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ESTIMATION OF FERTILITY IN POLAND
AND OF POLISH BORN WOMEN
IN THE UNITED KINGDOM

INTRODUCTION

The aim of the research presented in the paper is to compare fertility rates of Polish women in England and Wales with the rates of Polish women who are residents in Poland. In the paper an attempt is made to describe variation in the comparison of Total Fertility Rates (TFR¹) after adjusting the denominators of Age Specific Fertility Rates (ASFR). The proposed adjustments result from different population estimates. Therefore, the discussion also addresses problems with estimating the number of women of reproductive age according to the definition of usually residing population in line with international standards. We focus mainly on problems related to the denominator of ASFRs, though we do not ignore important issues with estimating the number of births, which is the nominator of the ratio.

Poland has been going through an economic and social transformation, which has also had a big influence on the development of demographic processes (Kotowska 2009, 2014, Józwiak et al. 2010, Matysiak et al. 2013, Kurkiewicz et al. 2004). Major changes that can be observed are related primarily to intensive migration, a decline in fertility, changes in marital behaviour, but also an increase in life expectancy. The uncertain situation in the labour market, high unemployment, especially among young people, have resulted in an increase in the education level, which means not only a delay in the start of a first job, but also an improvement in skills and increase in competitiveness (Matysiak and Tymicki 2009). Young people put off marital and childbearing decisions until achieving professional success and a fair standard of living (Kotowska et al. 2008). The decline in fertility and the rise in

¹ According to United Nations Population Division definition, TFR represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.

migration of young people, especially after the accession to the European Union, have accelerated aging of the Polish population. Polish emigrants are mainly young people, well educated, beginning their professional careers. But they are also at the age of family formation and the highest reproductive activity. Hence, any information relating to migration and fertility of Polish women in Poland and abroad is of particular public interest.

When it comes to measuring fertility of Polish women abroad, problems that are reported most often include the lack of adequate data, the small sample size and incompatible data sources for the numerator and denominator of Age Specific Fertility Rates (ASFR). To estimate fertility, one needs the number of births and the number of women that can give birth. In England and Wales the information on births by age and mother's country of origin can be obtained from the Births Register, which is the nominator of the ASFR. The number of births by mother's country of origin, however, does not provide information about the status of women giving birth to children, i.e. about their country of usual residence. The fundamental difficulty, however, is to determine the number of women who can give birth, which is the denominator of ASFR. It usually comes from the Annual Population Survey (APS²). This means that the numerator and denominator come from different data sources, which causes incompatibilities resulting from differences in populations targeted in both studies.

Problems with TFR estimation in Poland are mainly connected with population estimates. They result from extremely large emigration, particularly among young women of reproductive age. New opportunities for correct population estimates have been created by Eurostat's recommendations concerning the resident population, which were introduced by the European Parliament and Council Regulation No 1260/2013 of 20 November 2013 EU(1260/2013). 2013). Additionally, population censuses conducted in Poland and the UK in 2011 provided information for the assessment of demographic processes in Poland and their comparison with the situation of Poles in the UK.

In October 2012 ONS published a special report on childbearing among UK and non-UK born women living in the UK prepared by Zumpe et al. (2012). This report highlighted higher fertility rates of Polish women in the UK than in Poland. It was a very important voice, though not the only one³, in the discussion about Polish emigration to the United Kingdom. Similarly to Waller et al. (2012), we raise the question whether indeed the fertility of Polish women in the UK is higher than in their homeland? What is the difference in estimates of TFR and what are the reasons? Is it due to a different fertility pattern, the estimation methodology, or rather the con-

² The report on *Childbearing of UK and non-UK born women living in the UK, 2011* (ONS 2012) examined fertility patterns in the UK for UK born and non-UK born mothers in the period 2007–2011 on the basis of APS data.

³ A detailed list of press releases, Polish and British, on the fertility of Polish women in Poland and the UK is presented by Janta (2013).

sequence of statistical data? We formulate the hypothesis that besides the impact of migration on the timing of childbearing, differences in the TFR are also due to the overestimation of the population in Poland. The inconsistencies in estimates of the usually resident population are associated with extremely intensive migration, the quality of statistical data and an arbitrary interpretation of regulations.

To answer these questions, we provide some general information on fertility in Poland and of Polish born women in the UK. We begin by presenting the results of previous studies and analyses carried out on this subject. These are followed by a discussion of methodological problems. They include measurement in the situation of limited data availability, measurement for a relatively small and hard to reach population. However, some attempts to estimate fertility of Polish born women in the UK have been undertaken. When comparing results of the British estimates, the discussion refers to the population census in Poland. It is worth mentioning that the last census was based on administrative registers and sample survey data. The new methodology and the use of new data sources are important reasons for comparisons and a detailed assessment of census quality. In particular, population estimates need to be carefully assessed, considering various population categories. Two categories are considered: actual and usually resident population, as well as various sources of information, including mirror statistics. Based on the critical appraisal of the census population, some corrections are proposed. Finally, alternative estimates of the usually resident population (RAF) are provided. The analysis is concluded with the presentation of TFR estimates for various reference populations. When comparing the results, careful attention is paid to the limitations of the estimates and the identification of possible causes of discrepancies.

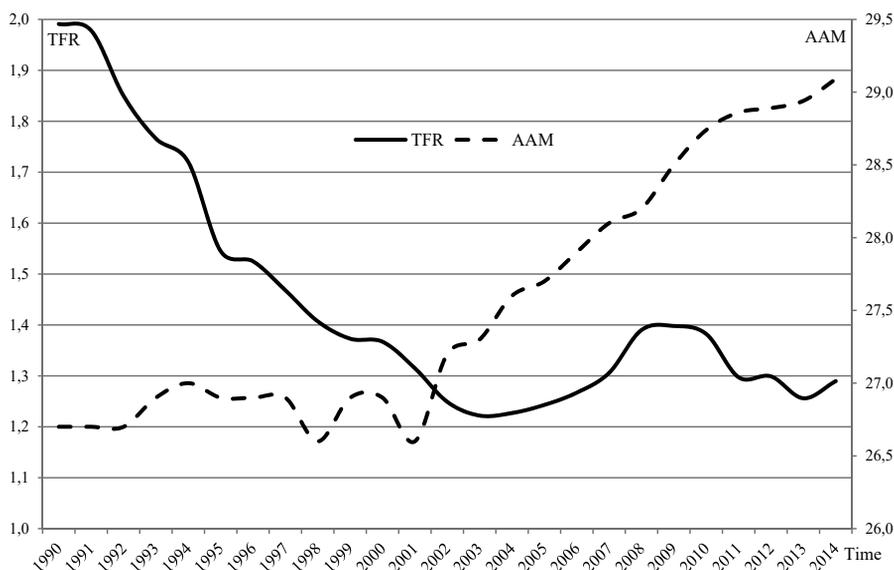
The analysis refers mainly to 2011, when the population census was carried in both countries, but it covers a wider period of time. It takes into account trends observed from the moment of Poland's accession to EU to the most recent available data.

FERTILITY IN POLAND AND OF POLISH BORN WOMEN IN THE UK – BASIC CHARACTERISTICS

Poland is among countries with one of the lowest fertility in Europe. In the early 1980s, during the period of the Polish 'baby boom', the number of births increased, reaching the maximum of 723,000 live births in 1983 and TFR of 2.42. Since then the annual number of births has decreased by about a half. The lowest number of births was recorded in 2003, when only 351,100 children were born (TFR=1.22). During this period TFR stabilized at a level of 1.2 to 1.4 in 2009. In the years 2007–2009 there was a slight increase in the number of births, but it did not exceed 418,000. This increase was primarily due to births "delayed" in time and was largely associated with the fact that women born during the baby boom of 1982–84 started to enter their procreation period. In 2009, while the growing trend

continued, there was a slowdown. In 2010 the number of births was already lower than in the previous year and TFR amounted to 1.38. The decrease in the number of births continued in subsequent years (2011–2013). The preliminary data of the Central Statistical Office (CSO 2015) show that in 2014, 376,000 live births were registered, resulting in TFR equal to 1.29.

Figure 1. Total Fertility Rate, Average Age at Maternity, Poland 1990–2014



Source: CSO Database Demografia: <http://demografia.stat.gov.pl/bazademografia/Tables.aspx>.

The decrease in the number of births in Poland was accompanied by significant changes in the timing of childbearing. In the early 70s the average age at maternity (AAM) oscillated around 26 years. Despite an intensive fertility decline in the 1990s, AAM remained almost unchanged until the beginning of the 21st century (Fig. 1). However, in a period of relative stabilization of fertility at a low level, we can observe a sharp increase in the mean age at childbearing of 2.5 years, from 26.6 in 1998 to 29.1 in 2014. Similar changes were also recorded in the case of the average age at birth of first and last child. A greater increase can be observed for the age at first childbirth: from 24.2 in 2000 to 26.8 in 2014. In contrast, the average age at last childbirth grew ‘only’ by about 1.3 years, from 36.9 years in 2000 to 38.2 in 2014. This resulted in the shortening of the effective reproductive period (ERP) by about one year from 12.4 to 11.4.

Following the Polish accession to the European Union, there was an increase in the number of Polish migrants (White 2011). Polish emigration is mainly economically motivated. Starting from May 1, 2004 United Kingdom, Ireland and Sweden

opened their labour markets to citizens of the new EU countries⁴. This situation affected the existing migration trends. According to CSO (2008), in 2002 most Poles resided in Germany (294,000), Italy (39,000) and also outside Europe – in the United States (158,000). After the accession the traditional destination countries for migrants, except Germany, have been replaced by the United Kingdom and Ireland. Later, increasingly many Poles also began to leave for Spain, the Netherlands and the Scandinavian countries, particularly Norway. It can be argued that migration to the UK and Ireland is a substitute for moving to the United States, which has become a less attractive option following the enlargement of the EU. This trend, most likely, results from the relatively higher costs associated with traveling to the US, lengthy visa procedures and the declining average dollar exchange rate (Baranowska et al. 2007).

Migration is not without impact on children and families (Pustulka 2012). Understandably, the increased number of migrants has also triggered an increase in the number of births to Polish women abroad. Statistics on births to Poles abroad were and still are very poor. The Polish demographic yearbook contains information only about children born to foreigners in Poland, but does not provide data on children born to Polish women abroad. Such information can only be obtained from statistics produced by destination countries – ‘mirror statistics’. For the first time information about children born to Polish women abroad was published by CSO in 2015 (CSO 2015a). Basically, CSO reproduced information published by ONS since 2010. Poles were the largest national group among foreigners in terms of the number of births. In the period 2004–2008 there were more than 38,000 births to Polish women in the UK, while in years 2009–2013 – more than 100,000 children were born.

In 2013 almost 700,000 live births were recorded in England and Wales⁵. Birth statistics by parents’ country of birth in the UK dates back to 1969 (ONS 2014), when the share of births to non-UK born mothers amounted to 11.6% and remained stable over decades to mid-1990s – 12.6%. But in subsequent years there was a sharp increase in the number of births and the birth rate for women born outside the UK, which in 2013 reached 26.5%. In 2013 there were over 185,000 live births to mothers born outside the UK, compared with more than 150,000 in 2003 (a rise of almost 8 percentage points over a decade). Information on births to Poles in England and Wales has been published by ONS since 2005, when their number became more significant in birth

⁴ The opening of the European labour market to Poles took seven years. Two years after the accession the following countries opened their labour markets: Greece, Finland, Iceland, Spain, Portugal (1 May 2006) and Italy (21 July 2006). In 2007, Poles obtained an opportunity to work in the Netherlands (1 May) and Luxembourg (1 November). In the next year, the group was joined by France (1 July 2008), and a year later by Belgium, Denmark and Norway (1 May 2009). And, finally, three more countries followed suit: Austria, Germany and Switzerland (1 May 2011). Iceland, Norway and Switzerland are not EU members but are associated by the Agreement on the European Economic Area.

⁵ Because statistical publications sometimes provide information for the UK, and sometimes for England and Wales, in each case the text contains appropriate annotation. However, in further analysis we included only data for England and Wales.

statistics. At that time Poland appeared in the list of the top 10 most common countries of birth for non-UK born mothers and was ninth. Additional information on the number of births to Poles can be found in the Statistical Bulletin (ONS 2014 p. 7): “in 2003 there were 1,392 live births to Polish born mothers in England and Wales, compared with 1,830 in 2004 when Poland joined the EU and 21,275 in 2013”.

A paper by Janta (2013) provides detailed information on the number of births to Polish mothers and to both Polish parents in the UK in the years 2004–2011⁶. The compilation presented by Janta and data from the Statistical Bulletin (2014a) show that the vast majority of births to Polish parents take place in England and Wales: in 2004 they accounted for 98% and in 2011 – 89%. Despite the significant fall resulting from the growing variety of destinations within the UK chosen by Polish migrants (Trevena 2009), further discussion will be limited only to births to Polish mothers in England and Wales, which is dictated by the availability of statistical data.

Since 2010 Poland has been the most common non-UK maternal country of birth in England and Wales with 19,762 births in 2010 and 21,275 in 2013⁷. The number of live births to women from Poland in recent years has stabilized; however, it remains the highest among non-UK born women. The number and proportion of births to mothers born in Poland has steadily risen over the last decade. It should be considered together with the change in the number of Polish residents in England and Wales. Population estimates (ONS 2013) show that between the census in 2001 (before the accession) and in 2011, the Polish born population in England and Wales increased from 58,000 to 579,000.

FERTILITY ESTIMATION OF POLISH BORN WOMEN IN THE UK – LITERATURE REVIEW

Comprehensive analysis of fertility needs to take into consideration both the intensity and age structure of the population as well as other determinants. The best measure, of course, is TFR. However, owing to limited availability of data for small and hard to reach populations (such as Polish emigrants in the UK) first studies of fertility to Polish women in England and Wales referred the number of births to migrants’ population (General Fertility Rates – GFR). The estimation of TFR is usually faced with problems resulting from difficulties in consistent estimation of the numerator and denominator of ASFR as well as discrepancies between different information sources used in the analysis (Zumpe et al. 2012, Dormon 2014, Janta 2013, White 2011).

Zumpe et al. (2012) analyse changes in fertility among UK born and non-UK born women (in the UK) during the period 2007–2011. They focus on the increasing

⁶ Data presented by Janta come from her personal communications with ONS.

⁷ Since 2009 Poland has been the most common country of birth in the UK with around 23,000 births in 2011.

proportion of women of childbearing age born outside the UK, higher fertility rates of non-UK born women and changes in the fertility rates of UK born women. The analysis is conducted using GFRs and is accompanied by a discussion about limitations and possible consequences resulting from the methods used. GFR is a crude rate, which excludes the impact of the age structure on fertility rates.

Zumpe et al. (2012) point out the mismatch between data sources for the numerator and denominator of Age Specific Fertility Rates (ASFR). Information on births by parents' country of birth comes from the administration register, which is considered to be of high quality. These data, with all details referring to the characteristics of mother and child, are collected at the moment of registering any birth for women of childbearing age (defined as 15–44)⁸ and come from the Annual Population Survey (APS). APS is a combined survey of households (HS) and the Labour Force Survey (LFS) in the UK. Despite including additional modules that increase the sample size, it is not sufficiently large to provide estimates with satisfactory precision for specific countries. Only data for all non-UK born women together can be analysed. Additionally, due to some limitations⁹, the specified number of births is related to an underestimated population and results in overestimated GFRs.

Likewise, Dormon (2014) analysed changes in fertility to UK and non-UK born women living in the UK. But he used 2001 and 2011 census data for population estimates and annual birth registrations. These data allowed more detailed estimates of the population by country of birth, and comparison analysis of Total Fertility Rates. The key results of Dormon's research were that the TFRs of non-UK born women in England and Wales in 2001 and in 2011 were the same, but TFR for UK born women increased from 1.56 to 1.84 in 2011, i.e. by 18% (Table 1). He also found that women born in Poland had the most births overall in 2011, but their TFR of 2.13 was only the 4th lowest among non-UK born women.

In the intercensal period TFR in the UK increased from 1.64 to 1.93 but there was no change in the TFR level for non-UK born women, though it varied depending on the country of origin. What is also noteworthy in this context, there are different trends in fertility in the home and in the host country. Migration involves selectivity and migrants are usually young healthy individuals characterised by greater mobility, activity, entrepreneurship and the ability to adapt to new conditions. The importance of the impact of migration on population reproduction, the growth and replacement of population is widely discussed (Ediev et al. 2014, Sobotka 2008).

⁸ Usually fertility analysis refers to women aged 15–49, but the number of births occurring after the age of 45 is very small. Zumpe et al. (2012) noticed that the proportion of births to women aged over 44 was less than 0.3%. They include those births in the previous age group.

⁹ The number of people born outside UK may be underestimated, because the survey does not take into account students and people in most types of collective dwellings (hotels, hostels etc.). Also, people who have been residents in the UK for less than six months and migrants staying for less than 12 months are excluded from the survey (this is consistent with UN and Eurostat recommendations for the concept of 'usual residence').

It can be noticed that in many Western European countries net migration greatly exceeds natural change, in some cases driving a considerable population growth or at least halting or slowing down the population decline. In this sense, migration can compensate for missing births in low-fertility countries.

Table 1. Total Fertility Rates for UK born and non-UK born women living in England and Wales, 2001 and 2011 Census

Country of birth	2001 Census TFR	2011 Census TFR
All women	1.64	1.93
UK born women	1.56	1.84
Non-UK born women	2.21	2.21
Poland	2.81 (in Poland 1.288*)	2.13 (in Poland 1.297*)
Pakistan	4.67 (in Pakistan 4.12**)	3.82 (in Pakistan 3.3***)

Table note: The 2001 Census estimates do not include births to women born in the Channel Islands and the Isle of Man, while the 2011 Census estimates do as part of the non-UK born group.

Source: Dormon 2014, p. 4, 10.

* Demographic Yearbook of Poland 2002 and 2012, Central Statistical Office, Warsaw.

** The author's estimates according to data from Pakistan Demographic Survey 2001, http://www.pbs.gov.pk/sites/default/files/population_statistics/publications/pds2001/table04.pdf; http://www.pbs.gov.pk/sites/default/files/population_statistics/publications/pds2001/table01.pdf.

*** World Bank estimates (<http://data.worldbank.org/indicator/SP.DYN.TFRT.IN?page=2>) <http://www.un.org/en/development/desa/population/publications/dataset/fertility/wfd2012/MainFrame.html>

Immigrants come predominantly from countries with levels of fertility higher than those in destination countries; they generally have higher fertility than native-born populations. According to the traditional assimilation theory, immigrants are expected to adjust to the local norms and follow new fertility patterns (Dubuc 2012). Therefore, it might be expected that immigrants' fertility in the host country will be lower than in their home country. In fact the opposite trend can be observed for Polish women, who, coming from a low fertility country, tend to have more children in England, their destination country. In the case of Poland, it might be motivated by the postponed timing of childbearing and family formation for economic reasons rather than owing to differences in culture and tradition. As a result, higher fertility can be observed in the host country than in the country of origin. Analysing the fertility of recent migrants to England and Wales, Robards and Berrington (2015) observed different fertility profiles by country of birth and noticed that they are likely to be linked with the reason for migrating¹⁰. The timing and number of

¹⁰ Their research showed that higher fertility rates for migrants from lower income countries may be to do with family-related migration, whereas lower fertility among migrants originating in higher income countries may be due to employment-related migration.

births are important dimensions of family formation influenced by migration and interlinked with other individual and family characteristics. Robards and Berrington (2015) noticed that relatively high period TFRs according to the country of birth may be inflated due to tempo distortions associated with increased migration rates after migration. Although fertility rates for Polish-born women are low just after migration, they rise slowly during the subsequent years. This is consistent with the reproductive behaviour in the home country, where postponement of fertility to older ages is now the norm (Kotowska et al. 2008). Robards and Berrington (2015) underline the complex interrelationship between migration and fertility to Polish women.

The 2001 census data for the UK show that TFR for women born in Poland amounted to 2.81 in the UK, while in Poland it was 1.3. After ten years, TFR for Polish-born women in the UK fell significantly to 2.13. This fact did not attract attention because of the observed increase in the absolute number of births, which, together with the difference in the fertility level of Polish women in the UK and in Poland, became the topic of public debate. Among a variety of explanations for this situation, the one considered first of all were the timing effects related to migration. As many studies point out (Dormon 2014, Toulemon 2004, 2006 and Wilson et al. 2013), the timing effect of migration is correlated with the timing of fertility. Compared to very low fertility in home countries, the observed difference in TFR, Dormon (2014, p. 12) can be explained by the migration impact in the following three ways: changes in fertility patterns; selectivity of migrant women who are “not typical”; more favourable conditions for childbearing in England and Wales; or a combination of the above factors. TFR is a good indication of the current intensity of childbearing, but is not necessarily a good predictor of completed family size and does not account for the tempo and quantum of the phenomenon.

Latest statistics show that TFR for UK born women fell to 1.79 in 2013, and, similarly, TFR for non-UK born women also fell to 2.19 (ONS 2014). This means a decline in the number of births, even though the population of non-UK born women of childbearing age increased by 2.8% from 2012 (reaching 2.20 million in 2013). When this information is compared with census data, one can expect comparatively lower TFR values for Polish-born women (since TFR for Polish women was one of the lowest among non-UK born women).

In his research Dormon (2014) raises a question concerning the method of measuring the TFR, asking about differences in TFR between populations and possible reasons for the existence of such differences. The author points out that the population estimates use the self-reported country of birth of the mother¹¹ and do not take into account the length of her stay in the UK or the age on arrival. An interesting idea to overcome problems of estimating the numerator and denominator of the TFR was presented by Waller et al. (2014). The authors used the UK Labour Force Sur-

¹¹ The analysis also fails to account for the country of birth of fathers, which is the normal practice.

vey (LFS) data to indirectly estimate age-standardised fertility. To obtain the number of women and their children they applied ‘Own Child Method’ (Cho et al. 1986), which enables the association of respective pairs. Data on the number of children (to calculate births in each year) and mothers (by age) are estimated assuming that both reside in the same household. A limitation of this approach is that the available sample size is small and therefore requires pooling several years of data to enlarge the sample for reliable estimation¹². On the other hand, an important advantage of this method is that both the nominator and denominator are estimated on the basis of the same database. With these data, an average TFR of 1.4 was estimated for Polish women across the 2004–2012 time period. This TFR estimate is much lower than that calculated by Dormon (2014) on the basis of the 2011 census and more comparable to that seen in Poland.

The aforementioned difference between the estimates by Dormon (2014), based on census data and those presented in the paper of Waller et al. (2014), was noted by the authors of this latest one and discussed in a working paper (Waller et al. 2012). After the decomposition of the LFS data into two-year groups, the authors notice an increasing trend in TFR from slightly above one in 2004–2005, more or less 1.25 in 2006–2007, about 1.8 in 2008–2009 to about 2.15 in 2010–2011. The authors emphasize the importance of the new findings resulting from the incorporation into the analysis of variables, such as age at migration and the association between migration and birth timing. These results are confirmed by other studies, which show childbearing postponed before migration and immediately after arrival¹³. Waller et al. (2012) found that relatively small proportions of migrants go on to have first births within three years of arrival. Afterwards, fertility increases but the peak of fertility is observed after 4 or more years of residence (Janta 2013, Toulemon, 2004, Lübke 2015, Hoorens et al. 2011). Similarly, Zumpe et al. (2012) noted that immigrant women typically have low fertility prior to immigration, followed by high fertility immediately after immigration.

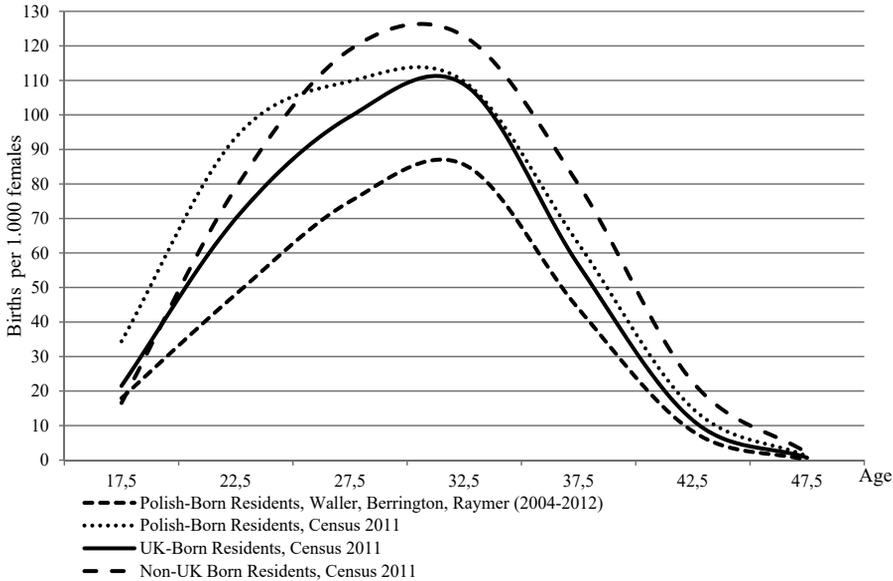
Admitting the validity of all the above insights, one should note the vast diversity of information sources (census and LFS) and the estimation methods: direct and indirect (Own Children Method) and the resulting consequences (Fig. 2). Estimates for two-year periods given by Waller et al. (2012) suggest that TFR for Polish women in the years 2004–2005 was approximately equal to 1.0 and then increased to about 2.15. Meanwhile, data from the 2001 census indicate that TFR for Polish women was equal to 2.8 (Table 1). This time the discrepancy between 1.0 (as in Waller et al. 2012) and 2.8 (from the 2001 census, Dormon 2014, p. 10) is even

¹² The own children method enables the estimation of fertility rates, taking into account only those children and women who at the time of the enquiry reside in the household. This approach ignores family members living outside the household (children who remained in the home country) and requires a correction to adjust for the mortality and migration of women and children.

¹³ Verifying his hypothesis, Lübke 2012 found no postponement of childbearing after migration and concludes that if there is any disruption it takes place before migration.

larger and clearly indicates data incomparability. Of course, one can raise objections to the estimates based on the LFS data, so there are also concerns with respect to census-based estimates. However, given unbiased direct estimates and larger sample size, census estimates will be used in further considerations as the point of reference.

Figure 2. Age Specific Fertility Rates to different groups of the UK population, 2011*



Note: * TFR estimates by Waller et al. (2014) refer to the period 2004–2012.

Source: ASFRs from Waller et al. (2014) *New insights into the fertility patterns of recent Polish migrants in the United Kingdom*. “Journal of Population Research” ONS 2012, Births and Deaths in England and Wales, 2011, Table 4 ONS, Nomis, Table DC2109EWr – Country of birth by sex by age (regional).

To sum up, one should emphasize the complexity of the relationship between fertility, migration, age at migration and birth timing. Total Fertility Rate is a measure commonly used in fertility analysis, in particular on account of its resistance to the impact of different age structures, but inconsistency in estimates might occur depending on data used. TFR estimation causes different problems and additionally the tempo and quantum effect is not easy to estimate, especially in small populations and in the case of limited data availability.

FERTILITY ESTIMATION IN POLAND – DATA AND METHODS

Official statistics, including statistics of the population in Poland, have been approved by Eurostat, having successfully gone through the process of adaptation to EU standards and requirements. Thus, the estimation of total fertility rate and comparisons should not pose any difficulties. Similarly, as in the case of TFR estimates for Polish women residing in the UK, also for Poland, data on the number of births are drawn from the register of births and the number of women by age is derived from the 2011 population census estimates.

As in the case of the UK estimates, we assume that the data on births are correct and do not arouse controversy. This assumption should not be accepted uncritically. Intensive migration and a large number of births to Polish women in the UK raise doubts regarding the registration of these births. An evaluation of the 2011 census found a discrepancy between census estimates and the birth register with respect to the number of children aged 0 (completed years of age) and aged 0–4 (Golata 2014). Data for infants showed that the 2011 census population was underestimated by nearly 13,000 compared with the number of registered births. On the other hand, the number of children aged 1–4 years was overestimated by more than 58,000 compared with registered births. Such results are difficult to explain, since census data comprised children not included in the birth register. While the typical coverage error is underestimation of the population, we are faced with a case of over-coverage. The observed discrepancies might be associated with intensive migration and the increasing number of births to Polish women abroad, especially in the United Kingdom (Janta 2013, Waller et al. 2014, Zumpe et al. 2012). The UK census data provided information on 62,000 children aged 0–14 years born in Poland and 110,000 Polish residents at this age living in the UK. This may be explained by the fact that parents holding Polish citizenship acquire a Polish passport for their children born and living in England and Wales (ONS 2013 p. 23). The ONS data for the youngest age group (0–4 years) indicate a difference of almost 50,000 between Polish born residents and Polish nationals. Despite these doubts, for the purpose of the comparisons, we assume the number of births estimated from the birth register. More attention will be devoted to estimates of the number of women by age.

The 2011 population census in Poland enumerated the following categories of people: actually living and usually resident population (CSO 2013b p. 32). Information on the first category was published immediately after the census in conjunction with preliminary estimates for the resident population (CSO 2011, CSO 2012). Final estimates of the resident population were first published on the Census Hub¹⁴ in

¹⁴ The “Census Hub” is new tool constructed by Eurostat for disseminating population census data. It is based on the concept of data sharing, where National Statistical Institutes provide access to their data according to standard processes, formats and technologies while Eurostat provides the IT structure that allows users to quickly and flexibly specify, compile and extract data stored in the different national census databases <http://ec.europa.eu/eurostat/web/population-and-housing-census/census-data/2011-census>.

2014. The actual population is also divided into two groups: permanently residing (registered, i.e. having the status of a legal resident) in Poland and those staying temporarily (up to three months)¹⁵. According to the census definition (2012a), the category of permanent residents includes all people registered in Poland, irrespective of the fact whether they were residing in the country during the census or were abroad. In particular, the category includes those people who were absent at the time of the census if their absence lasted less than three months, but also those who were absent at the time of the census for a period longer than three months provided their absence was due to being abroad or in prison. Thus the permanently residing (actual) population is not equivalent to the usually resident population. This essential difference refers to people having the status of a legal resident but staying abroad.

According to the National Population Census, in 2011 Poland was inhabited by 38,511,824 people (actual population, CSO 2013 p. 182). Early estimates of the usually resident population amounted to 37,244,000. The first census publications contained information about the usually resident population broken down by sex, working age group and region. First census data showed the difference between the actual and usually resident population of more than 1 million people (1,257,000). In the previous census, in 2002 the actual population amounted to 38,230,000 while the count of the usually resident population was 37,620,000. Thus in the intercensal period the difference between the actual and usually resident population had doubled.

The census usually resident population based on the place of residence should include all permanent residents, except those who have been staying somewhere else for more than 12 months (in the country or abroad) as well as those persons who have been temporarily staying in the country for at least 12 month. The term ‘usually resident population’¹⁶ is recommended by Eurostat to collect harmonised and comparable data from EU Member States (EU 1260/2013). However, countries may report to Eurostat population numbers based on data from their most recent census, adjusted by the components of population change that have been produced since the last census, or, alternatively, population figures based on the registered/legal population. As stated in Article 4 paragraph 2, population estimates should use “scientifically-based, well-documented, and publicly available statistical estimation methods”. In spite of possible differences resulting from the above arbitrariness, usually resident population seems most appropriate for comparison. So, after the publication of the data on the Census Hub, fertility rates were calculated based on both the actual and usually resident population.

¹⁵ This category mainly refers to people who during the census declared a different place of permanent residence in the country than the one in which they were currently staying.

¹⁶ In accordance with the United Nations international recommendations, the definition of the ‘usual residence’ is based on a 12 month reference period, i.e. it includes those people who have lived in their place of usual residence for a continuous period of at least 12 months before the reference date, or arrived in their place of usual residence during the 12 months before the reference date with the intention of staying there for at least one year.

First, note that the total count of the usually resident population is 38,044,565 and differs little from the actual population (Table 2, Fig. 3). Contrary to expectations resulting from early estimates, indicating a discrepancy of 1,200,000, the final difference turned out to be 0.5 million (477,565). Although the greatest discrepancies between the estimates are present in the most mobile age group (working age), accounting for over 82% of the total, these differences had no significant impact on fertility estimates. First results showed the difference between the actual and usually resident working age population amounting to almost 1.5 million, while the latest less than 400,000. Finally, TFR based on the actual population was equal to 1.31, compared to 1.34 based on the usually resident population, giving the highest underestimate of 2.7% of ASFR for women aged 25–29.

Table 2. Actual and usually resident population by sex, age and date of publication of the 2011 Census results

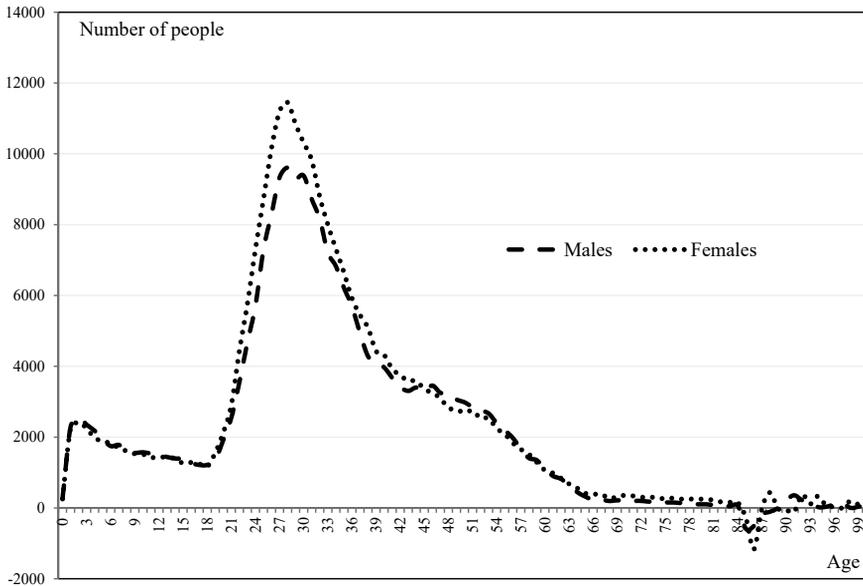
Population	Total	Pre-working age	Working age			Post-working age
			Total	Mobile	Immobile	
Actual population						
Estimates published in July 2012 (000)						
Poland	38512	7202	24797	15419	9379	6512
Male	18644	3691	12974	7821	5153	1979
Female	19868	3511	11824	7598	4226	4534
Usually resident population						
Early estimates published in March 2012 (000)						
Poland	37244	7202	23352	14308	9044	6686
Male	17830	3691	12120	7196	4924	2018
Female	19413	3511	11232	7112	4120	4669
Estimates published in 2014 (000)						
Poland	38045	7144	24402	15102	9300	6499
Male	18420	3662	12783	7673	5110	1975
Female	19624	3482	11618	7429	4189	4524

Source: CSO (2012, 2012a) <http://stat.gov.pl/obszary-tematyczne/ludnosc/> ; Eurostat: CensusHub2: <https://ec.europa.eu/CensusHub2/query.do?step=selectHyperCube&qhc=false&countrycode=pl-PL>.

Recognizing the published estimates of the usually resident population, we examined the reasons for differences between the initial and final estimates. Definitions used in the population census indicate that these differences result from different ways of identifying the migrating population. Let us, therefore, discuss the way of estimating immigrants and emigrants. The estimation of immigrants was based on a sample survey

supplemented by information on immigrants residing in collective dwellings. In the 2011 census the category of long-term temporary immigrants was applied to persons who had come before 1 April 2010 and had no permanent place of residence in Poland. Immigrants living temporarily in Poland were not included in the actual population, while some of them – those staying 12 months or more – should be considered as part of the usually resident population. Census data show that 40,097 immigrants had been staying in Poland for over three months and 27,215 for over 12 months CSO (2013).

Figure 3. The Difference between actual and resident population estimates by age and sex, 2011 Population Census



Source: Data on the number of residents, Eurostat: <https://ec.europa.eu/CensusHub2/query.do?step=selectHyperCube&qhc=false>.

Data on the number of actual population, Central Statistical Office: http://stat.gov.pl/bdl/app/dane_podgrup.display?p_id=638903&p_token=0.21373174263839367.

With respect to those who have migrated from Poland, estimates were based only on a sample survey. Additionally, in this case there were problems in collecting complete information¹⁷. In the final analysis, the 2011 census provides information about 2,017,501 emigrants staying abroad for more than 3 months and 1,564,580 who have been staying abroad for more than 12 months (CSO 2013).

¹⁷ For persons staying temporarily abroad answers to all census questions might have been obtained from other people living in the selected dwellings. Limited information on emigrants was collected depending on the knowledge of respondents present in the selected dwelling. In cases when no respondents from selected apartments were present at the time of the census, some information was collected from neighbours.

These figures have increased 2.5 times compared with 2002 census data¹⁸, before the accession.

According to the definitions presented above, it seems reasonable to expect the count of the ‘usually resident’ population to be an outcome of the following equation: actual population + immigrants staying for at least 12 months – emigrants staying for 12 months and over. That is why, one could suppose that the difference between the actual and residing population in Poland, according to the 2011 census, was about 1.5 million: $38,511,824 - 1,564,580 + 27,215 = 36,974,459$. Since the data published on the Census Hub (38,044,565) differed much from our expectations, we decided to examine possible causes of the divergence observed. It was found that according to Polish regulations, even foreigners staying in Poland for more than 12 months were not regarded as usual residents unless they had a legal resident status. The latter is associated, first of all, with the registration for permanent residence, which requires submission of a document confirming the right of permanent residence. This documentation differs depending on the immigrant’s home country and may involve complex procedures¹⁹. In the case of a failure to meet formal requirements for permanent residence, even immigrants living in Poland for over 12 months were not counted as residents in the census. Conversely, emigrants from Poland who did not comply with the obligation to notify the authorities about leaving the territory of the Republic of Poland were included in the usually residing population, irrespective of the length of their stay abroad.

Apart from the above mentioned regulations, we decided to estimate the usually resident population independently in accordance with the Eurostat definition (EU 1260/2013) and above-specified algorithm (Fig. 4). Data on the number, age and sex structure of the actual population, as well as immigrants and emigrants, come from various census publications (CSO 2012a, 2013, 2013a). As is usually the case in such situations, unforeseen complications occurred: information about emigrants’ age was incomplete. In particular, almost 83% of emigrants recorded in the census were of unknown age. Therefore, we assumed that the age structure obtained for about 17% of migrants is also valid for the remaining 83% (Polish pattern). With such an *a priori* age distribution the estimation was conducted separately for men and women and the total number is calculated as a sum for different age and sex groups (Fig. 5).

We are aware of the simplifying assumptions and the resulting bias. For that reason the name RAF should be associated with roughness of the estimates of the usually resident population. The estimates are obviously difficult to check and evaluate. Other assumptions will change the age distribution. Given a relatively small

¹⁸ The count of emigrants staying abroad for up to 3 months in 2002 was 786,085 compared with 626,190 long term emigrants.

¹⁹ For a person from outside the European Union such documentation includes, among others, permission for long-term residency in the EU, decision to grant the refugee status in the Polish Republic, the award of subsidiary protection or tolerated stay permit in Poland.

Figure 4. Algorithm for the estimation of the usually resident population RAF

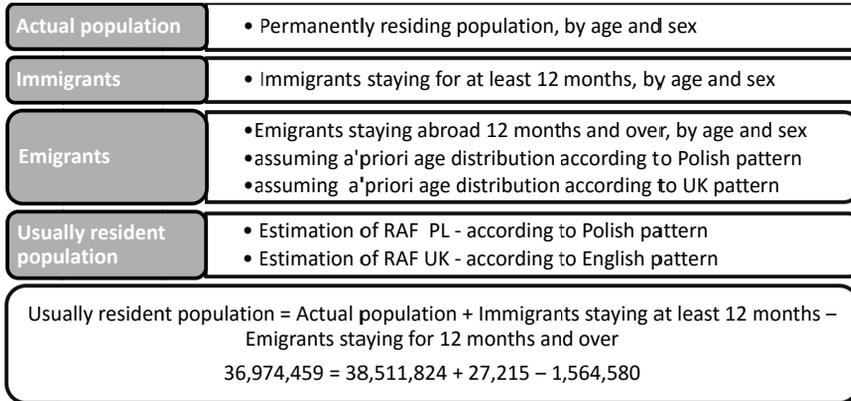
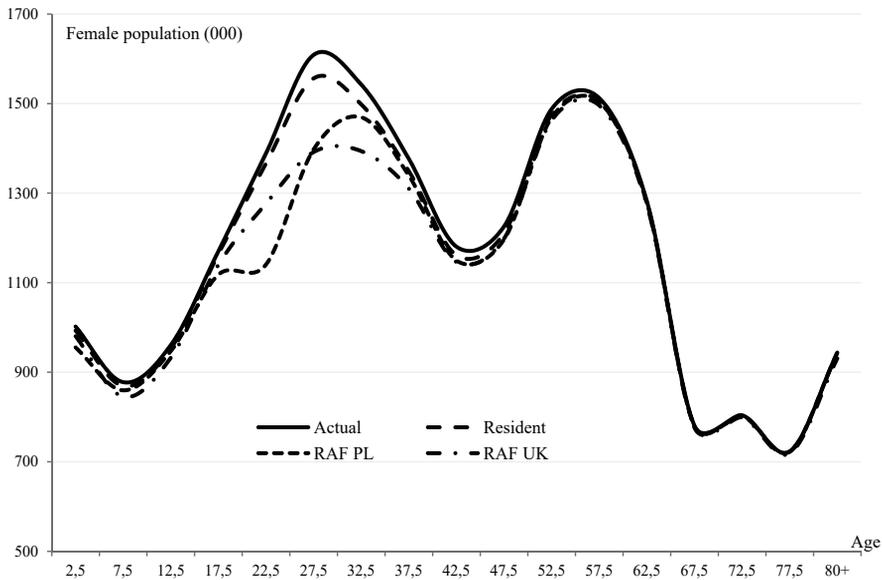


Figure 5. Actual, resident and RAF female population estimates, 2011 census, Poland

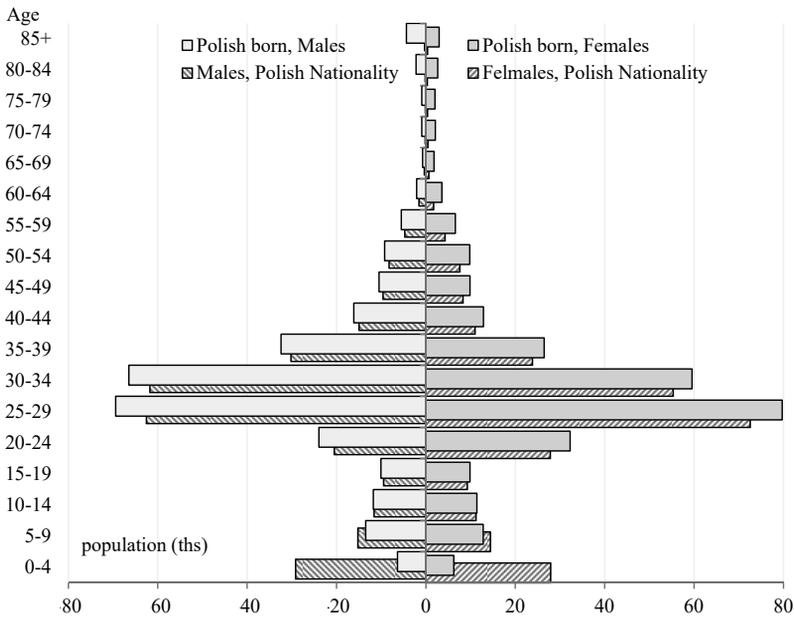


Source: CSO Database Demografia: <http://demografia.stat.gov.pl/bazademografia/Tables.aspx>, CSO (2012, 2013, 2013a), Eurostat: CensusHub2 Available on 6 November 2014: <https://ec.europa.eu/CensusHub2/query.do?step=selectHyperCube&qhc=false&countrycode=pl-PL>.

percentage of the emigrant population for which the age distribution was known, additional verification of the ‘stability’ of estimates was required. Performing an analysis for England and Wales, it seems natural to refer to the age and sex distribution of Polish residents in this country (Fig. 6). An assumption about the *a priori* age distribution of Polish emigrants was made to match the age distribution of Polish

residents in England and Wales (English pattern: RAF-UK population). Detailed information on the age of Polish residents in England and Wales is available from the 2011 census (ONS 2013, 2013a). It is worth noting that the UK is the most popular destination country for Polish emigrants. It was estimated that between December 2003 and December 2013 the Polish born population in the UK increased from 75,000 to 679,000 (ONS 2014 p. 7). Other comparisons for evaluation are, of course, possible, for example, based on information from statistical offices of the 10 top host countries of Polish emigrants (mirror statistics). However, they are associated with many difficulties and do not guarantee a full assessment of correctness.

Figure 6. The age distribution of Polish born usual residents in England and Wales, and the respective distribution for Polish nationals, 2011



Source: ONS 2013, Figure 10a, p. 25.

The RAF population estimates reveal a huge difference of over 820,000 people between the actual and usually residing population aged 20–29 years in Poland. If the age range is extended by another five years – the difference grows to over a million people (Fig. 5). Regardless of the estimation bias, such a huge difference should not be ignored. Neglecting this problem would lead to distorted characteristics of any demographic processes in Poland.

DISCUSSION

In the comparison of fertility the number of births is compared with the number of women at procreation age. According to the defined method of estimating the RAF population, its count depends on the age pattern used. The actual census population of women aged 15–45 years amounted to 9,493,749 compared to 9,306,044 according to the usually resident estimates published on Census Hub. RAF population estimates put the number of women at 8,810,899 according to the ‘Polish pattern’ (RAF PL) and 8,857,724 for ‘the UK pattern’ (RAF UK) estimates. The examination based on different assumptions showed that the Polish census pattern underestimated the number of usually residing women in Poland by 46,825 women aged 15–49, in comparison to the UK census pattern. This amounts to less than 0.5% of the UK census pattern estimate (Fig. 5).

The Polish census pattern underestimates the number of women aged 15–24 and over 45 years residing in Poland (in comparison to the UK pattern). And the UK pattern provides a slightly smaller count of usually resident women in Poland aged 25–44, including the ages of most intensive fertility. For two age groups: (20–24) and (30–34), the differences seem to be quite large amounting to as much as 10%. But they do not influence the TFR estimates.

Depending on the reference population, ASFR estimates vary. Based on the above analysis one can distinguish two groups of different values depending on whether long term migration is included or not. The difference in TFR ranges from 1.31 for the actual population to 1.45 for RAF and LFS population (Table 3). Bearing in mind the comparative analysis of fertility of Polish-born women in the UK and in their home country, our intention was to refer births in Poland to women who live in Poland. That is why, the usually resident population has been corrected (despite legal regulations concerning migration).

Table 3. Total Fertility Rates for different estimates of the population in Poland, 2011

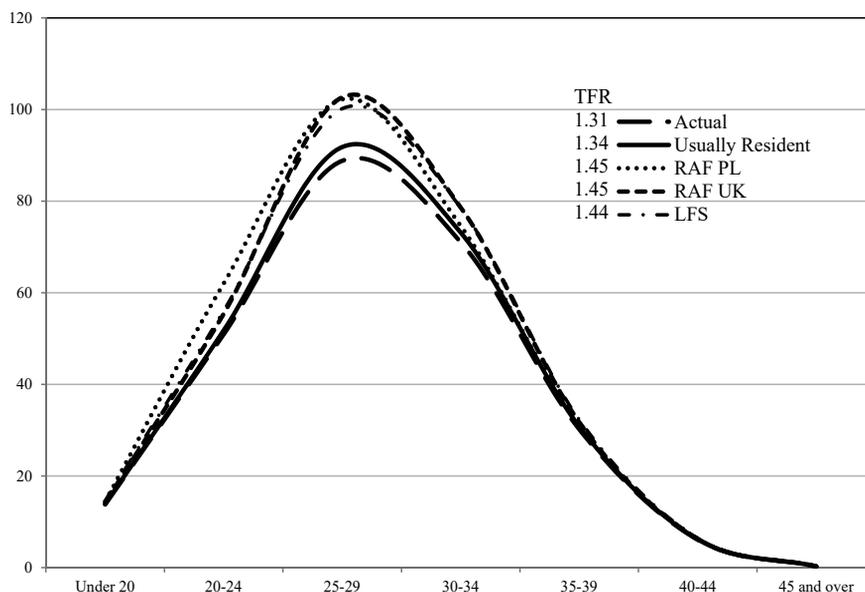
TFR	Actual	Census Hub Usually Resident	RAF PL	RAF UK	LFS
TFR	1,31	1,34	1,45	1,45	1,44
TFR Adjusted	1,47	1,50	1,63	1,63	1,61

Source: CSO Database Demografia: <http://demografia.stat.gov.pl/bazademografia/Tables.aspx>, CSO (2012, 2013,2013a), ONS (2013, 2013a), Eurostat: Census Hub2 Available on 6 November 2014: <https://ec.europa.eu/CensusHub2/query.do?step=selectHyperCube&qhc=false&countrycode=pl-PL>.

The ASFR for RAF PL and RAF UK population estimates differ slightly but the differences are not significant and both estimates provide identical TFR values. Some differences could be observed for women aged 20–34 years (Fig. 7). An even greater consistency of estimates was obtained for ASFR based on RAF UK population estimates and LFS data. The latter estimates were introduced due to the fact that

the population definition in the LFS takes into account emigration for the duration of 12 months and more. For this reason, it appears that the LFS population is more comparable with the idea of the resident population²⁰.

Figure 7. Age Specific Fertility Rates and TFRs for different population estimates, Poland, 2011



Source: CSO (2011a, 2012a, 2013, 2013a) ONS (2013).

Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates. As noted while characterizing fertility in Poland, the pattern of fertility has changed. First of all, a significant increase has been observed for the childbearing age (Fig. 1). If the timing of births changes, the TFR is a distorted measure of fertility. Namely, when the average age at maternity increases, TFR is underestimated and when the average age at maternity decreases, then TFR is overestimated. According to Ryder’s (1964) “translation” formula and its extension by Zeng and Land (2002) an index of fertility distortion was estimated²¹, which made it possible to produce Adjusted TFR. The relationship between the cohort and period measure of fertility was shown using the translation

²⁰ The difference is that LFS population does not include people living in collective households.

²¹ In the basic translation formula $TFR = CFR \cdot (1 - r_p)$, Ryder (1964) defined r_c as a rate of change in the mean cohort age at childbearing. Zeng and Land (2002) modified the formula by introducing r_p – the period mean age at births. Ryder’s formula assumes linearity in time trends of the ASFR, while Zeng and Land assume a constant shape of the schedule of ASFR.

formula. The Adjusted TFRs indicate an underestimation of TFR in Poland amounting to 0.16–0.18, depending on population estimates (Table 3).

The Central Statistical Office does not publish Adjusted TFRs, but some information is periodically published by the International Institute for Applied Systems Analysis (IIASA)²². According to IIASA report the tempo and parity adjusted total fertility for Poland in 2008 was equal to 1.6, while in 2010 it was already 1.66²³. The IIASA estimates provide an even higher TFR correction owing to changes in the timing of births. Nevertheless, the TFR estimates for Polish women in England and Wales (2.13) are still greater than in Poland (1.63). However, the difference between fertility in Poland and the UK is not that big²⁴.

CONCLUSIONS

The aim of the study was to identify differences in TFR estimates of Polish women in Poland and in the host country of emigration, particularly in England and Wales. Therefore, an insightful examination of available statistical data was carried out, including data on births and the reference population. Special consideration was given to the 2011 census in the UK and in Poland. The UK census data yielded detailed estimates about Polish residents in England and Wales. Similarly, Polish census data made it possible to estimate and correct the residing population in the home country. Population estimates were discussed in the light of international standards: usual residents, people registered for permanent residence and actually living in the country (de facto population), as well as the resulting consequences. It can be concluded that migration makes a difference.

An appropriate reference population is significant in any kind of demographic, social and economic analysis. It is natural that the number of people who are likely to experience the event of interest does influence the value of any measure, and that is why it should reflect the ‘real’ population as closely as possible. The importance of population estimates has inevitable consequences not only for fertility analysis but also for education, labour market, the pension system and, of course, for population projections. However, the estimation of the population size and structure is an extremely complex problem. Fortunately, thanks to the multiplicity of information sources, the quality of research can be verified.

²² Demographic Data Sheets are published on IIASA web-page; http://www.iiasa.ac.at/web/home/research/researchPrograms/WorldPopulation/PublicationsMediaCoverage/ModelsData/models_and_data.html.

²³ The European Demographic Data Sheet has used the tempo-adjusted TFR as proposed by Bongaarts and Feeney (1998, 2005), which is based on birth order-specific total fertility rates and mean ages at birth.

²⁴ At this point it should be noted that we do not have relevant information that would allow us to estimate potential distortion to the total fertility rate for Polish women in the UK.

Two specific questions were investigated. The first one is the question of the number of children born in Poland. It was observed that the number of children born in Poland estimated on the basis of census data was not consistent with birth records in the register. The Polish census underestimated the number of infants (13,000) and overestimated the number of children aged 1–4 years (58,000). It was found that the census included children not recorded in the birth register. In the process of looking for those children, the following observation could be made on the basis of the UK census data. The number of UK residents under the age of 5 born in Poland (12,600) is much smaller than the population at this age holding a Polish passport (57,056). The fact that the number of children with Polish passports exceeds the number of children born in Poland (UK residents) could be explained by the practice of parents with Polish citizenship who acquire a Polish passport for their child born and living in the UK. When producing estimates of fertility rates based on information about the number of births in the UK by mother's country of origin, we should also verify if these are births to mothers that are usual residents in the UK.

The second question concerned the count of the usually resident population in Poland. Because data presented on Census Hub about people classified as usual residents in Poland include those who have stayed abroad for more than 12 months in the case they when did not notify the authorities about leaving the country, an alternative algorithm for estimation was introduced. Another reason to propose RAF estimates of the usually resident population was to account for immigrants who were not enumerated in the census if they could not complete complex procedures required to obtain the legal resident status, even if their length of stay exceeded 12 months. Given the very large size of Polish migration (approximately 1.5 million), the omission of such a large number of mostly young people significantly changes results of the analysis and therefore requires careful estimation.

The estimated RAF population, regardless of the assumptions about the a priori distribution, enabled a comparative analysis of fertility. The estimated TFR of Polish women in England and Wales based on the UK census – 2.13 is higher than that obtained on the basis of revised information about the usually resident population in Poland – 1.45. But the difference is not as big as indicated by earlier estimates. In addition, taking into account changes in the timing of births that contributed to the distortion, a bigger underestimation of TFR in Poland was observed. Its adjusted value equals to 1.63.

Summing up results of the analysis, it is important to emphasize the following issues suggesting directions for further research:

- It is necessary to assess the quality of information from administrative records about population and demographic events, which is used in population statistics. In particular, the registration of demographic events should make it possible to recognize not only basic demographic characteristics for a given person, but also to determine their status of residence.

- The introduction of the concept of the usually resident population for international comparisons requires unification and harmonization of the measurement that should be based on international regulations. Allowing the regulations of the national law leads to such anomalies as those indicated in the study, when the usually residing population includes people who have for many years stayed abroad. As a result, the population classified as usually resident is, in fact, not in line with the definitions, unless one takes into account the flexibility offered by the applicable provisions in this regard (EU 1260/2013, Article 4 paragraph 2).

According to the 2011 Census, the most common non-UK nationality in England and Wales was Polish, with 558,000 residents²⁵. Poland is also the most common non-UK maternal country of birth in the UK, with over 21,000 births in 2013. Census data show that nearly all (91.71%) Polish-born UK residents have arrived after 2001 (531,000). Polish emigrants are young people beginning their professional careers. They are at the age of family planning and having children. Although they remain Polish citizens, the UK is at the moment the place of their residence and they form part of British society. Whether, and if so, when, these people and their children will return to Poland are questions that are difficult to answer today. Decisions about returning, just like decisions about emigration, are difficult, very complex and depend on many social and economic factors.

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²⁵ This is the number of Polish passport holders (ONS 2013 p. 7).

- ation of the Polish population and housing stock. Study prepared for the Demographic Congress, Warsaw 22 March 2012], GUS, Warsaw.
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ESTIMATION OF FERTILITY IN POLAND
AND OF POLISH BORN WOMEN
IN THE UNITED KINGDOM

ABSTRACT

The aim of research presented in the paper is to explore the comparison of Total Fertility Rates of Polish women in England and Wales, with the rates for Polish women who are residents in Poland. Population censuses in Poland and the United Kingdom in 2011 provide information for such comparisons and show higher fertility rates of Polish women abroad than in Poland.

Two specific questions were investigated. The first one is the question of the number of children born in Poland. It was observed that the number estimated on the basis of census data was not consistent with birth records in the register. The second question concerns the number of the usually resident population in Poland. We provide quality assessment of 2011 population census in Poland, estimates of actual and usually resident population. Based on thorough evaluation, a correction of the population estimates is proposed (RAF). Due to non-response and data omissions, the idea of Small Domain Estimation is applied with two a priori age and sex distributions: from the Polish Census Survey and upon the UK census.

Fertility in Poland is estimated with regard to usually resident population published on the Census Hub, our RAF estimates and LFS data. The estimates of women at reproductive age differ for over 495,000, what cause certain discrepancies in TFR. Additionally we analyse changes in timing of birth and provide tempo adjusted TFR. The paper shows consequences of population estimates for measuring fertility. It was found that depending on the population estimates TFR in Poland differs from 1.31 for actual population to 1.45 for RAF estimates and 1.63 for tempo-adjusted TFR.

Via detailed empirical examination of the usually resident population estimates in Poland we show inconsistencies resulting from the flexibility in interpretation of definitions given by EU 1260/2013 and specific regulations of individual countries.

Keywords: Population Census Quality, Population Estimates, Usually Resident Population, Polish Migration, Migrant Fertility