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Demographic consequences of migration

Doctoral thesis

Department of Economics

University of Oslo

Series of dissertations submitted to the
Faculty of Social Sciences, University of Oslo
No. 676

ISSN 1564-3991

Cover: Hanne Baadsgaard Utigard.
Print production: Reprosentralen, University of Oslo.

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Acknowledgements

I am greatly indebted to a number of people who made it possible for me to write this thesis. First and foremost, I want to thank my excellent supervisor Øystein Kravdal for his clear head, broad knowledge and kindness. I am also highly grateful for my co-authors – Astri Syse, Terje Skjerpen, Ådne Cappelen, Jørgen Carling, Vebjørn Aalandslid and Kjetil Telle – who have taught me a lot and been so rewarding to work with.

This PhD would not have been conceivable without the support from my employer Statistics Norway and my bosses Marte Rønning and Kjetil Telle. Kjetil has also been a very helpful co-supervisor. I would like to thank the University of Oslo and the Department of Economics with their faculty, staff and PhD students, and the demographers in Norway for being such a friendly and inspiring community.

Special thanks to the Fulbright Foundation and Alícia Adserà at Princeton University for making it possible for me to finish my thesis in an extremely stimulating environment. The students, faculty, staff and guest researchers at Princeton's Office of Population Research have made this a fruitful and fabulous year.

My family and friends have had their thumbs up all through this project, and my husband Øyvind with his humour, wit and patience has been a PhD student's dream.

Thank you all!

Princeton, May 2017

Summary

Demographic consequences of migration may be found at several levels: For societies and people in both origin and destination areas, and at the personal level for the migrants themselves.

Some demographic consequences are rather obvious: increased population in the area of destination and decreased population in area of origin. Other consequences include how the overall fertility, mortality and emigration at destination are affected by immigration. In the essay «Why immigrant fertility in Norway has declined» (Chapter 2) I show that immigrants' fertility in Norway is higher than that of the natives – so immigrants increase the overall fertility rate. However, the total fertility rate among immigrants has declined markedly since 2000, and I show that this is mainly due to newly arrived immigrant women having a lower fertility now compared to that of newly arrived immigrants 15 years ago.

Immigration may also generate more immigration, through migrant networks and migrant-supporting institutions. The essay «Forecasting Immigration in Official Population Projections Using an Econometric Model» (Chapter 3) shows how this mechanism, along with other determinants of migration, can be used to project future immigration to Norway.

For the area of origin, emigration may have several demographic consequences, particularly if the people who emigrate are different from the ones who stay. Also families may be affected if one of its members emigrates. The essay «Fathers' whereabouts and children's welfare in Malawi» (Chapter 5) compares the health and welfare of children whose father is a migrant with that of children with divorced parents, children with a deceased father and children whose father is present, and concludes that concerns about low welfare of migrants' children may be exaggerated.

Furthermore, migration may change the migrants' own demographic behaviour. When coming to a new place, a migrant may be affected by the new area's cultural and demographic patterns. This can translate into changed preferences (for example, preferred number of children and their gender) and changed behaviour (e.g. actual number of children). The essay «Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited» (Chapter 6) shows that among immigrants in Norway from India, more girls than boys are now born in higher parities – contrary to findings among immigrants from India in other Western countries. This may be due to a changed demographic behaviour: Although preferences for boys still seem to prevail among Indian immigrants in Norway, these preferences do not appear to be translated into sex selective abortions.

For some, migration may be challenging, and frequent relocations of children may be linked to adverse outcomes later in life. The essay «Childhood residential mobility and long-term outcomes» (Chapter 4) examines the effect of childhood moving on several outcomes, including early mortality and early parenthood, and finds that childhood moving does have a detrimental effect, also after controls for pre-existing differences between the children who moved and those who stayed.

Introduction

Migration is a powerful force for change, affecting lives and societies all over the world.

Today, around 250 million people live in another country than where they were born,[1] and roughly 40 million move across international borders over a five-year interval.[2] Even more people move inside countries – perhaps more than five times the number of international migrations.[3]

All these figures are, however, approximate. Data on migration, both international and internal, are usually incomplete and incomparable, due to different definitions of migration and migrants, and due to problems of actually recording the movements. As stated by Coleman (2009), «Data are always a problem in demography, but data on migration, and on foreign-born populations, are the worst. Little wonder that most demographers don't do migration».

Nonetheless, migration constitutes an important force – shaping today's societies and millions of people's lives. Even those who never move from their place of birth may still be affected by migration to or from their area.

The consequences of migration are found at several levels. Obviously, migration shapes the lives of the migrants themselves. It also affects the societies of destination as well as the societies and families they leave behind.

Theoretical and empirical migration research have been preoccupied with all these three aspects. They are sometimes interrelated; for instance, both an immigrant herself and her destination society will be affected by how she fares in her new country.

In this chapter, I will first go through some of the theoretical works and empirical findings on consequences of migration in general. Second, I will summarize research on demographic consequences of migration at the three levels and show how this thesis adds to the literature. Finally, I will briefly present each of the thesis' five essays and suggest some avenues for future research.

[1] United Nations (2016) estimates that in 2015, 243.7 million people were living in a country or area other than the one in which they were born (or, in the absence of such data, with foreign citizenship). The number is about 90 million higher than for 1990. International migrants comprise about 3.3 per cent of the world population in 2015, compared with 2.9 per cent in 1990.

[2] Abel & Sander (2014) estimate that the number of international movements were 39.9 million in the period 2000-2005 and 41.5 million in 2005-2010, corresponding to 0.6 per cent of the world population.

[3] An estimated 760 million people are internal migrants, and roughly 230 million move within their country over a five-year interval (Bell & Charles-Edwards, 2013).

Consequences of migration

Consequences of migration, along with causes of migration, have received considerable attention from theoretical and empirical scholars. A multitude of different migration theories exists, reflecting contributions from most of the social sciences and from many different theoretical traditions, and also reflecting the complexity of the migration phenomenon. Today, migration scholars have more or less abandoned the quest for one grand migration theory, and instead work to incorporate a variety of perspectives, seeing the different approaches as pieces of a puzzle rather than competing 'universal' theories, and trying to develop improved contextualised theorisation of migration (Massey, Arango, Hugo, Kouaouci, & Pellegrino, 1999; Piché, 2013; De Haas, 2014).

Existing migration theories may be categorized in many ways (Piché, 2013). It is possible to distinguish between theories on *effects* of migration and theories on *causes* of migration – and Massey *et al.* (1999) further distinguish between theories on *initiation* and *perpetuation* of international migration. Moreover, theories may focus on the *micro* (individual), *meso* or *macro* (structural) level, they can be concerned with certain *types* of migration (such as forced/voluntary migration, male/female migration, or migration for different reasons) or migration in different *contexts* (such as low- and high-income countries, in certain social groups or certain time periods) or certain *kinds of effects* from migration (economic, political, cultural etc.).
De Haas (2014) suggests that migration theories can be categorized into a few main paradigms: The functionalist paradigm (where migration is an optimizing strategy), the historical-structural paradigm (which focuses on how the powerful oppress the poor and vulnerable) and the symbolic interactionist perspective (which focuses on migrants' everyday experiences, perceptions and identity) – and perhaps a fourth group of meso-level theories focusing on the continuation or internal dynamics of migration (such as network theories).

In this section, and also in the next section where I discuss the demographic aspects, I will look at the effects of migration from three angles, based on the object of study: The migrants themselves, the area of origin or the area of destination. Every migration can have effects on all the three levels, but in the literature the effects on each level is usually studied independently.

Migration obviously has consequences for the **migrants themselves**. Early social scientists seem to have been of the opinion that most people would prefer to stay in their origin area. Adam Smith (1776), in his discussion of the large disparities in labour wages across the United Kingdom, concluded that «After all that has been said of the levity and inconstancy of human nature, it appears evidently from experience that a man is of all sorts of luggage the most difficult to be transported.»

Some decades later, Thomas Malthus (1798) wrote: «A great emigration necessarily implies unhappiness of some kind or other in the country that is deserted. For few persons will leave their families, connections, friends, and native land, to seek a settlement in untried foreign climes, without some strong subsisting causes of

uneasiness where they are, or the hope of some great advantages in the place to which they are going.»

Thus, the main reason these early scientists saw for an individual to migrate was an expected net gain from moving to a new place. This notion of anticipated benefits from moving has also characterised many later migration theories. According to neoclassical economic micro-theories on migration, individual rational actors decide to migrate because a cost-benefit calculation makes them expect a positive net return.

Another theoretical discourse has focused on immigrants' integration or assimilation into their country of destination. Particularly in the US, the idea of immigrants' assimilation has been criticised and modified with introduction of concepts such as 'segregated assimilation' and 'spatial assimilation'(Alba & Nee, 1997; Schneider & Crul, 2010). Empirical research on consequences for the migrants themselves has usually been concerned with how international migrants and their children integrate into the destination countries, measured by a wide range of (partly interrelated) indicators such as employment and occupation, language, religion, education, political participation, health and psychological welfare – and even changing of name (see for instance Borjas, 1985; Borjas, 2015; Kogan, 2011; Barrett & Duffy, 2008; Dustmann & Fabbri, 2003; Espenshade & Fu, 1997; Van Tubergen & Sindradottir, 2011; Reitz, Banerjee, Phan, & Thompson, 2009; Fuligni, 1997; De Rooij, 2011; McDonald & Kennedy, 2004; Antecol & Bedard, 2006; Escobar, Nervi, & Gara, 2000 and Carneiro, Lee, & Reis, 2015). Also, some research has focused on the consequences of moving for children and adolescents on outcomes such as education and health (Scanlon & Devine, 2001; Jelleyman & Spencer, 2008).

Interestingly, Piché (2013) notes that the question of whether the migration experience is positive for migrant men and women is rarely studied in developed countries, «as if the microeconomic hypothesis of the rational individual maximizing his interests has become a postulate that needs no verification.»

Instead, in most of these studies immigrants' performance is compared to the performance of natives (or other immigrants) in the destination area/country.

To correctly estimate the effect of migration on migrants, one should ideally compare with a hypothetical scenario in which they did not migrate, but remained in their origin area. This is challenging due to several reasons. First, data availability and quality is limited in many origin areas, making comparisons with origin area difficult. Second, even with good data from origin area, questions of selection pose serious challenges in studies on effects of migration. If those who leave are different from those who stay, comparing the outcomes between the two groups will give biased results. What is interpreted as an effect of migration, may rather be due to other differences between the two groups. Therefore, questions on who to compare with and how to control for potential differences between migrants and non-migrants are major methodological issues when trying to estimate effects of migration on the migrants themselves.

Migration also affects the **area of destination** in many ways. In neoclassical economic macro-theory (such as Lewis (1954) and Todaro (1969)), migration is viewed as a response to (relative) labour shortage in destination areas, and due to immigration the wages can be kept lower than in a case with no migration. Much of the economic empirical literature on migration focuses on how labour markets and wage structures are affected by (different types of) immigration, how it affects public finances, and which groups in the destination countries that benefit from immigration and which groups that do not (Chiswick & Miller, 2014; The National Academies of Sciences, Engineering, and Medicine, 2016; Dustmann & Frattini, 2014; Holmøy & Strøm, 2012).

Other researchers have been more concerned with the cultural changes associated with immigration, changes in crime, or ethnic, religious and linguistic changes (Morawska, 2008; Hagan & Palloni, 1998; Eck, 2002; Kulbrandstad, 2015). Immigration can change the 'mainstream' social and cultural spaces where the native majority feels at home (Alba, Beck, & Basaran Sahin, 2017), and it may also change the political landscape, both because some immigrants become voters and because natives' political opinions may be affected by immigration (Frey, 2008; Eger, 2009)

Another field of research has focused on the medical consequences of migration, including how the indigenous societies in America were exposed to diseases brought from overseas in the sixteenth and seventeenth century, and the role of migration in spreading HIV (Ashburn, 2010; Lurie *et al.*, 2003).

Much of this research on migration's consequences for the destination area – regardless of the specific topic – conclude that the effects depend on the *number* of migrants coming and their *characteristics*. Some countries, like the US, have histories dominated by the different waves of immigrants with their skills and cultures. Skill composition of immigrants can have a direct effect on wage structure, in particular when migration tends to be concentrated in particular occupations and industries. Effects on demand for housing and infrastructure also depend on the income level and preferences among the people arriving. And the consequences on the destination area's culture, language and ethnic composition – as well as medical consequences – obviously depends on where the migrants are from.

The consequences can also depend on how long the immigrants stay in the destination country. Duration of stay – or years since migration – is often crucial to immigrants' performance. Normally, the differences between immigrants and natives diminish with the immigrants' duration of stay. However, some groups may adapt quicker than other groups, and an immigrant may adapt quicker in some aspects than in others.

Migration's consequences for the **area of origin and those left behind** have also received attention. One key question is whether out-migration benefits or impairs the area left behind. According to various historical-structural theories (summarized by Massey *et al.* (1999)), migration flows are generated when peripheral regions come under the influence and control of global markets, trapping poor countries in their

disadvantaged position in the geopolitical structure; and the notion of *brain drain* suggests that origin areas are impaired when the better educated people leave.

On the other hand, hypotheses on *brain gain* suggest that origin area may benefit from migration of highly skilled people, because the higher potential returns from education may encourage many people to seek education, whereas only a few of them will eventually leave (Stark, Helmenstein, & Prskawetz, 1997). Also, remittances sent from migrants may have a great development impact in the origin, and migrants may return with new ideas, skills and contacts from which the origin area can benefit. These effects may be higher when the migration is temporary and not permanent, because of the gains induced by returning migrants (Cantore & Calì, 2015).

Again, much of the effect for the origin areas depends on the number and characteristics of the out-migrants. Here, the notion of *selection* is essential: Leavers may differ from the stayers in important ways, and the effect on origin area depends on who stays and who leaves. This selection can, in turn, depend on economic and political characteristics of the sending and receiving countries (Borjas, 1987).

The effect of migration on households and families left behind have also been topics of interest (Antman, 2013). Theories by the new economics of migration (Stark & Bloom, 1985) view migration as decided by families or households, in order to maximize total income and to minimize risks and overcome constraints associated with market failures. Thus, migration is a way for the left-behind households to access new income sources. The households' decision makers can be expected to also take into account the interest of children when deciding about a migration. However, children may still be negatively affected by moving. The welfare of left-behind children has also received some attention in the literature, where one of the core questions have been whether the benefits of remittances, risk diversion etc. outweigh the physical absence of one or both parents (Démurger, 2015).

Demographic consequences of migration

Within this large picture of migration's effects on people and societies, this thesis focuses on a narrower part: Demographic consequences of migration. This includes effects on population size and structure, and effects on the main components of demographic change: fertility, mortality and (re-)migration.

These effects may be relatively direct, or more indirect through for instance income/economic growth, brain drain/brain gain etc. In this thesis, the main focus is on the relatively direct effects, although some more indirect effects are also touched upon. The thesis is mostly concerned with international migration, but many of the effects may be similar when the migration happens within the same country.

Understanding how migration affects the demography of destination areas, origin areas and the migrants themselves is essential for explaining today's population trends and for forecasting future migration. With an increasing number of migrants, we need knowledge of these effects and how they change over time. Below, I briefly summarize some of the existing knowledge about demographic effects on the areas of destination, areas of origin and for the migrants themselves, and how my thesis adds to this body of knowledge. Each section is organised in two parts: what we already know, and how this thesis contributes.

Demographic consequences for the area of destination

What we already know:

The most obvious and immediate consequence of immigration into an area is an increase in that area's **total population**. Today, immigration is the main contributor to population change in many parts of the world. In most Western European countries, net immigration explains more of the population change than does the natural increase (Eurostat, 2017). In the longer run, immigrants also contribute to the population growth through childbearing, while re-migration and mortality among immigrants work in the opposite direction. Whether the effect of, say, 1000 immigrations will be more or less than 1000 extra inhabitants in the long run, thus depends on these migrants' sex and age and their rates of fertility, mortality and re-migration (and possibly also on the immigrants' effect on the natives' rates).

Immigration can also change the **age structure** in a destination area. People who migrate are often in their 20s or 30s, so in many cases immigration can curb ageing in a society by favourably affecting the old age dependency ratio. However, immigrants also age, and for immigration to completely prevent ageing in a society and maintain potential support ratios, the needed volumes of immigration would be entirely out of line with both past experience and reasonable expectations (United Nations, 2001). Studies by Bujard (2015) and Murphy (2016) have found that in the long run, immigration affects population size much more than it affects age structure.

Immigration into a country may also affect the **regional population distribution,** since many immigrant groups tend to settle in more urban areas (see for instance

Kostaki, Kotzamanis, & Agorastakis (2009) for Greece, Haan (2010) for Canada, and Tønnessen (2014) for Norway).

In addition, immigrants can affect the destination area's **fertility**. In many Western countries, immigrant women have a higher fertility than native women, however the total fertility rates for all women tend to be only slightly elevated due to the immigrants – often around 0.05-0.10 births per woman (Sobotka, 2008).

Since many migrants are in their child-bearing ages, their contribution to the number of births in the destination country is relatively high – the immigrants' share of births often far exceeds their share among the total population. Around 2005, births to immigrant women accounted for about every fifth birth in England and Wales, the Netherlands, Sweden and Germany (Sobotka, 2008). In the US, 23 per cent of the births in 2010 were to foreign-born mothers, higher than the 13 per cent immigrant share of the US population (Livingston & Cohn, 2012).

Studies on immigrant's **mortality** in Western countries find that immigrants tend to have lower mortality than natives (see for instance Singh, Rodriguez-Lainz, & Kogan (2013) and Syse, Strand, Naess, Steingrímsdóttir, & Kumar (2016)) – which may be surprising, since their socio-economic conditions in the destination country are often less favourable than that of natives. One reason may be a positive selection of immigrants – the so-called «healthy migrant effect», implying that they are among the healthiest from their origin area. Another explanation is the so-called «salmon bias», suggesting that migrants (like salmons) return to their origin area before they die – and therefore do not contribute to the mortality in destination area. The low mortality could also be due to immigrants bringing a healthy lifestyle from their origin culture, or to poor data quality on migrant population stock and migrant deaths (Kohls, 2010).

Mortality tends to vary by the immigrants' origin area and by cause of death. Also, the lowest mortality is often found among immigrants with a short duration of residency, while immigrants who have stayed longer, tend to have a mortality closer to the natives'. This could be due to adaptation of unfavourable habits such as smoking, alcohol use, unhealthy nutrition and low physical activity. In Norway, immigrants have a 20 percent survival advantage compared to the natives; however, the convergence in mortality with increasing duration of stay suggests that «healthy migrant» and «acculturation» effects counteract each other (Syse *et al.*, 2016).
The number of deaths in destination country is usually not much affected by immigration in the short run, since few people migrate at older ages.

In addition to contributing by their own births and deaths to the average level of fertility and mortality in a society, immigrants may also affect **mortality and fertility among the natives**. Immigrants can bring medical improvements – or carry infections – that affect mortality in the society they move into, and they can spread new ideas and new inventions that affect fertility behaviour and/or fertility norms. Or, as Furtado (2015) shows from the US, low-skilled immigration may have made it easier for educated urban American women to combine work and childbearing.

Immigration also, in turn, affects **emigrations** from an area. Usually, immigrants have particularly high emigration rates (Constant & Massey, 2003; Dumont & Spielvogel,

2008; Finch, Latorre & Pollard, 2009; Pettersen, 2013; Skjerpen, Stambøl, & Tønnessen, 2015). The majority of emigrants from most Western European countries in 2015 were not born in the country they left (Eurostat, 2016). An OECD study indicates that between 20 and 50 percent of immigrants leave again within five years after their arrival, depending on the country of destination and the time period considered (Dumont & Spielvogel, 2008). Whether an immigrant stays or leaves, appears to depend on a number of factors (Skjerpen *et al.*, 2015): Relatively unambiguous factors include where the rest of her/his family lives (those with close family in destination area emigrate less often), the migrant's sex (women emigrate less often), reason for migration (refugees emigrate less often), attachments to origin area (more attachment, more emigration), and political and economic development in origin area (better outlooks, more emigration), whereas research is more ambiguous regarding the effects of other variables – such as education, success in destination area, age and origin area.

Often, immigration spurs **more immigration**. Migrant networks and migrant-supporting institutions can make migration progressively independent of the factors that initially caused it, and by cumulative causation migration tend to create more migration (Massey *et al.*, 1999).

How strong all the above effects are, certainly depends on the number of immigrations and on the immigrants' characteristics (Edmonston, 2010). These characteristics include age, sex, fertility, mortality, emigration patterns, whether they prefer urban or rural areas (or areas with many or few other immigrants), their duration of stay and area of origin.

This thesis' contribution:

The essay «Why immigrant fertility in Norway has declined» (Chapter 2) shows that one in four new-borns in Norway has an immigrant mother, even though immigrants constitute only 14 per cent of the Norwegian population. The immigrants' fertility is also higher than the natives'. However, total fertility rate (TFR) among immigrants has declined markedly, from 2.64 births per woman in 2000 to 2.01 in 2015.[4] By creating what-if-scenarios and applying a decomposition method, the study aims to disentangle how much of the TFR decline that can be attributed to changed composition of immigrant women by origin area and duration of stay, and how much that is due to declining fertility within groups of immigrant women (by origin area and duration of stay). Using these methods to trace reasons for a changing immigrant TFR has not, to my knowledge, been done previously.

The essay «Forecasting Immigration in Official Population Projections Using an Econometric Model» (Chapter 3) investigates various determinants of immigration to Norway, and shows that previous immigration and the immigrant stock in Norway have a positive effect on new immigration to Norway. The network effect of the immigration stock is statistically significant for immigration from Non-Western parts of the world. The essay shows how this information (along with information on other

[4] Updates figures show that the immigrant TFR in Norway continued down to 1.98 in 2016.

migration determinants based on a neoclassical framework) can be used in an econometric model to forecast future immigration to Norway, which to my knowledge has not been done in official population projections before. Immigration from three geographical areas of origin are modelled separately, and the paper shows how different assumptions on future income differences between Norway and the origin areas give quite different projections of future immigration – partly through the network effect.

Demographic consequences for the area of origin

What we already know:

Many of the demographic consequences for the origin area, and those left behind, are mirrors of the consequences for destination areas: Out-migration will, all else equal, lead to a decrease in the **total population** and a changed age structure – usually with fewer people of age 20-40 years (and fewer children). And, as for the destination area, the effect depends largely on the number of those who leave and their characteristics – whether they are a select group compared with those who stay.

Some of the earliest migration studies in Norway were concerned with this selection. In the 1800s and early 1900s, Norway was a country of emigration. In 1843, before the great waves of emigration to America, a committee concluded that many of the emigrants were «partly useless and dissatisfied compatriots», and that the emigration had not weakened the nation's strength. However, less than 100 years later, things were viewed differently. A report concluded that the emigration not only had resulted in a «quantitative deterioration» because of the large number of people who had left Norway, but also a «qualitative reduction of the population» because the share of the working age population had declined, and because increasingly more women than men remained in Norway (Departementet for sociale saker, 1921).

Out-migration may affect origin area **fertility** in several ways. On the one hand, emigration may reduce population pressure in densely populated areas, and thus contribute to maintenance of otherwise unsustainable high birth rates (Crews & Lawson, 2015). On the other hand, if one partner migrates while the other one stays behind, their childbearing may be postponed or cancelled. In Mexico, a lower fertility and a lower share of marriages have been observed in areas with large out-migration of men (White & Potter, 2013). The large out-migration from Albania after 1990, initially mostly of men age 25-35, reduced the potential for childbearing due to lack of matching partners, which may have affected fertility (Gjonca, Aassve, & Mencarini, 2008). In Albania fertility effects are also found from indirect exposure to emigration, through migration's transformation of the larger social context (Lerch, 2015), supporting the conclusions put forward by Fargues (2011) on how migrants may convey ideas back to their community of origin and thus contribute to spreading the demographic transition.

Research from China also suggests that son preference in rural origin areas may be affected by migration when most of the out-migrants are women; migration can

enable women to accrue more economic power, thus redefining the value of women in the Chinese countryside (Lu & Tao, 2015).

Emigration's effect on **mortality** in origin areas may partly mirror the mortality effect in areas of destination; if the migrants are among the healthiest in origin area, and/or if they do return to die in origin area at old age, this will contribute to higher mortality rates at origin. Also, large outmigration of vital health personnel can impact the mortality in origin areas. On the other hand, for left-behind families, remittances can increase the household income and thus indirectly affect the health, wellbeing and mortality of migrants' families. And if the migrants return with a new life style, this may also affect the life style, health and possibly mortality of their family and friends. For children left behind, research have been inconclusive on whether having a migrant father benefits the child or not.

Just like immigration to a country of destination can generate more immigration, emigration from an origin country can generate **more emigration**. Previous emigrants may provide a network for potential migrants, they may demonstrate possibilities previously not considered achievable, and remittances and ideas may enable more people to qualify for opportunities to migrate.

Because some emigrants will eventually return to their origin area, increased emigration can be expected to increase gross immigration into a country – although the net migration may still be largely negative.

This thesis' contribution:

In the essay «Fathers' whereabouts and children's welfare in Malawi» (Chapter 5) the welfare of children whose fathers are absent due to different reasons are compared. One category of children have migrant fathers, whereas two other categories of children have fathers who are either dead or divorced from their mothers. The welfare of these groups are also compared to the welfare of children with their fathers in the household. Such comparisons of welfare across different groups of children in developing countries with absent fathers are not often found in the literature, where most of the focus has been on either HIV/AIDS orphans or children left behind by migration. The results show that although households with a migrant father may not always be similar to households with a present father, the welfare of children in these two types of households is markedly better than the welfare of children whose father is deceased or divorced from their mother. By investigating this using data from the Demographic and Health Surveys (DHS), which are not primarily designed for migration analyses, this study also represents a methodological contribution to the use of DHS data – a widely used data source from most developing countries.

Demographic consequences for the migrants

What we already know:

Migrating may have several demographic consequences for the migrants themselves. It may affect their fertility preferences and fertility behaviour as well as his/her health and mortality, and people who have migrated once may have a higher probability of migrating again, as they may be less attached to the place they live in. In studies on demographic consequences for migrants, three factors seem to be particularly important: Time since migration, age at migration, and origin area.

The **fertility** of immigrant women moving from high to low fertility areas often declines by their duration of stay in the destination area. This may be explained by several hypotheses (see, for instance Kulu, 2005; Milewski, 2010; Wilson, 2015; and Adserà & Ferrer, 2015). The *adaptation hypothesis* states that immigrant women will gradually adapt to the destination area's fertility behaviour, whereas the *hypothesis on interrelation of events* emphasizes that many migrants move because they are starting a family, implying that fertility is particularly high the first years after immigration. In addition to duration of stay and area of origin, age at immigration is important for fertility (Adserà & Ferrer, 2011), and origin area appears to be another important determinant, in line with the *socialization hypothesis* – immigrants from high fertility areas are influenced by their childhood's values, fertility behaviour and preferences and therefore display higher fertility even in low-fertility countries. However, immigrants may be a select group compared to other non-migrants in their origin area, a fact emphasized by the *selection hypothesis* on migrant fertility.

Fertility preferences can also relate to the sex of the child. In India, son preferences has resulted in hundreds of thousands sex selective abortions (Arnold, Kishor, & Roy, 2002), and studies from various countries in Western Europe and North America indicate that many immigrants from India maintain these son preferences when moving to a Western country.

Migrant **mortality** seems to be affected by duration of stay, too. As mentioned above, immigrant often have a mortality advantage over natives, but this appears to decline by time since migratoin.

Also the propensity to **migrate again** changes with duration of stay. Usually newly arrived immigrants are most prone to re-migrate (Constant & Massey, 2003; Dumont & Spielvogel, 2008; Finch *et al.*, 2009; Pettersen, 2013; Skjerpen *et al.*, 2015)

Moving as a child may have different consequences than moving as an adult. Research in fields like psychology, education and health have highlighted reasons why moving could be harmful for a child. One challenge in this research is to control for pre-existing differences between stayers and movers. Most empirical research has shown that movers perform poorer than non-movers, however after controls for differences between the two groups the adverse effects are reduced and sometimes disappear. Where effects are found, they seem to increase with the number of moves, whereas results concerning effects by age at moving are more ambiguous.

This thesis' contribution:

The essay «Childhood residential mobility and long-term outcomes» (Chapter 4) examines the effect of childhood moving on several outcomes, including early mortality and early parenthood. Models with and without sibling-fixed effects are used in order to control for differences between movers and stayers that may influence the risk of the adverse outcomes. Fixed effects models have not, to my knowledge, been use to investigate this issue before. The results indicate that childhood moving does have a detrimental effect, and that the risks of adverse outcomes increase with increasing number of moves. Also, age at moving matters; moves during high school years seem to be the most unfavourable.

The essay «Why immigrant fertility in Norway has declined» (Chapter 2) shows that also in Norway, immigrant women's fertility tends to decrease by their duration of stay – in particular among Non-Western immigrants. This could be due to adaptation effects and/or interrelation of events around migration. However, the essay shows that this decline by duration of stay is not the reason why the total fertility rate (TFR) among all immigrant women in Norway has declined since 2000, nor is changed composition of immigrant women by area of origin. The main reason for the TFR decline is found among newly arrived immigrant women, particularly from Asia, who have a lower fertility now than the newly arrived had 15 years ago. One likely explanation is that fertility has declined in origin areas, not the least in Asia. These findings underscores the need to take into account both time *since* arrival and time *of* arrival when studying immigrant fertility.

In the essay «Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited» (Chapter 6) the share of girls born to Indian-born women in Norway is investigated. Among births of third or higher order, there was a significant higher probability of having a boy in the period 1987 to 2005 – indicating a prevalence of sex selective abortions, in line with findings from India and among Indian immigrants in other Western countries. However, in the period 2006-2012 more girls than boys were born in the third or higher parity.[5] This has not been found before in the literature on sex ratios among Indian immigrants in Western societies. Even if preferences for a boy still seem to prevail among Indian immigrants in Norway, these preferences appear not to be translated into actual abortions. Immigrants may adapt quicker in some aspects than in others, and the results from this essay suggest that living in the relatively gender-equal Norwegian society may have affected the Indian-born women's fertility behaviour, even if preferences for sons may still be prevalent.

[5] Updated figures show that in 2013 and 2014, equally many girls and boys were born in third or higher parity, while in 2015 there were more girls and in 2016 more boys.

Summary of the essays

This thesis explores demographic consequences of migration from different angles. It relates to many disciplines, such as demography, economics, sociology, psychology, health and education research. Several methods are used: traditional logistic regression, binominal probability models, time series models, linear probability models with and without fixed effects, what-if scenarios and decomposition of demographic rates.

Whereas migration data often has dubious quality, the data from Norway's population register is generally of high quality, even on migration flows and migrant stocks (Pettersen, 2013; Vassenden, 2015). The Norwegian population register is the main data source used in these studies, sometimes supported by data from other registers in Norway or from international agencies. The essay from Malawi uses the Demographic and Health Survey – a survey that has been conducted over 300 times in over 90 countries.

Such data sources make it possible to answer many research questions. However, migration data is still among the least reliable in demography, and improvements in collecting and standardizing migration data can also improve further research in this field. This is discussed towards the end of this chapter, after a brief summary of each of the essays in this thesis. The full essays are presented in the next chapters.

Essay 1: Why immigrant fertility in Norway has declined

The goal of this study was to explain why the total fertility rate (TFR) of immigrants in Norway declined from 2.64 births per woman in 2000 to 2.01 in 2015. Such a decrease might be interpreted as a sign of successful integration of immigrants into the Norwegian society, since fertility usually is lower among immigrant women with longer duration of stay. Another possible explanation for the declining TFR is a change in composition of immigrant women by area of origin, such as a higher share of immigrants from low-fertility countries in Eastern EU. The decline could also be due to changed fertility *within* subgroups of immigrant women (by origin area and duration of stay).

The study used two different methods to disentangle the effect of changed composition by origin area and duration of stay from the effect of changed fertility within subgroups: First, what-if scenarios were calculated, in which either composition (by origin area and duration of stay) or fertility (in each subgroup) was kept constant at the 2000 level, while the other factor was allowed to change as it actually did. Second, a formal decomposition method was used. Both methods show that the main reason for the TFR decline among immigrant women in Norway since 2000 is not changed composition by origin area or duration of stay (which could be due to successful integration). The main reason for the declining fertility is found among newly arrived immigrant women, who have a lower fertility now than the newly arrived had 15 years ago. In particular, newly arrived immigrants from Asia have a considerably lower fertility now compared to what the newly arrived Asian immigrant women had in 2000.

A further decomposition, by reason for migration, shows that a key to understanding this fertility decline among the newly arrived can be found among the women who migrate for family reasons. Their share among all newly arrived women has decreased, and so has their fertility. Among newly arrived family migrants from Asia the TFR has declined by more than two births per woman. Fertility has declined also among other family migrants, especially from Non-Western parts of the world.

This declining fertility among family migrants may reflect a declining fertility in many (Non-Western) origin areas. Socialization theories on immigrant fertility emphasize the importance of childhood context for shaping women's fertility behaviour and fertility preferences. This study underscores the need to bear in mind that such socialization changes as societies change over time. Studies of immigrant fertility should therefore take into account time *of* arrival as well as time *since* arrival, particularly when there have been clear changes in origin area fertility.

Essay 2: Forecasting Immigration in Official Population Projections Using an Econometric Model [6]

The goal of this essay was partly to display migration forecasting methods used in national and international population projections, and partly to explain how immigration can be forecasted by using an econometric model.

First, the essay shows how migration is forecasted (in 2013) in 15 European and North American countries as well as by four international agencies. Most of these forecasts rely mainly on extending past immigration trends, often with some adjustment for policy changes and economic prospects, and sometimes with reference to expert opinions. However, most international as well as national population projections lack a formal migration forecasting model.

Second, an econometric model for forecasting (gross) immigration to Norway is presented. This model is used in the official Norwegian population projections and is based on standard migration theories. The main variables include income level, unemployment, population size in Norway and the areas of origin, as well as the number of immigrants already living in Norway. This latter variable takes into account one of the demographic consequences of migration discussed above: Through migrant networks, migrant-supporting institutions and cumulative causation, migration tends to create more migration.

In the model, immigration to Norway is disaggregated into three geographic areas: Western countries, Eastern EU members, and the rest of the world. Three conditional forecasts are presented for each area, with different assumptions about the development in relative income per capita. This illuminates how the forecasts of immigration to Norway are affected by different assumptions about future economic development.

[6] Joint with Ådne Cappelen og Terje Skjerpen, published in International Migration Review (2015).

The essay also discusses uncertainty in the forecasts, which stems from several sources. Two important sources of forecast errors are the presence of error terms in the econometric equation and uncertainty about the estimates of the parameters in the model. Yet another source is uncertainty about the future determinants of immigration, such as income differences and unemployment. It is also possible that the determinants' effect on immigration will change in the future, due to for instance new policies or changed behaviours. Migration patterns have been quite different in different historic periods, as Van Mol & de Valk (2016) show from Europe; the period up to the oil crisis was characterized by guest worker schemes and openness to migration, whereas the next period (until the fall of the iron curtain) saw immigration restrictions, more family immigration and more asylum seekers, and the last period (from 1990s until today) is characterized by removal of intra-European migration barriers and more restrictions on migration into the EU. These kinds of structural shifts are difficult to predict with econometric models.

Finally, the essay suggests possible further improvements of the model and concludes by stating some advantages of using a formal method for migration forecasting.

Essay 3: Childhood residential mobility and long-term outcomes [7]

This study aimed at uncovering how outcomes among young adults are affected by moves during childhood. Most previous studies on the effect of childhood moving show that movers, on average, tend to be disadvantaged compared to those who did not move, almost regardless of the outcome studied. However, there might be pre-existing differences between the two groups, and it is methodologically challenging to separate the effect of the move itself from other, underlying factors.

The study used data on complete cohorts of persons born in Norway between 1965 and 1980 (N = 967 151) and all their relocations between Norwegian municipalities. The outcomes analysed were high school completion, income at age 28, parenthood before age 20 and mortality before age 28. Models with and without sibling fixed effects were employed to investigate the long term effects of both the number of childhood moves as well as of age at moving.

The sibling fixed effects model makes it possible to sweep out all time-invariant characteristics of siblings in the same family, such as reasons for moving, parents' background etc. To estimate the effect of moving at different ages, this method uses variation between siblings who belonged to different age groups at moving. To estimate the effect of number of moves, the method compares siblings with different numbers of childhood moves. Observable covariates that vary between children in the same family, such as the child's gender, birth cohort, birth order and the mothers' age at birth of the child, were controlled for. By using sibling-fixed effects, this study takes one step closer to estimating the actual effect of moving for those who move. However, unobserved confounders that vary between children in the same family are still not controlled for, and there may also be important variation in effects between

[7] Joint with Kjetil Telle and Astri Syse, published in Acta Sociologica (2016).

different movers (by for instance reason for moving, municipalities of departure and destination or distance of the move).

The results show that on average, children who move have higher likelihood than children who do not move of high school dropout, low income, early parenthood and early mortality, even after controls for various observable characteristics. With control for non-observable family characteristics in fixed effects models, associations become weaker and for early mortality the effects are no longer statistically significant.

In general, risks for adverse outcomes increase with increasing number of moves. For children who moved only once, there is little evidence for adverse outcomes if the move happened prior to elementary school, whereas moves during high school are associated with increased risk for adverse outcomes.

Essay 4: Fathers' whereabouts and children's welfare in Malawi [8]

Migration may have consequences for migrants' left-behind children. However, migrant children are not the only children with one or both parents lacking in the household. While most previous studies on the impact on parental absence on children's welfare in developing countries have concentrated on two main topics – how orphanhood resulting from adult HIV/AIDS mortality affects children's welfare, and the effect of parental migration for children left behind – this study aimed at identifying vulnerable children across different groups of children with absent fathers, whose welfare has not often been compared in the literature.

The data in this essay were from the Demographic and Health Survey (DHS) in Malawi (2010). The DHS is not primarily designed for analyses of migration or parental migration, however this study shows how existing variables in the survey can be combined to identify children whose father is most probably a migrant. If their father was reported alive, but not living in the household, and their mother was reported as married, but not one of several wives in a polygamous marriage, the father was assumed to be a migrant.

The outcome variables used were partly directly related to children's health and thereby potentially to their mortality, and partly more indirect through clothing and education: Non-use of mosquito nets, too low weight, cases of diarrhoea, coughing or fever, non-attendance at school, fewer than two meals the day before the interview, no pair of shoes and fewer than two sets of clothes.

The results show a clear pattern of welfare differences: children whose father is either present or a migrant are better off, and children whose father is deceased or whose parents are divorced are worse off. This indicates that concern about low welfare of migrants' children might be exaggerated. By contrast, vulnerable children of divorcees are at risk of being overlooked in a policy environment that focuses on orphans.

[8] Joint with Jørgen Carling, published in Development Southern Africa (2013).

Essay 5: Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited [9]

In some parts of Asia, and particularly in India where son preference is strong, the female to male ratio among children is unnaturally low, indicating that female foetuses are being aborted. Also among some immigrant groups in Western Europe and North America a low share of girls has been attributed to sex selective abortions. A previous study based on figures until 2005 found the same trend for Indian immigrants in Norway; the aim of this study was to investigate whether the trend persisted after 2005.

Data on all live births in Norway for the period 1969–2012 were used to investigate the sex ratios among new-borns whose mother was born in India. The percentage of boys was calculated for each birth order, during four sub periods. In studies of sex preference it is essential to investigate birth orders separately, because parents may not take action to make sure their next child is a boy until they have already got some children, but no or few sons. A binominal probability model was used to test whether the observed sex differences among Indian-born women were significantly different from the sex differences among all births.

The results confirm that, after the introduction of ultrasound scanning technology in Norway in 1987 and until 2005, the Indian-born women in Norway did give birth to a higher than normal share of boys in third or fourth birth order. However, in 2006-2012, the trend seems to have changed: More girls than boys were born in third or higher birth orders in this period. Such a changed trend is not found among Indian immigrants in other Western countries. The study further shows that the change cannot be explained by new waves of immigrant women from India. Instead, it is due to changed sex patterns among the new-born children of long-residing Indian-born women in Norway.

The data indicate that Indian-born mothers in Norway with two children more often have another child if the two previous children are girls than if they are boys, even in the last period, indicating a persisting preference for sons. However, this preference does not seem to be translated into sex selective abortions.

Since the number of observations in this study is small, the results may just reflect random fluctuation. However, if the changed sex ratios are not a result of coincidence, they may suggest that living in the relatively gender-equal Norwegian society can affect Indian immigrants' inclination to perform sex selective abortions.

[9] Joint with Vebjørn Aalandslid and Terje Skjerpen, published in BMC Pregnancy and Childbirth (2013).

Into the future: More data, better research

Future research on demographic and other consequences of migration depends to a large degree on the availability of reliable data. Fortunately, much work is being done at national and international levels to obtain better migration data, and methods are being developed to extract migration information from a number of sources (as shown in Chapter 5 for the DHS data). Also, every year the time series on migration get longer and more useful.

This can enable researchers to conduct even more interesting and reliable analyses on demographic and other consequences of migration, for instance by applying fixed effects models that normally require large data sets (as shown in Chapter 4 on childhood movers), and by combining data from origin and destination countries in order to better understand how immigrants themselves are affected by the migration.

Reliable data on emigration has been particularly difficult to obtain. If emigrations are better recorded, this can open up more possibilities to analyse differences between movers and stayers, in order to better capture why some people migrate and how they differ from those who stay behind.

Better data can also enable better methods for forecasting future migration. For instance, with better data on migration by age and sex, it can be possible to use migration rates by age and sex in migration projections – which would be more accurate than simply using one rate for the whole population, since migration is usually concentrated around certain ages (20-40 years).

Another possible avenue for future work is to let research on internal and international migration better inform each other. Some determinants and consequences may be similar whether the mover crosses an international border or not. When barriers to border crossings are removed, such as for intra-EU migration, the difference may not be large to internal migration such as between states in India or provinces in China. Internal migration has also made the world increasingly urban. What it means for mortality, fertility and migration that most of the worlds' population now live in towns or cities, is a pertinent question that deserves more research.

More and better empirical research on migration and its consequences might also spur more theoretical migration research. For instance, theories on migration have often overlooked the intrinsic value of migration (De Haas, 2014) – some migrants appreciate the moving in itself, as an opportunity for adventure, discovery and sense of freedom. The intrinsic value of migration may vary between individuals (and by age), making some persons (in certain ages) more emigration prone than others. In other words: while Adam Smith's and Thomas Malthus' assumptions about the sedentary nature of man may describe some or most persons, it may not apply to all.

Migration is a powerful force of population change in today's world. With better data and better empirical and theoretical research, migration might also become an even more significant part of demography – a discipline which, in some aspects, is still based on a world view where all countries have zero net migration.

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I

Why immigrant fertility in Norway has declined

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Abstract:

Immigrant fertility has decreased in many Western countries. In Norway, immigrant women's total fertility rate dropped from 2.6 births per women in 2000 to 2.0 in 2015. The main reason for this decline is not successful integration or changed composition of immigrants by origin area. Decomposition and what-if scenarios show that the main reason is found among newly arrived immigrant women, in particular from Asia, who have a lower fertility now than the newly arrived had 15 years ago. This is to a large extent explained by the newly arrived family migrants, whose fertility often appear to reflect fertility changes in origin.

Introduction

In many Western countries, total fertility rate among immigrant women has declined over the last decades. Although the trends shown in Figure 1 are not uniform across all countries, and although data quality and comparability may pose challenges (Sobotka 2011), there appears to be a general tendency of decrease. Also, the fertility gap between immigrant and native women (or between non-citizens and citizens) has decreased in almost all these countries.

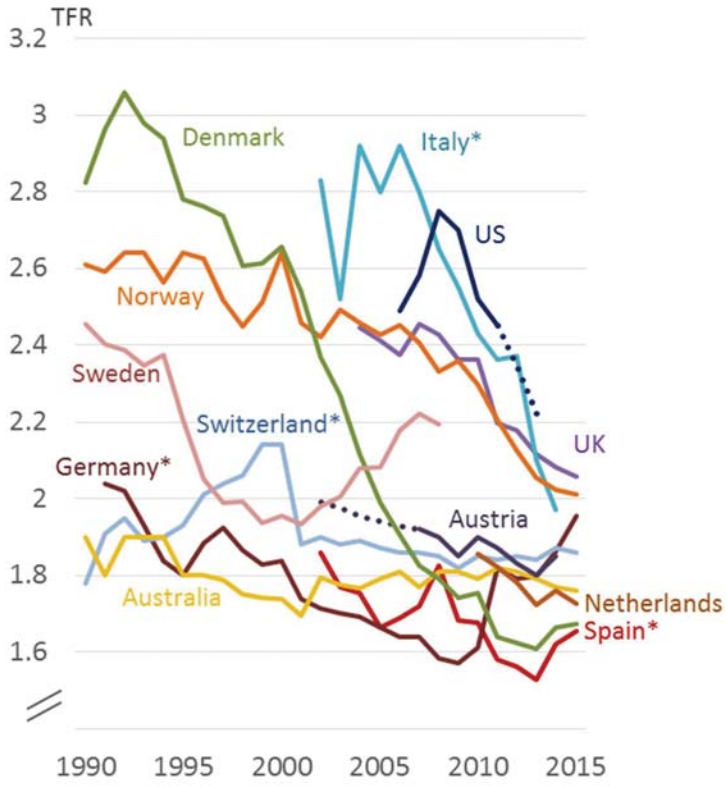

Figure 1. Total fertility rate among immigrant women (or *non-citizen women)[1] in some Western countries, 1990-2015.[2,3]

[1] Figures for non-citizens are used when figures for immigrants were not available.
[2] Dotted lines indicate lack of data for some years.
[3] Sources: Australian Bureau of Statistics (abs.gov.au), Statistics Denmark (dst.dk), Geburtenbaromenter Austria (oeaw.ac.at), Germany's Federal Statistical Office (destatis.de), Italian National Institute of Statistics (Istat.it), Statistics Netherlands (cbs.nl), Spain's National Statistics Institute (ine.es), Switzerland's Federal Statistical Office (www.bfs.admin.ch), United Kingdom's Office for National Statistics (ons.gov.uk), American Community Survey/Center for immigration studies (cis.org), Statistics Sweden and Statistics Norway.

The goal of this study is to explain why the total fertility rate among immigrants in Norway declined from 2.6 births per woman in 2000 to 2.0 in 2015, as shown in Figure 2. Fertility among native Norwegian women did not show a similar trend, and the fertility gap between immigrant and native women decreased from 0.9 to 0.3.

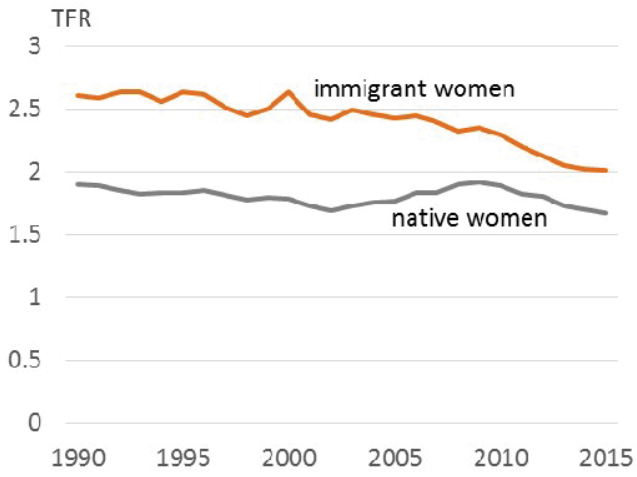

Figure 2. Total fertility rate in Norway, immigrant women and native women age 15-49, 1990-2015.

Immigrants' fertility affects Western societies in a multitude of ways. Since many immigrant women are in their childbearing ages, their contribution to the number of children born is relatively high. In Norway, one in four newborns has an immigrant mother, even though immigrants constitute only 14 per cent of the population. The number of children born to immigrants affects population size and age composition; in the short term, it translates into a higher need for kindergartens and schools, in the longer run it affects the labour force, the future number of women in childbearing ages and the old-age-dependency ratio. Immigrant fertility is also relevant for the public debate in many Western countries, where some may be concerned about the future number of immigrants and immigrants' children and a declining share of the majority population.

And, of course, immigrant fertility has an impact on the lives of immigrant women themselves and their families. A woman's number of children can affect her labour supply, which in turn can influence her and her family's income. In Norway, immigrant families with many children are among the poorest in society (Epland and Kirkeberg 2016), so immigrant fertility can also be linked to the income distribution in countries like Norway, as well as childhood conditions and later outcomes for immigrants' children. Finally, fertility decisions are often seen as a key indicator for immigrants' social integration in a society (Adserà et al. 2015), and thus a measure of a society's ability to include new migrants.

Total fertility rate (TFR) summarizes current fertility patterns into one number (usually interpreted as births per woman) and is a common measure for showing fertility changes over

time. Since immigrant TFR is a summary measure, it may change for several reasons. Understanding these reasons is essential in order to interpret trends correctly, to possibly implement the right policy responses and to better forecast future fertility.

One possible reason for declining immigrant TFR could be successful integration into Western societies. Integration often implies that an immigrant woman's fertility decreases as her duration of stay increases. However, this will only lead to decreases in TFR for all immigrant women if the proportion of women with long duration of stay increases. Immigrant TFR can also decline due to changed composition of immigrant women by origin area, for instance if the share of immigrants from low-fertility countries increases. A third possible reason could be changed fertility *within* subgroups of immigrant women (by duration of stay and country of origin).

This study aims to uncover how much of the decline can be attributed to these different explanations. In Norway, the share of immigrant women from Eastern Europe has increased markedly since 2000, while the share from Western Europe has decreased. The proportion of immigrant women with long duration of stay has changed only slightly. Two methods were used to examine how these (relatively small) changes contributed to the decline in immigrant TFR: In what-if scenarios, the composition of immigrant women (by 8 origin areas and 4 durations of stay) was allowed to change as it actually did, while the fertility in each subgroup was kept constant at 2000 levels – and vice versa. The second method was a decomposition based on Kitagawa (1955), applied to changing fertility over time.

The two approaches broadly gave the same conclusion: Although immigrants' fertility often declines with their duration of stay, this does not explain why immigrant TFR in Norway has fallen so noticeably since 2000, nor does changed composition by origin area. Almost all the decrease in immigrant TFR in this period can be explained by changed fertility *within* the subgroups (by origin area and duration of stay). In particular, more than half the decrease is explained by newly arrived immigrant women (0-2 years of stay), who have a lower fertility now than the newly arrived had 15 years ago.

Further decompositions, by reason for migration, show that a large part of this decline can be explained by the family migrants. Their share among all newly arrived immigrants has decreased since 2000, and so has their fertility. Among the newly arrived family immigrants from Asia, the TFR has declined by more than two births per women, possibly reflecting falling fertility in origin countries.

Theories and previous research

Over the last decades, much research has been done to describe immigrant fertility in Western countries (see for instance Haug et al. 2002 and Sobotka 2008 for a European overview; Abbasi-Shavazi et al. 2000 and Carmichael et al. 2003 for Australia; Zeman et al. 2015 for Austria; Sobotka 2011 for Austria, Germany and Switzerland; Bélanger et al. 2002, Woldemicael et al. 2012 and Adserà and Ferrer 2010, 2011, 2014, 2015, 2016 for Canada; Toulemon 2004 and Héran et al. 2007 for France; Mayer et al. 2000, Milewski 2007, 2010, Schmid et al. 2010, Stichnoth et al. 2013, Cygan-Rehm 2014 and Wolf 2016 for Germany; Mussino et al. 2012 and Giannantoni et al. 2015 for Italy; Goldstein et al. 2009 for Greece, Italy and Spain; Garssen et al. 2008 and Fokkema et al. 2008 for the Netherlands; Castro Martin et al. 2011 and del Rey et al. 2015 for Spain; Andersson 2004, Persson et al. 2010, Persson 2013 and Persson et al. 2014 for Sweden; Tromans et al. 2009, Coleman et al. 2010, Dubuc 2012, Waller et al. 2012, Wilson 2015, Kulu et al. 2016 and Robards et al. 2016 for United Kingdom; and Blau 1992, Carter 2000, Lindstrom et al. 2002, Frank et al. 2005, Blau et al. 2008, Parrado 2011, Lichter et al. 2012, Livingston et al. 2012, Choi 2014 and National Academies of Sciences 2015 for the United States). Among several other findings, such as the importance of age at immigration, these studies often describe two distinctive features of immigrant fertility in Western countries:

1) Fertility is usually relatively high among immigrants from high fertility areas of the world.
2) Immigrants' fertility tends to change by their duration of stay. Often, fertility is relatively high during the first years after immigration and declines as years since arrival grow.

Several hypotheses may explain these two patterns. A thorough overview of migrant fertility hypotheses are presented in for instance Kulu 2005, Kulu et al. 2008, Milewski 2010, Kulu et al. 2014, Wilson 2015 and Adserà and Ferrer 2015. Below is a brief summary of how the main hypotheses could explain the two patterns mentioned above and possibly also the decline in immigrant TFR in Norway.

The role of duration of stay

Several hypotheses may illuminate why immigrants' fertility tends to change with their duration of stay. According to *the adaptation hypothesis,* a person's fertility behaviour is affected by the context she currently lives in. When an immigrant settles in a new country, she will start adapting to this country's fertility level. As time goes on, her fertility will gradually resemble the fertility trends of native women. Women who initially have very different fertility

norms from those in the destination country may need longer time to adapt. This hypothesis may explain why, among migrants who have moved from high to low fertility countries, fertility rates are often lowest among women with long duration of stay.

However, the *hypothesis of interrelated events* (or family formation hypothesis) may also explain why immigrant fertility often is highest in the first years after migration. This hypothesis emphasises that many immigrant women migrate because they are starting a family, and therefore fertility will be particularly high the first years after migration, perhaps also because migrants catch up with births postponed during the migration event.

The disruption hypothesis, on the other hand, argues that since migration is stressful and often involves separations of spouses as well as depressed income, we can expect a temporary drop in fertility around the time of migration. Consequently, newly arrived immigrant women will have a lower fertility than those with more years of stay.

Thus, according to both the adaptation hypothesis and the hypothesis of interrelated events, the TFR for all immigrant women will decrease if the share of immigrant women with long duration in the destination country increases, while the disruption hypothesis would predict the TFR to decrease if the share of newly arrived immigrant women increases.

The role of origin area

According to the *socialization hypothesis,* people are formed by their childhood values and behaviours. Even if they move to a new country, their fertility will be defined by the norms they once were socialized into. Immigrants who arrive as children will have part of their socialization in their new country, and hence be formed by several sets of fertility norms. This hypothesis may explain why immigrants from different origin areas have different fertility.

However, different subgroups in the origin countries may have different fertility norms. The *selection hypothesis* states that immigrants may be a select group compared to non-migrants in their origin areas. This is one reason why immigrants' fertility is not exactly the same as in their origin areas. An immigrant women's reason for migration may reveal some of this selection. For instance, women who migrate to work may have lower fertility preferences than women from the same origin area that move to start a family.

These hypotheses predict that TFR for all immigrant women decreases if the share of immigrant women from low-fertility areas increases, or if the share of women with low-fertility preferences increases (for instance, if family migrants are replaced by labour migrants).

Hence, several hypotheses could explain why changed composition of immigrant women by duration of stay or origin area could lead to changed TFR for all immigrant women. However, TFR could also change if fertility changes *within* subgroups (by origin area and duration of stay). Such changes are not as often addressed in the literature. However, they could possibly be explained by expanding the theoretical framework to include changed speed of adaptation, changed forms of disruption/interrelation of events, changed selection in origin areas, or changed socialization. The TFR changes could also reflect general fertility trends in Norway, driven by for instance changing economic conditions.

Data

The data in these analyses were taken from Norway's population register, which includes complete cohorts of all immigrant women aged 15-49 and all their live births in Norway. Immigrants are defined as people born abroad to foreign-born parents (and grandparents) and who have immigrated to Norway in order to stay for at least six months, with legal permission to stay. This study included 174,464 births to immigrant mothers in the period 2000-2015 and a total of 2,292,488 person-years of immigrant women aged 15-49 (less than 90,000 in the first years and almost 230,000 in 2015). Due to insufficient information, 212 births to foreign-born mothers were excluded from the sample.

Composition by origin area and duration of stay

In the last decades, Norwegian immigration has experienced large changes. After the enlargement of the European Union in 2004, the number of immigrants from new EU members in Eastern Europe increased dramatically. The number of immigrants from other parts of the world also increased in this period. Figure 3 shows how the numbers and shares of immigrant women in childbearing ages (15-49 years) living in Norway changed from 1990 to 2016, by origin area and duration of stay. The origin area *Western EU* includes all countries in Western Europe, and Greece and Cyprus (many immigrants in this group are from the Nordic countries or Germany). *Eastern EU* includes the 11 new Central and Eastern Europe EU members since 2004 (Polish and Lithuanian immigrants are large groups). *Europe outside the EU* includes all Non-EU countries in Eastern Europe (many in this group are from Russia or former Yugoslavia). *Western and Southern Asia* includes all Asian countries west of Myanmar/Burma

– including Turkey (the Iraqi, Pakistani, Indian, Turkish and Iranians are large groups). *Eastern and South East Asia* includes all Asian countries east of India – including China and Mongolia (large groups here are from Vietnam, Thailand and Philippines). *Africa* includes the whole continent (Somalis and Eritreans are large groups). Latin America includes all of South and Central America, as well as the Caribbean and Mexico (many are from Chile and Brazil, however, this group is small in Norway). *US, Canada and Oceania* includes Canada, US, New Zealand, Australia and the Pacific islands (also a small group, most are from the US). Duration of stay is defined as the number of years since (first) migration to Norway.

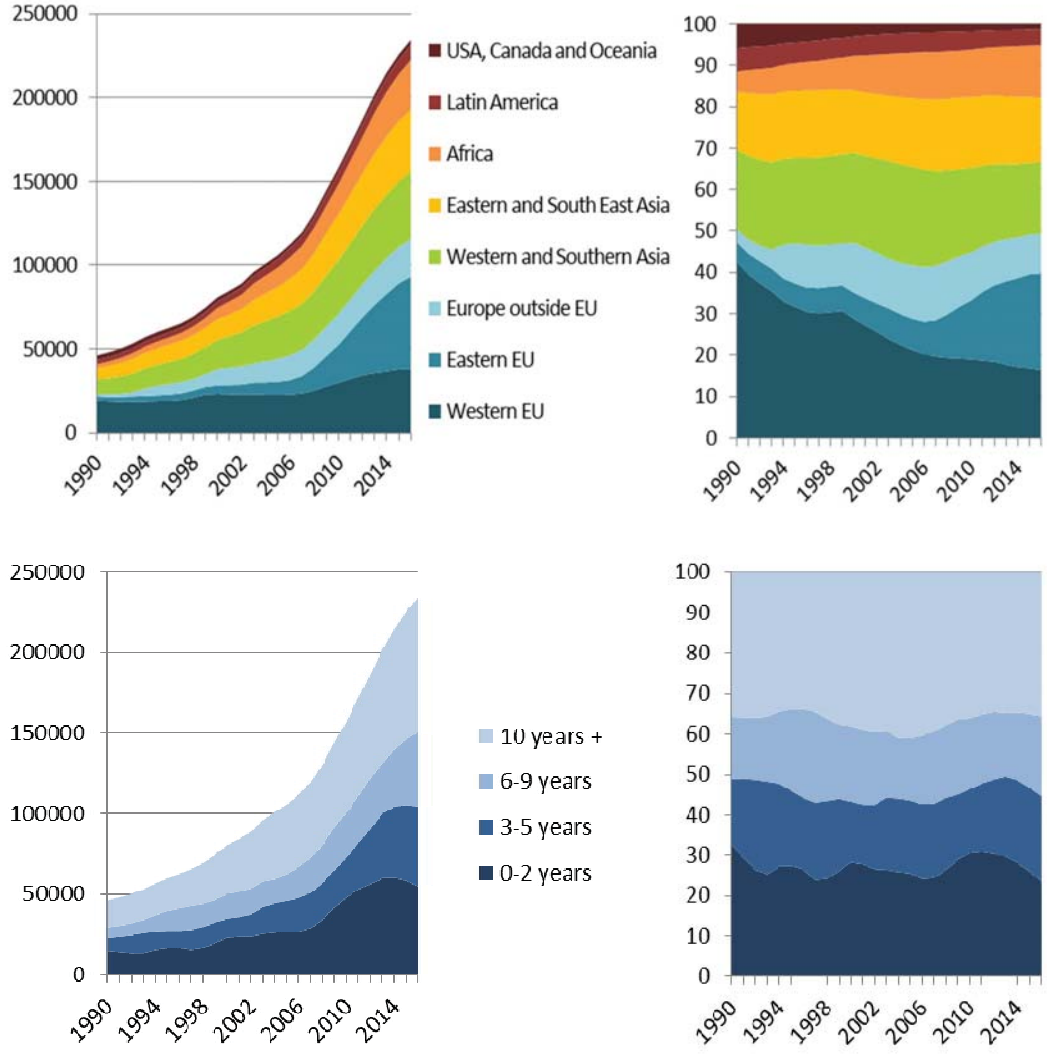

Figure 3. Immigrant women (age 15-49) in Norway, by origin area (upper panel) and duration of stay (lower panel). Absolute numbers (left) and per cent (right). 1990-2016.

The left panels in Figure 3 show the absolute number of immigrant women (age 15-49) living in Norway, by origin area (upper panel) and duration of stay (lower panel). The right panels show how the shares in the different groups have changed over time. The share of immigrants from Eastern EU has increased, both in absolute numbers and as share of all immigrant women. At the same time, the share of Western EU immigrants has decreased markedly. All the four duration-of-stay groups have seen large increases, however the shares in each group have been relatively stable over the last decades. This suggests that changed composition by duration of stay may not be the main driver behind the immigrant TFR decline.

Total fertility rate for the 32 subgroups

A core measure used in these analyses is the total fertility rate (TFR). TFR is the sum of age specific fertility rates (ASFR), which are calculated by dividing the number of children born in a certain year to women in a certain age group by all women in that age group.

To see how the TFR differs between and within subgroups of immigrant women by origin area and duration of stay, TFR trends are calculated for all immigrant women age 15-49 in Norway by 8 areas of origin and 4 durations of stay – altogether 32 subgroups. Used in this way, the TFR can best be viewed as a measure of *birth intensity* in different subgroups, and not as some prospect of how many children these women will eventually have (since, for example, no woman will have residence time of 0-2 years all her life). This study uses five-year age groups because some subgroups of immigrant women are small.

The results are shown in Figure 4. For each origin area, the women are grouped by their duration of stay, and women will move between these groups (and thus 'jump' to thinner lines) the longer they stay in Norway.

Figure 4 shows three main features. First, compared with immigrants from Western Europe (and Eastern Europe after 1995) fertility is often higher among immigrants from high-fertility areas of the world, such as Asia, Africa and Latin America, in line with the socialization hypothesis. Second, fertility is often higher among newly arrived immigrant women (0-2 years since immigration) and lower for women with long duration of stay. This is in line with hypotheses on adaptation and interrelated events. Third, some of the lines have quite clear trends, showing changing fertility *within* subgroups, in particular for women with short duration of stay from Asia, Latin America and Africa.

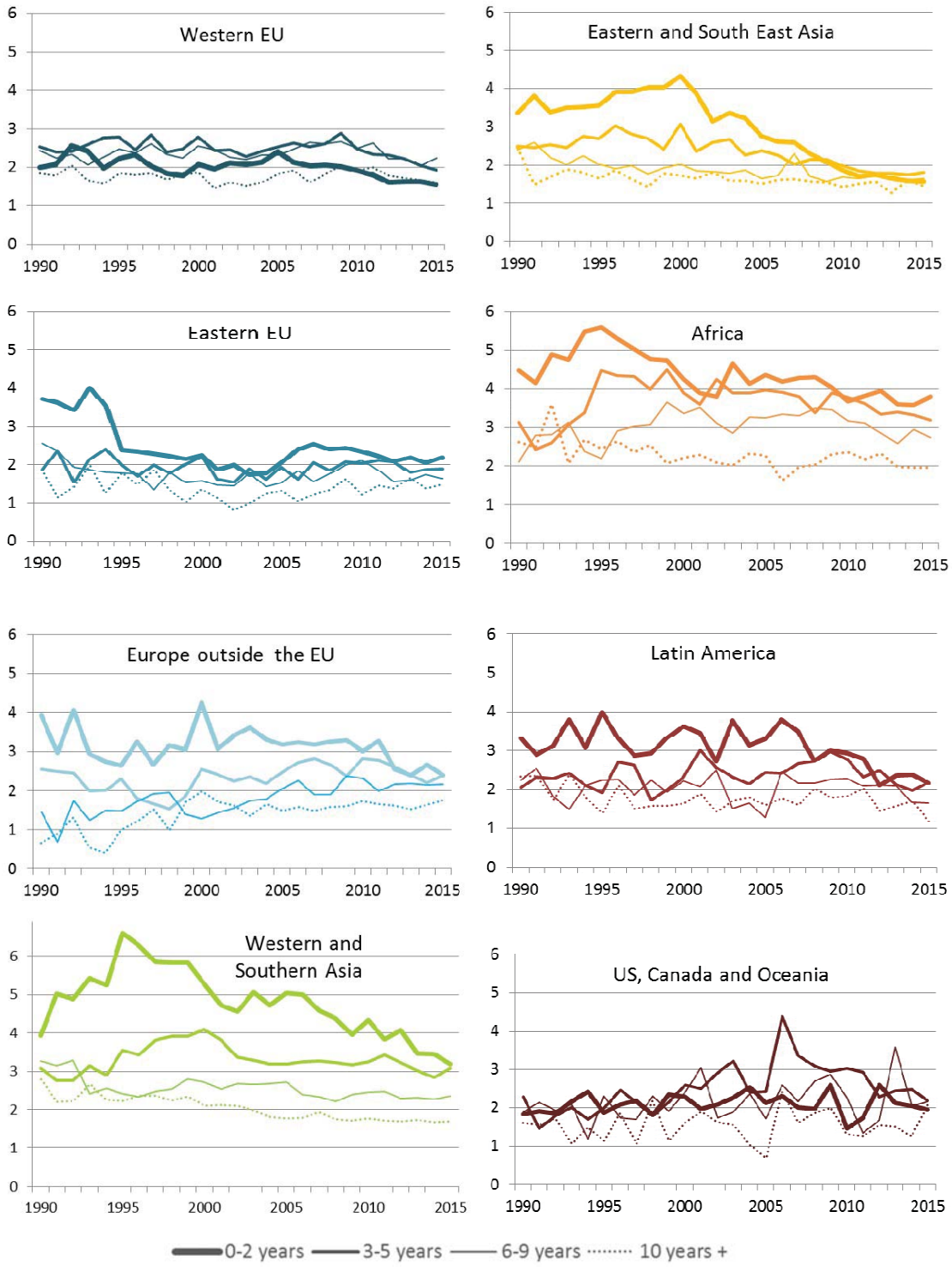

Figure 4. Total fertility rate among immigrant women in Norway, by origin area and duration of stay, 1990-2015.

Methods

Two methods were used to disentangle the effect of changed composition from the effect of changed fertility within subgroups: What-if scenarios and a more formal decomposition.

What-if scenarios

In the what-if scenarios, first the composition of immigrant women (by origin area and duration of stay) was kept constant at the 2000 level while fertility within each of the 32 subgroups was allowed to change like it actually did from 2000 to 2015. Second, the composition of immigrant women was allowed to change while fertility within each subgroup was kept constant. This method uses the fact that TFR across several groups of women can be calculated in this way:

$$TFR_t = \sum_a ASFR_{at} = \sum_a \frac{B_{at}}{W_{at}} = \sum_a \frac{\sum_i (ASFR_{ait} \cdot W_{ait})}{W_{at}} = \sum_a \sum_i (ASFR_{ait} \cdot w_{ait})$$

where *t* is year, *a* is age, *i* is immigrant group, *B* is the number of births, *W* is the number of women, and *w* is the share of all immigrant women (in that age group) who are in group *i*.

In the last term of this equation, $ASFR_{ait}$ represents the fertility whereas w_{ait} represents the composition of immigrant women. Keeping $ASFR_{ait}$ constant at the 2000 level while letting w_{ait} change, gives the what-if scenario where only composition is allowed to change while fertility within each group is kept constant. Letting $ASFR_{ait}$ change while the w_{ait} is kept constant gives the scenario where only fertility within each group changes while composition is constant. In this scenario the number of women in each age group is fixed as well.

It is also possible to let fertility change only within certain groups of immigrant women, keeping both composition and other groups' fertility constant. This was done to investigate the effect of changing fertility among the newly arrived immigrant women.

Decomposition

What-if scenarios are well suited to answer hypothetical questions. However, the estimated hypothetical changes in the what-if TFR paths from these exercises do not necessarily add up exactly to the real TFR change in the same period. A decrease in TFR has one rate component (assuming no change in composition) and one composition component (assuming no change

in rates), and also an interaction component reflecting changes in both rates and composition (see elaboration in Appendix A). This can be accounted for using a range of different methods (Canudas Romo 2003). The decomposition method used here, builds on Kitagawa (1955) and the elaboration in Preston et al. (2001, p 28). In short, if a rate $R = A \cdot B$ and we want to decompose a change in R, then $\Delta R = (\Delta A \cdot \overline{B}) + (\Delta B \cdot \overline{A})$, where Δ denotes change and $\overline{A}$ and $\overline{B}$ are the mean values of A and B. In this case, the changes were decomposed into

$$\Delta TFR = \sum_a \sum_i \left[\left(\Delta w_{ai} \cdot \frac{ASFR_{ai2000} + ASFR_{ai2015}}{2} \right) + \left(\Delta ASFR_{ai} \cdot \frac{w_{ai2000} + w_{ai2015}}{2} \right) \right]$$

where the first part is the change in a subgroup's share among all women (in that age group), weighted by the average fertility in that subgroup, and the last part is the change in the ASFR for each subgroup, weighted by the that subgroup's average share of all women (in that age group). The first part is the contribution to overall TFR change from changed composition, whereas the last part is the contribution from changed fertility.

Further decompositions by new variables can easily be done. To investigate possible selection effects, I used the above framework to decompose the changes in TFR among newly arrived immigrant women (from each origin area) by their reason for immigration.

Results

What-if results: Changed composition does not explain much

In the first what-if scenario, fertility in all the 32 subgroups was fixed at the 2000 level, while the composition of immigrant women (by origin area and duration of stay) was allowed to change. The resulting what-if TFR for all immigrant women is shown in the upper left panel of Figure 5. Compared to the actual TFR, this scenario shows almost no decrease.

The upper right panel of Figure 5 shows the opposite scenario, where composition (by origin area and duration of stay) was fixed at the 2000 level and only fertility within each subgroup was allowed to change. Contrary to the first scenario, this what-if scenario seems to explain a great deal of the general TFR change for immigrants in Norway.

Many of the panels in Figure 4 showed a particularly large fertility decrease among women with short duration of stay (0-2 years). To isolate the effect of this decrease, a what-if scenario was calculated where only fertility of newly arrived immigrant women was allowed to change, while the fertility of all other immigrant women, as well as their composition, was fixed at the

2000 level. The results are shown in the lower left panel of Figure 5. A large part of the total decrease appears to be due merely to this decline in newly arrived immigrants' fertility.

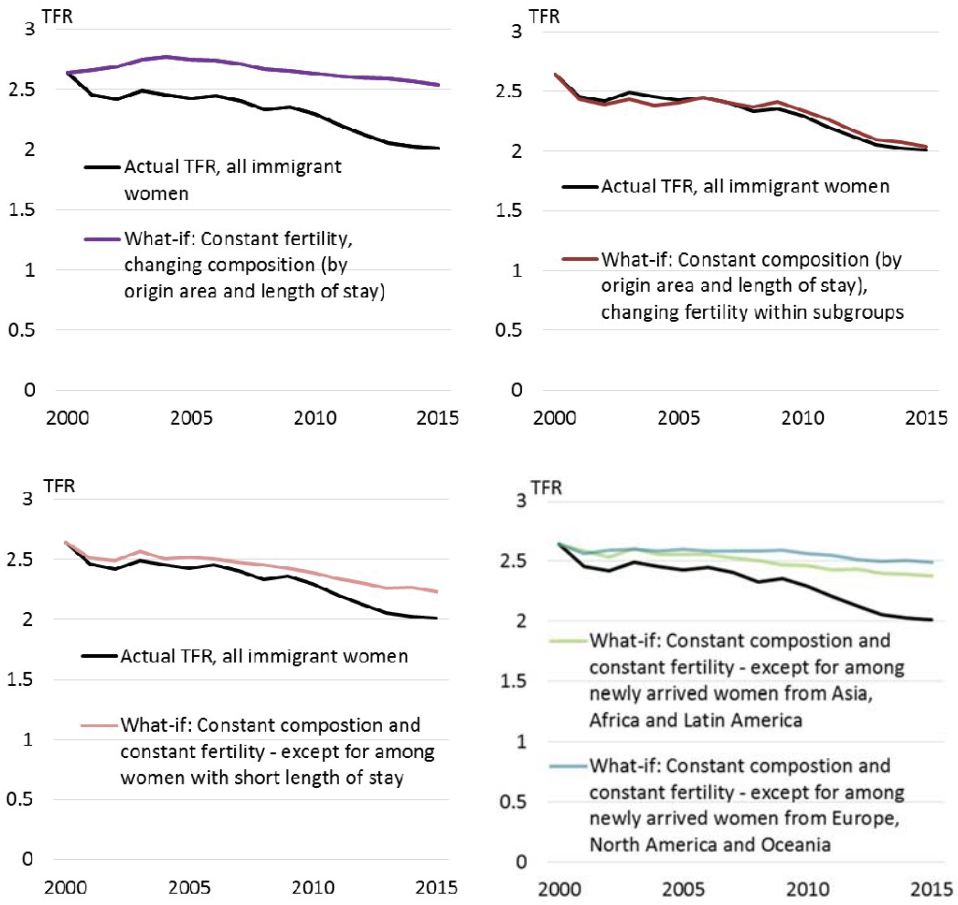

Figure 5. What-if-scenarios, where either composition of immigrant women, fertility for all subgroups or fertility for certain subgroups was allowed to change while the other factors were fixed at 2000 level.

The decrease among the newly arrived is most pronounced among women from high-fertility areas of the world (Figure 4). The effect of this was explored by creating a what-if scenario where everything was kept constant apart from the fertility among newly arrived immigrant women from Asia, Africa and Latin America, and a similar scenario where only the fertility of newly arrived immigrant women from Europe and US, Canada and Oceania was allowed to change. The results are shown in the lower right panel of Figure 5. The newly arrived immigrants from Asia, Africa and Latin America explain more than the newly arrived Western immigrants. However, the latter also contribute to the general TFR decrease, although the decrease in this scenario does not really start until after 2009.

Decomposition results: Newly arrived immigrants' fertility decline explains a great deal

Results from the decomposition (Table 1) show that 90 percent of the TFR decrease among immigrant women in Norway can be attributed to lower fertility *within* the subgroups, while 10 percent is due to changed composition by origin area and duration of stay.

Table 1: Decomposition of TFR change among immigrant women in Norway, 2000-2015

	TFR change	Per cent
TFR decrease, all immigrant women (from 2.64 to 2.01 births per woman)	**-0.63**	**100 %**
Decrease due to		
changed **composition** of immigrant women (by origin area and length of stay)	-0.06	10 %
changed **fertility** within each subgroup of immigrant women (by origin area and duration of stay)	-0.57	90 %
changed fertility among newly arrived immigrant women (0-2 years of stay)	-0.35	56 %
changed fertility among newly arrived immigrant women from Western EU	-0.04	7.0%
changed fertility among newly arrived immigrant women from Eastern EU	0.00	0.0%
changed fertility among newly arrived immigrant women from Europe outside the EU	-0.06	9.8%
changed fertility among newly arrived immigrant women from Western and Southern Asia	-0.09	15.1%
changed fertility among newly arrived immigrant women from Eastern and South East Asia	-0.11	17.6%
changed fertility among newly arrived immigrant women from Africa	-0.02	3.5%
changed fertility among newly arrived immigrant women from Latin America	-0.01	2.3%
changed fertility among newly arrived immigrant women from US, Canada and Oceania	0.00	0.5%
changed fertility among immigrant women with 3-5 years of stay	-0.16	25 %
changed fertility among immigrant women with 6-9 years of stay	-0.01	2 %
changed fertility among immigrant women with 10+ years of stay	-0.05	8 %

The fertility change among only the newly arrived immigrant women explains 56 per cent of the TFR decrease for all immigrant women in Norway since 2000. Although lower fertility among newly arrived women from Western countries does contribute, the newly arrived women from Non-Western parts of the world (Asia, Africa and Latin-America) explain 38 percent of the overall TFR decrease in this period. In particular, the contribution is large among newly arrived immigrants from Asia, who have a considerably lower fertility now than what the newly arrived from Asia had 15 years ago. The newly arrived Asian women alone explains more than 30 percent of the TFR decrease for all immigrant women since 2000.

Some of the decrease among the newly arrived may be due to changed selection. For instance, the reasons for migration may have changed. Reason for immigration is recorded at immigrants' first arrival in Norway. Labour and education migrants often have relatively low fertility, whereas family migrants' fertility is high. Figure 6 shows how the shares of newly

arrived women's reasons for migration have changed for each origin area, and Figure 7 shows the changes in TFR for each of these sub-subgroups.

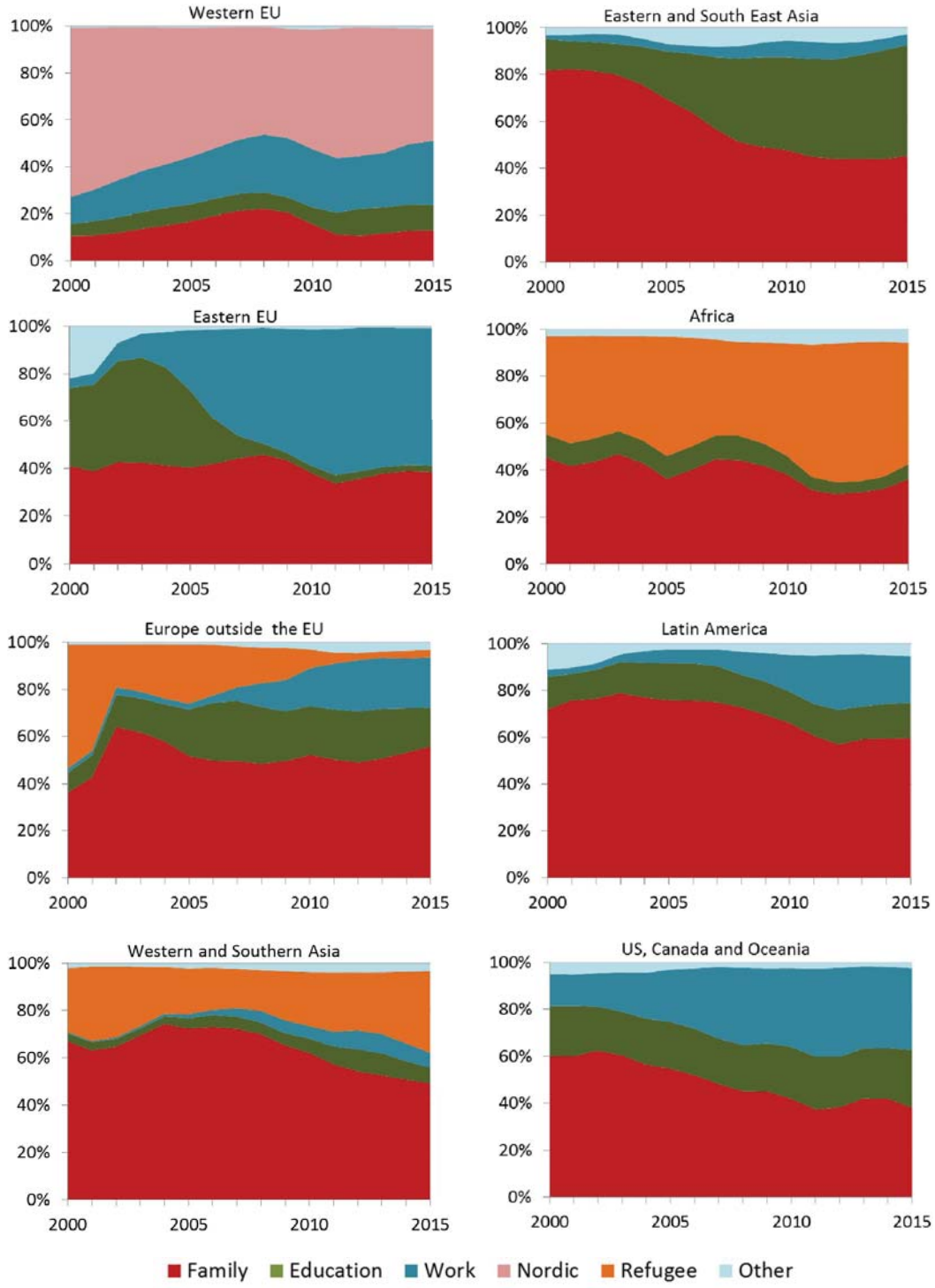

Figure 6. Immigrant women (age 15-49) in Norway with 0-2 years of stay, by origin area and reason for migration. Per cent. 2000-2015.

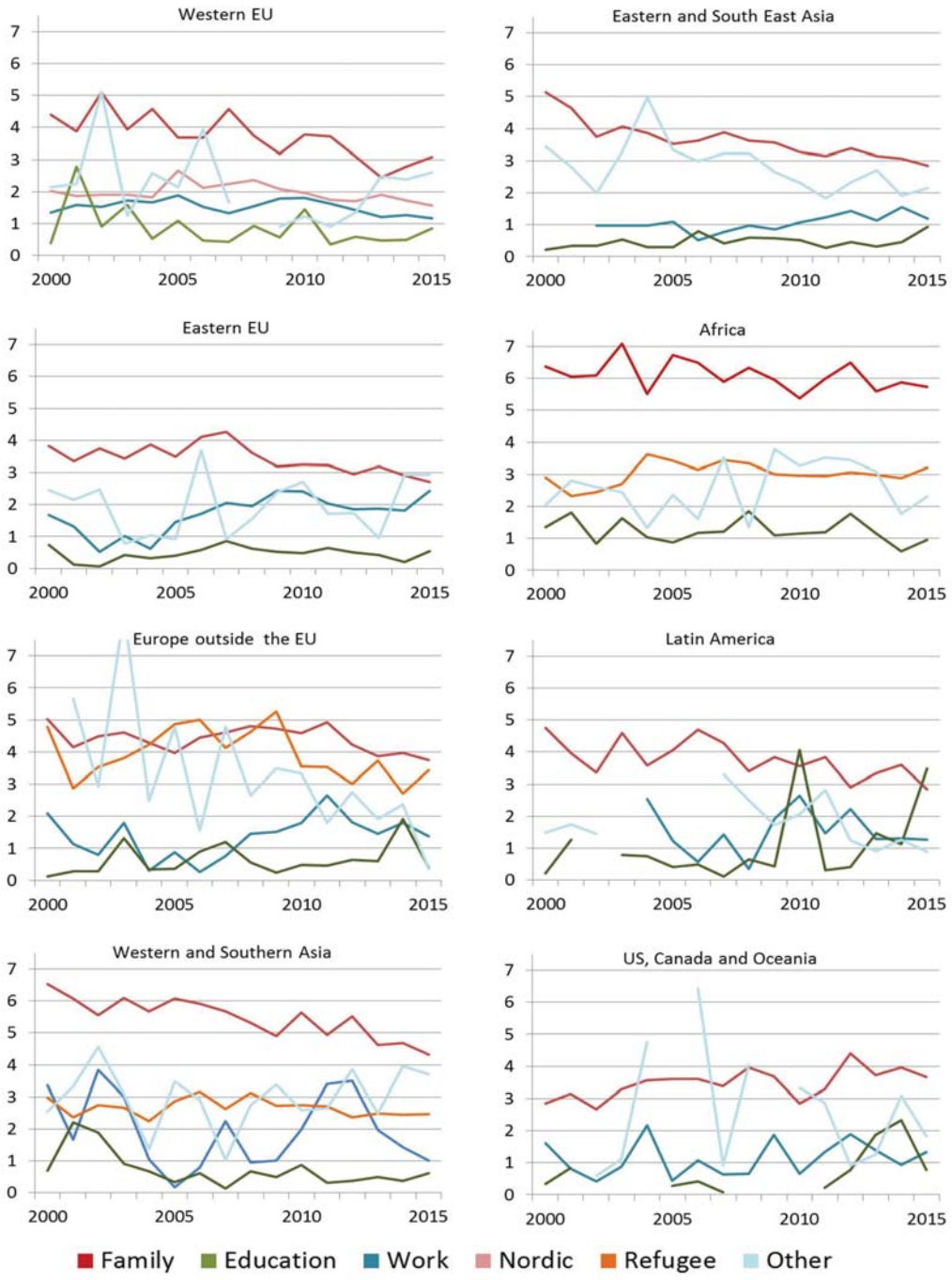

Figure 7. Total fertility rate among immigrant women in Norway with 0-2 years of stay, by origin area and reason for migration, 2000-2015.

Figure 6 and Figure 7 indicate that newly arrived family migrants are key to explaining the decrease in immigrant TFR, in two ways: Their share among all newly arrived immigrant women has decreased, and so has their fertility (for most origin area groups). Among the newly

arrived family migrants from Asia TFR fell by more than 2 births per woman (from 6.5 to 4.3 among Western and Southern Asians, and from 5.2 to 2.8 for Eastern and South East Asians).

Results from the decomposition by reason for migration are shown in Table 2. Since family migrants play an important role in these explanations, the contribution from their changing fertility is shown separately. The bottom row of the table shows the contribution to the overall immigrant TFR decline from this changed newly-arrived family migrant fertility.

Table 2: Decomposition of the TFR change among newly arrived immigrant women in Norway (0-2 years of stay) from 8 origin areas, by reason for migration, 2000-2015

	Western EU	*Eastern EU*	*Europe outside EU*	*Western and Southern Asia*	*Eastern and South East Asia*	*Africa*	*Latin America*	*US, Canada and Oceania*
TFR decrease	**- 0.5** (from 2.1 to 1.6)	**- 0.1** (from 2.3 to 2.2)	**- 1.9** (from 4.3 to 2.4)	**- 2.1** (from 5.3 to 3.2)	**- 2.7** (from 4.3 to 1.6)	**- 0.4** (from 4.2 to 3.8)	**- 1.4** (from 3.6 to 2.2)	**- 0.3** (from 2.3 to 2.0)
Decrease due to								
changed **composition** (by reason for migration)	- 0.2	0.2	- 0.9	- 0.6	- 1.4	- 0.3	- 0.2	- 0.5
changed **fertility** within each group (by reason for migration)	- 0.4	- 0.3	- 0.9	- 1.5	- 1.3	- 0.2	- 1.3	0.2
changed fertility among family migrants	- 0.1	- 0.5	- 0.6	- 1.2	- 1.4	- 0.3	- 1.1	0.3
Contribution (%) to overall immigrant TFR decline from changed fertility among newly arrived family migrants	*1.2*	*0.0*	*2.9*	*8.9*	*9.1*	*2.2*	*1.8*	*-0.5*

Of particular interest in Table 2 are the two groups of newly arrived immigrants from Asia, who had the largest TFR decrease and also made the largest contribution to the TFR decline among all immigrants (Table 1). Among immigrants from Western and Southern Asia, changed composition by reason for migration explains 0.6 of the TFR decline of 2.1, whereas decreased fertility within these groups explains 1.5. Most of this is due to lower fertility among family migrants – which alone explains 1.2 of the TFR decline, or 59 percent.

As shown in Table 1, 15.1 percent of the total TFR decrease among all immigrant women was due to the fertility decline among newly arrived immigrants from Western and Southern Asia. Since lower fertility among family migrants explains 59 percent of this decline, these newly arrived family migrants from Western and Southern Asia alone explain (15.1% · 59%) = 8.9 percent of the overall TFR decline among all immigrant women. Similarly, lower fertility

among newly arrived family migrants from Eastern and South East Asia explains 9.1 percent of the overall decline. Hence, the decreased fertility among newly arrived family migrants from Asia alone accounts for 18 percent of the TFR decrease of all immigrant women in Norway, which is a large effect from a quite small group – in 2016 they constituted 3 percent of all immigrant women in childbearing ages (6 percent in 2000).

Discussion

Although differences in immigrant fertility by origin area and duration of stay have been central to hypotheses on migrant fertility, changed composition by origin area or duration of stay are not the main reasons why immigrant TFR has declined so markedly in Norway. Figure 3 may illuminate why we do not see a larger effect of changed composition. The increased share from Eastern EU has largely been compensated for by a decreased share from Western EU and Europe outside the EU, where fertility is also relatively low. Hence, the share from low-fertility areas has not changed much in this period. A similar conclusion can be drawn about the duration of stay: The shares have barely changed over the last decades. Thus it is not surprising that TFR decreased so marginally when only composition was allowed to change like it actually did, because in this period it actually did not change much.

Why has fertility decreased among the newly arrived (family) migrants?

The marked fertility decrease among the newly arrived immigrants may have several reasons. It may reflect general fertility trends in Norway, and it may be due to changed speed of immigrant adaptation, changed forms of disruption/interrelation of events, changed selection in origin areas, or changed socialization. Below, the various explanations are explored.

The trend could be part of a *general fertility decline in the Norwegian society*. However, Figure 2 shows that fertility among native Norwegian women actually increased in part of this period. Also immigrants with longer duration of stay do not display a similar trend as the newly arrived. However, many of the subgroups (and the natives) have experienced declining fertility since 2009, which partly may be due to economic uncertainty after the financial crisis (Lappegård et al. 2015; Hart et al. 2015). The what-if scenarios in Figure 5, lower right panel, suggest that the newly arrived immigrants from Western countries contributed to the fertility decline mainly after 2009, which might be a result of economic distress. However, the fertility decline among Non-Western newly arrived immigrants, including newly arrived family

migrants, seems to be relatively unaffected by the financial crisis, as shown in Figure 3, Figure 5 (lower right panel) and Figure 7.

Adaptation may have changed, increasing the *speed of integration* among the newly arrived. However, these women have only stayed in Norway a very short time before conception (and some may be pregnant already at arrival), so there has not been much time to integrate. Integration may also be easier if women arrive as children, since *age of arrival* often is crucial for an immigrant woman's fertility (Adserà et al. 2014). However, none of the newly arrived immigrant women (0-2 years of stay) have been able to spend much of their youth in Norway. The share of newly arrived immigrant women who are 15-19 years also declined in this period.

The fertility decline among newly arrived migrants could be related changed forms of disruption or interrelation of events leading to a *changed timing of births* after or before the migration. Migrant women may, to a larger extent than before, have given birth before migration, and bring their children from abroad instead of giving birth in Norway. However, the number of immigrating children (age 0-15 years) have evolved similarly to the number of immigrating women (age 15-49) in this period, indicating that each arriving women does not bring more children to Norway. Alternatively, circumstances around the migration event may have led to more postponement of births. This would imply that fertility among women with slightly longer duration of stay would increase after some years. However, fertility has also fallen among women with 3-5 years of stay (and this group's declining fertility explains as much as 25 percent of the total TFR decline, see Table 1).

As Table 2 show, changed selection by reason for migration seems to explain a great deal of the fertility decline among newly arrived immigrants. Family migrants constitute a lower share in this group, which could partly be explained by *changing Norwegian immigration policies*. From May 2003, immigrants admitted to Norway following application for political asylum were no longer exempt from subsistence requirements when reuniting with their spouses, and the family unification requirements were also tightened again later (Brochmann et al. 2011). Effects of the May 2003 change were assessed by Bratsberg et al. (2010), who found that it curbed family reunions. Thus, policy changes probably contributed to the decreased share of family migrants shown in Figure 6, although it is unclear whether it had any effect on the fertility in this group. What may have effected family migrants' fertility, is another possible selection effect: Their fertility may have declined due to *changed partner patterns*. Immigrant women with a native Norwegian partner may be a select group with a different fertility than those with an immigrant partner. However, the share of births among newly

arrived family migrants in which the father was also an immigrant shows no trend in either direction for the groups with largest effect on the total TFR change (the Asian family migrants), indicating that changing partner patterns cannot explain their fertility decline.

Finally, fertility among newly arrived family migrants may also have declined because of *declined fertility in origin areas*. In Non-Western parts of the world, fertility is noticeably lower today than in 2000. Hence, the newly arrived immigrant women grew up in societies with different fertility norms than those who arrived 15 years before, and thus socialization has changed. In Figure 8, fertility among newly arrived family migrants in Norway from the main origin countries is combined with data showing the TFR in their origin countries (from databank.worldbank.org). Although the levels are not identical, the TFR trends among newly arrived family immigrant women often appear to reflect the trends in their origin countries. For women from Western countries the similarities are not as striking, but for women from Non-Western countries where fertility has declined most sharply, the trends seem similar. This suggests that origin country fertility trends indeed matter for the fertility of newly arrived immigrant women, at least for family migrants from Non-Western parts of the world.

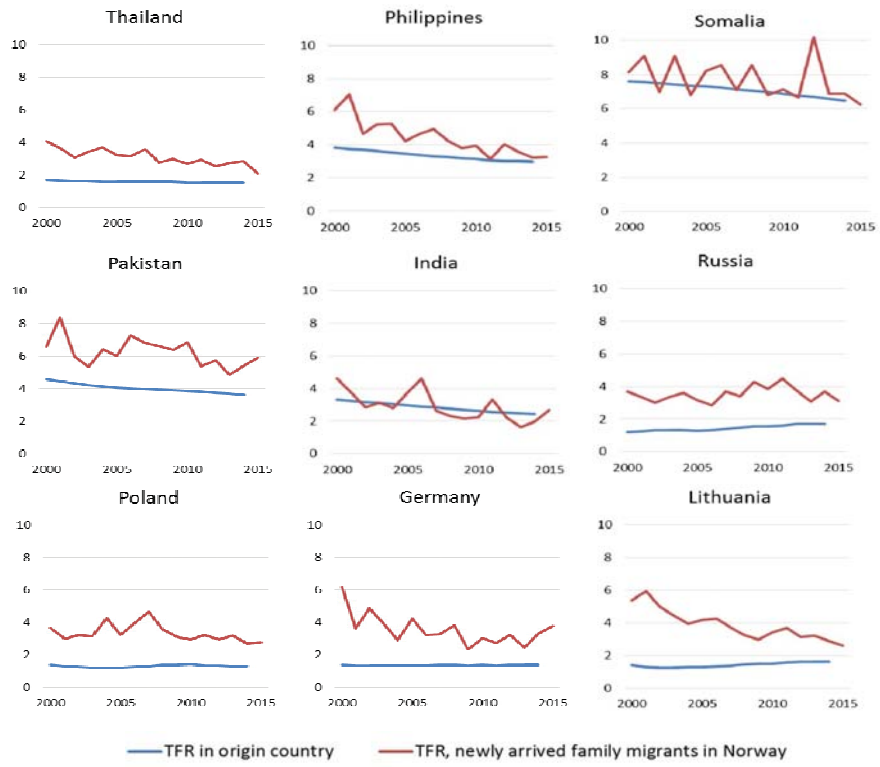

Figure 8. Total fertility rate among the largest groups of newly arrived family immigrant women in Norway and in their origin country[1], 1990-2014/15

[1] Source: World Bank Databank (databank.worldbank.org)

To sum up, after attempting to rule out explanations such as changed composition by origin area (which matters according to the socialization hypothesis), changed composition by duration of stay (which matters according to the adaptation, interrelation of events and/or disruption hypotheses) and changed composition by reason for immigration (which matters according to the selection hypothesis), fertility changes are still seen among immigrant women. In particular, fertility has declined markedly among newly arrived Non-Western family migrants, and this seems to be closely related to fertility trends in origin areas. Such trends are sometimes overlooked in studies of immigrant fertility. Although the newly arrived immigrant women grew up in the same origin areas as those emigrating to Norway 15 years earlier, they grew up in a different time. And as societies change over time, so does socialization.

These findings underscore the need for studies of immigrant fertility to take into account time *of* arrival as well as time *since* arrival, particularly when there have been clear changes in origin area fertility.

Policy implications

This study can be a reminder for policy makers not to draw too quick conclusions about the effect of domestic policies on immigrant TFR. Although an immigrant woman's fertility often declines with her duration of stay, for instance due to successful integration, this does not necessary translate into a declining TFR for all immigrants.

However, the effects of lower fertility among newly arrived immigrant women may be similar to the effects of integration: It may, for instance, make it easier for them to enter the labour force and increase their income, which may translate into higher welfare for immigrant families and reduced income inequality.

The results of this study also point to the future in several ways: If changed fertility in origin areas is a main reason for the fertility decline among Non-Western newly arrived family migrants, and if fertility continues to fall in important origin areas – as the UN projects for high fertility parts of the world (UN 2015) – we can expect further fertility declines among family immigrants from these areas. This may affect future population size and age structures in receiving countries, as well as future welfare among immigrant families. Also, policies affecting fertility preferences in high-fertility parts of the world may, in turn, affect the fertility of Western countries' own immigrant populations.

Conclusion

This study has aimed to explain why the total fertility rate (TFR) among immigrant women in Norway fell from 2.6 in 2000 to 2.0 in 2015.

Although immigrant women's fertility often declines with their duration of stay, this is not the main reason why the TFR declined, nor is changed composition by origin area. By disentangling the effect of changed composition by duration of stay and origin area from the effect of changed fertility *within* subgroups (by origin area and duration of stay), this study shows that more than half of the TFR decline can be explained by the newly arrived immigrant women, who have a lower fertility now than the newly arrived had 15 years ago. In particular, lower fertility among newly arrived immigrant women from Non-Western areas of the world explains almost 40 percent of the TFR decline among all immigrant women.

This newly-arrived women's fertility decline was further decomposed by reason for migration, and family migrants appear to provide a key: Their share among all newly arrived immigrant women has declined in this period, and their fertility has also declined. The decreased fertility among newly arrived family migrants from Asia alone explains 18 percent of the total TFR decrease among all immigrant women in Norway since 2000. The fertility decline among the newly arrived family migrants, in particular those from Non-Western areas of the world, may be a reflection of the fertility decline in their origin countries.

Further, this study contributes to the literature by showing how what-if scenarios and Kitagawa's method can disentangle the effect of changed composition of immigrant women from the effect of changed fertility within subgroups. And whereas studies on immigrant fertility often focus on the context within Western countries, this study emphasises the link to fertility changes in origin areas and points to the need for immigrant fertility studies to take into account time *of* arrival as well as time *since* arrival, particularly when there have been clear trends in origin area fertility.

Norway is one of many Western countries where immigrant TFR has decreased over the last decades. Also in other countries, lower fertility in origin areas may explain some of the decrease in TFR among immigrants. If fertility continues to fall in important origin areas, many Western countries may expect further fertility declines among newly arrived immigrant women. Also, policies affecting fertility preferences in high-fertility parts of the world may, in turn, affect the fertility of Western countries' own immigrant populations.

Appendix A: The what-if scenarios, the decomposition, and the difference

The total fertility rate (TFR) in year *t* can be written

$$TFR_t = \sum_a \sum_i (ASFR_{ait} \cdot w_{ait})$$

where *a* is age group, *i* is immigrant subgroup, $ASFR_{ait}$ are the age specific fertility rates and w_{ait} is group *i*'s share of all immigrant women (in that age group). For simplicity I assume 1-year age groups here. The first what-if scenario is calculated as

$$TFR_t^{(1)} = \sum_a \sum_i (ASFR_{ai2000} \cdot w_{ait})$$

In other words, the proportion in group *i* is allowed to change while fertility is kept constant. At *t* = 2015, the what-if TFR is $\sum_a \sum_i ASFR_{ai2000} \cdot w_{ai2015}$ .The difference between this and the actual fertility in *t* = 2000 is

(1) $$\Delta TFR^{(1)} = \sum_a \sum_i ASFR_{ai2000} \cdot \Delta w_{ai}$$

where $\Delta w_{ai} = w_{ai2015} - w_{ai2000}$. Similarly, the second what-if scenario is calculated as

$$TFR_t^{(2)} = \sum_a \sum_i ASFR_{ait} \cdot w_{ai2000}$$

At time *t* = 2015, the difference between this and the actual fertility in *t* = 2000 is

(2) $$\Delta TFR^{(2)} = \sum_a \sum_i \Delta ASFR_{ait} \cdot w_{ai2000}$$

The real TFR difference, $\Delta TFR = TFR_{2015} - TFR_{2000}$, is not equal to $\Delta TFR^{(1)} + \Delta TFR^{(2)}$. Instead, it can be written as

(3) $$\Delta TFR = \sum_a \sum_i [(\overline{ASFR_{ai}} \cdot \Delta w_{ai}) + (\Delta ASFR_{ai} \cdot \overline{w_{ai}})]$$

where $\overline{ASFR_{ai}}$ and $\overline{w_{ai}}$ are the mean values $\frac{ASFR_{ai2000} + ASFR_{ai2015}}{2}$ and $\frac{w_{ai2000} + w_{ai2015}}{2}$, respectively. Equation (3) can be described as a Kitagawa decomposition. Note that

$$\overline{ASFR_{ai}} \cdot \Delta w_{ai} = (ASFR_{ai2000} \cdot \Delta w_{ai}) + \left(\frac{\Delta ASFR_{ai} \cdot \Delta w_{ai}}{2}\right)$$

and

$$\Delta ASFR_{ai} \cdot \overline{w_{ai}} = (\Delta ASFR_{ai} \cdot w_{ai2000}) + \left(\frac{\Delta ASFR_{ai} \cdot \Delta w_{ai}}{2}\right)$$

Therefore, the contribution attributed to changed composition, $\sum_a \sum_i (\overline{ASFR_{ai}} \cdot \Delta w_{ai})$ is the same as the difference between the first what-if scenario and actual fertility (equation 1) plus $\frac{\Delta ASFR_{ai} \cdot \Delta w_{ai}}{2}$ (which is a quite small term). Similarly, the contribution attributed to change in fertility is not given by equation 2; the (small) term $\frac{\Delta ASFR_{ai} \cdot \Delta w_{ai}}{2}$ is added.

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III

Article

Acta Sociologica
2016, Vol. 59(2) 113–129

DOI: 10.1177/0001699316628614
asj.sagepub.com
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Childhood residential mobility and long-term outcomes

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Abstract
To study relations between childhood residential mobility and early adult outcomes, we use detailed longitudinal data on complete cohorts born in Norway between 1965 and 1980 ($N = 967\,151$) and information on all their relocations between municipalities. Results from models with and without sibling-fixed effects show that children with more residential moves are more likely to drop out of high school, to have a lower adult income and to experience early parenthood, although most of these associations are weaker in the sibling fixed effects models. We also find that age at moving matters: the outcomes are similar for children who move or remain in place prior to elementary school, whereas those who move in adolescence are worse off than those who do not.

Keywords
Adult, childhood, internal, migration, mobility, moving, outcomes, relocation, residential

Introduction
Every day, children around the world are moved to new schools and new neighborhoods. They have to adjust to a new life, make new friends and find their place in a new school. Parents may hope that any transitional problems are temporary, and that residential relocations do not harm their children in the long run. Research does not, however, necessarily comfort worried parents. On the one hand, general migration theories state that people move because they presume it is the best option for the future

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(Massey et al., 1993). On the other hand, research in fields such as psychology (e.g. Oishi and Schimmack, 2010), school research (e.g. Astone and McLanahan, 1994; Temple and Reynolds, 1999) and health (e.g. Bures, 2003; Busacker and Kasehagen, 2012) highlights several reasons for why moving could be harmful for a child. In sociological research, focus has been directed to the loss of social capital (Coleman, 1988), psychological distress and rootlessness, interrupted learning environments, reduced access to information and regular health care, problems finding good friends, reduced coping and cumulative stressful events (e.g. Myers, 1999; Pettit, 2004; Scanlon and Devine, 2001; South et al., 2005).

Most empirical studies show that movers perform poorer than non-movers, almost regardless of the outcome studied. However, when controlling for various pre-existing differences between the two groups, the adverse effects of moving are substantially reduced.

Research on effects of childhood moving has mainly been based on sample surveys, where selection, attrition and/or selective reporting may introduce interpretational problems. Methodologically, standard multivariate estimation methods are most commonly applied to control for differences between the movers and non-movers.

We utilize longitudinal data on complete Norwegian birth cohorts and information on siblings and parents to examine the association between childhood moves and outcomes in early adulthood. Using register data we minimize problems relating to sample selection or attrition, such as loss of the most mobile families. Unlike most previous studies, our data allow us to control for any family characteristics that are time invariant, using sibling fixed effects models. Further, the large data material allows us to study several different outcomes and thus provide a broader picture of the adult welfare of childhood movers.

Our main outcomes are high school dropout, low income, early parenthood and early mortality, which are outcomes often considered to measure well-being and performance: education and income are important life goals for many young adults and predictors of later life chances. Early mortality can be a result of unfavorable life styles, and teenage parenthood is found to increase the risk of adverse birth outcomes, educational setback and unstable marriages (Card and Wise, 1978; Chen et al., 2007; Kane et al., 2013).

We aim to address *whether* childhood moving is harmful, and to study the relationship between adult outcomes and both the *number* of childhood moves and the *age* at which moves take place. This may be important knowledge for decision-makers at many levels – parents considering residential moves, teachers, pupils and neighbors reflecting on how to deal with newcomers, and also politicians and municipality planners deciding on how best to meet movers. Our results show that children who move a lot fare worse than those who stay, and this association remains after controlling for potential observable confounders and sibling fixed effects.

Theory and previous research

Several theories suggest that childhood moving can be harmful. According to social capital theory, relationships, ties and networks within and between families enhance a child's human development, cognitive capacity and social functioning (Coleman, 1988). When families move, important relationships, information sources and networks that could guide positive behavior may be disrupted. Residential mobility can disrupt both ''inter-family'' social capital (due to loss of contact with other families, teachers or other community members) and ''intra-family'' social capital (because of strains on the parent–child relationship). Residential relocation may also lead to reduced basic knowledge about local conditions and norms, which can make it harder to feel in control. Coping, which can be defined as the ability to adequately manage the demands of a situation, may become more challenging. Residential mobility may disrupt the student's learning processes in school, and school changes may affect students' coping abilities and thereby their educational achievements (Boon, 2011). A child who moves, needs to find new friends. Especially finding close new friends can be hard for a newcomer, and South et al. (2005) surmise that ''newcomers are more likely to be welcomed into – and perhaps embraced by – low-performing and relatively delinquent friendship cliques''. As such, moves may be associated with ''bad''

or no friends. Furthermore, residential mobility can lead to anxiety, excitement and loneliness, as well as lower long term well-being, and removal of positively valued stimuli can cause strain and aggression (Agnew, 1992; Oishi and Talhelm, 2012). Lastly, a high number of child life stressors, including relocation(s), may increase the likelihood of negative adjustment (Humke and Schaefer, 1995). Simmons et al. (1987) found that children or adolescents are at elevated risk if they are forced to cope with several life transitions concurrently, such as pubertal development, early dating, school transition and residential mobility. The cumulative stress may thus be harmful for children.

On the other hand, several theories suggest that moving can be beneficial. General migration theories point at the perceived benefits of moving. People usually change residence because they presume it is the best available alternative. Whereas neoclassical economic migration theory stresses individual determinants such as income and work opportunities, the "new economics of migration" asserts that migration decisions are made in larger units – typically families or households (Massey et al., 1993). In this framework, "good parents" would be assumed to take into account their children's prospects in deciding whether to stay or move. If the family moves because of better job opportunities, the short-term disadvantages of childhood moving may be compensated for in the longer run by improved family economy and better housing. Or the family may move as a response to an adverse event, such as job loss, health problems or divorce, in which case the move may mitigate the more serious adverse outcomes that would have occurred had they not moved. Residential relocation may also increase children's repertoire of experiences, autonomy and ability to manage new situations and contexts.

Hence, from a theoretical perspective, both positive and negative associations between childhood relocations and various outcomes may be expected. This may depend on the number of moves and the age at moving. If moving is harmful in itself, a high number of moves could be even more harmful. On the other hand, children who move frequently may gain practice and improve coping with each move (Scanlon and Devine, 2001). Babies, young children and adolescents may be affected differently by relocations. Small children can be particularly vulnerable, being in a phase of rapid cognitive, physiological and affective development (Anderson et al., 2014; Knudsen et al., 2006). For teenagers, disruption of peer groups may be more problematic (Anderson et al., 2014). If the mobility primarily disrupts the "inter-family" social capital, whereas the "intra-family" social capital stays more intact, we could expect adolescents to be hardest affected by a move, as they depend more on networks outside the family.

The effect of moving may vary between children in different family structures and/or socioeconomic circumstances. Families with higher incomes may, for instance, have more resources to minimize the loss of social capital and thus minimize stressors in other parts of children's lives. Furthermore, moves of intact families may be less harmful than moves of split families as children in intact families can rely on their "intra-family" social capital to a greater extent. As such, moving may be more harmful for some groups of children than for others.

Previous empirical research

Most previous empirical research shows that moves during childhood are associated with poorer performance both during childhood and to some extent also in adulthood, almost regardless of the outcome studied. Whether the adverse association remains when important pre-existing differences in the characteristics of children are taken into account, is less clear. Long (1992) states that "Children who have moved with above-average frequency are less likely to be living with both parents, more likely to be poor, and more likely to be in households where the householder was unemployed or failed to graduate from high school. These differences are often striking". It is therefore important to try to separate the effects of the move itself from underlying factors.

When various differences between movers and stayers are controlled for, many adverse associations virtually disappear in some studies, as shown by Dong et al. (2005) and Murphey et al. (2012) for health and health behaviors, Alexander et al. (1996) for school achievements, Verropoulou et al. (2002) for educational attainment and well-being, and Gasper et al. (2010) and Porter and Vogel (2014) for

adolescent delinquency. Contrary to this, a number of other studies find that the adverse associations remain, for instance Bures (2003) and Busacker and Kasehagen (2012) for health, Astone and McLanahan (1994), Hagan et al. (1996), Haveman et al. (1991), Gasper (2012), Pribesh and Downey (1999), and South et al. (2007) for school performance, Haynie et al. (2006) for attempted suicide and South et al. (2005) and Stack (1994) for early sexual activity.

In studies showing an adverse association between moving and later outcomes, this adverse association is usually increasing with the number of moves (e.g. Astone and McLanahan, 1994; Busacker and Kasehagen, 2012; Gilman et al., 2003; Jelleyman and Spencer, 2008; Scanlon and Devine, 2001; Temple and Reynolds, 1999), although other studies contradict this (e.g. Verropoulo et al., 2002).

Results are generally more conflicting when it comes to age at moving. In a review of associations between residential mobility and behavioral and emotional problems, Jelleyman and Spencer (2008) find particular evidence for a negative association for school aged children. Rumbold et al. (2012) find a sensitive period before two years of age where residential mobility was associated with detrimental effects on later mental health. In studying high school completion, Haveman et al. (1991) found moves to be most harmful if the child was 4–7 years or 12–15 years old, whereas Myers (1999) concludes that the effect of migration on social integration is most pronounced in adolescence.

Few studies find *beneficial* associations between childhood relocation and outcomes. A Canadian study by Hango (2006) concludes that childhood residential mobility actually had a positive long-term impact on educational attainment. Analyses of the "Moving To Opportunity" program in the US, which provides disadvantaged families with the opportunity to move from deprived to wealthier areas, suggest that such moving reduces violent criminal behavior (Ludwig et al., 2001) and increases youth's performance (Rosenbaum, 1995). Clearly, both characteristics of the neighborhood of origin and destination can be crucial for the effects of relocation (e.g. Chetty et al., 2014; Sharkey and Sampson, 2010).

In summary, existing research provides ambiguous findings. Possible reasons for this can be that moving depends on characteristics of origin and destination neighborhoods, the reasons for moving and that it simply affects different children differently. Verropoulou et al. (2002) conclude that "geographic mobility seems to be a heterogeneous experience, with heterogeneous outcomes". Oishi and Shimmack (2010) see a negative association between residential moves and well-being among introverts but not among extroverts. Tucker et al. (1998) find that that school lives of frequently moving children were not significantly harmed if they resided with both parents. For children in other family structures, any move was detrimental. Scanlon and Devine (2001) conclude that the negative effects of moving on children's academic functioning are especially strong for poor children from single parent families. Likewise, Long (1975) found that frequent long-distance movement was associated with an increased likelihood of enrolment below the modal grade, except for children of college graduates.

Another possible reason for the ambiguous results is differences in research designs. Most of the quantitative research on children and residential mobility uses ordinary regression analyses, controlling for various observed variables. Access to data that enable a control for unobserved family characteristics is, however, rare. One exception is Gasper et al. (2010), who use a hybrid fixed/random effects model to study effects of residential mobility on adolescent delinquency and conclude that movers are more likely to be delinquent, but this is explained by their characteristics, not their mobility. Indeed, if moving coincides with, or is caused by, other events (such as job loss, health problems, divorce, and neighborhood deprivation) it is methodologically intrinsically difficult to attribute subsequent outcomes to the move, except in the presence of reliable randomized trials (Ludwig et al., 2001). It is thus crucial to be careful in not basing causal claims on analyses of observational data, especially studies of cross-sectional data but also on longitudinal data.

Context and data

We use a linked dataset from various Norwegian registries encompassing the entire population. This minimizes problems related to selective reporting, selection and attrition bias, and enables us to employ various methods in examining associations between childhood mobility and long-term outcomes.

The Norwegian setting

Within-country migration is generally lower in Europe than in the US, but Nordic countries have relatively high moving rates (Machin et al., 2012). In Norway, around 15% of the population moved to another address in 2014 (Statistics Norway, 2015), which is similar to the yearly rates for residential change in the US (Ihrke et al., 2011). As in many other countries, mobility in Norway is particularly high for people in their twenties and for highly educated individuals (Machin et al., 2012), and the main direction is towards centralized areas (Statistics Norway, 2015).

We study moves between municipalities. Norway's around 5 million inhabitants are living in 428 different municipalities, with populations ranging from a few hundred people in some remote municipalities to more than half a million in the capital of Oslo (median population size is 4 500). The municipalities are the responsible unit for providing public child and health care as well as primary and secondary education.

Moving to a new municipality normally implies that children have to change school, as they are not entitled to continue in another municipality's school (Norwegian Directorate of Education and Training, 2014). Children who move inside the municipality often continue at the same school, and may thus more easily stay in touch with their old peers.

Data

Detailed registry data covering the entire Norwegian population through 2008 were linked by means of a personal identification number. All children born in Norway 1965–1980 were identified. These cohorts were chosen as they gave us a large dataset of people who grew up in a society not too different from society today.[1] Inclusion of cohorts after 1980 would have resulted in shorter follow-up time.

The Norwegian Population Register provides information on dates of moves between municipalities and date of birth, death or migration. Dates of births allow us to identify early parenthood, defined as becoming a parent before age 20. Also parents' marital status is obtained from this registry, available from 1970 onwards. For children born 1965–1969, having parents who were married in 1970 and onwards is coded as having married parents through childhood. Unique family numbers enable us to link information on children to that of their mothers, fathers and siblings, obtaining a dataset comprising complete cohorts of children born between 1965 and 1980 and their families.

Children's and parents' educational levels are extracted from the Norwegian National Education Database, complete from 1970. Educational specifications are lacking for <1% of the individuals. Exclusion of individuals with missing educational attainment rendered identical results, and these individuals are thus kept in the study cohort and categorized with low education. We define the outcome variable *high school dropout* as not having completed high school during the follow-up period. Parents' higher education is defined as having obtained a college or university degree.

The Norwegian Directorate of Taxes provides information on yearly gross labor earnings from 1967 onwards. Information on children's income at age 28 has been extracted and categorized in percentiles by birth year. Income is defined as gross labor earnings including labor-related benefits. We define *low income* as belonging to the lowest quintile at age 28. Likewise are yearly statistics on parents' incomes when the children were 10 years old categorized into percentiles by calendar year. Missing income is coded as no income.

Cause-of-death for children who died between age 15 and 28 is obtained from the Cause-of-death Registry, complete from 1963. Our main focus is on all-cause mortality, but accidents, suicides and mental illnesses (primarily comprising substance abuse diagnoses) were examined separately.[2] The study was approved by the Ethics Committee for Medical Research in Norway.

Samples

We started out with 967 151 Norwegian-born children, for whom all childhood moves (0–18 years) between Norwegian municipalities have been recorded. We have linked children to their mothers (complete linkage) and fathers (98.9% linked, i.e. fathers were not found for 11 109 children) through unique family numbers. As we examine outcomes at or before specific ages, we have excluded individuals who emigrated or died prior to these ages. We are thus left with 943 821 children in the analyses of early mortality, 940 008 children in the analyses of high school completion and early parenthood, and 923 602 children in the analyses of income level at age 28. The distribution of outcomes and characteristics of children and parents are shown in Table 1. In sibling fixed effects models, siblings are linked to one another through their mother.

Methods

We examine the relationship between outcomes and the *number* of residential moves (mainly 0, 1–3 and 4+ moves) during age 0–18 years. The *timing* of moves is also examined to address whether moves may be particularly harmful at certain ages. We examine moves during ages 0–6, 7–12, 13–15 and 16–18 years, corresponding to school periods in Norway. The latter analyses include only children who have moved once (compared with children who have never moved) to avoid confounding age with number of moves.

Different methods with different strengths and weaknesses are employed to handle possible confounders in estimating the relationship between moving and outcome variables. First, we use standard linear probability models (ordinary least squares),[3] controlling for observable characteristics of the child and his or her family: the child's gender, birth cohort, number of siblings and birth order, the mother's education, her income and employment status at age 10 of the child, her age at birth of the child and whether or not she remained married through the child's first 18 years, as well as the father's education and income at age 10 of the child.[4]

Next, we use linear probability models with sibling fixed effects (Wooldridge, 2010) to control for any omitted variables capturing time-invariant, family-specific characteristics.[5] This allows us to control for many potentially confounding factors that we are unable to capture by the ordinary models, such as the parents' personalities, reasons for moving, family atmosphere, etc. Sibling fixed effects models sweep out any time-invariant characteristics – observable or not – of siblings in the same family. Thus we would expect the estimates to fall when going from the standard regression models to models with fixed effects. The fixed effects models allow us, for instance, to estimate the effect of moving at different ages by utilizing variation between siblings who belonged to different age groups at moving. The models thus require that the data contain families with siblings in different categories, such as different age groups when estimating effects of age at moving, or different number of moves when estimating effects of number of moves. Siblings may have different number of childhood moves if one child was not yet born when the older child moved, if one sibling was no longer a child (<18 years) when the family moved, or/and if one child moved without a corresponding family move.

Despite the advantages of fixed effects models, confounders that vary between children within families may still confuse the interpretation of the estimated results. For example, it might be that a parent becomes unemployed, which simultaneously makes one sibling drop out of high-school and the family to move. If so, it is the unemployment, and not the move, that leads the sibling to drop out of school. Thus, if moving coincides with, or is even caused by, another event, we cannot separate the impact of moving from the impact of the other event, invalidating the interpretation of even the fixed effects estimate as an effect of the move. Though one can never ensure against this kind of bias in studies on observational data, we address it by also including observable covariates that vary between children within families, i.e. the child's gender, birth cohort, birth order, the mother's income and employment status at age 10 of the child, her age at birth of the child and whether or not she remained married through

Table 1. Distribution of outcomes and characteristics of children and their parents by whether or not the children have moved during childhood (age 0–18).[1]

		Never-movers % ($N = 561\,312$)	Ever-movers % ($N = 378\,696$)
Outcomes	**Low education** (not completed high school)	22.3	24.9
	Low income (at age 28)[2]	14.6	18.9
	Early parenthood (before age 20)	5.1	7.0
	Early mortality (age 15–28)	0.8	1.0
	Suicide[3]	0.18	0.24
	Mental illnesses/substance abuse[4]	0.05	0.09
	Accidents[5]	0.34	0.37
Children's characteristics	Male	48.1	49.5
	Female	51.9	50.5
	Born 1965–1970	41.7	40.4
	Born 1971–1975	31.2	32.9
	Born 1976–1980	27.1	26.7
	0 siblings	5.0	6.6
	1 sibling	36.3	39.3
	2 siblings	34.1	33.9
	3 or more siblings	24.6	20.2
	Oldest sibling (or only child)	33.1	51.0
	Middle sibling	23.3	21.3
	Youngest sibling	43.6	27.7
Parents' characteristics	Mother higher education	15.5	25.5
	Mother in lowest income quintile[6]	24.9	28.2
	Mother works[6]	75.9	73.8
	Mother married through childhood	76.6	55.1
	Mother < 20 years at child's birth	5.3	10.0
	Mother 20–24 years at child's birth	30.0	41.3
	Mother 25–34 years at child's birth	52.7	44.3
	Mother 35+ years at child's birth	12.0	4.5
	Father higher education	17.5	32.9
	Father in lowest income quintile	18.9	21.6

1. The figures are based on the sample of children used in analyses of high school completion and early parenthood (alive through age 19). Slightly different samples of children were used for analyses of early death (alive through age 14) and income (alive through age 28). The distributions of characteristics are virtually identical in the three samples (not shown, available upon request).
2. Belonging to the lowest income quintile of one's birth cohort at age 28. Missing income was set to zero. As individuals who emigrate or die by default have missing income, the percentage belonging to the lowest income quintile consists of less than 20% of the sample used in our analyses.
3. Intentional self-harm comprised International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) codes U03, X60–X84 and Y87.0, and was renamed suicide.
4. Mental and behavioral disorders comprised ICD-10 codes F00–F99. On closer examination, it turned out that the majority of the deaths in this category were related to substance abuse (F10–F19), and the category was thus renamed Mental illnesses/substance abuse.
5. Accidents comprised all deaths within the ICD-10 codes V01–X59, Y10–Y86, Y88 and Y89.
6. At age 10 of child.

the child's first 18 years, as well as the father's income at age 10 of the child. One should also keep in mind that the fixed effects models utilize variation between siblings, implying that we only capture associations in the population of children with siblings, ignoring possibly diverging associations for children without siblings.

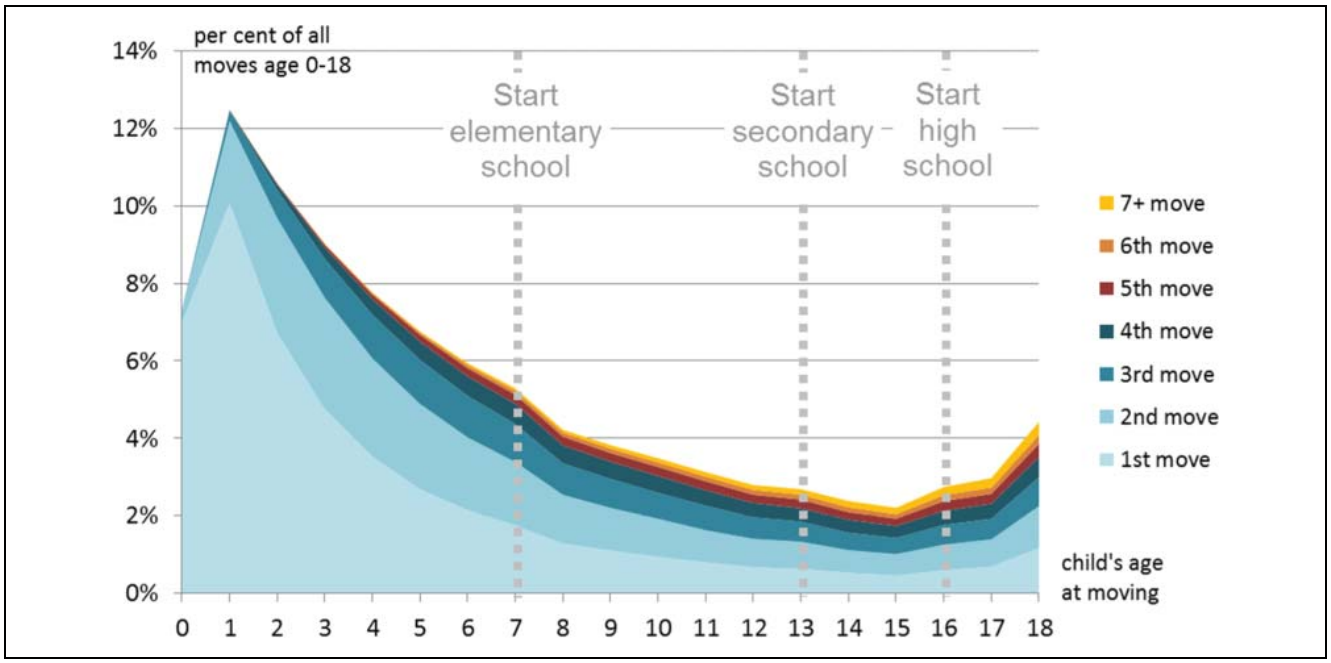

Figure 1. Residential mobility among children born in Norway 1965–1980, by age.

Results

Descriptive statistics

Descriptive results of the total number of moves and the ages at moving are provided in Figure 1, and distributions of outcomes and covariates are portrayed in Table 1.

Altogether, 40% of the children have moved between municipalities during childhood. A total of 19% have moved only once, 11% have moved twice, and 11% have moved three times or more. Moving is most common among the youngest children, and the majority of moves occur prior to elementary school.

As shown in Table 1, movers have more often dropped out from high school, more of them belong to the lowest income group at age 28, and they become teenage parents to a larger extent as compared to never-movers. Early deaths are also slightly more common among movers, although this is a rare event. Cause-of-death analyses show that movers appear to be over-represented particularly in deaths due to mental illnesses (see online supplementary material Tables A3–A5).

Table 1 also displays covariate characteristics, and shows that compared to children who never moved, the movers more often have younger mothers. Their mothers are also slightly less likely to be employed. Whereas the majority of non-movers have parents who remain married throughout their childhood this is true for only half of the movers. On the other hand, movers more frequently have mothers and fathers with a higher education. In line with this, the income distributions of children from moving and non-moving families differ somewhat, with movers having both a higher proportion of mothers and fathers in the highest as well as in the lowest income groups. Lastly, children who have moved are more frequently the oldest child in the family, whereas non-moving children are more often the youngest child.

Multivariate analyses

Even after controlling for pre-existing differences between movers and non-movers, we find that children who have moved during childhood are more likely to experience low education, low income and early parenthood compared with children who have not moved. Moreover, the risks increase nearly linearly with the number of moves (Table 2; and more detailed in Figure A1 in the online supplementary material). But the estimates tend to fall, sometimes considerably, when we account for sibling fixed

Table 2. Risk of adverse outcomes by number of moves during childhood (age 0–18).

	Low education			Low income			Early parenthood			Early mortality		
	$N = 940\,008$			$N = 923\,602$			$N = 940\,008$			$N = 943\,821$		
Mean dep. variable	0.23			0.16			0.06			0.01		
Standard linear regression models												
	Coef.	SE	*P*>|t|	Coef.	SE	*P*>|t|	Coef.	SE	*P*>|t|	Coef	SE	*P*>|t|
No moves	ref			ref			ref			ref		
1–3 moves	**0.0328**	0.0009	<0.01	**0.0245**	0.0009	<0.01	**0.0168**	0.0005	<0.01	**0.0014**	0.0002	<0.01
4+ moves	**0.0865**	0.0019	<0.01	**0.0706**	0.0017	<0.01	**0.0406**	0.0011	<0.01	**0.0027**	0.0004	<0.01
Linear regression models with sibling fixed effects												
	Coef.	SE	*P*>|t|	Coef.	SE	*P*>|t|	Coef.	SE	*P*>|t|	Coef	SE	*P*>|t|
No moves	ref			ref			ref			ref		
1–3 moves	**0.0181**	0.0020	<0.01	**0.0104**	0.0020	<0.01	**0.0257**	0.0013	<0.01	0.0004	0.0005	0.40
4+ moves	**0.0431**	0.0041	<0.01	**0.0316**	0.0040	<0.01	**0.0508**	0.0026	<0.01	0.0002	0.0010	0.84

Results in bold are statistically significant at the 0.05 level. In the standard linear regression models, we controlled for the child's gender, birth cohort, number of siblings and birth order, the mother's education, her income and employment status at age 10 of the child, her age at birth of the child, whether or not she remained married through the child's first 18 years, the father's education and his income at age 10 of the child. In the fixed effects models, we controlled all the variables mentioned before, with the exception of number of siblings, the mother's education and the father's education. A complete table with all the control variables is available as online supplementary material (Table A1).

effects. We see this in Table 2 when going from the linear probability model without (upper panel) to the model with (lower panel) sibling fixed effects.

The magnitude of the relationships varies across outcomes. From the marginal effects we can calculate the relative increase in the outcome variable associated with moving (to illustrate, we use estimates from the fixed effects model). For early parenthood, moving 1–3 times and 4 or more times increases the probability of early parenthood by 2.6 and 5.1 percentage points (compared to not moving), which corresponds to a relative increase (from the baseline of 5.8 percent) of about 50 and 90 percent. For both low education and low adult income the relative increase is about 10 and 20 percent. For early death, the results are not statistically significant in the fixed effects model.

Our analyses show that residential mobility prior to entering elementary school (age 0–6) is not associated with long-term disadvantages, whereas teenage moves seem to be a particular risk factor for low education, low income and early parenthood (Table 3). The results described above are based on analyses of children who moved only once during childhood. We also performed similar analyses for all moves of all children, by age at each move. These analyses show the same trend, only with more significant results.[6]

In the standard linear probability models, the risk of dying from accidents, suicide and mental illnesses increased with the number of moves. However, the only significant estimate in the fixed effects models was an elevated risk of dying from mental illnesses for those who moved four or more times (see Table A4 in the online supplementary material).

Moving may have a different effect on children from different subgroups. Of particular interest is whether moves involving the entire family are less harmful than moves by non-intact families. Interaction terms between number of moves and family intactness do not, however, indicate such a pattern.

Table 3. Risk of adverse outcomes by age at moving for children who moved only once during childhood (age 0–18).

	Low education			Low income			Early parenthood			Early mortality		
	$N = 733\,928$			$N = 722\,526$			$N = 733\,928$			$N = 736\,310$		
Mean dep. variable	0.22			0.15			0.06			0.01		
Standard linear regression model												
	Coef.	SE	P>|t|	Coef.	SE	P>|t|	Coef.	SE	P>|t|	Coef	SE	P>|t|
No moves	ref			ref			ref			ref		
0–6 years	−0.0007	0.0013	0.59	**0.0043**	0.0011	<0.01	0.0001	0.0007	0.85	**0.0007**	0.0003	0.01
7–12 years	**0.0176**	0.0024	<0.01	**0.0147**	0.0021	<0.01	0.0009	0.0013	0.49	**0.0013**	0.0005	0.01
13–15 years	**0.0608**	0.0046	<0.01	**0.0369**	0.0041	<0.01	**0.0103**	0.0025	<0.01	0.0019	0.0010	0.06
16–18 years	**0.1496**	0.0033	<0.01	**0.0707**	0.0030	<0.01	**0.1134**	0.0018	<0.01	0.0006	0.0007	0.40
Linear regression model with sibling fixed effects												
	Coef.	SE	P>|t|	Coef.	SE	P>|t|	Coef.	SE	P>|t|	Coef	SE	P>|t|
No moves	ref			ref			ref			ref		
0–6 years	−0.0059	0.0026	0.02	−0.0006	0.0025	0.81	0.0025	0.0016	0.11	−0.0003	0.0006	0.65
7–12 years	0.0033	0.0055	0.54	0.0000	0.0051	0.99	**0.0071**	0.0033	0.03	0.0017	0.0013	0.21
13–15 years	**0.0164**	0.0082	0.04	0.0128	0.0078	0.09	**0.0308**	0.0050	<0.01	0.0012	0.0020	0.56
16–18 years	**0.0830**	0.0051	<0.01	**0.0418**	0.0048	<0.01	**0.1125**	0.0031	<0.01	−0.0011	0.0012	0.39

Results in bold are statistically significant at the 0.05 level. In the standard linear regression models, we controlled for the child's gender, birth cohort, number of siblings and birth order, the mother's education, her income and employment status at age 10 of the child, her age at birth of the child, whether or not she remained married through the child's first 18 years, the father's education and his income at age 10 of the child. In the fixed effects models, we controlled all the variables mentioned before, with the exception of number of siblings, the mother's education and the father's education. A complete table with all the control variables is available as online supplementary material (Table A2).

We have also performed stratified analyses based on mothers' marital status through childhood (see Table A6 in the online supplementary material), and the results across the two groups (mother married vs. not married through childhood) are similar. Lastly, to account for a possible entanglement between parents' education and increased mobility, we stratified the sample by five year birth cohorts (i.e. 1966–1970, 1971–1975 and 1976–1980). Our findings were consistent and statistically significant across all birth cohorts – for all outcomes.

Moving may be less harmful if it happens at ages when all children change (or start) school. We investigated whether the effects were weaker for moves that happened just before school start or when moving to lower or upper secondary school, but no clear patterns emerged.

Frequent moves do however seem to have a different impact on children depending on whether their parents are college educated or not. For low income and high school dropout, the differences between movers and stayers are substantial for children of parents without college education. For children with higher educated parents, however, we found no significant disadvantages for movers compared to stayers on these outcomes.

Even if moving is harmful on average, it is possible that moving is beneficial for particularly resourceful children; if so, we may expect moving to be positively associated, not only with *low* income and education (Table 2), but also with *high* income and education. Thus, we estimated the relationship between moving and high income (top quintile) and high education (college education), but results show no statistically significant positive associations. In spite of these findings, it is clearly possible – even very

likely – that moving can be beneficial to specific groups of children, especially if they move from particularly deprived areas to areas with advantageous amenities (Chetty et al., 2014; Ludwig et al., 2001).

Discussion

Our results show that children who move a lot fare worse on average than those who stay, even after control for potential confounders. In general, more moves and adolescent moves appear to increase these risks. Results from the standard linear probability models tend to yield stronger associations than those from the sibling fixed effects models, suggesting that failing to control for common sibling characteristics may overstate the possible harm caused by childhood moves.

Loss of social capital may be one explanation for the adverse association observed, as broken ties with significant others may have lasting adverse effects. Social capital theory distinguishes between ''inter-family'' and ''intra-family'' networks. Since our results suggest that moving is most harmful for adolescents who normally have large external networks, and not particularly harmful for children below six years, this may suggest that the intra-family ties are not severely affected by residential relocation. This suggestion is in line with South et al. (2005), who studied residential mobility and early sexual activity and found ''no evidence that the quality of parent–child relationship or parents' involvement in their children's social networks can explain the higher rates of premarital sex among mobile youth''.

Another factor that may explain why moving is more harmful for teenagers than pre-school children is that adolescence may be a period of many stressful events. Moving can add one more stressful factor, making the cumulative stress too large to handle. Also, in the teenage period, friend groups may be more settled, so that newcomers more easily end up with no or bad friends. Our results do not support a diminishing effect of additional moves due to, for instance, growing resilience to the stressors of moving. As such, handling the loss of social capital, reduced coping and psychological distress does not appear to become easier with additional moves.

A discussion of our outcomes

The observed adverse relationship between residential mobility and *education* is in line with several other studies (Astone and McLanahan, 1994; Crowder and Teachman, 2004; Scanlon and Devine, 2001; Temple and Reynolds, 1999), and also the magnitude of the relative effects is comparable.[7] The association between childhood residential mobility and adult *income* has not, to our knowledge, been extensively studied before. Ziol-Guest and Kalil (2014) are currently studying childhood moves and adult earnings, work hours and education, and seem to confirm our findings regarding frequency of moves, but not age. Our results on *early parenthood* are also in line with previous research (Crowder and Teachman, 2004; South et al., 2005; Stack, 1994). Studies on effects on *mortality* have found associations between moving and higher mortality risks, at least for some groups (Oishi and Schimmack, 2010). Earlier studies have examined the association between moving and particular behaviors, such as suicidal behaviors (Dong et al., 2005; Juon and Ensminger, 1997), major depression (Gilman et al., 2003) and drug use (DeWit, 1998), but to our knowledge no other study has compared moving's association with various causes of death. We find that moving (in particular in adolescence), increases the risk of death from mental illnesses, but no statistically significant associations on death from suicide or accidents.

Methodological considerations, limitations and future research needs

The validity and completeness of data on residential moves across Norwegian municipalities are assumed to be high for families with children, as residential notifications to the state are required to gain access to, for instance, kindergartens and schools.

Using only moves between municipalities to assess the effect of childhood mobility may have some drawbacks. First, we may include some children who are not really disconnected from their previous

environment, for instance if they only move across the municipality border and still continue at the same school. Municipalities are, however, reluctant to let children continue in the same kindergarten or school if they have moved to a new municipality as it will incur additional costs (Norwegian Directorate of Education and Training, 2014). As such, our sample is unlikely to include many children who actually keep daily contact with their former environment. On the other hand, we may omit children with some similar experiences to that of our movers: some of the children coded as ''never-movers'' in our analyses have moved *within* their municipality. However, including this group would imply a risk of including children who only move across the street and still stay in the same school and with the same friends. Requiring that a move has to cross a municipality border is a way to avoid such across-the-street movers. Excluding this group also implies that our reference group, the ''never-movers'', actually comprises some movers – this means that our results may underestimate the real adverse effects of childhood relocations.

Several methodological considerations pertain to adolescent movers (16–18 years). Around half of the moves of these adolescents are moves where teenagers leave their parental homes.[8] Such moves, independent of their parents, may entail different impacts than family moves. In a robustness check where we examined effects for 16–18-year-olds who moved with and without their parents, consistently higher risk for adverse outcomes was observed for movers leaving their home as compared to those moving with their family, although some effects were also observed for those moving with their family (see Table A7 in the online supplementary material). Also, moves are most frequent at younger ages (see Figure 1), and teenagers who experience their first move at age 16–18 may be a select sample. Robustness analyses where we study the effect of moves at age 16–18 separately for children with one, two, three, four or five moves showed that the associations were quite similar, but tended to increase with an increasing number of moves, in particular for low income and low education, in line with the results shown in Table 2. As such, the effects of moving at older ages may be hypothesized to be even more adverse than what is shown in Table 3 as we have limited the main analyses to children who move only once. When we collapse all teenage moves (i.e. ages 13–15 and 16–18), we find that the associations between outcome variables and moving during teenage years is consistently elevated also in fixed effects models, early mortality exempted. Lastly, we estimated models excluding all moves after age 15. These results are in line with our main findings of weaker associations for those who moved before age 16.

Although our methods enable us to control for a wide range of observable and non-observable characteristics between movers and stayers, there will likely be relevant differences between the two groups that we have not been able to account for; an important limitation of our study is that we do not know the movers' point of departure and/or destinations. There may be important differences between movers to and from different types of municipalities, and there may be differences between long and short distance movers – as well as differences in the effect of such moves (Chetty et al., 2014; Ludwig et al., 2001). Long (1975) found an overrepresentation of highly educated parents among long-distance movers, and Sharkey and Sampson (2010) found that neighborhood moves within Chicago lead to increased risk of violence whereas moves to areas outside Chicago reduce violent offending and exposure to violence. The impacts of distance, destination, and departure municipality characteristics deserve further scrutiny in future research.

Also, we do not know *why* families move. Some may be motivated by the hope that the family will get a better life in a different municipality, and thus entail relocation to a better residential area, school and labor market. Other moves may result from a need to reduce living costs or seek employment opportunities, for example due to parental health problems, unemployment or divorce. Further research appears warranted to distinguish possible differential effects based on the motivation behind the relocations, including ensuring that effects of events causing moves, such asl job loss or divorce, are not erroneously attributed to moving.

Norway has less social inequality than many other countries. Smaller societal differences could imply that the magnitude of the differences to be overcome during relocations would be lesser. Moreover, schools are considered to be of equally high quality, irrespective of geographic location. Thus, possible adverse effects of moving may be mitigated by these specific societal structures. Since childhood moves

in Norway nevertheless are associated with adverse outcomes, this may suggest that adverse effects could be even more pronounced in societies and cultures with less welfare security and a larger degree of social inequality.

Conclusions

Children around the world are frequently relocated, and possible links between moves and early adult outcomes are thus relevant for various stakeholders, both in the decision-making process and in tailoring to needs once the move has taken place.

This study has shown that children who move have higher likelihood than children who do not move of high school dropout, low income, early parenthood and early mortality, even after control for various observable characteristics. With control for non-observable family characteristics in fixed effects models, most associations become weaker and for early mortality the effects are no longer statistically significant.

In general, risks for adverse outcomes increase with increasing number of moves. For children who moved only once, there is little evidence for adverse outcomes for moves prior to elementary school, whereas moves during high school are associated with an increased risk for adverse outcomes.

Our results suggest that children who move fare worse in adulthood, though we cannot settle whether the enhanced vulnerability is a result of the moving per se or (also) of detrimental associated and coinciding events. Still, knowledge about the vulnerability of moving children, especially teenagers, can be helpful for municipalities responsible for kindergartens, schools, children's primary healthcare, and welfare and child protective services. This information is also relevant for parents, teachers, health and welfare workers in schools and youth clinics, who may provide newcomers with extra attention and advice in order to help minimize possible negative consequences and facilitate smooth transitions.

Acknowledgements

We are grateful to a number of seminar participants at the Norwegian Institute for Social Research, the IUSSP conference in Busan and Statistics Norway for their input to discussions, and to Øystein Kravdal and Torbjørn Hægeland for comments and suggestions to earlier versions of the paper.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: the authors gratefully acknowledge financial support from the Norwegian Research Council.

Notes

1. During the period we study, educational attainment has increased successively over the birth cohorts, whereas the probability of early parenthood and early mortality has decreased (see online supplementary material Table A1).
2. Code categorizations are provided in the online supplementary material (see Table A3).
3. We have also undertaken all analyses using logistic regression models, with very similar results (provided in online supplementary material, Tables A8 and A9).
4. To ensure that possible model misspecifications are not driving our results, we reran our models excluding parental marital status, income and education. Our main results were robust to the exclusion of these control variables.

5. We apply the Stata12 command areg. See for example Wooldridge (2010, Sect. 15.2) for an introduction to the linear probability model, and Wooldridge (2010: 624–625) for a discussion of advantages and disadvantages of models with dichotomous dependent variables and fixed effects. Results for sibling fixed effects logistic models (Chamberlain, 1980) are also provided in the online supplementary material (see Tables A8 and A9).
6. This approach can, however, make it hard to disentangle the effect of age from the effect of number of moves. We also examined the outcome patterns for age at moves for children who moved two, three or four times versus those who moved only once. The patterns were similar.
7. For instance, Haveman et al. (1991) found that movers had probit estimates at around -0.03 – -0.30 for completing high school, whereas Astone and McLanahan (1994) reported logit estimates at -0.81 for completing high school for children who moved three or more times.
8. Adolescents' moves to high school are, however, not recorded as residential moves for the cohorts included here as they obtain "student statuses" with their permanent home address remaining that of their parents.

Supplemental material

The online supplementary material is available at http://asj.sagepub.com/supplemental

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Tønnessen et al. BMC Pregnancy and Childbirth 2013, 13:170
http://www.biomedcentral.com/1471-2393/13/170

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RESEARCH ARTICLE Open Access

Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited

Marianne Tønnessen*, Vebjørn Aalandslid and Terje Skjerpen

Abstract

Background: In some Western countries, a disturbingly low share of girls has been observed among new-borns from Indian immigrants. Also in Norway, a previous study based on figures from 1969–2005 showed a high percentage of boys among children of Indian origin living in Norway, when the birth was of higher order (third birth or later). This was suggested to reflect a practice of sex-selective abortions in the Indian immigrant population. In this article we have seen whether extended time series for the period 2006–2012 give further support to this claim.

Methods: Based on data from the Norwegian Central Population Register we used observations for the sex of all live births in Norway for the period 1969–2012 where the mother was born in India. The percentage of boys was calculated for each birth order, during four sub periods. Utilising a binomial probability model we tested whether the observed sex differences among Indian-born women were significantly different from sex differences among all births.

Results: Contrary to findings from earlier periods and other Western countries, we found that Indian-born women in Norway gave birth to more girls than boys of higher order in the period 2006–2012. This is somewhat surprising, since sex selection is usually expected to be stronger if the mother already has two or more children.

Conclusions: The extended time series do not suggest a prevalence of sex selective abortions among Indian-born women in Norway. We discuss whether the change from a majority of boys to a majority of girls in higher order could be explained by new waves of immigrant women, by new preferences among long-residing immigrant women in Norway – or by mere coincidence.

Background

A number of studies have discussed whether an observed low share of girls among some immigrant groups in Western Europe and North America can be attributed to a practice of sex selective abortions [1-5]. In some regions of Asia, and especially in India where son preference is strong, the female to male ratio is disturbingly low. Sex selective abortions may, if conducted on a large scale, disturb the sex balance of a society. It is also a sign of an attitude towards women that is condemned in modern societies.

The last Indian population census showed that among children 0–6 years old the number of girls per 1000 boys decreased from 941 in 1991 to 913 in 2011 [6], corresponding to an increase in the percentage of boys from 51,52 to 52,27 per cent. Together with female infanticide, the skewed sex ratio is believed to be caused by sex selective abortions [7]. The share of girls is often found to be especially low among higher birth orders in families without male offspring [7], confirming a hypothesis that families do not take action to make sure their next child is a boy until they have already got some children, but no or few sons.

Singh *et al.* [8] investigated whether the same low female to male ratios could be found among Indian and Pakistani immigrants living in Norway, indicating a practice of sex selective abortions in a Norwegian context. They studied live births of mothers of Indian and Pakistani origin for the period 1969–2005 and calculated the female to male sex ratios, in increasing birth order, for three periods (1969–1986, 1987–1996 and 1997–2005). The study found significant imbalances in the sex ratio of children born to mothers of Indian origin, but only from the mid 1980s and onwards and only for the third and fourth birth order. The tendency was not observed among births of children of Pakistani origin. The authors linked the decline in female births to the use of ultrasound scanning technology,

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introduced in Norway in 1987, and suggested that the imbalance, in the third and fourth birth order, could stem from sex selective abortions due to prenatal sex determination by ultrasound.

In Norway, the general abortion limit is at the 12th week of pregnancy. Ultrasound techniques that may reveal the foetus' sex is normally given around week 17–19. To have an induced abortion after week 12, one has to apply to a medical committee which does not accept sex selection as a valid reason for abortion. Hence, sex selective abortions after ultrasound would have to be performed abroad.

The aim of this study is to see whether extended time series for the period 2006–2012 give further support to the hypothesis of sex-selective abortions among Indian immigrants to Norway.

Methods

Sex ratio is the ratio of males to females in a given population, often expressed as the number of males for every 100 females. In this study, we use *percentage of boys* as a complementary measure.

Data collection and descriptive statistics

The micro-data used in this study is based on administrative data from the Central Population Register, managed by Statistics Norway under the Norwegian Statistics Act.[a] The data include all live births in Norway for the years 1969–2012. Of these, 4,619 births were registered as births given by Indian-born mothers. Information about birth order was derived from the same source. To determine the birth parity, siblings registered in Norway, but born abroad (by the same mother) were also included.

Compared to the study by Singh *et al*., we also present results from an additional time period – 2006–2012 (added to the three periods considered by Singh *et al*.: 1969–1986, 1987–1996 and 1997–2005). In total, we studied 4,619 live births of Indian-born mothers, 857 in the first period and 1,204, 1,186 and 1,372 in the 2nd, 3rd and 4th period, respectively. Of these, 2,156 were first born, 1,690 second born, 587 third born, 135 fourth born and 51 were of higher than fourth birth order. Of the children born as number three or four, 37 and 29 per cent respectively, had only female siblings.

In studies of small groups, small changes in the definitions of who to include or exclude will have consequences for the overall number of observations. If we only observed births where the mother was Indian-born, and where she had no Norwegian-born parents or grandparents, the overall number of observations would decrease from 4,619 to 4,117. If we also excluded the births where the father was Norwegian-born, the number of observations would be further reduced to 3,636. However, as was done in the study of Singh *et al*. we only observed the birth patterns of Indian-born mothers, and have chosen not to include information about the father in our study.

Statistical analysis

To test whether the sex ratios among the Norwegian-Indian births were significantly different from the average sex ratio of all Norwegian births we used a binomial probability model analysing each period and each birth order separately. From the total population, the calculated probability (p_0) of giving birth to a boy is 0.5136. The corresponding probability of a girl is $q_0 = 1\text{-}p_0$. Let X be a stochastic variable representing the number of male births among all births of Indian-born mothers corresponding to a given period and a given birth order. We assume that X is binomially distributed with parameters N (number of births corresponding to period and birth order) and p (the probability parameter). Since there is no reason to expect selective abortions in disfavour of boys, we found it appropriate to consider a one-sided hypothesis:

$$H_0 : p = p_0 \text{vs. } H_1 : p > p_0.$$

A high value of X would indicate that H_0 is false and that a high prevalence of boys is not based on coincidence. Since we in all cases have $\min(Np_0, Nq_0) > 10$, the statistical inference may be based on the normal distribution [9]. The estimator of p is given by $\hat{p} = \frac{X}{N}$, and the standard error is given by $Std\left(\frac{X}{N}\right) = \sqrt{\frac{pq}{N}}$. If H_0 is true, $Z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0 q_0}{N}}}$ will be approximately standard normally distributed. The realized value of Z, which we label z, can be compared to the critical value determined by the chosen significance level. At the 10 per cent significance level the critical value is 1.2815, whereas it is 1.645 and 2.325 at the 5 and 1 per cent significance levels, respectively.

Results

In Figure 1, the percentage of boys born to Indian-born women in Norway is compared to the percentage of boys among all births in Norway in the period 1976–2012. A separate line is also shown for the percentage of boys in third or higher order births among Indian-born mothers, which may be compared to the percentage of boys among all third or higher order births in Norway.

The figure shows two main trends: First, the percentage of boys among the new-borns from Indian-born mothers in Norway fluctuates a lot from year to year, and particularly for the higher order births (sibling number three or more). This is not surprising as the number of observations is relatively low (the total number of yearly births among Indian-born women in Norway was below 100 until 1988 and below 200 until 2009 – whereas the yearly number of third or higher order births was less than 20 before 1985, and has since stayed between 16 and 28).

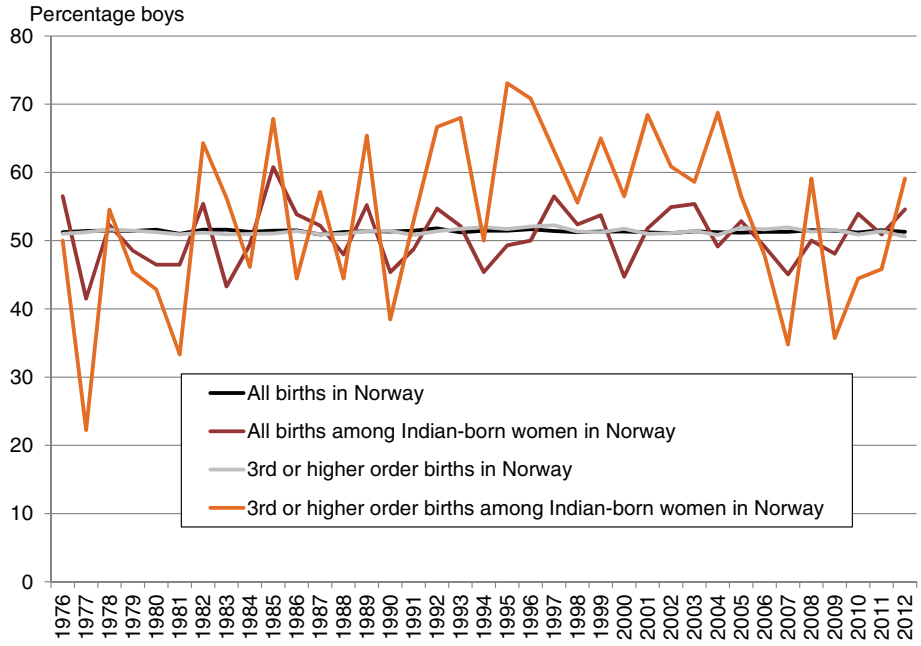

Figure 1 Percentage of boys. Percentage of boys born in Norway to Indian-born women, compared with all births in Norway, 1976–2012.

Second, although changes from one year to another may be just a result of chance, we see that in the period between around 1990 and 2005, the Indian-born women in Norway gave birth to more boys than girls in higher birth order. However, after 2005, the trend seems to have changed: As a whole, more girls than boys have been born in these birth orders in this last period.

The trend change among higher birth orders is also shown in Figure 2 – with absolute numbers of births for the four time periods. From the second period on, i.e., from the time when ultrasound technology was made generally available in Norway, a large majority of boys were born in these higher birth orders. However, the last period shows an opposite tendency – in spite of available ultrasound technology and relatively cheap international airline tickets.

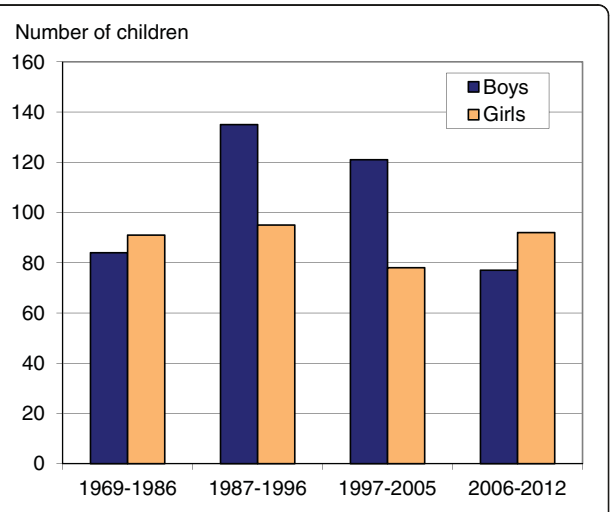

Figure 2 Number of boys and girls in higher birth order. Number of boys and girls in third and higher birth order born in Norway to Indian-born mothers, 1969–2012.

Are the variations shown only a matter of coincidences? Our binominal probability analysis (Table 1) reveals three main findings:

First, no significant discrepancies from the average percentage of boys were found for first and second order births.

Second, for third and fourth order births, in the two first periods after ultrasound technology was made available (1987–1996 and 1997–2005), the percentages of boys among new-borns were significantly higher than normal (significant at the 0.1 or 0.05 level). However, the discrepancies were not large enough to be significant at the 0.01 level. The risk of getting such a high share of boys without intervention, can thus be interpreted to lie between 1 and 5 per cent (or in one case, 10 per cent).

Third, for the last period (2006–2012) there were no significant results indicating any sex selection in disfavour of girls in any of the birth orders. For third order, only 42.9 per cent of the children were boys (in fourth order there was still a male majority, 16 boys and 14 girls). Since our test is one-sided, we did not test for discrepancies in the other direction (i.e., we did not look for sex selection in the disfavour of boys). A two-sided

Table 1 Binomial probability analysis of births by Indian-born women living in Norway, by sex and birth order, 1969-2012

	Period			
	1969-1986	1987-1996	1997-2005	2006-2012
First order births				
Male births/all births	187/378	259/543	258/533	357/702
Percentage boys	49.5	47.7	48.4	50.9
z	−0.735	−1.707	−1.365	−0.268
Second order births				
Male births/all births	157/304	209/431	243/454	259/501
Percentage boys	51.6	48.5	53.5	51.7
z	0.099	−1.191	0.923	0.151
Third order births				
Male births/all births	55/117	98/170	99/167	57/133
Percentage boys	47.0	57.6	59.3	42.9
z	−0.942	1.640*	2.048**	−1.962
Fourth order births				
Male births/all births	19/35	30/46	17/24	16/30
Percentage boys	54.3	65.2	70.8	53.3
z	0.346	1.880**	1.909**	0.216

*: Significant at the 0.10 level.
**: Significant at the 0.05 level.
Since we consider testing of one-sided hypotheses, we do not report (two-sided) confidence intervals for the probability parameter.
For fifth or higher birth orders, observations were few and no significant discrepancies were found.

Table 2 Binomial probability analysis of births by Indian-born women living in Norway where all older siblings are girls, by sex and birth order, 1969-2012

	Period			
	1969-1986	1987-1996	1997-2005	2006-2012
Second order births				
Male births/all births	76/152	110/224	122/240	124/259
Percentage boys	50.0	49.1	50.8	47.9
z	−0.335	−0.675	−0.163	−1.121
Third order births				
Male births/all births	14/39	35/57	40/65	27/57
Percentage boys	35.9	61.4	61.5	47.4
z	−1.932	1.517*	1.642*	−0.603

*: Significant at the 0.10 level.
Since we consider testing of one-sided hypotheses, we do not report (two-sided) confidence intervals for the probability parameter.

test however (with its critical value of z=1.96 at the 5 per cent level), would have revealed that the percentage of boys in third order births was significantly (at the 0.05 level) different from P_0=0.5136.

Our two first findings are in line with results from previous empirical analyses and theories about sex discrimination not appearing until for siblings of higher orders [3,4,7]. The observations from the last period, however, deserve some more elaboration.

As already mentioned, other studies have shown that the discriminatory practices are particular prevalent in families with only girls. We examined the high order sex ratios for families where all the previously born children are female, to see if the trend had changed for them as well. As shown in Figure 3, even in this group, where sex selective abortion would be most expected, the last period showed a small majority of girls being born. Results from the significance test (Table 2) show a similar trend as for all third and higher order births among Indian-born mothers: Some (slightly significant) discrepancies from a normal sex distribution for third order births in the two first periods after 1986, but no signs of sex selection in the last period. We disregarded fourth and higher order births for this group because of the low number of observations.

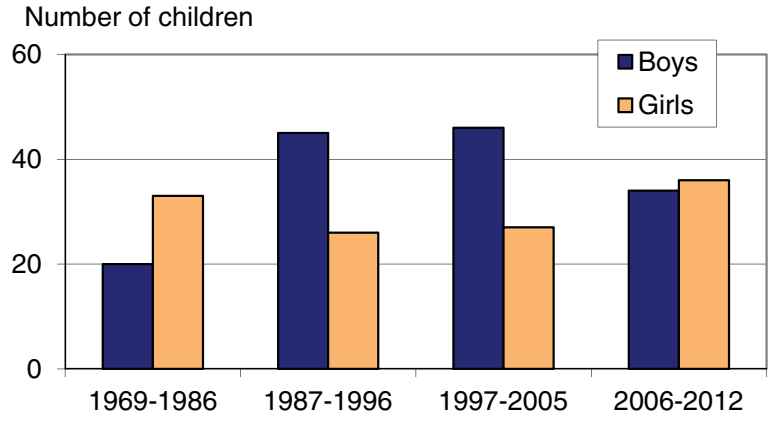

Figure 3 Number of boys and girls where all previous births are girls. Number of boys and girls in third and higher birth order born in Norway to Indian-born women who previously had only girls, 1969–2012.

Discussion

Why did the trend change? It could have been due to new Indian immigrants entering Norway. The Indian-born immigrant population residing in Norway increased from 4,600 in 2005 to 8,700 in 2012. However, Indian-born women who migrated to Norway after 2005 gave birth to less than 10 children in third or higher order (with a majority of boys) in the last period. It is among Indian-born women who have resided more than 6 years in Norway that we observed a majority of female births in the third and fourth order (90 girls vs 72 boys in the last period). Hence, the change in the observed sex ratio did not originate from new immigration from India.

Does this mean that the preferences for sons have changed among the Indian-born mothers who have resided many years in the relatively gender-equal Norwegian society? To find indications of son preference, we examined whether mothers who had only girls, were over-represented among those who chose to have another child. If mothers with two girls often choose to have another child, while mothers with two boys (or with one child of each sex) do not, this may be an indication of preference for sons.

Among all third or higher order children born to any mother in Norway in the period 2006–2012, 24 per cent had only brothers, whereas 21 per cent had only sisters. Among the children born to Indian-born mothers the corresponding shares were 15 and 41 per cent – meaning that fewer had only brothers and a considerably higher share had only sisters. Thus, Indian-born mothers more often got another child if they had only daughters compared to if they had only sons. Although the general trend among Indian-born mothers in Norway has been that fewer choose to have more than two children, the share of Norwegian-Indian new-borns in higher birth orders who have only female siblings actually increased over the time periods, which indicates a persisting preference for sons among some Indian-born mothers in Norway. However, as our extended data material show: this preference does not seem to be translated into sex selective abortions.

Almond *et al*. [4] point out that sex selection and continued childbearing are alternative ways of achieving a son, and that there may be some substitution between the two strategies; lower fertility levels may increase the use of sex selective abortions and vice versa. They found signs among South and East Asian immigrants in Canada of a relative substitution (across generations) towards the abortion route from the fertility route. Our results may suggest some substitution over time in the opposite direction.

The suggested interpretation above does not, however, explain why we have seen a *majority* of girls among third order births in the last period. Although the percentage of boys in third order is so low that it would be significant at the 0.05 level if we had used a two-sided test, neither previous theory nor our analyses of preferences suggest that the surplus of girls has been anything but a matter of coincidence. As shown in Figure 1, there are large fluctuations in these numbers from year to year. Consequently, if this last surplus was due to mere coincidence, the surplus of boys in earlier periods could just as well be due to random deflections.

Conclusions

Extended time series on percentage of boys among children born to Indian immigrants in Norway do not suggest a practice of sex selective abortions. While a previous study [8] found a significantly skewed sex ratio among higher order births after ultrasound was introduced in Norway, updated figures from 2006–2012 indicate that the trend has changed: As a whole, Indian-born women in Norway have given birth to more girls than boys in higher birth orders in this last period. The number of births is however low, and the annual variations are therefore large, making it difficult to draw clear-cut conclusions from the data.

Endnote

[a]The project is also approved by the Data Protection Official for Research (personvernombudet) as prescribed by the routines of Statistics Norway in accordance with the Person Information Act (personopplysningsforskriften § 7–12). The Norwegian Statistics Act precludes us from making the data publicly available, but Statistics Norway can provide access subject to approval of an application. Documentation that sufficient confidentiality can be guaranteed, as well as the consent of the Norwegian Data Inspectorate, may be required.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All the authors contributed to the study design and drafted different parts of the manuscript. MT carried out the data analyses, VAA participated in literature review, and TS performed the binominal probability analyses. All authors have read and approved the final manuscript.

Received: 13 May 2013 Accepted: 29 August 2013
Published: 5 September 2013

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doi:10.1186/1471-2393-13-170
Cite this article as: Tønnessen *et al.*: Changing trend? Sex ratios of children born to Indian immigrants in Norway revisited. *BMC Pregnancy and Childbirth* 2013 **13**:170.