Stockholm Research Reports in Demography | no 2019:08

Explaining declined immigrant fertility

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ISSN 2002-617X | Department of Sociology

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Abstract: In many Western countries, the total fertility rate (TFR) of immigrant women has declined over the last decades. This report proposes two methods for explaining such changes in the aggregate immigrant fertility level: what-if scenarios and a formal decomposition. Both methods disentangle the effect of changed composition – by origin area and duration of stay – from the effect of changed fertility within subgroups. The methods are applied to data from Norway, where immigrant TFR declined from 2.6 births per women in 2000 to below 2.0 in 2017. The results show that this decline cannot be explained by successful integration, nor by changed composition of immigrant women by origin area or duration of stay. A main reason for the decline is found among newly arrived immigrant women, particularly from Asia. They have a considerably lower fertility now than what the newly arrived had 15-20 years ago. After investigating several possible explanations for the TFR decline among the newly arrived, decreased fertility in origin areas is suggested as a key driver.

Keywords: immigrant fertility, migrant fertility, migration, decomposition, immigration, fertility

Stockholm Research Reports in Demography 2019:08

ISSN 2002-617X

Introduction

The total fertility rate (TFR) of immigrant women has declined in many Western countries, as shown in Figure 1. The TFR gap between immigrant and native women has also generally decreased. This paper shows how such a decrease in the TFR of immigrant women can be explained.

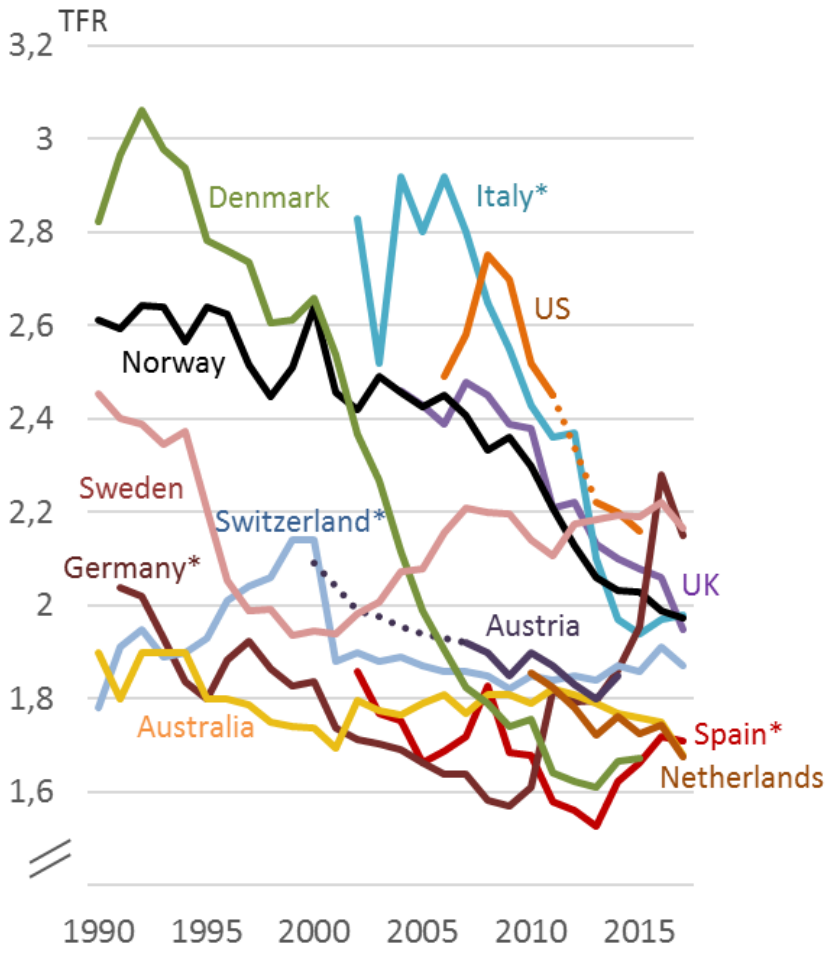

Figure 1. Total fertility rates among immigrant women (or *non-citizen women)[a] in some Western countries, 1990-2017.[b,c]

[a] Figures for non-citizens are used when figures for immigrants were not available.
[b] Dotted lines indicate lack of data for some years.
[c] 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.

Immigrants' fertility has received attention in many Western countries, for several reasons. Since many immigrant women are in their childbearing ages, their fertility has large impact on

the number of births. In Western Europe, where 13.5 percent of the population is foreign-born, every fourth child born in 2016 had a foreign-born mother (Eurostat 2019a and 2019b). Hence, immigrant fertility affects Western countries' population size and age composition, which translates into needs for kindergartens and schools; and in the longer run it affects labour force, future number of women in childbearing ages and the old-age-dependency ratio. Immigrant TFR is also relevant for the public debate in many Western countries, where some are concerned about the future number and share of immigrants and immigrants' children.

Numerous studies have contributed to explaining immigrant's fertility behaviour, displaying how fertility patterns vary between different groups of immigrant women, for instance by origin area or duration of stay. However, not much attention has been devoted to explaining changes in the aggregate fertility level of immigrants in a country.

The total fertility rate is the most common aggregate measure of fertility, summarizing current fertility patterns into a single number. Figures on immigrant TFR are regularly published in many countries and used by policy makers and others in the public debate. However, there is a risk of drawing too quick conclusions based on this summary measure. For instance, a decreased immigrant TFR may be interpreted as a sign of successful integration of immigrants, which may not be the reason for the decline. Even if integration/adaptation usually implies that an immigrant woman's fertility decreases by her duration of stay, this will only lead to decreased TFR for all immigrant women if the proportion of women with long duration of stay increases. Another factor that could change immigrant's TFR is changed composition of immigrant women by origin area, for instance if the proportion of immigrants from low-fertility countries increases. Another possible reason could be changed fertility within subgroups of immigrant women (by duration of stay and country of origin).

Understanding the determinants of a changed immigrant TFR is essential in order to implement appropriate policy responses and better forecast future fertility. Therefore, the aim of this paper is to show how changes in the overall immigrant TFR can be explained.

The paper is organized as follows: First, I briefly review how previous research on migrant fertility has identified two factors as particularly important for immigrant women's fertility: area of origin, and duration of stay in the destination country.

Second, I introduce two approaches for disentangling the TFR effect of changed composition by origin area and duration of stay from the effect of changed fertility behaviour within subgroups of immigrant women (by origin area and duration of stay): what-if-scenarios and a

formal decomposition. These methods have not, to my knowledge, previously been used to explain immigrant fertility trends. The methods are applied to data from Norway, where TFR among immigrant women decreased from 2.6 in 2000 to less than 2.0 in 2017. The two approaches broadly give the same conclusion: Although immigrants' fertility often declines with their duration of stay, this does not explain why the immigrant TFR in Norway has fallen since 2000, nor does changed composition by origin area. The decrease in immigrant TFR in this period can mainly be explained by changed fertility within subgroups (by origin area and duration of stay). Almost half the decrease is explained by newly arrived immigrant women, who have a noticeable lower fertility now than the newly arrived had in 2000.

Third, I examine possible explanations for this change among the newly arrived immigrant women by decomposing by reason for immigration. The results show that a large part of their TFR decline is explained by the family migrants – women who migrate for family-(re)unification. Their share among all newly arrived immigrants has decreased since 2000, and so has their fertility. Among the newly arrived family immigrants from Asia, TFR declined by more than two births per women.

I furthermore investigate this TFR decrease among these newly arrived family migrants, particularly those from Asia, by exploring possible explanations such as age at arrival, education, births before migration and whether the male partner was a migrant. I also compare the TFR trends of newly arrived family immigrants with TFR trends in their countries of origin. This latter approach suggests that the fertility decline among the newly arrived family migrants – particularly those from Non-Western countries – may reflect a declined fertility in origin. Thus, if fertility continues to decline in high-fertility countries, as the United Nations assumes, the results of this paper suggest we may expect further fertility declines among newly arrived immigrants from these countries in Western societies.

Theory and previous research

Although the TFR of immigrants is widely produced and used, previous research has not focused much on explaining changes over time in this macro measure. However, substantial work has been done to uncover factors that can explain fertility patterns among different groups of immigrant women in Western countries.[1] From this research, two factors appear particularly

[1] Examples include Haug et al. 2002 and Sobotka 2008 for European overviews; 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 et al. 2010, 2011,

crucial for an immigrant woman's fertility: Her origin area, and her duration of stay. These two factors will play a key role in the methods presented later in this paper. Several hypotheses may explain their importance. 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 et al. 2015. Below is a summary of how the main migrant fertility hypotheses can explain the role of origin area and duration of stay, and possibly also a change in the general immigrant TFR.

The role of duration of stay

Three different hypotheses may illuminate why immigrants' fertility tends to change with their duration of stay.

The hypothesis of interrelated events (or family formation hypothesis) emphasises that many immigrant women migrate because they are starting a family, and they may catch up with births postponed during the migration event. Therefore, fertility will be particularly high right after migration, and lower among women with long duration of stay.

The adaptation hypothesis points out that a person's fertility behaviour is affected by her current context. When an immigrant settles in a new country, she starts adapting to this country's fertility norms. This hypothesis might explain why, among migrants from high fertility countries, fertility rates are often lowest among women with long duration of stay.

The disruption hypothesis, on the other hand, argues that migration may be stressful and often involves separations of spouses and depressed income, so 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 longer duration of stay.

According to both the hypothesis of interrelated events and the adaptation hypothesis, the general immigrant TFR would decrease in a scenario where the proportion of immigrants with

2014 and 2016 for Canada; Puur et al. 2017 for Russians in Estonia, Toulemon 2004 and Héran et al. 2007 for France; Adserà et al. 2012 for Canada, UK and France; Mayer et al. 2000, Milewski 2007 and 2010, Schmid et al. 2010, Stichnoth et al. 2013, Cygan-Rehm 2014 and Wolf 2016 for Germany; Mussino et al. 2012, Mussino et al. 2015 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, del Rey et al. 2015, Kraus et al. 2017 and González-Ferrer et al. 2017 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, Dormon 2014, Wilson 2015, Kulu et al. 2016, Robards et al. 2016 and Wilson et al. 2017 for United Kingdom; and Blau 1992, Kahn 1994, 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, and Mora et al. 2017 for Latinas in US and Spain.

long duration of stay increases. However, the disruption hypothesis predicts the opposite result.

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 is defined by the norms they once were socialized into. This hypothesis may explain why immigrants from different origin areas have different fertility.

The selection hypothesis states that immigrants may be a select group compared to non-migrants in their origin area. This is one possible 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 for work may have lower fertility preferences than women from the same origin area that move to start a family.

These hypotheses predict that the general immigrant TFR will decrease if the share of immigrant women from high-fertility areas decreases, or if the share of women with high-fertility preferences (such as family migrants) decreases.

The role of other factors

Although the importance of origin area and duration of stay are dominant in the literature, research has also pointed at other factors that can affect immigrants' fertility, such age at migration (Adserà et al. 2014), education (Kahn 1994, González-Ferrer et al. 2017), residential segregation (Lichter et al. 2012, Wilson et al. 2017), whether the male partner is also a migrant (Van Landschoot et al 2017), number of births before migration (Toulemon 2004, Persson 2013, Choi 2014, del Rey et al. 2015, Robarts et al. 2016), and whether they migrate for family reasons (Ortensi 2015). Factors like these may explain why we sometimes see changed fertility within subgroups of immigrant women (by origin area and duration of stay).

From micro to macro

Uncovering factors that affects an immigrant woman's fertility, which has been the focus in much of the literature in this field, is necessary but not sufficient in order to explain macro

trends in immigrant TFR. For instance, if micro studies show that immigrant women's fertility declines by duration of stay, this does not necessarily translate into a declining TFR for all immigrant women unless the share of immigrant women with long duration of stay increases. To explain macro trends, we also need to take such compositional effects into account. That is the goal of this paper.

Data, measures and methods

To disentangle changes in the general immigrant TFR, I propose two approaches: What-if scenarios and a formal decomposition. First, in the what-if scenarios, the composition of immigrant women (by 8 origin areas and 4 durations of stay) is allowed to change like it actually did, while the fertility in each subgroup is kept constant at 2000 levels – and vice versa. Second, I use a decomposition based on Kitagawa (1955), applied to changing fertility over time.

Both methods can address this paper's main questions: to what degree the decline in immigrant TFR is due to changed composition of immigrant women (i.e. by origin area and duration of stay), and to what extent it is due to changed fertility within subgroups of immigrant women. The methods can also identify subgroups that are driving the change.

The two methods are demonstrated using register data from Norway. Norway may be a good case for several reasons: As Figure 1 shows, Norway's downward trend in immigrant fertility is comparable to many other Western countries'. Also regarding fertility and immigration in general, Norway is similar to many other European countries: The Norwegian TFR in 2000-2016 was higher than the European average, but lower than in countries like France, Iceland and Ireland (Eurostat 2019c). Even if Norway is not a member of the European Union, it is part of Europe's Schengen Area, where internal border checks have largely been abolished. The share of foreign born in the Norwegian population has increased markedly the last decades, and by 2017 it was at 15 percent. This is higher than the average of 13.5 percent in Western Europe, but still lower than in for instance Switzerland, Austria, Sweden, Ireland and Belgium (Eurostat 2019a). So with regard to immigration, fertility and immigrant fertility, Norway is comparable to many other Western countries. Another advantage of using Norway as case is the rich Norwegian register data which makes it possible to study how several background characteristics affect immigrants' fertility.

Data

The data are from Norway's population register, which includes complete cohorts of all immigrant women 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 207,078 births to immigrant mothers (2000-2017) and a total of 2,773,274 person-years of immigrant women aged 15-49 (<90,000 yearly in the first years and more than 250,000 in 2017). The population register furthermore provided data on previous births, municipality of residence and father's origin, whereas education data are from the National Education Database. 179 births were excluded from the sample due to insufficient information about the mothers.

Composition by origin area and duration of stay

As shown in Figure 1, TFR among immigrant women in Norway decreased from 2.6 in 2000 to below 2.0 in 2017. The difference between immigrant and native TFR also declined, from 0.9 to 0.3. In this period, both the number and the composition of immigrant women changed markedly. After the European Union enlargement in 2004, a substantial number of women from the new eastern member states migrated to Norway. Immigration from other parts of the world also increased. Figure 2 shows how the numbers and proportions of immigrant women age 15-49 in Norway changed from 2000 to 2018, by origin area[2] and duration of stay[3].

[2] The origin area Western EU includes all countries in Western Europe, and Greece and Cyprus (many of the immigrants in this group are from the Nordic countries or Germany), Eastern EU includes the 11 new Central and Eastern European EU members since 2004 (Polish and Lithuanian immigrants are large groups here), 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 South and Central America, as well as the Caribbean and Mexico (many are from Chile and Brazil, however this group is small in Norway), and US, Canada and Oceania includes US, Canada, New Zealand, Australia and the Pacific islands (also a small group, most are from the US).

[3] Duration of stay is defined as the number of years since (first) migration to Norway.

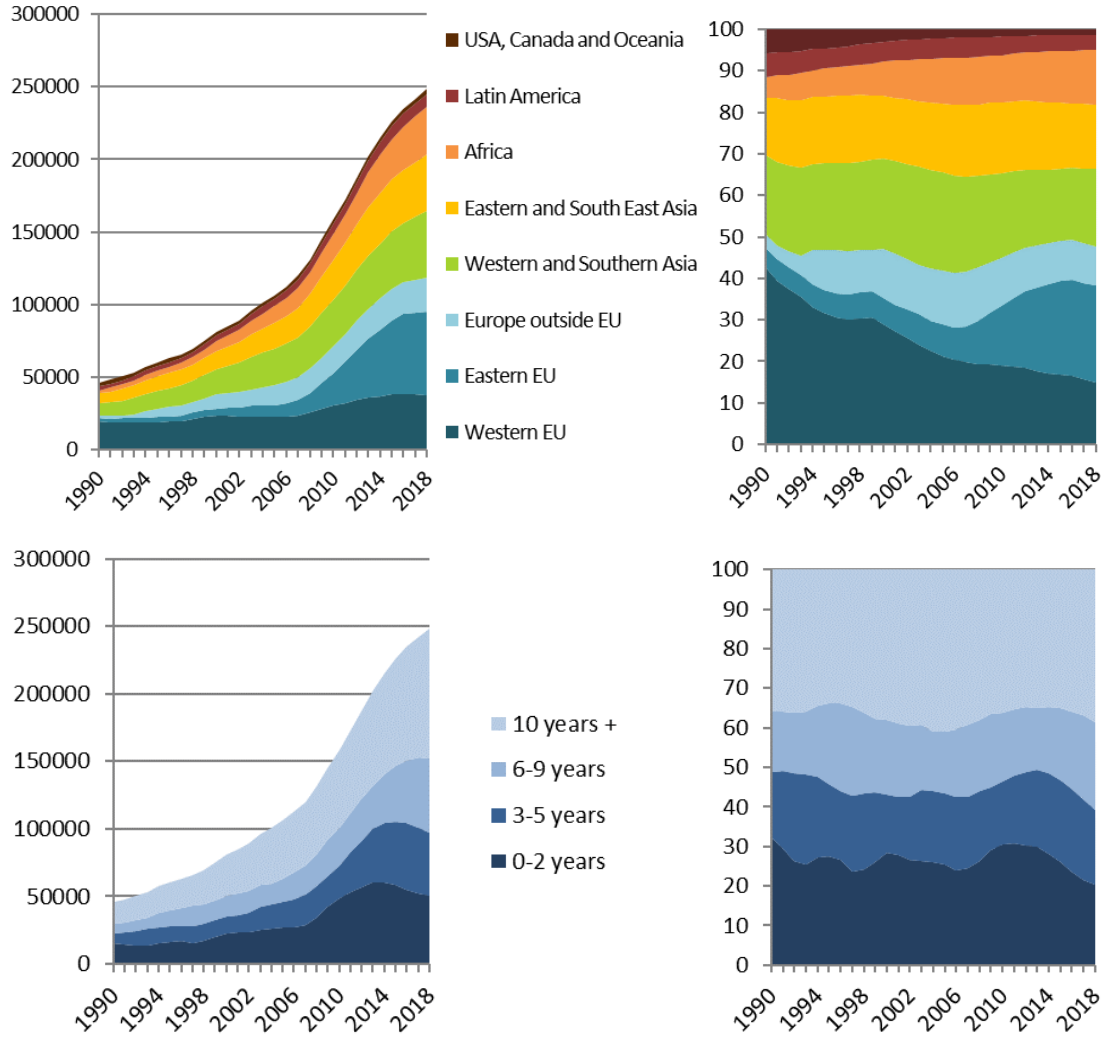

Figure 2. Immigrant women (age 15-49) in Norway, by origin area (upper panel) and duration of stay (lower panel). Absolute numbers (left) and percent (right). 2000-2018.

The left panels in Figure 2 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 number of immigrants from Eastern EU has increased, both in absolute numbers and as share of all immigrant women, while the share from Western EU has decreased markedly. Taken together, the proportion of women from Europe, where fertility is relatively low, only declined marginally from 2000 to 2015. All the four duration-of-stay groups have seen large increases, whereas the proportions in each group have been relatively stable over the last decades (lower right panel). Thus, the share of women from traditionally high vs. low fertility areas of the world has not changed very much, nor has the distribution by duration of stay. This suggests that changed composition by origin area or duration of stay may not be the main driver behind the immigrant TFR decline.

The total fertility rate

The total fertility rate (TFR) is the core measure in these analyses. TFR is probably the most widely used fertility measure worldwide. It 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.

TFR is often interpreted as 'number of children per woman'. This interpretation is not necessarily fruitful when TFR is used to analyse immigrant fertility. As several authors have noted (for instance Wilson 2015 and Robards et al. 2016), TFR may not be a good predictor of completed family size of migrants, due to for instance distortions in childbearing around the migration event. Hence, in this study, TFR can best be viewed as a measure of birth intensity in a certain subgroup in a certain year, and not as an indication of future family size (since, for example, no immigrant woman will have 0-2 years of stay all her life).

Using TFR as a measure of birth intensity in a certain group at a certain time – rather than as some indication of expected family size for this group – is not so common. If the aim of this study had been to analyse whether immigrants converge to natives' fertility, other measures might have been more appropriate, such as completed family size or cohort fertility. All measures of fertility have strengths and weaknesses, which is particularly true when analysing immigrants' fertility adaptation, because convergence to the native level in one indicator (e.g. TFR) does not necessarily imply convergence in another (e.g. completed family size/cohort fertility). However, since the aim of this paper is to explain changes over time in immigrants' overall TFR, the TFR and ASFRs are also the measures used in the methods presented.

To show how the births intensities differ between subgroups of immigrant women by origin area and duration of stay, annual TFRs are calculated for all immigrant women age 15-49 in Norway by 8 areas of origin and 4 durations of stay – altogether 32 subgroups. In the calculations of the underlying ASFRs, five-year age groups were used, since some subgroups of immigrant women are small. The results are shown in Figure 3. For each origin area, women are grouped by their duration of stay, and they will move from one group to another (towards thinner lines) the longer they stay in Norway.

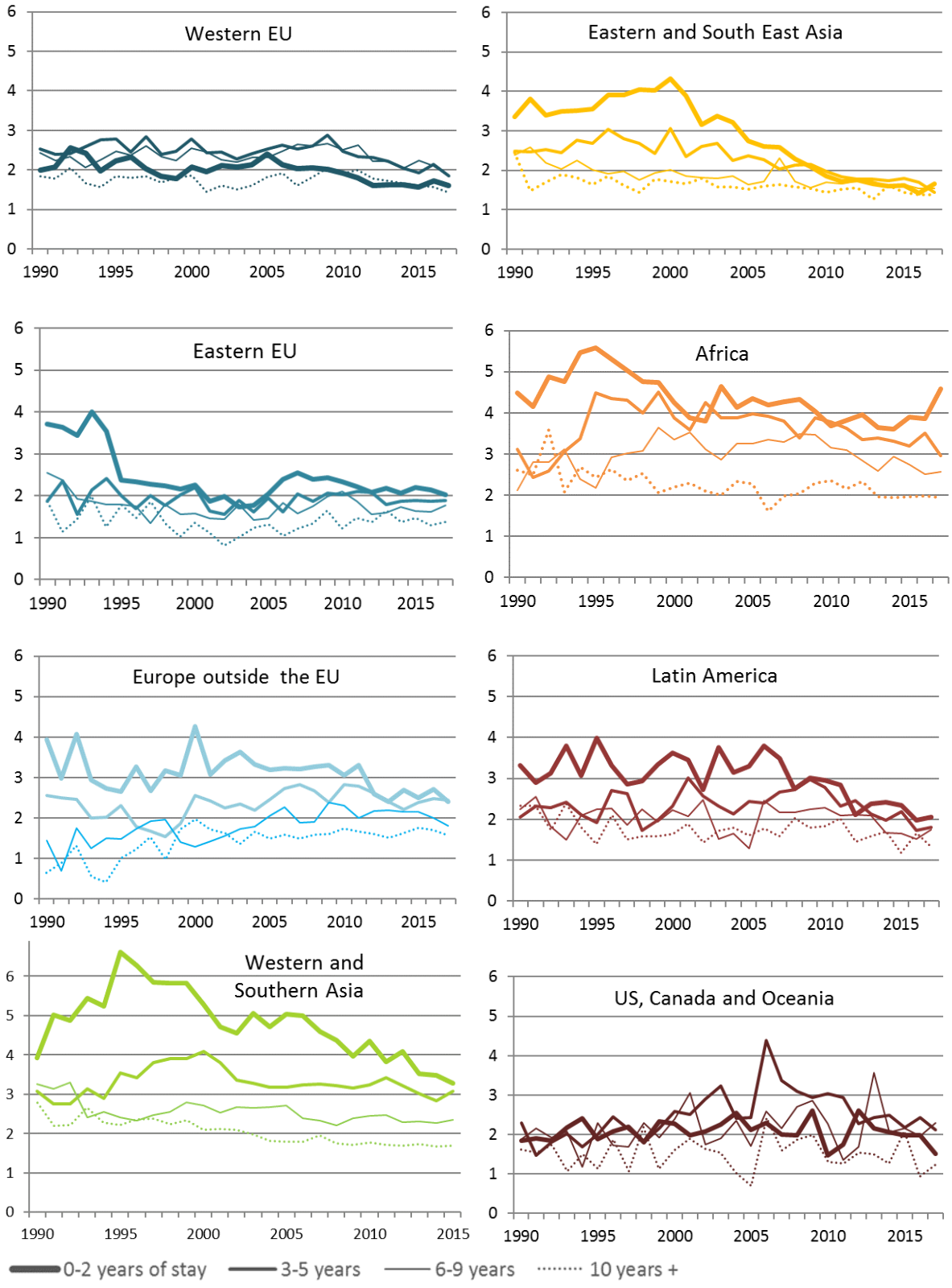

Figure 3. Total fertility rates among immigrant women in Norway, by origin area and duration of stay, 2000-2017.

Figure 3 shows three main features. First, TFR 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, TFR is often highest among women with short duration of stay. This is in line with hypotheses on interrelated events and/or adaptation. Third, some of the lines have quite strong trends, showing a declined fertility within subgroups, particularly for newly arrived women from many Non-Western parts of the world, such as Asia and Latin America.

Method 1: What-if scenarios

What-if scenarios can illustrate how these main features have affected the general immigrant TFR. In these scenarios, certain factors are kept constant while others are allowed to change over time. First, the composition of immigrant women (by origin area and duration of stay) is kept constant at the 2000 level while fertility within each of the 32 subgroups is allowed to change like it actually did from 2000 to 2015. Second, the composition of immigrant women is allowed to change while fertility within each subgroup is kept constant. This method takes advantage of 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.

Using the last term of this equation, it is possible to keep ASFRait constant at the 2000 level while letting wait change. This gives the what-if scenario where fertility within each group is kept constant while only composition changes. Letting ASFRait change while the wait is kept constant gives the scenario where only fertility within each group is allowed to change, 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 is done to investigate the separate effect of changed fertility among newly arrived immigrant women.

Method 2: Formal decomposition

What-if scenarios are well suited to answer hypothetical questions. However, the estimated hypothetical changes in the what-if TFR paths 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 with many 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 are 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 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 within the subgroups.

Further decompositions by new variables can also be done. To investigate possible selection effects, I use the above framework to decompose the changes in TFR among newly arrived immigrant women by their reason for immigration.

Results

In this section, the main results from the two methodological approaches are elaborated.

What-if results

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 like it actually did between 2000 and 2017. The resulting what-if TFR for all immigrant women is shown in the upper left panel of Figure 4. This scenario shows almost no decrease, while the observed immigrant TFR decreased. This is not very surprising; as Figure 2 showed, the shares of women from traditionally high vs. low fertility origin area, as well as by different durations of stay, were relatively stable from 2000 to 2017.

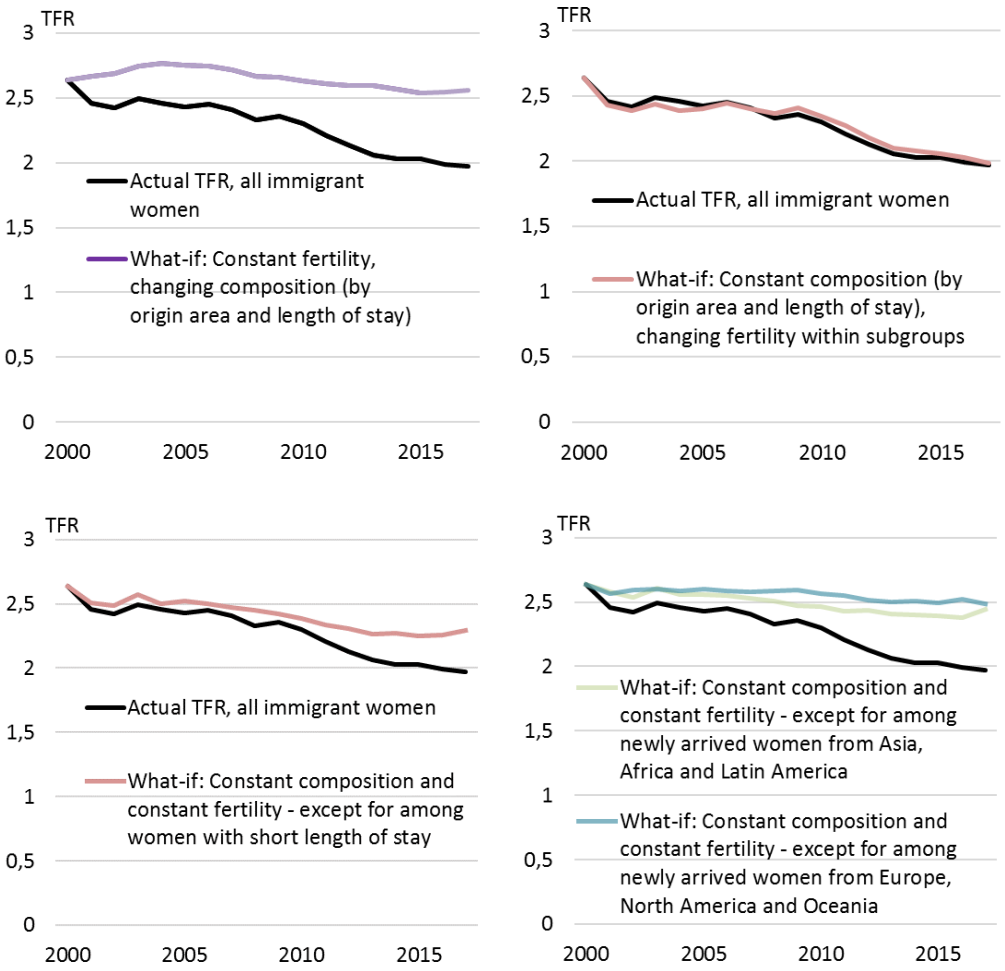

Figure 4. What-if-scenarios, where either composition of immigrant women, fertility for all subgroups or fertility for certain subgroups was allowed to change while the other factors were fixed at 2000 level.

The upper right panel of Figure 4 shows the opposite scenario, where composition was fixed at the 2000 level and only fertility within each subgroup was allowed to change like it actually did. This scenario seems to explain a great deal of the changed immigrant TFR in Norway.

Many of Figure 3's panels show 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 all other immigrant women's fertility, as well as their composition, was kept constant. The results are shown in the lower left panel of Figure 4. A large part of the total decrease appears to be due to this decline in newly arrived immigrants' fertility.

The decrease among the newly arrived seems most pronounced among women from high-fertility areas of the world (Figure 3). The effect of this decrease was explored by creating a what-if scenario where everything was kept constant except 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 4. Newly arrived immigrants from Asia, Africa and Latin America explain marginally more of the decrease than newly arrived Western immigrants. The latter mostly contribute to the general TFR decline after 2009.

Decomposition results

The decomposition shows that 93 percent of the TFR decrease among immigrant women in Norway can be attributed to lower fertility within the subgroups, while 7 percent is due to changed composition by origin area and duration of stay (Table 1).

Table 1: Decomposition of changed TFR among immigrant women in Norway (2000-2017)
Percent wise contribution to the immigrant TFR decrease in Norway (from 2.64 in 2000 to 1.97 in 2017)

Changed **composition** of immigrant women (by origin area and length of stay)	7.0 %
Changed **fertility** within each group of immigrant women (by origin area and duration of stay)	93.0 %
changed fertility among newly arrived immigrant women (0-2 years of stay)	45.0 %
changed fertility among newly arrived immigrant women from Western EU	5,3 %
changed fertility among newly arrived immigrant women from Eastern EU	0,5 %
changed fertility among newly arrived immigrant women from Europe outside the EU	9,4 %
changed fertility among newly arrived immigrant women from Western and Southern Asia	12,6 %
changed fertility among newly arrived immigrant women from Eastern and South East Asia	15,0 %
changed fertility among newly arrived immigrant women from Africa	-0,9 %
changed fertility among newly arrived immigrant women from Latin America	2,2 %
changed fertility among newly arrived immigrant women from US, Canada and Oceania	0,9 %
changed fertility among immigrant women with 3-5 years of stay	27.5 %
changed fertility among immigrant women with 6-9 years of stay	7.2 %
changed fertility among immigrant women with 10+ years of stay	13.3 %

Note: Rows with the same shade sum up to the above row with darker shade.

The fertility change among the newly arrived immigrant women explains 45 percent of the TFR decrease for all immigrant women in Norway since 2000. The contribution is particularly large among newly arrived immigrants from Asia, who have a considerably lower fertility now than what the newly arrived from Asia had in 2000 (figure 3). The newly arrived Asian women alone explain 27.6 percent of the TFR decrease for all immigrant women in Norway since 2000.

The fertility decline among women with somewhat longer duration of stay (3-5 years) also explains a large deal (27.5 percent) of the total decline. About half of this (13.4 percent) is due to lower fertility among Asian immigrants.

Further decomposition of the TFR decline among the newly arrived

To sum up, both the what-if scenarios and the decomposition suggest that the decline in immigrant TFR in Norway to a large extent can be explained by the newly arrived immigrant women, who have a lower fertility now than then newly arrived had in 2000. Some of the decrease may be due to changed selection. For instance, reasons for migration may have changed. Reason for immigration is recorded at immigrants' first arrival in Norway (unless they are Nordic citizens). Fertility differs by reasons for migration, and women who migrate for family reasons often have relatively high fertility (Castro Martín et al. (2011), Mussino et al. (2012) and Ortensi (2015))

As further documented in Appendix B, family migrants are found to be essential for explaining the TFR decrease among all immigrants in Norway, in two ways: Their proportion among all newly arrived immigrant women has decreased for many of the origin groups, and their fertility has declined in all 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 5.1 to 2.9 for Eastern and South East Asians, se Figure B2).

Results from the decomposition by reason for migration are summarized in Table B1, which is an extension of Table 1 where the contribution from newly arrived immigrant women in each origin group is further broken down. The two groups of newly arrived family immigrants from Asia, who had the largest TFR decrease, also made the largest contribution to the declined TFR for all immigrants. Among newly arrived immigrants from Western and Southern Asia, lower fertility among family migrants explains 9.7 percent of the overall TFR decline. Similarly, lower fertility among newly arrived family migrants from Eastern and South East Asia explains 8.2 percent. Hence, 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 – by end-2017 they constituted 3 percent of all immigrant women in childbearing ages (5 per cent in 2000).

Possible reasons for the decline among the newly arrived

As the results show, after taking into account two of the most important determinants of immigrant fertility – duration of stay and area of origin – one group is identified as a main driver behind the TFR decrease among immigrants in Norway: The newly arrived immigrants. After also taking into account the reason for migration, a key explanation is found among the

family migrants, particularly those from Asia. This section investigates several possible reasons why the TFRs of newly arrived immigrants, and especially family migrants from Asia, have changed. From previous studies, factors such as age at migration, education, residential segregation, the role of the male partner and the number of pre-migration births are shown to influence immigrant fertility. Explanations may also be found in the general Norwegian society or in the immigrants' origin areas.

First, the trend could be part of a general fertility decline in Norway. However, TFR among native women increased in part of this period (2002-2009). Moreover, Figure 3 shows that immigrants with longer duration of stay do not display a similar trend as the newly arrived.[4]

Second, age of arrival is found to be crucial for an immigrant woman's fertility, indicating that immigrants who arrive as children may adapt faster (shown for instance by Adserà et al. (2012) for fertility patterns in Canada, US and France, and Hermansen (2017) for life chances among childhood immigrants to Norway). However, none of the newly arrived immigrant women (0-2 years of stay) have been able to spend much of their youth in Norway.

Third, the fertility decline among newly arrived migrants could be due to a changed timing of births after or before the migration. Migrant women may to a larger extent 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) have evolved similarly to the number of immigrating women (age 15-49) in this period, indicating that each arriving woman 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 immigrant 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 (Table 1).

Forth, several studies have found an effect of education on immigrants' fertility; women with higher education tend to have lower fertility (Kahn 1994, González-Ferrer et al. 2017). Thus, a higher share of more educated immigrant women would suggest a lower TFR. However, the proportions of high and low educated women evolved quite similarly from 2000 to 2017, whereas the TFR within each of these groups declined markedly, suggesting that educational

[4] Many subgroups (and the natives) have experienced declined 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 4, lower right panel, suggest that newly arrived immigrants from Western countries contributed to the fertility decline mainly after 2009, which might be a result of economic distress. However, the decline among Non-Western newly arrived immigrants seems relatively unaffected by the financial crisis, as illustrated in Figure 3.

composition does not explain the TFR decrease.

Fifth, residential segregation or immigrant density may influence immigrant women's fertility (Lichter et al. 2012, Wilson et al. 2017); if they live in less segregated areas, their fertility is often closer to the natives'. However, most municipalities in Norway had more immigrants from most origin areas in 2017 than in 2000, and thereby an increased immigrant density. From this we would actually expect an increased immigrant TFR.

Sixth, changing Norwegian immigration policies could explain some of the changes, most notably the lower share of family migrants among the newly arrived. From May 2003, immigrants admitted to Norway following application for political asylum were no longer exempt from subsistence requirements when reuniting with their spouses. Later the family unification requirements were further tightened (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, but it is an open question whether it had any effect on the family migrants' fertility.

The family migrants' fertility may have declined due to changed background of the child's father. Research from Norway and elsewhere show that people with immigrant background often have higher fertility if their partner is also an immigrant (Mohn 2016, Van Landschoot et al. 2017), and immigrant women who prefer a Norwegian partner may also have fertility preferences closer to the Norwegian level. However, the share of births among all newly arrived immigrant women where the father was Norwegian, decreased rather than increased after 2000.

Finally, fertility among newly arrived family migrants may have declined because of declined fertility in origin areas. In many 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 one or two decades before, implying that socialization has changed. In Figure 5, fertility among newly arrived family migrants in Norway from the main origin countries is combined with data showing the TFR in their origin countries. Although the levels differ (which may indicate selection, since these women migrate to start a family), the trends often show the same direction. This suggests that origin country fertility trends may indeed matter for the fertility of newly arrived immigrant women, at least for family migrants from countries where fertility has been high.

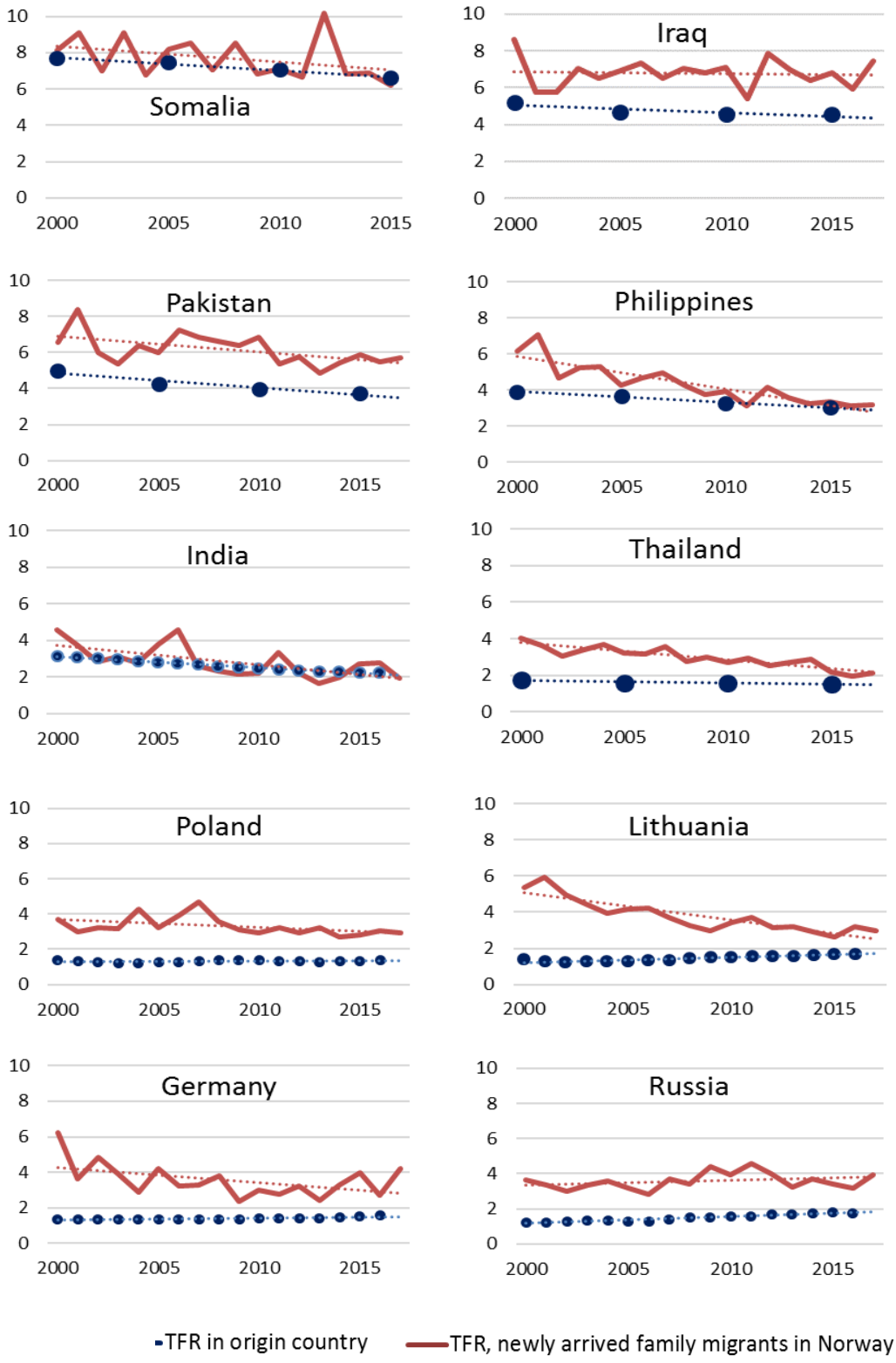

Figure 5. Total fertility rates among the largest groups of newly arrived family immigrant women in Norway and in their origin countriesa (linear trends in thin dotted lines), 2000-2017

[a] Sources: Human Fertility Collection (Russia, India), Eurostat (Poland, Lithuania, Germany) and United Nations (Somalia, Iraq, Pakistan, Philippines, Thailand). The UN data are given for 5 years interval, in these graphs they are plotted at the last year of the interval.

Discussion

At first glance, declined TFR among immigrant women might easily be interpreted as a sign of successful integration of immigrants. There are, however, reasons to be careful before drawing such conclusions: First, using fertility – and particularly TFR – as a measure of integration/adaptation has challenges, as discussed in section 3.3. Second, although immigrant women with long duration of stay often have lower fertility than the newly arrived, which may be due to integration/adaptation (but it could also be due to family formation/interrelation of events), this can only explain an overall TFR decrease if the share of immigrant women with long duration of stay increases.

This study highlights other reasons for changes in immigrant TFR. After investigating 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 clearly seen among immigrant women in Norway. In particular, TFR declined markedly among newly arrived family migrants, particularly from Asia (and Latin America). This seems to be related to fertility trends in origin areas.

Such origin area trends are sometimes overlooked in studies and theories of immigrant fertility. Although the newly arrived immigrant women grew up in the same origin areas as those who moved to Norway one or two decades ago, they grew up in a different time. And as societies change over time, so does socialization.

How representative is Norway?

Although Norway is similar to many other Western countries when it comes to both fertility, immigration and immigrant fertility trends, the decreased immigrant TFR in other Western countries (Figure 1) may have different causes than in the Norwegian case. The results from this study may thus not be transferable to other contexts.

To get a hint on whether the decrease elsewhere could instead be due to changed composition of immigrant women, I have examined two other European countries with rich population data publicly available on their statistical offices' web sites: Denmark and the Netherlands. In both countries immigrant TFR has declined (Figure 1). If these countries have seen an increased share of women from low fertility countries, or an increased share of immigrant women with

long duration of stay, their TFR decline could mainly be due to such compositional effects.

In Denmark, the composition of immigrant women age 15-49 by continent of origin was relatively unchanged from 2000 to 2018 (from 56 to 55 percent from Europe, North America and Oceania, and from 44 to 45 percent from Africa, Asia and South and Central America) (Statistics Denmark 2019a), indicating that the decline is not due to a lower share of immigrant women from high-fertility parts of the world. The TFR for Western immigrant women decreased from 1.6 in 2000 to 1.4 in 2017, whereas the decline among Non-Western immigrant women was much sharper – from 3.1 to 2.1 (Statistics Denmark 2019b), suggesting similar immigrant fertility trends as in Norway. The decreased Non-Western fertility in Denmark could however be due to a higher share of women with long duration of stay. No data on immigrant population by duration of stay was found on Statistics Denmark's web site, but the annual number of women (age 15-49) without Danish citizenship migrating to Denmark from Asia, Africa and Latin America more than doubled in this period, from almost 4,000 immigrations in 2000 to more than 8,300 in 2015 (Statistics Denmark 2019c). Such an increased influx of new immigrants suggest that a relatively high share of all immigrant women in Denmark in 2015 had arrived recently – which makes it less likely that the TFR decrease among all immigrant women can be due to a higher share with long duration of stay.

In the Netherlands, on the other hand, the share of residing immigrants with Non-Western background went down from 2010 to 2017, the period for which immigrant TFR data are provided. In 2010, 66 percent of immigrant women age 15-49 in the Netherlands originated from Africa, South America or Asia (excluding Indonesia and Japan) or Turkey. In 2017, their share had decreased to 59 percent (Statistics Netherlands 2019a). This changed composition may explain part of the TFR decrease for all immigrant women in the Netherlands. However, TFR also declined from 2010 to 2017 among Non-Western immigrant women, slightly more than among Western immigrants (Statistics Netherlands 2019b). This is probably not due to higher shares of long-residing immigrant women, as immigration to the Netherlands increased substantially in this period, particularly among Non-Western women (Statistics Netherlands 2019c).

This suggests that the decreased immigrant TFR also in Denmark and the Netherlands might, at least partly, be driven by changed fertility of newly arrived immigrant women. More detailed data – and the methods proposed in this paper – may give more precise answers.

Implications of this study

This study has relevance for research on migrant fertility as well as for policy. First, it proposes methods to explain changes in the general immigrant TFR in a country by disentangling composition effects from the effects of changed fertility within subgroups. The methods can be used in any context with adequate data on births and mother's characteristics.

Second, the results show that the decreased immigrant TFR in Norway is mainly driven by lower fertility among newly arrived women – possibly reflecting fertility trends in their countries of origin. This may remind migration researchers to look for explanations of changed immigrant fertility beyond the destination country and characteristics of the individual migrants. Moreover, it 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. For instance, one should be cautious when pooling immigrant women over many arrival cohorts unless changing fertility in origin is controlled for.

Third, this study can be a reminder for policy makers and others 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, due to for instance successful integration, this does not necessary translate into a declining TFR for all immigrants.

Fourth, the results of this study also point to the future: If changed fertility in origin areas is a key explanation for the fertility decline among many Non-Western newly arrived migrants, and if fertility continues to fall in important origin areas – which the UN projects for high fertility parts of the world (UN 2017) – we may expect further fertility declines among immigrants from these areas. Moreover, policies affecting fertility preferences in high-fertility parts of the world may, in turn, affect the fertility of Western countries' own immigrant populations.

Conclusion

Immigrants' total fertility rate has declined in many Western countries over the last decades. This may be due to several factors, such as successful integration, changed composition of immigrants by origin area, or other reasons.

Whereas existing research has focused mainly on immigrant women's fertility behaviour and variations between groups of immigrant women, there is much less evidence on the mechanisms behind changes in the aggregated fertility level of all immigrants in a country.

This paper aims at filling the knowledge gap by proposing two methods – what-if-scenarios and a formal decomposition – to disentangle the effect of changed composition from the effect of changed fertility within subgroups.

Both methods are demonstrated using data from Norway, where immigrant TFR declined from 2.6 in 2000 to below 2.0 in 2017. The effect of changed composition by origin area and duration of stay was disentangled from the effect of changed fertility within subgroups (by origin area and duration of stay). The results show that although an immigrant women's fertility often declines with her duration of stay, this is not the main reason for the TFR decrease, nor is changed composition by origin area. Instead, most of the TFR decline is explained by changed fertility within the subgroups, most notably among the newly arrived immigrant women, who have lower fertility now than the newly arrived had 15-20 years ago. In particular, lower fertility among newly arrived immigrant women from Asia explains 27.6 percent of the TFR decline among all immigrant women.

This fertility decline among newly arrived women's was further decomposed by reason for migration, and a great deal is explained by the family migrants: Their share among all newly arrived immigrant women declined in this period, and so did their fertility. After investigating several possible explanations for their fertility decline, such as changed age at migration, education level, number of pre-migration births and residential segregation, I suggest that a large part of the fertility decline among newly arrived family migrants from Non-Western parts of the world may be a reflection of fertility decline in origin areas. Consequently, if fertility continues to decline in high-fertility countries, this may bring about further fertility declines among newly arrived immigrants from these countries in Western societies.

Acknowledgements

I greatly appreciate all the constructive comments to previous versions of this paper from Øystein Kravdal, Alícia Adserà, Kjetil Telle, Rannveig Hart, Gina DelCorazon, Lars Dommermuth, Terje Skjerpen and seminar participants at Cornell, Hannover and Princeton.

Funding

This work was supported by the Swedish Research Council (Vetenskapsrådet) via the Swedish Initiative for Research on Microdata in the Social and Medical Sciences (SIMSAM), grant 340-2013-5164, as well as from the Swedish Research Council for Health, Working life and Welfare (FORTE), grant 2018-00310.

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, ASFRait are the age specific fertility rates and wait 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.

Appendix B – more on fertility among newly arrived migrants, by reason for migration

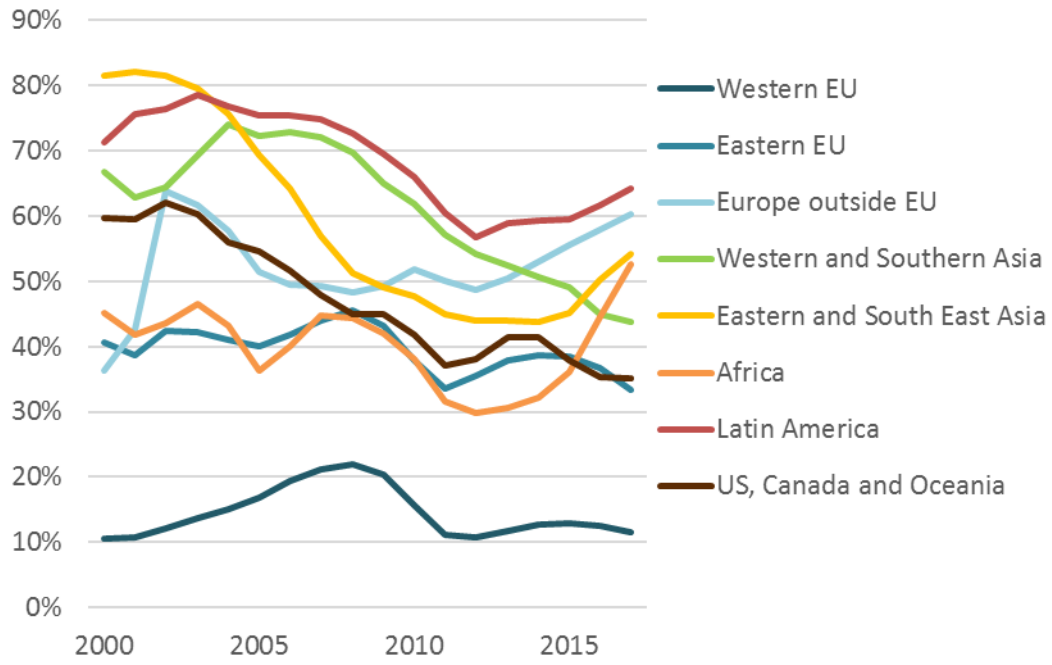

Figure B1. Share of newly arrived immigrant women (age 15-49) in Norway who are registered as family migrants, by origin areas. Percent. 2000-2017.

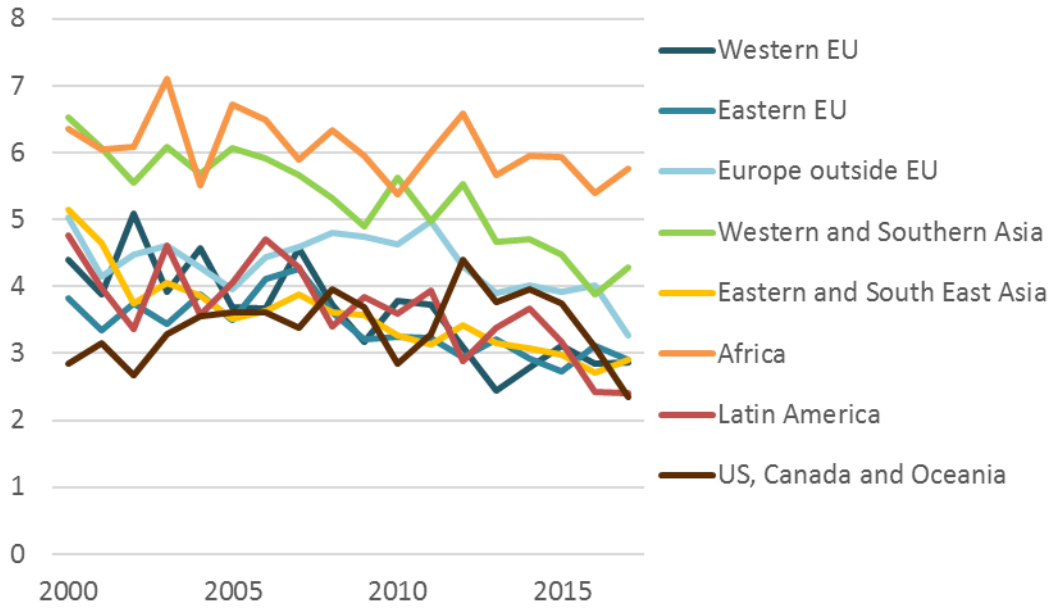

Figure B2. Total fertility rate of newly arrived immigrant women (age 15-49) in Norway who are registered as family migrants. 2000-2017.

Table B1. Further decomposition of the TFR change among newly arrived immigrant women in Norway 2000-2017, by reason for migration

Note: Rows with the same shade sum up to the above row with darker shade.

Percent wise contribution to the immigrant TFR decrease in Norway (from 2.64 in 2000 to 1.97 in 2017)	
Changed **composition** of immigrant women (by origin area and length of stay)	7.0 %
Changed **fertility** within each group of immigrant women (by origin area and duration of stay)	93.0 %
changed fertility among newly arrived immigrant women (0-2 years of stay)	45.0 %
changed fertility among newly arrived immigrant women from Western EU	5.3 %
… due to changed composition by reason for migration	0.4 %
… due to changed fertility within groups by reason for migration	4.9 %
… due to changed fertility among family migrants only	1.7 %
changed fertility among newly arrived immigrant women from Eastern EU	0.5 %
… due to changed composition by reason for migration	0.4 %
… due to changed fertility within groups by reason for migration	0.1 %
… due to changed fertility among family migrants only	0.9 %
changed fertility among newly arrived immigrant women from Europe outside the EU	9.4 %
… due to changed composition by reason for migration	-1.6 %
… due to changed fertility within groups by reason for migration	11.0 %
… due to changed fertility among family migrants only	3.6 %
changed fertility among newly arrived immigrant women from Western and Southern Asia	12.6 %
… due to changed composition by reason for migration	4.4 %
… due to changed fertility within groups by reason for migration	8.2 %
… due to changed fertility among family migrants only	9.7 %
changed fertility among newly arrived immigrant women from Eastern and South East Asia	15.0 %
… due to changed composition by reason for migration	6.7 %
… due to changed fertility within groups by reason for migration	8.3 %
… due to changed fertility among family migrants only	8.2 %
changed fertility among newly arrived immigrant women from Africa	-0.9 %
… due to changed composition by reason for migration	-0.6 %
… due to changed fertility within groups by reason for migration	-0.3 %
… due to changed fertility among family migrants only	0.8 %
changed fertility among newly arrived immigrant women from Latin America	2.2 %
… due to changed composition by reason for migration	0.2 %
… due to changed fertility within groups by reason for migration	2.0 %
… due to changed fertility among family migrants only	2.0 %
changed fertility among newly arrived immigrant women from US. Canada and Oceania	0.9 %
… due to changed composition by reason for migration	0.4 %
… due to changed fertility within groups by reason for migration	0.5 %
… due to changed fertility among family migrants only	0.3 %
changed fertility among immigrant women with 3-5 years of stay	27.5 %
changed fertility among immigrant women with 6-9 years of stay	7.2 %
changed fertility among immigrant women with 10+ years of stay	13.3 %

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Stockholm Research Reports in Demography

Stockholm University, 106 91 Stockholm, Sweden
www.su.se | info@su.se | ISSN 2002-617X

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