Housing affordability in Czech regions and demographic behaviour – does housing affordability impact fertility?[1]

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Introduction

Demographic behaviour[2] of individuals is influenced by many different factors. Some of these factors are of the biological nature (e.g. age or health), others are of the cultural nature (e.g. religious or moral values), yet some of the factors that influence the demographic behaviour are the socio-economic ones (like education, incomes, or unemployment)[3]. While it is quite difficult to predict a demographic behaviour of an individual, it is more plausible to predict the aggregate indicators that describe the demographic behaviour of the whole population provided that we know the characteristics of the population, the conditions in which the population lives, and the relations between the demographic behaviour and the underlying factors.

On the macro-level of aggregated indicators, it is possible to estimate how fertility is influenced by structural and biological characteristics of populations like the number of women in the reproductive age, mortality rates or the share of infertile women in the respective population. It is somewhat more complicated to estimate the effects of the culture-related factors on the demographic behaviour of populations but at least the short term estimate is quite possible because many of the cultural characteristics of the population (e.g. the percentage of Catholics or perceived ideal number of children in a family) change only slowly over time and the relations between these characteristics and

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[2] Demographic behaviour includes all aspect of behaviour that is connected to human reproduction. In practice it comprises fertility, morbidity, abortions, mortality, marriage, divorces and migration.

[3] The socioeconomic factors may influence the demographic behaviour directly or, as Easterlin (1976, p. 417) reminds us, through "interplay between aspirations and resources people have to satisfy their aspirations".

the demographic behaviour remain relatively stable. An attempt to estimate the effects of socio-economic factors on the demographic behaviour is, however, a tough task. It is namely because the relations between some socio-economic phenomena and demographic behaviour are not of simple "cause and effect" nature and, moreover, the socio-economic conditions under which people make their decisions about their reproduction often change quite dramatically over the relatively short period of time while the demographic behaviour not necessarily so.

This paper obviously cannot deal with the effects of all possible underlying factors on the all aspects of demographic behaviour. As the title suggests we concentrated on the relation between one specific socio-economic factor – the housing affordability – and one aspect of demographic behaviour – fertility – in a comparative perspective of the Czech regions. The decision to analyze this particular relationship was motivated by the existence of a unique data set about the housing affordability in Czech regions in period 2000-2006 that was the outcome of the project "Regional disparities in availability and affordability of housing, their socio-economic consequences and tools directed to increase availability and affordability of housing and decrease the regional disparities" led by Martin Lux in the Institute of Sociology (Lux, Suda 2008). The main purpose of this paper is to examine the potential impact of differences in housing affordability among the regions of the Czech Republic on regional variation in fertility[4]. The key questions asked is whether the housing affordability influences the reproductive decisions of the Czech households. If the answer to the main question is affirmative, then we would like to know which aspects of fertility are influenced, to which direction, and to what extent.

[4] In this paper, we understand the housing affordability as an independent variable and the fertility as the dependent variable. We are well aware that also the reverse causal direction may be examined (e.g. how different levels of fertility impact housing affordability) but in the conditions of the Czech Republic and in the relatively short period of time that we examine our approach is more appropriate.

The paper consists of four sections. After a brief discussion of the scientific literature concerning the potential impact of housing conditions on the demographic behaviour, namely different aspects of fertility, a methodological section is included providing information about definition of indicators that we used and the description of methods that we applied in the analytical part of the study. The third section is devoted to the examination of the relations between fertility and economic conditions in Czech Republic. Finally, the fourth section provides the results of an analysis of relationships between housing affordability and different aspects of fertility in a comparative perspective of the Czech regions.

1. Does housing conditions affect fertility?

Although studies of the relations between the fertility and socio-economic factors are plentiful after Becker (1981) there are not too many published texts that deal specifically with the relations between fertility and housing conditions. Moreover, when relation between fertility and housing conditions is examined housing is often considered as dependent variable in the causal relation between the two phenomena as it is assumed that housing conditions of the household are to be adjusted to the number of children and needs of the households (Courgeau 1985, Goodman 1990, Clark and Huang 2003). But even those who analyse the impact of children on consumption patterns (including the demand for housing) admit that the causal relation might go in the opposite direction, that is that "fertility may be affected by the availability and the cost of housing" (Browning 1992, p. 1435).

The causal relation between the availability of housing and independent variable and fertility behaviour as dependent variable was often observed in less developed societies or societies where the housing market is controlled by the state. Felson and Solaún (1975) analyzed the fertility-inhibiting effect of crowded apartment living in a tight housing market in Columbia concluding that life in small apartments reduced fertility of members of lower-middle and upper-working classes. Peled (1969) showed the same type of relation between housing shortage and fertility in Israel while Berent (1970) in Easter Europe and the Soviet Union under Communism and Paydarfar (1995) in Iranian cities. Another point of view on the same relation was provided by Tan, Lee, and Ratnam (1978) who studied effects of social disincentive policies on the fertility behaviour in Singapore. In an attempt to reduce fertility, the Singapore state introduced in seventies the set of policies aimed at discouraging families from having more children. Giving priority to small families in the allocation of the government subsidized housing units to

applicant was one of the five policy measures. The analysis showed that this specific housing-related measure for discouraging people from having more children was not particularly effective as most of mothers who gave birth to their fourth or more children were already living in the state subsidized apartments.

There are, of course, also studies that deal with the situation in the most developed countries. Goodsel (1937) considered the home overcrowding as one of the factors explaining the low fertility level in Swedish cities. Thompson (1938) came to basically the same conclusion while studying the situation in the USA. An interesting study of Murphy and Sullivan (1985) analyzed effects of housing tenure on childbearing in post-war Britain. Authors came to conclusion that the family size of home owners is smaller than that of tenants, but fertility of those living in the single family houses is higher than fertility of those living in apartments. In a recent study, Kulu and Vikat (2007) analyzed fertility differences by housing types in Finland applying the hazard regression on the unique individual longitudinal data from population registers. The study proved that there is a significant variation in the fertility levels across the housing types. Fertility was the highest among couples who lived in single family houses and the lowest among those who lived in apartments even when effects of other factors were controlled for. Although the difference could be partly attributed by the selected moves (those who planned to have child or more children moved to a single family house before the plan was realized), but it was proved that couples living in single family houses tend to have more kids several year after the move which suggested that improved housing condition could encourage increased fertility. More general view on the relation between housing and fertility is provided by Mulder (2006) who suggested that fertility is not affected by only the size, type of dwelling or housing tenure but rather by the whole housing system (including its parameters like what is the overall quality of housing, how diverse is

housing stock and how easy or difficult is the access to housing market for young people). Similar type of argument is used in paper of Mulder and Billari (2006) that relate recent 'lowest-low' fertility in Southern European countries with the existence of a special home-ownership regime that combines the high share of owner-occupation with low access to mortgage – a combination that proved to be discouraging childbearing among young people. Interestingly for us, Mulder and Billari excluded countries of Central and Easter Europe from their analytical framework despite the prevalence of lowest-low fertility levels in the region claiming that "the development of housing markets is still in full swing" but admitted that low fertility could be impacted by the problems of young couples to secure "housing suitable for forming families" (p. 8).

This article is aimed to contribute to the general debate on the potential impact of housing on the fertility by the analysis of the case of the Czech Republic. Before we analyze relationship between housing affordability and fertility on the both national and regional level a short methodological section providing the information about the used indicators and methods of analysis is necessary.

2. Indicators and methods

In this paper we consider fertility as the dependent variable, housing affordability as an independent variable, while some other variables as the controlled variables. From the multitude of existing fertility level indicators we opted for the total fertility rate, the age specific fertility rates and the average age of the first time mothers that can be calculated for both individual regions and the whole country. The total fertility rate (TFR) is defined as the "total number of children a woman would have by the end of her reproductive period if she experienced the currently prevailing age-specific fertility rates throughout

her childbearing life" (World Population Prospects… 2005). Total fertility rate can be simply expressed as the number of children per woman of the reproductive age. From a variety of age specific fertility rates we chose three separate fertility rates at age cohorts that are the most relevant in terms of the total fertility – 20 to 24 years, 25 to 29 years, and 30 – 34 years. The indicators are defined as ratio between the numbers of live births to women at the specific age to a mid-year female population of the respective age group in the respective calendar year. Finally, we used the average age of the first time mothers that is calculated as simple arithmetic average in the individual calendar year. The indicator provided us with information about the timing of the first births.

There are three different approaches how to measure the housing affordability – affordability can be measured simply by comparing the housing expenditures to the household incomes, or by comparing housing expenditures in some sectors or housing expenditures of some specific groups of people with that in the whole national economy, other sectors or other groups, or by using the concept of residual income in which residual household income after covering the housing costs is compared with some normatively determined budget thresholds (Garnett 2000). In the indicator approach the housing affordability is considered the problem when ratio between housing costs and household incomes exceed a normatively determined percentage. In the reference approach, the housing affordability is a problem if the housing costs in a sector or housing costs for a specific group substantially exceeds national standards. Finally, in the residual approach the housing affordability is considered a problem when residual income of the household is too low to cover other basic needs of the household. As Robinson, Scobie and Hallinan (2006, p. 3) remind us "housing affordability also can be viewed from three different perspectives: affordability for renter; affordability for would-be home owners; and affordability for existing homeowners". As the principal aim of our

research is to study potential relation between housing affordability and fertility, we concentrated to the housing affordability of renters and would-be homeowners and decided to omit the potential affordability problems for existing homeowners who are on average much older in the Czech Republic and therefore less relevant in terms of current fertility rates[5].

In practice, different indicators might vary in the way how both the housing expenditures and household incomes are defined (Lux, Suda 2008). We chose two different indicators of housing affordability. The housing affordability for renters was measured by the rate between the total housing expenditures of the households that rent an apartment or house on the free market[6] and the total net incomes of the households. In concordance with Lux and Burdová (2000) we refer to this indicator as the "rent-to-income ratio". The most usual indicator of the housing affordability for those who consider buying their own house is the price-to-income ratio that compares the average/median price of the home/apartment with the average/median net annual income of the average household (Garratt 2001, Case, Shiller 2003, Rooij 2003). This indicator, however, do take into account neither the interest rates which are asked by the mortgage providers from the potential borrowers nor the potential changes in the willingness of banks to actually lend money to the potential borrowers. After considering more possible options we finally opted for the percentage of households that would qualify for a mortgage for the purchase of an averagely priced apartment of the appropriate size[7] in the respective

[5] Existing home owners are not only older than the renters and would-be owners. Moreover, most of homeowners do no not repay any mortgage debts (mortgages did not exist before mid of 1990's) and, thus, their average monthly housing expenditures are somewhat surprisingly lower than that of renters in the Czech Republic (Kostelecký, 2005).
[6] Housing expenditures of households in the rental market with regulated rents were not considered. The negligible percentage of young households lives in regulated rental sector (Kostelecký, 2005).
[7] Households of different sizes were supposed to qualify to the purchase of apartments of different sizes.

region[8] as the indicator housing affordability for the would-be owners. This indicator takes simultaneously into account all four important parameters that might decide about financial affordability of potential buyers – the housing prices, the household incomes, the interest rates, and the willingness of the banks to lend money.

In our analyses of relations between the housing affordability and fertility in regions we also used some other characteristics of regions as controlled variables. Controlled variables included the indicators of economic well being (measured by the average wages from the annual statistics of the Czech Statistical Office), economic distress (measured by general rate of unemployment and specific unemployment rates for women and men from the annual statistics of the Czech Statistical Office), the religiousness (measured as the percentage of inhabitants who claimed they belong to a religious denomination[9] in Census 2001), the share of urban population (from Census 2001), and several different indicators of the education of women (the average number of years of education per adult woman, the average number of years of education of women in age cohorts most relevant to the reproduction, the share of women with secondary education and the share of women with tertiary education in age cohorts most relevant to the reproduction – all data from the Czech Statistical Office).

The actual analysis of the data was conducted in the two steps. In the first step, we analyzed the development of available macro data in relation to the changes of fertility at the national level after 1989. The potential relations among variables were identified by

[8] The information about household incomes came from the Regional Statistics of Labour Costs collected regularly by representative surveys in individual regions under the supervision of the Ministry of Labour and Social Affairs. The data about housing prices came from regular monitoring conducted by the Institute of Regional Information. The information about the annual averages of the mortgage interest rates came from the Czech National Bank. The information about the criteria used by mortgage banks to decide whether applicant would qualify for mortgage came from banks themselves. The actual indicators of housing affordability were then calculated in the Department of Socioeconomics of Housing (details are provided in Lux, Kuda 2008).

[9] Only 32 % of inhabitants of the Czech Republic were religious according to Census in 2001 – over the four fifth of them were the Roman Catholics and most of the rest members of various protestant denominations. Majority of population, however, is non-religious.

the simple correlation techniques. In the second step, we concentrated on what is the core of our inquiry - more detailed analysis of the relationships between housing affordability and fertility on the level of the Czech regions. Unfortunately, the key data about the housing affordability were not available before 2001, so the regional part of the analysis could only cover the period 2001-2006 for which all relevant data are available. We used standard modelling technique of backward regression that enabled us to specify different indicators of fertility as dependent variables, indicators of housing affordability as independent variables, while control the effects of the other variables and thus to test whether fertility in the observed period was influenced by the housing affordability.

3. The effects of socio-economic factors on fertility in the Czech Republic

There are not many examples of studies which would explicitly concentrate on the relations between the housing conditions and fertility in the Czech Republic. The Czech post-WWII baby boom was partly considered natural reaction of the population to the end of the war (postponed births that were not realized during the war) and partly seen as the secondary effect of fertility of strong post-WWI generations. It was not connected whatsoever with the housing situation in the country. During fifties, however, the average number of children per woman rapidly decreased from 2.8 in 1950 to 2.1 in 1960. Sobotka et al. (2003) attribute decline in fertility mainly to the high participation of women in the labour market that press women to combine a traditional role of house-keeping and child care with the full time job, but also to an introduction of liberal legislation of divorce in 1950 and namely abortion in 1957. But Frejka (1980: 68) explained declining fertility rates also by socio-economic factors, naming specifically a chronic housing shortage as one of the underlying factors. “Difficult housing situation”

was mentioned as one of the factors that caused the fertility decline also by Rychtaříková (2007).

Constantly decreasing fertility rates led the communist government to consider implementation of the pro-population policy measures. In practice, they were adopted only after the invasion of the Soviet Army to the Czechoslovakia in 1968. These measures were the most extensive, comprehensive and the most costly fertility-related population policy measures ever implemented in any developed country. The expenditures to pro-population policy amounted for 10 % of the total budget expenditures of Czechoslovakia at the beginning of 1970s (Frejka 1980: 71, 89). The measures comprised substantial rise of child care family allowances, extension of maternity leave, introduction of maternity grants and low-interest loans of newly-wed couples. It was combined with the increased investment into the child-care services and massive construction of social housing.

The policy became quite successful in the short term – the average number of children per woman grew up from 1.8 in 1968 to 2.4 in 1974. Although the increase could not be fully attributed to the policy measures and changing socio-economic conditions for childbearing (the other effects include particularly strong cohorts of post-WWII baby boomers that reached the age of the highest fertility in the first half of 1970s), their effects were undoubtedly important (Rychtaříková 2004, Frejka 1980, Sobotka et al. 2003). The increase of fertility was the most pronounced among the woman of higher education and women living in the larger towns that were the most receptive to the improvement of conditions for family formation (Rychtaříková 2007). In 1980s, the effects of population policy measures gradually vanished and fertility gradually declined.

The collapse of the Communist regime in 1989 led to a dramatic change of many state policies. It is possible to claim, however, that the state population policy practically

ceased to exist after the regime change. Some measures aimed to financially support families had survived the economic transformation (namely child allowances and tax deductions for parents of dependent children) but they lost its relevance because provided benefits no longer represented a noticeable part of the family budgets. In time when unemployment increased substantially and the public expenditures for the day-care centres were significantly reduced, it became harder for women to combine full time job with the child care (Hašková 2005). At the same time, however, the window of opportunity far surpassing everything what was known to the young generations under Communism opened for those with high education, the marketable skills or the courage to establish their own business. Above described situations represented an environment under which the profound changes in fertility patterns were observed. Cohorts of women that were born in 1970's postponed their childbearing, whereas the women born in 1960's reduced births of the second and third children. It resulted in the drastic decrease of total fertility rate to less then 1.2 that lasted the whole period between 1996 and 2003. Such an unprecedented low fertility attracted attention of many demographers who attempted to identify its causes (e.g. Rychtaříková 2000a, 2000b, Billari, Kohler 2002, Hamplová et al. 2003, Sobotka 2003, Chase 2003, Sobotka et al. 2008, Klasen and Launov 2006, Frejka 2008). The possible underlying factors were many. The opportunities to study increased and so the return of education on the labour market which resulted to increased school attendance of young women and consequently to a decrease of number of young mothers. The proportion of women at the age between 20 and 24 that were enrolled in tertiary education increased from 13 % in 1995 to 30 % in 2003 (Sobotka et al. 2008). Moreover, the delay between the graduation and motherhood sharply increased (Klasen, Launov 2006). The average age at the first child delivery increased particularly among the most educated (Rychtaříková 2007). The competition

on the job market led young graduates to prefer accomplishing relevant professional experience before family was formed. Particularly for women with high education it became difficult to combine the professional career and motherhood as the prevailing public opinion consider long maternity leave the best option for children (Kulhavý, Bartáková 2007, Hašková 2005) while competitive labour market tolerated only short maternity leaves for those who want to pursue their professional careers. Social distress connected with the emergence of unemployment and economic uncertainty for low skilled employees played also certain role in the decrease of fertility. A rising costs of childbearing resulted in the widespread opinion that sharp decline of the standard of living is unavoidable after the birth of a child (Fialová et al. 2000). The fear that motherhood means the threat to the professional career and personal isolation became widespread namely among young people without tertiary education (Kulhavý, Bartáková 2007).

The breakdown of the Communist rule in the 1989 also dramatically changed the situation in housing. The profound changes of 'the rules of the game' in the housing market, the sharp decrease of housing construction and the dramatic increase of housing prices (Lux et al. 2003) that were simultaneously accompanied by the dramatic decrease of the fertility rates raised the question whether (or to what extent) the changes in housing affordability may be responsible for the fertility decline.

The first 'Housing Policy Concept' that was passed by Czech government in 1991 "foresaw complete withdrawal of the state from the housing investment and the creation of a real state market" (Buzar 2005, 385). Indeed, the state was no longer too much involved in the housing market, limiting its interventions to the financial support of

building saving banks[10] and to passing the legislation that allowed the constitution of mortgage banks. But only several years after the start of the economic transformation Musil (1995, p. 1681) described the housing situation of newly formed households as "critical" and "particularly severe for young people". Buzar (2005, p. 393) pointed that "low income young families and retirees" were hardest hit by problems with housing cost. Some researchers linked problems with housing with the decline of fertility. Sobotka et al (2008) considered declining housing affordability one of the relevant factors that played a role in explanation of decreasing fertility, namely for the less well-to-do households. Similarly, Klasen and Launov (2006) identified the housing conditions as the most important stated reason for the decline of the fertility.

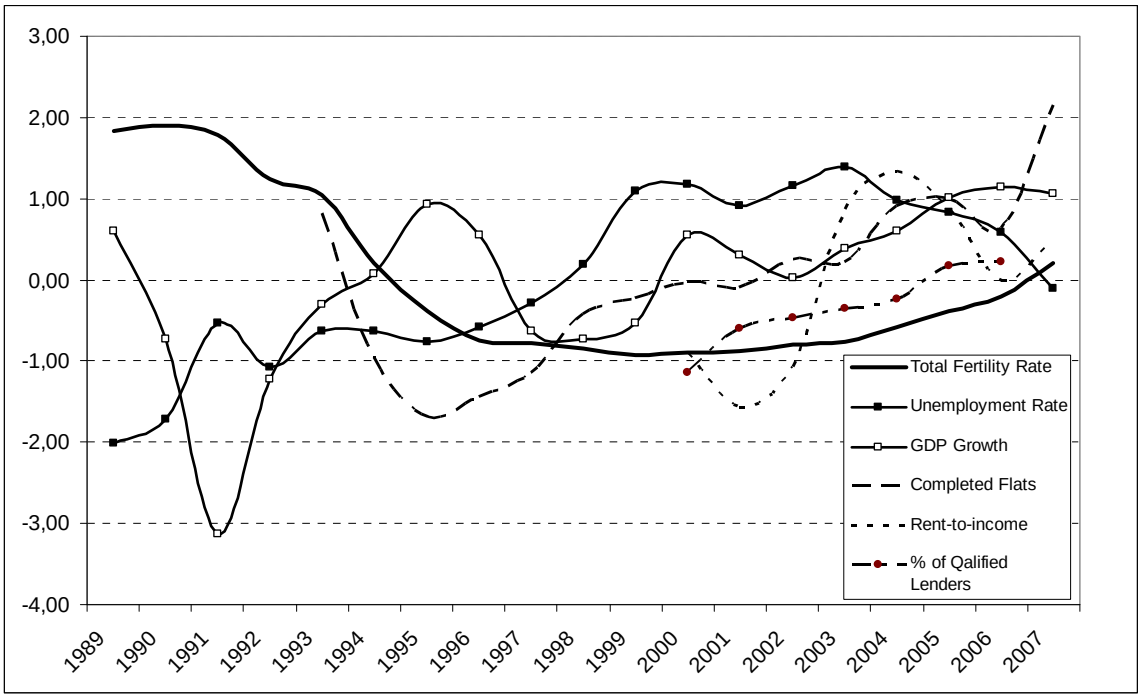
The deep and long lasting decline of fertility did not attract much attention of the early post-Communist governments that considered the phenomenon as a natural reaction to the new situation and the expression of the free will of the young generations. When the Social Democrats replaced the right-wing parties in the national government for the first-time in 1998, the attitude of the government changed – it declared family policy as one of its priorities. In practice, however, the first policies supporting young families were adopted only several years later and were rather modest in their scope and relevance. A special state subsidy for the mortgage debt payment for young families (both husband and wife had to be younger than 36) was introduced in 2002. State also introduced a limited support for the construction of the social housing but newly constructed apartments were of very limited numbers and, moreover, were usually not used for housing of the young couples. The first comprehensive family policy was approved only in 2005. A policy introduced possibility of legal work during parental leave without

[10] State provides special bonus to savings that are deposited in special building saving banks, which made this type of deposits quite popular among the population. Only part of the collected money was in practice borrowed to lenders interested in purchase of ownership housing which make this state policy quite ineffective and costly measure (Sunega 2005).

reduction of the maternity benefits while noticeably increased the benefits themselves. National Family Policy (2005, p. 21) also declared housing affordability a crucial factor in decision making of young couples whether to have a child or enlarge their families. The document nevertheless declared municipalities to be responsible for the solution of the housing affordability problem claiming that municipalities are the sole providers of the social housing. While effects of the state pro-population policies (or the lack of them) is difficult to measure, the reproductive decisions of young Czechs after 1989 can be interpreted in relation to the general economic or specifically housing conditions under which they live. Chart 1 is aimed to illustrate such potential relations. In the chart the total fertility rate is supplemented with some indicators describing the macroeconomic situation and the housing affordability. All indicators are all expressed in Z-score to have comparable measurement scale[11].

Chart 1: The total fertility rate and the basic economic and housing market indicators in the Czech Republic after 1989 (all indicators expressed in Z-score)

[11] Unfortunately, not all indicators are available for the whole period 1989-2007. Reliable data about the number of completed flats are available since the 1993. The indicators of housing affordability can only be computed since 2000 when regular monitoring of the housing prices started. Moreover, the share of households who qualify for the mortgage for "an average apartment" cannot be calculated in 2007 when national system of subsistence minimum was abolished and the mortgage banks consequently ceased to apply the comparable nation-wide criteria for determining the bonity of the clients. While reading data from the chart, readers should be aware that for each indicator, the zero value of the Z-score means the average value of the respective indicator in the period for which the data are available.



Source: own calculations based on data from the Czech Statistical Office, the Institute of Regional Information, the Ministry of Labour and Social Affairs, and the Czech National Bank

It is clear from the chart that the total fertility rate declined rapidly in the first half of the 1990's and started to recover only after year 2000. Since 2004 total fertility rate was raising more noticeably as large cohorts of mothers born in 1970's finally started to give birth to children. But even after seven years of the increase the total fertility rate remained substantially lower than in the beginning of 1990's.

When the whole observed period is taken into account the decline of fertility seems to be quite unrelated to the GDP growth. In 1990 and 1991 when the economy was hit by the transformation problems and the GDP rapidly declined, the total fertility remained basically unchanged. Between 1993 and 1996 when economy witnessed quick post-transformation recovery, the total fertility declined the most rapidly. Between 1997 and 2002 fertility remained stable and very low at the same time while the GDP witnessed the second post-transformation decline followed by a noticeable recovery. Only after 2003 modest rise of total fertility rate was accompanied by the rise of the GDP growth.

On the other side, the total fertility rate seems to be quite strongly related to the unemployment[12]. Between 1989 and 1999 the increase of unemployment was accompanied by the decline of fertility while decreasing unemployment after 2002 went together with the increase of fertility.

The observation about the potential relation between the total fertility rate and the indicators of the situation in the housing market is naturally limited only to periods for which the data on housing are available. Total fertility rate is positively correlated to the number of completed flats after 1992 but the correlation is not statistically significant. Relation between the total fertility rate and indicators of housing affordability is not a simple one after 2000. While fertility is slightly positively (albeit not significantly) correlated to the rent-to-income ratio - the increase of fertility was accompanied by relative increase of market rents (that is the decrease of affordability of the rental housing), it is positively and significantly correlated to the percentage of potential lenders who qualified for the mortgage (that is the increase of affordability of the ownership housing). The rise of affordability of the ownership housing was observed despite the rise of price-to-income ratio. This was made possible by the sharp decrease of inflation rate from over 10 % in 1998 to about 2 % in 1999 that was followed by the profound decline of the interest rates. Thus, price of ownership housing was increasing but cheaper mortgages made it more affordable for an increasing portion of households.

Despite of having limited number of indicators (and incomplete data), one can generally say that the total fertility seems to be related to both economic situation and the housing affordability. At least after 2000 the decline of unemployment and the rising affordability of ownership housing might positively affect the decision of people to give birth to children that were not born in the previous period of economic insecurity and housing

[12] The Pearson correlation -0.795 between the two indicators in the period 1989 and 2007 is significant at the 0.01 level.

problems. But this statement is necessarily rather hypothesis than the statement about the causal relationship, not only because the data are incomplete; but also because the effects of too many other potential underlying factors are not (and probably cannot be) controlled for.

4. The housing affordability and fertility in the Czech regions. Does housing affordability influence the regional variation in fertility?

To get more detailed information about the possible impact of housing affordability on the fertility we conducted series of analyses centred on the relationship between the different features of fertility and housing affordability in fourteen Czech regions. If the housing affordability affects fertility than we can expect that regional differences in housing affordability will be related to the regional differences in fertility. In other words, we might expect lower fertility in regions with less affordable housing, provided the effects of other important underlying variables are controlled for.

First, we conducted a regression analyses that used the data from 2001 when Census was organized and, consequently, the highest number of possible controlled variables was available. In the first analysis the total fertility rate was the dependent variable while the rent-to-income ratio and the percentage of households that qualify for the mortgage for the purchase of an average apartment were independent variables. After an elimination of the most highly inter-correlated variables we identified several controlled variables that contribute the most to the explanatory power of the regression models: the average salary in the region as the measure of its economic prosperity, the general rate of unemployment as the measure of the economic distress of some specific groups of

population[13], the average number of years of education of women aged 25-29 as the measure of the level of education of the age cohort that has the highest fertility in the Czech context, the percentage of urban population as the measure of urbanization, and the percentage of women aged 25-29 who are religious. The result of the modelling is displayed in the Table 1.

Table 1: Regression model explaining the regional variation in the total fertility rate in 2001 (backward regression, the first and the last step)

Step		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	2,207	,392		5,632	,001		
	UNEMPLOYMENT RATE	-,001	,003	-,093	-,392	,709	,276	3,618
	RENT-TO-INCOME RATIO	-,001	,005	-,105	-,131	,900	,024	40,948
	% OF QUALIFIED FOR THE MORTGAGE	,000	,002	,077	,161	,877	,069	14,502
	AVERAGE SALARY	,000	,000	-,109	-,245	,814	,080	12,473
	EDUCATION WOMEN 25-29	-,086	,040	-,741	-2,155	,075	,133	7,519
	URBANIZATION RATE	,001	,001	,420	1,545	,173	,213	4,704
	RELIGIOSITY WOMEN 25-29	-,001	,001	-,266	-1,165	,288	,302	3,312
5	(Constant)	2,373	,166		14,323	,000		
	EDUCATION WOMEN 25-29	-,103	,014	-,885	-7,087	,000	,665	1,504
	URBANIZATION RATE	,001	,000	,371	3,003	,013	,679	1,473
	RELIGIOSITY WOMEN 25-29	-,001	,000	-,257	-2,184	,054	,750	1,334

Note: adjusted R square = 0.865
Source: own calculation

The model was quite successful – the final version of the model explained over 86 % of the total regional variation. Backward regression gradually eliminated those variables that did not contributed enough to the explanation of regional differences in the total fertility rate. After five steps only three variables remained in the model and neither of them were characteristics of housing affordability – it seems that regional variation in total fertility does not depend on housing affordability. The average total number of children per woman in region does not reflect the differences in housing affordability when the effects of other underlying factors are taken into account. The best predictor of

[13] The average salary and the unemployment rate are somewhat surprisingly not significantly correlated at the level of regions.

the total fertility rates in individual regions is the education of women aged 25-29: the higher the level of education the lower total fertility can be expected. Controlling for the level of young women's education, the higher rate of urbanization add to the level of total fertility while the percentage of religious women of the age 24 to 29 decrease the total fertility. The effects of the last two mentioned variables are rather surprising and somewhat counterintuitive as the fertility was traditionally higher in rural areas and among the religious population. The demographic data from the last two decades, however, show the difference in fertility between the rural and the urban areas practically ceased to exist nowadays (Vobecká 2009). Similarly, the more rapid decline of fertility was observed in regions with the traditionally high level of religiosity (Vobecká 2009), so any difference among demographic behaviour in regions there is no longer based on differences of religious structure of their populations. When education of women is controlled, the percentage of rural population and the religiosity of young women have even negative effect on total fertility.

It seems that differences in housing affordability do not have any significant impact on the total fertility in regions (that is the total number of children born per women of the reproductive age). Yet, it is still possible that housing affordability influences other aspects of fertility. Table 2 presents results of regression modelling aimed at the explanation of the regional variation of the average age of mother at the time when they gave birth to their first child in 2001.

Table 2: Regression model explaining the regional variation in the average age of mother at the birth of their first child in 2001 (backward regression, the first and the last step)

Step		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	12,543	3,062		4,096	,006		
	UNEMPLOYMENT RATE	-,024	,024	-,099	-1,001	,355	,276	3,618
	RENT-TO-INCOME RATIO	,034	,037	,309	,928	,389	,024	40,948

	% OF QUALIFIED FOR THE MORTGAGE	,004	,013	,059	,299	,775	,069	14,502
	AVERAGE SALARY	,000	,000	,435	2,366	,056	,080	12,473
	EDUCATION WOMEN 25-29	,760	,311	,349	2,440	,050	,133	7,519
	URBANIZATION RATE	-,003	,006	-,055	-,489	,642	,213	4,704
	RELIGIOSITY WOMEN 25-29	,004	,006	,072	,764	,474	,302	3,312
5	(Constant)	11,694	2,241		5,217	,000		
	RENT-TO-INCOME RATIO	,037	,010	,342	3,572	,005	,254	3,941
	AVERAGE SALARY	,000	,000	,348	4,950	,001	,471	2,124
	EDUCATION WOMEN 25-29	,854	,205	,392	4,172	,002	,264	3,783

Note: adjusted R square = 0.970
Source: own calculation

The last version of the model was very successful – it explained 97 % of the total regional variance. Similarly to the previous model, only three variables remained in the model after the backward elimination of the other variables – all of them were positively related to the average age of women at the first births. The higher the average salary in the region, the higher the education of women aged 25-29, and the higher rent-to-income ratio, the higher age of the first-tome mothers can be expected in the region. The combination of independent variables that remained in the model is easy to interpret. The higher education level of young women expectedly leads to delay in their decision to become mothers. The higher average salary indicate more prosperous regions in which better economic situation and better career prospects contribute to the decision of young people to postpone the births of their children – and this is true even when the effect of different educational level of women are controlled for. Finally, the high market rents in relation to local salaries (that is low affordability of rental housing) also increase the average age of the first-time mothers. The costly rental housing discourages young people from having children in younger age and led them to the postponement of their reproduction to the higher age.

The results of analyses that we conducted so far suggests that problems with housing affordability affect rather the timing of the childbearing than the total number of children

that is born per women of the reproductive age. If it is the case, then women living in regions with highly affordable housing have their children sooner and women living in regions with housing affordability problems have their children later but after all women living in different regions have similar total number of children despite of the situation on the housing market (provided other important variables, namely the education of women are controlled for). The additional regression analyses aimed at the explanation of regional variation of the fertility rates of women in the specific age cohorts confirmed this conclusion. The fertility of women aged 20-24 in regions decreases with the increasing rent-to-income ratio, the higher education of women, and the average salary. The fertility of women aged 25-29 does not depend on either of the above mentioned variables, but is somewhat higher in the rural areas. The fertility of women aged 30-34 is higher in the regions with the higher rent-to-income ratio, the higher percentage of households that qualify for the mortgage, while decreases with the level of women's education. Thus, when education of women is controlled for, the higher affordability of ownership housing increases the probability of childbearing among women from older cohorts of the reproductive age in a region. It is worth to mention that fertility of women aged 30-34 is higher in regions where the market rents are relatively more costly in relations to local salaries. Thus, the two indicators of housing affordability point to the different direction in the model. It is possible that the reproductive decisions of couples in which women is over 30 are dependent on the affordability of the ownership housing and low affordability of the rental housing is no longer relevant for them because such couples had enough time to acquire secure and well paid jobs and to accumulate means necessary take a mortgage and to purchase their own housing. It is also possible, however, that women who live in the regions with the high rent-to-income ratio and who

therefore avoided their childbearing when they were younger finally decide to have children when they are older despite of the high cost of rental housing.

All analyses that were made so far were based on the data from 2001 when the last Census was organized. As the situation could change over time we repeated regression analyses using the data from the whole period 2001-2006 in order to recognize whether the revealed relationships among fertility, housing affordability and other characteristics of regions tend to be stable. To make the analyses comparable we had to limit the number of independent variables to those that are available in comparable format in all respective calendar years. Unfortunately, only four independent variables met such criterion – beside the two indicators of housing affordability it was the unemployment rate and the average number of school education of women older than 15[14]. The Table 3 displays the parameters of final versions of regression models that explained the regional variation in the total fertility rate.

Table 3: Parameters of regression models explaining the regional variation in the total fertility rate in period 2001-2006 (the last step of backward regression, standardized Beta and significance)

	2001	2002	2003	2004	2005	2006
% OF QUALIFIED FOR THE MORTGAGE		0.414 (0.082)	0.728 (0.003)	0.591 (0.026)	0.509 (0.063)	0.568 (0.034)
RENT-TO-INCOME RATIO	-0.669 (0.009)					
EDUCATION WOMEN 15+		-0.486 (0.046)				
UNEMPLOYEMNT RATE						
Adjusted R square	***0.401***	***0.497***	***0.491***	***0.295***	***0.197***	***0.267***

Source: own calculation

[14] Precise data about the education of the individual age cohorts of women is provided only by Census. In this case we had to use Labour Force Surveys that are annually repeated by the Czech Statistical Office as the basic source of data about the education of women. This data source is not ideal as it originate from survey that cannot avoid some sampling error. Moreover it does not allow distinguishing the education of different age cohorts and, thus, we had to work with the education of all women over 15. Naturally, this indicator of women's education in regions is not identical to the indicator of education that was used in the previous regression analyses.

It is clear from the table that the ability of models that use the reduced number of independent variables to explain regional variation in total fertility rate is generally lower that that of model that used the data from 2001 Census. The percentage of explained variability remained below 50 % in all cases and, moreover, tended to decrease over time. The single most important independent variable in the models was the affordability of ownership housing that was positively and statistically significantly, albeit not particularly strongly related to the total fertility in all analyzed years but the 2001. High rent-to-income ratio was the main predictor of the total fertility rate in regions in 2001, the education level of adult women was negatively related to the total fertility in 2002, while the unemployment rate was not significant in a single case. Thus, the results suggests that the housing affordability do have effect on total fertility rate in regions – more affordable housing is associated with more children per women in reproductive age. But one has to be careful before making the authoritative decisions: the models are not particularly successful in terms of explained variance, the results of modelling with reduced number of independent variables is not in concordance with the result of more successful model using larger set of independent variables. Moreover, the indicator of women's education used in the models in Table 3 is not particularly suitable measure of the effects of education on the reproductive decisions as it takes into account education of all adult women, including those whose reproductive age already passed, while for the contemporary fertility the education level of the youngest cohorts of women is decisive.

The Table 4 summarizes the results of the modelling the average age of the first time mothers in regions in period 2001-2006 that used the same reduced number of independent variables.

Table 4: Parameters of regression models explaining the regional variation in the total fertility rate in period 2001-2006 (the last step of backward regression, standardized Beta and significance)

	2001	2002	2003	2004	2005	2006
% OF QUALIFIED FOR THE MORTGAGE	0.403 (0.004)		-0.270 (0.036)	-0.298 (0.010)		-0.314 (0.007)
RENT-TO-INCOME RATIO	1.203 (0.000)	0.556 (0.005)				
EDUCATION WOMEN 15+		0.443 (0.018)	0.777 (0.000)	0.772 (0.000)	0.832 (0.000)	0.743 (0.000)
UNEMPLOYEMNT RATE					-0.211 (0.047)	
Adjusted R square	***0.917***	***0.928***	***0.881***	***0.912***	***0.920***	***0.926***

Source: own calculation

The models explaining regional variation in the timing of a childbearing were generally much more successful that models explaining the total fertility – all models but one explained more than 91 % of variance. In all cases but one the best predictor of the average age of the first time mothers in regions was the general education of women – the higher was education the higher was the average age of the first birth. But indicators of housing affordability were significant as well. Generally speaking, the more problems with housing affordability (of either rental or ownership housing) the higher is the age of the first time mothers in region[15] provided the differences in women's education is controlled for. The unemployment rate was significant only in model describing the situation in 2005 when the higher unemployment was associated with the lower age of the first time mothers in regions (provided the education of women were controlled for).

Conclusions

The article examined the relations between the housing affordability and fertility in the Czech Republic after 1989. Analysis of the data on the national level revealed statistical relations among the fertility, housing affordability, and the indicators of the macro-

[15] In model concerning the year 2001 the effects of both indicators of housing affordability were statistically significant. In this specific case, the housing affordability of the rental housing was stronger predictor of the average age of the first time mothers. When rent-to-income ratio was controlled for the percentage of households that qualify for the mortgage was positively related to the average age of the first time mothers – the opposite direction of the relationship than was expectedly found in all other cases.

economic development, namely after 2000 when the improvement of the economic situation (the increase of the GDP and the housing construction, the decrease of the inflation and the unemployment) was paralleled by improving affordability of the ownership housing and rising fertility (both increase of the absolute number of births and the total fertility rate). Thus, the analysis of the nation-wide data suggested that improving housing affordability might be factor that influenced the rise of fertility that was observable since the end of 1990's.

To get deeper insight into the potential effects of housing affordability on fertility we concluded a series of analysis on regional level covering the period 2001-2006 for which the regional data were available. We found that the regional variation in fertility is generally lower than the regional variation of indicators of both housing affordability and economic situation. Although numbers of born children increased noticeably, the total fertility did not increase by the same pace, and its regional patterns remained rather stable. In contrast to the fertility, indicators of economic situation and housing affordability were changing more rapidly over time and across the regions. The regression analysis of the relations among the various indicators of fertility and the housing affordability on the regional level proved that housing affordability influenced fertility significantly but it is not the only underlying factor. The most important factor that influences the regional variation in fertility is the education of women, namely the young ones. The higher is education of regional population of women, the lower total fertility rate and the higher average age of the first time mothers can be expected in the region. When education of women is controlled for, the housing affordability plays an important role in explaining the regional variation in fertility. Problems with housing affordability lead to delay in decision to have children. As a consequence, the average age of the first time mothers is increasing and the fertility rate of women under 26 is

decreasing. Although the decline of fertility at the younger reproductive age in regions with low affordability of housing tends to be partially compensated by the increase of fertility among women over 30, the total number of children born to women of the reproductive age remains lower. The analysis of the data from six consecutive years showed that although the strengths of the statistical relations between housing affordability and fertility is changing over time, the logic of relations is unchanged.

References

Becker, G. 1981. *A Treatise on the Family*. Cambridge: Harvard University Press.

Berent, J. 1970. "Causes of Fertility Decline in Eastern Europe and the Soviet Union". *Population Studies* 24 (July): 247-278.

Billari, F.C., Kohler, H.-P. 2002. „Patterns of Lowest-Low Fertility in Europe". *Max Planck Institute for Demographic Research Working Pápera.* Available at http://ideas.repec.org/s/dem/wpaper1.html.

Browning, M. 1992. "Children and Household Economic Behavior". *Journal of Economic Literature* 30: 1434-1475.

Case, K., Shiller, R. 2003. *Is there a Bubble in the Housing Market? An Analysis.* Paper. Brookings Panel on Economic Activity.

Chaloupková, J. 2005. „Faktory ovlivňující dělbu domácí práce v českých domácnostech a hodnocení její spravedlnosti". *Sociologický časopis/Czech Sociological Review* 41(1): 57-77.

Chase, R.S. 2003. "Household fertility responses following communism: Transition in the Czech Republic and Slovakia". *Journal of Population Economics* 16: 579: 595.

Clark, W.A., Huang, Y. 2003. "The life course and residential mobility in Britain Housing markets". *Environment and Planning A* 35: 323-339.

Courgeau, D. 1985. "Interaction between spatial mobility, family and career life cycle: a French survey". *European Sociological Review* 1(2): 139:162.

Easterlin, R.A. 1976. "The Conflict between Aspirations and Resources". *Population and Development Review* 2(3-4),:417-424.

Felson, M., Solaún, M. 1975. "The Fertility-inhibiting Effect of Crowded Apartment Living in a Tight Housing Market". *American Journal of Sociology* 80 (6): 1410:1427.

Fialová, L., Hamplová, D., Kučera, M., Vymětalová, S. 2000. *Představy mladých lidí o manželství a rodičovství*. Praha: Sociologické nakladatelství.

Frejka, T. 2008. "Overview Chapter 5: Determinants of family formation and childbearing during the societal transition in Central and Eastern Europe". *Demographic*

Research 19 (7): 139-170. Available at http://www.demographic-research.org/ (12.11.2008).

Frejka, T. 1980. "Fertility Trends and Policies: Czechoslovakia in the 1970s". *Population and Development Review* 6 (1): 65-93.

Garratt, D. 2001. "Affordability". *Housing Finance* 51 (1): 13-20.

Garnett, D. 2000. *Housing Finance (Housing Policy & Practice)*. Coventry: Chartered Institute of Housing.

Goodman. A.C. 1990. "Demographics of Individual Housing Demand". *Regional Science and Urban Economics* 20 (1): 83-102.

Goodsel, W. 1937. "Housing and birth rate in Sweden". American Sociological Review 2 (6): 850-859.

Hašková, H. 2005. "Pracující matky a genderové role ve výsledcích mezinarodního longitudinálního průzkumu". *Gender, rovné příležitosti, výzkum* 6 (1): 22–27. Available at: http://www.genderonline.cz/download.php.

Hamplová, D., Pikálková, S., Rychtaříková, J. 2003. *České ženy: vzdělání, partnerství, reprodukce a rodina.* Praha: The Institute of Sociology, Academy of Sciences of the Czech Republic.

Hamplová, D. (ed) 2007. *Děti na psí knížku? Mimomanželská plodnost v České republice*. Praha: The Institute of Sociology, Academy of Sciences of the Czech Republic.

Kocourková, J. 2007. "Populační klima a rodinná politika", pp. 95-102 in *Populační vývoj České republiky 2001-2006*. Praha: Department of Demography and Geodemography, Faculty of Science of the Charles University.

Klasen, S., Launov, A. 2006. „Analysis of the determinants of fertility decline in the Czech Republic". *Journal of Population Economics* 19 (1): 25–54.

Kostelecký, T. 2005. "Postoje obyvatel k situaci na trhu s bydlením a bytové politice: existují v České republice „housing classes"?" *Sociologický časopis/Czech Sociological Review*, 41 (2): 253-270.

Kulhavý, V., Bartáková, H. 2007. *Rodina a zaměstnání II. Mladé rodiny*. Research Report. Praha: The Research Institute of Labour and Social Affairs.

Lux, M. 2004. "Housing the Poor in the Czech Republic: Prague, Brno and Ostrava", pp. 23-66 in Fearn, J. (ed.) *Too Poor to Move, Too Poor to Stay*. Budapest: Open Society Institute (LGI).

Lux M., Sunega, P., Kostelecký, T., Čermák, D. 2003. *Standardy bydlení 2002/2003: Finanční dostupnost a postoje občanů*. Praha: The Institute of Sociology, Academy of Sciences of the Czech Republic.

Lux, M., Sunega, P. 2006. "Vývoj finanční dostupnosti nájemního a vlastnického bydlení v průběhu hospodářské transformace v České republice (1991-2003)". *Sociologický časopis/Czech Sociological Review* 42 (5): 851-881.

Lux. M. 2007. "The Quasi-normative Approach to Housing Affordability: The Case of the Czech Republic". *Urban Studies* 44 (5-6): 1109-1124.

Mulder, C.H. 2006. "Population and housing: a two sided relationship". Demographic Research 15 (13): 401-412.

Mulder, C.H., Billari, F.C. 2006. “Home-ownership regimes and lowest-low fertility”. Paper presented at the Workshop Home ownership in Europe: policy and research issues, Delft, 23-24 November 2006.

Národní koncepce rodinné politiky. [National Family Policy]. 2005. Praha: Ministry of Labour and Social Affairs.

Paydarfar, A.A. 1995. “Effects of multi-family housing on marital fertility in Iran: population policy implications”. Social Biology 42 (3-4): 214-225.

Peled, T. 1969. “Problems and Attitudes in Family Planning: Summary of Main Findings”. Unpublished paper. Jerusalem: Israeli Institute for Applied Social Research.

Robinson, M., Scobie, G.M., Hallinan, B. 2006. “Affordability of Housing: Concepts, Measurement and Evidence*”. New Zealand Treasury Working Paper* 03, March 2006.

Rooij, J.M.P. 2003. *Monetary Policy and Boom-Busts in Residential Property Markets.* Tilburg: Tilburg University.

Rychtaříková, J. 2000a. „Is Eastern Europe experiencing a second demographic transition”? *Acta Universitatis Carolinae Geographic*a 34 (1): 19-44.

Rychtaříková, J. 2000b. “Demographic transition or demographic shock in recent population development in the Czech Republic?” *Acta Universitatis Carolinae Geographica* 35 (1): 89-102.

Rychtaříková, J. 2004. „Změny generační plodnosti v České republice se zaměřením na vzdělání žen“. *Demografie* 46 (2): 77-87.

Rychtaříková, J. 2007. “Porodnost v České republice: současný stav a nedávné trendy”, pp. 79-94 in *Populační vývoj České republiky 2001-2006*. Praha: Department of Demography and Geodemography, Faculty of Science of the Charles University.

Sobotka, T. 2002. „Ten years of rapid fertility changes in European post-communist countries: evidence and interpretation“. *Working paper*. University of Groningen, Groningen.

Sobotka, T., Zeman, K., Kantorová, V. 2003. "Demographic shifts in the Czech Republic after 1989: A Second demographic transition view". *European Journal of Population* 19 (3): 249-277.

Sobotka, T. 2003. "Re-emerging diversity: Rapid fertility changes in Central and Eastern Europe after the collapse of the communist regimes". *Population-E* 58 (4-5): 451-486.

Sunega, P. 2003: Objektivní a subjektivní hodnocení finanční dostupnosti bydlení v ČR v průběhu 90. let. *Sociologické texty* 05/2003. Praha: The Institute of Sociology, Academy of Sciences of the Czech Republic.

Sunega, P. 2005. “Efektivnost vybraných nástrojů bytové politiky v České republice”. *Sociologický časopis/Czech Sociological Review* 41 (2): 271-300.

Tan, S.B., Lee, J., Ratnam, S.S. 1978. “Effects of Social Disincentive Policies On Fertility Behavior in Singapore”. *American Journal of Public Health* 68: 119-124).

Vobecká, J. 2009. *Spatial dynamics of population and it structural changes in the Czech Republic after 1989*. Unpublished manuscript of dissertation. Dijon: Université de Bourgogne.

World Population Prospects: The 2004 Revision. 2005. New York, Department of Economic and Social Affairs, Population Division, United Nations.