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Research Article

Post-transitional regional fertility in Romania

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Abstract

BACKGROUND
The slight variations in the main demographic indicators, particularly in fertility, recorded after 1995 suggest that the process of demographic transition has reached its final stage. Despite this stabilization at national level, significant differences in the evolution of fertility are found among the eight development regions of Romania.

OBJECTIVE
The aim of this article is to analyze empirically the specific dynamics of this phenomenon in relation to its main demographic and socioeconomic determinants.

METHODS
Using regional data registered between 1995 and 2015, pooled, fixed effects, and random effects panel models were applied.

RESULTS
Our empirical findings highlight that the variations in the total fertility rate are explained, at regional level and within the post-transitional demographic stage, by the changes in female employment rate, urbanization degree, real GDP per capita, marriage rate, and mean age of woman at first birth.

CONTRIBUTION
We consider that the study responds to a real need for research in this field and that the results may provide support for the development, in Romania, of demographic policy strategies at both regional and national levels.

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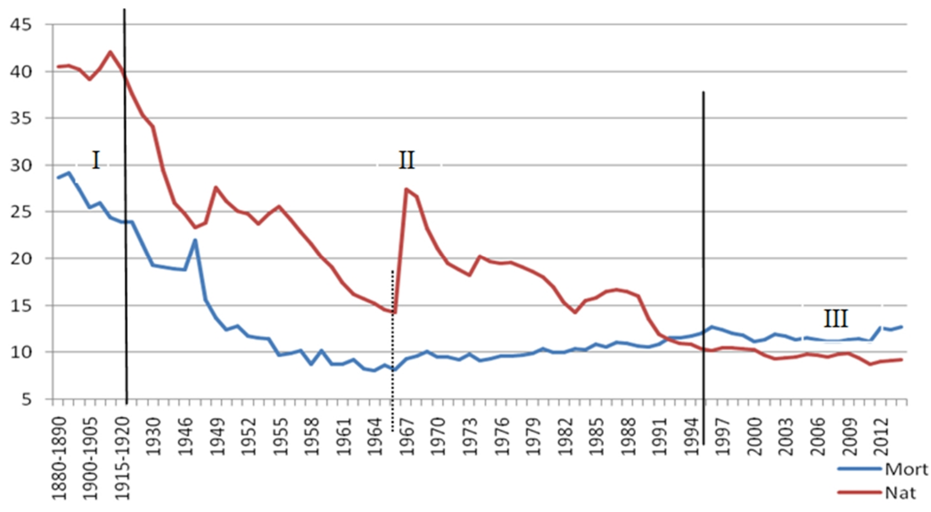
1. Introduction

The social, economic, cultural, and educational changes produced in Romania throughout its history have strongly influenced the structure of the population and the evolution of demographic phenomena, especially mortality and natality. Following a pattern similar to that of the European countries, Romania has witnessed a long-term fertility decline trend – characterized by significant variations – that lasted almost a century (see Figure 1). Based on the statistical analysis of the reconstructed data on birth and fertility in the Romanian population during the 1900–1960 period, demographer Retegan-Şerbu (1962) notes that the trigger of the declining fertility process started only after World War I (after 1920). However, we agree with the hypothesis developed by Gheţău (1997), according to which the fertility decline began as early as 1885, except for the 1910–1914 period, when a slight increase of the phenomenon was registered (see Figure 1).

Figure 1: Crude birth and mortality rates in Romania between 1880 and 2015



Source: Authors' computations based on data provided by the National Institute of Statistics of Romania (INSSE) and by Gheţău (1997).

From the beginning of the 21st century until World War I, natality registered a slow decline. Between the two world wars, fertility declined abruptly, reaching a level that was almost half of the early 21st century one. After World War II, more precisely between 1948 and 1956, similarly with other European countries, Romania experienced its own baby boom phenomenon. As a result, according to the model of the Western countries, in Romania fertility increased at an average rate of 3.23 children per woman, followed by a slow decline trend, a total rate of 2.9 children per woman being registered in 1956. In 1957, liberalization of abortion accelerated the process, leading to a rate of 1.9 children per woman by 1965.

The change of the communist regime leadership in 1965 also brought about a change in the demographic policy as part of a development project for the whole of society. The new general secretary of the party and, later, head of the state, Nicolae Ceaușescu, imposed the pronatalist policy. Under the effect of the law, the demographic policy measures on abortion prohibition, adopted at the end of 1966, had a very strong short-term impact. In 1967 and 1968, the total fertility rate registered was almost double, from 1.9 children per woman (in 1966) to 3.7 (in 1967) and 3.6 (in 1968). In social and demographic terms, the Ceaușescu period was important because the proposed development project led to the promotion of gender equality and to a specific family formation model and childbearing. The woman came to assume a double role, both as mother, responsible for the domestic space, and as active actor in the economic and social life. Despite such measures, the increase period was very brief, the total fertility rate coming back to its downward tendency. At the end of the communist period, a fertility rate of 2.2 children per woman was reached, which was approximately the same value as in the 1960–1966 period. The 1967–1983 period represented a parenthesis in the decline of fertility, which only appeared as a historical fact induced by the pronatalist measures of the communist regime. Practically, in 1983 a fertility level equal to the one of the year 1966 was reached, meaning that Ceaușescu's pronatalist policy delayed the fertility decline by nearly 20 years. After a final effort of the communist regime to encourage fertility in the early 1980s, the decline was resumed in the second half of the decade.

The decreasing fertility trend continued after the fall of the communist regime. The socioeconomic model underwent major restructuring, and the demographic changes were marked by these transformations. According to statistical data, fertility continued its past downward trend, started before the pronatalist policy (Rotariu 2006; Jemna 2011, 2015). Despite the pronatalist syncope that maintained fertility over the replacement threshold, the fertility decrease followed its downward course begun at the end of the 19th century. In 1990, fertility fell below the replacement threshold (1.84), and the decrease phenomenon continued by virtue of this long-term process. The fertility level relatively quickly reached very low values, well below the replacement threshold. After 1995, up to the present day, stability in fertility evolution, admitting fluctuations around an average value of about 1.3 children per woman, was recorded.

This evolution trend is not unique in Europe, corresponding to a pattern followed by the Central and Eastern European (CEE) countries characterized by a common historical past, marked by the communist period. The decrease of fertility up to very low levels, along with the increase of mortality, are specific to these countries, which explains why, after 1990, most of them registered negative natural increase rates, besides the negative migration ones. Over the last 25 years, the situation of Romania, as well as of the other CEE countries, corresponded to the end of a long-term process that led to a demographically inauspicious situation. Numerous studies devoted to such aspects, which attempt to explain the phenomenon and to identify the possible demographic policy measures, have often mentioned that the demographic and socioeconomic factors that could explain the post-1990 demographic changes should be analyzed in the specific context of each country in spite of their similar pattern in fertility evolution (Frejka 2008; Kohler, Billari, and Ortega 2002).

The present study discusses the hypothesis according to which some conditions specific to the demographic evolution are manifesting in each country. Analysis of the demographic changes observed at the level of CEE countries has allowed highlighting variations of demographic phenomena both among and within them. Regional demographic variability is an important issue in the context of regional development strategies at the European level. Specifically, we are talking about the analysis of the relationship between the demographic and the socioeconomic factors viewed as fertility determinants in a regional context. Despite a relative stabilization of the demographic phenomena at national level after 1995, Romania still registers a series of differences regarding the fertility level and evolution as well as some other demographic phenomena that should be considered for future demographic policy measures. Identification of the regions and of the counties among which the most pronounced disparities are registered, as well as of the causes of these demographic disparities, appear as very important and are current research objectives.

The eight development regions of Romania were established in 1998, in accordance with the second-level regulations of the territorial classification (NUTS 2) in force in the European Union (EU). At European level, special emphasis is placed on analyzing the regional economic, demographic, and social trends and differences on understanding the specificity of each region and on identifying specific local factors – which can be of economic, social, and demographic development nature. In this respect, studies on Romania are relatively few, the obtained results being largely based on the structural changes of the demographic system regarding the socioeconomic and demographic realities.

Based on such coordinates, in this study we aim to analyze empirically the specific dynamics of fertility decline, both in time and at regional level, in relation with the main determinants that explain the trend and the differences among the regions of Romania after 1995. We consider that this study corresponds to a real need for research in the field and that the results can provide support for the development of useful demographic policy strategies and measures.

The paper is structured as follows. Two sections are devoted to the analysis of specialty literature. Section 2 reviews some theoretical aspects on demographic evolution in the CEE countries, and Section 3 refers to a series of results obtained in empirical studies on fertility using panel data. Section 4 is dedicated to a synthesis of the evolution of fertility and of its determinants at regional level in the 1995–2015 period, while Section 5 presents the data and the methodology used in this study. Section 6 illustrates the main empirical results. The study ends with a series of concluding remarks, discussions, and references.

2. Fertility in CEE countries

The demographic changes in the CEE countries are of particular interest for at least two reasons: these countries follow a similar demographic phenomena evolution pattern within a historical context with similar characteristics; the fertility evolution has reached very low rates, well below the replacement threshold, and the phenomenon seems to persist, with some fluctuations over the past 25 years. The specialty literature has attempted at explaining these changes by proposing a series of theories based not only on the experience of these countries but also on the evolution in the countries of Western Europe, Asia, etc.

The demographic transition theory, formulated by Warren Thompson (1929) and Frank Notestein (1954), is the first theoretical explanatory framework on fertility evolution. This theory was analyzed and evaluated empirically in various socioeconomic and cultural contexts of the world. Overall, the demographic transition involves several closely linked basic processes: mortality decrease, population growth, urbanization, fertility decline, population aging (Dyson 2010). The manner in which these processes have been manifested in different areas has brought a number of criticisms and amendments to this theory. Among the criticisms of the demographic transition theory, two specific elements can be mentioned as more important: the final (post-transitional) stage of the process does not correspond exactly to the theory (especially as to the fertility level, which must be stable and close to the replacement threshold); the theory is unable to predict the fertility level after the end of the process. The lack of a general theory on fertility evolution, as the demographic transition theory could have been, has led to the idea of analyzing the demographic dynamics in different socioeconomic contexts and coming up with some explanatory theories that serve in such contexts (McDonald 2002).

For the CEE countries, several explanatory theories on demographic changes have been developed. Specialty studies have taken into account both the specificity of the communist regime and a number of characteristics of the socioeconomic transition period after the fall of the communist system. The CEE countries have a demographic regime marked by at least three determinants coming from the past: a probirth demographic policy, a centralized socioeconomic system, and an authoritarian political system (Frejka 2008). The communist period provided a relatively stable framework for family formation and childbearing, job security, free education and health systems, and low-cost housing. Moreover, within this system, an interesting model on both the economic and reproductive role of the woman has emerged. Based on pronatalist policies, the demographic evolution in the communist era delayed fertility – according to the past trend – for almost 20 years, and the process was resumed in the late 1980s. After 1990, fertility continued to decline, according to the previous trend, then reached a level of relative stability with low values, well below the replacement threshold. The fall of the communist system eliminated the favorable conditions for family formation and childbearing, replacing them with a number of restrictive features: job insecurity, expensive housing, labor market dynamics, etc.

In literature, fertility decline in the CEE countries is most often explained by two theories. One of them argues that demographic change is strongly determined by the socioeconomic transition process of these countries from the communist to the capitalist society type (Frejka 2008; Philipov and Kohler 2001; Kohler and Kohler 2002). From this perspective, some authors talk about a demographic transition crisis that led to a fertility decline well below the replacement threshold (Cornia and Paniccià 1996). This explanatory model considers that deterioration of the socioeconomic conditions and a certain amount of uncertainty at this level entails a rational response at demographic level that ultimately leads to fertility decrease. The second theory refers to the internalization of the Western value system in these countries: ideas, attitudes, and norms that give a specific demographic behavior type. To be more exact, we are talking about the internalization of the family formation and childbearing Western pattern, as stipulated by the second demographic transition theory (Sobotka, Zeman, and Kantorová 2003; Frejka 2008).

The second demographic transition theory is based on the idea of a significant relationship between the changes of the axiological system and the reproductive behavior. Consequently, we are witnessing a cultural change regarding family, sexuality, and reproduction. The theory is formulated by the contributions of authors such as van de Kaa (1987, 1996) and Lesthaeghe (1995, 1998). According to them, within the first demographic transition, the downward movement of fertility is explained by the replacement of the Malthusian fertility model with a family formation model that emphasizes the superior rank birth control (we are witnessing a shift from the natural fertility model to a controlled one). The defining element of the new theory is the transition of fertility in close connection with the changes in the value system of the Western world, in particular the replacement of the numerous family model with the narrowed family one, characterized by planning of child's birth, according to the parents' choices. In this regard, the fertility decline below the replacement threshold is explained by the increased contraception use, by the abortion legislation change, by the low marriage rates, by the increasing divorce rate, and by a higher consensual union level. Marriage rate decrease is related to the prolongation of the schooling period for women, which determines an age increase at marriage. Moreover, fertility decline also coincides with a massive economic and social restructuring, especially in gender relations. Men have lost their economic power in relative terms, while women, by massively entering the labor market, have had the tendency to earn more money and to gain economic and social independence (Lesthaeghe 1998). Within the second demographic transition, two more important components explaining the downward movement of fertility are distinguished. First, the significant and long-lasting decline in fertility is the result of the economic, social, and cultural factors relevant to the modernization process of societies. Second, fertility evolution below the replacement threshold is caused by postponing the birth of the first child, which leads to the general increase in the mean age of mothers at the birth of the child, or even to the abandonment of the idea of having children.

There are studies that try to evaluate the manner in which this theory works in different countries of Europe, Asia, and America. The research results show that we are actually witnessing a plurality of manifestation forms of the relationship between the value system and fertility dynamics within different contexts. Such studies seem to argue that postponement of childbearing and a decline in higher order births are two distinctive characteristics of fertility decline in the CEE countries, strongly correlated with the deterioration of the economic and social state of affairs (Billingsley 2010).

The two explanatory theories for fertility decline have been evaluated through empirical studies for different CEE countries, and arguments to support them have been found. However, it seems that these attempts have not been sufficiently convincing in explaining the demographic behavior change of the CEE countries after 1990, resulting in very low fertility rates – with values between 1.1 and 1.3 children per woman. Reaching some low fertility levels in CEE countries and keeping them below the replacement threshold is a phenomenon that has been analyzed by specialists not only as an important deviation from the predictions of the demographic transition theory. A number of studies consider that we are dealing with a particular phenomenon that has been called lowest-low fertility (Kohler, Billari, and Ortega 2002). Even though these fertility values are recorded over a relatively long period of time, after the end of the decline period, this new stage is not considered to be one of demographic balance (corresponding to the post-transitional stage, predicted by the demographic transition theory). On the contrary, it is considered that we are dealing with a specific phenomenon and that a theoretical explanatory framework, which allows analysis of fertility evolution in the countries and regions affected by this situation, can be built up (Kohler, Billari, and Ortega 2002). According to the quoted study, such a theoretical framework explains the lowest-low fertility phenomenon by means of four reciprocally combined demographic and socioeconomic determinants: demographic distortions of period fertility measures; socioeconomic factors leading to the postponement of fertility; social interaction effects on the timing of fertility; postponement-quantum interactions, which lead to reductions in completed fertility.

The phenomenon of fertility decline to a level below the replacement threshold has been first observed in Western countries. The specialty literature considers that the emergence and persistence of low fertility is the consequence of two major socioeconomic phenomena: social liberalism, which questions the fertility issue in relation to gender equity, and labor market deregulation, which brings into discussion the relationship between fertility and risk aversion (McDonald 2006). According to the first dimension, fertility remains low because of some incoherence between two types of social institutions that put pressure on woman's choice between family and work: the individual-oriented and family-oriented institutions. The second analysis dimension leads to the conclusion that a low fertility level arises as a result of people's perception that childbirth would represent a risk to economic well being (McDonald 2000, 2006). These two characteristics are also valid for the CEE countries and correspond to the period following the year 1990.

The studies that take into account the lowest-low fertility idea for the CEE countries seem, in the end, to highlight two main causes of the phenomenon: childbearing postponement (Kohler, Billari, and Ortega 2002) and unfavorable socioeconomic conditions specific to the transition process from communism to a democratic society (Sobotka 2004; Frejka 2008). Practically, these explanations correspond to the two previously mentioned theoretical directions, however nuanced for the peculiarities of the CEE countries. If we accept these two explanations, or a version that combines them, then this phenomenon will persist in the future. On one hand, postponement may persist because, in these countries, the mean age of women at first marriage is still low compared to the Western countries. On the other hand, if the socioeconomic transition process continues, we may not record a recovery in fertility. Equally, certain measures that act upon these two factors may cause some fertility recovery.

In conclusion, based on the above observations, several theoretical approaches to the demographic dynamics of the CEE countries should be considered, even if they are still under debate and admit new contributions. The interaction between the demographic, social, and economic factors mentioned by the various theoretical approaches acquires different expressions not only in the CEE region, but also in each country separately, and we tend to think that this also happens at regional level. The regionalization paradigm, the socioeconomic development orientation in terms of regional resources and specificity, is an important reference point for both demographic phenomena dynamics analysis and possible measures that may have an impact on the demographic situation of a region or country.

3. Fertility determinants: A panel approach

Considering the magnitude and importance of the demographic transformations, as part and parcel of the socioeconomic development process of a society, many demographers and economists have attempted to explain their nature, the correlations between the economic and demographic factors, the implications of these changes for various future development scenarios. Thus, in order to identify the main features specific to fertility decline at both global and regional development levels, we have synthesized (in Table 1) the results of certain empirical studies. The methodology approached in these studies corresponds to panel analysis, as it aims at discussing the phenomenon both in time and at country level, which highlights some more complex relationships. For the most part, the studies are carried out at the level of OECD countries as well as in Asian and European countries experiencing the low fertility phenomenon. Analysis of these studies allows general conclusions on the factors influencing fertility as well as their impact over time and their space heterogeneity. The results of the analysis will be used to substantiate the empirical study, in the case of Romania, at regional level.

The strong decline of the fertility rate, even below the replacement level, in many developed countries has been highly evaluated in literature in relation to the increase in female employment rate. There are at least two positions on the relationship between the two variables. On one hand, although the negative relationship between the two factors has got theoretical support (Becker 1960, 1992; Mincer 1963; Willis 1973; Butz and Ward 1979), the studies dedicated to OECD countries show that the negative value of the cross-country correlation between these two factors is maintained until 1980, after which a change in the sign of this association is registered (Esping-Andersen 1999; Brewster and Rindfuss 2000; Ahn and Mira 2002; Pampel 2001; Rindfuss, Guzzo, and Morgan 2003). With regard to the reversed sign of the cross-country association, there are studies showing that it is based on the change in the time series association (Esping-Andersen 1999; Brewster and Rindfuss 2000; Rindfuss, Guzzo, and Morgan 2003). On the other hand, Kögel (2004) and Engelhardt, Kögel, and Prskawetz (2004) show that neither causality, nor the time series association between fertility and female employment have changed over time. The authors support this hypothesis through both the presence of unmeasured factors specific to each country and the heterogeneity in the magnitude of the negative time-series association between fertility and female employment. Their results show that the initial increases in female employment rates lead to a substantial fertility decrease, but the continuous increases of this factor have an increasingly lower impact upon fertility. Therefore, the correlation sign between the two factors does not change, while a progressive decrease in the negative influence intensity of the female employment rate on the total fertility rate is registered.

Table 1: Empirical panel data studies on fertility

Fertility determinants	Empirical studies	Panel data used	Sign of correlation
Social factors			
Female employment rate	Brewster and Rindfuss 2000	21 OECD countries, 1965–1998	negative until 1980 and positive thereafter
	Pampel 2001	18 OECD countries, 1951–1994	negative and weakened over time
	Ahn and Mira 2002	25 OECD countries, 1970–1995	negative until 1980 and positive thereafter
	Rindfuss, Guzzo, and Morgan 2003	22 low fertility countries, 1960–1997	negative until 1980 and positive thereafter
	Kögel 2004	21 OECD countries, 1960–2000 (five-year data)	negative
	Adserà 2004	23 OECD countries, 1960–1997	negative until 1986 and positive thereafter
	d'Addio and d'Ercole 2005	16 OECD countries, 1980–1999	negative until 1985 and positive thereafter
	Engelhardt and Prskawetz 2005	22 OECD countries, 1960–2000	positive
	Hondroyiannis 2010	27 European countries, 1960–2005	negative
	Engelhardt 2011	16 European countries, 1970–2005	negative until 1980 and positive thereafter
	Vitali and Billari 2011	99 Italian provinces, 1999–2008	positive
Women's education level	Al-Qudsi 1998	11 Arabian countries, 1971–1996 (five-year data)	negative
	Adserà 2011	16 European countries, 1980–1990	negative
	Engelhardt 2011	16 European countries, 1970–2005	negative
	Teguh 2013	12 South and South-East Asian countries, 2003–2008	negative
Unemployment rate	Gauthier and Hatzius 1997	22 OECD countries, 1970–1990	negative
	Adserà 2004	23 OECD countries, 1960–1997	negative
	d'Addio and d'Ercole 2005	16 OECD countries, 1980–1999	negative
	Hondroyiannis 2010	27 European countries, 1960–2005	negative
	Brainerd 2009	72 Russian regions, 1990–2001	negative
	Goldstein, Sobotka, and Jasilioniene 2009	27 OECD countries, 1995–2008	negative
	Adserà 2011	16 European countries, 1980–1990	negative

Table 1: (Continued)

Fertility determinants	Empirical studies	Panel data used	Sign of correlation
Demographic factors			
Urbanization degree	Al-Qudsi 1998	11 Arabian countries, 1971–1996 (five-year data)	negative
	Teguh 2013	12 South and South-East Asian countries, 2003–2008	negative
Marriage rate	d'Addio and d'Ercole 2005	16 OECD countries, 1980–1999	positive
	Hondroyiannis 2010	27 European countries, 1960–2005	positive
	Brainerd 2009	72 Russian regions, 1990–2001	positive
	Engelhardt 2011	16 European countries, 1970–2005	positive
	Vitali and Billari 2011	99 Italian provinces, 1999–2008	negative
Divorce rate	Engelhardt 2011	16 European countries, 1970–2005	negative
Infant mortality rate	Al-Qudsi 1998	11 Arabian countries, 1971–1996 (five-year data)	positive
	Hondroyiannis 2010	27 European countries, 1960–2005	positive
	Teguh 2013	12 South and South-East Asian countries, 2003–2008	positive
Mean age of women at first birth	Engelhardt 2011	16 European countries, 1970–2005	negative
Mean age of women at first marriage	Vitali and Billari 2011	99 Italian provinces, 1999–2008	positive
Economic factors			
Gross domestic product per capita	Adserà 2004	23 OECD countries, 1960–1997	negative
	Hondroyiannis and Papapetrou 2005	8 European countries, 1960–1998	positive
	Goldstein, Sobotka, and Jasilioniene 2009	27 OECD countries, 1995–2008	positive
	Hondroyiannis 2010	27 European countries, 1960–2005	positive
	Vitali and Billari 2011	99 Italian provinces, 1999–2008	negative
	Luci-Greulich and Thévenon 2014	30 OECD countries, 1960–2007	negative up to certain threshold level of GDP per capita and positive for higher levels of GDP per capita
Income per capita	Al-Qudsi 1998	11 Arabian countries, 1971–1996 (five-year data)	positive
	Hondroyiannis and Papapetrou 2005	8 European countries, 1960–1998	positive
	Brainerd 2009	72 Russian regions, 1990–2001	positive
	Hondroyiannis 2010	27 European countries, 1960–2005	positive
	Teguh 2013	12 South and South-East Asian countries, 2003–2008	positive
	Fox, Klüsener, and Myrskylä 2015	20 European countries (256 sub-national regions), 1990–2012	negative at low levels of per capita income and positive as per capita income increases
Wage	Hondroyiannis 2010	27 European countries, 1960–2005	negative

In this context, the major impact of gender equality progress supported by the access to education and women participation in the labor market is worth mentioning. In the case of modern societies, McDonald (2000) postulates that fertility transition from high to low levels is also explained by the conflict emerged between gender equality and women's roles as mothers and spouses in the family. This hypothesis is in line with the studies of Engelhardt and Prskawetz (2005) and Engelhardt (2011), who argue that educational attainment of women contributes to the association change between total fertility rate and female employment, as well as with Hondryiannis' observation (Hondryiannis 2010), according to which women's level of education plays an important role in female labor market involvement, which directly affects marriage and childbirth decisions and, implicitly, fertility. Consequently, the education level increase and women's delayed transition to the labor market lead to a postponement of childbirth (tempo effect) while not necessarily affecting parents' demand for the total number of children (quantum effect). In other words, the total fertility rate registers a decline tendency due to the changes in the timing of births, which, however, begins to increase at the end of the postponement period (Rindfuss, Bumpass, and St. John 1980; Lesthaeghe 2001; Bongaarts 2002; Sobotka 2004; Luci-Greulich and Thévenon 2014).

A downward shock to infant mortality, due, for example, to the advanced technology in medicine and to the improvement of the living standards, contributes to fertility decrease (Al-Qudsi 1998; Panopoulou and Tsakloglou 2001; Hondroyiannis 2010; Teguh 2013). For the highly developed countries, the already low level of infant mortality no longer has an important effect on fertility, but the theory argues that a continued decline of this index may lead to further reductions in fertility (Cigno 1998; Sah 1991; Becker, Glaeser, and Murphy 1999; Pommeret and Smith 2005).

Other proximate demographic determinants of fertility are marriage and divorce. The increase of marriage rate leads to a subsequent fertility increase, considering that one of the major goals of marriage remains related to the desire to have children (Bailey and Chambers 1998; Hondroyiannis and Papapetrou 2005; Brainerd 2009). The divorce rate is negatively correlated with the total fertility rate, which, unlike the marriage rate, also contributes significantly to changing the association sign between female employment and fertility (Engelhardt 2011).

Another factor that has been repeatedly mentioned for explaining lower fertility is the unemployment rate. In studying the association among unemployment, labor market institutions, and fertility, Adserà (2004) concludes that, even when the individual employment situation is controlled for, a high and long-term unemployment level contributes to the postponement of the first and second birth, with obvious implications upon fertility decrease. The significant impact of unemployment on fertility decline is explained by increased employment insecurity (Goldstein, Sobotka, and Jasilioniene 2009), which reflects negatively on present and future incomes (Hondroyiannis 2010). However, this effect has to be assessed in relation to a number of issues such as duration of unemployment, gender- or age-affected segment of unemployment, labor market arrangements, as well as to the changes produced in the economic environment (Adserà 2011).

In the context of low fertility, the negative impact of economic advancement has been widely discussed in literature; however, the robustness of some results continues to be debated. Numerous empirical studies support the negative correlation between the dynamics of economic development and the fertility trend at both regional level (Brainerd 2009; Vitali and Billari 2011) and European (Hondroyiannis and Papapetrou 2005; Hondroyiannis 2010), Asian (Al-Qudsi 1998; Teguh 2013), or OECD countries (Adserà 2004; Goldstein, Sobotka, and Jasilioniene 2009) level. Therefore, the countries with low economic level register high fertility rates, while the economically developed ones contribute to fertility decrease. Nevertheless, recent evidence suggests that the long-term negative association pattern between fertility and the economic level is no longer significant for some of the most economically developed countries since, above a certain economic growth level, the turnaround of this association is observed. For example, Myrskylä, Kohler, and Billari (2009) show that, for high socioeconomic development levels, measured by the human development index, the relationship becomes positive. Considering the economic development of the OECD countries, Luci-Greulich and Thévenon (2014) argue that the strong negative relationship between GDP per capita and fertility is no longer valid for high values of the economic indicator, but that it becomes positive starting from a certain economic development threshold. The authors argue that this change in the correlation sign between the two indices is supported by the modified relationship between fertility and female employment within-country variation sign. This explanation implies that reversal in the positive relationship between fertility and economic trends is only possible for countries where economic development is accompanied by an increased female employment rate. An alternative interpretation suggests that fertility rebound is largely linked to the end of postponement (Goldstein, Sobotka, and Jasilioniene 2009; Bongaarts and Sobotka 2012). However, literature does not clearly support the postponement end effect on the relationship between economic development and fertility dynamics. In this respect, although Luci-Greulich and Thévenon (2014) conclude that birth postponement has a certain role in explaining such tendencies towards a reversal of fertility in the economic development process, other factors captured by GDP per capita contribute to fertility reincrease. In the same note, Fox, Klüsener, and Myrskylä (2015) point out that this causality hypothesis is not entirely supported, as the end of postponement and the economic outcome improvement can occur simultaneously. However, in line with the works of Myrskylä and Goldstein (2013), Myrskylä, Goldstein, and Cheng (2013), and Schmertmann et al. (2014), part of the fertility increase in highly developed countries is not attributed to this tempo effect but rather to a real fertility level increase.

In light of the positive association between fertility and the economic development level, Fox, Klüsener, and Myrskylä (2015) analyze the impact of income per capita upon the dynamics of fertility in a number of European countries and in their sub-national regions. For most of these countries, the results suggest a decline in the previously strong negative relationship between fertility and income per capita at regional level while, for others, a turnaround in the relationship between the two factors. However, the fertility and economic development levels at which this change occurs vary significantly among countries. With these results, the authors manage to show that the regional dimension is important in understanding the potential mechanisms through which economic development could positively influence fertility, given that this approach allows the control of idiosyncrasies at national level and, at the same time, large income variations.

To conclude with, the previous empirical evidences suggest that the traditional determinant effects of fertility dynamics must be analyzed in relation to the influence of the different social, cultural, institutional, and economic characteristics of a country. Likewise, as pointed out by Luci-Greulich and Thévenon (2014), in the context of modern societies, a recovery in fertility cannot take place unless it is accompanied by institutional changes aimed at improving parents' opportunities to combine their professional and family life.

4. Regional demographic and socioeconomic development in Romania (1995–2015)

The aim of the present study is to analyze fertility dynamics both in time and within the regional profile of Romania, in relation to a series of economic, social, and demographic factors identified in literature. Analysis of these factors at Romanian level is carried out mainly in the context of the broader topic of regional economic and social disparities recorded (Pintilescu 2011, Benedek and Verres 2013; Goschin 2014, 2015; Chirilă and Chirilă 2014). Regional disparities are considered a phenomenon specific to countries with emerging economies (Kuznetz 1995) whose economic development is carried out at different rhythms. However, these disparities are directly correlated with the natural, geographical, and demographic potential of the regions, namely with the differential spatial distribution of their resources (OECD 2013). Last, but not least, regional disparities are also explained by the quality of the functioning political and social institutional mechanism (Kutscherauer et al. 2010). At the level of Romania, studies evidence the presence of regional disparities, which depend on both their natural profile and past development process dynamics. The most important factors responsible for such disparities are the economic development; the natural, demographic, social, and cultural profile of the regions; the regional development policy measures.

Therefore, the fertility determinants identified in the specialty literature are part of the variables that explain the regional disparities of Romania.

Synthesis of the evolution of fertility and of its determinants at regional level, for the 1995–2015 period, realized by descriptive statistical analysis, is presented in the following.

4.1 Development regions of Romania: An overview

As shown in the figure below (Figure 2), the eight development regions of Romania are first built based on a geographical criterion, with the rigor limits. The first region, called Nord-Est, is the largest one, both territorially and demographically, being always considered as the demographic basin of Romania, registering the highest fertility rates and the lowest demographic aging level. At the same time, this is the least economically developed region, with a low degree of urbanization, agriculture being an important part of its economic activity. The second region, called Sud-Est, encompasses six counties belonging to three historical regions, with quite different cultural elements: Moldova, Muntenia, and Dobrogea. In terms of development, its level is close to the national average and, demographically, it follows the Nord-Est region. The third region, Sud-Muntenia, is heterogeneous in terms of economic development, having three more developed and three less developed counties. Moreover, it is the region with the lowest degree of urbanization and highest level of demographic aging. The fourth region, known as Sud-Vest Oltenia, is also characterized by a high aging degree and a level of development close to that of the Sud-Muntenia region. The fifth region, the Vest region, is, demographically speaking, the smallest, having the highest degree of urbanization and being the most developed zone, after Bucureşti-Ilfov. The sixth region, Nord-Vest, is one of the most balanced areas when it comes to the economic development level and also from a demographic point of view, its values being close to the national average. Considering the economic development level and the urbanization degree, the seventh region, Centru, follows the Vest region. It is the most heterogeneous region from an ethnic and religious point of view. Geographically, the last region, Bucureşti-Ilfov, the smallest one, has a particular specificity due to the concentration of population and to the economic assets provided by the capital of Romania, Bucureşti. For the last 25 years, it has been the most dynamic region, both economically and socially as well as demographically.

Figure 2: Development regions of Romania

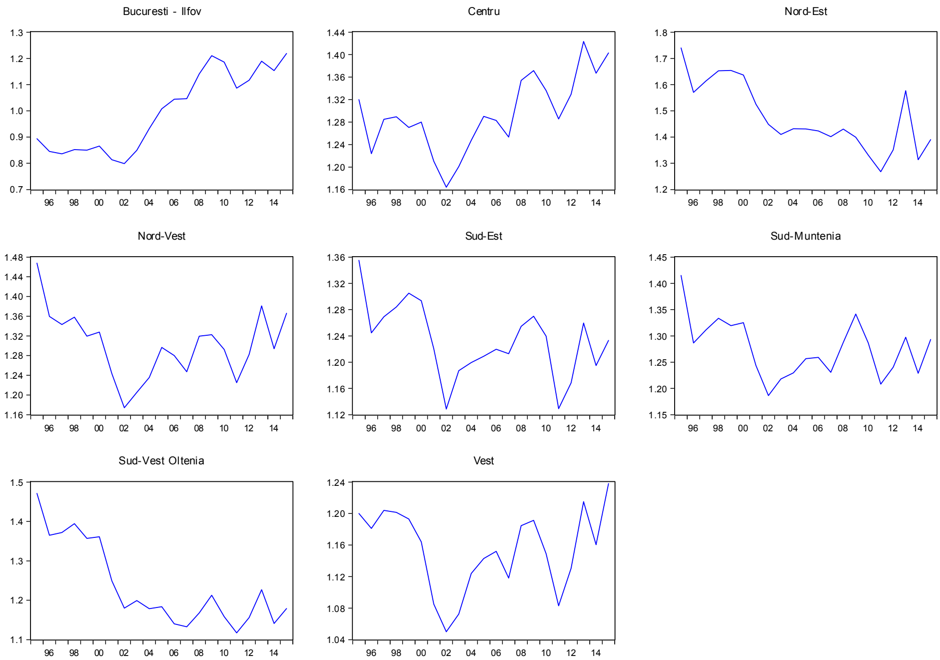
Source: INSSE.

Specialty studies show that regional disparities, such as economic development and demographic configuration, tend to increase during the transition period, opened by the 1990s. The determinants of fertility identified in literature and discussed in the previous section are part of the variables that may also explain the regional disparities in Romania. Using the descriptive statistical analysis, we present a synthesis of the evolution of fertility and of its determinants at regional level, along the 1995–2014 period.

4.2 Dynamics of fertility

At national level, between the years 1995 and 2015, fertility allows a poor variability, around an average of 37 children born to 100 women in the fertile age group, or of about 1.3 children per woman. Despite this pattern, at regional level, a number of differences regarding both the variation trend and the level of the phenomenon may be mentioned (see Figure 3).

Figure 3: Total fertility rate in Romania between 1995 and 2015



Source: Authors' computations based on the data provided by INSSE.

At regional level, two situations can be identified. First, there are regions that register a fertility increase trend: Bucureşti-Ilfov, Centru, and Vest. These are also economically developed regions that have continued the development process at a higher pace than the others. The economic development in these regions is an attraction for the internal migration of young people, presenting certain stability that may encourage family formation and childbearing. It should be mentioned that they have recorded a low fertility rate, below the average of 1.3 children per woman. The other regions form a second category, where a decrease tendency and slight variations around the national average can be noticed. This trend complies with the theory, which appreciates the existence of a negative relationship between fertility and the economic development level.

4.3 Dynamics of fertility determinants

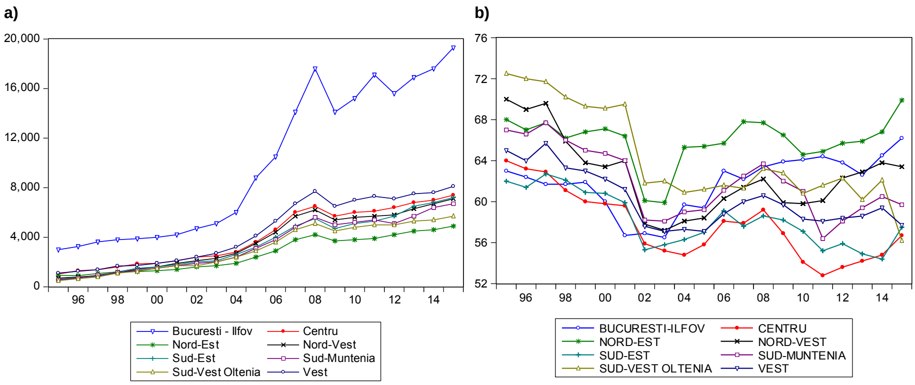
Over the analyzed period, the real GDP per capita shows an increase trend at both national and regional level, however regional variability implies an important temporal dynamics (Figure 4a). In addition to an upward trend of the economic development level, affected by the 2008 crisis, an increase in regional disparities regarding the economic development may be observed.

If assessing the real GDP per capita variability between regions, using the variation coefficient, one may mention that this indicator is increasing, from 0.19 in 1995 to a value of 0.53 in 2015. It follows that the differences between regions as to the degree of economic development are gradually increasing from one year to another.

Such GDP discrepancies can also be observed if analyzing the variation in the participation of each region in the national GDP. According to the INSSE data, between 1995 and 2015, the Bucureşti-Ilfov region increased its regional GDP share in the national GDP share (%) by almost 12% (i.e., an increase from 15% to 27%). The Vest region also recorded an increase (0.23%) while the other regions reduced their contribution. The least economically developed regions, the Nord-Est, the Sud-Est, and the Sud-Vest Oltenia, also reduced their contribution to the national GDP in 2015 by 3.4%, 2.1%, and 1.6%, respectively, compared to the year 1995.

The policy of the communist system to include the whole available labor force in economic activities led to high rates of women's participation in the labor market. In Romania, at both national and regional levels, the employment rate decrease characterizes the transition period opened in 1990. However, this process is more intense in the case of women. The female employment level fell more than that of the employed male population, a phenomenon specific to the CEE countries (UNIFEM 2006). At regional level in Romania, an increase of disparities with this indicator is noticed (Figure 4b). The industrialized regions recorded significant decreases in the 1990s. The most important variations were recorded by the Bucureşti-Ilfov region. The less economically developed regions, the Nord-Est and the Sud-Est, also recorded the lowest values of this indicator.

Figure 4: Real GDP per capita (a) and female employment rate (b) for Romanian regions between 1995 and 2015

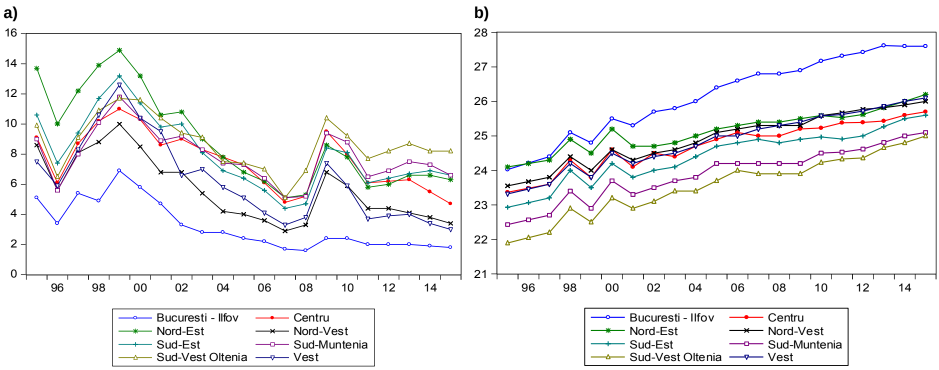


Source: Authors' computations based on data provided by Eurostat (a) and INSSE (b).

The rapid rise in unemployment after 1990 was a phenomenon specific to CEE countries after the collapse of the communist system. As shown in Figure 5a, the evolution of unemployment at national and regional levels after 1995 shows quite clearly the conjectural nature of the transition. The less developed regions, where the labor market structure was not diversified, were the most affected by unemployment. The industrialized areas of the Centru and Sud-Est regions suffered because some huge industrial complexes have been closed. The disparities among regions tend to increase over time, even though this indicator registers a downward trend. Overall, unemployment does not achieve a certain trend but conjectural variations at the level of all regions. Exceptions are the Centru region, where unemployment presented a slight upward trend, and the Nord-Est region, where a slight downward trend was registered.

Postponing the birth of the first child was another phenomenon specific to CEE countries after 1990. Analysis of the below graph (Figure 5b), regarding the evolution of women's mean age at first birth by region, allows some observations: the increase trend of the indicator, from an average of 23 years in 1995 to 26 in 2015; in the Bucureşti-Ilfov region, the increase rate was higher; the differences between regions were slightly reduced, yet maintained; the developed regions showed the highest values, with the exception of the Nord-Est one. This phenomenon is likely to continue in the future, taking into account both the socioeconomic transition process and the population structure by age groups.

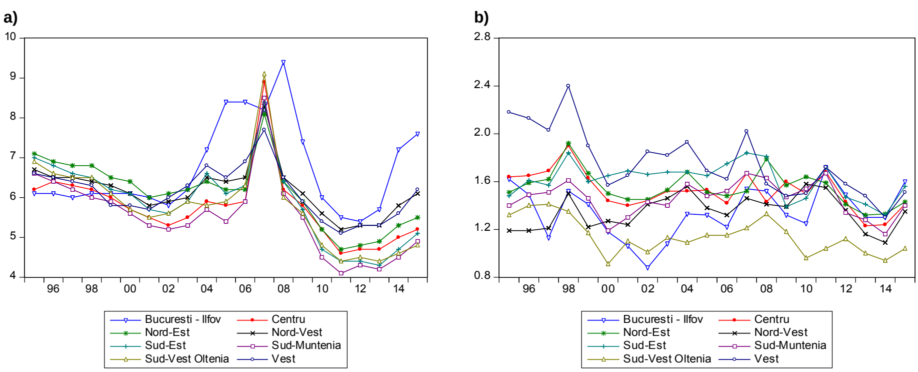
Figure 5: Unemployment rate (a) and mean age of women at first birth (b) in Romania between 1995 and 2015



Source: Authors' computations based on data provided by INSSE (a) and Eurostat (b).

At regional level, the marriage and divorce phenomena somehow followed the national level trend (Figure 6): the marriage rate was decreasing, with a syncope registered in 2007 (when the increase is conjectural, due to some financial measures taken to encourage marriage, which were stopped afterwards); the divorce rate allowed slight fluctuations, around an average of 1.4 divorces per one thousand people. Over time, inter-regional differences are accentuated when it comes to marriage, and reduced in the case of divorce. The higher marriage rate in the developed regions is easy to explain, and it is a sign of the transition period.

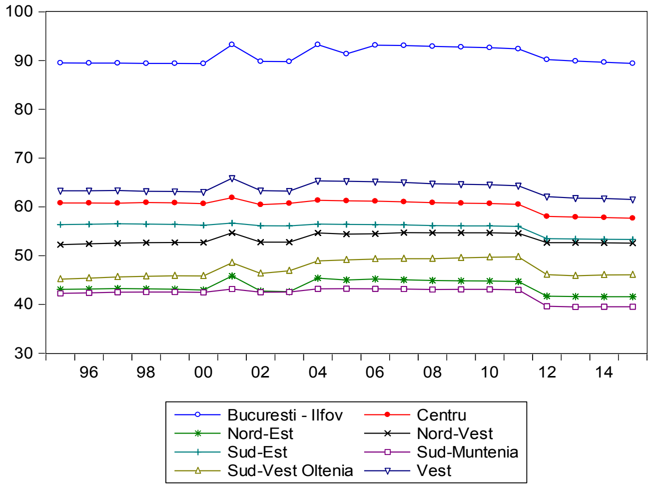
Figure 6: Marriage (a) and divorce rate (b) in Romania between 1995 and 2015



Source: Authors' computations based on data provided by INSSE.

As to the degree of urbanization (Figure 7), the differences among regions are obvious: the developed regions were also those with a higher urbanization level (over 60%), whereas the least developed ones (Nord-Est, Sud-Muntenia, and Sud-Vest Oltenia) registered a low level (below 50%). The increase of the urbanization level is not very important during the analyzed period (a mean of 0.8%).

Figure 7: Degree of urbanization in Romania between 1995 and 2015



Source: Authors' computations based on data provided by INSSE.

5. Data and methodology

This section presents the data and the methodology used to assess empirically the output effects of the demographic and socioeconomic factors upon the dynamics of regional fertility.

5.1 Data

Study of the dynamics of fertility in the eight development regions of Romania for the 1995–2015 period is based on data provided by the National Institute of Statistics of Romania (INSSE) and by Eurostat.

As in the studies described in Table 1, the dependent variable is the total fertility rate (the average number of children who would be born to a woman over her reproductive lifetime), while the independent variables on which focus is laid are theoretically and empirically well known as demographic and socioeconomic determinants of fertility. Out of the demographic factors, the degree of urbanization (%), the crude marriage rate (number of marriages per 1,000 mid-year total population), the crude divorce rate (number of divorces per 1,000 mid-year total population), and the mean age of women at first birth (years) are used. Out of the social factors group, included here were the female employment rate (%) and the unemployment rate (%). From the last category of factors, the economic ones, the real GDP per capita (euro) was considered.

As a standard method in most applied macro-econometric works, all variables are transformed by logarithm. This common practice has theoretical reasons. In addition to the possibility of obtaining more homogeneous data series, using log-log models facilitates the interpretation of results in terms of elasticity and, as Comolli (2017) argues, allows smoothing of any non-linearity in the relationship between fertility and its determinants.

5.2 Stationary tests

It is possible that the variables in this study are stationary in first difference, meaning that the mean and the variance values are constant over time after the first differencing. This could give rise to a spurious regression problem, which implies that it is not appropriate to apply standard inference to the estimation results.

In literature, two categories of unit root tests, which allow the analysis of the integration order of the variables in the panel data setting, are distinguished. On one hand, there are the tests that verify the hypothesis according to which there is an individual unit root for each panel in the series, against the alternative of at least one stationary panel. On the other hand, the tests that assume the null hypothesis of a common unit root for each panel against the alternative that all panel data series are stationary are distinguished.

Taking into account the specificity of our panel data, we explored the time series properties of variables using three types of panel unit root tests. From the first category, we employed a Fisher-type test developed by Choi (Fisher-ADF, 2001) and the test proposed by Im, Pesaran, and Shin (IPS, 2003), because these tests allow the autoregressive parameter to be specific to each region and because they do not impose the restriction of a balanced panel. Out of the second category, we selected the test introduced by Levin, Lin, and Chu (LLC, 2000), if taking into account the relatively small size of the panel, which is inherent in analyzing the regional data in a country, having as reference a short period. To test for both difference and trend stationarity, we include both the trend and the intercept in the autoregressive specification of each test.

5.3 Panel data modeling

The panel models are based on the idea of pooling cross-sectional time series, which involves including simultaneously the cross-sectional and the time series effects of the independent variables on the dependent variable.

In the present analysis, alternative models are built up to measure the effect of an increase in different demographic and socioeconomic factors upon fertility. This approach also allows for assessing the change in the magnitude of the relation between fertility and its determinants. By applying pooled OLS, a first model is estimated with the log of fertility as the endogenous variable and the log of the exogenous variables – taking into consideration the first-differenced transformation of the log of non-stationary ones. The pooled time series regression equation is:

$$lnTFR_{it} = \beta_0 + \beta' lnX_{it} + \varepsilon_{it},\ i = \overline{1,n}\,,\ t = \overline{1,T}, \tag{1}$$

where X_{it} is a vector of the independent variables and ε_{it} is the error term assumed with conditional mean zero and independent on X_{it}.

Following several authors (Pampel 2001; Kögel 2004; Adserà 2004, 2011; Engelhardt and Prskawetz 2005; Hondryiannis 2010; Engelhardt 2011), we attempt to capture the unobserved region- or time-specific (demographic, socioeconomic, as well as social policy) factors that may affect fertility by applying the fixed effects estimation method with robust standard errors (Wooldridge 2015). To do so, three variants of models are distinguished: the region-specific fixed effects model, the time-specific fixed effects model, and the jointly region- and time-specific fixed effects model.

The first model captures the unobserved effects of region-specific variables (μ_i), which are constant over time and correlated with the explanatory variables. The analytical equation of this model is:

$$lnTFR_{it} = \beta_0 + \beta' lnX_{it} + \mu_i + \varepsilon_{it}, \tag{2}$$

where μ_i is the region-specific term that is constant over time and dependent on X_{it}.

Time-specific effects (λ_t) capture instead the unobserved heterogeneity caused by the factors that explain the dynamics of fertility over time and that are common to all regions in the panel. Specifically, equation (1) becomes:

$$lnTFR_{it} = \beta_0 + \beta' lnX_{it} + \lambda_t + \varepsilon_{it}. \tag{3}$$

The inclusion of both fixed effects in the model controls for the time-constant region-specific factors and the time-varying factors common to all regions in the panel. Such a model allows assessing the change in fertility controlling for time- and region-specific heterogeneity in the effect of the demographic and socioeconomic factors that influence fertility. Theoretically, this model is given by:

$$lnTFR_{it} = \beta_0 + \beta' lnX_{it} + \mu_i + \lambda_t + \varepsilon_{it}. \tag{4}$$

The validity of the fixed effects included in the model is tested by performing a Fisher test, which takes into account the residual variance of the restricted model (pooled OLS) and the residual variance of the unrestricted one (fixed effects model). If the null hypothesis is not true, the model with fixed effects is significant.

5.4 Robustness checks

Further on, several robustness checks for the estimated models are applied for capturing the possible biases caused by the unobserved heterogeneity, the sensitivity of the stationary panel unit root tests, and the presence of multicollinearity.

In our analysis, in order to capture the unobserved heterogeneity, two panel data estimation methods were employed: the fixed effects and the random effects estimations. By applying fixed effects OLS estimation with robust standard errors (Wooldridge 2015) might produce unbiased and consistent estimates of the coefficients. The approach of the random effects estimation, which consists in applying the generalized least square (GLS) estimation method while also allowing control of the unobserved heterogeneity, but, unlike the fixed effects one, it captures both within- and between-regions variation. The difference between the two estimation specifications is underlined with the μ_i and λ_t components, which are random variables with zero mean and constant variance, independent on X_{it} and on each other, regardless of i and t. To test for the validity of the random effects estimator, the Hausman test is used. Hence, a significant value of the test suggests that the fixed effects model is better than the random effects one. As shown in the following, the fixed effects models turn out to be better suited than the pooled and the random effects models for assessing the relationship between fertility and the demographic and socioeconomic factors.

In a second step, the robustness of the fixed effects models is checked in relation to the sensitivity of the stationary panel unit root tests. Thus, by applying fixed effects estimation with robust standard errors, the log of total fertility rate is modeled as a function of the log of all exogenous variables. Then, using the same specification estimation, the first-differenced transformation of the log of total fertility rate is expressed as a function of the first-differenced transformation of the log of all independent variables. These robustness checks are important because the estimation results show whether, once different fixed effects are included, the relationship between fertility and each exogenous factor becomes insignificant, or whether this association remains similar in sign and magnitude once different transformations on variables are included.

Finally, the lack of any statistical significance for some exogenous variables may be driven by the existence of possible multicollinearity. In order to test for the presence of multicollinearity among independent variables, the variance inflation factor (VIF) is used.

6. Modeling results

This section presents the main results of fertility modeling following the previously discussed steps regarding the methodology on panel data.

6.1 Panel unit root tests results

To assess the stationarity of our variables, Table 2 reports the results of the LLC, IPS, and Fisher-ADF unit root tests. The correction of non-stationarity, if applicable, is performed by means of the difference operator.

Table 2: Panel unit root tests

	Undifferenced			First difference		
Variables	**LLC**	**IPS**	**Fisher-ADF**	**LLC**	**IPS**	**Fisher-ADF**
LTFR	–2.93770 ***	–0.04541	35.3757 ***			
LGDP	0.80851	2.15732	3.69360	–4.17130 ***	–2.15551 **	26.4384 **
LFEM	–1.51000 *	–1.21669	27.5886 **	–	–	–
LNUP	–2.10675 ***	–2.65669 ***	28.3303 **	–	–	–
LDIV	–3.92158 ***	–2.39486 ***	29.3710 ***	–	–	–
LUNEMP	0.71359	0.17024	12.1618	0.20511	–5.60832 ***	61.9684 ***
LURB	–0.42164	3.02948	1.99687	–7.56003 ***	–6.60612 ***	71.8154 ***
LMAB	–4.22626 ***	–0.40780	15.7471	0.61355	–6.67650 ***	72.6041 ***

Note: *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%. Variables are abbreviated as follows: LTFR – log of total fertility rate; LGDP – log of real GDP per capita; LFEM – log of female employment rate; LNUP – log of nuptiality rate; LDIV – log of divorce rate; LUNEMP – log of unemployment rate; LURB – log of urbanization degree; LMAB – log of mean age of women at first birth.
Source: Authors' computations.

To reject the non-stationarity hypothesis, the results of at least two tests were simultaneously taken into consideration. According to Table 2, the logarithm of real GDP per capita, the unemployment rate, the degree of urbanization, and the mean age of women at first birth are non-stationary. On the contrary, the test rejected the null hypothesis for the first differences. For the other variables, the null hypothesis of the presence of a unit root is rejected.

6.2 Panel estimation results

To assess the effects of the demographic, social, and economic factors on the dynamics of fertility over time and at the level of the Romanian regions, several panel regression models (discussed in Sections 5.3 and 5.4) were built up. The empirical analysis allows for heterogeneity across regions and/or time in the association between fertility and its potential determinants. The results obtained from the estimation of these models are synthesized in Table 3 and included in the core text and in the tables available in the Appendix.

Table 3 summarizes the estimation results of two categories of models: pooled and fixed effects models. The latter category includes three types of models: the model with region-specific fixed effects (model 2), the model with time-specific fixed effects (model 3), and the model also including fixed effects but specific to both dimensions (model 4).

We start with testing a log-log model (model 1) capturing the relationship between fertility and its determinants by using pooled OLS estimation. The results obtained suggest that fertility is significantly related to demographic and socioeconomic factors, such as female employment rate, real GDP per capita, degree of urbanization and marriage rate. The fertility decline can be explained by the increase in real GDP per capita and in the degree of urbanization, and by the decrease in female employment rate and nuptiality rate. For all exogenous variables, the VIF values fall below 5 (Table A-1). Therefore, the model has no problem of multicollinearity.

To further assess the relationship between fertility and its determinants, fixed effects with robust standard errors were applied (Table 3). Besides the estimation results, which are qualitatively similar to the results obtained following the estimation of the pooled model (model 1), the higher goodness of fit as well as the significance of the fixed effects estimations (Fisher test results) suggest that the impact of the demographic and socioeconomic factors upon fertility is actually dominated by within-region and over time variation.

Table 3: Estimates of the pooled and fixed effects regression models on fertility

Variables	Pooled Model 1		Region heterogeneity Model 2		Time heterogeneity Model 3		Region and time heterogeneity Model 4	
Constant	0.345107		–0.044257		0.184282		1.269587	
	(0.295558)		(0.778802)		(0.240740)		(0.935278)	
DLGDP	–0.191984	**	–0.091037	*	–0.187279	*	–0.122937	*
	(0.093020)		(0.048537)		(0.105956)		(0.065695)	
LFEM	0.354150	***	0.430151	***	0.353122	***	0.525628	***
	(0.077360)		(0.061936)		(0.068334)		(0.046829)	
LNUP	0.164871	**	0.097141	**	0.380759	***	0.326466	***
	(0.063579)		(0.037266)		(0.089750)		(0.061283)	
LDIV	–0.054005		–0.093128	***	0.011008		–0.006050	
	(0.066193)		(0.034868)		(0.068246)		(0.038019)	
DLUNEMP	–0.021417		0.022271		–0.070680		–0.003999	
	(0.052056)		(0.027290)		(0.052963)		(0.029292)	
DLURB	–0.464776	***	–0.418910	**	–0.511554	***	–0.943853	***
	(0.035681)		(0.170559)		(0.028249)		(0.237541)	
DLMAB	0.015762		0.341656		–3.253539	***	–0.926141	
	(0.842149)		(0.396517)		(1.234077)		(1.076488)	
Fisher test	–		69.788005	***	16.077022	***	50.327202	***
Adjusted R^2	0.592893	***	0.742064	***	0.707791	***	0.811072	***

Notes: *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%; Robust standard errors in parentheses. Variables are abbreviated as follows: DLGDP – first difference of log of real GDP per capita; LFEM – log of female employment rate; LNUP – log of nuptiality rate; LDIV – log of divorce rate; DLUNEMP – first difference of log of unemployment rate; DLURB – first difference of log of urbanization degree; DLMAB – first difference of log of mean age of women at first birth.
Source: Authors' computations.

Furthermore, we apply random effects models, which also control for unobserved region and time heterogeneity. Table A-2 shows the results of GLS estimations with region-specific random effects (model 5), time-specific random effects (model 6), and jointly region- and time-specific random effects (model 7). The table also includes the test results for choosing between the models with fixed effects and the ones with random effects. For any of the three types of models described above, the estimated statistics for the Hausman test were high enough to reject the null hypothesis at the 1% level of significance. Therefore, we could conclude that, for our data, the fixed effect specification is superior to a random effects specification in controlling for unobserved heterogeneity. Yet, potential bias in these estimates may be caused by the sensitivity of panel unit root tests. For this reason, the three types of models with fixed effects are re-estimated, including once all variables transformed by log and once the first-differenced transformation of the log of all variables (Tables A-3 and A-4). Overall, the results are not qualitatively different, being robust to different transformation of variables and estimation techniques used.

A comparison of the three fixed effects models (Table 3) shows that the outcomes are generally similar. What differs among the estimated models is the significance of the divorce and mean age of women at first birth variables, which change their magnitude and significance in the case of two models. The divorce rate is significant only in the case of the region-specific fixed effects model, which is explained by the existing level of differences of this indicator by regions. Including regions fixed effects avoids omitted variable bias arising from unobserved factors that vary across regions but are constant over time. This result suggests that the unobserved factors, such as the cultural ones, which differ among regions, may have a more important impact on the influence of divorce on fertility. On the contrary, when controlling for time-specific unobserved factors, the mean age of women at first birth is significant for fertility decline. In this case, the negative impact of this indicator could be explained by the over time variations and lack of significant differences between regions after 1995. A similar aspect for all three models is the significant positive effect of female employment rate and of marriage rate on fertility. For all models, the negative impact of the economic development and of the urbanization degree on fertility is also maintained. Among the positive effect factors, the highest impact on fertility dynamics rate is that of the female employment rate, and among the negative ones – the degree of urbanization.

The signs of the regression coefficients are consistent with other literature studies (see Table 1), with the exception of the female employment rate. The estimates unveil that, in the regions with high levels of real GDP per capita, divorce (only when region-specific factors are included), urbanization, and mean age of women at first birth (only when time heterogeneity is controlled), the total fertility rate trend is decreasing. Within the regions with increasing rates of female employment and nuptiality, a fertility increase is also expected.

In order to emphasize the differences among regions over the post-communist period, the fixed effects estimates are compared (Table A-5). Estimates corresponding to region-specific fixed effects represent variations of fertility rate in each region, comparatively with the average level. A positive sign of these effects is registered for the Centru, Nord-Est, and Sud-Est, and a negative one for the Bucureşti-Ilfov, Nord-Vest, Sud-Muntenia, Sud-Vest Oltenia, and Vest regions. In other words, the unobservable and time-constant factors specific to each region contribute to a slight increase in fertility for the Centru, Nord-Est (for which the average fertility rate exceeds the national average rate), and Sud-Est regions (with a lower average value, but close to the national average fertility rate), and to a decrease of fertility rate for the other regions. Considering time heterogeneity, positive and negative variations of fertility, which are common to all Romanian regions, are found. The fixed effects estimates show that, after 2008 (except for 2014), the average fertility rate has grown over the estimated average level of fertility. While controlling for the time-constant region level factors and time-varying factors common to all regions in the panel, one can observe that the intra-regional and over time variations of the total fertility rate from the average estimated level change, compared to the other two models. The change is more obvious in the case of fixed effects specific to the Bucureşti-Ilfov, Nord-Est, and Vest regions, which change their sign.

As a final step of analysis, we look at the change in the magnitude of fertility elasticity to each exogenous variable from one specification model to another (Table 3, Table A-3, and A-4). Considering that some of the independent factors are log first-differenced, the elasticity of fertility should be related to the growth rate of these variables. Our findings show that the strongest positive fertility response is elicited by female employment and nuptiality, while the most important negative effect on fertility is due to the variation of the mean age of women at first birth and urbanization. Turning to the labor market effect upon fertility, a 1% increase in female employment rate is associated with an average increase in total fertility rate of 0.35% when we only allow for time heterogeneity (model 3), of 0.43% when we consider only the unmeasured factors across regions (model 2), and of 0.52% when we include both time and region effects (model 4). The former result implies that, by controlling the unobserved factors specific to both regions and time, the impact of female employment on fertility is stronger and better highlighted. Compared to other fixed effects models (model 8 to model 13), the fertility response to female employment is consistent in terms of sign and significance. Among the fixed effects models, similar estimates of the elasticity of total fertility rates to marriage are found, with a stronger effect (0.38%) while controlling for time heterogeneity (model 3). A significant negative but minor fertility response to divorce is found only when we allow for region heterogeneity (model 2, model 8, and model 11). These results might unveil that change in attitudes or perception concerning the values of marriage institution could have a negative effect upon fertility. In addition, the literature confirms the indirect significant impact of the educational level on decreasing fertility, since it directly influences marriage and female employment. Although, in the present study, the influence of this factor on fertility is not captured directly due to lack of data. By including in models the fixed effects just to capture the effect of the unobserved factors, we could conclude that the educational level of women might play an important role on the decision to postpone or delay birth. In this regard, the negative elasticity of fertility to the mean age of women at first birth has to be interpreted in part as a response to the effect of birth postponement. Importantly, even if in magnitude the strongest negative fertility response is associated with the mean age of women at first birth, the coefficient is statistically different from zero only when the time-specific fixed effects are included (model 3, model 9, and model 11). For the negative effect of urbanization, we witness an increase in the elasticity of fertility to 0.94%, when allowing for both region and time heterogeneity (model 4). Turning to the direct economic effect on fertility, our results show that a 1%

increase in the growth rate of real GDP per capita reduces the total fertility rates by 0.18% (model 3). The negative association between the real GDP per capita and the total fertility rate is statistically different from zero and almost identical in magnitude for the rest of the fixed effects models.

7. Discussion and conclusions

Analysis of the specialty literature allowed us to identify some possible explanatory theories regarding the evolution of fertility in CEE countries, to which Romania also belongs. The theoretical and empirical approaches to the low fertility rate support the development of research toward new directions that should analyze the interaction between fertility and the demographic, social, and economic factors in the specific context of each country and also at regional level.

In the case of Romania, the slight variations of the main demographic indices after 1995 reveal that the demographic transition process reached a stage of relative stability, with a low fertility level, around an average of 1.3 children per woman. Despite this stabilization at national level, the regional profile registers significant differences regarding the level and variation of fertility and its possible determinants.

In order to analyze the variation of fertility in time and space, the specialty literature recommends the panel data modeling methodology. A detailed analysis of the empirical studies employing this approach enabled us to identify a series of fertility determinant factors at both country and region level. Synthesis of these studies (presented in Table 1) permitted the identification of three categories of factors: social (female employment rate, women's education level, unemployment rate), demographic (mean age of women at first birth, mean age of women at first marriage, urbanization, divorce, marriage, infant mortality), and economic (GDP per capita, income per capita, wage).

The empirical analysis developed in this study led to the construction of some panel econometric models to assess the relationship between fertility and its main determinants at the level of the eight development regions of Romania over the 1995–2015 period. As to the evolution of fertility, we identified two categories of regions with weaker or more pronounced variations from the national average: regions with a downward trend (Nord-Est, Sud-Est, Sud-Muntenia, Sud-Vest Oltenia, and Nord-Vest) and regions with a slight increase (Bucureşti-Ilfov, Centru, and Vest).

The relationship between fertility and its determinants was studied using three types of models: pooled, with fixed effects, and with random effects. Because of the small panel size employed (21 years and 8 regions), the number of explanatory variables was limited to seven factors. According to several robustness checks, we could conclude that the fixed effects models turn out to be superior to the pooled and random effects ones, being more appropriate for practical reasons.

The empirical results obtained for fixed effects models unveil that fertility variations observed at regional level after 1995 are explained by the changes in the female employment rate, marriage rate, degree of urbanization, and real GDP per capita. In addition, for the region-specific fixed effects model, the divorce rate has a significant impact upon fertility while, for the model with fixed effects over time, the mean age of women at first birth becomes significant in explaining fertility variation. Moreover, it was noticed that unemployment is not a significant fertility factor for any of the models. The regression coefficient signs for the significant variables are maintained for all constructed models and, except for the female employment rate, are consistent with the specialty literature results.

The significant positive relationship between fertility and female employment rate at regional level is one of the peculiarities of Romania and, eventually, of all CEE countries. This type of relationship finds support in at least two arguments. On one hand, we are talking about a woman's profile 'forged' in the communist era, which asks her to play a double role within the society: the productive role as participant in the labor market and the reproductive role as mother. On the other hand, after 1990, the socioeconomic transition had a massive impact on the labor market, leading to a decline of the female employment rate. This particularity could be exploited for the possible fertility recovery policies by encouraging women to assume this double role within society. On one hand, it is possible to encourage women's labor participation by eliminating any gender inequality and discrimination in the labor market. On the other hand, the support of women's employment should be correlated with a series of measures that facilitate a coherent relationship between work and family life (a top public nursery system, working program flexibility, etc.). In this respect, the experience of France should be carefully analyzed (Toulemon, Pailhé, and Rossier 2008).

The empirical results support a significant impact of marriage upon fertility variation. In agreement with other empirical studies, there is a positive relationship between fertility and marriage. Despite a slight decline, in Romania we are witnessing stability of the family institution, with a high rate of marriage and small differences among regions.

Another proximate determinant of fertility is divorce. In literature, the significant negative effect of the divorce rate upon fertility is explained by the change in the vision of the traditional family model that is supported, in particular, by women's financial independence. The results of our analysis are consistent with those from literature only when heterogeneity within the region is controlled, which can be explained by the intra-regional variations of the divorce rate over the entire analyzed period. In the meantime, there is no upward trend over time, but slight variations were recorded.

The previous empirical evidence outlined the hypothesis of a negative impact of unemployment on couples' decision to have a child and, implicitly, on fertility levels. Our results confirm the negative association between fertility and unemployment, but no significant fertility response to unemployment was found out. A possible explanation might be related to the small differences among regions and to the intra-regional variations over the post-communist period – from 1995 to 2015. In the same time, it is possible that due to the presence of other factors in the models, unemployment has very little additional explanatory power.

The mean age of women at first birth is another factor of interest for the analysis, as it partially allows the capture of birth postponing, especially at advanced ages, upon fertility. Empirical analysis suggests a significant negative effect of this indicator on fertility only if heterogeneity over time is controlled. This result is in line with literature studies, and it can be explained by the mean age at the first birth upward trend for all eight regions as well as by the very low intra-regional variations. Postponing the birth of the first child is a specific reality for CEE countries during the post-communist transition period, a phenomenon to be probably continued in the future, as the indicator level is below the EU average.

The significant negative impact of the urbanization degree on fertility complies with the specific character of the different demographic behavior of the two environments considering that, in Romania, by comparison, fertility is higher in the rural areas than in the urban ones. At the same time, the urbanization effect on fertility dynamics has to be studied in relation to the significant disparities regarding the level of this indicator recorded among regions. On one hand, for the regions with the highest urbanization degree and lowest fertility rates (Bucureşti-Ilfov, Centru, and Vest), a slight increase in the fertility rate is observed. On the other hand, in the regions with the lowest urbanization level (Sud-Muntenia, Nord-Est, and Sud-Vest Oltenia), fertility is declining and, moreover, the population is decreasing. Therefore, the influence of the urbanization degree should be taken into consideration both from the perspective of the inter-regional disparities and of the population structure by age group of each region (in the regions with a low degree of urbanization, there is a tendency of population aging), and even from that of the slight tendency decrease in the indicator observed in recent years at the level of each region.

As to the relationship between the real GDP per capita and the total fertility rate, the modeling results support the hypothesis of the significant negative impact of the economic development upon fertility. Indeed, an upward trend of GDP is observed at the level of each region, which, in the context of the socioeconomic changes produced after 1995 within the regional profile, leads to increasingly pronounced disparities. At the same time, in most regions, a fertility decrease trend is registered with the increase in GDP. Indeed, in the less economically developed regions, the fertility level is higher but declining, whereas the regions with a high GDP level have lower but increasing fertility rates. Despite the overall negative impact of the economic development, the observed variation of the real GDP per capita and fertility for some regions (Bucureşti-Ilfov, Centru, and Vest) agrees with the recent empirical results recorded in literature. Based on them, the hypothesis of lowest-low fertility – according to which, under a certain fertility rate, the economic improvement plays an important role in explaining the increase of the total fertility rate – is supported.

The results of the empirical analysis carried out in this paper may be useful in developing fertility recovery policies that take into account regional specificities. Encouragement of natality could be sustained by the increase in female employment rate. For almost all regions, the female employment rate increase has led to a slight recovery of fertility in recent years and, for the regions also registering a high economic development level, such as Bucureşti-Ilfov, Centru, and Vest, the fertility recovery rate is even more pronounced. In this respect, the support of the public and private institutions and the public policy measures that allow parents to combine professional and family life plays an important part. As these public and private work-life balance instruments are part of the GDP measures, the economic development can be a crucial element in this process. In other words, economic development can lead to fertility increase for the regions that encourage women's participation in the labor market. According to the obtained results, attention should also be focused on the urbanization degree, considering that the negative impact of this factor upon fertility is more pronounced compared to the GDP. Maintaining a higher fertility in the rural area in relation to the urban environment could be exploited in the direction of recovering fertility by providing a series of favorable socioeconomic conditions in rural environments, especially regarding the health and education systems. This observation should be correlated with that of the relative stability of marriage and divorce indicators, which still show that Romanians prefer the traditional family model. It is difficult to predict the evolution of the family within a society that tends to adopt the behavior of the Western societies, still tormented by the uncertainties of the transition process. However, encouraging and supporting family formation could be an important measure for fertility recovery. Synthesizing what has been discussed, we note that it is essential to understand the overall effect of the determinants upon fertility dynamics. In this regard, on one hand, the impact of heterogeneity over time and at regional level upon fertility and, on the other hand, the effect of the significant explanatory factors upon fertility dynamics should also be studied in detail.

Our research results should, however, take into consideration some limits. In this respect, a daunting problem in the study comes from the relatively low number of cross-sections and time dimension. Nevertheless, data limitation is inherent, considering that the analysis includes only the Romanian regions and the period after 1995. Taking into account that Romania falls in the profile of the CEE countries, a possible solution of this limitation could be the analysis of fertility dynamics at the regional level of CEE countries or at the level of the Romanian counties. Secondly, because of the lack of regional level data, other factors to complete or even replace some of the used independent variables were not considered in the analysis. Finally, the analysis does not address the role of different social, cultural, and institutional settings as norms and family policies in the relationship between traditional determinants and fertility. Carrying out a future study on fertility at the level of the CEE countries regions could allow such limits to be exceeded.

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Appendix

Table A-1: Variance inflation factor for the independent variables

Variables	Adjusted R^2	VIF
LGDP	0.825804	4.740660
LFEM	0.241586	0.318541
LNUP	0.403771	0.677208
LDIV	0.100625	0.111883
LUNEMP	0.759564	3.159111
LURB	0.411802	0.700108
LMAB	0.750177	3.002834

Source: Authors' computations.

Table A-2: Estimates of the random effects models on fertility

Variables	Region heterogeneity		Time heterogeneity		Region and time heterogeneity	
	Model 5		Model 6		Model 7	
Constant	0.345107	*	0.268696		0.255136	
	(0.176685)		(0.237683)		(0.236810)	
DLGDP	–0.191984	***	–0.211684	**	–0.185851	*
	(0.051172)		(0.085844)		(0.101162)	
LFEM	0.354150	***	0.358968	***	0.339264	***
	(0.045905)		(0.064070)		(0.066169)	
LNUP	0.164871	***	0.232807	***	0.310720	***
	(0.036507)		(0.063647)		(0.077929)	
LDIV	–0.054005		–0.018288		0.006833	
	(0.038514)		(0.060664)		(0.066201)	
DLUNEMP	–0.021417		–0.033370		–0.039891	
	(0.030880)		(0.047531)		(0.051303)	
DLURB	–0.464776	***	–0.479295	***	–0.489081	***
	(0.021150)		(0.028548)		(0.029055)	
DLMAB	0.015762		–0.660973		–2.033709	
	(0.446622)		(0.887219)		(1.322517)	
Hausman test	174.34487	***	16.62589	**	11.91715	**
Adjusted R^2	0.592893	***	0.635435	***	0.666219	***

Note: *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%; Robust standard errors in parentheses. Variables are abbreviated as follows: DLGDP – first difference of log of real GDP per capita; LFEM – log of female employment rate; LNUP – log of nuptiality rate; LDIV – log of divorce rate; DLUNEMP – first difference of log of unemployment rate; DLURB – first difference of log of urbanization degree; DLMAB – first difference of log of mean age of women at first birth.
Source: Authors' computations.

Table A-3: Estimates of the fixed effects models on fertility

Variables	Region heterogeneity Model 8		Time heterogeneity Model 9		Region and time heterogeneity Model 10	
Constant	–3.568710 (1.980969)	*	–6.712590 (1.278842)	***	–4.551283 (2.911993)	
LGDP	–0.049011 (0.043840)	*	–0.141407 (0.033820)	***	–0.061385 (0.032812)	*
LFEM	0.449188 (0.104954)	***	0.388265 (0.106328)	***	0.502921 (0.134207)	***
LNUP	0.130487 (0.077790)	*	0.284365 (0.069975)	***	0.247486 (0.092960)	***
LDIV	–0.065241 (0.025198)	***	0.077991 (0.071109)		–0.058837 (0.038375)	
LUNEMP	0.051268 (0.039357)		–0.121165 (0.066071)		–0.029705 (0.032973)	
LURB	–0.313921 (0.117710)	**	–0.530746 (0.258967)	***	–1.185817 (0.181054)	***
LMAB	–1.087187 (0.694577)		–2.070284 (0.312093)	***	–2.426565 (0.942948)	
Fisher test	9.711172	***	5.669809	***	13.885990	***
Adjusted R^2	0.724443	***	0.746903	***	0.823622	***

Note: *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%; Robust standard errors in parentheses. Variables are abbreviated as follows: LGDP – log of real GDP per capita; LFEM – log of female employment rate; LNUP – log of nuptiality rate; LDIV – log of divorce rate; LUNEMP – log of unemployment rate; LURB – log of urbanization degree; LMAB – log of mean age of women at first birth.
Source: Authors' computations.

Table A-4: Estimates of the fixed effects models on fertility

Variables	Region heterogeneity Model 11		Time heterogeneity Model 12		Region and time heterogeneity Model 13	
Constant	–0.010242 (0.012221)		–0.006490 (0.005538)		–0.006576 (0.004637)	
DLGDP	–0.065267 (0.062313)	*	–0.080406 (0.033409)	*	–0.032644 (0.029479)	*
DLFEM	0.069110 (0.064899)	***	0.052730 (0.079398)	***	0.127707 (0.111963)	***
DLNUP	0.024199 (0.026786)	***	0.050214 (0.017528)	***	0.032783 (0.073640)	***
DLDIV	–0.023044 (0.014167)	***	–0.012003 (0.022520)		–0.010438 (0.017049)	
DLUNEMP	0.025079 (0.028061)		–0.083447 (0.070357)		–0.035892 (0.014151)	
DLURB	–0.122568 (0.026985)	**	–0.125318 (0.051498)	**	–0.242967 (0.030859)	***
DLMAB	0.511248 (0.362462)		–1.719503 (0.238775)	***	–0.039801 (0.535544)	
Fisher test	11.083363	***	22.121208	***	13.885990	***
Adjusted R^2	0.575761	***	0.772701	***	0.823622	***

Note: *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%; Robust standard errors in parentheses. Variables are abbreviated as follows: DLGDP – first difference of log of real GDP per capita; DLFEM – first difference of log of female employment rate; DLNUP – first difference of log of nuptiality rate; DLDIV – first difference of log of divorce rate; DLUNEMP – first difference of log of unemployment rate; DLURB – first difference of log of urbanization degree; DLMAB – first difference of log of mean age of women at first birth.
Source: Authors' computations.

Table A-5: Estimates of the fixed effects

Region and/or time	Region-specific FE estimates	Time-specific FE estimates	Region- and time-specific FE estimates
Bucureşti-Ilfov	–0.049383	–	0.177796
Centru	0.080837	–	0.131143
Nord-Est	0.095935	–	–0.030981
Nord-Vest	–0.009132	–	–0.048223
Sud-Est	0.040236	–	0.055962
Sud-Muntenia	–0.055942	–	–0.175978
Sud-Vest Oltenia	–0.074015	–	–0.144719
Vest	–0.028536	–	0.035000
1996	–	–0.056733	–0.073688
1997	–	–0.020587	–0.022914
1998	–	0.142127	0.016441
1999	–	–0.107584	–0.008339
2000	–	0.145084	0.019125
2001	–	–0.131384	–0.022049
2002	–	–0.039486	–0.075773
2003	–	–0.072864	–0.049192
2004	–	–0.001511	–0.002216
2005	–	0.046365	0.022799
2006	–	–0.013291	–0.005527
2007	–	–0.149121	–0.113269
2008	–	–0.041527	0.005571
2009	–	0.013415	0.058283
2010	–	0.101137	0.101459
2011	–	0.029554	0.057907
2012	–	0.022721	0.026449
2013	–	0.142771	0.113996
2014	–	–0.018830	–0.043216
2015	–	0.009742	–0.005846

Source: Authors' computations.