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Economic Determinants of Fertility in Belarus: a Micro-Data Analysis

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Abstract

This paper examines the determinants of births in Belarus in 1996-2007 by using detailed micro data from the Belarusian Household Budget Surveys (BHBS). The literature offered several explanations of the recent trends in fertility in Belarus and in other former Soviet Union (FSU) countries. It was argued that the collapse of the Soviet Union and the concomitant economic instability reduced fertility in the 1990s, while the economic growth and stabilization were responsible for its recovery since 2005. We evaluate these hypotheses by looking at the determinants of the first, the second, and the third births, separately for women aged below 30 and above 30. We provide new evidence on the presence and the relative importance of the economic determinants, including income and wages, economic uncertainty, maternity and childcare benefits. Our findings can be incorporated in the future demographic policies in Belarus and other countries with similar experiences.

JEL codes: J13, J12, P0, P13

Keywords: Belarus, low, fertility, economic transition.

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1. Introduction

Many countries have experienced a sharp decline in childbearing over the past several decades. In some European countries, such as Spain, Italy, Germany, Austria, Russia and Belarus the total fertility rate fell especially sharply - to 1.5 and below (Adsera 2004; Gustafsson 2001). As pointed out by Goldstein (2007) even though many countries in Europe experienced comparable levels of very low fertility, the causes underlying this process could be very different. He differentiates three types of low fertility regimes in Europe. The first of them – "no family" – is typical for Germany and Austria, where low aggregate fertility level is explained by high rates of childlessness. The second type – "late family" – is typical for Southern Europe (Italy, Spain, and Greece). There delayed progression to adulthood and family formation does not allow women to reach the desired number of children (see also Kohler, Billari, and Ortega 2002). The third type – "small family" – is typical for Russia, Belarus and Ukraine. Low fertility in these counties is explained by one-child families (see also Perelli-Harris 2005; 2008).

The recent decline in fertility in the former Soviet Union (FSU) (with the exception of the Caucasus, the Central Asian countries) and the Central and Eastern European (CEE) countries started much later than in the more developed European countries. However the magnitude of this decline was no less severe, (Philipov and Dorbritz 2003; Perelli-Harris 2005; Kumo 2009). Figure 1 shows that while Belarus, Russia and Ukraine and the CEE countries had much higher total fertility rate (TFR)[1] than some of the more developed European countries in the late 1980s, their TFR declined sharply during the 1990s and in some cases even fell below the rate seen in more developed European countries by the end of the decade (Perelli-Harris 2005; Council of Europe 2005). Belarusian TFR plummeted from 2.03 in 1989 to less than 1.3 in 1997. Even though its fertility had started to rebound in the second half of 2000s, Belarus ranked only 214th out of 223 countries in terms of TFR in 2009 (The World Factbook 2009).

{Figure 1 here}

A growing body of literature attempts to explain the reasons behind the "lowest low fertility"[2] of the European countries, including some of the FSU countries (Sobotka 2004; Perelli-Harris 2005). Most of the literature explains it in terms of quantum (level) and tempo (timing) effects in TFR adjustment. Bongaarts and Feeney (1998) define the tempo effect as the change in TFR caused by the adjustment in timing of births, and the quantum effect as the change in TFR that would have been observed in the absence of tempo distortions. The reason for separating these two effects is that the usual period TFR measure does not adequately describe the real fertility behavior of the cohorts when timing of birth changes. Thus, declining period TFR could be in part explained by the postponement of childbearing. However, the quantum and the tempo effects are not independent of each other, and significant postponement of childbearing can ultimately result in a lower completed fertility due to biological limitations on childbearing.

Some authors view the postponement of births (tempo effect) as the main explanation for exceptionally low TFR in Southern, Central and Eastern European countries (Lesthaeghe and Willems 1999; Philipov and Kohler 2001; Kohler *et al.* 2002; Sobotka 2004). Others point out that even after tempo adjustment, fertility rates in CEE countries lag behind the levels of Western and Northern European countries (Sobotka 2004). The joint team of the Vienna Institute of Demography and the International Institute for Applied System Analysis estimates tempo-adjusted TFRs for all European and Caucasus countries (European

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[1]Total fertility rate is a period fertility measure that shows the average number of children a group of women would have if they experienced the age-specific fertility rates of the calendar year in question throughout their childbearing lifespan.

[2] TFR of below 1.3 birth per woman. The term "lowest low fertility" was coined by Kohler et al. (2002) to differentiate between relatively high sub-replacement fertility in Western and Northern Europe and extremely low fertility in Southern, Central and Eastern Europe.

Demographic Data Sheet, 2008)[3]. The results of this analysis for Belarus are summarized in Table 1. It reveals that the tempo effect in TFR has been relatively small and decreasing, and the fertility remained depressed after 2003 mainly due to the quantum, and not the tempo effect. While the calculations of the adjusted TFR are not available for periods before 2004, the period TFR has remained stable and above 2 since the mid-1970s, and has declined sharply after 1989.

{Table 1 here}

Changes in the quantum of fertility can generally be caused by such factors as changes in social norms, economic conditions and the spread of contraception use. It had been argued that the major reason behind the fall in the number of births in the 1990s was that the small 1960s birth cohorts entered their childbearing age in those years, while the reason behind the rise in fertility in the 2000s was the contribution of the large generation of the 1980s (Shakhotska 2007). However this would not explain changes in the number of births per woman, measured by TFR. Several complimentary explanations for the fall in the fertility level in the 1990s included the delay in first births and changing women's roles in the family, increasing demand for child "quality", declining child death rate, worsening of the housing problem, increasing concerns about child health in the aftermath of the 1986 Chernobyl disaster, worsening of reproductive health and increasing infecundity (Shakhotska 2007), changing social values (from traditional to post-modern), increased access to birth control and growing divorce rate (Perelli-Harris 2008a). However, it seems unlikely that changes in demographic structure and social norms can explain the very rapid decline in the total number of births and the fertility rate during the 1990s and the unusually depressed fertility afterwards. In just eight years Belarusian TFR fell from 2.03 (in 1989) to 1.23 (in 1997). The

[3] For countries that did not have detailed fertility data by order of birth, including Belarus, they applied a simplified Bongaarts and Feeney (1998) formula using conventional TFR and mean age at childbearing (MAC) for all births:

$adjTFR(t) = TFR(t) / (1 - r(t))$ where $r(t) = [MAC(t+1) \; MAC(t-1)] / 2$

speed of the decline exceeded that of any of the more developed European countries, and the fact that the fertility rate remained under 1.5 for over 14 years has become a defining feature of population dynamics in Belarus.

The decline in TFR in the FSU countries during the 1990s coincided with the period of economic transition and transformation. Economic problems are among the most commonly cited reasons behind the fall in birth rates: a sharp drop in GDP following the transition reduced family incomes which led to a falling demand for children. Economic uncertainty and increased job insecurity might have also led Belarusians to delay or forgo children as this has been observed over the past few decades across the European Union (Adsera 2005), in Germany after the reunification (Bhaumik and Nugent 2005; Kreyenfeld 2005), and in Russia during the transition (Kohler and Kohler 2002). Rising childcare costs could have also depressed fertility as many public daycare facilities and kindergartens either became commercial or disappeared (Kumo 2009). Childcare costs are expected to create an especially strong conflict between work and childrearing in the FSU country with traditionally high female labor force participation. Several studies on fertility in the FSU countries emphasized the importance of reduced economic activity and incomes that accompanied the economic transition (e.g., Kohler and Kohler 2002; DaVanzo and Grammich 2001). Yet other studies pointed at the timing effect on births from the expansion of pronatalist policies in the FSU in the 1980s, which resulted in depressed fertility in the early 1990s (e.g., Zakharov and Ivanova 1996).

The decline in fertility and the aging of the population have become a major policy focus for many countries where the shrinking workforce is projected to strain economic growth, and pension and social security programs. Several countries facing low birth rates implemented fertility policies that use the assumed relationship between economic variables and fertility. Lindo (2010) provides a review of the current pronatalist policies in more and less developed countries.

In Belarus the link between low fertility and population ageing is especially pronounced. Unlike in Western Europe, where population aging resulted mostly from an improvement in longevity, low fertility in Belarus has been the main determinant of the growing proportion of the elderly (Grigorieva 2009) and has been the main factor of the natural population decline after 1992 (see Figure 2). It is considered a major threat to the demographic security of Belarus followed by high adult mortality (Shakhotska 2006; 2007). According to the 2009 Census, the population of Belarus shrank by 5.5% in 10 years. With the current rate of childbearing, the population is estimated to shrink to about half of its size by 2050 (Shakhotska 2007). Furthermore, the share of population aged 60 and above is projected to double, and will almost reach the proportion of those of working ages by 2050 (Grigorieva 2009).

{Figure 2 here}

After the population of Belarus had started to decline in 1992 following the drop in fertility, the government introduced several measures to halt the decline. In the 1990s, the government family policy was considered as a tool of preventing poverty among households with children: childbirth and childcare allowances were paid at a fixed rate per child and were not intended as incentives to increase childbearing (Gasyuk and Morova 1995). Recently, the childbirth allowances were increased and transformed into a tool of promoting births: in 2007 the childbirth allowance was differentiated by parity and increased to BYR 1.5 mln (approximately USD 500) for the first child and BYR 2.0 mln (USD 625) for the second and each subsequent child. Currently, the Belarusian Ministry of Labor is developing a strategy for stimulating second births, within a complex of measures under the National Program of Demographic Security (NPDS) for 2011-2015.[4]

{Figure 3 here}

It is hard to say whether the government incentives were responsible for the rising fertility rate after 2004 (see Figure 3) or whether something else was affecting fertility concurrently (e.g., changing social norms, rising incomes, reduced economic uncertainty). It is important to understand how economic factors influence fertility in Belarus in order to evaluate the consequences of policy interventions, and in order to forecast fertility trends.

The factors behind fertility decline in Belarus are likely to be very different from those in the more developed European countries. But so far, quantitative research on the determinants of childbearing in Belarus has been limited to cross-tabulations and has only been descriptive without attempting to disentangle the independent influence of various factors, or to establish the causal effect of economic factors on fertility (e.g. Shakhotska 2007). The paucity of fertility studies on Belarus is in part due to the lack of data: many other studies looked at fertility in Russia with the use of the Russian Longitudinal Monitoring Survey (RLMS) (e.g., Kohler and Kohler 2002; Grogan 2006; Kumo 2009), and in Ukraine with the use of the Ukrainian Reproductive Health Survey (URHS) (Perelli-Harris 2005) and the Ukrainian Longitudinal Monitoring Survey (ULMS) (Perelli-Harris 2008b). To the best of our knowledge, Belarus does not have comparable panel surveys or retrospective fertility surveys. The population census and the Belarusian Household Budget Survey (BHBS) are not designed specifically for studying the determinants of fertility at the individual level. Many findings for neighboring Russia and Ukraine can be applied to study fertility in Belarus because of the similarities in economic and fertility experiences. However, Belarus is usually considered a special type of economy among the FSU countries. Importantly, the pace of

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[4] See the project of the Concept of the National Program for Demographic security of the Republic of Belarus for 2011-2015. Available at http://un.by/pdf/bezopas.docx , accessed on 01.26.2011.

market reforms was much slower in Belarus than in most of the FSU countries including Russia and Ukraine[5] (Brixiova and Volchok 2005) and it historically had a higher educated and skilled labor force (World Bank 2007). Further, the most recent fertility data used in the quantitative analysis of births in the most comparable states was from 2002 in Ukraine (Perelli-Harris 2005) and from 2004 in Russia (Kumo 2009). This makes it impossible to understand the trend in the most recent years when fertility rate was growing in all of these countries. We address these limitations by using the most recent micro-data from BHBS for the period 1995-2008.

The remainder of this paper is structured as follows: section 2 describes the data, the construction of the demographic and the economic variables and the estimation methodology, section 3 describes the results, and section 4 puts the results in perspective and offers a concluding discussion.

2. Methods

Data

Our empirical analysis focuses on births in 1996-2007 by using the Belarusian Household Budget Survey (BHBS), also referred to in the literature as Belarusian Household Survey of Income and Expenditure. BHBS was initiated in 1995 and a nationally representative sample of approximately 5,000 households and all their members was interviewed every year. BHBS is considered to be the most reliable and comprehensive source of micro-data in Belarus. Although the primary goal of the survey is to record various sources of income and types of expenditures, it also has detailed demographic and socio-economic information, as well as information on self-assessed health status and smoking that are

[5] Belarus was the only post-soviet country that reversed market reforms in favor of a centrally planned economy in the 1990s. According to the index of structural reforms in the year 2000, Belarus was not even considered a transition economy (Aslund 2002, p. 246). Belarus remains among the least reformed among the European FSU countries and has a very closed economy, tight government control and very a small private sector.

relevant to the analysis of fertility. The survey questions changed only slightly over the years and the majority of questions and codes are comparable across years.

The information on fertility can be obtained in each year from the questions about the number of children a woman had in her lifetime and the age at first birth (in years). Since every member of a household was included in the survey, it was also possible to determine the presence of 1 y.o. children and match them to mothers residing in the same household by using women's fertility variables. [6] Appendix Table 1 contains the description of the steps involved in determining which women gave birth to the 1 y.o. children living in the same household for the analyzed sample.[7] As demonstrated in Figure 4, TFR level and trend constructed from the BHBS are very close to the official level and trend (World Bank 2010) during the analyzed years. The discrepancies may be due to a measurement error or the sampling procedure. Provided that the total fertility based on BHBS uses a sample of the population, rather than vital registration data, having some differences should be expected.

{Figure 4 here}

Measures and Methods

Our primary interest is in investigating whether economic conditions, such as income, wage, and economic uncertainty, have an effect on fertility after accounting for other important demographic covariates. Our analysis employs cross-sectional yearly data from BHBS to study the economic determinants of births by using information on women with 1 y.o. children. The analysis focuses on women between the ages 15 and 44, in which almost all of the childbearing takes place. Because individual-level covariates were measured after the

[6] Using information on children who were 1 y.o. at the time of survey yielded a better match of fertility rates to the official birth data from World Bank (2010) compared to using children who were 0 y.o. In addition, using information on the live children does not impose a substantial restriction on birth data since infant mortality in this period was very low. Furthermore, not accounting for multiple births should not bias the results either given their low number.

[7] We have checked how sensitive our empirical estimates were to the imputation. The qualitative results in Table 1 did not change, and the estimates changed their magnitude and significance slightly only after we used the most stringent imputation procedure by assigning child to the only woman in the household who reported having had a child (i.e. only using imputation step 0 in Appendix 1).

birth took place, we rely on a synthetic cohort approach and make several assumptions in order to come close to identifying the causal effect of economic factors on fertility. We estimate the following model using probit regression:

$$\Pr(birth_{ig}) = \alpha + \beta_1 \overline{X}_g + \beta_2 Z_{ig} + \varepsilon_{ig} \qquad \text{(Equation 1)}$$

where the dependent variable is a binary indicator of giving birth (for all births, and separately for the first, the second, and the third birth). Our independent variables consist of two types: average economic characteristics within woman's 5-year age, region and education group g measured at the time of conception of the 1 y.o. (i.e. two years before the survey year), $\overline{X}_g$; and actual individual-level characteristics that are unlikely to change over time, measured at the time of the survey, Z_{ig}. Group-level variables in $\overline{X}_g$ include average monthly earnings of a woman and its square, average monthly household income and its square, standard deviation of the monthly household income, average pregnancy and maternity benefits, childcare benefits and the percentage of employed women. By using the standard deviation of household income within a narrowly defined group (year-age-education-region), we hope to provide a reasonable approximation to the individual-level uncertainty experienced by the families.

Estimating the causal effect of men's and women's earnings on fertility is complicated by the endogeneity of earnings (Hotz et al. 1997). Third factors that affect individual's earnings potential, such as health or preference for family, could also affect family formation and fertility decisions. At the family level, fertility may be closely related to other lifetime choices of parents, such as the amount of time allocated to work, the investment in the human capital of children, and saving to smooth lifetime earnings. Estimation techniques that do not account for these factors lead to biased estimates. In order to give the coefficients on economic variables a causal interpretation and to deal with the measurement error, our empirical strategy is to use group averages of economic variables measured at the time of conception. While group-level earnings are likely to be correlated with the individual-level earnings, the group-level earnings are unlikely to be influenced by the earnings of any particular individual provided that grouping is done at a sufficiently aggregate level. An additional advantage of using group-level earnings instead of the individual-level earnings is that we do not have to deal with the sample selection issue of only including workers who reported earnings[8]. Thus, the average earnings in our regressions can be interpreted as the earnings a woman can expect to earn given her characteristics, and thus are a reasonable proxy for the theoretical opportunity cost of childbearing.

For woman's earnings we used average net monthly earnings. Household income was measured using total household expenditure, which is considered to be a better measure than total household income due to frequent under-reporting of income in transition countries, where the share of informal sector is large (see discussion in Milanovic 1998). Household expenditure was adjusted for the household composition by using the OECD equivalence scale.[9] For pregnancy and maternity benefits we used the survey item "Maternity benefits, benefits for women registered within 12-week pregnancy period, benefits for those who look after the disabled/elderly, burial, lump-sum payments related to the termination of work and other local authority benefits". We believe that this variable mainly captures pregnancy and maternity benefits. For childcare benefits we used the survey item "Postnatal allowance and benefits for care of children under 16(18)".

We include the standard deviation of income as a measure of income uncertainty in the fertility equation, because micro-economic theories of demand for children predict a negative association between economic uncertainty and fertility (Becker 1991; Easterlin and

[8] This is not a big issue in case of Belarus, where an unusually high employment ratio among women is the result of the Soviet legacy and the labor hoarding practiced in the state-run enterprises that are the major employers in the country. This is confirmed by the fact that 76 percent of women in the analysis sample were employed.

[9] We used the so-called "OECD-modified" equivalence scale adopted by the Statistical Office of the European Union (EUROSTAT) in the late 1990s. It assigns 1 to the household head, 0.5 to each additional adult member and of 0.3 to each child under 19 (Hagenaars, de Vos and Zaidi 1994).

Crimmins 1985). These models imply that during an economic crisis that leads individuals to lose jobs involuntarily or to expect a job loss, the pressure on the family's income or expected income leads the family to delay or forego having a child. Economic uncertainty that resulted from the economic crisis is considered to be a major cause for the "lowest-low fertility" in the FSU countries (Kohler, Billari and Ortega 2002; Macura 2004; Perelli-Harris 2008). This literature argues that macro-economic instability results in financial uncertainty at the individual level, which in turn leads to delay of marriage and fertility due to the individuals' pursuit of higher education and attempt to secure a steady job. Economic uncertainty may also lead a family to postpone or forego higher-order births if it causes the family to downgrade their outlook regarding economic resources (Philipov 2002; Perelli-Harris 2005).

Individual-level demographic controls in Z_i include year dummies, 5-year age group dummies, number of children a woman had and its square, a dummy for being single, and age at first birth (in the models for the second and the third birth). Other socio-economic controls measured at the individual level include a residence ownership dummy, living area of the dwelling, a woman's education dummy, regional dummies (including Minsk), a rural dummy, a poor health dummy, dummies for smoking and practicing sports. The dummy for poor health could in part capture problems with reproductive health. Smoking is recognized to have a negative impact on the ability to become pregnant and carry a pregnancy to term (see reviews in Augood et al. (1998), Speroff et al. (2004)). We also include three educational categories: below secondary, secondary, and university education.

3. Results

Descriptive analysis

Belarusian TFR declined in the 1990s, stagnated between 1997 and 2004, and gradually recovered thereafter. One is tempted to ask whether the economic transformation was responsible for the sharp drop in fertility at the beginning of the transition to the market economy and a gradual recovery from 2005 onwards. Between 1989 and 1997 Belarusian GDP per capita plummeted (Panel A of Figure 5) along with real incomes. Since 1998, macro-economic conditions have improved and the continuous growth of GDP per capita could have helped to stabilize and to later increase the fertility rate (Panel A of Figure 5).[10] However, the relationship between average real income and fertility appears much weaker in Belarus compared to Russia and Ukraine (Panel A of Figure 5), which suggests that other factors might have exerted greater influence on fertility in Belarus. Annual per-capita GDP[11] and TFR followed a similar path up until 1999 (correlation coefficient 0.92) but the relationship broke down after 1999 (correlation coefficient only 0.67).

{Figure 5 here}

While the correlation between general economic growth and fertility does not appear strong overall, the classical models of demand for children (Becker 1960; Mincer 1963) suggest the need to separate the wage of wife and the household income (usually measured using the husband's earnings). These models view children as durable goods in the utility function of parents. While household income is usually assumed to cause higher demand for children, higher women's wages are associated with both increased household income and increased time cost of children, thereby having offsetting income and substitution effects on the demand for children. Usually however, the observed association between family income and fertility is negative in both cross-sectional ad time-series data. Trying to reconcile this phenomenon with the neoclassical fertility theory and the assumption that children are normal goods, Becker and Lewis (1973) and Willis (1973) assumed that parents view the human capital of their children (child quality) and the number of children (child quantity) as

[10] The computation of the real GDP per capita in Belarus might be distorted due to the limited applicability of the usual methodology to compute GDP deflator to the economy with regulated prices (see discussion in Zlotnikov 2011).

substitutes by incorporating an interaction between child quality and child quantity into the parental budget constraint. Assuming that the income elasticity of child quality is greater than that for quantity helped to explain why parents have fewer children (of higher quality) as income rises.[12]

The positive relationship between fertility and per capita income in the 1990s in Belarus is consistent with the prediction from the neoclassical theory if income effect dominates the substitution effect. However, this positive correlation is itself surprising, given that the data for European countries for the last 150 years only showed negative correlation. And while the data for Belarus does not show a consistent relationship between TFR and GDP after 1999, the relationship continued to be positive in the other neighboring transition countries (Russia and Ukraine, panel A of Figure 5), making fertility during transition an interesting object of study.

Panel B of figure 5 looks at the trends in male and female wages separately. The only available data on earnings and income measures come from BHBS, which starts from 1995. Both male and female monthly wages had very similar levels and followed very similar trends (possibly as a result of administrative wage determination in Belarus), with gender wage gap increasing slightly between 1996 and 2008. All income measures are one-year lagged to match the year of conception, so they were actually measured in 1995-2007. There does not appear to be a consistent relationship between either of the wage series and the TFR during this period. The lack of a clear relationship could be due to omitting other important factors (e.g. female employment rate) or the need to look at separate components of the TFR. Total monthly household expenditure and income are not consistently related to TFR either (Panel

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[11] Per capita GDP was lagged by one year in order to correspond to the year of conception of births used in the calculation of TFR.

[12] In addition, Jones et al. (2008) demonstrated that the models that incorporate parental time into the production function for children can also generate a negative relationship between husbands' earnings and fertility even without requiring husbands' time in the production of children. For example, assortative matching can lead couples with high-earning husbands to have low fertility. Alternatively, increasing value of time in non-market

C of Figure 5). The standard deviations (used as a measure of volatility) of income and expenditure also do not exhibit a consistent relationship with the TFR.

{Figure 6 here}

In order to explore the hypothesis that fertility decline during the 1990s was driven by the convergence of social norms of childbearing in Belarus towards those that prevail in the OECD countries, we have plotted mean age at first birth (MAFB) in Figure 6. Under the changing social norms hypothesis, fall in fertility in the 1990s should coincide with (and result from) the delay of first births and rising MAFB. First, we calculate period MAFB using data from BHBS. Figure 6 suggests that between 1988 and 1999, the period MAFB ("period all", i.e. computed for all women) stayed between 22.4 and 23 years.[13] Period MAFB declined slightly in the late 1980s, possibly due to the Soviet pronatalist incentives that encouraged early childbearing (Zakharov and Ivanova 1996; Perelli-Harris 2005). However, period MAFB was slightly increasing after 1999, reaching 23.7 in 2006. While the BHBS data after 2006 was not used to calculate MAFB, according to TransMONEE database, period MAFB continued to increase after 2006, reaching 24.2 in 2007 and 24.4 in 2008.

Period MAFB may not reflect the actual MAFB because the survey asks women about their first birth up to the age in the last calendar year, resulting in a truncation of birth histories for the younger women. In order to reduce the effect of truncation, we have plotted MAFB line for the first births that occur under the age of 31 in any given calendar year ("period < 31"). This line is very close to the aggregate period MAFB, suggesting that the number of first births after age 30 is not significant in Belarus. On the other hand, cohort MAFB ("cohort all"), computed over women's entire life for women who are 30-44 years old at the time of the survey, suggests that MAFB was slightly increasing for older birth cohorts

activities as a function of husbands' earnings may lead parents to substitute time-intensive goods (children) with money-intensive goods.

(aged 30-44 between 1986 and 1993), was stable for the subsequent birth cohorts (between 1993 and 2002), and was slightly increasing after that. In order to reduce the effect of truncation from not accounting for the first births to the older women, we have provided MAFB under the age of 31 only ("cohort < 31"), regardless of the age at the time of the survey. This MAFB shows a monotonic trend towards slightly younger childbearing. While an increasing share of the younger women might be delaying first births past age 30, it seems unlikely that this share is big enough to raise the period or cohort MAFB substantially for the later calendar years or the later cohorts. Therefore, the fall in birth rates during the 1990s and the increase after 2004 has little to do with the transition of Belarus towards the European pattern of childbearing, and has more to do with the timing and the number of births of higher parities. Furthermore, because 89% of women had children before age 25 and 92% of women had children before age 30 between 1995 and 2008, first birth appears to be a nearly universal phenomenon and there is not much variation in its timing despite big social and economic changes during this period. Therefore, our analysis also examines the determinants of the second and the third births, which are more likely to be amenable to the economic conditions.

Descriptive statistics for the analysis sample appear in Table 1. 40,126 women were at risk of giving birth during the analysis period. Out of these, 14,499 women were at risk of first birth, 10,974 were at risk of second birth, and 11,976 were at risk of third birth. The residual number of women who were at risk of birth of the fourth or higher parity was only 2,677, suggesting that having three or more children is very rare in Belarus. Out of 849 first births in the sample, only 90 first births were conceived at age 30 and above. The rest of the descriptive statistics refer to the years 1995-2006, which is when the sample births were conceived. Average monthly female wage was 79.3 constant 2008 USD, while average monthly household expenditure was USD 138.5 during the analysis period. The analysis

[13] This is consistent with the UNECE Gender Statistics (http://www.unece.org/stats/gender/), which reports that the age at the first birth in Belarus was increasing very slowly, from 22.9 in 1990 to 23.3 in 2000 and is one of

focuses on the 15-45 year old women, who conceived 1,630 children between 1995 and 2006. The average age at first birth was close to 22 years.

Multivariate analysis

The results of estimating equation 1 using probit regression are presented in Table 3. Estimation was done for all births, and separately for the first, the second and the third birth. All regressions were run separately for the 15-29 and the 30-44 year old women in order to allow the effect of demographic and socio-economic factors to differ between these age groups. Only women who are at risk of giving birth of a given parity were included in the regressions.

Turning to the results of the regression analysis, the demographic variables such as female age, age at first birth, number of children, and dummy for being single all had the expected signs and were significant in most of the specifications. As expected, the rural dummy shows that the probability of having a birth was higher in the rural area. Housing arrangements were significantly associated with the likelihood of giving birth, however the sign of this association differed by parity and by the age of the woman. Ownership of dwelling and its living area were negatively associated with having a first child among the 15-29 year olds. This suggests that first births are more prevalent among people who have an unstable housing tenure and could be an indicator of economic disadvantage. The negative coefficient on home ownership is also present for the third births among the 30-44 y.o. women. However, this result is reversed for the second births, which are positively associated with the home ownership among the 30-44 y.o. and with the larger living area among the 15-29 y.o. women. Variables related to health were consistently significantly associated with the childbearing. Woman's evaluation of own health as "Bad" or "Not very good, but not bad"

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the lowest in the region (Pastore and Verashchagina 2008).

(relative to “Very good ” and “Good”) was associated with significantly lower probability of giving birth of any parity and across all age groups (except for the third births among the 30-44 y.o.). Women who practiced sports had on average lower probability of having a birth. Practicing sports and involvement in physical fitness have been linked to amenorrhea and infertility in women (Backer 1981; Noakes and Van Gend 1988). Smoking showed the expected negative association with having a first child among the 30-44 y.o. women, and with having a second child among the 15-29 y.o. women. After accounting for other factors, higher educational attainment (secondary or university education relative to less than secondary) among the younger women showed an unexpected positive association with having the first child and the expected negative association with having the third child. The unexpected positive coefficient in case of the first birth was due to the fact that the regression compared young women still in high school to older women who had a chance to complete secondary education: the unexpected coefficient disappeared (became small and statistically insignificant) after the sample was restricted to ages 20 and above.

Economic variables, which were measured as group averages at the time of conception, exerted significant influence on fertility. Total household income had a significant and non-linear effect on births, which also differed by age of the woman and by parity. Higher income led to a higher probability of a second birth among the younger women, and a lower probability of first and third birth among the older women: a 100 dollar increase in per capita monthly income led to a 6.8 percent increase in the probability of a second birth among the 15-29 y.o. women, to a 6.2 percent decrease in the probability of a first birth among the 30-44 y.o. women, and to a 0.6 percent decrease in the probability of a third birth among the 30-44 y.o. women. The positive effect of household income found among the younger women fits with the classical economic model of fertility, where, if a child is viewed as a normal good, higher income leads to higher fertility. On the other hand, the negative effect on fertility observed among the older women can be explained either using the quantity-quality framework, where parents invest in child quality instead of child quantity if their income increases (e.g., Becker and Lewis 1973), or using other explanations based on assortative matching of parents or the assumption that the value of time in non-market activities is increasing in husbands' earnings (for a discussion, see Jones et al. 2008). Further analysis is necessary in order to discriminate among these competing explanations. Female wage did not have a significant effect on birth probability, except for the expected negative but only marginally significant effect on second births among the younger women.

There was a strong response of fertility to economic uncertainty: increase in household income volatility by 1 standard deviation led to 2.2 and 0.8 percent decreases in the probability of giving birth among the younger and the older women, respectively. The analysis by birth parity revealed that this response was confined to the second births among the younger women and the third births among the older women. Maternity benefits were associated with a lower probability of first birth among 30-44 y.o. women. This is likely a result of sample selection, i.e. women who plan to have a child and face higher maternity benefits have it at the age of 15-29, and those who are still at risk for the first child after age 30 comprise a very selected group of women with unusually low fertility or who have problems with fecundity. Unfortunately, there is no question in the survey that would ask about fertility expectations or reproductive health of a women or men. On the other hand, higher maternity benefits resulted in higher probability of having a second child at the age of 30-44. Higher childcare benefits raised the probability of having the first child at all ages, with no effect on the second or the third child.

4. Discussion and Conclusion

In this paper we analyzed several hypotheses about the potential determinants of recent trends in fertility in Belarus, with a focus on the economic factors. Our analysis revealed the importance of some previously unexplored economic determinants after holding the salient demographic and socio-economic factors constant. In particular, we found household income to positively affect the fertility of younger women and negatively affect the fertility of older women. We also found these effects to differ by birth parity. In addition, we confirmed that income uncertainty plays an important role in fertility decisions, with the effect confined to the second and the third births. We also found that fertility is amenable to maternity and childcare benefits. These results are in contrast to the recent literature on the determinants of fertility in Russia (Kumo 2009; Roshina and Boikov 2005) that did not find a significant effect of economic factors on fertility after accounting for the usual demographic controls. The lack of effect of economic factors in these studies could be due to the limited number of the economic variables used, the endogeneity of income and wages that were measured at the individual level, or the failure to consider the differential effect of these factors on births of different parities. Careful analysis of the specifics of the childbearing process, such as the nearly universal childbearing and young age at first birth in transition countries, should precede and inform the formulation of the empirical specification.

Our findings can aid in formulating specific recommendations for demographic policies in Belarus, and in other countries with similar experiences. In particular, our findings support the policy of stimulating primarily higher order births (second and third) in an attempt to raise fertility. We confirmed that first births are ubiquitous in Belarus, with almost all women (89%) having first birth before the age 25 and with average age at first birth being low (22-24 in 1995-2006). We found that the reduction in fertility during the 1990s and increase in fertility after 2004 were primarily a result of changes in the number of second and third births. The emphasis of the Belarusian demographic policy (as outlined in NPDS) on economic incentives is consistent with our findings that the childbearing in Belarus after 1995 was significantly influenced by economic factors. Our estimates imply that raising standards of living of young families will likely result in higher fertility. The estimates also suggest that policy measures increasing job and income stability especially in the families with younger women will likely result in higher fertility. Higher maternity benefits are projected to lead to higher second births among the older women, thus supporting the focus of NPDS on stimulating higher-order births. On the other hand, it seems unlikely that increasing childcare benefits within the current system can be successfully used to stimulate childbearing. Large increases in the benefits are necessary to increase fertility rate significantly. The finding of lower fertility among single women compared to married women implies that raising marital rates would indirectly result in higher fertility. Finally, our findings for health measures justify the NPDS policy towards strengthening reproductive health of the population.

An important innovation of our study is the combination of cross-sectional survey data with group-level economic variables in a micro-level study of the conditional probability of giving birth. This empirical framework can be applied to study the effect of economic factors on fertility in other settings, especially when the retrospective fertility questionnaires or panel data are not available. An important limitation of our analysis is that we consider only the short-term effect of economic fluctuations on the contemporary fertility decisions. The effect of income and wages on current fertility should be studied by considering a full history of earnings and the expectation of earnings in each future period (Hotz et al. 1997). While the inclusion of several lags and leads of earnings did not yield significant coefficients (results not reported), future studies using other measures should come up with better tests of the predictions from the dynamic fertility model (Hotz et al. 1997).

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Table 1. Total fertility rates, tempo-adjusted total fertility rates and estimated tempo effect for Belarus.

Year, t	TFR, t	adjTFR, t-3 to t-1	Tempo effect
2004	1.20	1.44	-0.24
2006	1.29	1.47	-0.18
2008	1.42	1.47	-0.05

Source: European Demographic Data Sheets, 2006, 2008, and 2010.
Note: adjTFR is calculated as a mean for the corresponding three-year period.

Table 2. Descriptive statistics of the analysis sample

Variable	Mean	SD	Min	Max	N
Any birth	0.04	0.197	0	1	40126
First birth	0.057	0.232	0	1	14499
Second birth	0.05	0.218	0	1	10974
Third birth	0.011	0.104	0	1	11976
Female wage (avg.)	0.793	0.618	0.014	3.896	40126
Female wage sq. (avg.)	1.266	2.076	0	19.998	40126
Household expenditure (avg.)	1.385	0.86	0.104	5.411	40126
Household expenditure sq. (avg.)	3.292	4.294	0.011	47.59	40126
SD of household expenditure	0.658	0.449	0	4.57	40126
Maternity benefits (avg.)	0.015	0.025	0	0.327	40126
Childcare benefits (avg.)	0.061	0.066	0	0.934	40126
Share employed women	0.664	0.324	0	1	40126
Rural	0.506	0.5	0	1	40126
Own dwelling	0.56	0.496	0	1	40126
Living area (sq. m)	35.951	13.775	4	270	40126
Bad health	0.06	0.237	0	1	40126
Sports practicing	0.026	0.16	0	1	40126
Smokes	0.012	0.111	0	1	40126
Single	0.49	0.5	0	1	40126
Year of conception	2000.405	3.463	1995	2006	40126
Brest voblast	0.148	0.355	0	1	40126
Vitsyebsk voblast	0.137	0.344	0	1	40126
Homyel voblast	0.154	0.361	0	1	40126
Hrodna voblast	0.117	0.322	0	1	40126
Minsk city	0.182	0.386	0	1	40126
Minsk voblast	0.145	0.352	0	1	40126
Mahilyow voblast	0.117	0.322	0	1	40126
Below secondary education	0.262	0.44	0	1	40126
Secondary education	0.566	0.496	0	1	40126
University education	0.173	0.378	0	1	40126

Age 15-19	0.175	0.38	0	1	40126
Age 20-24	0.159	0.365	0	1	40126
Age 25-29	0.148	0.355	0	1	40126
Age 30-34	0.152	0.359	0	1	40126
Age 35-39	0.172	0.377	0	1	40126
Age 40-44	0.195	0.396	0	1	40126
Has 0 children	0.366	0.482	0	1	40126
Has 1 child	0.275	0.447	0	1	40126
Has 2 children	0.296	0.457	0	1	40126
Has 3 children	0.048	0.215	0	1	40126
Has 4 children	0.014	0.118	0	1	40126
Age at first birth	22.022	2.644	15	42	40126

Source: Prepared by the authors based on data from BHBS.
Note: Estimates are weighted by the BHBS sampling weight. Monetary measures are in 100s of 2008 U.S. dollars.

Table 3. Determinants of childbearing in Belarus in 1996-2007, by birth parity and age group.

	Any birth		First birth		Second birth		Third birth	
	Age 15-29	Age 30-44	Age 15-29	Age 30-44	Age 15-29	Age 30-44	Age 15-29	Age 30-44
Female wage (avg.)	0.030	-0.000	0.046**	0.001	-0.078*	-0.008	-0.006	-0.001
	(0.022)	(0.004)	(0.021)	(0.019)	(0.042)	(0.015)	(0.020)	(0.006)
Female wage sq. (avg.)	-0.003	-0.000	-0.003	0.000	0.008	0.001	0.007	0.000
	(0.006)	(0.001)	(0.005)	(0.003)	(0.010)	(0.002)	(0.007)	(0.001)
Household income (avg.)	0.009	-0.006*	-0.005	-0.043**	0.059***	0.008	0.006	-0.006**
	(0.009)	(0.003)	(0.008)	(0.018)	(0.014)	(0.012)	(0.019)	(0.002)
Household income sq. (avg.)	0.001	0.002***	-0.001	0.002***	0.002	0.001	-0.006	0.001***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.000)
SD of household income	-0.021***	-0.007***	-0.005	0.005	-0.046***	-0.016	0.006	-0.006***
	(0.002)	(0.003)	(0.006)	(0.007)	(0.013)	(0.011)	(0.009)	(0.002)
Maternity benefits (avg.)	0.050	0.058*	0.029	-0.339**	-0.008	0.169***	-0.082	0.040
	(0.051)	(0.035)	(0.058)	(0.146)	(0.116)	(0.063)	(0.092)	(0.038)
Childcare benefits (avg.)	0.091***	-0.001	0.081***	0.090**	0.035	-0.022	0.024	-0.003
	(0.021)	(0.011)	(0.023)	(0.036)	(0.089)	(0.030)	(0.022)	(0.008)
Share employed women (avg.)	-0.023	0.005	-0.018	-0.002	0.025	0.023*	-0.012	-0.002
	(0.017)	(0.004)	(0.020)	(0.013)	(0.021)	(0.012)	(0.019)	(0.003)
Rural	0.014***	0.003***	0.007***	-0.001	0.033***	0.005**	0.001	0.002
	(0.004)	(0.001)	(0.002)	(0.006)	(0.007)	(0.003)	(0.005)	(0.001)

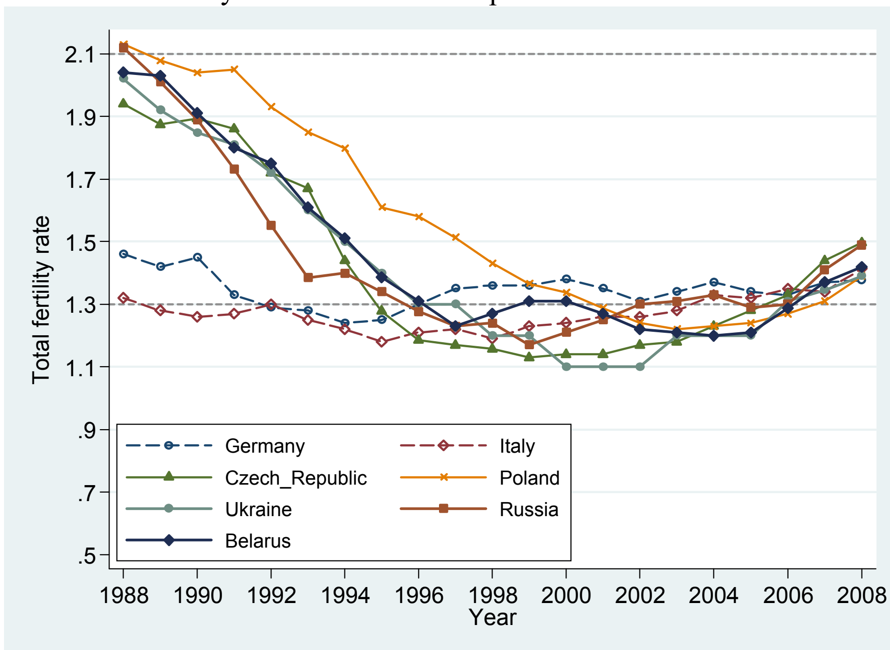
Own dwelling	-0.010***	-0.000	-0.009***	0.007	-0.012*	0.007***	-0.000	-0.004***
	(0.002)	(0.001)	(0.002)	(0.005)	(0.006)	(0.002)	(0.003)	(0.001)
Living area (sq. m)	-0.000*	-0.000	-0.001***	-0.000	0.001**	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bad health	-0.029***	-0.006**	-0.021***	-0.027***	-0.039***	-0.014***	-0.016***	-0.001
	(0.004)	(0.002)	(0.005)	(0.002)	(0.007)	(0.005)	(0.002)	(0.001)
Sports practicing	-0.027***	-0.004	-0.025***	-0.013*	-0.022	-0.017***	-0.013***	0.007
	(0.008)	(0.005)	(0.004)	(0.008)	(0.024)	(0.005)	(0.002)	(0.009)
Smokes	-0.016*	0.001	-0.007	-0.034***	-0.038**	0.006	0.006	0.004
	(0.009)	(0.004)	(0.013)	(0.006)	(0.015)	(0.009)	(0.020)	(0.008)
Single	-0.016***	-0.006**	-0.015***	-0.020*	-0.019***	-0.016***	-0.006*	-0.002
	(0.003)	(0.003)	(0.003)	(0.012)	(0.004)	(0.006)	(0.003)	(0.001)
Secondary education	0.017***	-0.003	0.026***	-0.008	-0.001	-0.006	-0.012***	-0.001
	(0.006)	(0.003)	(0.007)	(0.014)	(0.014)	(0.006)	(0.004)	(0.001)
University education	0.009**	0.000	0.027**	0.024*	-0.014	-0.003	-0.008*	-0.000
	(0.004)	(0.001)	(0.011)	(0.012)	(0.013)	(0.004)	(0.004)	(0.002)
Has 1 child	-0.026***	-0.007**						
	(0.003)	(0.003)						
Has 2 children	-0.042***	-0.024***						
	(0.001)	(0.004)						
Has 3 children	-0.036***	-0.009***						
	(0.003)	(0.002)						

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Has 4 children	-0.033**	-0.002						
	(0.013)	(0.004)						
Age at first birth					-0.007***	-0.001*	0.000	-0.000*
					(0.001)	(0.000)	(0.001)	(0.000)
Year dummies	□	□	□	□	□	□	□	□
Age group dummies	□	□	□	□	□	□	□	□
Voblast dummies	□	□	□	□	□	□	□	□
Observations	19268	20858	12899	1600	4750	6224	1443	10533
Pseudo-R2	0.089	0.13	0.12	0.13	0.055	0.10	0.12	0.12
Log likelihood	-4060.0	-1826.2	-2484.2	-298.3	-1165.0	-808.2	-184.2	-432.1

Source: Prepared by the authors based on data from BHBS.

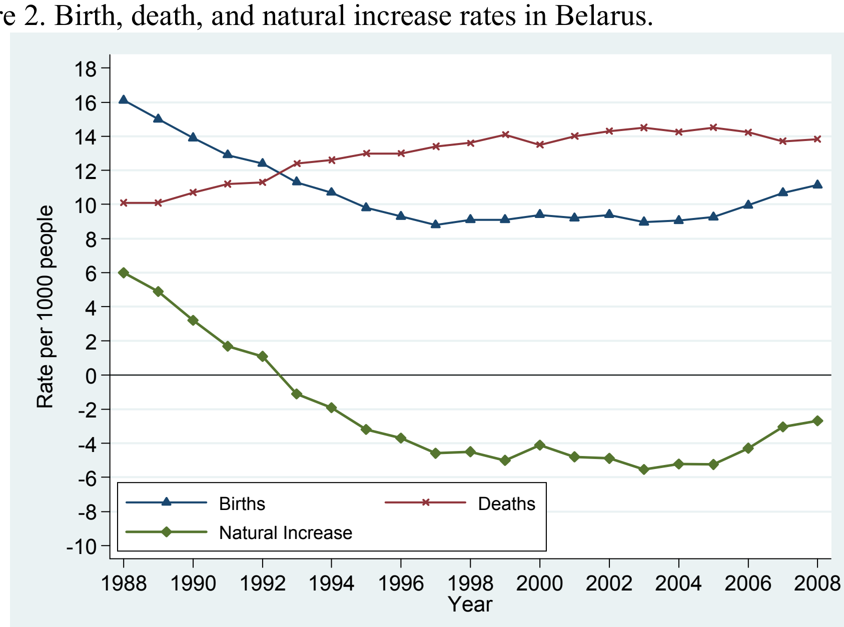
Notes: Significance: * p<0.1, ** p<0.05, *** p<0.01. Estimates in the table are probit marginal effects. For indicator variables, the omitted category is always the lowest category. Heteroskedasticity-robust standard errors, clustered by region, are in parentheses. Estimates are weighted by the BHBS sampling weight. Sample includes women aged 15-44 who are at risk of birth of a given parity.

Figure 1. Total fertility rate in selected European countries.



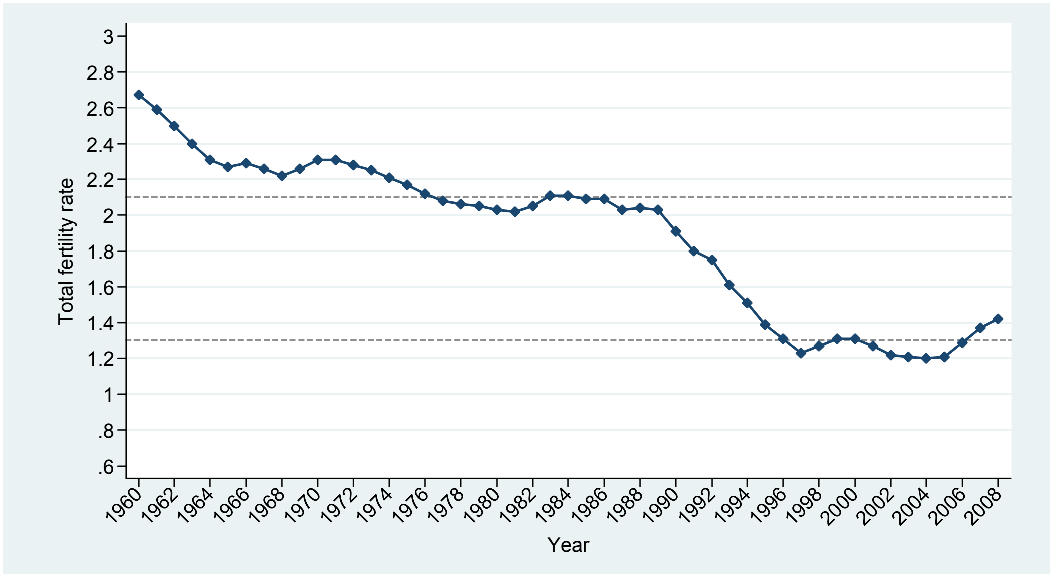
Source: Prepared by the authors based on data from World Bank (2010). Horizontal dashed lines indicate replacement level (2.1) and "lowest-low fertility" level of TFR (1.3).

Figure 2. Birth, death, and natural increase rates in Belarus.



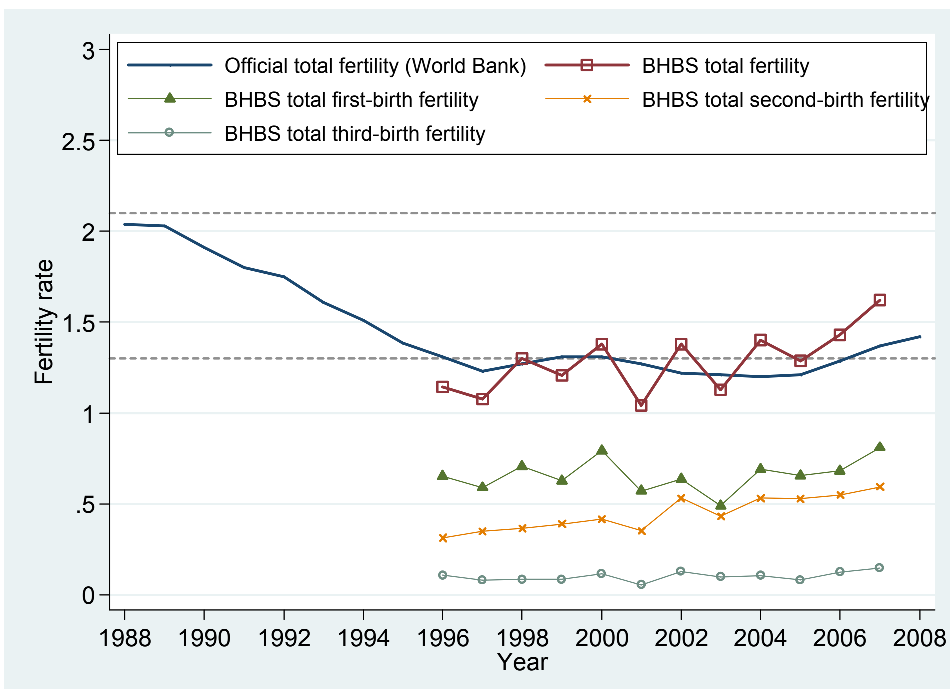
Source: Prepared by the authors based on data from World Bank (2010).

Figure 3. Total fertility rate in Belarus.



Source: Prepared by the authors based on data from World Bank (2010). Horizontal dashed lines indicate replacement level (2.1) and "lowest-low fertility" level of TFR (1.3).

Figure 4. Total fertility in Belarus according to the official data and according to the Belarusian Household Budget Survey (BHBS) data.

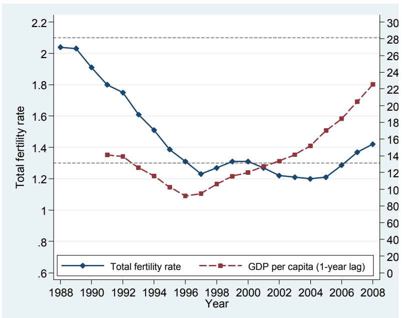


Source: Prepared by the authors based on data from World Bank (2010) and BHBS. Horizontal dashed lines indicate replacement level (2.1) and "lowest-low fertility" level of TFR (1.3).

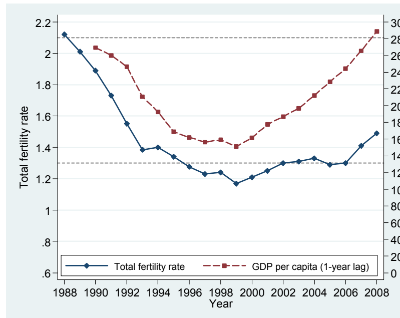
Figure 5. Income and TFR in Belarus, Russia, Ukraine (Panel A) and in Belarus (Panels B and C).

Panel A.

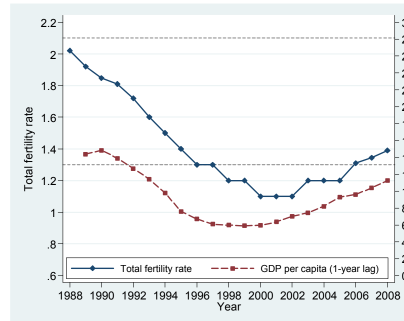
Belarus



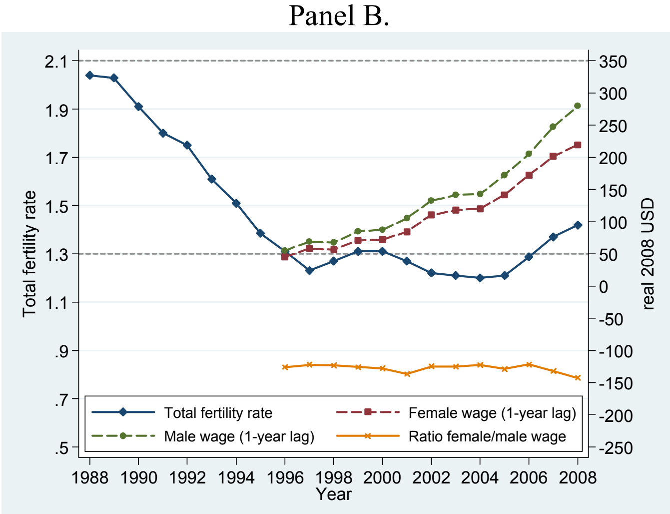
Russia



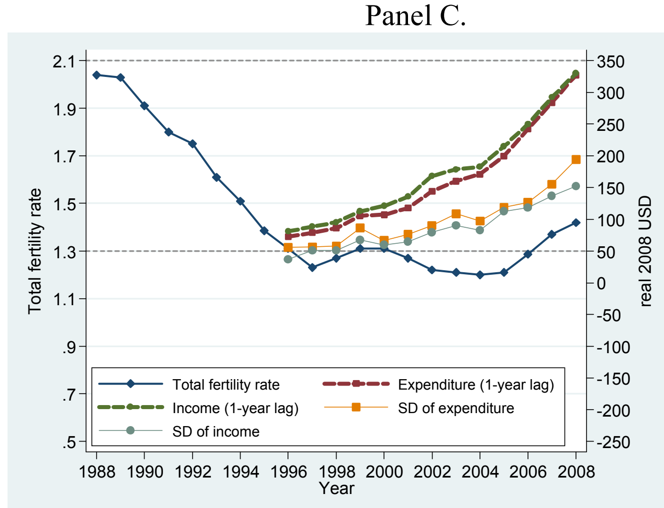
Ukraine



Panel B.



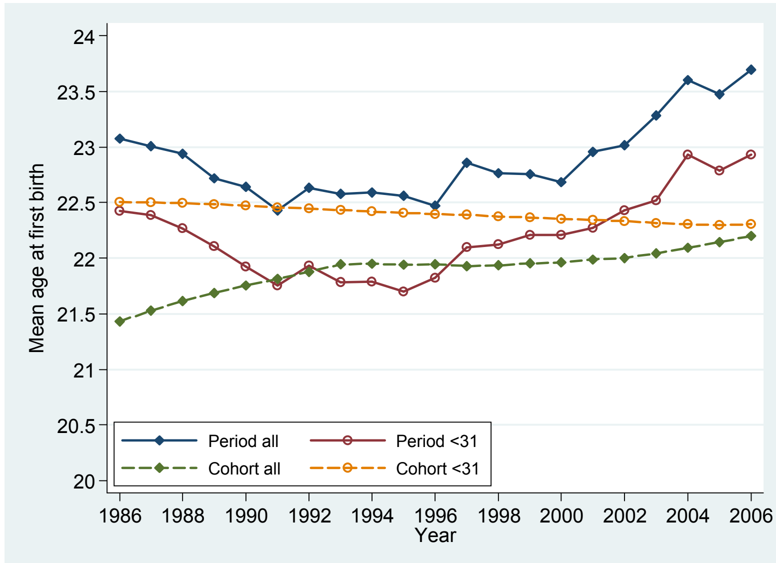
Panel C.



Source: TFR in all panels and GDP per capita in panel A are based on World Bank (2010) data. Wage and income measures in panels B and C are based on BHBS data. Horizontal dashed lines indicate replacement level (2.1) and “lowest-low fertility” level of TFR (1.3).

Note: Yearly GDP per capita appears in panel A Female and male wages in panel B are real usual monthly wages. Ratio of female to male wage in panel B uses the left-hand-side axis scale. Expenditure and income in panel C are usual household total expenditure and income divided by equivalence scales (see text for details about the equivalence scale). SD is standard deviation.

Figure 6. Period mean age at first birth (MAFB) and cohort MAFB for all women and for women age 30 and under in Belarus.



Source: Prepared by the authors based on data from BHBS.

Note: Points represent weighted averages across the 1995-2008 survey years computed for each calendar year indicated on the X-axis. The last two years of each survey were dropped from the computation in order to reduce noise from having low number of observations "Period all" shows MAFB for all first births that were given in this year. Period <31 shows the MAFB for all first births to women under the age of 30 in a given year. "Cohort all" is MAFB for women whose age at the time of a given BHBS survey ranges from 30 to 44. Cohort <31 shows the MAFB for births to women when they were under the age of 30.

Appendix 1 Appendix table 1. Assignment of 1 y.o. children to their mothers (analysis sample).

Imputation step	Freq.	Percent	Cum. Percent
0	1,376	84.42	84.42
1	50	3.07	87.48
2	192	11.78	99.26
3	12	0.74	100
Total	1,630	100	

Note: In step 0, children were assigned to the only woman in the household who reported having had a child. In step 1, children were assigned to the only woman in the household regardless of whether she reported having had children. In step 2, children were assigned to the only woman who reported having had birth within one year of the year of birth of the 1 y.o. child. In step 3, children were assigned to the only woman aged 20-40 who reported having had a child. This assignment procedure rendered a complete assignment of 1 y.o. to the mothers.