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On the Relationship between Development and Fertility: The Case of the United States

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Abstract: The present article addresses the question of whether there is a link between the spatial patterns of human development and period fertility in the United States at the county level. Using cross-sectional analyses of the relationship between Total Fertility Rate (TFR) and an array of human development indicators (pertaining to three components of the Human Development Index (HDI) – wealth, health, and education), this study sheds light on the relationship between fertility and human development. The analyses were conducted separately for urban, suburban and rural counties. According to the multivariate results, a negative association between selected human development indicators and TFR exists in suburban and rural counties, as well as in the United States as a whole. However, this is not the case for urban counties, where the results were inconclusive. Some indicators (e.g., median income per capita) were found to be positively, and some (e.g., the share of adults with at least bachelor's degree) negatively, associated with TFR in urban counties. All in all, our results provide evidence of a negative relationship between human development indicators and period fertility in the United States at the county level, a finding which is consistent with the basic tenets of classic demographic transition theory.

Keywords: Period fertility · Development · Fertility-development relationship · United States · Second demographic transition

1 Introduction

Recent research (e.g., *Myrskylä et al.* 2009) suggests that the negative relationship between human development and fertility in industrialized countries reverses when the Human Development Index (HDI) progresses beyond the threshold of 0.85-0.9. The present study seeks to further explore this relationship on the example of the United States. Some scholars (*Lesthaeghe/Neidert* 2006) regard the United States as an exception to the Second Demographic Transition (SDT) which is characterized by sub-replacement fertility, rising cohabitation and, more generally, the disconnec-

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tion of marriage and procreation (e.g., *Lesthaeghe* 2010; *Lesthaeghe/Surkyn* 1988; *Van de Kaa* 1987; *Van de Kaa* 1994). Using cross-sectional analyses of the relationship between period Total Fertility Rate (TFR) and selected human development indicators (life expectancy at birth for males and females, median income per capita, the share of population below the poverty line, the shares of adults without a high school diploma and with bachelor's degree or higher), the present study explores the link between human fertility and development in the U.S.

Our choice of human development indicators is based on an exploratory factor analysis which allowed us to identify the most relevant predictors of period fertility at the county level. Each human development indicator corresponds to one of the three dimensions of the Human Development Index: wealth, health (longevity), and education (knowledge). HDI is generally the most commonly used index for human development (*Anand/Sen* 1994; *Noorbakhsh* 1998). Not only has it been widely used for monitoring the relative development among all nations of the world, but it has also been applied to regions within countries (*Acayaba/Oliveira* 2013). Particularly, HDI has been used to quantify the regional differences in human development in the United States at the state and county levels (*Burd-Sharps et al.* 2008).

This article examines the relationship between TFR and human development indicators by type (urban, suburban and rural) of county and county-equivalent administrative entities in the United States. The urban-suburban-rural classification of counties used in the present study is based on the National Centre for Health Statistics (NCHS) classification scheme, which is fundamentally a delineation of geographical areas by urbanicity-rurality (*Ingram/Franco* 2012). Our classification allows delineating urban, suburban and rural counties following the simplified NCHS scheme (see section 6 for details).

This article is organized as follows. The next two sections comprise a review of theoretical and empirical research devoted to the issue of socio-economic development and fertility. More specifically, the first of these sections discusses fertility regimes in advanced societies. A recent study by *Myrskylä et al.* 2009 is given special attention. The subsequent section addresses the applications of the Second Demographic Transition to the study of fertility regimes at the sub-national level, particularly in the United States. Next, we outline the rationale for the current study and the research hypotheses. A methodology section followsin which we describe data and variables employed in our empirical approach. In the results section which follows, we report descriptive statistics as well as multivariate analyses that model TFR as a function of human development indicators and racial-ethnic composition across the three types of U.S. counties (urban, suburban and rural).

2 Human Development and Fertility: Recent Evidence

Research examining the relationship between human development and fertility has a long history (*Luci/Thévenon* 2010). Starting with *Malthus* (2013[1798]), according to whom fertility increases lead to the pauperization and moral degradation of large sectors of population due to the finite nature of natural resources, the weight of early scholarly opinion made a formulaic "truth" out of the negative relationship between fertility and development (*Myrskylä et al.* 2009). While there exist a number of respectable theories predicting cyclical variations of fertility as a result of economic growth or decline (of which Malthusianism is a classical example), much scholarly attention has been dedicated to the demographic transition theory (DTT). Originally the theory was set to imply that in countries undergoing modernization, long-term economic growth should lead to a transition from high to low birth and death rates (*Davis* 1945; *Notestein* 1945). However, DDT was later expanded to predict ever-decreasing fertility rates with economic growth in various kinds of contexts (*Caldwell* 1976, 1982; *Kirk* 1996; *Lee* 2003). Although in the second half of the 20th century DTT clearly dominated theoretical discussions related to fertility and development (*Mason* 1997), a more revisionist stance toward the issue was developed by the late 20th century. An influential report of the U.S. *National Research Council* (1989) presented a view that departed, in important respects, from the classical interpretation of the fertility-development relationship offered by DDT. First, the report pointed out that population decline in and of itself can thwart economic growth. Secondly, and more importantly, it stressed that the correlation between slower population growth and decreased poverty does not imply causation. It is worth noting that when the report was published, the world's TFR was approximately 3.4 children per woman (in contrast to today's 2.3) and sub-replacement fertility was rare and limited to one region of the world – Europe (*United Nations* 2013). Although fertility below replacement level (defined as TFR<2.1) was a rarity 30 years ago, today it is widespread in Europe, Asia and the Americas.

Fertility rates in some European countries has plummeted within the last decade, thus creating the phenomenon of "lowest-low fertility", defined as a total fertility below 1.3 (*Kohler et al*. 2002). As of today, the lowest fertility levels are found in the Eastern European and Mediterranean countries (*Billari/Kohler* 2004; *Kohler et al.* 2002). At the same time, in highly developed countries, either the centuries-long fertility decline has stalled or an opposite trend has been observed simultaneously with continuing socio-economic development (*Balbo et al.* 2013; *Bongaarts/Sobotka* 2012; *Goldstein et al.* 2009). In north-western European countries (e.g., Denmark, Netherlands, and United Kingdom), where below-replacement fertility persisted at least for the length of one generation, there has been *a fertility rebound* since the late 1990s.

Whereas contemplating the fact that fertility cannot decline *ad infinitum* is quite compatible with DTT, explanations of the reversal of the fertility trend are not (*Mason* 1997). It is worth mentioning that one of the most prominent contemporary theories of post-transitional fertility, the Second Demographic Transition (reviewed in more detail below), predicts indefinitely lower fertility in the context of industrialized countries as women obtain higher education and higher wages (*Lesthaeghe/Surkyn* 1988). Paradoxically, however, fertility now appears to be rebounding in those countries which have progressed farthest on the path of the second demographic transition (*Goldstein et al.* 2009). Moreover, these very countries are also the world's leaders in gender equity – women's labour market participation and tertiary education rates are the world's highest, and still rising. Overall, we can summarize that this brief overview of dominant theoretical approaches to reproductive behaviour shows shortcomings in explaining why long-term socio-economic development does not necessarily go hand-in-hand with a decline in period fertility rate.

It has to be noted that, despite the long history of research on these questions, the field has still not reached a consensus on the relative importance of different components of human development for fertility change (*Bryant* 2007; *Lee* 2003; *McDonald* 2000). Traditionally, in human geography and across social sciences, much emphasis has been placed on economic determinants of fertility in the industrialized world (*Bryant* 2007). There are signs, however, that scholarly interest has begun to shift toward the social, non-economic components of human development (education, health, gender equity) as predictors of trends in period and cohort fertility among developed countries (see, for example, studies of *Goldstein et al.* 2009; *McDonald* 2000; *Myrskylä et al.* 2012).

A widely cited, and much discussed study by *Myrskylä et al.* (2009) empirically tested the hypothesis of an impact of the overall level of human development, proxied by the Human Development Index (HDI),[1] on fertility, using cross-sectional and longitudinal data from the OECD area spanning from 1975 to 2005. In confronting cross-country data, the researchers contended that the development-fertility relationship is negative when HDI levels are below the range of 0.85-0.9. However, when at the turn of the 21 century some countries reached an HDI above 0.9, the HDI-fertility association reverses to positive. Hence, by designating a clear turning point in the relationship between human development and fertility, *Myrskylä et al.* (2009) find that human development is likely to induce a fertility rebound. It is reasonable to assume that the theoretical framework put forward by *Myrskylä* and colleagues can be used not only to explain cross-country variations in HDI-fertility association, but also to examine the effect of human development indicators on fertility within a particular country. The clear drawback of *Myrskylä et al.'s* (2009) work is that the effect of human development was represented by one integrated parameter, while its components (wealth, longevity and education) were not modelled as separate effects. Subsequent research (*Furuoka* 2009) argued that clarifying the effect of each component of the human development process is important for identifying the causal structure of the relationship between human development and fertility.

3 The Second Demographic Transition in the United States

As mentioned above, the SDT is one of the dominant theories for explaining family formation and reproduction in the industrialized countries. Inspired by the rise of post-materialism (*Inglehart* 1971), the theory views marriage and reproduction as independent spheres and predicts the end of the predominance of the nuclear family as the only legitimate family type in the modern era (*Van de Kaa* 1987; *Van*

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[1] The human development index is a composite number that values between 0 and 1. A greater value of the HDI indicates a higher human development.

de Kaa 1994). The key argument of the theory is that individuals in contemporary industrialized societies assign stronger importance to their own self-realization than to their family and children. According to this causal framework, the value shift toward individualism and self-realization is taken as an explanation for the delay of union formation and parenthood, an increased frequency of having several partners before the first child, and a rise in cohabitation, which has been associated with a later age at entry marriage, if not a retreat from marriage. Ultimately, all these behavioural changes lead to fertility decline (*Lesthaeghe/Surkyn* 1988).

According to *Lesthaeghe* (2010), the new transition first began in the Benelux countries in the 1970s and began to spread across Western Europe, Canada and Australia. North-western European countries have been among the first to embrace a new family model by delaying childbearing and, simultaneously, a new economic model by investing in the educational and workplace opportunities of both men and women (*Lesthaeghe* 2010; *Van de Kaa* 1994). Furthermore, recent studies framed within the SDT theory argue that the second demographic transition would not remain a regional idiosyncrasy, but would spread to the United States, Southern, Central, and Eastern Europe and industrialized Asian states (*Lesthaeghe* 2010; *Raley* 2001). Regardless of past demographic regimes in these countries, the SDT theory predicts the same demographic outcomes – the rise of divorce, cohabitation and out-of-wedlock childbearing – and most importantly – fertility decline.

Of more direct relevance to this study is a paper by *Lesthaeghe* and *Neidert* (2006) which is devoted to the geographical pattern of the SDT in the United States. Examining geographical variations in the age at marriage, cohabitation rates and extramarital fertility as correlates of the SDT, the authors found that the "blue states," that is, the states that traditionally vote Democratic, exhibit an idiosyncratic pattern of the SDT, whereas the "red states," that is, the states that traditionally vote Republican, exhibit traditional patterns of union formation. In other words, the conservative "red states" generally stick to the "breadwinner" model of the family that celebrates marriage as the institution ordained to promote the unity of sex, procreation and childrearing. In contrast, the "blue states" have moved toward the SDT by delaying childbearing and embracing a more liberal view of family. The authors conclude that the political divide in the U.S follows the same geographic pattern as does the SDT. There is one apparent weakness of *Lesthaeghe* and *Neidert*'s (2006) study – all analyses are conducted at the state level. Although many demographic policies are endorsed at the state level, it is worth mentioning that counties generally are the primary political units of local government and have programmatic importance at the federal and state levels. It is also worth mentioning that many socio-demographic indicators vary significantly at the county level. For example, TFR varies from 0.5 to 3.6. The percentage of adults holding bachelor's or a higher educational degree varies from 4 to 70 percent at the county level, while the corresponding minimal and maximal values for the share of non-Hispanic whites are 1 and 100 percent.

4 Urban-Rural Divide and the Issue of Geographic Scale

Changing geographic scale (the size of geographic units) can dramatically change estimated parameters. The United States is not only a vast country, but it is also known for its remarkable geographic fractionalization of demographic outcomes (*Frey* 1996; *Massey* and *Denton* 1988; *Zelinsky* 2011). Measuring American fractionalization calls for geographically precise data. For example, as our preliminary analyses indicate (not shown for parsimony), geographic clustering of fertility patterns rarely follows state lines. This is because prior waves of fertility change that had swept through the country produced over time a remarkable geographical pedigree of fertility regimes (*Lesthaeghe* and *Neidert* 2006). The "blue states" (e.g., California, New York) in *Lesthaeghe* and *Neidert*'s (2006) study contain, in addition to some of the largest urban areas in the country, a number of less urbanized and even rural areas that demographically are not distinguishable from similar areas of the neighbouring "red states". In other words, examining geographic patterns of fertility behaviour at the level of U.S. states does not capture variations in fertility *within* states.

No less important than the problem of geographic scale to this project is the issue of urban-rural disparities in fertility. According to *Lesthaeghe* and *Neidert*'s (2006), the TFR is higher in those states which are "more rural than metropolitan." (p. 27). This finding points to the familiar pattern, by no means exclusive to the United States, of a rural "surplus" of fertility. Indeed, numerous studies across the globe (including the U.S.) demonstrate that, on average, urbanites tend to have less children than rural residents (*Caldwell* 1982; *Gallup et al.* 1999; *Glenn*/*Hill* 1977; *Sharlin* 1986).

Moreover, considering human development indicators and fertility together, it becomes evident that there is an overlap between spatial patterns of human development and fertility. Unfortunately, much of what we know about urban-rural dimension in the relationship between human development and fertility is based on a small number of studies. However, there is an ample body of research documenting the relationship between urbanization and development. Incorporating empirical evidence from around the world, socioeconomic status (SES) is shown to be positively correlated with urbanicity, with lower poverty and higher education and income levels found in urban than rural areas (*Bradshaw* 1987; *Cochrane* 1983; *London*/*Smith* 1988; *Sicular et al.* 2007). Cities have higher concentrations of human capital – skilled workers are paid higher wages, and this tendency has been rising over time (*Glaeser*/*Redlick* 2009; *Rauch* 1993). A recent study by *Singh* and *Siahpush* (2014) also shows that there are noticeable health differences across urbanization levels in the U.S., with the life expectancy at birth being 2.0 years higher in urban than in rural areas.

5 Study's Rationale

Unfortunately, there have been no empirical studies devoted to the development-fertility relationship in the context of the United States. To cover this gap, this paper investigates the impact of selected human development indicators on TFR by county type (urban, suburban and rural) in the United States. The conceptual basis for this study *draws* from the empirical evidence that the relationship between human development and fertility in advanced industrialized societies is not necessarily negative, as is the case in developing nations (*Goldstein et al.* 2009; *Myrskylä et al.* 2009). Particularly, it has been argued that there could exist a threshold after which period fertility does not decline with increasing levels of socio-economic development (*Myrskylä et al.* 2009).

Among the industrialized countries, the United States is characterized not only by relatively high human development, but also by high period fertility, especially in contrast to the sub-replacement fertility patterns of Europe (see Table 1). However, recent research confirms that there are strong regional differences in correlates of SDT, with some states advancing further toward SDT and some not (Lesthaeghe/*Neidert* 2006). The states that exhibit fertility and family change patterns which are more characteristic of SDT are usually more urbanized (*Lesthaeghe*/*Neidert* 2006).

Tab. 1: TFR and HDI of Selected Industrialized Countries

Country	USA		France		Germany		UK	
	TFR	HDI	TFR	HDI	TFR	HDI	TFR	HDI
1980	1.8	0.825	2.0	0.722	1.6	0.739	1.9	0.735
1985	1.8	0.839	1.8	0.741	1.4	0.752	1.8	0.747
1990	2.1	0.858	1.8	0.779	1.5	0.782	1.9	0.768
1995	2.0	…	1.7	…	1.3	…	1.7	…
2000	2.1	0.883	1.9	0.848	1.4	0.854	1.6	0.863
2005	2.1	0.897	1.9	0.867	1.3	0.887	1.8	0.888
2010	1.9	0.908	2.0	0.879	1.4	0.904	1.9	0.895

Source: CDC, Eurostat, UNDP

It has to be noted at the outset that the theories (i.e., DDT and SDT) that underlie this research have been constructed at the macro level for the entire world, and for regions to reveal the general trajectory of reproductive regimes. However, this investigation is based on the analyses conducted at the county level within one country. Thus, the general objective of the present paper is to test these theories at the county level. Particularly, this study will assess whether the relationship between human development and fertility at the U.S. county level is indeed positive, as has been predicted by *Myrskylä et al.* (2009) for the industrialized countries. It is important to mention that the SDT theory predicts the opposite of what we expect to find in this study (*Lesthaeghe*/*Neidert* 2006). Our main hypothesis is that each and every human development indicator has a positive impact on fertility. Thus, per each component of human development (wealth, health, and education), we expect that more affluent, healthier and better educated U.S. counties will have higher fertility. We also predict that the urban-rural divide will have a moderating effect on the relationship between human development and fertility. Specifically, consistent with the premises of the SDT theory (e.g., *Lesthaeghe/Neidert* 2006; *Van de Kaa* 1994), period fertility is expected to be lower in urban counties than in rural counties, while suburban counties will occupy the middle ground between the two. This prediction is derived from the fact that urbanites were at the forefront of the SDT (*Buzar et al.* 2007). According *Lesthaeghe* and *Neels* (2002), urbanicity is one of the main structural predictors of the SDT.

6 Methodology

The study sample is drawn from several sources. The information on all independent variables, except health, was obtained from the American Community Survey (ACS), arguably *the most* recent and complete source of official statistics at the county level. The fertility data – Age Specific Fertility Rates (ASFR) by county – were obtained from the National Centre for Health Statistics (NCHS). The NCHS data cover the period of five years (2007-2012) which allows aggregating the irregular and fragmented natality data from less populated counties.

The dependent variable is Total period Fertility Rate (TFR), perhaps the most commonly used fertility indicator. Age Specific Fertility Rates (ASFR) were calculated from the county-level NCHS natality data (vital statistics) averaged over the period of 2007-2012, while the data on female population by age were obtained from the ACS. TFR is averaged over the period of 5 years to adjust for relatively small numbers of births in certain age groups in less populated rural counties.

In order to identify the most important human development indicators at the county level, we carried out several explorative analyses (not shown for parsimony). Specifically, per each component of the Human Development Index (wealth, health and education), we identified between four and six theoretically relevant human development indicators obtained from the U.S. Census or vital statistics (via ACS and NCHS) and conducted an exploratory factor analysis. Per each indicator we selected two variables that loaded highly on one factor. To account for heteroskedasticity and autocorrelation, indicators that were highly correlated with other indicators were excluded, as were indicators for which there was little or no variation across counties. Thus, we obtained three factors that were interpreted by us as wealth, health and education. The variables that scored highly on health were (1) male and (2) female life expectancies at birth. The selected wealth indicators were (3) median income per capita and (4) the percentage of households with income below the poverty line. Finally, the two indicators that loaded highly on education were (5) the percentages of adults 25 years and older with less than a high school education and (6) with bachelor's degree or higher. Importantly, we included an indicator that controls for the racial-ethnic composition of population – percentage of non-Hispanic whites – because fertility differs widely between racial-ethnic groups. It is also important to note that racial-ethnic minorities score significantly lower on some, if not all, human development indicators in the U.S. (*Oliver/Shapiro* 2006; *Olshansky et al.* 2012; *Shapiro et al.* 2013). Specifically, race gaps in longevity and education are a well-established fact (*Guralnik et al.* 1993; *Olshansky et al.* 2012; *Ryabov* 2011; *Singh/Siahpush* 2014). Thus, given the findings of these studies, we reasoned that not controlling for racial-ethnic population composition would significantly eschew our results.

The distinction between urban, suburban and rural counties is based on the NCHS urban-rural classification scheme, which was developed for monitoring the health of urban and rural residents (for details see *Ingram/Franco* 2012). The NCHS groups U.S. counties and county-equivalent entities into six urbanization levels (four metropolitan and two nonmetropolitan), on a continuum ranging from most urban to most rural. In short, counties are classified as "large central metro" if they contain a Metropolitan Statistical Area (MSA) with 1 million or more inhabitants and satisfy at least one of three conditions: they (1) contain the entire population of the largest principal city of the MSA, or (2) have their entire population contained in the largest principal city of the MSA, or (3) contain at least 250,000 inhabitants of any principal city of the MSA. According to the NCHS classification, the next group – "large fringe metro" – includes those urban counties that belong to MSAs of 1 million or more inhabitants that did not qualify as "large central metro" counties. The next two types, "medium metro" and "small metro" counties, are differentiated by population size. "Medium metro" contains MSAs of populations from 250,000 to 999,999 and "small metro" MSAs have less than 250,000 inhabitants. Nonmetropolitan categories are "micropolitan", that is counties located in Micropolitan Statistical Areas, and "noncore" – rural counties that did not qualify as "micropolitan." The detailed description of the NCHS classification scheme can be found elsewhere (see *Ingram/*

Tab. 2: Types of the U.S. Counties by Urbanicity

Urbanicity	Description	NCHS Classification
Urban	Counties in MSAs* with 1 million or more residents	Large central metro, large fringe metro
Suburban	Counties in MSAs* of populations of less than 1 million	Medium metro, small metro
Rural	Counties containing no MSAs*	Micropolitan,* noncore

* In the United States, metropolitan and micropolitan statistical areas (metro and micro areas) are geographic entities delineated by the Office of Management and Budget (OMB) for use by Federal statistical agencies in collecting, tabulating, and publishing Federal statistics. A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population. Each metro or micro area consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration with the urban core.

Source: Based on NCHS Classification

Franco 2012). We simplified the NCHS scheme by creating three urbanization levels (see Table 2). Our definition of urban counties includes "large central metro" and "large fringe metro." The U.S. counties classified in the NCHS scheme as "medium metro" and "small metro" are identified by us as suburban. Finally, our definition of rural counties encompasses NCHS nonmetropolitan categories – "micropolitan" and "noncore."

7 Results

Table 3 gives the TFR values across the upper quartile, median, and lower quartile of each parameter (6 human development indicators plus the percentage of non-Hispanic whites) for a sample of 3,145 countries during the period 2007-2012. The bivariate analyses are also presented in the graphical form in Fig. 1-7. As shown in Table 3, academic achievement of Latino adolescents is associated with school SES and minority composition. As expected, academic achievement in schools increases with average school SES and decreases with the percentage of minority enrollment. As evident from Table 3 and Figures 1-7, an association between the selected human development indicators and TFR is likely, but the magnitude of the association varies depending on the variable in question. For example, the bivariate analyses indicate that a stronger association is likely between TFR and the percentage of non-Hispanic whites than between TFR and life expectancy at birth (for both

Tab. 3: Average TFR across Three Levels (High, Medium and Low)* of Human Development Indicators in the U.S. Counties (N=3,145; 2007-2012)

Human Development Indicators	Low	Median	High
Wealth			
Median Income (dollars in 2010)	2.15	2.05	1.92
Poverty Rate (% below poverty threshold)	2.13	2.04	1.93
Health			
Male Life Expectancy at Birth (years)	2.07	2.04	2.00
Female Life Expectancy at Birth (years)	2.10	2.05	2.00
Education			
Less Than High School (%)	2.11	2.04	1.96
At Least Bachelor's Degree (%)	2.13	2.05	1.94
Population Composition			
Non-Hispanic White Population (%)	2.19	2.05	1.89

* High, medium and low levels correspond to upper quartile, median and lower quartile of the variable distribution.

Source: ACS, NCHS

Fig. 1: Scatter Plot and exponential Trend Line of the Association between Median Income in 2010 and TFR in the U.S. Counties (N=3,145; 2007-2012)

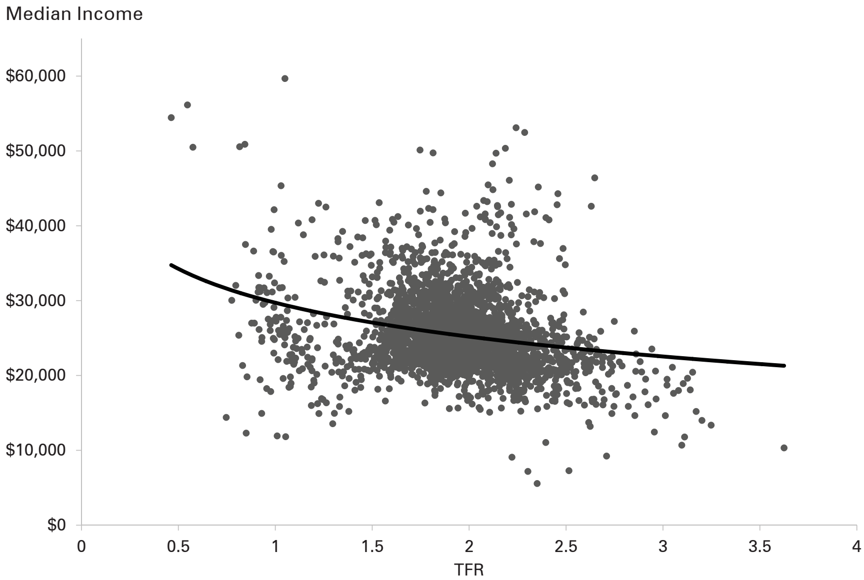
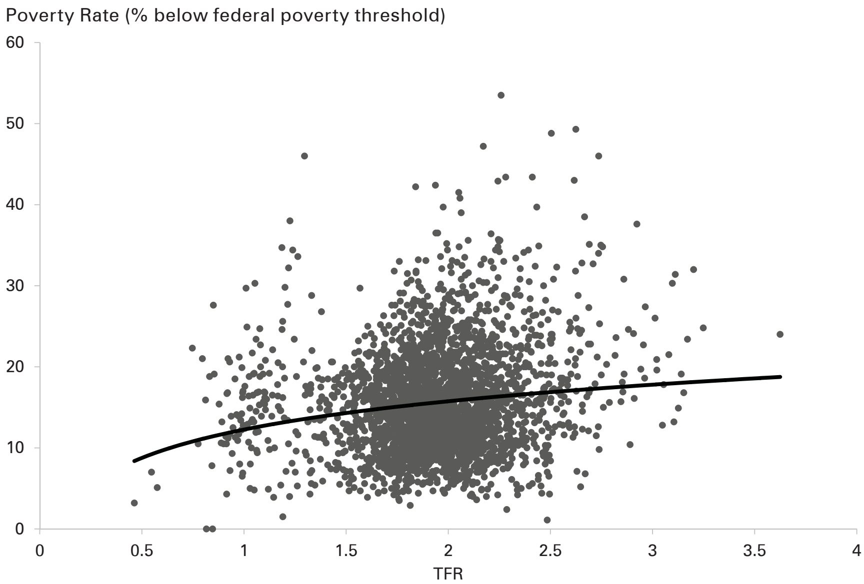


Fig. 2: Scatter Plot and exponential Trend Line of the Association between Poverty Rate and TFR in the U.S. Counties (N=3,145; 2007-2012)



Source: ACS, NCHS

Fig. 3: Scatter Plot and exponential Trend Line of the Association between Male Life Expectancy at Birth and TFR in the U.S. Counties (N=3,145; 2007-2012)

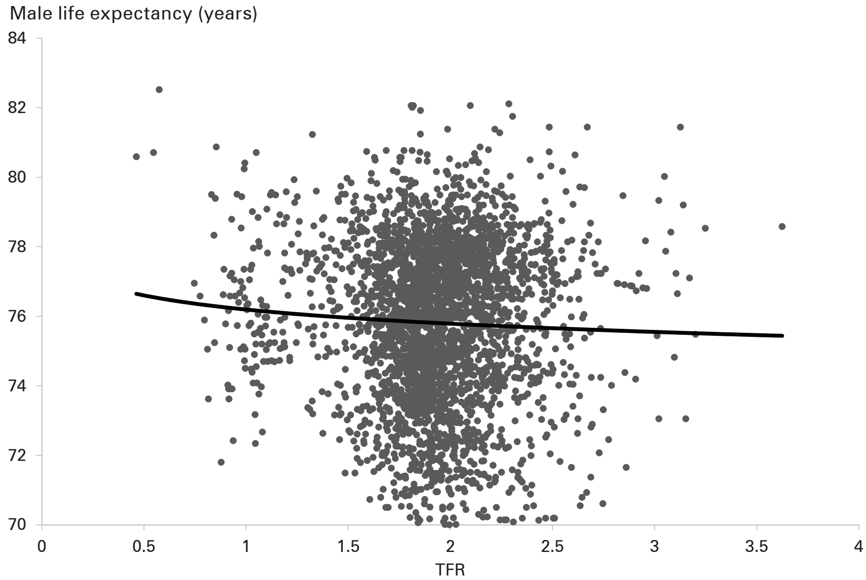
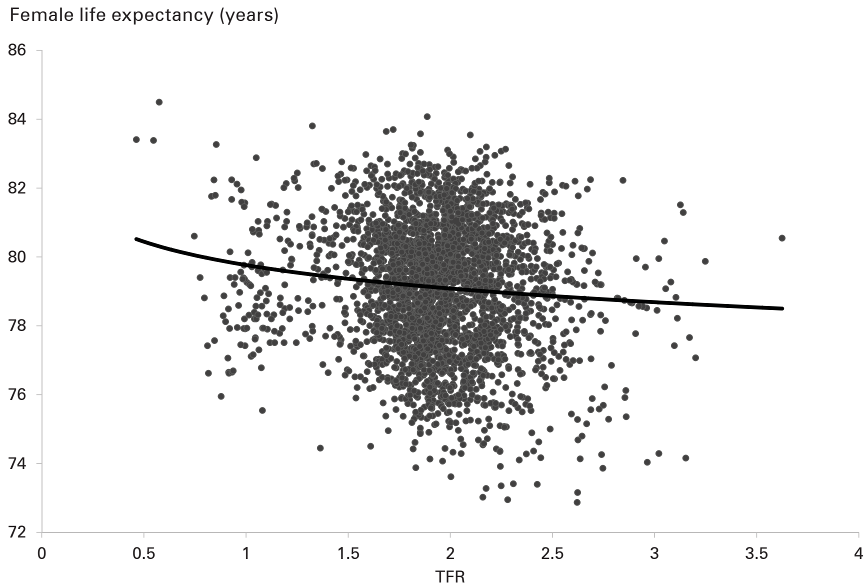


Fig. 4: Scatter Plot and exponential Trend Line of the Association between Female Life Expectancy at Birth and TFR in the U.S. Counties (N=3,145; 2007-2012)



Source: ACS, NCHS

Fig. 5: Scatter Plot and exponential Trend Line of the Association between Percentage of Adults with Less than High School and TFR in the U.S. Counties (N=3,145; 2007-2012)

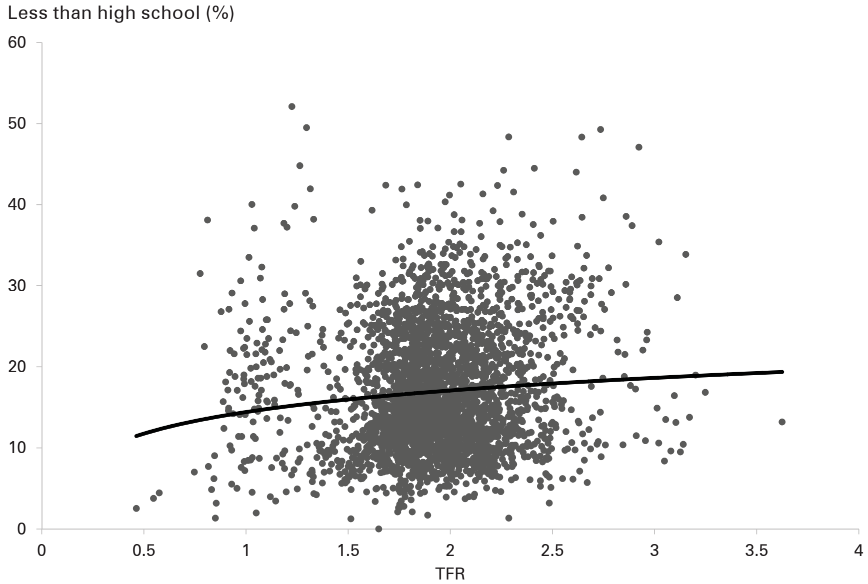
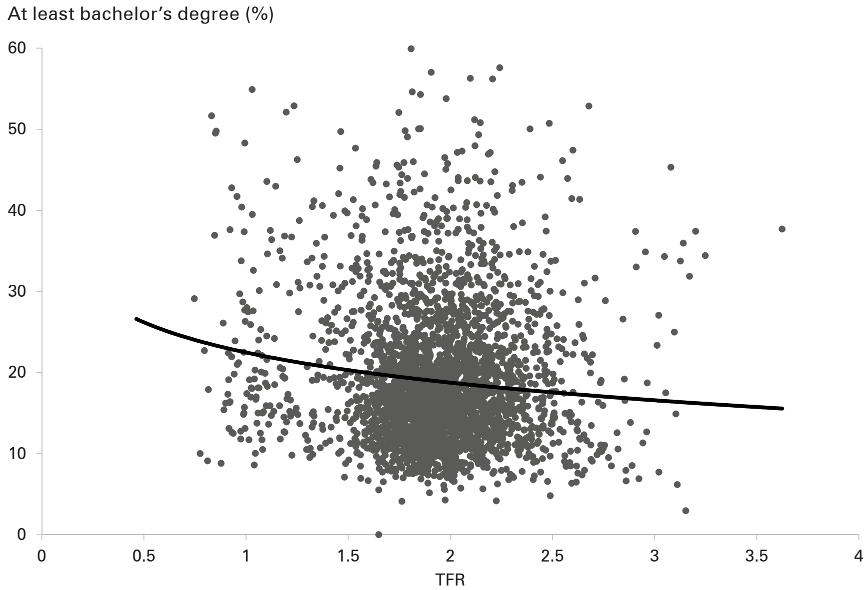
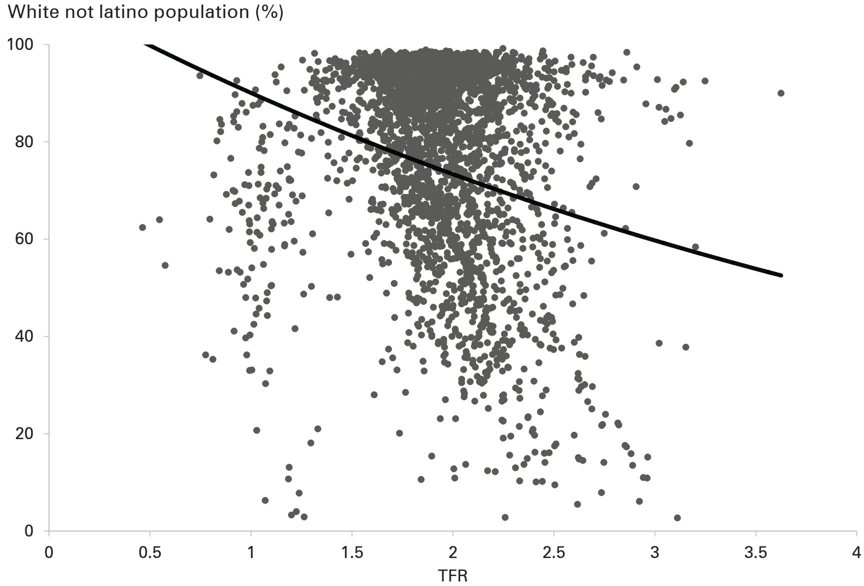


Fig. 6: Scatter Plot and exponential Trend Line of the Association between Percentage of Adults with at least Bachelor's Degree and TFR in the U.S. Counties (N=3,145; 2007-2012)



Source: ACS, NCHS

Fig. 7: Scatter Plot and exponential Trend Line of the Association between Percentage of Non-Hispanic White Population and TFR in the U.S. Counties (N=3,145; 2007-2012)



Source: ACS, NCHS

women and men). Compared to TFR at the lowest quartile of male and female life expectancy (2.07 and 2.09, respectively), TFR corresponding to the lowest quartile of the distribution of percent non-Hispanic white is 2.19. Generally, the interquartile range in TFR is higher by at least a factor of two for the percentage of non-Hispanic whites and wealth indicators than for longevity indicators. Another noteworthy fact is that higher wealth, longevity and education correspond to lower levels of TFR, thus suggesting a pattern consistent with the DTT.

The means of all variables by county type are shown in Table 4. The comparison of means between urban, suburban and rural counties reveals that there are quite a few urban-rural disparities in fertility and human development indicators. The first noteworthy feature is that TFR is significantly higher ($p<0.01$) in suburban and rural counties than in urban counties. Compared to suburban and rural counties, urban counties are characterized by significantly higher incomes, lower poverty rates, higher female life expectancy, lower shares of adults without a high school degree and higher shares of adults with a college degree (bachelor's or above). It is important to note that we also found significant differences between suburban and rural counties in income and educational attainment. Additionally, urbanites tend to be more racially diverse than residents of suburban and rural counties. The share of non-Hispanic white population was 74.5 percent in rural counties, as compared to 53.7% in urban counties. Suburban counties occupied an intermediate position with respect to this parameter (64.0 percent).

Tab. 4: Means of Study Variables by U.S. County Type (N=3,145; 2007-2012)

Study Variables	U.S. Counties			
	Urban (N=436)	Suburban (N=731)	Rural (N=1,976)	All (N=3,143)
Outcome Variables				
Total Fertility Rate	1.87[ac]	2.08[a]	2.15[c]	2.05
Independent Variables				
Wealth				
Median Income (2010 dollars)	$34,974[ac]	$28,980[ab]	$25,383[bc]	$29,103
Poverty Rate (% below poverty threshold)	14.6[ac]	15.4[a]	16.8[c]	15.4
Health				
Male Life Expectancy at Birth (years)	75.3	75.0	74.6	74.9
Female Life Expectancy at Birth (years)	81.8[ac]	80.3[a]	79.7[c]	80.1
Education				
Less Than High School (%)	12.2[ac]	14.3[ab]	16.8[bc]	14.5
At Least Bachelor's Degree (%)	33.3[ac]	28.4[ab]	23.8[bc]	28.0
Population Composition				
Non-Hispanic White Population (%)	53.7[ac]	64.0[ab]	74.5[bc]	64.6

Note: Bonferroni method of comparing multiple means was used in the analysis.
[a] Difference in the means significant at $p < 0.05$ between urban and suburban counties.
[b] Difference in the means significant at $p < 0.05$ between suburban and rural counties.
[c] Difference in the means significant at $p < 0.05$ between urban and rural counties.

Source: ACS, NCHS

Multivariate results are presented in Tables 5 and 6. Table 5 models TFR as a function of seven predictors – median income per capita, population living in poverty (%), male life expectancy, female life expectancy, adult population with less than high school education (%), adult population with bachelor's degree or higher (%) and non-Hispanic population (%) – in urban, suburban and rural counties, correspondingly. Each column in Table 5 shows the same regression model run on urban, suburban and rural counties. In contrast to Table 5, which shows the analyses conducted on three groups of counties, Table 6 presents an aggregate picture, predicting TFR in all U.S. counties. Multivariate regression model 1 in Table 6 is the same as the models in Table 5. Model 2 of Table 6 is the expansion of model 1. In addition to the aforementioned predictors, it includes the urbanicity level (reference: rural).

Turning to Table 5 first, observe that only one of the two effects monitoring wealth – income – is consistently significant in all Table 5 models. Income is found to be conducive to higher fertility in urban counties (at $p<0.01$). At the same time, the association between income and TFR is negative in suburban and rural counties (at $p<0.05$). The effect for male longevity is negative and highly significant, but only in rural counties. A negative association is also observed between life expectancy for females and period fertility in suburban and rural counties. However, longevity, regardless of gender differences, does not seem to matter when predicting variations

Tab. 5: Unstandardized Regression Coefficients and Their Standard Errors (in Parenthesis) in OLS Regression Models Predicting Total Fertility Rate in, Suburban and Rural Counties (N=3,145; 2007-2012)

Study Variables	Urban Counties (N=436)	Suburban Counties (N=731)	Rural Counties (N=1,976)
Wealth			
Median Income	0.16*** (0.06)	-0.12** (0.05)	-0.12*** (0.03)
Poverty Rate	-0.06 (0.05)	0.08 (0.04)	0.04 (0.03)
Health			
Male Life Expectancy at Birth	0.07 (0.06)	0.05 (0.04)	-0.12*** (0.03)
Female Life Expectancy at Birth	0.07 (0.05)	-0.11* (0.05)	-0.07* (0.03)
Education			
Less Than High School	0.06 (0.04)	0.08 (0.04)	0.11*** (0.03)
At Least Bachelor's Degree	-0.12*** (0.05)	-0.10* (0.05)	-0.05 (0.04)
Population Composition			
Non-Hispanic White Population	-0.15*** (0.05)	-0.23*** (0.07)	-0.14*** (0.04)
Pearson's R^2	0.169	0.156	0.170

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Source: ACS, NCHS

in period fertility among urban counties. On educational attainment measures, U.S. counties seem to be split along the suburban/rural line. Only in rural counties is the percentage of adults who have not finished high school positively related to TFR. In urban and suburban counties, the other indicator of educational level is significant – that of highest level of attainment. Urban and suburban counties with lower percentages of adults with college degrees are predicted to have lower fertility. All in all, populations of those urban and suburban counties that are better educated are more likely to have lower period fertility. The effect of the share of non-Hispanic white population is uniformly negative across U.S. counties, regardless of their urbanity level. Thus, U.S. counties with significant shares of minority populations are likely to have higher fertility. Considered together, the findings presented in Table 5 show that in rural and suburban counties, wealth, health and education are inversely

Tab. 6: Unstandardized Regression Coefficients and Their Standard Errors (in Parenthesis) in OLS Regression Models Predicting Total Fertility Rate in All U.S. Counties (N=3,145; 2007-2012)

Study Variables	Model 1	Model 2
Wealth		
Median Income	-0.12**	-0.12**
	(0.04)	(0.04)
Poverty Rate	0.08	0.08
	(0.03)	(0.03)
Health		
Male Life Expectancy at Birth	0.05	0.05
	(0.03)	(0.03)
Female Life Expectancy at Birth	-0.11*	-0.11*
	(0.03)	(0.03)
Education		
Less Than High School	0.08	0.08
	(0.03)	(0.03)
At Least Bachelor's Degree	-0.12**	-0.14***
	(0.03)	(0.03)
Population Composition		
Non-Hispanic White Population	-0.18***	-0.15***
	(0.04)	(0.04)
Urbanicity (Reference: Rural)		
Urban		-0.12***
		(0.05)
Suburban		0.08
		(0.04)
Pearson's R^2	0.171	0.174

**p* < 0.1; ***p* < 0.05; ****p* < 0.01

Source: ACS, NCHS

related to TFR. Whether this holds true for all U.S. counties or county equivalents is further investigated below (see Table 6).

In model 1 of Table 6, there are four significant (p<0.05) effects. Per capita income, female life expectancy at birth, percentage of college-educated, and percentage of non-Hispanic whites are all negatively associated with TFR. Finally, the full model adds two dummies for urbanicity – urban and suburban (rural is the reference category). While the effect for suburban is not significant, the effect for urban counties is significant and negative. Consistent with earlier studies (e.g., *Glenn/Hill* 1977; *Lesthaeghe/Neidert* 2006; *Westoff* 1954), this finding suggests that urban populations tend to have lower fertility. All in all, the results presented in Table 6 are quite similar to those presented in Table 5. Controlling for population racial-ethnic composition, the relationship between human development indicators and fertility is likely to be negative across suburban and rural counties as well as in the Unites States as a whole.

8 Discussion

The determinants of fertility in industrialized societies are a recurrent topic in public policy debates on demographic policy (*Balbo et al.* 2013). One largely unsettled issue concerns the impact of human development on fertility in these countries. Although conventional wisdom posited a negative and resistant correlation between human development and fertility, recent evidence seems to contradict this assertion (*Goldstein et al.* 2009; *Myrskylä et al.* 2009). *Myrskylä et al.* (2009) argue that in advanced industrialized countries, further development halts the declining fertility rates. Another issue, often overlooked, is the impact of the place of residence on reproductive behaviour (*Sharlin* 1986). Urban–rural differences both in human development and fertility have long been recognized (*Bradshaw* 1987; *Glenn/Hill* 1977; *London/Smith* 1988). Specifically, it is largely assumed that urbanites tend to have smaller families than rural residents (*Caldwell* 1982; *Glenn/Hill* 1977; *Sharlin* 1986). In the context of the United States, strong regional contrasts have been found with respect to fertility and family formation patterns between more and less urbanized areas (*Glenn/Hill* 1977; *Lesthaeghe/Neidert* 2006).

In the present paper, we addressed the question of whether there is an association between the spatial pattern of human development and period fertility in the United States at the county level. In order to address this question, we simultaneously engaged with the issues of geographic scale, urbanicity-rurality and a choice of socio-economic factors that define the concept of human development. Six human development indicators – male life expectancy, female life expectancy, median income per capita, the share of population below poverty line, the shares of adults without high school diploma and with bachelor's degree or higher – were selected as the ones representing the three domains of human development (wealth, health and education) and were regressed on TFR. The analyses were conducted separately for urban, suburban and rural counties. Following *Myrskylä et al.* 2009, we hypothesized that, holding all else constant, counties with elevated levels of human development would have higher levels of period fertility as well. In other words, we expected to find a positive association between human development indicators and TFR. On the basis of literature documenting various degrees of association between spatial patterns of urbanicity-rurality and fertility (e.g., *Cochrane* 1983; *Glenn/Hill* 1977; *Lesthaeghe/Neidert* 2006; *Sharlin* 1986), we also expected that TFR should be lower in urban rather than rural counties.

Our results reveal a pattern somewhat consistent across suburban and rural counties of a negative association between wealth, health and education, on the one hand, and period fertility, on the other. Hence, all things considered, our research hypothesis derived from *Myrskylä et al.* (2009) did not hold in the case of suburban and rural U.S. counties. Rather, our findings provide evidence of support for the DTT and SDT theoretical models. The analyses carried out on all counties also showed that, as predicted at the outset, urban counties tend to have lower fertility. Urban setting is also unique in that only one human development indicator – the share of adults with at least bachelor's degree – was found to have a negative effect on TFR in urban counties. Moreover, income in urban counties is found to be positively associated with the outcome variable. In other words, the effects of wealth and education on period fertility in the urban United States seem to be in different directions.

Apart from this, the effect of the ethnic composition of the population seems to be quite relevant in urban as well as rural settings. U.S. counties with lower percentage of non-Hispanic whites tend to have lower period fertility, *ceteris paribus*. This result confirms that there are clear differences in period fertility between the major racial-ethnic groups in the U.S. and these differences exist not only at the individual but also at the regional (county) level. It must be mentioned here that fertility differentials along racial and ethnic lines have existed in the United States for a long time and there have been identified a number of analytical hypotheses concerning fertility differentials (*Lichter et al.* 2012; *Parrado* 2011). Although a full discussion of these hypotheses lies beyond the scope of the present study, we have to mention that racial and ethnic group differences in the distribution of social and economic resources are often credited as the main factor responsible for the persistent racial and ethnic fertility differentials in the U.S. (*Parrado/Flippen* 2012; *Sweeney/Raley* 2014).

While we must be careful *not to overstate the importance* of these findings given the limited explanatory power of our statistical models, it is worth noting that in U.S. urban areas the relationship between human development and fertility is not negative, as is likely to be the case in suburban and rural areas. It is also reasonable to assume that the trend toward low fertility in urban areas is not irreversible. Theoretically, further increases in economic development could bring about a fertility rebound in U.S. urban areas. However, a growing share of college graduates can offset this rebound. It is also possible that, due to high costs of living in urban areas, only high-income families can afford to stay in urban areas while their families are growing, while families of lesser means allocate to suburban areas. That would also explain why in urban areas the percentage of adults with at least a bachelor's degree correlates with lower TFR while income does not. All in all, the analyses carried out in urban setting lend as much support to the SDT theory (e.g., *Lesthaeghe/Neidert* 2006) as to the thesis put forward by *Myrskylä et al.* (2009).

This research has limitations. To begin with, human development and fertility variations are highly interconnected. Although the present study assumes that period fertility is determined by socio-economic development, there are arguments in the literature concerning the ways in which fertility impacts socio-economic outcomes (e.g., *Reher* 2011). Secondly, period fertility measures like TFR are known to suffer from "tempo distortion" (*Bongaarts/Feeney* 1998; *Bongaarts/Sobotka* 2012). Although we do acknowledge that there is a discrepancy between period fertility measures and cohort experiences, we also need to point out the fact that intraregional differences in fertility are stable over time (*Jones/Tertilt* 2008; *Pratt et al.* 1984). For example, urban-rural differences in period fertility in the U.S. have been noted since the 1950s (*Jones/Tertilt* 2008; *Westoff* 1954).Thirdly, we did not account for the fact that some women can change residence during their pregnancy. Many rural areas do not have high-quality health personnel or facilities and, therefore, quite a few women residing in rural areas would prefer to travel to another, usually, suburban county for delivery and even for post-partum care (*Starfield/Shi* 2004). Although proximity to clinics that offer high-quality care is an important factor for pregnant women, anonymity is also an issue that is usually taken into consideration by adolescent mothers. Some women prefer to travel to more distant health care centres in order to ensure that their identity will not be revealed (*Parkes et al*. 2004). Therefore, it is possible that some births are registered in a county where the mother did not reside. Fourthly, we did not account for the modifiable areal unit problem (MAUP), a bias resulting from the arbitrariness of the geographical partition used. The essence of the MAUP is that there are many ways to draw boundaries to demarcate space into discrete units, such as the U.S. counties, and the way boundaries are drawn conditions the choice of statistical approaches. Finally, we used only a few measures that are meant to capture the concept of "human development". We cannot rule out the possibility that the results could have been different, had we used different human development indicators.

From the perspective of future research, it is advisable to focus on contextual factors of regional differences in human development and fertility. Clarifying the contextual factors of the human development process is crucial for the investigation of the geographic patterns of development and fertility. This applies no less to empirical investigation than to theoretical analysis. Further investigation is also warranted to assess spatial dependence and spatial autocorrelation in human development and fertility. According to our preliminary analyses (not shown), period fertility levels in nearby counties are more similar to each other than those in distant counties, regardless of urbanicity. Geographic Information System (GIS) models can address this problem by modeling spatial dependency.

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