step towards comprehensive description of these effects and opens a new perspective on understanding of reproductive behaviour in the past.

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TABLE 1. Number of studied events (births) by fertility regime (birth cohort of women) and birth order in the population of Bejsce parish.

Birth order	Natural fertility	Controled fertility	Total
2	1639	483	2122
3	1533	405	1938
4	1398	296	1694
5	1254	163	1417
6	1062	88	1150
7	848	43	891
8	670	23	693
9	462	14	476
10	282	8	290
11	144	3	147
12	58	1	59
13	27	0	27
14	11	0	11
15	2	0	2
Total	9390	1527	10917

TABLE 2. Kin influence on parity transition risks among natural fertility birth cohorts of women form Bejsce parish. Parameters refers to the relative risks - exp(β), standard errors in parentheses.

	Transition													
	1-2		2-3		3-4		4-5		5-6 & 6-7		7-8 & 8-9		9-10 and higher	
Female helpers-at-the-nest (ref. cat.-present)														
no female helpers-at-the-nest	0.95	(0.049)	0.97	(0.057)	0.97	(0.064)	1.01	(0.071)	0.90 *	(0.058)	0.96	(0.076)	0.99	(0.154)
Male helpers-at-the-nest (ref. cat.-present)														
no male helpers-at-the-nest	1.02	(0.050)	0.99	(0.057)	0.93	(0.065)	0.95	(0.072)	1.11 *	(0.058)	1.12	(0.073)	1.10	(0.150)
Mother’s younger brothers (ref. cat.-present)														
no younger brothers	1.14 **	(0.023)	0.79	(0.204)	0.85	(0.165)	1.08	(0.095)	1.32 ***	(0.061)	1.58 ***	(0.074)	1.42 ***	(0.094)
Mother’s younger sisters (ref. cat.-present)														
no younger sisters	1.04	(0.023)	1.40 *	(0.203)	1.28	(0.165)	1.03	(0.095)	1.47 ***	(0.063)	1.51 ***	(0.074)	1.45 ***	(0.139)
Maternal grm at reproductive ages (ref. cat.–alive*)*														
Dead	1.12 ***	(0.032)	1.23 ***	(0.037)	1.12 **	(0.045)	1.17 ***	(0.054)	1.35 ***	(0.046)	1.08 *	(0.037)	2.29 ***	(0.059)
Maternal grm at post-rep. ages (ref. cat.–alive)														
Dead	0.79 ***	(0.040)	0.81 ***	(0.046)	0.82 ***	(0.054)	0.78 ***	(0.062)	0.70 ***	(0.051)	0.82 ***	(0.041)	0.32 ***	(0.091)
Maternal grf (ref. category-alive)														
Dead	1.01	(0.048)	1.03	(0.053)	1.07	(0.065)	0.96	(0.071)	0.90	(0.067)	0.81 **	(0.092)	0.63 ***	(0.135)
Paternal grm (ref. category–alive)														
Dead	1.15 ***	(0.052)	1.17 ***	(0.059)	1.03	(0.071)	1.09	(0.076)	0.85 **	(0.073)	0.69 ***	(0.106)	0.54 ***	(0.158)
Paternal grf (ref. category-alive)														
Dead	1.23 ***	(0.052)	1.25 ***	(0.061)	1.37 ***	(0.071)	1.47 ***	(0.078)	1.10	(0.079)	1.56 ***	(0.103)	1.96 ***	(0.153)
Single vs. multiple birth(ref. cat.-single birth)														
multiple birth	0.86	(0.483)	0.87	(0.273)	0.67	(0.251)	0.60 *	(0.295)	0.99	(0.258)	1.20	(0.234)	0.23	(1.013)
Age of mother at given transition (ref. cat. 14-19)														
19-25	1.26 ***	(0.048)	1.31 ***	(0.061)	1.32 ***	(0.081)	1.21	(0.138)	1.09	(0.278)	1.00	(0.000)	1.00	(0.000)
25-30	1.02	(0.061)	1.01	(0.065)	1.04	(0.068)	1.06	(0.077)	1.13	(0.083)	1.49	(0.307)	1.34	(1.732)
30-35	0.77 ***	(0.096)	0.75 ***	(0.082)	0.86 *	(0.081)	0.79 ***	(0.079)	0.90	(0.064)	1.05	(0.089)	2.90 ***	(0.250)
35+	0.51 ***	(0.141)	0.37 ***	(0.118)	0.32 ***	(0.115)	0.34 ***	(0.101)	0.44 ***	(0.067)	0.42 ***	(0.077)	0.41 ***	(0.126)
Fate of the previous child (ref. cat. Previous child survived until first birthday)														
Previous child died within 1 year since birth	3.51 **	(1.143)	0.97	(0.065)	0.89	(0.081)	0.93	(0.085)	0.97	(0.074)	0.86	(0.093)	1.11	(0.137)
ln-L	-77305.2		-77290.7		-77314.7		77314.0		-77177.2		-77212.1		-77210.8	

TABLE 3. Kin influence on parity transition risks among controlled fertility birth cohorts of women form Bejsce parish. Parameters refers to the relative risks - exp(β), standard errors in parentheses.

	Transition							
	1-2		2-3		3-4		4-5 and higher	
Female helpers-at-the-nest (ref. cat.-present)								
no female helpers-at-the-nest	0.99	(0.0894)	0.97	(0.1205)	0.77	(0.1780)	1.07	(0.1625)
Male helpers-at-the-nest (ref. cat.-present)								
no male helpers-at-the-nest	0.94	(0.0895)	0.92	(0.1197)	0.93	(0.1614)	1.11	(0.1593)
Mother's younger brothers (ref. cat.-present)								
no younger brothers	1.94 ***	(0.1826)	1.09	(0.1347)	2.64 ***	(0.3511)	1.80 **	(0.2425)
Mother's younger sisters (ref. cat.-present)								
no younger sisters	3.19 ***	(0.0466)	1.11	(0.1825)	1.07	(0.1143)	2.49 ***	(0.2628)
Maternal grm at reproductive ages (ref. cat.–alive)								
Dead	0.74 *	(0.1612)	1.46 **	(0.1527)	0.97	(0.3683)	2.84 ***	(0.3564)
Maternal grm at post-rep. ages (ref. cat.–alive)								
Dead	0.78 **	(0.1089)	0.72 ***	(0.1215)	0.61 ***	(0.1673)	0.40 ***	(0.1603)
Maternal grf (ref. category-alive)								
Dead	0.95	(0.0896)	0.90	(0.1156)	0.83	(0.1612)	0.57 ***	(0.1547)
Paternal grm (ref. category–alive)								
Dead	0.81 **	(0.0952)	0.81 *	(0.1177)	0.86	(0.1745)	0.84	(0.1958)
Paternal grf (ref. category-alive)								
Dead	0.96	(0.1010)	1.22	(0.1415)	1.13	(0.1985)	0.98	(0.2136)
Single vs. multiple birth(ref. cat.-single birth)								
multiple birth	1.26	(0.5586)	2.10 *	(0.4352)	1.14	(0.6124)	0.58	(0.7559)
Age of mother at given transition (ref. cat. 14-19)								
19-25	1.03	(0.1034)	0.58 ***	(0.1482)	0.41 ***	(0.2278)	0.40	(0.6128)
25-30	0.94	(0.1367)	0.49 ***	(0.1481)	0.31 ***	(0.1879)	0.38 ***	(0.2666)
30-35	1.17	(0.2380)	0.41 ***	(0.1987)	0.30 ***	(0.2265)	0.37 ***	(0.2233)
35+	0.22 ***	(0.4399)	0.19 ***	(0.3565)	0.19 ***	(0.3371)	0.28 ***	(0.2561)
Fate of the previous child (ref. cat. child survived until first birthday)								
Previous child died within 1 year since birth	2.09	(0.6843)	1.63 ***	(0.1359)	0.88	(0.2226)	1.26	(0.2536)
ln-L	-14738.8		-14831.2		-14825.9		-14841.6	