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TITLE:

**DO GRANDCHILDREN PERFORM BETTER AT SCHOOL IF MATERNAL AND PATERNAL
GRANDPARENTS LIVE CLOSE-BY VERSUS WHEN THEY DON'T?**

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Abstract

This study investigates whether grandchildren from intact families perform better at school when their maternal and paternal grandparents live close-by versus when they don't. The answer to this question is based on assumption that geographic proximity measures grandparental participation in grandchildren's lives therefore influencing their outcomes which are measured as Grade Point Average in 10th grade. Relevant theories are presented like resource allocation and mandate attribution in a family system, direct and indirect processes through which grandparents are able to influence their grandchildren, in combination with available previous research studies.

A unique database was available in order to enable to provide an answer to the research question applying a quantitative research design by using analytical program Stata on 151 092 Norwegian grandchildren 12 years of age. The results generated by Ordinary Least Squared Regression analyses show that, there is *no* difference how well a grandchild performs at school considering maternal and paternal grandparents' proximity level because estimates obtained for this association is essentially statistically significant zero. Parents' educational level is the decisive element in choice of proximity in relation to grandparents.

It is also noted that intact families living in close proximity to grandparents tend to possess less resources available within a family compared to the ones living further away indicated by lower earnings, higher proportion of parents receiving social benefits, higher proportion of parents with primary or secondary education. This selection bias in the sample might be a cause of not finding the expected association of geographic distance and Grade Point Average of grandchildren.

Proximity variable is also discussed in terms of its appropriateness to measure the intended association of interest since there might be implications that it is the relationship quality and not the contact frequency which allows for greater direct influence on grandchildren's performance at school. Alternatively, possibility that an important parents' related control variable is not accounted for in the model of the study is presented. The inconsistency of the results of conducted sub-sample analyses might reinforce to support the last two statements.

The results of this study cannot be generalized to all grandparents and grandchildren, since the analytical sample consisted only of grandchildren raised in intact families with several other restrictions imposed.

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Foreword

I would like to thank Mari Rege, Ingeborg F. Sølvi and Åse Lea for granting me a scholarship and therefore also giving me this opportunity to write a project which is related to a program Economics of Child Development. Appreciation goes to my supervisor Ingeborg F. Sølvi for introducing me to Stata and how research is conducted in practice.

I would like to thank my grandmother for her support and motivation for many years. Her resources and input efforts have definitely been decisive for at least one of her grandchildren. Great thanks go also to my husband for the support.

Introduction

Education is a visible signal of a productivity a person possesses and is also rewarded accordingly in the labor market (Jaeger & Page, 1996). It is related to human capital¹ and how it influences future earnings for an individual (Mincer, 1958). The more of it a person has, the more probable it is that success in labor market will be present. Also other aspects, like better health, better adaptability to changing situations, increased likelihood of contribution to advancement in technology, increased likelihood of raising children who also will receive more education etc. which are carried along as advantage with increased education. (Haveman & Wolfe, 1994) This is why so much attention in research is on children's success at school, and which factors influence these. The study presented in this project will investigate one such influential factor applying quantitative research design, and will show to what extent *grandparents* play a role in outcomes of their grandchildren.

The focus of this research is to investigate the link between grandparents' proximity to their grandchildren as an indicator of their participation opportunities in grandchildren's lives, and the children's achievements at school, specifically: **Do grandchildren perform better at school if maternal and paternal grandparents live close-by versus when they don't?** One would generally expect that living proximity characterizes grandparents' possibility of more frequent contact with their children and their grandchildren, therefore reinforcing grandparent-grandchild emotional closeness enabling greater influence on grandchildren's behavior. This influence would thereafter assumingly be reflected in grandchildren's academic achievements. In this context geography plays a role in determining the extent to which generations are able to interact with each other vis-à-vis and exchange help. If the geographical distances cause decreased family member interaction, it would imply also possibly lost resource for the family as an input factor both for the parents and the children.

Since the attention in this study is on grandparents and grandchildren, in order to follow the same terminology throughout the whole project, from now on, three generations referred to will be called grandparents, parents and grandchildren, where parents are children of grandparents, and grandchildren are children of parents.

¹ Human capital – unique set of abilities and acquired skills through schooling, formal and informal training (Borjas, 2008).

In social science the economic perspective of a child being considered as an outcome or a product of rational choices is made by the parents in order to maximize parent's wellbeing (Becker, 1993). This conscious choice evolves further in consequences of actions, like raising the child, providing for him/her and prepare the child to be ready to live his/her own life. In this context these actions are seen as input factors or investments in the outcome/product, thus a child. Education and training in industrialized countries is of greater importance, and this is leading to higher parental investments in human capital of their children (Becker, 1993). Also grandparents contribute in these processes and therefore it is of interest to investigate their importance in these. This is particularly of interest in Norway, a country with great geographical distances between North and South, where people's often change of their location is widespread when studying, working or establishing family (Sørli, 2005). Still in most cases, the distance between grandparents and parents is less than 30 km where a starting point is the place where they live, with exception of some regional differences (Lappegård, 2009). If grandparents' proximity is of significant importance in grandchildren's outcomes, showing this explicitly would enable one to consider this influence channel to even greater extent.

Distance among family members have to be seen in relation to the general development in society's moving trends which have a tendency towards increased centralization in Norway (Kristiansen, Flatebø, & Modig, 2009; Langørgen, 2007; Lappegård, 2009). This development seems to explain also the smaller distances between family members in the centrally placed municipalities² because the number of people born and grown up in these areas lead to increased number of second generation also establishing in the same area or nearby the city areas (Sørli, 2005). If proximity to grandparents and parents increase and decrease depending on where they live, it is of interest to determine whether and to what degree this geographic component has any consequence on grandchildren's school performance.

The remainder of the project is as follows: firstly, in the Literature Review a discussion on available and relevant literature presenting influence factors on child outcomes will be discussed, thereafter followed by discussion on influence factors related to grandparents and grandchildren. This discussion is included to entice the understanding of how and why

² Municipalities which cover densely populated area of level 3 (i.e. population at least 50 000 people) or which are in areas within 75 minutes (90 minutes from Oslo) of travel time from the center of the level 3 densely populated area (Statistics_Norway, 2008).

grandparents influence their grandchildren. Then geographic distance's importance in this context is reviewed. Furthermore, since the focus of the study is child outcomes defined in terms of their educational achievements, a literature review will reflect also this issue. A short overview of the methodological issues will be presented as well. Practical part of the study starts with a section Empirical Strategy, thereafter followed by Data description of the sample of the study and operationalization of the variables to be included in Ordinary Least Squared Regression analysis. Results are presented in a following section. In the Discussion section the study's findings are related to the theory presented in the Literature Review, and conclusions are drawn in a final section.

Literature Review

Grandparent research is influenced by different disciplines with different theoretical perspectives (Hjardemaal, 2002). Each theoretical approach discussing grandparent-grandchild relationships phenomenon has slightly different focus, however complementing each other when observing the phenomenon as a whole. A model developed by Evenshaug and Hallen (1997), in a combination with another one presented by Szinovacz (1998a) will be used to present overall environment a child grows up in and most of the factors which each has inputs in a child's development but on different level of intensity, as well as, in relation to grandparents, what type of influence processes take place. Though economic theory is not mentioned explicitly, it is noticeable that the model's theoretical approach has similarities with it when considering a family as a system with input and output factors. The model presented takes also into account most of the factors observed in social science studies when grandparents and grandchildren are in focus.

Before discussing why grandparents' geographical proximity might be of importance to grandchildren's outcomes, it is important to understand the factors which influence and in what ways the outcomes of children in general. Figure 1 presents the introduced model showing factors which have an influence on a child when considering teaching and upbringing. Central and primary source of socialization and influence is a family, and in this context, a core family in a household: a mother and / or a father. These family members have a primary mandate³ functions in raising a child. The interaction between them is influenced by outside and inside factors of living, financial situation and employment of the mother and/or father, as well as leisure time activities. Secondary mandate functions are reserved to contact with other adults, kindergarten, school, church, mass media, as well as to the contact with children of the same age. There is continues interaction among all these factors, and they are affected by outside, more general elements, as society, culture, religion, science, politics etc. This model originally does not consider grandparents as a separate element, and therefore would situate grandparents under "other adult contact". Evenshaug, Hallen & Hjardemaal (2002) empirical attempt to determine grandparents' mandate, presents a middle mandate between primary and secondary mandate function though grandparents are placed closer to the family circle, rather than the secondary circle.

³ In this study's context, mandate can be considered as magnitude of the influence, or how important in a family a particular mandate holder is perceived.

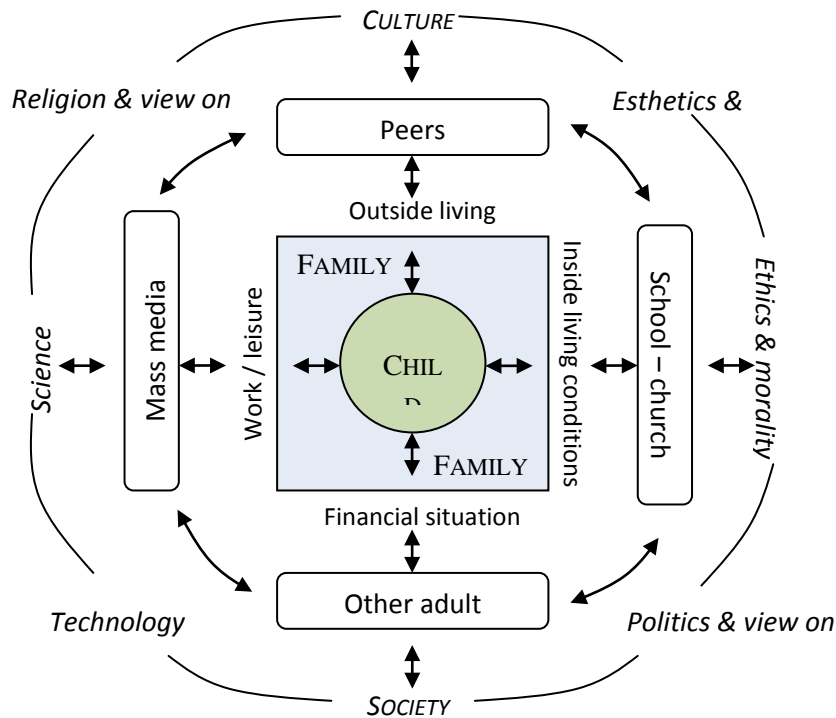


Figure 1. Child's surrounding influence factors on different levels, translated and adapted from Evenshaug and Hallen (1997)

This model can also be extended to a greater degree – it can include other family members in the household, like siblings, and family members outside the household, like grandparents, aunts, uncles. Then the factors surrounding the family presented earlier can be considered as family background in a broader extent. Since grandparents do not hold neither primary nor secondary mandate in the model, there should be another level added in between specific for extended family members. Also this level should be surrounded by their relevant family backgrounds; the family backgrounds of all the extended family members overlap, but they are not identical allowing for differences and variation within the family, making social interaction system in a family even more complicated. The research in the area of family issues is a complex one because a family can be perceived as an active and ever-changing system where input is not equal to output, therefore very difficult to measure and isolate (Hjardemaal, 2004).

Further discussion will review relevant literature in the following areas: family (including grandparents) as a provider for social capital with sub-sections related to this; direct and indirect influence processes on grandchildren; parents as mediators in grandparent-grandchild relationship; grandparental hierarchy and grandchildren's gender. Thereafter geographic

distance is discussed and related to contact frequency. Finally, the study's main hypotheses to be tested are introduced.

Family as a provider for Social capital

Coleman (1988) calls attention to studies with a goal of determining effects on children's' achievements at school and pinpoints that these consider family background as one entity. Coleman, on the other hand, presents that a family background can be analytically separable into three components: financial capital, human capital and social capital. Financial capital refers to the financial resources a family possesses, and these normally enable a child to get additional aid in learning and therefore enhance academic achievements. Human capital can be measured by educational levels of the parents. If this human capital is high, then a favorable cognitive environment for a child is present and helps learning. Social capital within the family is of importance for the child's intellectual development and characterizes the relationships between the family members. Human capital of the parents in this context has only influence on a child's outcomes if it interacts with the social capital, i.e. if this interaction is not in place, the child does not get access to that human capital and there is no effect of high educational levels of both parents on child's educational attainments. Thus, the strengths of the relationship between the child and the parents, not least between grandparents, aunts and uncles are an important indicator of the social capital in the family. Lack of social capital lead to different educational outcomes, and here also the family structure plays a role. For instance, in non-intact families lack some of the social contact because of one parent not being physically present at all times compared to intact families.

Competition for available Human and Social capital in a family

Number of siblings in this context is considered as a measure of lack of social capital, or in other words, there is a competition for limit resources, i.e. parents, among the siblings, where the eldest one usually is more advantaged (Coleman 1988). This has been empirically shown in a series of studies, e.g. Blair, Legazpi Blair and Madamba (1999), Ming Ming (2007), Downey (2001). This association is expected also in this study's context assuming that number of siblings in a family would impose negative influence on children's outcomes measured as grade point average at school. Additionally, one would expect that, with relevance to this study, possibility of many cousins would also carry this type of relation on children's outcomes since in these situations grandparents would have to divide their time resources, and considering their geographical location (accessibility) in relation to every

single grandchild, it is expected that possibility of seeing every grandchild frequently and vis-à-vis are negatively correlated (enhanced by geographic barriers) with increasing number of grandchildren, aunts and uncles a grandchild has.

Fewer competing siblings and cousins would lead to a probable increase of support from grandparents therefore reducing completion's extent and, according to Cherlin and Furstenberg (1986), also the impact of selective investments in grandchildren. They expect also situation if fertility remains low and grandparents are economically well-off, and then grandparents would be increasing their spending on transportation for covering greater distances in order to maintain the relationship with their grandchildren. This can be seen in relation to the "verticalization" processes of family bonds implying increased relations among generations with increased impact and intensity of these relationships on individuals involved (Evenshaug, 2002). This aspect of usage of available social capital implies that one would anticipate that children coming from families with fewer household members would be better off compared to children who are coming from families with many siblings, also when grandparents are considered. Consequently, grandchildren from small households would benefit more from grandparents' proximity than grandchildren in larger households.

Daatland, Slagsvold and Lima (2009) have shown indications of the norm of independence between generations in North-Western Europe which is a distinctive mark of individualism within the culture, as well as a prioritizing downwards in generations – parents commitments are stronger towards grandchildren than towards grandparents. The elders are seen to be the society's responsibility where the family acts in a supporting additional role (Daatland, et al., 2009; Slagsvold, Daatland, Brunborg, & Lima, 2009). This individualism characteristic in regard to children's outcomes would lead to increased resources directed to grandchildren, thus grandparents are contributors of resources either directly or indirectly rather than competitors for the ones directed from parents. This could enable to uncover somewhat larger influence effect on children's outcomes without large interferences of opposing mechanisms in resource flow from parents (as would be in case when parents would contribute considerably to grandparents). Thus, culturally and because of the good welfare system the focus in the society is on the grandchildren.

Location-specific capital

When economic and social capital is tied to a specific location, it is a case of location-specific capital (DaVanzo, 1981). This concept includes all types of factors which are of importance to

a person and are linked only to a particular place. They are very costly or impossible to replace when moving to another location, therefore increasing the costs of moving. This has also been illustrated empirically that families with children tend to be less mobile than families without children (Bordone, 2009; Michielin, Mulder, & Zorlu, 2008) since their location-specific capital would be of high value for families. If re-location is very costly for the family as whole, it should also be costly for children involved. Consequently re-location of children should influence their grades negatively, and in regard to this study's problem it could be of interest to see whether this relocation influences association between children's grades and proximity of grandparents. In general there are the parents who influence the proximity to the grandparents since they change their residence, and not the grandparents (Lappegård, 2009), though there is some evidence that also elderly generation migrates for some reasons (Rogers, Frey, Speare, Rees, & Warnes, 1992). Michielin and Mulder (2007b) find that grandparental characteristics, with exception to educational level, are not important in determining geographic distance among family members.

Influence processes in grandparents – parents – grandchildren's relationships

Interaction or social capital in a family enables influence on a child. In this regard, two aspects have to be taken into account: processes and outcomes - only though processes there are possibilities of influencing child outcomes. This is presented in a figure 2 adapted from Szinovacz (1998a). This model shows, first of all, that there is an interaction among grandparents, parents and grandchildren. Secondly, it distinguishes between direct and indirect influence processes on each of the respective members in a family. This model has to be considered also in context of the extended model of Evenshaug and Hallen (1997) because all these influence processes have to be seen in relation to the factors outside this social capital which influence each of the relevant family members in different ways.

There is a series of research conducted on the direct and indirect influence processes. The direct influence processes are the ones without direct interference of the parents of the children, like face-to-face contact (looking after grandchildren when needed, visiting them etc.), communication by phone or mail with the grandchildren. There is some evidence that grandparental care frequency, allowing more direct interaction, varies with access to alternative care (Dunn, Fergusson, & Maughan, 2006). The indirect influences include grandparent psychological, supportive and sometimes financial support to the parents' with extended effects on grandchildren. Normally families with financial problems, single mothers,

teenage or younger mothers, or families with firstborn child receive more grandparental help (Dunn, et al., 2006), therefore association between proximity of grandparents and grandchildren's school performance to be in greater magnitude in these types of families. (Szinovacz, 1998a)

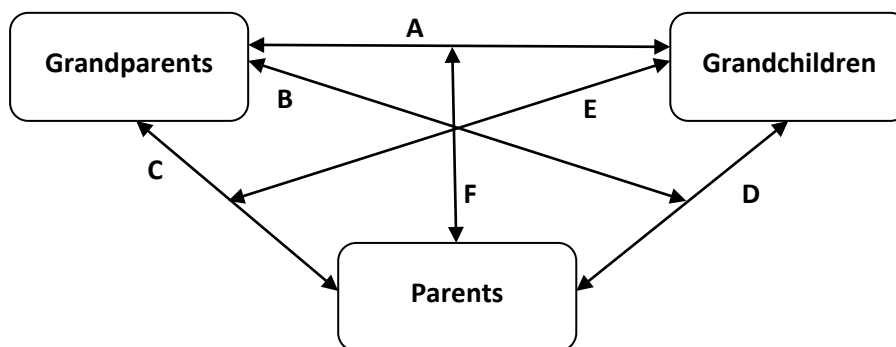


Figure 2. Processes of interaction and influence in grandparents-parents-grandchildren's relationships

Attention to grandparents' contribution in taking care for their grandchildren in different levels (regular, time-to-time etc.) and perceived intensity (variety of activities etc. (Boon & Brussoni, 1996)) has also been investigated (Fergusson, Maughan, & Golding, 2008; Hank & Buber, 2009; Hoff, 2007b; Vandell, McCartney, Owen, Booth, & Clarke-Stewart, 2003). In contrary to the South European countries, the Scandinavian grandmothers do not care for their grandchildren on daily basis (Hagestad & Herlofson, 2009; Hank & Buber, 2009). It needs to be called attention to that in the same time in Scandinavia (including Norway) there are good possibilities for having after-school programs for the children enabling parents to actively participate in working life without a need to involve grandparents in regular care for grandchildren, which is not the case in South Europe. However, Hagestad and Herlofson (2009) show in their study that Norwegian grandparents are willing to step in when needed. This would mean that also in this case a family support is acting as a supplement for the public services provided by the government. If the all grandparents are considered, then 80 per cent of the Norwegian parents get help directed to grandchildren from grandparents (Hagestad & Herlofson, 2009).

Changes in family situation like a divorce (separation) of parents could trigger the need for increased proximity to grandparents since this would enable better transmission of help (Hoff, 2007b; Lappegård, 2009), and their presence is valued positively (Lang, 2005; Lussier, Deater-Deckard, Dunn, & Davies, 2002), similarly to situations when a grandchild is in need of special care (Katz & Kessel, 2002; Mitchell, 2007). In the research conducted,

grandparents have been viewed in majority of cases as care providers when parents are unable to, especially in USA (Thomas, Sperry, & Yarbrough, 2000). However, there is little attention directed to grandparent's influence with consequent grandchildren's outcomes in intact families.

One would expect the direct and indirect influence processes last longer because of the demographic changes taking place nowadays, and is reflected in the discussion taking place about aging population and how this change would influence the society in general in the long run (e.g. Christensen, Doblhammer, Rau, & Vaupel, 2009; Lloyd-Sherlock, 2000; Olshansky, Goldman, Yuhui, & Rowe, 2009). In the past several decades life expectancy has increased due to improved technological and medical solutions, thereby enabling younger and older generation to spend more time together with each other compared to as it was before (e.g. Christensen, et al., 2009).

Parents as mediators

A family is considered as a filter between family members, previously referred to as a system, and society at large. This filter is of a *direct* and *indirect* type: the *direct filter* function is related to people a grandchild has the most contact with therefore enabling him/her to identify with and imitate these persons. Parents play an essential role in determining the people to be around a child. Thus, also grandparents' role and function in this socialization and raising their grandchildren depends in a great extent on the needs and interests of the parents for support and participation (Hjardemaal, 2004). In this context parents act as mediators, or gate keepers, in relationships developed and eventually, the relationship between the parent and grandparents determines the relationship a grandparent would have with a grandchild (Attar-Schwartz, Tan, & Buchanan, 2009; Hjardemaal, 2004; King & Elder Jr, 1995; Oppelaar & Dykstra, 2004; Whitbeck, Hoyt, & Huck, 1993).

The *indirect filter* function, on the other hand, activates when a child is able to express the preferences and make his or her own decisions where a socialization and childhood experience has developed a certain kind of perception which is then used in socialization with other people (Hjardemaal, 2004). In relation to this, grandparents are attributed possibility to helping grandchildren become strong and resilient (David, 2006), especially in stressful situations in a family (Smith & Drew, 2004).

Coleman's (1988) presentation includes grandparents and aunts and uncles in a family, however, as stated earlier, grandparents are not considered on equal bases as parents. This corresponds also to the findings of several studies that parents of a grandchild are the mediators of the contact between grandparents and grandchildren (thus also aunts and uncles), allowing or prohibiting contact on more personal basis with the grandchildren compared to the secondary mandate function holders. In this case grandparent-parent relationship quality will influence grandparent-grandchild relationship, and, in relation to Coleman's theory, extra family members (except siblings) increases potential human capital and accessibility would enhance more available social capital. Considering this, one would anticipate that this usage and access of more and maybe better available social capital, reinforced by the individualistic characteristics in the Norwegian family culture, would reflect in better children's outcomes in terms of their scholastic achievements.

Grandparental hierarchy and grandchildren's gender

It is common in research to differentiate between grandparents by lineage and gender. Firstly, assumption that maternal grandparents tend to have larger investments (measured as contact frequency) more in their grandchildren lives than paternal grandparents since there is some uncertainty present on paternal grandparents' side (Lussier, et al., 2002; Pollet, Nettle, & Nelissen, 2006). Maternal grandparents tend to be considered as one of emotionally closest grandparents for grandchildren in a greater degree compared to paternal grandparents (Boon & Brussoni, 1996). Secondly, in research studies it is normal to differentiate on how important each of grandparents are perceived, consequently placing maternal grandmother as the one in highest frequency of contact, thereafter following by maternal grandfather. Thereafter in importance pyramid comes paternal grandmother and at the bottom is paternal grandfather (Pollet, et al., 2006). There is, however, ambiguity of exact effects of lineage and gender of grandparents since many of the studies have not controlled for geographic distance, as called attention to by Somary and Stricker (1998).

The studies focusing on the differences are often of qualitative type and in many cases based on convenience samples (Fischer, 1983). Based on these type of samples, their representativeness to a population at large are questionable (Neuman, 2009). There is some evidence that grandfathers are receiving some attention in the field of grandparenthood, but in their role and contribution in grandchildren's lives in non-intact families (e.g. Bullock, 2005).

Their contribution in family context might also be underestimated or imprecisely estimated because grandfathers might be underrepresented in a study (e.g. Wilson, 1987).

There is no difference in how help of the grandparents is perceived, but the gender of the grandparent plays a role in how often they provide care for the grandchildren. Help from the Norwegian grandmothers are mentioned twice as often as from the grandfathers. If a grandparent has lost his/her spouse, the likelihood of getting help from the grandmother is about 40%, but from the grandfather only 10%. Also Bordone (2009) shows empirically that marital status of grandparents influence grandparent-grandchildren contact frequency. In this regard the researchers claim that grandfathers are more peripheral and engage themselves in care for their grandparents only when grandmothers do, and when grandparents are divorced, grandfathers are not central in the grandchildren's lives. (Hagestad & Herlofson, 2009)

Gender of a grandchild is also of importance, though studies published show contradicting findings as pointed out by King and Elder (1995). Some find that contact frequency with grandchildren by gender does not differ (Oppelaar & Dykstra, 2004), but it is influenced by gender of a grandparent, where grandmothers have more contact with grandchildren (Silverstein & Long, 1998). Also mothers tend to have more frequent contact with maternal grandmothers compared to sons (Bordone, 2009; Lawton, Silverstein, & Bengtson, 1994). Regarding phenomenon of gender and lineage importance in grandchildren's lives Hagestad (2006) states that it has to be investigated more thoroughly because of possibility that maternal grandmother's status might be overestimated due to some type of asymmetry.

Age of a grandchild as well as grandparent can be a factor in contact frequency. The last one can be related to the social availability, as introduced earlier. Sticker's (1991) and Tyszkowa (1991) findings show that contact frequency is lower with older grandchildren (attending school) compared to younger grandchildren. The results suggest that also emotional closeness between grandparent-grandchild decreases as grandchildren are attending school.

Lineage of a grandparent (mediated by parents) and age of a grandchild seems to be of importance in the quality and quantity of the direct and indirect processes, thus also these aspects are influencing grandchildren's scholastic achievements to be considered in a study.

Geographic proximity

So far it has been reviewed how grandparents can influence their grandchildren. In this frame of reference, geographic distance can be perceived as a platform on which processes are flowing and outcomes are generated. When people are in close proximity to each other possibility of available resources of the family members is ensured to have a greater access and availability of these. Greater proximity would assumingly enable greater degree of grandparent's participation in grandchildren's lives, thus also greater influence on the grandchildren's outcomes, which are of main interest in this study. Proximity to grandparents can be considered as an asset in case of scarcity of resources (e.g. educational, financial) in a family (Malmberg & Pettersson, 2008), and most cases the proximity is driven by the needs of the parents, not the grandparents (Bordone, 2009; Lawton, et al., 1994; Malmberg & Pettersson, 2008).

In grandparent-grandchildren research field, geography has been paid much attention to, specifically in relation to how distance influences contact frequency between these two generations (DeWit & Frankel, 1988; Lawton, et al., 1994; Szinovacz, 1998a; Whitbeck, et al., 1993), as well as to what extent parents choose their location in relation to other relatives – uncles and aunts of grandchildren (Holmlund, Rainer, & Siedler, 2009; Lappegård, 2009; Malmberg & Pettersson, 2008; Michielin & Mulder, 2007b).

Location choices of a family are related to two different levels of development in a society: on a macro level, continues centralization is related to important factors in the Norwegian society like need for education, technological and industrial development, importance of information and communication related issued as well as requirements for efficiency. On more individual plan there are aspects like relative and family bonds, heritage, traditions, property and local culture which enhance the macro level observations. Statistics show that most central municipalities keep their local populations more than other type of municipalities, thus also generational proximity is in higher proportion in urban areas (Malmberg & Pettersson, 2008). There is evidence that more persistence of sedentary level in big cities is related to the considerably more people living there with higher education relative to other places. Several studies confirm that education is also related to greater geographical distances between generations (Bordone, 2009; Lawton, et al., 1994). (Sørлие, 2005)

Geography and location of family members are interlinked with processes and outcomes among family members. David (2006) states that effects of indirect influence effects will be

present no matter where the grandparents live, however it is the effects of direct influence processes that are affected negatively by increasing geographic distances. An example of this was provided in a study in China, in which increased proximity of the paternal grandparents showed decreased mothers' childcare involvement indicating that grandparent's assistance can be considered as childcare substitutes (Chen, Short, & Entwisle, 2000). Because of the strong persistence of patrilineal culture, the findings show also that it is not in case for maternal grandparents.

Also size and placement of location seems to be of importance. Chen, Short & Entwisle (2000) indicated that the influence of grandparents' proximity on maternal childcare is higher in rural areas than in urban, by speculating that the proximity in rural areas captures also availability of the grandparent help. There are findings indicating that proximity to grandparents is larger in rural (non-metropolitan areas) compared to urban areas (Malmberg & Pettersson, 2008; Rogerson & Weng, 1993). However Malmberg & Pettersson (2008) find that parents living in densely populated areas are less likely to stay close to their parents.

There are several reasons why children live nearby their parents. It is mostly attractive in cases when parents get children and their mobility is reduced, while the ties with their local community and residence are strengthened. Also the change of becoming grandparents could increase willingness to live nearby, having grandchildren associates normally with shorter distances to grandparents (e.g. Malmberg & Pettersson, 2008; Michielin & Mulder, 2007a). The marital status appears to influence the proximity of the parents as well. The parents who do not live together live further away from grandparents compared to the parents living together or in situations where only one grandparent is alive. Furthermore, the distance to the father is larger than to the mother when grandparents do not live together. (Lappegård, 2009) Educational level of parents is closely related to geographic proximity to grandparents: the higher the educational level, the higher degree of mobility and therefore also reduced proximity to parents (e.g. Bordone, 2009; Lundholm, Garvill, Malmberg, & Westin, 2004; Malmberg & Pettersson, 2008; Michielin & Mulder, 2007b; Rogerson & Weng, 1993; Wilson, 1987).

One would assume that health of grandparents play an important role in relationship development with their grandchildren. However, when this aspect has been investigated by Cherlin and Furstenberg (1986, cited in Kivett (1998)) and when controlled for geographic

proximity it turns to be not of great importance. Also Clark and Wolf (1992) and Rogerson and Weng (1993) find that likelihood of grandparents living close-by or far away from parents of the grandchildren is not influenced by their function limitations if these are present, thus this aspect can be disregarded in this study.

In general, Clark and Wolf (1992) finds evidence that grandparents with more resources (living spouse, high level of education, or relatively younger age) are less likely to live in close proximity to parents of their grandchildren compared to grandparents with fewer resources. Needs of the younger generation are the driving force for geographic distances, and these are shorter when need for support and contact are present (Bordone, 2009; Michielin & Mulder, 2007b).

Contact frequency

The research has previously shown that geographical distance correlate with contact frequency and exchange of support (Mulder and Meer (2009) provide an overall overview of researchers who have found this strong association). With increased geographic proximity, contact frequency is higher, and therefore enabling increased activities, related to the direct and indirect processes, and dimensions of the processes presented in Szinovacz's model earlier. This means that geographic proximity enables greater degree of influence on grandchildren's outcomes.

Oppelaar and Dykstra (2004 pp. 91, 95-97) introduces so called "opportunity structure" which consists of physical and social availability and finds that frequency of contact between grandchildren and grandparents is more determined by the opportunity structure than personal motives. Geographic distance is directly related to the physical availability of grandchildren, while social availability is determined by mediation of parents, age of grandchildren, and marital status of grandparents.

Normann (2009) presents that the more frequent contact between grandparents and parents is in sparse areas than for those residing in densely populated areas, but in general 78 per cent of respondents had contact with their parents at least once a month no matter the gender of the parent. In his research contact is referred to a vis-à-vis interaction on monthly basis. This contradicts an expectation of more frequent contact in densely populated areas despite the

previously presented data showing increased proximity between grandparents and parents in such areas.

Boon & Brussoni (1996) looked upon factors influencing emotional closeness with the grandparents, and found that more frequent contact, as well as its diversity enhances emotional closeness. Because emotionally close people tend to allow greater exchange and acceptance of opinions and advice, this would imply that grandparent-grandchild relationship based on these terms would enable grandparent's influence in grandchildren's lives in a greater extent. Confirming these findings, Attar-Schwartz, Tan & Buchanan (2009) showed that also greater grandparent involvement and better grandparent-parent relationship predicts grandchildren's perception of closeness to and respect for closest grandparent. Geographic distances in relation to contact frequency can be an obstacle for developing emotional closeness (if the last one is depending on contact frequency). Also Lawton & Silverstein (1994) presented empirical findings indicating that contact frequency is linked interchangeably with affection – the more parents see their children, the greater affection between them, and vice versa.

Today's technological advances enable grandparents to communicate with their grandchildren in a variety of ways – landline phone calls, mobile phone calls, short messages, letter, e-mails etc., therefore proximity, though still important, might be becoming less important (Smith & Drew, 2004). A study on grandparent-grandchild communication means in Europe among children of age 10-15 reveals that face-to-face contact still remains the most frequent form of communication; however it is negatively affected by increased distance between grandparents and grandchildren (Quadrello, et al., 2005). Landline phone, following by mobile phone use are the other popular means of communication with grandchildren. Since face-to-face communication is known to be more efficient (and apparently preferred by grandparents) than other types of communication means, it would imply in relation to this study that greater geographic distance would reduce grandparents' possibility of frequent face-to-face communication, hence their influence in grandchildren's lives since other communication means are not as impactful.

The researchers find that contact frequency depends to a greater extent on geographical distance and thus accessibility; when grandparents and grandchildren live in the same locality, the contact frequency is higher versus when they don't share the same locality. Cherlin &

Furstenberg (1986) presents that geographical distance works as a barrier for frequent contact and closer ties. However, the emotional bond between grandparent and grandchild developed during grandchild's childhood endures (Tyszkowa, 1991).

There is no explicit study published presenting how grandparents' proximity influences children's academic performance in a quantitative way. How proximity influences grandparent-grandchild relationship has been investigated with clear indications that distance affects this relationship negatively, i.e. the further a grandparent lives from a grandchild the more reduces the strength of the relationship is (Pollet, et al., 2006). However, the research results are inconclusive. This could be caused by the fact that it is the contact frequency which might be determined by the distance, and might be the main variable influencing grandparent-grandchild relationship though other tests are necessary to be performed to validate this hypothesis (Boon & Brussoni, 1996). Boon and Brussoni (1996) showed also that distance is not determining if a relationship between a grandparent and grandchild is close or not. They confirmed however that the closest grandparents were seen more often in person, the interaction was more frequent also on the phone, and the interaction took variety of forms. Also Whitbeck, Hoyt and Huck (1993) reported geographic distance being weaker predictor of grandparent-grandchild relationship quality. Frequent contact is also observed more often if parent-grandparent relationship is good (King & Elder Jr, 1995; Oppelaar & Dykstra, 2004). In this study geographic proximity will be used as proxy for grandparental participation in grandchildren's lives, thus their influence factor in grandchildren's performance at school. This way it will be a contribution in further investigation of this uncertainty.

Educational achievement

So far in the literature review a presentation on influence factors of grandparent-grandchildren relationship was presented. These had mostly focus on processes or in other words, input factors, rather than outcomes, or output. In this sub-section attention is now turned to outcomes of grandchildren as the result of the above discussed processes within the family mediated by demographic factors, lineage, parent-grandparent relationship on a platform of geographic distances between grandparents and grandparents which in turn, is interlinked with contact frequency.

Children's outcomes are measured in a variety of ways, e.g. judging their behavior, ability scores, IQ, academic performance, high school attendance, college attendance etc. All these

measures are aspects trying to assess competence of children, where competence is “reasonable success with major development tasks expected for a person of a given age and gender in the context of his or her culture, society and time” (Masten & Coatsworth, 1998 p.206). In economics, measures of children’s outcomes are of interest if these predict and are of importance to labor market participation or human capital development because these generate value for a person as an individual and for the society at large. Card and Kruger (Card & Krueger, 1994) discusses to what extent test scores measure skills which are acquired at school and has an economic value are in fact proxy for economic value of schooling to an individual, and state that it is a partial measure of economic outcomes of people. Though it is not a perfect measure of long-term success, it is correlated with earnings, and therefore would indicate likelihood of success. But education is considered as a key factor when determining long-term economic success of a person (Haveman & Wolfe, 1994). If this is related to Human Capital theory (Borjas, 2008), probability of attaining more education is present for grandchildren with better grades because grades indicate that the skills attained are a result of lower costs of studying (either by high ability or good available resources in a family), and also perceived benefits would be relatively present since effort is undertaken to study rather than use the time for alternative activities therefore reducing scores in subjects.

Haveman and Wolfe (1994) presents a formulation on children’s successful outcomes as depending on:

“The resources and opportunities that social and parental decisions have made available to children, together with the choices that they make given these resources and opportunities, strongly influence the success that these children achieve when they reach young adulthood” (Haveman & Wolfe, 1994 p.23).

In other words, children’s educational attainment is a result of conscious decisions made by all three parties involved: society, parents and the children themselves. When considering investments in children, economists are interested specifically in areas where the largest payoffs come from considering children’s achievements: in formal educational sector, pre-school education, in parental time quality and quantity, higher economic resources available to the family (e.g. income), parents with more resources (e.g. with higher educational level) or in neighborhood quality. Haveman and Wolfe (1994) pinpoint that many studies with a focus on economic attainment consider education as a prior intervening factor for earnings and occupational status, where the last one is seen as a determinant of earnings and income. Though Haveman and Wolfe (1994) do not include grandparents in their model explicitly,

they can easily be considered as included in the model since it takes into consideration a wide range of factors, like series of family background variables, and governmental resources made available to the parents.

Furthermore, Astone & McLanahan (1991) provide some empirical evidence to differences in children's likelihood of positive academic achievements when considering family structure. Parental encouragement and attention regarding school progress is greater in intact families versus non-intact families. In all, family resources available and decisions how these are distributed have an influence on school achievement (Entwisle & Alexander, 1995). Their findings in relation to Coleman's (1988) theory highlights not only the greater access to social capital in intact families, but also the necessity of considering "*strengths of the attachment*" between parent and child (Astone & McLanahan, 1991 p. 319). In this study only intact families are considered in order to investigate whether there is any grandparental influence on children's school performance in general. Additionally, proximity to grandchildren would lead to better opportunities to develop "*strengths of the attachment*" and therefore enable better transfer of social capital in a family system leading to a positive contribution in grandchildren's pursuit for better grades.

Racial/ethnic background of the child and their parents can have a negative influence on children's academic performance (Blair, et al., 1999). Parent's educational aspirations, parental involvement and expectations are another factor influencing children's educational success (Astone & McLanahan, 1991; R. M. Clark, 1983; Flouri & Hawkes, 2008). Quality and characteristics of school, peers and teachers, neighborhood are also of significant importance (see Haveman & Wolfe, 1994 for a thorough overview on these factors). Unless information on these factors is gathered specifically for a purpose of a study, these are normally unobservable variables in quantitative studies, and thus must somehow be incorporated in a model.

So far, general factors influencing grandchildren's academic achievements were reviewed, but how can grandparents proximity influence grandchildren's grades at school? There are studies showing a direct link between grandparental involvement and participation on grandchildren's scholastic achievements and their behavior, however in non-intact families (Lang, 2005; Lussier, et al., 2002). The studies give no reason to think that different influence direction is for grandparental roles in intact families, therefore positive influence can be assumed also for

intact families, but to a much lesser degree because resources available in intact families are greater than those in non-intact families, therefore also the effect of grandparents' proximity would not account more than where it is more needed. A study conducted by Falbo in China indicate that more contact with grandparents (also not co-residing) with better education is positively associated with academic outcomes (Falbo, 1991) where frequent contact is related to proximity, however the study is lacking theoretical foundation, and does not appear to be of high quality because of few citations in studies thereafter (GoogleScholar, 2010).

Common research methodology on grandparent-grandchild relationships

The common methods studying the grandparent-grandchildren phenomenon are qualitative ones, involving longitudinal data, surveys, based on opportunity or convenience samples (Fischer, 1983; or as pinpointed by Oppelaar & Dykstra, 2004). A general overview on the development and phases in the research on grandparents can be found in Finn Hjardemaal (2002). Rather large response drop-out-rates are characteristic to these types of studies especially when a study has taken a long-term perspective therefore when interpreting the results presented one has to consider non-response bias (e.g. Evenshaug, et al., 2002; Hagestad, 2006; Hoff, 2007b). This is avoided in this research because the intended and analytical sample is the same based on the restrictions of the study's criteria, ensuring that no information is lost or distorted by respondents in the study.

Despite these disadvantages, these studies have contributed to better understanding of and insight in how grandparents are indeed the resource in a family, rather than several decades ago old perception of grandparents having negative and disturbing impact on family life (e.g. Strauss, 1943 cited in Fischer, 1983). These data, however, do not explicitly state the statistical strength which quantitative data can provide; therefore this project is another contribution to the research done in the area. The qualitative research in the area has uncovered the depth of the phenomenon, but quantitative research can provide better and statistical generalization possibility when investigating larger samples (Neuman, 2009).

Despite the extensive research on grandparent-grandchild relationships, per today, to my knowledge, there is no other similar research published relating grandparents' proximity to grandchildren's outcomes in terms of educational achievements in a quantitative way and on macro level – on a substantial number of observations. This might be due to the fact that data

access to investigate these problems of interest is limited. Normally it is time consuming to gather all the necessary information in social studies with quantitative research design (Neuman, 2009). In case of grandparent-grandchildren relationship and extra challenge is involved because information has to be gathered from three generations. An example of an approach taken to overcome this problem is the research conducted in Germany which is based on data German Aging Survey collected in a period of mid 1990ies to early 2000 on a large number of Germany's residents and therefore provides a progress into quantitative research methodological direction (Hoff, 2007a).

Concluding remarks

The above presentation of literature in relation to theory shows that grandparents, as part of a family system, are assumed to play a role in processes within the family, thus also are empowered by possibility to influence their grandchildren's lives, with reflecting consequences in outcome measure – Grade Point Average – which is the focus in this study. There is no denial of grandparent's contribution in situations when a family is under stress, i.e. divorce, financial problems, dysfunctional parenthood etc. Geography has been in focus in grandparenthood research for years, however no specific research is found to be done by estimating to what extent geographical distance between grandparents and grandchildren influence these children's outcomes in intact families with intact intergenerational ties. It is known that proximity enables more frequent face-to-face contact and exchange of resources (human, financial and social capital) among family members, and therefore assumingly also greater effect of closer living grandparents compared to those living further away.

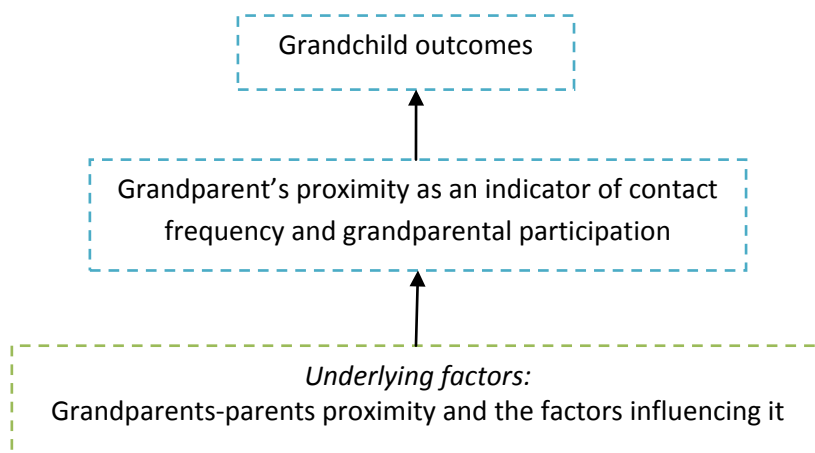


Figure 3. Simplified model of study's theoretical approach to illustrate influence channels through which grandparents are able to contribute to grandchildren's outcomes

A simple model presented in figure 3 is developed to present overall literature review in a simplified way. Basing on underlying factors of a family system with regard to grandparents and parents interrelated by outside factors, proximity to grandparents is developed to a wished level as parents and grandparents maximize well-being. Geographic distance between these particular family members is a decision made as part of maximizing behavior, taking into consideration the costs and benefits this behavior entails. This geographic distance in turn affects directly contact frequency between grandparents and grandchildren, mediated by parents. Contact frequency mediated by geographic proximity, are then assumed to influence grandchildren's performance at school.

Hypotheses of the study

Based on the theory on human and social capital, grandparents are considered as additional resources for the family. These resources are transferred through direct and indirect processes resulting in outcomes which are behavior maximizing at their origin. Geographic distance is a barrier for a better flow and exchange of the resources available to the family; and the closer grandparents live to their grandchildren, the better is the chance for more efficient and frequent transfer of these resources. More resources lead to better learning opportunities to children, thus, the following hypothesis is developed:

H₁: Close geographic proximity of both maternal and/or paternal grandparents has a positive association on grandchildren's grades at school.

Considering the hierarchy of grandparents with regard to lineage, and according to several findings of previous research presented earlier, the following second hypothesis is developed:

H₂: Maternal grandparents' proximity has more influence on grandchildren's grades at school than that of paternal grandparents.

Several aspects discussed in this chapter will also be taken into consideration in analysis part of the study in order to uncover existence of e.g. gender, grandparents' marital status and parents' educational level specific influences on the association between grandparental proximity and grandchildren's academic outcomes at primary school level. An attention will be also directed to compare the association in urban versus rural areas, as well as, in relation to limited resources in a family idea, whether child order or number of people in a household has an effect on the association.

Empirical Strategy

As presented in literature review, children's success in future could be predicted by how well they perform at school, and in this study will be measured by application of Ordinary Least Squared Regression analyses on a dependent variable which is Grade Point Average (GPA) on children's final year of primary educational level. This is an observable indicator of children's outcomes and information is available for all children grades in all subjects they have scores in.

In order to assess how grandparents participate in grandchildren's lives, the literature review above presented that many of processes within a family and outcomes of grandchildren are mediated by geographical distances among family members, which is actually the platform of enabling or hindering flow of processes in a family system. Therefore geographical variable is of interest, particularly proximity of grandparents in relation to grandchildren since geographic proximity is anticipated to mediate more frequent contact, greater extent of participation of grandparents in grandchildren's lives and therefore enabling greater exchange of resources within family in a variety of ways. Thus this in turn is reflecting in children's outcomes, measured in term of their average grades.

There are strengths and weaknesses of this chosen variable in relation to what it is intended to measure. This variable does not really measure quality and frequency of contact geographic proximity mediates which are, as mentioned earlier, important aspects in how emotionally close grandparent and grandchild feels for each other. It does not reflect either any potential variation across families who live in close proximity, but experience some intergenerational problems mediated by parents, therefore despite proximity, the contact frequency and grandparental involvement might be limited. It does not reflect also family specific features of how parental and grandparental practices in how grandchildren are raised. These practices depend in a great extent on how intergenerational relationships have been cared for in previous generations (e.g. Whitbeck, et al., 1993). Despite these weaknesses, the proximity variable is a strong indicator of contact frequency and mediator of intergenerational relationships as reviewed in the previous chapter and stated by several studies, and cannot be overseen. When considering different sets of control variables trying to capture some of previously mentioned unobserved characteristics, this measure is a good variable to be used in a quantitative research context.

Central question of interest is what type of proximity has to be used in order to answer the research question in a best possible way. Two aspects have to be considered: how the proximity itself has to be measured, and to which grandparents in relation to grandchildren this proximity has to be developed⁴.

Studies considering geographical proximity use different strategies. Some measure proximity in exact kilometers or miles (Hank & Buber, 2009; King & Elder Jr, 1995; Malmberg & Pettersson, 2008), some in traveling time between the family members (Lawton, et al., 1994; Oppelaar & Dykstra, 2004). In the data set available for this study it might be possible to calculate exact kilometers between two points of interest; however due to time limitations, a simplified measure is used to indicate whether grandchildren live close to grandparents. If a grandchild and grandparent shared the same municipality (locality), they were considered to have lived close, and not if otherwise.

Decision on which grandparents' proximity had to be measured in relation to grandchildren imposes a thorough discussion on advantages and disadvantages for each of possible measures. There could be developed several possible proximity variables. First of all, proximity to every grandparent separately is an option, so four proximity variables would have to be considered. However maternal grandparents' variables are highly correlated since these grandparental couples tend to live together in most of the cases and the association of each of the coefficients might be incorrect distorting the real influence effect magnitude. The same problem occurs for paternal grandparents proximity variables.

Secondly, only gender related proximity variables could be generated, i.e. one proximity variable for at least one of grandmothers living close-by, and another one for at least one of grandfathers. This measure would not though uncover any differences of maternal and paternal line influence on children's outcomes, only in more general terms how gender of grandparent would influence these outcomes. In this study maternal and paternal lineage particular influence is of importance, therefore this approach would not be the appropriate to apply.

If only individual grandmothers are considered by generating proximity variable for each, then grandfathers get excluded from the study, and this makes it impossible to evaluate their contribution in grandchildren's outcomes as part of grandparent couple contribution. This

⁴ In the process of attaining variables for this study, all possible measures regarding last aspect were generated.

variable would not uncover grandparent's overall effect of their participation in grandchildren's lives. As mentioned earlier, it has been a problematic issue in many of grandparent-grandchild related research that the focus has mostly been on grandmothers.

This leads to remaining two other means of measuring grandparent's participation in grandchildren's lives when also considering their matrilineal and patrilineal distinctive influence. Firstly, a proximity variable can be generated considering whether *at least one* of maternal grandparents lives close-by. Similarly, one such variable is for paternal grandparents' geographic distance in relation to their grandchildren. This means also that if grandparents are divorced and one of them still remains in close proximity to grandchildren, "both" grandparents will be considered as living close-by in the regression analysis.

The weakness of this measurement is that also grandparents who are deceased are considered as living far away from the respective grandchildren, but since the purpose of the study is to investigate close-proximity influence on children's outcomes, this aspect would not be considered so problematic. However, this can also be dealt with by investigating grandparent's participation in grandchildren's lives when considering only grandparents who are still together and are not divorced by keeping the same division in the proximity variables of interest, i.e. one for proximity of maternal grandparents and one for paternal grandparents. The strength of this variable is that interaction between grandparental couples is captured since in many cases, as pinpointed in the literature review, grandfathers are involved in grandmother's activities (they are a family, too), and this might entail a synergy in their influence. In this study both approaches will be investigated –proximity variables will be considered on more general terms, as well as a sub-sample will be generated for further investigation of the associations in families with completely intact intergenerational ties.

Based on this, the study's approach can be expressed as a model, presented below:

$$Y_i = \alpha + \beta_1 * X_{1i} + \beta_2 * X_{2i} + \beta_3 * Z + u_i, \text{ where}$$

Y_i = 10th Grade Point Average for the i th grandchild.

α = Constant

β_1 = Coefficient measuring influence of maternal grandparents' proximity

X_{1i} = Indicator of having maternal grandparents in close proximity

β_2 = Coefficient measuring influence of paternal grandparents' proximity

X_{2i} = Indicator of having maternal grandparents in close proximity

β_3 = Coefficient measuring influence of the vector of control variables in the model

Z = A vector of control variables characteristic to grandchildren, parents and grandparents

u_i = Error term, assumed to be normally distributed, mean zero

In this model, children's outcomes are presented by Y_i , and is a linear function of a constant α added the variables of interest. β_1 is the coefficient of indicating strength of effect of having maternal grandparents close-by, and similarly, β_2 is reflecting effect of having paternal grandparents' close proximity. Z is a vector of control variables characteristic to grandchildren, parents and grandparents, while β_3 is the coefficient of this vector.

A positive association between average grades of children is expected by both maternal and paternal grandparents' participation in these children's lives considering small geographical distances, therefore β_1 and β_2 coefficients are assumed to be positive. The sign of the coefficient β_3 is ambiguous since many control variables are involved, each with different direction of association on children's grades.

Omitted variables

In quantitative research design caused by limited resources (time and information) there will be restrictions to how many variables can be included in models to take into account for all variation in children's pursuit of attaining grades, thus leading to the observed outcomes in terms of average grades. Omitting a relevant variable would distort the association between GPAs and grandparental proximity, and consequently, it would not be reflecting the real association between the dependent and explanatory variables (Studenmund, 2006). This problem is partly solved by taking into account some observable variables which would carry along some of characteristics of the important unobserved variables. This does not necessarily account for all the unobserved variables, but would improve the model of interest and reduces omitted variable bias.

The control variables considered based on the mentioned aspects in the literature review are demographic and socio-economic variables for all three generations involved (e.g. Michielin & Mulder, 2007b). For grandchildren these are gender, number of younger and older siblings, birth of year, birth of month, municipality size. For grandparents these include age, marital

status and grandmothers' employment status indicator. For parents these are their age, mother's age when her first child was born, earnings, indicator whether social benefits were received, and educational levels. Operationalization of these is presented in the next chapter.

Validity

A study does not have good external validity or high statistical inference if it systematically differs from the population that it is supposed to represent. Most often the cause for this is systematic exclusion of or underrepresentation of groups of people with certain characteristics. Disadvantage of this problem's presence prevents one to generalize findings to the whole population at large. (Studenmund, 2006)

In this study, restrictions applied in order to attain analytical sample are clear and explicit, therefore, also the results attained in this study should be generalized only to the relevant subgroup of the whole grandparents' population. The criteria for the analytical sample are also presented in the next chapter. Since the analytical sample characterizes the intended population according to the same restrictions, the external validity is assumed to be good for the study. The purpose of this study is not to find any causal relationships between the proximity variables and GPA, therefore internal validity discussion becomes irrelevant.

Methodology and Data

The answer to the research question will be based on a quantitative data available from Statistics Norway on the Norwegian population in a period of 1992 to 2003. This is database of a unique kind since a variety of quantitative data are collected and related to every single person by personal identifiers, also allowing to link persons from three generations with each other. Through the statistical program Stata, the relevant data has been filtered and combined so that children born in a period of 1986 to 1991 are distinguished with their respective parents and grandparents, including their final academic results in a time frame from 2002 to 2007 which is extracted from another database with data available for this time period. Several relevant variables describing each of the parents and each of the grandparents are included in the analysis such as average income or received welfare transfers in the respective years of interest, residing location, nationality, number of siblings, age etc. The time frame of these variables is from 1992 to 2003, respectively in the period when the children were in age of 6 and 12 years old.

The intended sample size consists of children who finalized their studies at a secondary school level in a period of 2002 to 2007; therefore their respective birth of year is from 1986 to 1991. Every single person in the database had an exclusive identifier, and by using it, children were related to their respective parents, and maternal and paternal grandparents. Attention was also raised on registration status⁵ of the parents and grandparents. A reasonable assumption on grandparents' status as deceased was made in case of missing data on their registration status. The missing data in this category was almost 1/3 of the sample size, and is caused by the fact that a person is registered as deceased in the respective year, however in the following years the information of his/her registration status is missing. Thereafter the sample size of this study to be applied several criteria upon consisted of 269 478 children.

Based on the obtained sample of children, a database was created combining every child's respective characteristics (gender, grades in different subjects at the final year, place of residence, number of siblings), also data characterizing parents (education, age, mother's age when her first child was born, income variables, variable indicating if social benefits were received, number of siblings) and grandparent (maternal, paternal line distinction, their place

⁵ Registration status indicates 9 groups: 1=living in Norway; 3=emigrated, 4=disappeared, 5=deceased, 6=invalid personal identification number, 7=registered when born, 8=annulled access and 9=non-registered person (Akselsen, Lien, & Sivertstøl, 2007).

of residence, age, pension points) were included. These variables were the foundation for variables used in data analyses.

Children starting earlier or later at school than their peers have been excluded from the sample as this factor may induce another (opposite) type of effects on grades when controlling for parent's education and family income (Suet-ling & Chen, 2010). In this study the general legislation, stating that age of 6 is normal starting age for attending school (Kunnskapsdepartementet, 1998), is taken as a starting point, therefore providing more similar background characteristics of children. Hence, this would enable less interference in observing effects of grandparents' influence on their grandchildren's grades.

The main criterion for the sample of the study was to include only grandchildren whose intergenerational ties were intact, i.e. both of the parents alive, and still married by the time children were 12 years old. Grandchildren with no grandparents at all alive were also excluded from the sample, as well as grandchildren who did not have any maternal or paternal grandparents. Any kind of foreign background was also a criterion for exclusion, since grandchildren did not have any grandparents in Norway the relevant point of time. One could argue that despite their grandparents not residing in Norway, intergenerational ties still could be intact, but this type of research considering different countries of residence is not a subject of this project and has another angle of the research problem, therefore not considered in this study. Grandchildren who had not been permanently living in Norway (moved away for longer periods of time) within these 6 years of interest were not included. Any of grandchildren having missing information on GPA or school specific identifier were excluded. See Appendix I for details on exclusion criteria and number of lost observations for the sample. Final sample of this study consist of 151 092 grandchildren.

Operationalization of variables

In the following section operationalization of variables is presented. Firstly, process of generating the dependent and the explanatory variable will be presented. Furthermore, variables constructed characterizing demographic characteristics of grandchildren-parents and grandparents will be presented, following by an explanation of how parents' socio-economic variables were attained.

The dependent variable – GPA of the grandchildren

A grade point average from 10th grade was calculated based on a child's final assessment in 13 subjects, plus oral and/or written examination marks in several of the subjects where the grades were indicated as ranging from 1 (worse) to 6 (the best), where 2 is the minimum grade to be considered as pass in the subject. In Norway final evaluation of a student consists of these 13 subjects, as well as, by drawing type of selection, in one written and one oral exam. The subjects a child gets a grade are Norwegian primary language (written), Norwegian secondary language (written), Norwegian (oral), Mathematics, English (written), English (oral), Science and Environment, Religious instruction and Ethics, Social Subject, Domestic science, Art and Craft, Physical Education (gymnastics) and Music. One written exam has to be taken in subjects: Norwegian language, Mathematics and English. One oral exam has to be done in one of the following subjects: Norwegian (oral), English (oral), Mathematics, Science and Environment, Religious instruction and Ethics and Social Subject. (Hægeland & Kirkebøen, 2007; Kunnskapsdepartementet, 2006)

In this study *all* marks a child received as part of the final assessment are considered, thus the subjects in whom a student had got a grade are included in the GPA. The grades presented in form of letters (e.g. W (excellent), G (good) etc.) were excluded from the calculation since these constituted for a very small percentage of all the grades (less than 1%) and are complicated to transform to today's grading system. This divergence is probably due to usage of old grading system (Hægeland & Kirkebøen, 2007).

In some subject, some students got grades ranging from 0 to 6. The grade 0 is not normally used in educational assessment in primary schools, but has the same implication, i.e. not pass in the subject. There is no clear explanation of the grading differences, since these are present in years 2002, 2004, 2005 and 2006 in several subjects, however the number of observations of this type of grading is small, i.e. for subject grades only 0,16% in the sample of 151 092 children. Hægeland and Kirkebøen (2007) suggest that also this way of grading children is continuum of old grading system, though officially, e.g. in 2006 grades in primary school were supposed to be ranging from 1 to 6 (Utdanningsdirektoratet, 2007). Despite this ambiguity, following practice of the regulation applied to grading in secondary schools, also in this study grades 0 were coded as grades 1, therefore enabling better comparison of children's 10th grades.

In Norway the curriculum is almost similar in schools; however variation of what has been taught can be present. Also grading in subjects could be influenced by teachers' perception, teaching skills and other factors (Haveman & Wolfe, 1994), therefore enabling measurement errors to be present. However, none of these issues can be observed explicitly in the database available for this study, but one measure can be taken and is considered in this study – doing OLS regression analysis with school specific fixed effects.

The independent variables - proximity variables:

In order to attain the independent, explanatory variables of interest, it was necessary to determine the place of residence of grandchildren when aged 12 years. It was done by using a family specific identifier which is the same to all family members who were one family and co-resided in one residence. Thereafter, the address of the core family is used as an address for the place of residence of a grandchild.

The family specific identifier was not applicable determining grandparents' and grandchildren's geographical location; therefore the municipalities' identifiers were used. If a grandchild and grandparent lived in the same municipality, they were considered to have lived near-by each other. If it was different, a grandchild was considered to have lived far from the grandparent.

General control variables – child related covariates:

- ***Gender of a child:*** Several studies have shown that females are advantaged and perform better when considering their academic achievements (e.g. Sheree, David, & Horwood, 2008), therefore based on the available data, a gender dummy was made for females.
- ***Number of younger and older siblings*** a child had, in total 5 levels (1 denoting 1 younger/older sibling and 5 denoting 5 or more younger/older siblings) determined by child order of all children in the family by the time a child was 12 years old.
- ***Birth years*** of children: cohorts, i.e. 1986, 1987, 1988, 1989, 1990 and 1991.
- ***Birth month of a child***, i.e. January, February etc.
- ***Size of municipalities a child lived in:*** municipalities were divided into 4 levels based on population density in the area – small (population less than 4 999 people), medium-

small (population 5 000 – 9 999), medium (population 10 000-49 999) and large (population 50 000 and more). This division is used according to one of the way Statistics Norway operate in their statistics summaries (see e.g. Brunborg & Texmon (2003)). A dummy variable for unknown was also added because of one region (Møre og Romsdalen) where several municipalities had merged alongside with other municipal geographically related boarder changes. Comparing the data dating back to 1992 with the available data per today does not allow distinguishing the municipality size for 256 children in this region.

General control variables – parent related covariates:

- **Mother's age when her first child was born** is a variable controlling for possible teenage mothers' effects on children's outcomes because these are normally negatively associated with children's outcomes (Haveman & Wolfe, 1994). In the database a birth year of each child a mother gave birth to is available. Considering also the children's birth order, mother's age is calculated with respect to the birth year of the first born child.
- **Mother's age:** provided when the child in the sample was 12 years old: birth year of the child added 12 years and deducted birth year of the mother. In order to allow for better comparison of age categories across generations, this variable in the data presentation is changed to mother's age when the grandchild in the analytical sample was born. Mothers' age was categorized in 4 age categories: [<23 years], [23-27], [28-32] and [>33 years].
- **Father's age:** similarly to procedure of finding mother's age, father's age is also provided. Also this age variable is changed to father's age when the grandchild in the analytical sample was born. Fathers' age was categorized in 5 age categories: [<23 years], [23-27], [28-32], [33-37] and [>38 years].

General control variables – grandparent related covariates:

- **Grandparents' age:** age of each grandparent (maternal grandmother, maternal grandfather, paternal grandmother, and paternal grandfather) is calculated similarly to the procedure of attaining parents' age, and thereafter categorized in 7 age groups: [<43 years], [43-47], [48-52], [53-57], [58-62], [63-67] and [>68 years] (this age

variable is changed to age of a respective grandparent when the grandchild in the analytical sample was born).

- ***Marital status of parents and grandparents:*** Statistics Norway provides a classification available in the dataset (Akselsen, et al., 2007 p.8), however this classification is not used since family specific identifier is a more reliable determinant whether parents or grandparents are married/living together, divorced or widowed. Based on this information, a variable indicating whether maternal or paternal grandparents are alone, i.e. are widowed or divorced.
- ***Grandmothers' employment status variable in terms of earned pension points*** as an indicator of grandmothers' employment status. In the dataset a dummy variable was generated to indicate whether grandmothers had earned these pension points. Though this approach does not capture whether the grandmothers are still working, these pension points indicate that a person has been employed (not self-employed) and will be or are receiving more than minimum pension: minimums pension plus extra pension amount which's is calculated based on pension points (Arbeidsdepartementet, 1997). In this study's context this variable would have implications of social status – their higher earnings leading to earned pension points and thus implying more resources (financial and intellectual) attained by these grandmothers. However, interpretation of this variable has to be done with caution because of special cases present when pension points are provided.

General control variables – parent's earnings covariates:

- ***Earnings of each of the parents:*** Only earnings of each parent which accumulate right for pension at retirement age are chosen. The data on earnings are in nominal terms, and therefore does not allow for comparison across years. An earning variable was attained for every single year in a time frame when children were 6 to 12 years old, and average based on these was calculated to be used in the analyses. Squared and cubic values of this continue variable are also generated to enable to extract more information on the effect of income variable on children's average grades.
- ***Received social benefits by each of the parents:*** father or mother receiving this type of benefits are normally associated with negative educational achievements of children (Haveman & Wolfe, 1994), and to capture this aspect a dummy variable indicating whether a mother and/or father had been receiving any sickness or unemployment

benefits is provided in the original database. So this variable does not capture short-term or long-term involvement in benefit system, but only takes into consideration only the cross-sectional observation in the year of interest.

General control variables – parent's educational covariates:

- ***Educational level of parents*** is of importance to the proximity to their parents and to children's' school performance, as presented in the Literature Review. In this study each level of education father and mother had was divided into 4 levels (1 denoting the lowest and 4 the highest level), as well as 1 dummy variable for distinguishing unknown education level.

The division was conducted based on the Statistics Norway official educational levels: *compulsory education, secondary education or equivalent, higher education or equivalent* (Statistics Norway, 2000), though additional level within category *higher education or equivalent* was made distinguishing specifically parents holding Bachelor degree or educational level which leads to a Bachelor degree from parents having higher educational attainment than Bachelor degree.

Fixed Effects control variables with regard to:

- ***Schools*** children attended: each school a child in the sample attended are originally with an identifier which enables to control for variations in grading across schools.
- ***Municipalities*** children lived in: each municipality a child lived in enables to control for variations across municipalities in Norway.
- ***School and birth year fixed effects*** (interaction) were also combined to extract variation of both in the sample. This implies that regression analyses with this procedure enable to investigate the effects of grandparents' proximity on average grades for all children studying in the same school and in the same or parallel grade

Other variables generated for sub-sample analyses

- ***Number of siblings a child had***: instead of birth order, a number is computed indicating how many children a mother had. This number deducting 1 unit is also used as number of siblings every child had. This variable takes into account also twins.

- *Number of siblings each parent had*: similarly as described above, but for mother and father separately.
- *Children's family location moved* are considered as stress factor and therefore with its negative influence on children's probability of high-school graduation and with years of schooling (Haveman & Wolfe, 1994). Re-location of children's household is distinguished in this study by comparing municipality code in combination with municipality sub-codes registered when a child was aged 6 and 12. If these were different, the family was considered to have moved, otherwise not. This variable does not account for number of moves done by a family, neither whether the re-location happened within the same municipality or to another municipality.

All the above described variables have been generated for when a child was 6 and 12 years old if not otherwise indicated, however in this project because of the time limitations the focus will be on analyzing effects of grandparents' proximity when grandchildren were of age 12, though possibility of conducting analyses for age 6 is present in the final dataset.

Description of the sample

The following description of the sample is for the point of time when children were 12 years old. The sample consists of 151 092 children of which 48.66% are females. 52.1% of them live in close proximity to one or both of their maternal grandparents, and 60.9% to one or both of their paternal grandparents. 35.4% of children live close-by to both maternal and paternal grandparents, while 22.3% don't have any of the grandparents in a short distance away. Because of sample selection criterion, there are no children who have no or only 1 grandparent alive included, therefore 15.42% of children have two grandparents, 45.24% have three grandparents, and 39.34% of children have all four grandparents alive.

Grandchildren

The dependent variable, Grade Point Average, is measured as continues variable and in the sample and is 4.08 with the standard deviation 0.7824. The quartiles are 3.5; 4.1 and 4.7 points. There are no significant differences between GPAs among children who live in close proximity or far away from their grandparents.

There are 7.09% of children in the sample with missing one or more subjects in their GPA when not considering oral and written exam grades (table 1 presents more detailed overview of number of observations for missing subjects). One or two missing grades in subjects

account in majority of cases in two subjects: Norwegian secondary language (written), and Social Subject.

Most of children live (41.3%) in areas with a population of between 10 000 – 49 999 people; in highly populated areas (over 50 000 people) there were living 27.8% of all the children. 15.3% of children lived both in medium (5 000- 9 999 people) and small (<4 999 people) sized areas in Norway. For

Table 1. Overview of number of missing grades among the main 13 subjects

Number of missing subjects	N	In per cent
0	140 378	92.91
1	6 974	4.62
2	1 621	1.07
3	643	0.43
4 and more	1 186	0.78

0.32% of children it was not possible to distinguish regional belonging because of municipality changes, as well as changes in boarder lines in some municipalities. Detailed division of this variable taking into account proximity to children's grandparents is presented in table 3. When investigating municipality size in regard to proximity to grandparents, there is a different pattern found based on maternal and paternal grandparental line. In case of smaller versus greater geographical distance to maternal grandparents, there are somewhat more families living close-by maternal grandparents if municipality size is very large; while the opposite effect is for paternal grandparents. It is also more likely that in small municipalities more grandchildren live far from maternal grandparents, but fewer grandchildren live far from paternal grandparents.

For all the children in the sample, there are 65.02% who are having both grandparents from mother's side alive, and 58.91% who are having both grandparents from father's side alive. There are 86 (or 0.06%) of children in the sample who lost one of their grandparents within a period of 6 years. None lost more than 1 grandparent. Loss of a grandparent might be expected to influence a grandchild in one way or another, thus also their scholastic success, but this small number implies a relatively stable time frame for grandparent-grandchild relationship to take place, thus disabling large interferences of loss of grandparent's on observed children's outcomes.

Children's respective births of years are ranging from 1986 to 1991, and the distribution according to the birth year in the sample is varying from 15.45% to 17.5% of the total sample size. There is a pattern of increasing numbers of observations for the later years of birth, therefore there are more children born in 1991 than in 1986, but the differences constitute to less than 2%. There are no noticeable differences observed within the cohorts comparing their

proximity to grandparents from mother's and father's side. An overview of the number of observations for a specific birth of year is presented in table 2. In the same table a detailed number of observations are showed in respect of month of birth for children.

Table 2. Distribution of number of observations in % per each cohort and each month of birth

Cohorts	# of observations	in %
1986	23337	15.45
1987	23548	15.59
1988	24994	16.54
1989	26020	17.22
1990	26644	17.63
1991	26549	17.57
Month of birth	# of observations	in %
January	11377	7.53
February	12129	8.03
March	13798	9.13
April	14132	9.35
May	13596	9.00
June	12825	8.49
July	13204	8.74
August	12816	8.48
September	12620	8.35
October	11995	7.94
November	11278	7.46
December	11322	7.49

In average a child in the sample has 2.7 siblings. 43.43% of children are first born, 37.49% are second born, and 15.56% are third born children in their families. If we look at family size, in this sample, there are few children living as alone-children (4.24%). Having 4 and 5 family members including parents is more common, respectively 42.88% and 40.33%. More specific division considering child order and number of younger or older siblings is presented in table 3.

Grandparents

Maternal grandmother's age when a grandchild was born was on average 55, maternal grandfather was on average 58 years old; paternal grandmother is 57 years old, and paternal grandfather is 61 years old. When grandchildren were 12 years old, most of the grandparents have normally retired since average age of retirement is 67 (Arbeidsdepartementet, 1997). In

the regression analysis age of grandparents who are diseased are also considered, however mean age is not affected much for grandmothers, however reduction of approximately 2 years from the presented averages should be deducted when considering average age of living grandfathers. In table 4 age categories not used in the regression analyses of the study are marked with a star (*) behind the variable name. There is pattern of grandparents being somewhat older when proximity to grandchildren is not present, while, on the other hand, grandparents tend to be somewhat younger when living close-by their grandchildren.

Table 3. Descriptive statistics on variables related to grandchildren

	All	Near <u>maternal</u> grandparents	Far from <u>maternal</u> grandparents	Near <u>paternal</u> grandparents	Far from <u>paternal</u> grandparents
# of observations	151 092	78 884	72 208	92 027	59 065
	100,00 %	52,21 %	47,79 %	60,91 %	39,09 %
Dependent Variable					
Grade Point Average	4,08	4,02	4,14	4,03	4,16
Std.dev.	0,7824	0,7805	0,7797	0,7779	0,7832
Missing 1+ subjects in GPA	7,09 %				
Child specific variables					
Gender (female=1)	48,66 %	48,69 %	48,62 %	48,78 %	48,47 %
# people in the household					
3	4,24 %	4,32 %	4,16 %	4,11 %	4,46 %
4	42,88 %	43,85 %	41,81 %	43,12 %	42,50 %
5	40,33 %	39,99 %	40,70 %	40,48 %	40,09 %
5+	12,55 %	11,84 %	13,33 %	12,29 %	12,95 %
Younger siblings					
0	36,39 %	36,30 %	36,49 %	36,65 %	35,98 %
1	40,33 %	40,60 %	40,04 %	40,31 %	40,37 %
2	19,10 %	19,14 %	19,06 %	19,11 %	19,09 %
3	3,31 %	3,21 %	3,42 %	3,17 %	3,53 %
4	0,55 %	0,49 %	0,62 %	0,49 %	0,64 %
5+	0,32 %	0,26 %	0,37 %	0,27 %	0,39 %
Older siblings					
0	43,88 %	44,33 %	43,39 %	43,50 %	44,47 %
1	37,48 %	37,82 %	37,10 %	37,72 %	37,10 %
2	15,31 %	14,81 %	15,85 %	15,45 %	15,09 %
3	2,69 %	2,52 %	2,87 %	2,74 %	2,61 %
4	0,44 %	0,37 %	0,51 %	0,42 %	0,46 %
5+	0,20 %	0,15 %	0,28 %	0,17 %	0,27 %
Geographic variables					
50 000+	27,82 %	29,55 %	25,93 %	27,07 %	28,97 %
10 000 - 49 999	41,28 %	41,11 %	41,46 %	39,73 %	43,70 %
5 000 - 9 999	15,28 %	14,80 %	15,80 %	15,85 %	14,39 %
< 4 999	15,30 %	14,26 %	16,43 %	16,98 %	12,69 %
unknown	0,32 %	0,28 %	0,38 %	0,37 %	0,25 %
How many grandparents a child has?					
Maternal grandmother	92,83 %	93,71 %	91,86 %	92,99 %	92,57 %
Maternal grandfather	72,19 %	73,41 %	70,86 %	72,79 %	71,25 %
Paternal grandmother	91,83 %	91,91 %	91,75 %	92,41 %	90,93 %
Paternal grandfather	67,07 %	67,68 %	66,41 %	67,49 %	66,43 %
Both maternal grandparents	65,02 %	67,12 %	62,72 %	65,78 %	63,82 %
Both paternal grandparents	58,91 %	59,59 %	58,16 %	59,90 %	57,36 %

St.dev. is standard deviation of a variable just above.

The divorce rates for maternal grandparents is 7.97% and for paternal grandparents 6.38%. When considering a distinction of grandparents alone, i.e. one's partner is a widow/widower or that

they are divorced, then there are 42.95% of maternal grandparents alone and 47.48% of paternal grandparents alone. The difference of 4.5% can mainly be attributed to the higher mortality rates of paternal grandfathers versus maternal grandfathers. The difference between maternal and paternal grandparents is due to the fact that fathers usually have their children in later stage in life; therefore also paternal grandparents became grandparents later in life when also mortality rates are higher. In the entire sample, there are 67.07% of children who have their paternal grandfathers alive, while corresponding number for maternal grandfathers is 72.19%. There is a high probability that children's grandmothers are alive: nine out of ten children have both their maternal and paternal grandmothers present.

Table 4. Descriptive statistics on variables related to grandparents.

	All	Near maternal grandparents	Far from maternal grandparents	Near paternal grandparents	Far from paternal grandparents
# of observations	151 092	78 884	72 208	92 027	59 065
	100,00 %	52,21 %	47,79 %	60,91 %	39,09 %
Grandparent's demographic variables					
Maternal grandmother's age	55,20	54,45	56,03	54,58	56,18
St.dev.	7,82	7,77	7,80	7,82	7,73
Maternal grandfather's age	58,70	57,88	59,60	58,10	59,64
St.dev.	8,47	8,37	8,49	8,47	8,38
Paternal grandmother's age	57,83	57,20	58,53	57,60	58,16
St.dev.	7,71	7,68	7,68	7,73	7,66
Paternal grandfather's age	61,33	60,67	62,05	61,13	61,66
St.dev.	8,35	8,35	8,28	8,38	8,28
Maternal grandmother's age*	54,97	54,23	55,81	54,34	55,97
St.dev.	7,76	7,71	7,74	7,75	7,68
Maternal grandfather's age*	56,78	56,03	57,64	56,22	57,69
St.dev.	7,57	7,50	7,56	7,57	7,49
Paternal grandmother's age*	57,61	56,98	58,29	57,38	57,97
St.dev.	7,67	7,64	7,64	7,69	7,62
Paternal grandfather's age*	59,05	58,43	59,75	58,83	59,42
St.dev.	7,38	7,38	7,33	7,41	7,33
Maternal grandparents divorced	7,97 %	8,67 %	7,20 %	8,44 %	7,22 %
Paternal grandparents divorced	6,38 %	6,88 %	5,84 %	6,27 %	6,55 %
Maternal grandparent/s alone	42,95 %	41,55 %	44,49 %	42,66 %	43,40 %
Paternal grandparent/s alone	47,48 %	47,29 %	47,68 %	46,38 %	49,19 %
Maternal grandmother's empl. status	21,83 %	24,01 %	19,45 %	23,57 %	19,12 %
Paternal grandmother's empl. status	15,22 %	16,50 %	13,83 %	15,86 %	14,22 %

Notes: Variables with a (*) indicate average age for grandparents, not included the deceased ones. All age categories are generated considering the age of a grandparent when a grandchild was born. St.dev. is standard deviation of a variable just above.

Variable based on earned pension points was obtained to enable to find any implications of employment status. There are 21.83% maternal grandmothers who have earned pension points, while 15.22% paternal grandmothers have these. Though not presented in the table 4, average age when a grandchild was born of maternal grandmothers earned pension points is 49.84 (std.dev. 4.14, min 33, max 57), while for paternal grandmothers it is somewhat higher 49.04 (std.dev.3.86, min 34, max 57). Grandmothers who *do not* have an indicator of attained

pension points are on average older: for maternal grandmothers average age is 57.26 (std.dev. 7.36) and for paternal: 59.4 (std.dev.7.14). Nevertheless, also regarding this variable, there are some differences in number of grandmother's working depending on geographical distance from their grandchildren. More grandmothers with this indicator are observed when proximity to grandchildren is close.

Parents

The mean age of mothers when grandchildren were born is 27.5 years (std.dev. 4.26), and for fathers on average 29.89 years (st.dev 4.52). On average comparing age category of mothers and fathers, there is somewhat higher age for both parents living further away from grandparents in comparison to parents living close-by grandparents. Also age when mothers got their first born child has similar trend, while average for the whole sample is 24.57 years of age (st.dev 3.76). These are in the meantime very small differences and within a normal variation range of an age variable. The descriptive data about parent's related variables are presented in table 5.

Table 5. Descriptive statistics on variables related to parents

	All	Near maternal grandparents	Far from maternal grandparents	Near paternal grandparents	Far from paternal grandparents
Parent's demographic variables					
Father's age	29,89	29,47	30,34	29,67	30,20
St.dev.	4,52	4,49	4,51	4,53	4,49
Mother's age	27,50	26,98	28,06	27,11	28,10
St.dev.	4,26	4,21	4,24	4,22	4,24
Mother's age with her first born	24,57	24,10	25,14	24,15	25,23
St.dev.	3,76	3,61	3,84	3,65	3,82
Parent's income variables					
Mother's average earnings	148 212,50	143 722,70	153 117,40	141 841,70	158 138,70
St.dev.	95 904,53	91 984,02	99 782,01	89 608,16	104 192,00
Father's average earnings	325 365,20	316 365,40	335 197,00	310 253,80	348 909,80
St.dev.	208 950,30	194 058,80	223 678,20	189 944,10	233 587,80
Mother receiving soc.benefits	1,66 %	1,85 %	1,46 %	1,79 %	1,46 %
Father receiving soc.benefits	1,02 %	1,11 %	0,93 %	1,07 %	0,95 %
Parent's educational variables					
Father					
Compulsory	8,13 %	9,22 %	6,94 %	9,27 %	6,36 %
Secondary or equivalent	60,34 %	64,98 %	55,28 %	66,72 %	50,41 %
Bachelor or leading to Bachelor	21,74 %	19,05 %	24,66 %	17,84 %	27,80 %
Higher than Bachelor degree	9,36 %	6,32 %	12,68 %	5,75 %	14,98 %
Unknown	0,43 %	0,43 %	0,43 %	0,41 %	0,45 %
Mothers					
Compulsory	6,75 %	7,58 %	5,84 %	7,43 %	5,68 %
Secondary or equivalent	60,22 %	64,60 %	55,43 %	65,03 %	52,72 %
Bachelor or leading to Bachelor	29,53 %	25,45 %	33,99 %	25,40 %	35,96 %
Higher than Bachelor degree	3,31 %	2,19 %	4,53 %	1,95 %	5,42 %
Unknown	0,20 %	0,18 %	0,21 %	0,18 %	0,22 %

Notes: All age categories are generated considering the age of a parent when a grandchild was born. St.dev. is standard deviation of a variable just above.

Average number of siblings mothers and fathers have is 3, fathers with more than 3 siblings constitute to 32.39% of the sample, while mothers with more than 3 siblings constitute to 33.52%.

Most of mothers in the sample have secondary education or equivalent. One third has Bachelor degree or higher education leading to Bachelor degree attainment. There are 3.31% of mothers who have very high educational level, while on the other hand twice this number have very low education.

Similarly to situation describing mothers, 60% of fathers have secondary education or equivalent. There are fewer fathers with Bachelor degree or education leading to this level compared to mothers, however there are three times as many fathers with very high educational level. There are 8% of fathers having compulsory educational level, i.e. 10 classes.

The table 5 uncovers that also educational levels vary across proximity of grandparents. Higher percentage of parents has higher education if they are living away from grandparents, while parents living close-by grandparents show educational levels below the average for the educational level categories bachelor degree or education leading to a Bachelor degree and higher. In the sample *more* mothers tend to have Bachelor level degrees compared to fathers; however *more* fathers tend to have highest level of education (master degree or higher) compared to mothers.

Average pension accumulating earnings for fathers are 325 365.2 NOK annually, for mothers this type of income is lower, on average 148 212.5 NOK. When not considering any significance levels between variables, only descriptive data, table 6 can be generated presenting average earnings for mothers and fathers living close-by or far away from maternal and paternal grandparents.

Table 6. Comparison in NOK and percentages between parents' earnings across groups

	All	Near maternal grandparents	Far from maternal grandparents	Near paternal grandparents	Far from paternal grandparents
Mother's average earnings	148 212,50	143 722,70	153 117,40	141 841,70	158 138,70
Father's average earnings	325 365,20	316 365,40	335 197,00	310 253,80	348 909,80
Mother's average earnings	148 212,50	-3,03 %	3,31 %	-4,30 %	6,70 %
Father's average earnings	325 365,20	-2,77 %	3,02 %	-4,64 %	7,24 %

Numerical presentation indicate that there might be possibility for a trend that earnings of mothers and fathers in general are higher in case they live further away from grandparents

than an average. Caution has to be taken however to state that this indeed is the case since earning variables attained are averages of 7 years of earning in nominal terms where, e.g. overrepresentation of high earnings can be present if higher inflation not-adjusted earnings in later years are obtained. Nevertheless, there are some implications that a trend could be present since differences as well as directions of divergence with a reference to average value presented in the last rows in table 6 are noticeable.

If variable distinguish effects of unemployment or sickness by indicating whether mother or father received any social benefit is looked upon, results are presented in table 7.

Table 7. Comparison in percentages between proportions of parents receiving social benefits

	All	Near maternal grandparents	Far from maternal grandparents	Near paternal grandparents	Far from paternal grandparents
Mothers receiving soc.benefits	1,66 %	1,85 %	1,46 %	1,79 %	1,46 %
Fathers receiving soc.benefits	1,02 %	1,11 %	0,93 %	1,07 %	0,95 %
Mothers receiving soc.benefits	1,66 %	11,45 %	-12,05 %	7,83 %	-12,05 %
Fathers receiving soc.benefits	1,02 %	8,82 %	-8,82 %	4,90 %	-6,86 %

There were 1.66% of mothers and 1.02% of fathers who received social benefits among the sample's parents. When comparing parent living in close proximity to maternal grandparents, then there are 0.19% *more* mothers and 0.09% *more* fathers receiving welfare benefits than on average in the whole sample. The mothers and fathers who live further away from grandparents are *less likely* to be receiving social benefits comparing with the average: respectively -0.20% and -0.09%. Similar pattern is observed when looking upon proximity to paternal grandparents: there are 0.13% *more* mothers and 0.05% *more* fathers getting welfare transfers compared to the average in the sample, and 0.20% *less* mothers and 0.07% *less* fathers getting these benefits if living far away from paternal grandparents.

Clearer differences are seen if one considers the average percentage of mothers and fathers receiving social benefits as a point of reference as presented in the last two rows in the table 7. Then 11.45% *more* mothers received social benefits when living close to maternal grandparents, and 7.83% *more* mothers than average received social benefits when living close to paternal grandparents. There are 12.05% *less* mothers living further away and receiving social benefits compared to an average of those who were receiving these benefits. The same trend is observed concerning fathers, but to a lesser degree.

Sub- sample of families with all intergenerational ties intact

Sub-sample in which grandchildren have all four grandparents alive and still married is generated, and some of the variables used to characterize the analytical sample are also used to investigate this sub-sample (table 8). In this sub-sample 37.52% of grandchildren live close-by to both maternal and paternal grandparents, and one fifth do not have any of the grandparents living nearby. There is however a large difference in number of grandchildren living in close proximity to paternal grandparents: 62.52% live close-by while only 37.48% live far away. The differences between these two variables are smaller regarding maternal grandparents: 53.77% live close-by while 46.23% live away.

Table 8. Descriptive statistics on some chosen variables for families with all intergenerational ties intact

	All	Near maternal grandparents	Far from maternal grandparents	Near paternal grandparents	Far from paternal grandparents
Number of observations	46 046	24 759	21 287	28 787	17 259
in per cent	100,00 %	53,77 %	46,23 %	62,52 %	37,48 %
Dependent Variable					
Grade Point Average	4,12	4,06	4,18	4,06	4,21
Std.dev.	0,7704	0,7680	0,7685	0,7663	0,7686
Parent's income variables					
Mother's average earnings	146 046,10	141 690,30	151 112,30	139 940,70	156 229,60
Std.dev.	92 906,24	87 959,78	98 106,13	86 092,19	102 472,60
Father's average earnings	328 117,40	319 973,40	337 589,80	312 980,00	353 365,80
Std.dev.	196 587,10	192 960,30	200 311,50	175 114,60	225 702,90
Mother receiving soc.benefits	1,59 %	1,83	1,31	1,78	1,28
Father receiving soc.benefits	0,99 %	1,14	0,81	1,06	0,86
Parent's educational variables					
Father					
Compulsary	6,54 %	7,50 %	5,42 %	7,57 %	4,82 %
Secondary or equivalent	61,19 %	65,76 %	55,87 %	67,79 %	50,18 %
Bachelor or leading to Bachelor	22,28 %	19,74 %	25,23 %	18,43 %	28,70 %
Higher than Bachelor degree	9,59 %	6,57 %	13,10 %	5,81 %	15,90 %
Unknown	0,40 %	0,43 %	0,38 %	0,40 %	0,40 %
Mother					
Compulsary	5,41 %	6,16 %	4,55 %	6,07 %	4,32 %
Secondary or equivalent	60,50 %	64,79 %	55,52 %	65,57 %	52,04 %
Bachelor or leading to Bachelor	30,45 %	26,59 %	34,94 %	26,24 %	37,48 %
Higher than Bachelor degree	3,51 %	2,35 %	4,85 %	2,01 %	5,99 %
Unknown	0,13 %	0,11 %	0,14 %	0,11 %	0,17 %
Demographic variables					
Father's age	28,77	28,37	29,24	28,6	29,14
Std.dev.	4,07	4,04	4,07	4,06	4,09
Mother's age	26,59	26,09	27,18	26,20	27,23
Std.dev.	3,91	3,87	3,88	3,87	3,91
Mother's age with her first born	24,30	23,70	24,90	23,80	24,95
Std.dev.	3,44	3,28	3,52	3,35	3,48
Maternal grandmother's work status	27,79 %	30,11 %	25,06 %	29,79 %	24,41 %
Paternal grandmother's work status	20,38 %	21,99 %	18,46 %	21,24 %	18,89 %

Notes: All age categories are generated considering the age of a parent when a grandchild was born. St.dev. is standard deviation of a variable just above.

On average children in this sub-sample attain 4.12 (std.dev. 0.7704) in their grade point average which is somewhat (but not significantly) higher than in the analytical sample. When comparing to the descriptive data with the ones for the analytical sample, it is observable that on average, mothers' earnings are lower and fathers' earning higher for this sub-sample with all intergenerational ties intact, but within a range of normal variation.

On the other hand, proportion of both mothers and fathers receiving social benefits is smaller, also when considering across group comparison, though a pattern across groups of proportion of parents receiving social benefit remains the same as in the analytical sample. Grandmother's working status indicator is also proportionally more observed in the sample with all intergenerational ties intact. There is lower proportion of mothers with primary education in the sub-sample versus the analytical sample, but patterns observed in the analytical sample regarding proximity in relation to educational levels remain the same. There is an implication that the sub-sample consists of families with somewhat more resources available compared to the analytical sample, but the differences are fairly marginal. Moreover, the analytical sample and the sub-sample with all intergenerational ties intact are relatively similar.

Selection bias in data

Based on the presentation on the descriptive statistics there is a clear pattern emerging in characteristics regarding families who live close-by versus far away from the grandparents. Families living close-by tend to have less earnings, higher proportion of mothers and fathers receiving social benefits, higher proportion of parents with compulsory and secondary educational levels, and lower proportion of higher educational levels, than on average in the sample. It is apparent that families with fewer resources choose or select to locate their households in close proximity to the grandparents'. This means that selection bias will be influencing the estimates of the proximity variables in the regression analyses conducted because a comparison will be made basically between two groups: those coming from families with fewer resources (residing close-by the grandparents) versus those who are having more resources (residing far away from the grandparents).

Results

The Ordinary Least Squared Regression analyses presenting the association between grade point average of a grandchild and proximity of maternal and paternal grandparents are done by building up the main model by adding groups of control variables: firstly demographic variables for grandchildren, parents and grandparents, thereafter lastly adding parent's socioeconomic variables. This particular stepwise process is chosen in order to illustrate the impact of each group of control variables on the association between dependent and explanatory variable, and allows therefore distinguishing the category of importance differentiated by belonging to the generation (grandchild, parent or grandparent) as well as to characteristics of the categories (demographic or socio-economic).

In order to observe if there is *any* association between grade point average of children and proximity of maternal and paternal grandparents, a simple model is generated, presented as Model 1* in table 4. Contrary to an expected positive association, a negative and significant one is found with equal estimated coefficients -0.1, for proximity of maternal and paternal grandparents. As very low R^2 -adjusted is indicating, there are many unobserved factors which explain GPA; therefore the model has to be controlled for other available variables and investigate how these affect the explanatory variables' estimates. At this stage school fixed effects are introduced to exclude variation among schools. Though controlling for school fixed effects in Model 1 does not generate large differences in estimates of explanatory variables, the presentation of further models developed will take into account school fixed effects. This enables the reader to follow the different variable changes across models on similar terms, because, as presented in Appendix II, school fixed effects account for some variation in proximity variables of interest, especially in the later stages of the main model development. Taking into account school fixed effects, both of the proximity variables are also significant compared to OLS regression without fixed effects.

Introducing grandchild specific control variables (gender, number of younger and older siblings, cohort, birth of month and municipality size) does not change the estimated beta coefficient of proximity to maternal and paternal grandparent, and is shown in Model 2. The proximity variables are still statistically significant at 0.1% level. The model confirms that being a female is positively associated with better grades. Having older siblings has a significant negative effect on children's grades, and this seems to be increasing in strength to

further negative direction as the number of older siblings increases. In contrary, having younger siblings show positive influence on children's grades and this association is increasing in strength up to two younger siblings and thereafter decreasing in strength as well as in significance levels.

There is in the meantime positive and in few cases of coefficients that are larger than the proximity coefficients, when controlling for the month a child was born in, implying that month a grandchild was born in has more to say for GPA than grandparents' proximity. When using grandchildren born in December as a reference, grandchildren born in the first five month of a year are more advantaged in getting better grades. Grandchildren's cohort specific positive influence on their grades is also observed when comparing to children born in 1986. The size of the residence area does not influence the grades directly, thus despite somewhat strong coefficients, these are not significant.

Model 3 presents results when adding parent's related demographic variables (mothers' and fathers' age when a grandchild was 12 years old, and age of mother when her first child was born). This has *reduced* coefficients of proximity variables, and the reduction is larger for proximity of maternal parents. When considering the strength of the demographic variables of the parents, it is observable that age of both parents is of significant importance (a reference category is the youngest age category [<23 years]). For mothers having their first child is associated positively as their age having their first child increases. There is an increasingly positive influence of mothers' age categories: older mothers induce higher grades than their younger peers. The same effect is observed among fathers' age categories, however not in the same degree as for mothers.

When adding grandparent specific variables presented in model 4, their age and their status as living alone as well as indicator of employment in terms of pension points, the proximity coefficients do not change considerably. This implies that there are no systematic differences observed between grandparents living close-by versus living far away based on these variables, similarly to that what was noted regarding grandchild specific covariates. Only grandmothers' age categories are significant, and positive. There is a small difference in coefficients among the age groups, but maternal grandmothers' age coefficients are slightly larger than for paternal grandmother, though the same trend in coefficients' trend across age groups is observed: it is only increasing in strength with increasing grandmothers' age. Age

categories of grandfathers do not show any statistical significance, but in some categories the coefficients are negative. Having a maternal or paternal grandparent living alone seems equally negative statistically significant at 0.1% level. On the other hand maternal or paternal grandmothers having worked and earned pension points has in itself positive effect on grandchildren's grades.

In Model 5 earnings and reception of social benefits status' variables of grandchildren's parents are added. Introducing these control variables in the model reduces somewhat the negative effect of proximity of maternal and paternal grandparents on grandchildren's grades and increased the model's explanatory power from 19.52% to 23.26%. All income related variables are significant at 0.1% level. It is observable that grade point average for children increases positively as parents' income increases. Situations in which mothers and/or fathers receive social benefits, i.e. sick leave, unemployment benefits etc., has a negative influence on grades of the grandchildren concerned.

Mothers' income has larger effect than fathers' income with coefficients respectively $1.62e-06$ and $1.03e-06$ i.e. for each crone a mother and father earns, the average grade increases by the constant. For sake of easier presentation, this coefficient states that per each 10 000 Norwegian cronas a mother earns per year, average grade of her child increases by 0.0162 points (0.0103 points for father's matter). The effect is increasing, but diminishing with higher earnings, and diminishing in greater extent for mothers (coefficient $-1.23e-12$) than for fathers (coefficient $-2.99e-13$). Estimated coefficients of the cubic value of income show values for mothers' $2.23e-19$ and for fathers' $1.93e-20$. It is negative for both of the parents receiving social benefit; coefficients estimated of value -0.11 for mothers and -0.12 for fathers.

Finally, in Model 6 also educational variables of the parents are included, and as noted earlier, these capture also some of the effects of grandparents' educational effects. This control variable forces the coefficient of proximity to paternal grandparents becoming positive, thus at a very low level: 0.0096. The coefficient of proximity to maternal grandparents remain still negative, but to a lesser extent: -0.0090 . This means that the effect of grandparent's proximity is estimated to zero (statistically significant at 5% level). The model 6 in detail is presented in Appendix III. The educational level of mothers shows clearly that the higher the education, the greater positive effect of children's grades, the coefficients are considerably large, the

largest ones within the model. The same trend is observed for fathers, but to a lower extent. Model's explanatory degree has increased from 23.26% to 29.55%.

Though not shown in the table 9, if adding parents' educational variables in model 3 instead of their demographic variables, the association between grandparent's proximity and GPA reduces immediately to -0.0252 (***) for maternal grandparents and 0.0012 for paternal grandparents (not significant). This implies that the change influenced by demographic variables added in the Model 3 is capturing the educational level of parents, since age and education is correlated. This leads to conclusion that parents' educational level is the decisive one in determining whether there are any systematic differences between living close-by or further away from grandparents, and proximity of grandparents as such does not have an effect on GPA of grandchildren when education is controlled for.

If the same model takes into consideration both school and birth of year fixed effects, the proximity variable of maternal grandparents remains negative: -0.01 , and proximity to paternal grandparents also 0.01 , but positive, at 1% significance level both values. R^2 -adjusted in this case is 30.05%.

If municipality fixed effects are used instead of school specific fixed effects, there is a minor change in coefficient size of proximity variables: proximity of maternal grandparents is estimated to associate for -0.0086 of average grade value, and is significant at 5% level. Proximity of paternal grandparents gets a coefficient, significant at 1% level: 0.0107 . These estimates are similar to findings from the main regression, though significance level of paternal grandparental proximity has increased, showing that the estimates of the main regression analysis are rather stabile.

Model 6 accounts for controls it was possible to attain considering limited time for this project, however these are accounting for several dimension of the proximity variables of interest, and so far can be suitable to be called the main regression model of the study. Higher score of R^2 -adjusted indicates that a model with school and birth year fixed effects might be a better model; however, in Stata program it is extremely time consuming to apply, therefore Model 6 with school fixed effects will be applied also in sub-sample analysis part.

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Table 9. Models developed considering groups of control variables

Variables	Model 1*	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dependent variable: 10th Grade Point Average							
Proximity maternal grandparents	-0.1035*** (0.004)	-0.1018*** (0.0041)	-0.1047*** (0.0039)	-0.0545*** (0.0038)	-0.0518*** (0.0038)	-0.0448*** (0.0037)	-0.0092* (0.0036)
Proximity paternal grandparents	-0.1101*** (0.004)	-0.1023*** (0.0042)	-0.1047*** (0.0041)	-0.0652*** (0.0039)	-0.0654*** (0.0039)	-0.0431*** (0.0038)	0.0094* (0.0037)
Controlled for							
School specific fixed effects:		X	X	X	X	X	X
Child specific covariates			X	X	X	X	X
Parent's specific covariates				X	X	X	X
Grandparents specific covariates					X	X	X
Parents' income						X	X
Parents' education							X
Constant	4.2028	4.2*** (0.0036)	3.8935*** (0.0132)	3.2308*** (0.0163)	3.1286*** (0.0327)	2.7692*** (0.0324)	2.5866*** (0.0317)
R ² adjusted	0.0104	0.0104	0.1236	0.1857	0.1960	0.2330	0.2957
N	151 092	151 092	151 092	151 092	151 092	151 092	151 092

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Model 6 controlled for school and cohort specific fixed effects provide coefficient for proximity to maternal and paternal parents respectively: -0.011** and 0.009*, R² adjusted is 0.3018

The relevance of municipality size in the regression presented above could be questionable; however this seems not to be an irrelevant variable because including it in the regression does not reduce R^2 -adjusted nor the t-scores of the proximity variables if compared to a regression equations not considering this dummy variable (Studenmund, 2006).

R^2 value accounts for percentage of prediction accuracy considering the variables in the model, and in social science studies R^2 of 0.20 is considered a very good value (Neuman, 2009). In this study the main regression model R^2 -adjusted (which takes into account also degrees of freedom) is above this level, therefore providing a rather good prediction accuracy.

Sub-sample analyses

Several sub-sample analyses are conducted in order to investigate if there are any differences among different kinds of samples, like gender of grandchildren, educational levels of parents, number of people in a household etc. A number of the model presented for each subsample is indicated alongside with the criterion of the subsample. Significance levels of the remaining sample generated in this type of regression analyses with school fixed effects are presented with a star (*); when it is not present, the estimated coefficient is not significant.

1) ***Gender***, model S1, table 10

For male grandchildren coefficient for proximity to maternal grandparents becomes -0.0079, while for paternal parents it is 0.0012, although none of these variables are statistically significant. Being a girl reproduces coefficient value -0.011 for maternal grandparents' proximity and 0.018 for paternal grandparents' proximity. These, in contrary to results generated to boys, are significant at 5% and 0.1% level, respectively. Also in this case it means that the association between GPA and proximity variables is 0 and there is no difference observed based on gender.

When comparing coefficients for educational levels of mothers and fathers across these two sub-groups, it is observable that coefficients are larger for mother's educational categories in regression results for girls 0.2651 for secondary education or equivalent, 0.5088 for Bachelor degree leading education, and 0.5886 for more than Bachelor degree level education, with reference to primary education) versus boys (respectively 0.2138, 0.4833 and 0.5608), indicating, that for girls mother's education has greater effect than for boys. Similarly, when comparing coefficients for father's educational categories, the coefficients are larger for boys

(0.2206 for secondary education or equivalent, 0.4789 for Bachelor degree leading education, and 0.5339 for more than Bachelor degree level education, with reference to primary education) than for girls (respectively 0.1862, 0.3996 and 0.4697), thus for boys it is father's education which has marginally more to say compared to girls. It is important to note that despite these small differences, it is still the mother's education which is more important on grade point average measure than father's education.

2) *Mother's age*, model S2 and model S3, table 10

Sub-sample regression analyses were conducted to investigate if there is any distinct age of mothers which would entice different associations between proximity to grandparents and child outcomes measured in terms of GPA. On one hand, one would anticipate that there might be different effects of proximity to maternal and paternal grandparents for young mothers, i.e. younger than 18 years old, since the time of giving birth corresponds with their graduation of secondary education, and would interfere with this, with further negative influences on their own outcomes. In general, it does not favor children's outcomes if mothers giving birth are teenagers (e.g. Shaw, Lawlor, & Najman, 2006), and consequently, since these mothers lack some resources, proximity to grandparents might be of importance to compensate for these, therefore influencing the association between GPA of grandchildren and proximity of grandparents. On the other hand, one would anticipate that associations of interest for this study would differ from the rest on the sample when mother's are 35 or above this age when getting their children since it is becoming an increasing trend in developed countries, like Norway. These mothers are anticipated holding higher educational degrees or longer work experience. The descriptive data support this idea, since mothers in this category are twice more likely to get higher education than Bachelor degree (7.32% versus overall 3.31%), also probability of getting Bachelors degree or education leading to it is higher (41.10% versus overall 29.53%), however there is also evidence that older age when mothers give birth might have no influence on grandchildren's wellbeing (Boivin, et al., 2009).

And indeed, there were found empirical implications for two week "breaks" – when mothers were 30 years old or less, and when they were 47 years old or more. Mother's aged at maximum 30 years when children were 12 years old implies that these children were born when mothers were 18 years old or less, i.e. very young mothers, and these constitute to 1 103 mothers in the sample. On the other hand, 8 660 mothers aged 47 or more were minimum 35 years old when getting their children, thus their age of giving birth was on average higher

than for other mothers. This division of age categories does not specify whether mothers at these age groups got their first born children, only children within the sample are accounted for.

When considering only mothers aged 18 years or less when grandchildren were born, the regression analysis presents larger coefficients on both maternal and paternal grandparents' proximity variables (i.e. larger influence on proximity variables), thus without changes of signs. Coefficient for close-by residing maternal grandparents becomes -0.085 (versus -0.0084* for the rest of the sample), and for paternal grandparents 0.128 (versus 0.009* for the rest of the sample). Especially the last increase can be considered as large enough to impose an influence on grandchildren's grades. However, these results are not significant, but this might be result of the few observations this sub-sample consists of.

When considering mothers 35 years old or older when grandchildren were born, coefficient of proximity variable for maternal grandparents have increased in negativity value to -0.031 (versus -0.0079* for the rest of the sample), while for paternal parents have actually become negative -0.013 (versus 0.0105** for the rest of the sample). The coefficients are not significant, but also in this case might be attributed to low number of observations in this subsample category.

3) *Mother's educational level*, model S4 and model S5, table 10 and table 11

Subsample analysis was conducted on each of mother's educational levels, i.e. four levels, however for the last two highest levels (Bachelor degree or education leading to this degree and higher educational level than Bachelor degree) similar patterns in regression analyses were found, and these were therefore combined leading to examination and presentation of sub-sample results for three levels; only levels 1 and 3 are presented since these provide a meaningful comparison between groups. Grandchildren of mothers with unknown educational level were excluded from this sub-sample analyses, therefore number of observations are by 178 less than in the analytical sample.

Starting with the *compulsory level (level 1)*, there is a slight increase in coefficients of interest; however the change has not increased the association degree on GPA to a great extent. Coefficient for proximity to maternal grandparents is -0.0198 (versus -0.0083* for the rest of the sample), and for paternal grandparents 0.018 (versus 0.009* for the rest of the sample), though not significant. There are in total 11 046 mothers with this educational level.

If highly educated *mothers with Bachelor degree or education leading to this degree, as well as mothers with higher than bachelor degree attainments (level 3)* (in total 46 377 such mothers) are selected as a subsample criterion, the proximity coefficient with regard to maternal grandparents becomes: -0.0166 (versus -0.006 for the rest of the sample) and is significant at 1% level. With regard to paternal parents the analysis uncovers a negative, non-significant value of -0.0083 (versus 0.0185***).

Regression analyses constant coefficients for level 1 education is lower than for level 3 education, 2.5642 and 3.3796 respectively, indicating that grade point average for children with mothers with lower education is on average lower already at the starting point (i.e. keeping all other variables as zero) than that of mothers with higher education. However complexity due to many variables in the regression analyses does not allow explaining this constant entirely.

4) *Father's educational level*, model S6 and model S7, table 11

The approach as for investigating effects of mothers' educational levels in grade point average of children was also applied for fathers' educational levels, i.e. three educational levels. Similarly to procedure for sub-sample criteria for mothers' educational levels, also fathers' educational levels were, first of all, looked upon on four levels, thereafter levels 3 and 4 were combined. Grandchildren of fathers with unknown educational level were excluded from this sub-sample analyses, therefore number of observations are by 320 less than in the analytical sample.

Regression results on total of 13 303 fathers with lower educational level corresponding to *compulsory or primary level (level 1)* show a positive value on *both* maternal and paternal grandparents' proximity (respectively 0.0023 and 0.0331), but still higher, as well as significant at 5% level, value for paternal line. The corresponding variables in the remaining sample get coefficients -0.0093 for maternal grandparents' proximity and 0.0071 for paternal grandparents' proximity. Similarly to the results on mothers' lower educational level, paternal father's corresponding categories all show non-significant, positive effects on grades.

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Table 10. Sub-sample analyses models with specified criteria, Models S1 to S4

Variables	Model S1		Model S2		Model S3		Model S4	
	Gender		Mother's age		Mother's age		Mother's educational level	
Dependent variable: 10th Grade Point Average								
	Females	Males	[≤18 years]	(>18 years)	[≥35 years]	(<35 years)	Level 1	> Level 1 ⁶
With school specific fixed effects:								
Proximity maternal grandparents	-0.0112* (0.0049)	-0.0079 (0.0052)	-0.0850 (0.0755)	-0.0084* (0.0036)	-0.0313 (0.0161)	-0.0079* (0.0037)	-0.0198 (0.0156)	-0.0083* (0.0037)
Proximity paternal grandparents	0.0184*** (0.0051)	0.0012 (0.0054)	0.1283 (0.0809)	0.0090 (0.0037)	-0.0136 (0.0163)	0.0105** (0.0038)	0.0180 (0.0161)	0.009* (0.0038)
Controlled for								
Child specific covariates	X	X	X	X	X	X	X	X
Parent's specific covariates	X	X	X	X	X	X	X	X
Grandparents specific covariates	X	X	X	X	X	X	X	X
Parents' income	X	X	X	X	X	X	X	X
Parents' education	X	X	X	X	X	X	X	X
R ² adjusted	0.2476	0.2514	0.1589	0.2943	0.2511	0.296	0.2028	0.2780
N	73 522	77 570	1 103	149 989	8 660	142 432	11 046	139868

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

⁶ Level 1 compared to Level 2 and Level 3 where Level 3 consists of Bachelor degree or education leading to this level and higher education than Bachelor degree

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Table 11. Sub-sample analyses models with specified criteria, Models S5 to S8

Variables	Model S5		Model S6		Model S7		Model S8	
	Mother's educational level		Father's educational level		Father's educational level		Maternal grandmother employment status	
Dependent variable: 10th Grade Point Average								
	Level 3	< Level 3	Level 1	> Level 1 ⁷	Level 3	< Level 3	Yes	No
With school specific fixed effects:								
Proximity maternal grandparents	-0.0166** (0.006)	-0.006 (0.0045)	0.0023 (0.0137)	-0.0093* (0.0037)	-0.0135* (0.0061)	-0.0067 (0.0044)	-0.0217** (0.0082)	-0.0055 (0.0040)
Proximity paternal grandparents	-0.0083 (0.006)	0.0185*** (0.0047)	0.0331* (0.0146)	0.0071 (0.0039)	-0.0001 (0.0061)	0.0155** (0.0045)	0.0233** (0.0086)	0.0050 (0.0042)
Controlled for								
Child specific covariates	X	X	X	X	X	X	X	X
Parent's specific covariates	X	X	X	X	X	X	X	X
Grandparents specific covariates	X	X	X	X	X	X	X	X
Parents' income	X	X	X	X	X	X	X	X
Parents' education	X	X	X	X	X	X	X	X
R ² adjusted	0.1895	0.2214	0.2332	0.2812	0.1876	0.2278	0.2892	0.2965
N	46 377	104 537	13 303	137 469	44 126	106 646	31 294	119 798

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

⁷ Level 1 compared to Level 2 and Level 3 where Level 3 consists of Bachelor degree or education leading to this level and higher education that Bachelor degree

Highest level of education among fathers (level 3) induces an opposite effect of the one observed in the remaining sub-sample regarding proximity to paternal grandparents; the coefficient becomes negative, but very close to zero: -0.0001. Proximity to maternal grandparents shows still negative influence on grades having a coefficient: -0.0135. There are 44 126 fathers with this educational level in the sample.

Regression analyses constant coefficients for level 1 education is lower than for level 3 education, 2.578 and 3.437 respectively, indicating that grade point average for children with fathers with lower education is on average lower already at the starting point when all other regression variables are kept as zero, compared to that of fathers with higher education. The coefficients for level 1 and level 3 are almost identical for both mothers and fathers.

5) ***Maternal and paternal grandmothers' employment status***, model S8 and model S9, table 11 and table 12

When separating 31 294 grandchildren with maternal grandmothers who have earned pension points from the rest of the sample, coefficients of proximity to maternal grandparents become -0.0217, and to paternal grandparents 0.0233, both significant at 1% level. Respective values for the proximity variables for the rest of the sample are -0.0055 and 0.005, statistically insignificant.

If distinguishing criterion for the sub-sample is that paternal grandmothers have earned pension points (21 872 children in this case), the coefficients for proximity to maternal and paternal grandparents is insignificant, respectively: -0.0032, and 0.0056 while for the remaining sample these are -0.0107** (maternal line) and 0.0095* (paternal line).

6) ***Municipality size***, model S10 and model S11, table 12

As discussed in the Literature Review, there is some empirical evidence suggesting that rural versus urban areas have different influence on grandparent-grandchild relationships. This is further investigated in a sub-sample analyses with respect to small municipalities (with population of less than 4999 people) and with respect to large municipalities (with population size of more than 50 000 people).

Small municipalities versus other municipalities: there are 23 116 children in the sample who lived in this type of municipalities, and the regression analyses show insignificant, but positive coefficient of value 0.0007 for maternal grandparents' proximity; and significant at 1% level coefficient of value 0.0277 for paternal grandparents' proximity.

**Do grandchildren perform better at school if maternal and paternal grandparents live close-
by versus when they don't?**

Table 12. Sub-sample analyses models with specified criteria, Models S9 to S12

Variables	Model S9		Model S10		Model S11		Model S12	
	Paternal grandmother employment status		Municipality size		Municipality size		Mother has ≥ 3 siblings	
Dependent variable: 10th Grade Point Average								
	Yes	No	Small	Other	Large	Other	Yes	No
With school specific fixed effects:								
Proximity maternal grandparents	-0.0032 (0.0099)	-0.0107** (0.0039)	0.0007 (0.0094)	-0.0109** (0.0039)	-0.0096 (0.0067)	-0.0096** (0.0043)	-0.0207** (0.0063)	-0.0023 (0.0045)
Proximity paternal grandparents	0.0056 (0.0103)	0.0095* (0.0040)	0.0277** (0.0102)	0.0047 (0.0040)	-0.0165* (0.0069)	0.0167*** (0.0045)	0.0226** (0.0065)	0.0029 (0.0046)
Controlled for								
Child specific covariates	X	X	X	X	X	X	X	X
Parent's specific covariates	X	X	X	X	X	X	X	X
Grandparents specific covariates	X	X	X	X	X	X	X	X
Parents' income	X	X	X	X	X	X	X	X
Parents' education	X	X	X	X	X	X	X	X
R ² adjusted	0.2768	0.2979	0.2931	0.2975	0.2994	0.2926	0.2979	0.2945
N	21 872	129 220	23 116	127 976	42 029	109 063	52 046	99 046

* $p < 0,05$, ** $p < 0,01$, *** $p < 0,001$

Because only the value of variable indicating maternal grandparents living close-by is significant at 1% level, and not the other one, one cannot conclusively state that there are any distinguishing systematic differences between the association of grandparents' proximity and GPA in small versus other places.

Large municipalities versus other municipalities: 42 029 children lived in large municipalities, and regressing proximity variables of interest with control for other variables on grade point average shows that there is statistically significant difference between grandchildren who's *paternal* grandparents live close-by: in the sub-sample the coefficient for this dummy variable is significant at 5% level of a negative value -0.0165 versus 0.0167*** for the rest of the sample. Proximity variable for maternal grandparents' proximity is the same for both sub-samples though statistically significant only for the remaining sample.

7) ***Mother and father has more than 3 siblings each***, model S12 and model S13 , table 12 and table 13

Possibility of many cousins present in a grandchild's life expects to reduce grandparental time spent with each of the grandparent separately. And if there are many cousins, the time becomes a limited resource for grandparents to divide among all the grandchildren. This effect would be enhanced by geographic barriers. This aspect is tried to be captured by variable indicting how many siblings does a mother and father (each) has. Hereby a subsample is distinguished with grandchildren who have 3 or more aunts or uncles form mothers, and then fathers side. The number 3 is chosen arbitrary.

Within the sub-sample of grandchildren with mothers having 3 or more siblings, the proximity variable of maternal grandparents has a coefficient -0.0207, and of paternal grandparents: 0.0226, both of these values are statistically significant at 1% level. This sub-sample is not though statistically different from the remaining sub-sample since the coefficients for the proximity variables for the last one are not significant.

If fathers with 3 or more siblings are considered, the variables of interest get -0.0072 for maternal line and 0.0115 for paternal line grandparents. Neither these nor the coefficients for the remaining sample are statistically significant at 1% level.

8) ***Grandchildren with no older siblings***, model S14, table 13

Grandchildren with no older siblings have also been chosen as a sub-sample since one would expect more influence of grandparents on the first born grandchildren than when several

others are present and competing for attention and resources. In this case a sub-sample of 66 297 children is distinguished, and the regression analysis provide a significant at 5% level value -0.0132 for variable characterizing proximity of maternal grandparents, and insignificant value of 0.0035 for paternal grandparental proximity.

It is however not possible to state that those grandchildren who are the eldest or the only ones in the family have significantly different association effects of grandparental proximity compared to other grandchildren, since value for maternal grandparent proximity is statistically insignificant -0.0053 and for the paternal line it is significant at 1% level with a value of 0.0135 .

9) *Children with no younger siblings*, model S15, table 13

If a child does not have any younger siblings, the proximity association strength on GPA from maternal grandparents' proximity side becomes 0.0013 , while from paternal grandparents' side 0.0069 . Though none of these values are statistically significant, there is a change in sign for proximity variable of maternal grandparents, which is -0.0141 (sign. at 1% level) for the remaining sample. For the remaining sample also the coefficient for proximity of paternal grandparents is significant at 5% level, valued 0.0102 . Most probably there is no significant difference for grandparental influence on these grandchildren as for the rest of the grandchildren in the sample, and insignificance issues for the sub-sample of interest cannot be attributed to low number of observations.

10) *Grandchildren in families who have relocated within 6 years from/within the last municipality registered when children were 6 years old*, model S16, table 13

Since relocation is tightly linked with geography and location-specific capital, a sub-sample was identified to investigate whether relocation influences also degree to which grandparental proximity variable effects average grades of these grandchildren. The coefficient attained for maternal grandparental proximity shows insignificant value of -0.0149 , while for paternal line it is also insignificant, but negative: -0.0068 . Hence, there is no statistical evidence that relocation influences grandchildren's grades also through proximity variable of grandparents when comparing to grandchildren who have not moved to another location with their families.

**Do grandchildren perform better at school if maternal and paternal grandparents live close-
by versus when they don't?**

Table 13. Sub-sample analyses models with specified criteria, Models S13 to S16

Variables	Model S13		Model S14		Model S15		Model S16	
	Father has ≥ 3 siblings		No elder siblings		No younger siblings		Household relocation	
Dependent variable: 10th Grade Point Average								
	Yes	No	Yes	No	Yes	No	Yes	No
With school specific fixed effects:								
Proximity maternal grandparents	-0.0072 (0.0063)	-0.0092* (0.0044)	0.0013 (0.0061)	-0.0141** (0.0045)	-0.0132* (0.0054)	-0.0053 (0.0049)	-0.0149 (0.0086)	-0.0094* (0.0040)
Proximity paternal grandparents	0.0115 (0.0066)	0.0074 (0.0046)	0.0069 (0.0063)	0.0102* (0.0046)	0.0035 (0.0056)	0.0135** (0.0050)	-0.0068 (0.0086)	0.0080 (0.0042)
Controlled for								
Child specific covariates	X	X	X	X	X	X	X	X
Parent's specific covariates	X	X	X	X	X	X	X	X
Grandparents specific covariates	X	X	X	X	X	X	X	X
Parents' income	X	X	X	X	X	X	X	X
Parents' education	X	X	X	X	X	X	X	X
R ² adjusted	0.2987	0.2940	0.2848	0.3002	0.2875	0.2966	0.3354	0.2878
N	51 251	99 841	54 985	96 107	66 297	84 795	28 383	122 709

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

11) *Number of people in the household*, model S17 and model S18, table 14

Two types of regression analyses were conducted to investigate whether number of people in the household has any effect on the association of interest. In the first approach number of people in the household were identified to be 3 (i.e. a mother, father and one grandchild) versus other types of families. In this case regression analysis provides proximity coefficients with opposite signs to the remaining sample: for maternal grandparents 0.0321 and for paternal grandparents -0.0056, however these both are not statistically significant versus statistically significant at 1% level respective coefficients -0.0109 and 0.0099.

This implies that despite the opposite effects, there are no significant differences between proximity variables' influence on grades for very small and other types of families. However insignificance could be due to low number of observations – only 6 413 grandchildren came from such families.

Table 14. Sub-sample analyses models with specified criteria, Models S17 and to S18

Variables	Model S17		Model S18	
	Number of people in the household (1)		Number of people in the household (2)	
Dependent variable: 10th Grade Point Average				
	≥ 5	< 5	3	> 3
With school specific fixed effects:				
Proximity maternal grandparents	-0.0149** (0.0049)	-0.0018 (0.0053)	0.0321 (0.0197)	-0.0109** (0.0037)
Proximity paternal grandparents	0.0095 (0.0051)	0.0095 (0.0055)	-0.0056 (0.0204)	0.0099** (0.0038)
Controlled for				
Child specific covariates	X	X	X	X
Parent's specific covariates	X	X	X	X
Grandparents specific covariates	X	X	X	X
Parents' income	X	X	X	X
Parents' education	X	X	X	X
R ² adjusted	0.3098	0.2837	0.2801	0.2967
N	79 898	71 194	6 413	144 679

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Secondly, families with 5 and more people are looked upon separately because grandchildren from these families compete with at least 2 of their siblings for grandparents' attention. In this case, regression analysis estimates coefficients of the proximity variables to be -0.0149 (sign. at 1% level) for maternal grandparents and 0.0095 (insignificant) for paternal grandparents. The remaining sample provides insignificant values for these variables: -0.0018 for maternal

proximity line and 0.0095 for paternal proximity line. So there are no statistically found differences between families of at least 2 grandchildren and families with less than 2 grandchildren when it comes to association between proximity variables and average grades of the grandchildren.

12) *Alternative measure of close proximity between grandparent and grandchildren, model 7, table 15*

In the sample, there is a possibility of distinguishing another geographical distance level, i.e. if grandparents and grandchildren lived in the same small municipal area, or from now on, referred to as locality. This division of geographical area is rather detailed, but implies that if a grandparent and grandchild live in the same locality, they would be able to interact with each other on much more frequent bases since they would live a walking distance apart only. There were 14.21% of grandchildren living very close to maternal grandparents and 22.95% living close to paternal grandparents. 2.5% of grandchildren lived very close to both maternal and paternal grandparents.

Table 15. Models 7, an alternative measure of proximity applied

Variables	Model 7
	Very close proximity
Dependent variable: 10th Grade Point Average	
With school specific fixed effects:	
Proximity maternal grandparents	0.0020 (0.0050)
Proximity paternal grandparents	0.0218*** (0.0044)
Controlled for	
Child specific covariates	X
Parent's specific covariates	X
Grandparents specific covariates	X
Parents' income	X
Parents' education	X
Constant	2.5817*** (0.0315)
R ² adjusted	0.2958
N	151 092

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In this sample there is no case of co-residence with a grandparent, therefore confirming the findings of Hank (2005) that co-residence in Nordic counties is not common. When considering only very close proximity to grandparents as another measure of grandparental influence on grandchildren, i.e. that they live from a walking distance away, regression analysis on these grandchildren's attainments show a positive effect on grades when maternal grandparents live so close, coefficient 0.002 (though not significant), but ten times as positive association between grades and proximity to paternal grandparents with a coefficient 0.0218, significant at 0.1% level. However, also these values indicate zero correlation between GPA and the proximity variables.

13) *Families with all intergenerational ties intact*, model 8, table 16

Whether the association found from the main regression holds also for completely intact families, i.e. all grandparents alive and living together, as well as parents of the grandchildren living together, a regression analysis was conducted for this sub-sample separately without comparing to the remaining sample. The procedure used in presentation of previous sub-samples becomes too complex and time demanding, in order to attain it for this sub-sample since many types of variables were accounted for to attain this particular sample. Therefore only the proximity variables within this regression analyses output have to be considered without accounting for differences from the remaining sample.

By specifying intact families, 46 046 grandchildren were identified fitting the sub-sample criterion. Detailed results produced by the regression analysis with school and cohort specific fixed effects (interaction) are presented in Appendix IV (Model 9). Noticeably, proximity variables are both negative, insignificant and show an effect close to zero on grades. Thus, there is no statistical evidence that any of these variables account for influence on grades on grandchildren from intact families.

Concluding remarks

As presented, grandparents' participation possibilities, measured in terms of their proximity to their grandchildren show zero effect on grandchildren's grades, thus, the findings suggest that grandchildren do not perform better or worse when their grandparents are close-by compared when they are not very accessible because of geographic distance in between. Robustness of the findings are shown by conduction regression analysis with different fixed effects, also

sub-sample analysis results presented show that the findings are relatively stable and do not vary across different sub-samples.

Throughout the results of different models presented it is observed that in majority of cases, marginally proximity variable of paternal grandparents is larger than that of maternal grandparents. In the next chapter a discussion will be presented to investigate the magnitude and some implication on marginal differences between the proximity variables and their effect on GPA of grandchildren.

Table 16. Models 8; Model 6 applied to grandchildren's sample with all intergenerational ties are intact

Variables	Model 8
	Very close proximity
Dependent variable: 10th Grade Point Average	
With school specific fixed effects:	
Proximity maternal grandparents	0.0020 (0.0050)
Proximity paternal grandparents	0.0218*** (0.0044)
Controlled for	
Child specific covariates	X
Parent's specific covariates	X
Grandparents specific covariates	X
Parents' income	X
Parents' education	X
Constant	2.5817*** (0.0315)
R ² adjusted	0.2958
N	151 092

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Model 8 controlled for school and cohort specific fixed effects provide insignificant coefficients for proximity to maternal and paternal parents respectively: -0.0034 and -0.0054, R² adjusted 0.2964

Discussion

This research is investigating what effect there is from a near-by presence of grandparents on grandchildren's school performance assuming that geographic proximity enables more frequent and more varied contact, thus increased grandparental participation. In the empirical strategy maternal and paternal grandparental proximity to their grandchildren was anticipated to have positive effect on the children's GPAs, however, the results attained are in contrast to what was expected and what was estimated. Effect of close proximity of paternal grandparents is estimated to be positive, although the effect is essentially zero. The association between maternal grandparents' proximity and average grades of children is estimated to the same magnitude, however unexpected marginally in a negative direction. By adding different types of fixed effects⁸ in the model, the final estimates seem to be rather robust. Also sub-sample analyses indicate that the estimates are indeed converging to zero value. The estimates indicate that grandparental proximity to grandchildren account even less than the month of birth of the grandchild or grandchild's cohort specific influence on GPA.

The question raised is therefore – is this real effect of grandparental proximity or are there some underlying factors entailing this type of association? In this chapter an answer to this question will be tried to provided, as well as some implications of very marginal differences between estimates of maternal and paternal grandparents' proximity will be discussed.

Underlying theoretical foundation for this study is based on human and social capital availability and usage in families, as presented by Coleman (1988). Close geographic proximity of maternal of paternal grandparents in this regard, reinforced by the individualistic characteristics of Norwegian culture with a focus on directing available resources mostly to grandchildren and not grandparents, has to be considered as extra available human and social capital in a family. These extra resources available would in turn assumingly accommodate better learning opportunities for grandchildren by reflecting on their scores at school. When keeping other influential factors constant, it would be anticipated that grandparents' proximity should be a positive contribution to grandchildren's outcomes.

There are two central issues of the findings that have to be discussed in relation to the two main hypothesis stated in this study: the magnitude to the associations found between the dependent variable (GPA of grandchildren) and the direction of the association for maternal

⁸ School, municipality specific fixed effects, and interaction of school and cohort specific fixed effects

and paternal grandparents separately. This will be the main theme in the following two subsections.

Magnitude of the association

There was observed no real effect, though significant, of grandparents' proximity on grandchildren's performance at school. Consequently, the first hypothesis has to be rejected in favor of zero hypotheses that grandparents' proximity does *not* influence grandchildren's GPA. This seems to contradict the theoretical prediction, but as presented in the literature review, grandparent-grandchild relationship area is a complex one, and requires more thorough investigation.

During the main regression model's development, one can notice that it is the parental control variables which accounts for most of the influence in the association between grandchildren's school performance and proximity of grandparents (models 3, 5 and 6), while grandchild and grandparent specific characteristics do not account for any systematic differences in living close-by versus far away. This confirms the fact that parents' socio-economic status, especially educational level, is not only an extremely important determinant in grandchildren's outcomes, but also reinforces the systematic differences in choice of location, where parents with low education tend to live close-by the grandparents, and highly educated parents tend to live far away, thus selection bias is an issue in this study. Furthermore, in the study's sample, the level of resources available to the families is already at a high level, (if compared to non-intact families) according to theory that more parents in a household is considered as more human, social and financial resources available in a family system. But if a comparison is made within the sample characterizing families living close-by the grandparents versus far away, cross-tabulations in the descriptive part uncover that there are differences in demographic and socioeconomic variables. Living close-by are characterized by lower earnings of mothers and fathers, higher benefit transfers from the state, lower percentage of parents with higher and very high education compared to the families living far away from the grandparents. These families are in need of extra resources in form of also financial assistance, psychological advice etc. This reasoning is in line with the findings of Clark and Wolf (1992), Bordone (2009), and Michielin and Mulder (2007b) who stated that also more resources in a family tend to increase geographic distances between family members.

One would normally expect since parents make the rational choice to locate their household in close proximity to the grandparents, they are enabling better transfer and exchange of resources between family members (as indicated in the Literature review), thus one would expect actually positive effect of proximity on GPA of the grandchildren since the grandparents' help would be exerted in a greater extent. This is however not observed and is most likely caused by a selection bias problem in estimating real grandparent's proximity effects on GPA because two groups of comparison are those who are with insufficient resources available, and those who have enough of those, as reflected in educational levels. One would therefore assume that the positive effects of grandparent's proximity would be observed if comparison of proximity levels would be done *within* the groups of families with fewer resources *or* families with more resources *separately*.

Another alternative explanation is that the influence is mediated by parents, which is also according to the theory, thus implying that the arrows in Szinovacz's model do not indicate equal strengths, specifically those in direction from grandparents to grandchildren, at least not when outcomes are measured in GPA. By examining how proximity of grandparents influences grandchildren scholastic outcomes, attention is directed mostly towards direct influence processes, since geography has an effect on these, not the indirect processes. The essentially zero value estimates in this study might also indicate that direct influence is not as effective and decisive as indirect processes through parental influence on grandchildren in intact families, meaning that grandparents influence their grandchildren through parents' influence channel, and not directly. As suggested earlier, in non-intact families are assigned a greater responsibility where grandparents have to replace either mother or father of grandchildren, therefore allowing for efficient and stronger direct influence on grandchildren, as noted by several studies presented in the Literature Review. When grandparents have to step in the roles of parents (permanently or temporarily), consequently their mandate function in the family system changes, therefore allowing for greater participation and influence in grandchildren's lives. An example for this type of grandparental active participation and its consequences on grandchildren's outcomes is a study conducted by Hansen and Hawkes (Hansen & Hawkes, 2009). They find that in UK grandparental care in early childhood is positively associated with vocabulary test scores, as well as behavioral scores when measured for children at age three. In intact families, this means, that grandparents are not assigned this increased input function in development of a grandchild since sufficient resources are available compared to non-intact families, enhanced by good after-school programs, cultural

norm that states that grandparents have a support function only and do not engage in regular child care, so grandparents can step in only when necessary. Hence, there are no significant effects of their contributed resources in grandchildren's school performance.

This supports the idea that transfer of social capital in a family is conditioned on the *strength of the attachment* and grandparents do not appear to have it to a degree where influence occurs. So it is the parent-grandchild strength of the attachment which is the strongest one, and therefore the most influential one. One gets even more willing to support this view by the fact that even child specific covariates, which in its own force has an influence directly on their outcomes, does not influence an expected effect of near-by grandparents on the dependent variable. Parental mediation was not accounted for in the study's model because of the data limitations to measure it, and for future studies it would be of interest to incorporate this in quantitative research studies.

One can argue that the direct influence is of importance after all, in terms of grandchildren's wellbeing, resilience to withstand difficulties in development, understanding family origins (e.g. David, 2006). On the other hand, close to zero magnitude in the coefficients estimated could also mean that grandparents' influence might be on a different dimension in children's outcomes, and cannot be measured in average scores in subjects. The different dimension might be related to social behavior, e.g. a grandchild might be a very good student, but prefers rather to spend more time on social activities rather than reading only, therefore reducing GPA. So grandparents might influence grandchildren's behavior, but not their abilities to perform well at school, though Minter suggests that cognitive skills and behavior are interlinked (Masten & Coatsworth, 1998). This reasoning is also in line with the Human Capital theory, where a grandchild coming from families with fewer resources might have higher costs of studying relative to the grandchildren coming from resourceful families, therefore these grandchildren's attention might be directed to alternative use of time providing higher benefits than school performance can provide.

In general, the discussion so far implies that the probability for more frequent contact is a behavior maximizing decision which leads to increased flow of processes to exchange different capital (help, assistance, advice etc.) between the family members because not sufficient resources are present to start with. By making the location of residence decision this factor has been accounted for in parents' costs and benefit calculations with the best indented outcomes for their children. This apparently is a good rational decision, since though there are

differences between children's outcomes in terms of GPAs for children living close-by versus those who do not, these are not statistically significant. However, if the estimates are not the right ones because of the selection bias, no such conclusions can be drawn.

Age category variables for grandparents included those of deceased grandparents, but since grandparent's demographic variables had no influence on the association between grandparents' proximity and GPA, this does not seem to cause any problem in estimates of the proximity coefficients.

Direction of the association

The second hypotheses stated that maternal grandparents have a greater influence on grandchildren's outcomes compared to paternal grandparents. Also this hypothesis is rejected in favor of a zero hypothesis that no such association is present. Contrary to expectations, a marginal negative association is found between maternal grandparents' living close-by, and greater, and positive association in relation to paternal grandparent.

King and Elder (1995) research shows an interesting finding in regard to paternal grandparents having more influence on grandchildren than maternal grandparents which is also the case for this study. These researchers investigate grandparent-grandchild contact and relationship quality, and find that grandchildren in families with farming background tend to live closer to their grandparents, specifically paternal grandparents compared to families with no such background. These grandchildren rate also quality of their relationship with paternal grandparents higher than children from nonfarm families. It is probably arguable that in this study the distinction is between farm or nonfarm families, however the idea that greater prominence of paternal grandparents is in cases with more *interdependence* nature characterized by farm families. In that case, as King and Elder point out, the results are in contrast to other studies, but this particular study is a support for their findings. Sørli (2005) and analysis on Sweden data (Malmberg & Pettersson, 2008) have implied that in Scandinavian context, there is higher probability for females to relocate than the males, indicating that males have more location-specific capital than females. This study's data on the sample where all intergenerational ties are intact show that grandchildren tend to live closer to paternal grandparents than maternal grandparents. In the analytical sample an observation was made that in small municipalities the same pattern is present. Thus, patrilineal patterns observed among farm family characteristics, could be an underlying factor also in Norwegian context.

As mentioned already previously, in intact-families grandparents are extra resources available for the family, in this case, as parents make behavior maximizing decisions with regard to their own and grandchildren's desired outcomes considering costs and benefits the decision carries along, then proximity can be an indicator that the family sees a necessity to have these additional resources present. In that regard, the negativity of maternal grandparental proximity does not reflect the real effect as such, but other factors which imply that the family is lacking some resources and that is not a favorable starting point for a grandchild's school performance in any case. Hence, this factor is not incorporated or controlled for in the study's model. Therefore, maternal grandparents, who are according to previous theoretical predictions and empirical findings more influential among all grandparents, gets the negative magnitude on grandchildren's outcomes, since matrilineal is of high importance to a child, and lack of resources is more visible in this variable. Logically, since paternal grandparents do not play such an important role, either because of accessibility to grandchildren or other reasons, the lack of resources is not so visible in the variable indicating that these grandparents live close-by.

If that is the case, the findings contains omitted variable bias: estimated coefficient that is significant in the direction opposite from that expected is an indication of omitted variable bias (Studenmund, 2006). However, most of the relevant demographic, socio-economic and family structure variables are accounted for in the model considering that these were used in other studies (Lawton, et al., 1994; Malmberg & Pettersson, 2008). Because of uncertainly involved in variable estimating grandparent's educational levels, these were not added to the model, but there is evidence to educational level's heritage between generations, i.e. grandparent's educational attainments are mediated through parents' educational levels (e.g. Pettit, Tianyi, Dodge, & Bates, 2009). Grandparental covariates did not uncover any systematic differences between locations in relation to their grandchildren, therefore if there are any omitted variables in the model, these must be related to parents' covariates or must be highly related to these, and most probably would be a measure capturing a lack of some type of resources in the family.

One such measure could be cultural capital. This concept is often applied to explain how cultural knowledge, traits and behaviors affect educational outcomes independently of socioeconomic and family background variables (Jæger, 2009). Education is not able to capture this variable because of low correlation between them (DiMaggio). This study presents that cultural capital is rooted in cultural reproduction theory developed by Bourdieu.

Similar to the investment theory presented by Coleman (1988) and Haveman and Wolfe (1994), also cultural capital depends on three aspects: parents must possess it, by their investments, they have to transfer it, and children have to utilize it. Only when all three are present, educational outcomes are positively associated with cultural capital in a family. If this is the case, when such associations are present in a family, then these are passed over to younger generations, i.e. grandparental cultural capital through investments and utilization of it by parents, must be transferred to grandchildren if all aspects are present described are present. Based on the dataset available for this study, no possible construct of this concept can be made. But it is recommended for future studies to include also this variable in a model to investigate empirically its influence on grandparental proximity effect on grandchildren's grades. (Jæger, 2009)

Another opposing fact to the signs of proximity effects of maternal and paternal grandparents is presented in coefficient values of grandparent's age categories in the regression analysis, which confirms the hierarchy of grandparents in grandparent-grandchild relationships. Maternal grandmother's age categories are more influential on grandchildren's GPA, followed by paternal grandmother's age categories. Positive, and considerably influential, effects are present in both grandmothers' age categories; that does not allow disregarding their positive influence on their grandchildren's school performance. Interestingly, maternal grandfather's age categories show negative association (but in magnitude, disregarding the direction, to a much lesser degree compared to grandmothers) on GPA, but only two categories are significant. Finally, paternal grandfather's age categories are all positive and in small magnitudes, but seem not to play any significant role directly on children's outcomes.

Proximity variable measurement issues

The influence or participation indicator variable considered is proximity to grandparents. Though there is a clear link established between contact frequency and proximity throughout in literature, there is a possibility present that the intervening variable – contact frequency – is actually the one which describes grandparental involvement in a better way than geographic proximity. Geographic proximity might in this regard be an indicator whether a family is in need of some resources they do not possess which are available to other families who do not live near-by their grandparents. People with greater resources would have also opportunity of directing these to increase frequent visits among family member despite larger geographic distances.

King and Elder's (1995 p. 174) article give reason for another interpretation of the results. They find that, indeed, proximity is highly related to contact frequency ($r=0.65$); however it does have "little direct effect on the quality of relationship". Also Boon and Brussoni (1996) and Whitbeck et al. (1993) find support for this relationship. It raises a question – does grandparental influence depends on contact frequency or grandparent-grandchildren relationship quality. If the answer is contact frequency, then the above discussed alternative explanations are still valid, but if it is the relationship quality which is the foundation for influence, then proximity is not an appropriate variable to estimate the association of interest in this study. There is a modest correlation between contact and relationship quality ($r=0.30$), but proximity is influencing relationship quality through contact, with no direct influence on relationship quality. This might explain the insignificant associations of proximity variables on GPA of grandchildren. Nonetheless, Szinovacz (1998b) in his discussion on behavioral components of grandparents' role enactment relates quantity of grandparenting activities with investment of time and money, as well as involvement expressed as frequency of contact with grandchildren. This implies that involvement which is similar to participation is linked to contact frequency and not the quality of the relationship. In this case, proximity variables used in the study are appropriate units of measure of grandparental participation in grandchildren's lives.

Covariates and data for this study were gathered at an age when grandchildren were 12 years old, though graduation from primary educational level was at age 16 years. The difference of 4 years under which characteristics of the grandchildren, parents and grandparents was not observed might also have lead to inaccurate estimates of the real effects of grandparental proximity. It is therefore recommended to investigate the models applied in this study for age when a grandchild was 6 years old, as well as try to obtain more data on the remaining 4 years before the graduation.

In the literature review it was mentioned that also contact frequency with grandparents diminishes when children are attending school (Sticker, 1991; Tyszkowa, 1991), then in combination with the finding that also affection between grandparents and grandchildren is declining over the first 14 years, but then reversed modesty (Silverstein & Long, 1998), meaning that age 12 might not be the right age to measure grandparental influence at. On the other hand, Tyszkowa (1991) states that the emotional bond between grandparent and grandchild developed during grandchild's childhood endures, and this bond is supposedly developed to greater extent in early childhood when grandparents tend to have more frequent

contact with younger grandchildren. This would therefore mean that even when affection and contact is reduced between grandparents and grandchildren, the emotional closeness would enable influence to take place.

Discussion on findings observed in sub-sample analyses

The following part of the discussion will investigate how association between grandparents' proximity and GPA of grandchildren are for some specific sub-samples and relate it to literature and theory presented in the Literature Review. The discussion so far shows that the interpretation of the findings can have different viewpoints; therefore the angles of the problem must be taken in to consideration also when investigating the sub-samples. Following the same layout so far, firstly, sub-samples categorized as grandchild specific are presented. Then two grandparents' related sub-samples are discussed, with a continuation of investigation of sub-sample analyses according to some chosen variable criteria for parents.

Sub-samples according to criteria related to grandchildren

Looking at grandchildren's demographic variables and how these influence relationship between proximity variables and GPA, there are systematic insignificant differences between two groups of comparison for all variables used as criterion for sub-sample analysis, with an exception of large versus other municipality size analysis. Firstly, there are no significant differences between sub-samples of female and male grandchildren on what effect grandparents' proximity has on GPA though signs of proximity variables are having the same direction as in the main model.

The human and social capital available and obtained by one grandchild is interlinked with competition among siblings since a family system has limited resources. This means, in line with previous reasoning, that if there is insufficiency of some resources, then grandparental influence would account for more on grandchildren's grades. Downey (2001) uncovered a pattern presenting weak association between sibship size and educational outcomes in cases when extended family members were part of these children's lives. By applying this study's theoretical reasoning, in Downey's study the extended family members were granted greater degree of mandate, so their influence accounted for more, therefore outweighing the negative influence of having many siblings in a family. The current findings indicate that there is no empirical evidence found that would indicate that grandparents have greater influence measured by their proximity on grandchildren's outcomes for being youngest or eldest child

in a family. Apparently, individualism characteristic in Norwegian culture do not allow grandparents attaining different mandate, therefore, also limiting their influence in grandchildren's outcomes. There is however a clear pattern in Model 6 that being a younger siblings in a family has a negative and considerably large influence (coefficients in range from -0.12 to -0.21) on these children's grades, while the opposite effect (coefficients in range from 0.03 to 0.13) is observed for older siblings with increasing magnitude of effects as number of siblings are added in both cases, therefore supporting Coleman's (1988) resource competition idea.

In relation to location-specific capital, attention was directed also to grandchildren who had re-located with their families within 6 years prior to being of age 12 years, assuming that grandparental influence might be increased in magnitude when parents and grandchildren lose their location-specific capital and need for resources from grandparent might be present. However, this finding does not support the idea. On the other hand, it supports the economic interpretation of rational choice and behavior maximizing theories – parents re-locate the household when it is beneficial, considering costs and benefits this move embodies, thus, re-location with older grandchildren does not seem to be related to specific increase of needs to receive greater care of grandparental resources.

Household size indicates how many siblings a grandchild has to compete for resources with, and according to the Coleman's theory, having many siblings lead to less resources obtained by a single child, and in that case also grandparental limited resources would have to be distributed among several grandchildren, and would not be directed to only one. According to Cherlin and Furstenberg (1986) there should be observed a greater impact of selective investments in grandchildren when fewer siblings are observed in a family. Therefore it was expected to observe higher estimates of proximity variables as indicator of grandparental involvement in small households. However, different number of people in a household does not generate any significant difference between groups indicating that household size does not play a role on influence that grandparents' proximity generate on GPA. For a small household, a positive coefficients was observed for maternal grandparental, and opposite for paternal grandparents, however not significantly different from the remaining sample. One can speculate that this might have be due to the small proportion (4,4%) of such families in the sample.

In the Literature review differences between geographical distances between grandparents and grandchildren was presented with regard to urban versus rural areas, but in the main model all dummy variables for municipalities size were insignificant. These do not uncover any systematic differences to how grandparents and grandchildren's residence are located in relation to one another, but when investigating association between GPA and proximity variables depending on a sub-sample of children living in small and large municipalities, a comparison can be drawn between grandchildren living in large municipalities. In these urban areas, also paternal grandparents' proximity gets a negative sign, and is of the same magnitude (but opposite sign) as for the remaining sample, though also here essentially zero. The significance levels allow stating that there are differences between the two groups of children, i.e. grandchildren living in large and other types of municipalities, with regard to paternal grandparents. This is in contrast to findings of Pollet, Nettle and Mark (2006) who find urbanization not relatively important for contact with grandchildren, but in line with findings of Normann (2009) and King and Elder (1995) who find area density effects on contact frequency. No such statement can be made for maternal grandparents' proximity, though coefficients estimated are equal in magnitude, but significant only in one of the groups. Interpretation of the differences of paternal grandparents' proximity in densely populated areas versus others is ambiguous. It might be an indication that these families lack resources which parental grandparents contribute the most, or, if another control variable would be introduced to eliminate the negativity, then paternal grandparents would no longer play more role than maternal grandparents. It would only be speculative to draw any kind of conclusion of this finding.

Sub-samples according to criteria related to grandparents

Only two variables were used in the sub-sample analysis regarding grandparents. Since average age of maternal grandmothers (when their grandchildren were 12 years old) was only 67 years, which is age of retirement, there is an indication that there are grandmothers in the sample who were still working. This would entice limited participation in grandchildren's because time resources should be also allocated at work and for other social activities and might be of importance in these grandmothers' choice of proximity. Consequently, it was of interest to investigate whether there are significant differences between groups of grandmothers who had an indication for active employment status versus those who did not. There are no such differences observed between groups of maternal and paternal grandmothers separately who have an indicator of active employment status versus those who

don't. However, within the sub-sample of maternal grandmothers the association on GPA has increased somewhat in magnitude and is significant, though the effect it generates is still very small. It is noticeable also in the descriptive statistics on variables related to grandparents (table 4), that there are more maternal and paternal grandmothers with this employment status indicator when their grandchildren are in near proximity to them compared when they do not. There are slightly more maternal than paternal grandmothers with this employment indicator in general, but caution must be taken to interpret these differences without accounting for older age of paternal grandmothers, however, the direction of deviations are showing a pattern. Firstly, it could indicate that in these families grandparents who are in close proximity are not having as sufficient resources as grandparents living further away; therefore they are working longer to compensate for these (either for their own sake or in order to help out parents). Secondly, since maternal grandparents are important as a resource provider in a family, also the marginal negativity for maternal grandparents proximity (-0.022 and 0.023 compared to the remaining sample -0.0055 and 0.005) is larger, though the same development in proximity variables' effect is observed for paternal grandparents.

Sub-samples according to criteria related to parents

If demographic and socio-economic factors are investigated for parents, there are no significant differences observed between sub-sample and remaining sample, therefore no explicit conclusions can be drawn on these sub-samples, similarly to the previously observed patterns of results from other sub-sample analyses.

To investigate an effect of possibility of having many cousins, therefore also increased possibility that grandparents have to share their attention on several grandchildren, mothers and fathers with three or more siblings were compared with those who had less than 3 siblings. The reason for looking at this division of sub-samples is the same as presented under section describing effects of competition among number of siblings, but in this case cousins, for the limited resources grandparents can provide. The results show no significant changes in association between GPA and grandparents' proximity to their grandchildren between sub-groups. Therefore, at least the possibility of having many cousins does not have different effect of grandparental participation opportunities on grandchildren's school performance if living near-by versus further away.

Age of mothers seems to have an influence on grandparental influence on grandchildren when young mothers are in focus, who were 18 years old or less than when their children (in the

sample) were born. The sub-sample is very small, only 0.7% of mothers are distinguished by the criterion, and this might influence the significance levels. However, though even more influence of grandparents was expected in this case, the coefficient of paternal grandparents' proximity is 0.13 – the largest one found among all the results, though also this is considered to have only a modest effect on GPA. For maternal grandparents matter, the association direction still holds as in the main regression, but also this value is somewhat increased to minus 0.09, but goodness of fit of the model is reduced to 16%. Though proximity variable of paternal grandparents is negative in case when mothers were 35 years old or older, the effects are still very small, and no significance is observed. The increase in coefficients estimated for younger mother's might have an explanation in social capital theory, where these mothers start their motherhood with less human capital as others who give birth later in life, and depending on social capital in a family, the capital to be absorbed by a grandchild is less. Therefore, as these mothers maximize their well-being as well as their behavior in order to maximize their children well-being, grandparents might receive greater mandate, therefore the effects are larger.

Covariates of parents were decisive in reducing the negative association of having grandparents in close proximity on GPA with no controls added, especially educational level indicators. But when investigating effects in sub-groups holding different educational levels, no explicit conclusions can be drawn based on the insignificant differences between sub-sample groups. There is not a single proximity variable which is significantly different from the remaining sample in this type of analysis, and no significant maternal and paternal proximity variable estimates are observed simultaneously within a sub-sample of interest. However, few interesting points can be presented which are significant within a given sub-sample.

For grandchildren of mothers with minimum Bachelor degree or education leading to Bachelor degree, maternal grandparents' proximity variable is still significantly negative, similarly to association observed when considering fathers with this type of education. These are parents assumingly possessing more human, social and financial capital as education indicate, and the grandparent's proximity generated negative association on grandchildren's outcomes might be an indicator that some kind of other resources are in scarcity in these families which are not related to any of the three mentioned ones.

When fathers are having only primary education, there is actually small positive association between grandchildren's grades at school and paternal grandparents' proximity. It might be case that in a sub-sample people are grouped with similar characteristics; therefore an association is more detectable. As observed in previous research, low educated parents tend to live closer to grandparents, and in this case, it could indeed be an indicator that proximity contributes positively to grandchildren's outcomes: grandchildren would be better off living closer than further away from grandparents in these types of families. Therefore, parents might have made the well-being maximizing choice and remained living close-by.

Sub-samples according to different proximity measure and restriction related to intact intergenerational ties

It was of interest to investigate and apply the study's model on grandchildren who live a walking distances away from grandparents. As in line with the theory, this would mean that these families should have similar characteristics, and would be in need of some types of resources which grandparent's can contribute with. Similar trend to ones observed among small municipalities and fathers with primary educational level is noticeable. Maternal proximity coefficient is positive 0.002, and for paternal proximity estimated effect on GPA is 0.02 (significant). This might imply that these groups tend to have lack of some type of capital in a family that, even when not considering other influential factors, proximity to grandparents has a positive influence on grandchildren's school achievements, interestingly, that also in this case paternal lineage is of greater value than maternal lineage. Alternatively, in these sub-samples, proximity measure might actually be correlated highly with the relationship quality in a greater extent alongside with contact frequency, therefore reflecting the positive effect of grandparental proximity on grandchildren's outcomes.

In the study a sample was distinguished who had all their intergenerational ties intact. In this case, model 9 presented estimates of the grandparental proximity effect on GPA, and both negative, insignificant and close to zero values were found, with paternal proximity variable being marginally larger than that of maternal proximity variable. This indicates that one cannot talk about any real effects of grandparental participation, in terms of their proximity, on grandchildren's average subject scores based on the findings in this study.

The discussion provided in this chapter presented the findings in relation to theory to enlighten possibilities of interpretation and different angles of the problem in question. There is a clear pattern of selection bias where families with fewer resources tend to live close-by

the grandparents. Difficulties are encountered in interpreting sub-sample analyses results because no clear differences were observed across sub-samples. Some of the discussion is based on very marginal values, therefore also the attribution of the interpretation have to be adjusted accordingly to present a situation closer to the reality.

Conclusion

This study investigates whether grandchildren perform better at school when their maternal and paternal grandparents live close-by versus when they don't. The answer to this question is provided assuming that geographic proximity would enable greater degree of grandparental participation in grandchildren's lives, therefore having an effect on their Grade Point Average at school. In contrary to expectations, there is essentially zero association between grandparent's proximity and Grade Point Average of grandchildren. Persistency of estimates being close to zero for the proximity variable is observed in most of the results of regression analyses conducted.

In relation to economic theory of people maximizing their behavior or maximizing their own or children's wellbeing, proximity to grandparents would indicate that a rational choice is made by these parents to locate a household this way in order to enable better exchange of available resources from grandparents. This was observed in the descriptive statistics which show that families living in close proximity tend to have fewer resources (higher proportion of parents with lower levels of education, less earnings, higher proportion of people receiving social benefits) available than families living further away. This is also an indication of selection bias problem in this study, therefore, most likely disabling to uncover any real effect of grandparents' proximity on GPA of their grandchildren since two groups of comparison are not similar.

Zero association between proximity of grandparents and GPA of grandchildren has an implication that grandchildren's grades do not vary according to where their grandparents live if proximity is assumed to be a measure of influence and participation of grandparents in grandchildren's lives. It is also related to possibility that grandparent's influence is mostly mediated by parents, thus indirect influence processes taking place are the decisive ones in a family system. Grandparents seem not to have either a mandate in a family which allows exerting greater influence. This is observed in how estimates of the proximity variables are affected by adding control variable groups, where parental demographic, socio-economic variables, especially education, are the ones determining essentially zero correlation between grandparents' proximity and grandchildren's GPA.

Marginal differences between maternal and paternal grandparents' proximity effects on grandchildren's grades (respectively -0.009 and +0.009) lead to several interpretations.

Firstly, they may be reflecting only an association which is present when not controlled for another important control variable (most probably related to parents), e.g. cultural capital, which is not included in a model. Alternatively, proximity variable might not be the one measuring greater grandparental participation since grandparent-grandchild relationship quality might be more correct measure capturing the influence level a grandparent can exert, and not the contact frequency which is highly correlated with geographic distance. The results on sub-sample analyses could support this view.

The results from this study cannot be generalized to all grandparents and grandchildren, since restrictions imposed on the sample have led to including families which in general have more resources available if compared to non-intact families. But external validity in relation to a population of families characterized by the analytical sample is good.

Literature list

- Akselsen, Anders, Lien, Sandra, & Sivertstøl, Øyvind (2007). FD-Trygd. Variabelliste. Retrieved 15.12.2009, from Statistics Norway:
http://www.ssb.no/emner/03/04/notat_200717/notat_200717.pdf
- Lov om folketrygd (folketrygdloven), LOV-1997-02-28-19 C.F.R. (1997).
- Astone, Nan Marie, & McLanahan, Sara S. (1991). Family structure, parental practices and high school completion *American Sociological Review*, 56(3), 309-320.
- Attar-Schwartz, Shalhevet, Tan, Jo-Pei, & Buchanan, Ann (2009). Adolescents' perspectives on relationships with grandparents: The contribution of adolescent, grandparent, and parent-grandparent relationship variables. *Children and Youth Services Review*, 31(9), 1057-1066.
- Becker, Gary S. (1993). Nobel lecture: the economic way of looking at behavior. *The Journal of Political Economy*, 101(3), 385-409.
- Blair, Sampson Lee, Legazpi Blair, Marilou C., & Madamba, Anna B. (1999). Racial/Ethnic Differences in High School Students' Academic Performance: Understanding the Interweave of Social Class and Ethnicity in the Family Context. *Journal of Comparative Family Studies*, 30(3), 539-555.
- Boivin, J., Rice, Frances, Hay, Dale, Harold, Gordon, Lewis, Allyson, van den Bree, Marianne M. B., et al. (2009). Associations between maternal older age, family environment and parent and child wellbeing in families using assisted reproductive techniques to conceive. *Social Science & Medicine*, 68(11), 1948-1955.
- Boon, Susan D., & Brussoni, Mariana J. (1996). Young adults' relationships with their 'closest' grandparents: Examining Emotional Closeness. *Journal of Social Behavior & Personality*, 11(3), 439-458.
- Bordone, Valeria (2009). Contact and proximity of older people to their adult children: a comparison between Italy and Sweden. *Population, Space and Place*, 15(4), 359-380.
- Borjas, George J. (2008). *Labor economics* (4th ed.). Boston: McGraw-Hill/Irwin.
- Brunborg, Helge, & Texmon, Inger (2003). Regionale befolkningsframskrivinger 2002-2020: Størst vekst rundt Oslofjorden. *Samfunnsspeilet 2/2003*, 17, 19-28. Retrieved from
<http://www.ssb.no/samfunnsspeilet/utg/200302/ssp.pdf>
- Bullock, Karen (2005). Grandfathers and The Impact of Raising Grandchildren. *Journal of Sociology & Social Welfare*, 32(1), 43-59.
- Card, David, & Krueger, Alan B. (1994). The economic return to school quality: a partial survey, *Working paper # 334*: Industrial relations section, Princeton University.

- Chen, Feinian , Short, Susan E. , & Entwisle, Barbara (2000). The impact of grandparental proximity on maternal childcare in China. *Population Research and Policy Review*, 19(6), 571-590.
Retrieved from
<http://proquest.umi.com/pqdweb?index=6&did=501073171&SrchMode=2&sid=4&Fmt=10&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1266914333&clientId=75186>
- Cherlin, Andrew J. , & Furstenberg, Frank F. (1986). *The new Americal grandparent. A place in the family, a life apart*. New York: Basic Books.
- Christensen, Kaare, Doblhammer, Gabriele, Rau, Roland, & Vaupel, James W. (2009). Ageing populations: the challenges ahead. *The Lancet*, 374(9696), 1196-1208.
- Clark, Rebecca L., & Wolf, Douglas A. (1992). Proximity of children and elderly migration. In Andrei Rogers, William H. Frey, Alden Jr. Speare, Philip Rees & Anthony M. Warnes (Eds.), *Elderly migration and population redistribution: a comparative study*. London: Belhaven Press.
- Clark, Reginald M. (1983). *Family life and School Achievement: Why Poor Black Children Succeed in Shool*. Chicago: University of Chicago Press.
- Coleman, James S. (1988). Social Capital in the Creation of Human Capital. [Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure]. *The American Journal of Sociology*, 94, 95-120.
- DaVanzo, Julie (1981). Repeat migration, information costs, and location-specific capital *Population and Environment*, 4(1), 45-73.
- David, Tricia (2006). Grandparents matter. In Lesley Abbott & Ann Langston (Eds.), *Parents matter: supporting the birth to three matters framework* (pp. xii, 184 s.). Berkshire: Open University Press.
- DeWit, David J., & Frankel, B. Gail (1988). Geographic distance and intergenerational contact: A critical assessment and review of the literature. *Journal of Aging Studies*, 2(1), 25-43.
- Downey, Douglas R. (2001). Number of Siblings and Intellectual Development. *American Psychologist*, 56(6/7), 497.
- Dunn, Judy, Fergusson, Emma, & Maughan, Barbara (2006). Grandparents, grandchildren, and family change in contemporary Britain. In Judy Dunn & Alison Clarke-Stewart (Eds.), *Families count: effects on child and adolescent development* (pp. 299-318). Cambridge: Cambridge University Press.
- Daatland, Svein Olav, Slagsvold, Britt, & Lima, Ivar A. Åsland (2009). Folkemeningen om familiens og velferdsstatens ansvar, i syv europeiske land: Hvor langt strekker familiens ansvar seg? *Samfunnsspeilet 1/2009*, 23, 105-109. Retrieved from
<http://www.ssb.no/ssp/utg/200901/ssp.pdf>
- Entwisle, Doris R., & Alexander, Karl L. (1995). A parent's economic shadow: Family structure versus family resources as influences on early school achievement. *Journal of Marriage & Family*, 57(2), 399-409.

- Evenshaug, Oddbjørn (2002). Besteforeldreskapet i forandring. *Prismet: pedagogisk tidsskrift*, 53, 239-254.
- Evenshaug, Oddbjørn, & Hallen, Dag (1997). *Familiepedagogikk. Appdragelsens hva, hvordan og hvorfor*. Oslo: Ad Notam Gyldendal.
- Evenshaug, Oddbjørn, Hallen, Dag, & Hjordemaal, Finn (2002). Bør besteforeldrene ha noe å si? . *Prismet: pedagogisk tidsskrift*, 53, 263-269.
- Falbo, Toni (1991). The impact of grandparents on children's outcomes in China. *Marriage & Family Review*, 16(3), 369-376.
- Fergusson, Emma, Maughan, Barbara, & Golding, Jean (2008). Which children receive grandparental care and what effect does it have? *Journal of Child Psychology & Psychiatry*, 49(2), 161-169.
- Fischer, Lucy Rose (1983). Transition to grandmotherhood. *International Journal of Aging & Human Development*, 16(1), 67-78.
- Flouri, Eirini, & Hawkes, Denise (2008). Ambitious mothers - successful daughters: Mothers' early expectations for children's education and children's earnings and sense of control in adult life. *British Journal of Educational Psychology*, 78(3), 411-433.
- GoogleScholar (2010). Search on "Falbo. The impact of grandparents on children's outcomes". Retrieved 14.06.2010:
http://scholar.google.com/scholar?q=Falbo+the+impact+of+grandparents+on+children%27s+outcomes&hl=en&as_sdt=2001&as_sdt=on
- Hagestad, Gunhild O. (2006). Transfers between grandparents and grandchildren: The importance of taking a three-generation perspective. *Zeitschrift für Familienforschung*, 18(3), 315-332.
Retrieved from <http://www.zeitschrift-fuer-familienforschung.de/pdf/2006-3-hagestad.pdf>
- Hagestad, Gunhild O., & Herlofson, Katharina (2009). Småbarnsfamiliens støttespillere: dagens besteforeldre *Samfunnsspeilet* (Vol. 23(2009) nr 1, pp. S. 92-94). Oslo: Statistisk sentralbyrå.
- Hank, Karsten, & Buber, Isabella (2009). Grandparents Caring for Their Grandchildren: Findings From the 2004 Survey of Health, Ageing, and Retirement in Europe. *Journal of Family Issues*, 30(1), 53-73.
- Hansen, Kirstine, & Hawkes, Denise (2009). Early Childcare and Child Development. *Journal of Social Policy*, 38(2), 211-239.
- Haveman, Robert, & Wolfe, Barbara (1994). *Succeeding generations: on the effects of investments in children*. New York: Russell Sage Foundation.
- Hjordemaal, Finn (2002). Besteforeldreforskning. Noen utviklingstrekk. *Prismet: pedagogisk tidsskrift*, 53, 255-262.
- Hjordemaal, Finn (2004). *Familiepedagogikk og besteforeldreforskning: teoriutvikling* (No. 82-569-6296-8). Oslo: Universitetet i Oslo, Pedagogisk forskningsinstitutt.

- Hoff, Andreas (2007a). Functional Solidarity between Grandparents and Grandchildren in Germany
Working Papers Retrieved from
http://www.ageing.ox.ac.uk/system/files/workingpaper_307.pdf
- Hoff, Andreas (2007b). Patterns of intergenerational support in grandparent-grandchild and parent-child relationships in Germany. *Ageing & Society*, 27, 643-665. Retrieved from
<http://www.globalaging.org/elderrights/world/2007/Germanyintergenerational.pdf>.
doi:10.1017/S0144686X07006095
- Holmlund, Helena, Rainer, Helmut, & Siedler, Thomas (2009). Meet the Parents? – The Causal Effect of Family Size on the Geographic Distance between Adult Children and Older Parents.
Discussion Papers. Retrieved from
http://diw.de/documents/publikationen/73/diw_01.c.340321.de/dp923.pdf
- Hægeland, Torbjørn, & Kirkebøen, Lars J. (2007). Skoleresultater 2006: en kartlegging av karakterer fra grunn- og videregående skoler i Norge. from Statistics Norway:
- Jaeger, David A., & Page, Marianne E. (1996). Degrees matter: new evidence on sheepskin effects in the returns to education. . *The Review of Economics and Statistics*, 78(4), 733-740.
- Jæger, Mads Meier (2009). Equal Access but Unequal Outcomes: Cultural Capital and Educational Choice in a Meritocratic Society. *Social Forces*, 87(4), 1943-1971.
- Katz, Shira, & Kessel, Louise (2002). Grandparents of children with developmental disabilities: perceptions, beliefs, and involvement in their care. *Issues in Comprehensive Pediatric Nursing*, 25(2), 113-128.
- King, Valarie, & Elder Jr, Glen H. (1995). American children view their grandparents: linked lives across three rural generations. *Journal of Marriage & Family*, 57(1), 165-178.
- Kristiansen, Jan Erik, Flatebø, Gro, & Modig, Ingrid (2009). *Dette er Norge: Hva tallene forteller*. Retrieved from http://www.ssb.no/norge/norge_2009.pdf
- Lov om grunnskolen og den videregående opplæringa (opplæringslova), LOV-1998-07-17-61 C.F.R. (1998).
- Forskrift til opplæringslova, nr 724 / § 3-17. Sluttvurdering i fag C.F.R. (2006).
- Lang, Susan (2005). A Grandparent at Home Buffers Drawbacks of Single-Parenthood. *Human Ecology*, 33(2), 20-10.
- Langørgen, Audun (2007). Sentralisering – årsaker, virkninger og politikk. *Samfunnsspeilet 2/2007*, 21, 46-59. Retrieved from <http://www.ssb.no/ssp/utg/200702/ssp.pdf>
- Lappegård, Trude (2009). Geografisk avstand til foreldre og barn: De fleste bor nær foreldre og voksne barn. *Samfunnsspeilet 1/2009 23*, 84-88. Retrieved from
<http://www.ssb.no/ssp/utg/200901/ssp.pdf>
- Lawton, Leora, Silverstein, Merrill, & Bengtson, Vern L. (1994). Affection, Social Contact, and Geographic Distance Between Adult Children and Their Parents. *Journal of Marriage & Family*, 56(1), 57-68.

- Lloyd-Sherlock, Peter (2000). Population ageing in developed and developing regions: implications for health policy. *Social Science & Medicine*, 51(6), 887-895.
- Lundholm, Emma, Garvill, Jörgen, Malmberg, Gunnar, & Westin, Kerstin (2004). Forced or free movers? The motives, voluntariness and selectivity of interregional migration in the Nordic countries. *Population, Space and Place*, 10(1), 59-72.
- Lussier, Gretchen, Deater-Deckard, Kirby, Dunn, Judy, & Davies, Lisa (2002). Support Across Two Generations: Children's Closeness to Grandparents Following Parental Divorce and Remarriage. *Journal of Family Psychology*, 16(3), 363-376.
- Malmberg, Gunnar, & Pettersson, Anna (2008). Distance to elderly parents: Analyses of Swedish register data. *Demographic Research*, 17, Article 23, 679-703.
- Masten, Ann S., & Coatsworth, Douglas J. (1998). The development of competence in favorable and unfavorable environments. Lessons from research on successful children. *American Psychologist*, 53(2), 205-220.
- Michielin, Francesca, & Mulder, Clara H. (2007a). Geographic distances between adult children and their parents in the Netherlands. *Demographic Research*, 17, Article 22, 655-678.
- Michielin, Francesca, & Mulder, Clara H. (2007b). Geographical distances between adult children and their parents in the Netherlands. *Demographic Research*, 17(Article 22), 655-678.
- Michielin, Francesca, Mulder, Clara H., & Zorlu, Aslan (2008). Distance to parents and geographical mobility. *Population, Space and Place*, 14(4), 327-345.
- Mincer, Jacob (1958). Investment in Human Capital and personal income distribution. *The Journal of Political Economy*, 66(4), 281-302.
- Ming Ming, Chiu (2007). Families, Economies, Cultures, and Science Achievement in 41 Countries: Country-, School-, and Student-Level Analyses. *Journal of Family Psychology*, 21(3), 510-519.
- Mitchell, Wendy (2007). Research Review: The role of grandparents in intergenerational support for families with disabled children: a review of the literature. *Child & Family Social Work*, 12(1), 94-101.
- Mulder, Clara H., & Meer, Marieke J. van der (2009). Geographical distances and support from family members. *Population, Space and Place*, 15(4), 381-399.
- Neuman, W. Lawrence (2009). *Understanding research?* Boston: Pearson Education.
- Normann, Tor Morten (2009). Sosial og politisk deltakelse: Mest familie- og nabokontakt på bygda. *Samfunnsspeilet 5-6/2009*, 23, 114-123. Retrieved from <http://www.ssb.no/ssp/utg/200905/ssp.pdf>
- Olshansky, S. Jay, Goldman, Dana P., Yuhui, Zheng, & Rowe, John W. (2009). Aging in America in the Twenty-first Century: Demographic Forecasts from the MacArthur Foundation Research Network on an Aging Society. *Milbank Quarterly*, 87(4), 842-862.

- Oppelaar, Janneke, & Dykstra, Pearl A. (2004). Contacts between grandparents and grandchildren. *The Netherland's Journal of Social Sciences*, 40(2), 91-113.
- Pettit, Gregory S., Tianyi, Yu, Dodge, Kenneth A., & Bates, John E. (2009). A Developmental Process Analysis of Cross-Generational Continuity in Educational Attainment. *Merrill-Palmer Quarterly*, 55(3), 250-284.
- Pollet, Thomas V., Nettle, Daniel, & Nelissen, Mark (2006). Contact frequencies between grandparents and grandchildren in a modern society: estimates of the impact of paternity uncertainty. *Journal of Cultural and Evolutionary Psychology*, 4(3), 203-214. Retrieved from <http://www.students.ncl.ac.uk/t.v.pollet/pollet%20et%20al%202006%20grandparents.pdf>. doi:10.1556/JCEP.4.2006.3-4.1
- Quadrello, T., Hurme, H., Menzinger, J., Smith, P., Veisson, M., Vidal, S., et al. (2005). Grandparents use of new communication technologies in a European perspective. *European Journal of Ageing*, 2(3), 200-207.
- Rogers, Andrei, Frey, William H., Speare, Alden Jr., Rees, Philip, & Warnes, Anthony M. (1992). *Elderly migration and population redistribution: a comparative study*. London: Belhaven Press.
- Rogerson, Peter A., & Weng, Richard H. (1993). The spatial separation of parents and their children. *Annals of the Association of American Geographers*, 83(4), 656.
- Shaw, Mary, Lawlor, Debbie A., & Najman, Jake M. (2006). Teenage children of teenage mothers: Psychological, behavioural and health outcomes from an Australian prospective longitudinal study. *Social Science & Medicine*, 62(10), 2526-2539.
- Sheree, J. Gibb, David, M. Fergusson, & Horwood, L. John (2008). Gender differences in educational achievement to age 25. *Australian Journal of Education*, 52(1), 63-80.
- Silverstein, Merril, & Long, Jeffrey D (1998). Trajectories of grandparents' perceived solidarity with adult grandchildren: A growth curve analysis over 23 years. *Journal of Marriage and the Family*, 60(4), 912-923.
- Slagsvold, Britt, Daatland, Svein Olav, Brunborg, Helge, & Lima, Ivar A. Åsland (2009). Holdninger til ansvar for gamle foreldre, i syv europeiske land: Er vi villig til å ta oss av gamle mor og far? *Samfunnsspeilet 1/2009*, 23, 99-104. Retrieved from <http://www.ssb.no/ssp/utg/200901/ssp.pdf>
- Smith, Peter K., & Drew, Linda M. (2004). Grandparenting and extended support networks. In Hoghugh Masud & Long Nicholas (Eds.), *Handbook on parenting. Theory and research for practice*. London: Sage Publications.
- Somary, Karen, & Stricker, George (1998). Becoming a grandparent: a longitudinal study of expectations and early experiences as a function of sex and lineage. *The Gerontologist*, 38(1), 53-61.
- Statistics_Norway (2000). Norwegian Standard Classification of Education, Revised 2000 (C 617).

- Statistics_Norway (2008). Database for standard klassifikasjoner. Sentralitetet 2008. Retrieved 21.04.2010: <http://www3.ssb.no/stabas/ItemsFrames.asp?ID=5285601&Language=nb>
- Sticker, Elisabeth J. (1991). The importance of grandparenthood during the life cycle in Germany. In Peter K. Smith (Ed.), *The psychology of grandparenthood*. London and New York: Routledge.
- Strauss, Clifford A. (1943). Grandma made Johnny delinquent. *Journal of Orthopsychiatry*, 13, 343-347.
- Studenmund, A. H. (2006). *Using econometrics: a practical guide*. Boston, Mass.: Pearson Education.
- Suet-ling, Pong, & Chen, Vivien W. (2010). Co-resident Grandparents and Grandchildren's Academic Performance in Taiwan. *Journal of Comparative Family Studies*, 41(1), 111-129.
- Szinovacz, Maximiliane (1998a). *Handbook on grandparenthood*. Westport, Connecticut; London: Greenwood press.
- Szinovacz, Maximiliane (1998b). Research on grandparenting: needed refinements in concepts, theories, and methods. In Maximiliane Szinovacz (Ed.), *Handbook on grandparenthood*. Westport, Connecticut; London: Greenwood Press.
- Sørli, Kjetil (2005). Bosetting, flytting og regional utvikling. In Lise Kjølørød & Ivar Frønes (Eds.), *Det norske samfunn* (Vol. 5, pp. 328-356). Oslo: Gyldendal akademisk.
- Thomas, Jeanne, Sperry, Len, & Yarbrough, M. Sue (2000). Grandparents as Parents: Research Findings and Policy Recommendations. *Child Psychiatry and Human Development*, 31(1), 3-22.
- Tyszkowa, Maria (1991). The role of grandparents in the development of grandchildren as perceived by adolescents and young adults in Poland. In Peter K. Smith (Ed.), *The psychology of grandparenthood*. London and New York: Routledge.
- Utdanningsdirektoratet (2007). Karakterstatistikk for grunnskolen og videregående opplæring skoleåret 2005-2006. Retrieved 06.06.2010, from Utdanningsdirektoratet: http://www.udir.no/Artikler/_Statistikk/Karakterstatistikk-for-grunnskolen-og-videregaende-opplaring-skolearet-2005-2006/
- Vandell, Deborah Lowe, McCartney, Kathleen, Owen, Margaret Tresch, Booth, Cathryn, & Clarke-Stewart, Alison (2003). Variations in Child Care by Grandparents During the First Three Years. *Journal of Marriage & Family*, 65(2), 375-381.
- Whitbeck, Les B., Hoyt, Danny R., & Huck, Shirley M. (1993). Family Relationship History, Contemporary Parent-Grandparent Relationship Quality, and the Grandparent-Grandchild Relationship. *Journal of Marriage & Family*, 55(4), 1025-1035.
- Wilson, Gail (1987). Women's work: the role of grandparents in inter-generational transfers. *Sociological Review*, 35(4), 703-720.

Appendices

APPENDIX I

NUMBER OF OBSERVATIONS EXCLUDED ACCORDING TO RESTRICTIONS IMPOSED

<i>Criterion</i>	<i># of observations</i>	<i># of observations excluded</i>
With foreign background	269 478	6 301
0 grandparents	263 295	3410
Parents divorced at age 6	259 885	48 160
Parents divorced at age 12	211 725	26 159
0 paternal grandparents	185 566	19 900
0 maternal grandparents	165 666	12 282
Starting school too late/early	153 384	1 678
Missing school specific number	151 706	265
Children not living with parents	151 441	45
Lacking GPA score	151 396	304
Final sample	151 092	

APPENDIX II

COMPARISON OF ORDINARY LEAST SQUARED REGRESSION AND ORDINARY LEAST SQUARED REGRESSION WITH SCHOOL SPECIFIC FIXED EFFECTS AS CONTROL VARIABLES ARE ADDED. PART I

Proximity variable change with diff.controlls		OLS regression			OLS regression with FE		
		Coeff.	St.dev.	Sign.	Coeff.	St.dev.	Sign.
<i>1) only proximity variables</i>							
	Proximity to maternal grandparents	-.1034881	.0040531	***	-.1018572	.0041172	***
	Proximity to paternal grandparents	-.1100719	.0041491	***	-.102317	.0042439	***
<i>2) gender added</i>							
	Proximity to maternal grandparents	-.1035836	.0039141	***	-.1019292	.003971	***
	Proximity to paternal grandparents	-.1113193	.0040068	***	-.1037683	.0040932	***
<i>3) older siblings added</i>							
	Proximity to maternal grandparents	-.1055838	.0039031	***	-.1043252	.0039605	***
	Proximity to paternal grandparents	-.1100072	.0039947	***	-.1044531	.0040811	***
<i>4) youger siblings added</i>							
	Proximity to maternal grandparents	-.1054438	.0039023	***	-.104115	.0039603	***
	Proximity to paternal grandparents	-.1102537	.0039939	***	-.1040237	.0040821	***
<i>5) municipality size added</i>							
	Proximity to maternal grandparents	-.1098264	.0038968	***	-.1039759	.0039612	***
	Proximity to paternal grandparents	-.1078863	.0039935	***	-.1039149	.0040836	***
<i>6) cohort added</i>							
	Proximity to maternal grandparents	-.1098264	.0038968	***	-.1039759	.0039612	***
	Proximity to paternal grandparents	-.1078863	.0039935	***	-.1039149	.0040836	***
<i>7) month of birth added</i>							
	Proximity to maternal grandparents	-.1102217	.0038833	***	-.1047212	.0039474	***
	Proximity to paternal grandparents	-.1083725	.0039796	***	-.1047436	.0040694	***
<i>8) mother's age added</i>							
	Proximity to maternal grandparents	-.0662727	.0038046	***	-.0673378	.0038724	***
	Proximity to paternal grandparents	-.0688259	.0038921	***	-.0723943	.003985	***
<i>9) mother's age when 1st born child added</i>							
	Proximity to maternal grandparents	-.0521436	.0037754	***	-.0553765	.0038411	***
	Proximity to paternal grandparents	-.0592576	.0038555	***	-.0646747	.003947	***
<i>10) father's age added</i>							
	Proximity to maternal grandparents	-.0514063	.0037726	***	-.0545467	.0038389	***
	Proximity to paternal grandparents	-.0601381	.0038529	***	-.0652512	.0039445	***
<i>11) maternal grandmother's age added</i>							
	Proximity to maternal grandparents	-.0504122	.0037665	***	-.0535221	.0038336	***
	Proximity to paternal grandparents	-.0573037	.0038483	***	-.0623524	.0039409	***
<i>12) paternal grandmother's age added</i>							
	Proximity to maternal grandparents	-.0486352	.0037603	***	-.0518916	.0038281	***
	Proximity to paternal grandparents	-.059373	.003842	***	-.0639683	.003935	***
<i>13) maternal grandfather's age added</i>							
	Proximity to maternal grandparents	-.0485836	.0037608	***	-.0518688	.0038288	***
	Proximity to paternal grandparents	-.0594167	.0038422	***	-.0640395	.0039353	***

Do grandchildren perform better at school if maternal and paternal grandparents live close-by versus when they don't?

PART II

Proximity variable change with diff.controlls		OLS regression			OLS regression with FE		
<i>14) paternal grandfather's age added</i>							
	Proximity to maternal grandparents	-.0485152	.003761	***	-.0517931	.0038292	***
	Proximity to paternal grandparents	-.0594488	.0038422	***	-.0640498	.0039354	***
<i>15) maternal grandparents alone added</i>							
	Proximity to maternal grandparents	-.0495974	.0037565	***	-.0527833	.0038246	***
	Proximity to paternal grandparents	-.058787	.0038373	***	-.0630521	.0039306	***
<i>16) paternal grandparents alone added</i>							
	Proximity to maternal grandparents	-.048225	.003752	***	-.0514967	.00382	***
	Proximity to paternal grandparents	-.0609114	.0038335	***	-.0650112	.0039266	***
<i>17) maternal grandmother's working status added</i>							
	Proximity to maternal grandparents	-.0484663	.0037508	***	-.0518923	.0038191	***
	Proximity to paternal grandparents	-.060899	.0038321	***	-.0651423	.0039255	***
<i>18) paternal grandmother's working status added</i>							
	Proximity to maternal grandparents	-.0482434	.0037497	***	-.0517946	.0038182	***
	Proximity to paternal grandparents	-.0610931	.003831	***	-.0653928	.0039246	***
<i>19) mother's earnings added</i>							
	Proximity to maternal grandparents	-.0438093	.0037133	***	-.0484353	.0037819	***
	Proximity to paternal grandparents	-.0496776	.0037989	***	-.0561912	.0038908	***
<i>20) mother receiving benefits added</i>							
	Proximity to maternal grandparents	-.0434964	.0037117	***	-.0483542	.0037802	***
	Proximity to paternal grandparents	-.0496771	.0037973	***	-.056394	.003889	***
<i>21) father's earnings added</i>							
	Proximity to maternal grandparents	-.0372741	.0036681	***	-.0447933	.0037323	***
	Proximity to paternal grandparents	-.0313915	.0037629	***	-.0428011	.0038453	***
<i>22) father receiving benefits added</i>							
	Proximity to maternal grandparents	-.0371494	.0036672	***	-.0447811	.0037313	***
	Proximity to paternal grandparents	-.0315699	.003762	***	-.0430664	.0038444	***
<i>23) mother's education added</i>							
	Proximity to maternal grandparents	-.0179777	.0035765	***	-.0232892	.00364	***
	Proximity to paternal grandparents	-.0077058	.0036739	*	-.0168934	.003755	***
<i>24) father's education added</i>							
	Proximity to maternal grandparents	-.0054333	.0035305		-.0091718	.0035916	**
	Proximity to paternal grandparents	.0175915	.0036456	***	.009352	.0037228	**
	<i>R² Adjusted</i>		0,2768			0,2957	

APPENDIX III

OVERVIEW OF A DETAILED OLS REGRESSION ANALYSES MODEL WITH DETAILED CONTROL VARIABLE'S SPECIFICATION - ANALYTICAL SAMPLE. PART I

Variables	Model 6		
	Coefficient	St.dev.	sign
Dependent variable: 10th Grade Point Average			
With school specific fixed effects:			
Proximity mother's parents	-0,0092	0,0036	**
Proximity father's parents	0,0094	0,0037	**
Controlled for child specific co-variates			
Gender	0,4052	0,0034	***
Number of older siblings (0 as a reference)			
1	-0,1231	0,0049	***
2	-0,1714	0,0076	***
3	-0,1957	0,0128	***
4	-0,2078	0,0272	***
5 and more	-0,2078	0,0383	***
Number of younger siblings (0 as a reference)			
1	0,0364	0,0046	***
2	0,0645	0,0061	***
3	0,0639	0,0107	***
4	0,0914	0,0236	***
5 and more	0,1321	0,0319	***
Cohort effects: (1986 as a reference)			
1987	0,0222	0,0061	***
1988	0,0339	0,0061	***
1989	0,0290	0,0061	***
1990	0,0116	0,0062	
1991	0,0023	0,0064	
Month of birth effects: (december as a ref)			
January	0,1305	0,0088	***
February	0,1339	0,0086	***
March	0,1166	0,0084	***
April	0,1157	0,0083	***
May	0,0962	0,0084	***
June	0,0888	0,0085	***
July	0,0603	0,0085	***
August	0,0507	0,0085	***
September	0,0425	0,0085	***
October	0,0202	0,0086	**
November	0,0085	0,0088	
Size of the place of residence (large as ref)			
population < 4 999	0,0290	0,0156	
population 5 000 - 9 999	0,0159	0,0151	
population 10 000 - 49 999	0,0146	0,0111	
population unknown	-0,1168	0,0841	

PART II, CONTINUATION

Controlled for parent's specific co-variables				
<i>Mother Age when grandchild was born (<23 as a ref)</i>				
	age 23-27	0,0379	0,0072	***
	age 28-32	0,0753	0,0091	***
	age >33	0,1182	0,0118	***
<i>Mother Age when having her first child (<20 as a ref)</i>				
	age 20-24	0,1310	0,0070	***
	age 25-29	0,1987	0,0083	***
	age 30-34	0,1722	0,0112	***
	age >35	0,1861	0,0207	***
<i>Father Age when grandchild was born (<23 as a ref)</i>				
	age 23-27	0,0318	0,0106	**
	age 28-32	0,0347	0,0115	**
	age 33-37	0,0265	0,0124	*
	age >38	0,0101	0,0146	
Controlled for grandparents specific co-variables				
<i>Maternal grandmother's age (<43 as a ref)</i>				
	age 43-47	0,0630	0,0116	***
	age 48-52	0,1036	0,0129	***
	age 53-57	0,1286	0,0138	***
	age 58-62	0,1512	0,0146	***
	age 63-67	0,1602	0,0154	***
	age >68	0,1843	0,0167	***
<i>Paternal grandmother's age (<43 as a ref)</i>				
	age 43-47	0,0475	0,0186	**
	age 48-52	0,0914	0,0199	***
	age 53-57	0,1240	0,0206	***
	age 58-62	0,1427	0,0211	***
	age 63-67	0,1646	0,0215	***
	age >68	0,1801	0,0221	***
<i>Maternal grandfather's age (<43 as a ref)</i>				
	age 43-47	-0,0078	0,0168	
	age 48-52	-0,0232	0,0178	
	age 53-57	-0,0224	0,0184	
	age 58-62	-0,0136	0,0188	
	age 63-67	-0,0099	0,0192	
	age >68	0,0070	0,0198	
<i>Paternal grandfather's age (<43 as a ref)</i>				
	age 43-47	-0,0133	0,0284	
	age 48-52	-0,0195	0,0294	
	age 53-57	-0,0173	0,0299	
	age 58-62	-0,0040	0,0302	
	age 63-67	0,0069	0,0304	
	age >68	0,0114	0,0307	
	Maternal grandmothers' working status	-0,0380	0,0036	***
	Paternal grandmothers' working status	-0,0396	0,0036	***
	Maternal grandmothers' working status	0,0189	0,0051	***
	Paternal grandmothers' working status	0,0287	0,0058	***

Notes: Age categories are presented for parents and grandparents when a grandchild was born, i.e. 12 years deducted

PART III

Controlled for parent's income			
Mother's income		6.48e-07	4.28e-08 ***
	^2	-5.11e-13	1.00e-13 ***
	^3	9.30e-20	2.66e-20 ***
Mother receiving welfare benefits		-0,1055	0,0137 ***
Father's income		5.60e-07	1.79e-08 ***
	^2	-1.69e-13	9.22e-15 ***
	^3	1.12e-20	7.65e-22 ***
Father receiving welfare benefits		-0,1202	0,0172 ***
Controlled for parent's education			
<i>Mother's educational level (compulsory ed, as ref)</i>			
	Secondary education or equivalent	0,2384	0,0069 ***
	Bachelor degree or equivalent	0,4957	0,0079 ***
	More than Bachelor degree	0,5763	0,0131 ***
	Unknown	-0,2444	0,0499 ***
<i>Father's educational level (compulsory ed, as ref)</i>			
	Secondary education or equivalent	0,2028	0,0062 ***
	Bachelor degree or equivalent	0,4401	0,0075 ***
	More than Bachelor degree	0,5025	0,0092 ***
	Unknown	-0,2158	0,0376 ***
	Constant	2,5866	0,0317 ***
	R^2 adjusted	0,2957	
* p<0,05, ** p<0,01, *** p< 0,001			

APPENDIX IV

OVERVIEW OF A DETAILED OLS REGRESSION ANALYSES MODEL WITH DETAILED CONTROL VARIABLE'S SPECIFICATION - SAMPLE WITH ALL INTERGENERATIONAL TIES INTACT.

PART I

Variables	Model 9		
	Coefficient	St.dev.	sign
Dependent variable: 10th Grade Point Average			
School and birth year fixed effects			
Proximity mother's parents	-0,0034	0,0069	
Proximity father's parents	-0,0054	0,0071	
Controlled for child specific co-variates			
Gender	0,4041	0,0065	***
Number of older siblings (0 as a reference)			
1	-0,1105	0,0093	***
2	-0,1687	0,0150	***
3	-0,2385	0,0278	***
4	-0,1861	0,0680	**
5 and more	-0,3719	0,0829	***
Number of younger siblings (0 as a reference)			
1	0,0366	0,0091	***
2	0,0672	0,0117	***
3	0,0532	0,0190	***
4	0,1085	0,0407	**
5 and more	0,1768	0,0528	**
Cohort effects: (1986 as a reference)			
1987	0,0408	0,3961	
1988	0,0766	0,3494	
1989	0,3058	0,3070	
1990	-0,0037	0,3495	
1991	0,3336	0,3962	
Month of birth effects: (december as a ref)			
January	0,1138	0,0167	***
February	0,1151	0,0165	***
March	0,1120	0,0158	***
April	0,0869	0,0158	***
May	0,0806	0,0159	***
June	0,0620	0,0160	***
July	0,0526	0,0161	***
August	0,0497	0,0161	**
September	0,0352	0,0161	*
October	-0,0011	0,0163	
November	-0,0124	0,0165	
Size of the place of residence (large as ref)			
population < 4 999	0,0340	0,0311	
population 5 000 - 9 999	0,0107	0,0291	
population 10 000 - 49 999	-0,0121	0,0212	
population unknown	-0,3169	0,1426	*

PART II

Controlled for parent's specific co-variates			
<i>Mother Age when grandchild was born (<23 as a ref)</i>			
	age 23-27	0,0535	0,0126 ***
	age 28-32	0,0973	0,0168 ***
	age >33	0,1786	0,0238 ***
<i>Mother Age when having her first child (<20 as a ref)</i>			
	age 20-24	0,1544	0,0139 ***
	age 25-29	0,2139	0,0165 ***
	age 30-34	0,1751	0,0230 ***
	age >35	0,2116	0,0580 ***
<i>Father Age when grandchild was born (<23 as a ref)</i>			
	age 23-27	0,0185	0,0180
	age 28-32	0,0125	0,0199
	age 33-37	-0,0070	0,0223
	age >38	-0,0421	0,0314
Controlled for grandparents specific co-variates			
<i>Maternal grandmother's age (<43 as a ref)</i>			
	age 43-47	0,0679	0,0206 **
	age 48-52	0,1060	0,0230 ***
	age 53-57	0,1280	0,0247 ***
	age 58-62	0,1408	0,0264 ***
	age 63-67	0,1518	0,0288 ***
	age >68	0,1715	0,0355 ***
<i>Paternal grandmother's age (<43 as a ref)</i>			
	age 43-47	0,0608	0,0321
	age 48-52	0,1006	0,0344 **
	age 53-57	0,1155	0,0357 **
	age 58-62	0,1226	0,0368 **
	age 63-67	0,1317	0,0380 **
	age >68	0,1773	0,0410 ***
<i>Maternal grandfather's age (<43 as a ref)</i>			
	age 43-47	-0,0540	0,0309
	age 48-52	-0,0671	0,0326 *
	age 53-57	-0,0689	0,0336 *
	age 58-62	-0,0574	0,0345
	age 63-67	-0,0549	0,0356
	age >68	-0,0573	0,0379
<i>Paternal grandfather's age (<43 as a ref)</i>			
	age 43-47	0,0263	0,0498
	age 48-52	0,0283	0,0513
	age 53-57	0,0150	0,0522
	age 58-62	0,0494	0,0527
	age 63-67	0,0639	0,0533
	age >68	0,0677	0,0544
Maternal grandmothers' working status		0,0133	0,0091
Paternal grandmothers' working status		0,0165	0,0100

Notes: Age categories are presented for parents and grandparents when a grandchild was born, i.e. 12 years deducted

Do grandchildren perform better at school if maternal and paternal grandparents live close-by versus when they don't?

PART III

Controlled for parent's income			
Mother's income	4.48e-07	1.34e-07	**
^2	8.65e-14	5.26e-13	
^3	-2.18e-19	5.01e-19	
Mother receiving welfare benefits	-0,1192	0,0270	***
Father's income	5.42e-07	3.63e-08	***
^2	-1.64e-13	1.93e-14	***
^3	1.11e-20	1.71e-21	***
Father receiving welfare benefits	-0,1268	0,0340	***
Controlled for parent's education			
<i>Mother's educational level (compulsory ed, as ref)</i>			
Secondary education or equivalent	0,2670	0,0145	***
Bachelor degree or equivalent	0,5274	0,0163	***
More than Bachelor degree	0,6158	0,0253	***
Unknown	-0,3507	0,1501	*
<i>Father's educational level (compulsory ed, as ref)</i>			
Secondary education or equivalent	0,1981	0,0131	***
Bachelor degree or equivalent	0,4253	0,0151	***
More than Bachelor degree	0,4888	0,0183	***
Unknown	-0,0958	0,0846	
Constant	2,5039	0,2366	***
R^2 adjsuted	0,2964		
* p<0,05, ** p<0,01, *** p< 0,001			