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Is a positive link between human development and fertility attainable? Insights from the Belgian vanguard case

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Insights from the Belgian vanguard case

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Abstract

It is expected that by the end of the twenty-first century the vast majority of the human population will live in densely populated and highly developed environments that are frequently characterized by low fertility. However, Belgium constitutes one of the few recently emerged cases, where a densely populated and highly developed country not only escapes low fertility, but also exhibits a positive association between education and childbearing. It has been argued, that these patterns are related to extensive policies supporting the reconciliation of family and career goals, and that especially highly educated people benefit from these policies. We look into these hypotheses by studying a unique micro-dataset covering all residents between 2002 and 2005. The main focus is on the relevance of between-municipality variation in economic conditions and social services for understanding variation in second birth hazards by educational attainment. We show that second birth hazards of highly educated women are by far most sensitive to variation in local conditions, compared to other educational groups. Controlling for ethnic composition effects and internal migration, we reveal that a considerable part of the municipality-level variation in the educational gradient in second births can be related to a positive link between fertility and childcare provisions as well as wealth for the highly educated. Low educated mothers, on the contrary, are less likely to have a second child in more prosperous municipalities. Our findings suggest that institutional support for families might indeed be very relevant, but also incurs the risk of increased social polarization.

Keywords: Education – Fertility – Development – Childcare – Register Data

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Introduction

According to many important fertility theories of the twentieth century, increases in human development in modern societies are likely to lead to decreases in fertility. This aspect has been central to the demographic transition theory (Kirk, 1996), as well as to the second demographic transition framework (Lesthaeghe, 2011). And indeed until the last decades of the twentieth century, most of the available empirical evidence has provided support in this direction (Skirbekk, 2008). This has motivated the proposition of future global population scenarios in which human population might decline drastically if low fertility in highly developed urbanized settings prevailed (Basten, Lutz, & Scherbov, 2013). However, since the 1980s we are witnessing mounting evidence for substantial shifts in the macro- and micro-level relationships between human development and fertility in some highly developed parts of the world. At the macro level, the cross-country correlation between female labor force participation and fertility has turned positive since the mid-1980s (Ahn & Mira, 2002). Similarly, the negative relation between human development and fertility seems to become positive for countries with advanced levels of human development (Myrskylä, Kohler, & Billari, 2009). Tendencies in this direction are not only observed between countries, but also across subnational regions of a growing number of highly developed countries (Fox, Klüsener, & Myrskylä, 2015). At the micro level, recent research provides mounting evidence that the long-standing negative relation between women's socio-economic position and childbearing is subject to shifts as well (Kravdal, 1992; Kravdal & Rindfuss, 2008; Neels & De Wachter, 2010; Sobotka, Beaujouan, & Brzozowska, 2017; Wood & Neels, 2016; Wood, Neels, & Kil, 2014)[2]. Parallel to the emergence of this new evidence, new theoretical frameworks have been presented which argue that increases in fertility among women with high socio-economic positions are linked to improvements in gender equality (e.g. Esping-Andersen & Billari, 2015; Goldscheider, Bernhardt, & Lappegard, 2015) or enhanced possibilities to outsource household and childrearing tasks (Brewster & Rindfuss, 2000; Raz-Yurovich, 2014, 2016; Rindfuss, Guilkey, Morgan, Kravdal, & Guzzo, 2007).

In order to further enhance our understanding of these trends, this paper focusses on Belgium, which seems to constitute a vanguard country when it comes to shifts in the relationship between human development and fertility. Belgium is one of the most densely populated countries in Europe, and reports high levels of human development. Given these conditions, it is remarkable that Belgium is escaping from low fertility levels (Lesthaeghe & Permanyer, 2014) with cohorts born in the 1960s reporting cohort fertility rates of 1.80-1.86 children per women and a completed fertility level of 1.79 for the 1970 cohort. It also seems to be a forerunner related to shifts in the association between educational attainment of women and fertility outcomes (Neels & De Wachter, 2010; Sobotka et al., 2017; Wood et al., 2014). In contrast to many other developed countries, Belgium exhibits a clear reversal in the educational gradient in fertility (Sobotka et al., 2017). Whereas cohorts born in the 1930s and most of the 1940s displayed negative educational gradients in completed childbearing, women who have reached the end of their reproductive ages in the 2000s show little educational variation in overall fertility outcomes (Klüsener, Neels, & Kreyenfeld, 2013) and remarkably high fertility levels among women with tertiary education (CFR of 1.8-1.9 depending on the cohort considered) (Neels & De Wachter, 2010). Comparing completed fertility levels for cohorts since the 1930s for thirteen developed countries, Sobotka and colleagues (2017) indicate that Belgium is the only country with increasing cohort fertility levels for highly educated groups relative to other educational groups. This trend stems predominantly from a strong positive educational gradient in

[2] This in contrast to the situation among men, where at least new findings for Scandinavian countries suggest that the relationship between fertility and income has been positive and stable over the cohorts born since the 1930s (Andersson et al. 2016).

second births, which is accompanied by a weak positive educational gradient in childlessness and a weak U-shaped educational pattern in the progression to third births (Wood et al., 2014).

It has been argued, that these patterns might be related to Belgium's extensive policies supporting the reconciliation of family and career goals, and that especially highly educated people are benefiting from these policies (Klüsener et al., 2013; Van Lancker, 2017). Belgium has over the last decades continuously been one of the top-ranked countries worldwide in formal childcare provision (Gornick, Meyers, & Ross, 1997; Klüsener et al., 2013), and was one of the first countries to be included in a short list of nations that meet the Barcelona target of 33 per cent childcare enrolment for children aged 0-3 (Population Council, 2006). In addition, Belgium is also a forerunner country with respect to the subsidized outsourcing of household work, with a system of service vouchers that subsidizes 70 per cent of the cost of outsourcing housework (Marx & Vandelannoote, 2014; Raz-Yurovich, 2014). We believe that the vanguard status of Belgium makes it an interesting laboratory to explore how a positive relationship between fertility and human development can be obtained both at the individual and aggregate level.

The main aim of our study is to improve our understanding of the Belgian vanguard case by taking a close look at the compositional and regional dimensions of variation in the educational gradient in fertility. In this regional approach, we benefit from the fact that Belgium exhibits strong subnational variation in population composition, wealth, and social services. Previous research has mostly focused on changing educational gradients over time within a single country (Kravdal, 1992; Kravdal & Rindfuss, 2008) or cross-national comparisons (Klesment, Puur, Rahnu, & Sakkeus, 2014; Wood et al., 2014), whereas regional differences in the educational gradient in fertility have hitherto received less attention. Available literature shows that the study of regional contextual effects on fertility behavior is mostly hampered by the lack of appropriate data (Neyer & Andersson, 2008; Rindfuss et al., 2007). Our study uses a unique dataset of all women legally residing in Belgium between 2002-2005 combined with municipality-level data on income and formal childcare coverage. In our analysis we will focus on second births as fertility variation among highly developed countries is mainly shaped by variation in the transition to second births (Frejka, 2008; Frejka & Sobotka, 2008) and Belgium exhibits a pronounced positive educational gradient in second births (Wood et al., 2014).

Understanding the underlying mechanisms that have fostered the observed shifts in fertility outcomes in Belgium is likely to provide important insights for the large number of highly developed societies which are still confronted with a substantial gap between the number of intended and realized children particularly among the higher educated (Testa, 2012). As Belgium's family and labor market policies constitute a mixture of liberal and corporatist elements, it might have appeal as a role model for countries from a large variety of welfare state regimes (liberal, corporatist, conservative).

Background and Theoretical Considerations

The association between female education and second births has been studied extensively in a large number of developed countries, and a considerable degree of variation between countries is found. Most research documents lower second birth intensities for highly educated women in German-speaking countries (Klesment et al., 2014) and many Central and Eastern European countries (Klesment et al., 2014; Muresan & Hoem, 2010; Perelli-Harris, 2008; Wood et al., 2014). This contrasts with the non-negative or even positive associations in Nordic European countries (Norway: Kravdal and Rindfuss (2008); Sweden: Hoem and Hoem (1989), Olah (2003); Finland: Vikat (2004)), some Western European countries (Belgium: Neels (2006); France: Köppen (2006); United Kingdom: Kulu and Washbrook (2014)), and Australia (Evans and Gray (2016), Wood et al. (2014)).

In attempts to explain spatial and temporal variation in the educational gradient in second births, researchers have considered varying economic, socio-cultural and policy contexts across the developed world (Ahn & Mira, 2002; Brewster & Rindfuss, 2000; Matysiak & Vignoli, 2008). These strands of literature tend to focus on contextual factors that facilitate the combination of work and family life and thus stimulate childbearing among highly educated women. In addition to literature putting forward changing gender roles as one of the main drivers of these changes (Esping-Andersen & Billari, 2015; Goldscheider et al., 2015; McDonald, 2000), the rise of reconciliation and outsourcing policies has also been suggested to be responsible (Brewster & Rindfuss, 2000; Raz-Yurovich, 2014). For the Belgian case this implies that the emergence of a positive educational gradient in second births might be related to the above-discussed forerunner status of Belgium in the implementation of extensive family and labor market policies supporting the reconciliation of family and career goals (Klüsener et al., 2013; Neels & De Wachter, 2010).

Educational attainment and Fertility in Highly-Developed Countries

In many developed countries declining fertility levels since the 1960s coincided with educational expansions and increasing female labor force participation. As a result most scholars for decades supported the assumption that fertility and female educational attainment are negatively associated due to higher opportunity costs (Becker, 1981), post-materialist attitudes (Lesthaeghe & Van de Kaa, 1986) and/or pursuing a career as a way to reduce uncertainty (Friedman, Hechter, & Kanazawa, 1994). Later contributions highlighted the fact that education has a substantive negative effect on the timing of fertility which is likely to deflate period fertility levels (Neels & De Wachter, 2010; Ni Bhrolchain & Beaujouan, 2012). Recent evidence of positive educational gradients in higher-order births in highly-developed countries enticed scholars to consider contextual factors that enhance work-family compatibility and thus particularly stimulate childbearing among highly educated women (Liefbroer & Corijn, 1999; Wood et al., 2014). In addition, contemporary contributions also increasingly take into account continued income inequality which may negatively affect fertility among low and medium educated women (Adsera, 2015; OECD, 2016). In line with these recent developments, we revisit three broad mechanisms through which educational attainment is believed to affect fertility.

First, higher educated groups typically have more resources to handle the direct costs connected to childrearing (Becker, 1981). In the labor market, high educational qualifications yield higher earning potential. In addition, highly educated women are more likely to have a partner or relatives with more resources. High levels of resources may increase the demand for children. However, available literature suggests that highly educated parents have higher aspirations for their children, which increase the cost of childrearing (Becker & Lewis, 1973). Classic economic approaches of education and fertility rely on this quantity-quality substitution to explain the absence of positive relations between income and fertility. However, the continued and in part rising income inequality in many developed countries and resulting concentration of poverty risks in lower status households may hamper the transition to higher order births particularly among low educated groups, which are increasingly selective groups in this respect (Adsera, 2011, 2015; Corluy, 2014; Goos, Manning, & Salomons, 2009; OECD, 2015). Available literature for Western countries indicates persistent or even rising levels of inequality (Cantillon & Buysse, 2016; Milanovic, 2016), a concentration of individual unemployment and poverty risks in low status households (Cantillon & Buysse, 2016; Corluy, 2014), but also that this inequality is further exacerbated by the gap between home owners and tenants (Kurz & Blossfeld, 2004; StatBel, 2014) and that social policy struggles to remediate these inequalities (Cantillon & Buysse, 2016; Iversen & Soskice, 2015).

Second, highly educated women have more *opportunities* in the labor market. As a result early economic approaches of the relation between education and fertility asserted that highly educated women have less children due to the higher cost of time spent on non-market activities (Becker, 1981). In addition, more job opportunities for highly educated women may yield a stronger emphasis on a career as a means of uncertainty reduction and self-realization (Friedman et al., 1994). However, later contributions – taking into account wages and job conditions over the life course – indicate that among highly educated groups, particularly at young ages considerable time investments are needed in order to enter a favorable career track with increasing returns over time (Liefbroer & Corijn, 1999). Hence, the negative impact of education on fertility through opportunity costs may be limited to the timing of the onset of childbearing. Furthermore, many developed welfare states have developed a wide range of family policies comprising parental leave schemes and extensive formal childcare, and labor market policies such as flexible working schemes and subsidized domestic services employment, which yield an easier combination of work and family. These policies, often by design, are better tailored to highly educated career paths (Kil, Wood, & Neels, 2017; Marx & Vandelannoote, 2014; Van Lancker & Ghysels, 2012). Technological advancements such as the Internet also increasingly allow companies to at least partly free their employees from the obligation to be present at a work place. Due to the enhanced teleworking opportunities, the private household regains importance for income-related activities, which potentially provides dual-earner couples more opportunities to combine family and career (see also Fox et al., 2015). Highly educated workers have generally been found to have easier access to and more control over flexible working hours (Golden, 2001). In addition, as parental leave entitlements are connected to previous labor force participation in many developed countries, highly educated mothers benefit to a larger extent (Bartova, 2015; Desmet, Glorieux, & Vandeweyer, 2007). Similarly, highly educated groups are represented disproportionately among the beneficiaries of (subsidized) childcare programs (Van Lancker, 2017; Van Lancker & Ghysels, 2012). Explanations for the latter include stronger labor force attachment and higher resources to manage the costs of formal childcare among highly educated women (Gabrielli & Dalla-Zuanna, 2011; Hank & Kreyenfeld, 2003), but also a stronger preference for and supply of informal childcare instead of formal arrangements among lower educated groups (Johansen, Leibowitz, & Waite, 1994; Mamolo, Coppola, & Di Cesare, 2011). In addition, existing research demonstrates that it is particularly the higher educated dual earner households that benefit from the availability of subsidized service vouchers to gain leisure time (Marx & Vandelannoote, 2014). In contrast, low educated groups experience fewer labor market opportunities, lower returns to career investments, and have also been found to benefit to a lesser extent from work-family reconciliation policies as these policies mostly benefit those who are already established in the labor force (Bartova, 2015; Desmet et al., 2007; Kil et al., 2017; Liefbroer & Corijn, 1999; Van Lancker & Ghysels, 2012). In that sense, the emergence of a positive association between fertility and development might at least in part stem from an increasing polarization within society (Adsera, 2015).

Third, enrolment in higher education potentially reflects a higher interest in individual self-realization and post-materialist values. Although this mechanism has been put forward to explain lower fertility for highly educated women (Lesthaeghe & Surkyn, 1988; Lesthaeghe & Van de Kaa, 1986), post-materialist attitudes do not seem to be negatively correlated to ideal family sizes and available research finds no consistent evidence of lower fertility intentions for highly educated groups (Beaujouan, Sobotka, & Brzozowska, 2013; De Wachter & Neels, 2011; Ruokolainen & Notkola, 2002). This suggests that the idea that the choice for high education and possibly also a professional career conflicts with family formation is progressively outdated. Today, it still seems reasonable to assume that the choice to attend high education reflects an interest in higher-order needs such as self-realization. However the increased work-family combination allows highly educated women to pursue a professional career as well as conform to the two-child norm. It is likely that, in tandem with the rising share of women with tertiary degrees, highly educated women have become a less select group in terms of attitudes and willingness to sacrifice family formation for career goals, particularly in contexts that have succeeded in reducing the opportunity costs to childbearing and -rearing.

Regional Variation

The idea that the impact of female education on fertility varies depending on the context considered is widely supported by scholars in demography (Kravdal, 1996; Liefbroer & Corijn, 1999; Rindfuss, Guilkey, Morgan, & Kravdal, 2010). The comparison between educational gradients in second births across developed countries suggests that non-negative or even positive differentials occur in some highly-developed contexts with extensive work-family policies (Klesment et al., 2014; Wood et al., 2014), and a handful of cross-country assessments of the effects of such policies indeed indicate stronger positive effects among highly educated groups (Puur, Klesment, Rahnu, & Sakkeus, 2016; Wood, Neels, & Vergauwen, 2016). However, influential literature reviews have drawn attention to the limited contribution of such cross-country associations (Gauthier, 2007; Neyer & Andersson, 2008), which may be driven by a limited number of vanguard countries with high work-family compatibility in Northern and Western Europe (Klüsener, 2016). Next to extensive work-family policies or access to market-based childcare, these forerunner countries are likely to differ from other highly developed parts of the world in many other socio-economic, political and cultural respects (Thevenon, 2008). In addition, variability in educational systems and distributions of educational attainment between countries suggest that the meaning of a particular level of education varies considerably across developed countries. This motivated us to perform a regional analysis of one vanguard country to explore whether such patterns can also be found within a country in which inhabitants are subject to the same national policies and educational attainment is captured similarly across the whole study area.

Local Opportunity Structures and Cultural Milieus

Local opportunity structures have been put forward as an explanation for regional fertility patterns (Basten, Huinink, & Klüsener, 2011; Hank, 2001, 2002; Kulu, 2010; Kulu & Washbrook, 2014). Opportunity structures include both the indirect costs of childrearing through opportunity costs which depend on the amount of competing activities to childrearing (e.g. a professional career, leisure activities) and the availability of childcare services, as well as the direct costs of children such as the cost of commodities and services (Hank & Kreyenfeld, 2003; Kulu & Washbrook, 2014). With respect to the former, in areas with a high availability of childcare the opportunity costs of fertility will be lower, which in turn might especially support second births among highly educated. However, the potential impact of childcare provision need not be limited to the enhancement of work-family combination in a strictly economic sense. In addition, a context with extensive formal childcare may also enforce egalitarian gender role attitudes and the normative importance of developing a career in addition to family formation both for men and women (Fagnani, 2002; Sjöberg, 2004). This gradual acceptability of work-family combination is likely to depend on a diffusion process in which change to norms occurs through social interaction and previous work-family behavior acts as a role model (Baizan, 2009; Hank, 2002). The relationship between childcare accessibility and social acceptance in a locality is very likely to be self-enforcing as increasing demand for childcare can have a positive effect on the availability of childcare services. Although Belgium has a long-standing history in public childcare provision and in general exhibits favorable attitudes toward work-family combination and the use of formal childcare (Klüsener et al., 2013; Neels & Theunynck, 2012), there is considerable variability in formal childcare availability across the country and formal childcare supply frequently cannot keep up with the growing demand (Hedebouw & Peetermans, 2009; Vande Gaer, Gijselinckx, & Hedebouw, 2013). This variation in formal childcare is expected to induce variability in the economic and social compatibility between work and family, which in turn may shape the educational gradient in second births.

With respect to the direct costs of children, we identify income and resources at the municipal level as potentially important predictors for the local educational gradient in second births. Areas with high mean incomes and high housing prices yield high child-related costs connected to services and commodities, housing, and culturally entrenched norms and status symbols (e.g. expensive vacations and cars). It is likely that highly educated groups will more easily be able to afford such living conditions for themselves and their children. Highly educated groups have more wealthy networks and are more likely to be home owners, which yields considerable capital accumulation compared to home rental. As a result highly educated women may perceive the high living standard of wealthy municipalities as a precondition to childbearing. Low educated groups on the contrary are more likely to rent a dwelling and have less resources to cope with the higher costs in municipalities with high average income levels. Hence among low educated groups in wealthy municipalities, there may be a stronger tension between the high costs of living and conforming to costly social norms on the one hand, and childbearing on the other. Despite the fact that Belgium, generally, is an economically highly developed country, it exhibits substantial regional variability in economic prosperity which is expected to affect the educational gradient in second births.

With respect to local opportunity structures and cultural milieus, it is also important to point out that Belgium is divided into a Dutch- and French-speaking part (Flanders and Wallonia) and a small German-speaking area which differ in family formation norms and attitudes, but also in economic conditions and childcare coverage (Klüsener et al., 2013; StatBel, 2017). We therefore have to carefully evaluate whether and to what degree our findings are driven by distinct differences between these regions.

Composition Effects and Selective Migration

Previous research identifies composition effects and selective migration as the two main confounders of regional effects on fertility (Hank, 2001, 2002; Kulu, 2010; Kulu & Washbrook, 2014). With respect to the former, differential compositions may cause fertility variations as various types of people live in different places. For instance, regional fertility disparities have been related to compositional differences with respect to education and marital status (Hank, 2001; Kulu, 2010). An important compositional factor in many developed countries is the presence of ethnic minorities. Migrant populations in Belgium, especially non-European groups, on average exhibit higher fertility levels than natives while they attain lower levels of educational attainment (Baert & Cockx, 2013; Baert, Heiland, & Korenman, 2016; Corluy, 2014; Van Landschoot, Van Bavel, & de Valk, 2014). This compositional effect may be partly responsible for stronger negative or attenuated positive educational gradients in second births in urban areas. Although second generation migrants typically attain higher levels of education than the previous generation and display lower fertility compared to their parents, a wide native-migrant gap persists (Baert et al., 2016; Neels & Stoop, 1998; Timmerman, Vanderwaeren, & Crul, 2003).

Selective migration has also been identified as a confounding factor in the identification of how regional contextual conditions are linked to fertility. In addition to direct effects of local characteristics on second births among the resident population, particular local characteristics may also attract women who intend to have a second birth, which in turn inflates the fertility level of the area (Hank, 2001; Kulu, 2010). Depending on the characteristics of the municipality, this may occur differentially across educational groups. With respect to the availability of childcare, it is expected that this will attract groups with higher birth intentions. This selectivity is likely to be stronger for highly educated groups as work-family compatibility may be a stronger prerequisite for continued childbearing among this group (Neels, Wood, & Kil, 2016; Wood et al., 2016). With respect to municipal wealth, it is also assumed that selective migration occurs differently between educational groups. Although moving to a wealthy area may reflect the choice to raise children under the highest possible living standard, this strategy may not be feasible for low educated groups. As a result, migration to wealthy municipalities by low educated groups may be a search for upward social mobility. Given the higher costs related to childrearing in wealthy municipalities, this upward social mobility may come at the cost of lower fertility (Dalla Zuanna, 2007). Whereas selective migration has received considerable attention in research on regional differences in fertility (Hank, 2001, 2002; Kulu, 2010; Kulu & Washbrook, 2014), its importance for understanding regional variation in the educational gradient in fertility remains unclear.

Data and Methods

The 2001 Belgian census provides detailed information on all individuals legally residing in the country, including fertility histories, education, nationality and detailed information on household composition (Deboosere & Willaert, 2004). The individual microdata from the 2001 census have been linked to data from the National Register, which provide information on changes in household composition in the period 2002-2005. This prospective research design allows to estimate the effect of education in the 2001 census on second birth hazards in the subsequent 4-year period. We combine the microdata with contextual-level information at the level of the Belgian municipalities (N=588[3]). With respect to work-family compatibility, we use data on formal childcare coverage which represent the amount of places as a per cent of the population aged 0-3 in a given municipality in a given year and are provided by regional childcare offices. Regarding municipalities' socio-economic status we obtained data on the median income per year derived from tax returns.

[3] One of the 589 municipalities ("Herstappe") is excluded due to missing data as a result of the limited population size (84 residents in 2002).

In our analysis we estimate mixed effects discrete-time event history models of second birth hazards. We decided to exclude from the full sample of mothers aged 15-49 between 2002 and 2005, mothers who declared to be in education in 2001 (2,034 women or 0.49 per cent) as the fertility behavior of those enrolled in education has been documented to differ substantially (Lappegård & Ronsen, 2005). In addition, we also dropped all women for whom no educational attainment is available (10,054 women or 2.4 per cent), as well as first generation migrants (44,275 women or 11 per cent). The latter decision ensures that we focus on persons who are likely to have been socialized in Belgium, and whose fertility schedules are not affected by the frequently observed postponement of births due to international migration plans into a foreign country (Wilson, 2013). In total, our subset consists of 356,821 women at risk of a second birth between October 2002 and December 2005 between the age of 15 and 49. These women are observed until they have a second birth, or until they are censored after December 2005, at the age of 50, or as a result of death or emigration. Our analyses use 11,602,755 person-months to estimate second birth hazards.

In the fixed part of the model, we include the following micro-level characteristics: (i) age at first birth, (ii) months since first birth, (iii) education in 2001, (iv) origin group. *Age at first birth* (time-constant) is included as a quadratic function to account for the lower second birth hazards among mothers who entered motherhood at relatively low or high ages. With respect to *months since the first birth* (time-varying), dummies for the second and third year are included in addition to a linear function. Deviance tests indicate that this specification yields a better approximation of the observed second birth hazard functions compared to polynomial specifications. *Education* in 2001 (time-constant) distinguishes low education (all levels below higher secondary education, ISCED-levels 0-2) from medium education (higher secondary education, ISCED-levels 3-4) and high education (all post-secondary levels of education, ISCED-levels 5-6). Some authors have speculated that elevated second birth risks among highly educated mothers might be related to squeezing effects as highly educated women become mothers later and might thus have less to time to realize higher-order birth intentions (Kreyenfeld, 2002). However, variations in the functional form of the observed baseline hazard function for different educational groups are very limited. Hence no interaction between education and second birth schedules is included. While we only consider women born in Belgium, we still make a distinction by *origin group* (time-constant). For this we use information on the nationality at birth of both the parents. In case parents exhibit different foreign nationalities at birth, the most distant country is considered as country of origin. The reference group is (i) women with a Belgian background. We further distinguish women with (ii) a neighboring country background (United Kingdom, France, the Netherlands, Luxembourg, Germany), (iii) Southern European background, (iv) other European background, (v) Turkish or Moroccan origin, (vi) women with a background from a limited number of highly developed non-European countries (USA, Canada, Japan, Australia, New Zealand), and (vii) women with a background from another non-European country. In addition to the aforementioned micro-level characteristics, we include annual indicators at the municipal level for *childcare coverage* (time-varying) and *median income* (time-varying) in the model with a one-year time lag.

Next to the fixed effects, a random term is included for every combination of municipality and education. This entails (588*3) 1764 deviations from the main intercept which allow for municipality-specific educational gradients[4] in second births. The analytical strategy of this paper is to include covariates in the fixed effects part of the model in a stepwise manner and to assess to which degree the fixed part of the model can explain municipality-specific educational gradients in second births. Model one only includes age at first birth, years since the first birth and education, which allows us to document the regional variation in the educational gradient in second births in Belgium. Model two assesses to which degree variation can be explained by compositional differences in terms of the different origin groups. In the third model we add the municipality-level indicators for work-family compatibility and wealth to the model. The effect of childcare coverage and median income is allowed to vary by level of education, and changes in the random part of the model are informative on whether these contextual variables explain variation in the educational gradient in second birth hazards. Finally, in order to cancel out the effect of selective migration patterns, model four only takes into account women who have been living in the same municipality for at least four years.

As we run models on data with high spatial detail, it is also immanent to explore whether and to what degree spatial autocorrelation might affect our findings. One important assumption of a regression model frequently violated in models of spatially detailed data is that the observations are independent from each other. Social science research is usually confronted with positive spatial autocorrelation where neighboring spatial units share many similarities. If these similarities are not adequately controlled for in the model, spatial autocorrelation can introduce bias in the estimates. In the case of positive spatial autocorrelation the explained variance tends to be overestimated, which entails too narrow confidence intervals and too high significance levels. In addition, spatial autocorrelation can also introduce bias in the derived coefficient and random intercept estimates (Anselin, 2009; Bivand, Pebesma, & Gómez-Rubio, 2013). To look into the degree to which spatial autocorrelation is affecting our model results, we apply the Moran's I test of spatial autocorrelation (Moran, 1950) on the mean municipality-level residuals and the municipality-level random intercepts. This test is similar to Pearson's correlation coefficient, but instead of measuring the correlation between two variables x and y it detects the correlation between the value of a variable x in municipality i with the (weighted) average value of the same variable in neighboring regions j. Neighborhood is defined via a spatial weight matrix. In our case we consider a contiguity-based first order queen definition of adjacency, in which municipalities are neighbors if they have at least one border point in common, and spatial weight matrices based on n-nearest neighbors (3-7 nearest neighbors).[5] In addition, we mapped the municipality-level mean residuals and random intercepts of the models to identify areas in which high and low municipality-level residuals or municipality-level random intercepts are clustered.

Results

Regional Variation in the Educational Gradient in Second Births

The results of model 1 (Table 1) indicate a general positive educational gradient in second births, which corroborates previous research (Neels & De Wachter, 2010; Wood et al., 2014). In general, women with medium levels of education exhibit ((1.146 - 1)*100) 14.6 per cent higher odds of having

[4] Tests for basic models indicated that models including a random intercept for the 588 municipalities and random slopes for medium and high education for the 588 municipalities yield similar results. Since the estimation procedure is far more efficient, we report models including 588*3 random intercepts.

[5] We use the spherical distance between the regional centroids to derive the n-nearest neighbours.

a second birth, whereas the corresponding number for highly educated women is 108.1 per cent higher odds. In addition, the random part of the model shows that there is a considerable amount of variation in the educational gradient in second births across Belgian municipalities. Especially with respect to the difference in second birth hazards between low and highly educated individuals the model exhibits notable variation (STDEV: .3164). The municipality-specific associations of medium (versus low) education and second births range from 16.3 per cent lower second birth odds to 61.2 per cent higher second birth odds (Figure 1), whereas the corresponding relations of high education range from 14.2 per cent to 192.1 per cent higher second birth odds (Figure 2).

Composition Effects

In line with previous studies, model 2 (Table 1) indicates that non-European migrant groups and especially women with a Moroccan or Turkish background exhibit higher odds of continued childbearing compared to women with a native origin (Kulu & Gonzalez-Ferrer, 2014). Non-European migrant groups from a set of highly developed countries (USA, Canada, Japan, Australia and New Zealand) exhibit birth odds similar to native groups. With respect to European migrant groups, women with a Southern European background display 9.4 per cent higher second birth odds, whereas women from remaining European migrant backgrounds exhibit similar birth odds than native groups. Although birth hazards clearly differ across different origin groups, the random part of the model indicates that the regional variability in the educational gradient remains very similar when controlling for origin group composition (STDEV of association medium education: .1344; STDEV of association high education: .3121). The municipality-specific associations of education with second birth odds (Figure 1-2) are nearly identical to the corresponding effects in model 1.

Income and Childcare Coverage at the Municipal Level

Subsequently, this study assesses to which degree variation in local opportunity structures – median income and childcare coverage at the municipal level – coincides with varying effects of level of education. To explore this relation, the random effects of model 2 are plotted against these municipal characteristics (Figure 3). It is striking that both for median income as well as for childcare coverage positive associations seem to emerge for highly educated women only. Lowess-fitted smooth curves indicate that this conclusion is not driven by distinct differences between the four large regions (Dutch-speaking Flanders and French-speaking Wallonia, Brussels capital, German community) but also holds true if these areas are looked at separately. Model 3 (Table 1) indicates that whereas the effect of median income is negative for low and medium level educated women, the contrary holds for highly educated groups. A 5,000 € increase in the median income, which is routinely observed between municipalities in Belgium, is associated to ((1-.994^50)*100) 26 per cent lower second birth odds among low educated women, while among highly educated women a 10.5 per cent increase is found. With respect to the availability of formal childcare, low educated women do not seem to be affected in their transition to a second birth, whereas medium level and particularly highly educated women exhibit positive effects of childcare coverage. A 25 per cent difference in childcare coverage, which is frequently observed across Belgian municipalities, entails a ((1.003^25-1)*100) 7.8 per cent and a 19 per cent increase in second birth odds among medium level and highly educated women respectively. With respect to the explanatory value of these municipal characteristics, the random part of model 3 indicates that the standard deviation of the random effects of medium and high education have decreased by 23 per cent and 34 per cent respectively. Municipality-specific effects of medium level and especially high education are drawn to the average of 1.188 and 2.160 respectively and the range of associations is narrowed down considerably (Figure 1-2). Hence local income and childcare availability are identified as important predictors of the educational gradient in continued childbearing in Belgium.

Sensitivity Model for Selective Migration

Model 4 (Table 1) indicates to which degree regional variation in the educational gradient in second birth odds alters when excluding women who have recently moved. Parameter estimates for the fixed part of the model are similar to the results for model 3 and substantive conclusions remain the same. In addition, the random part of the model indicates that the degree of regional variation in the educational gradient in second births does not differ noteworthy from the previous model (Figure 1-2).

Spatial Autocorrelation and Robustness Checks

Although the use of unique register data for the complete resident Belgian population allows for more detailed assessments of regional correlates of the educational gradient in fertility compared to cross-national comparisons (Klesment et al., 2014; Puur et al., 2016), spatial autocorrelation may distort our results. Our models assume that the 588 municipalities under consideration are independent, whereas neighboring municipalities may share common features both in terms of regional characteristics as well as fertility regimes. The Moran's I tests on the mean municipality-level residuals and the municipality-level random intercepts return evidence for quite high spatial autocorrelation (Table 2). We thus implemented sensitivity checks to explore whether our main findings derived from the models could potentially be artefacts due to bias introduced by spatial autocorrelation. For this we specified the same models at the level of the 43 Belgian districts as we expected lower levels of positive spatial autocorrelation at this higher level of spatial aggregation.

Our district-level sensitivity models yield very similar results, indicating that also at this higher subnational level childcare coverage and municipal income are important explanatory variables for regional variations in the educational gradient in fertility. For the observed second birth hazards at the level of the 43 districts we still obtained high Moran's I (0.45-0.77 dependent on the model and weight matrix). But for the spatial autocorrelation tests on the residuals and random intercepts, we obtained much reduced Moran's I indices, which were, however, generally still significant. Maps allowed us to identify that these outcomes seem to a large degree be driven by an area with high second birth hazards in the south-east of Belgium that our models do not explain. In order to assess to which degree our findings hold when this region is excluded from the analysis, we estimated additional models excluding five districts in the South-East (Verviers, Aarlen, Bastenaken, Neufchâteau and Virton), or 375,376 person-months (3.2 per cent of the sample). This model yields nearly identical results with respect to the regional correlates and their explanatory value towards the educational gradient in birth hazards. The correlation between income and formal childcare coverage at the one hand and second birth hazards on the other, varies depending on the educational group considered, and the inclusion of these regional contextual conditions decreases the standard deviation of the municipality-specific correlations of medium and high education by 23 per cent and 42 per cent respectively. Finally, after excluding the aforementioned districts in the

South-East, Moran's I tests for model 3 provide only weak indications for remaining spatial autocorrelation, while for model 4 none of the spatial autocorrelation tests on the residuals and random intercepts is significant (see supplementary material, Table 3). This provides us reassurance that our main findings are not just artefacts due to bias introduced by spatial autocorrelation.

Discussion and Conclusion

We motivated our study by Belgium being a vanguard case in recent shifts in the association between educational attainment of women and their fertility outcomes. In contrast to many other developed countries, fertility levels by education indicate limited educational gradients or even increasingly high fertility for highly educated women compared to other educational groups (Sobotka et al., 2017), which results mainly from a strong positive educational gradient in second births (Neels & De Wachter, 2010; Wood et al., 2014). Due to extensive childcare provisions combined with fertility levels above the European average and relatively weak socio-economic gradients in fertility, the Belgian context is likely to support the cross-national hypothesis that reconciliation policies stimulate fertility and counteract negative effects of women's socio-economic position (Myrskylä et al., 2009; Van Bavel & Rozanska-Putek, 2010; Wood et al., 2016). It is noteworthy that most literature on women's education and fertility levels is preoccupied with the position of highly educated women, typically in terms of opportunity costs of childrearing (Klesment et al., 2014; Puur et al., 2016; Wood et al., 2014). Whereas this emphasis on highly educated women resulted from the appearance of an ever increasing group of highly educated women in the second half of the twentieth century (Becker, 1981; Lesthaeghe & Surkyn, 1988), contemporary contributions increasingly focus on social polarization and the position of the lowest educated women as a factor determining educational fertility differentials (Adsera, 2015). Also in this respect, Belgium provides a well-suited laboratory as the country – similarly to many other Western countries - exhibits a concentration of unemployment and poverty risks in an increasingly select group of low educated women. Social policy struggles to remediate these inequalities (Cantillon & Buysse, 2016; Corluy, 2014; Iversen & Soskice, 2015) and even exacerbates inequality by supporting work-family reconciliation particularly for higher status households (Kil et al., 2017; Marx & Vandelannoote, 2014; Van Lancker, 2017; Van Lancker & Ghysels, 2012).

This study brings together multiple strands of literature. First, research on the educational gradient in fertility increasingly consists of multi-country contributions suggesting that economic and social policy development plays a role (Klesment et al., 2014; Puur et al., 2016; Van Bavel & Rozanska-Putek, 2010; Wood et al., 2014). This paper takes a regional perspective within a country, which benefits from the fact that our results are less likely to be driven by (unobserved) variation in national policies, national welfare state development and variation in educational attainment classifications across countries. Second, influential reviews on the effects of work-family policies have called for varying effects by population subgroups (e.g. education) to be tested (Bartova & Emery, 2016; Gauthier, 2007; Neyer & Andersson, 2008) and have called for the usage of more detailed longitudinal information on the local availability of such policies (Rindfuss et al., 2007). Third, literature on subnational fertility differences – such as urban-rural gaps – provides a fruitful set of mechanisms through which local opportunity structures, composition effects and selective migration influence fertility levels (Kulu, 2010; Kulu & Washbrook, 2014). These different components may also be instrumental in the literature on educational gradients in fertility.

Exploiting uniquely detailed data for a vanguard country with respect to the development-fertility nexus, this article shows that local opportunity structures are strongly related to the regional educational gradient in fertility. Whereas the role of ethnic composition and selective migration seems limited, controls for formal childcare coverage and wealth at the municipal level explain a considerable part of the variation. Regional childcare coverage positively associates to second birth hazards among highly educated groups in particular, whereas no association is found for low educated women (Neyer & Andersson, 2008; Wood et al., 2016). This result seems consistent with the growing body of literature indicating that highly educated groups to a higher extent benefit from work-family reconciliation programs (Cantillon & Buysse, 2016; Marx & Vandelannoote, 2014; Van Lancker & Ghysels, 2012). With respect to wealth at the municipal level, our results show that residing in a wealthy municipality is a stimulating factor for fertility among highly educated groups, whereas it impedes the transition to a second birth among low and medium level educated women. Highly educated women might perceive the high living standards and conformation to culturally entrenched norms of wealthy regions as a precondition to childbearing, and are also more likely to have the resources to maintain this standard of living. In contrast, low educated groups in wealthy municipalities possibly experience a stronger tension between the high costs of living and conforming to costly social norms on the one hand, and continued childbearing on the other (Dalla Zuanna, 2007). Belgium, but also other Western countries, exhibit considerable concentration of unemployment and poverty risks in low status households which among other factors is related to differences in housing tenures and social investment policies geared towards the (higher-)middle class (Cantillon & Buysse, 2016; Corluy, 2014; Iversen & Soskice, 2015; Kurz & Blossfeld, 2004).

We identify several limitations to this study and corresponding avenues for future research. First, this study highlights the explanatory power of local correlates of the educational gradient in fertility, but our analyses do not allow for a strict interpretation of the mechanisms through which the contextual factors – formal childcare and municipal wealth – affect educational gradients in fertility. Although the theoretical section of this article puts forward local opportunity structures and cultural milieus as potential pathways of association, a sharp distinction between both strands of explanation requires more detailed indicators (e.g. the cost of formal childcare or the local acceptance of childcare use) and available literature suggests that the understanding of the causality between demographic behaviour and regional characteristics requires a different research setups, such as (quasi-) natural experiments (Klüsener et al., 2013; Neyer & Andersson, 2008). Second, our focus on second order births is justified as the positive educational gradient in fertility is mostly driven by second births (Wood et al., 2014) and fertility variation among highly developed countries is mainly shaped by variation in the transition to second births (Frejka, 2008; Frejka & Sobotka, 2008). However, it would definitely be interesting to expand this study to total fertility. As a result of differential fertility schedules and timing effects between educational groups, the assessment of first and third or higher order births requires a different and – in many respects – more complicated analytical strategy to estimate regional variation in differential birth hazard functions.

Using the Belgian vanguard case, this study has shown that a positive link between human development and fertility seems to be attainable, especially when work and family life is compatible and local income levels are high. In this respect Belgium might serve as an example for countries in which work-family reconciliation policies are currently underdeveloped. However this study also highlights the risk that such work-family reconciliation policies might result in higher social polarization (see also (Kil et al., 2017; Marx & Vandelannoote, 2014; Van Lancker & Ghysels, 2012). One option to reduce social polarization effects of the existing family support might be to include elements of the more inclusive Scandinavian work-family policies. Sweden for instance has a more equal distribution of the benefits of public childcare and universal parental leave benefits (Andersson, Ma, Duvander, & Evertsson, 2011; Van Lancker & Ghysels, 2012). Such elements might be considered by policy-makers throughout the developed world in the design of inclusive work-family policies.

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Table 1: Exponentiated coefficients (odds-ratios) from mixed effects logit models of second births, 588 Belgian municipalities, 2002-2005

	Model 1		Model 2		Model 3		Model 4	
	e(b)	*sig.*	*e(b)*	*sig.*	*e(b)*	*sig.*	*e(b)*	*sig.*
Micro characteristics								
Age at first birth								
. linear	1.014	***	1.015	***	1.015	***	1.016	***
. square	.999	***	.999	***	.999	***	.999	***
Years since first birth								
. one year	.415	***	.416	***	.418	***	.386	***
.two years	.817	***	.818	***	.821	***	.796	***
. linear	.736	***	.738	***	.738	***	.720	***
Education *(low is reference)*								
. medium	1.146	***	1.158	***	1.188	***	1.203	***
. high	2.081	***	2.118	***	2.160	***	2.169	***
Origin group *(Belgian is reference)*								
. Neighbouring country	.		.998		1.001		.998	
. Southern Europe	.		1.094	***	1.090	***	1.146	***
. Other European country	.		.847		.852		.861	
. Turkey or Morocco	.		1.837	***	1.818	***	1.858	***
. USA, Canada, Japan, Australia, New Zealand	.		.727		.727		.962	
. Other non-European country	.		1.283	***	1.281	***	1.416	***
Micro-macro interactions								
Median income								
. median income – low edu.	.		.		.994	***	.994	***
. median income – medium edu.	.		.		.997	***	.997	***
. medium income – high edu.	.		.		1.002	***	1.002	*
Childcare coverage								
. childcare – low edu.	.		.		1.000		.998	
. childcare – medium edu.	.		.		1.003	**	1.002	
. childcare – high edu.	.		.		1.007	***	1.006	***
Model parameters								
Number of person-months	*11,602,755*		*11,602,755*		*11,602,755*		*9,223,318*	
Number of municipalities	*588*		*588*		*588*		*588*	
-2LL	*548854.64*		*548314.18*		*548078.74*		336628.82	
Random intercepts for municipality by education								
Standard deviation (med. edu.)	*.1363*		*.1344*		*.1035*		*.0999*	
Standard devation (high edu.)	*.3164*		*.3121*		*.2052*		*.2008*	

Source: Belgian 2001 census & register data, calculations by authors
Significance levels: p < .05 (*), p < .01 (**), p < .001 (***)

Table 2: Test for spatial autocorrelation for different spatial weight matrices

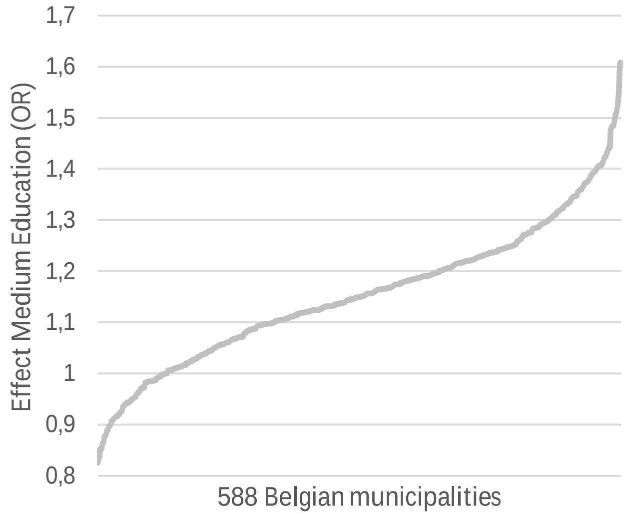
Description	N	FOQ	NN3	NN4	NN5	NN6	NN7
Observed 2nd birth hazards and residuals							
Models 1-3 - Observed 2nd birth hazard	588	.606***	.605**	.616***	.595***	.594***	.584***
Model 4 - Observed 2nd birth hazard	588	.555***	.545***	.554***	.530***	.528***	.520***
Model 1 - Residuals 2nd birth hazard	588	.446***	.435***	.455***	.425***	.423***	.403***
Model 2 - Residuals 2nd birth hazard	588	.460***	.452***	.471***	.440***	.438***	.418***
Model 3 - Residuals 2nd birth hazard	588	.459***	.445***	.469***	.441***	.441***	.424***
Model 4 - Residuals 2nd birth hazard	588	.398***	.393***	.401***	.370***	.370***	.359***
Random intercepts							
Model 1 - Low education	588	.239***	.242***	.228***	.221***	.247***	.239***
Model 1 - Medium education	588	.244***	.247***	.244***	.232***	.232***	.221***
Model 1 - High education	588	.362***	.355***	.351***	.348***	.337***	.329***
Model 2 - Low education	588	.175***	.168***	.155***	.152***	.176***	.168***
Model 2 - Medium education	588	.238***	.229***	.234***	.223***	.224***	.214***
Model 2 - High education	588	.379***	.380***	.375***	.370***	.358***	.351***
Model 3 - Low education	588	.102***	.107***	.102***	.089***	.099***	.092***
Model 3 - Medium education	588	.200***	.198***	.203***	.185***	.184***	.176***
Model 3 - High education	588	.229***	.210***	.216***	.210***	.202***	.198***
Model 4 - Low education	588	.088***	.067*	.053*	.063**	.076***	.062**
Model 4 - Medium education	588	.176***	.150***	.152***	.143***	.148***	.148***
Model 4 - High education	588	.185***	.177***	.183***	.178***	.159***	.158***

FOQ: First order queen adjacency, NNn: n-nearest neighbors
Source: Belgian 2001 census & register data, calculations by authors
Significance levels: $p < .05$ (*), $p < .01$ (**), $p < .001$ (***)

Fig. 1: Municipality-specific effects (odds-ratio) of medium level education (low education is reference) on 2nd birth hazards, 588 Belgian municipalities, 2002-2005

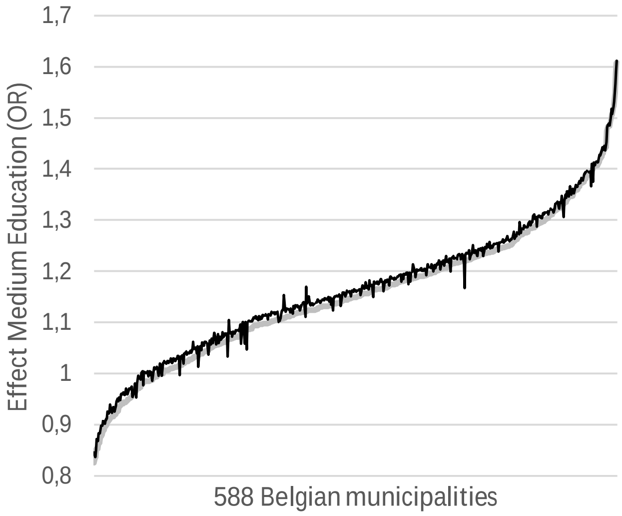
Model 1

Controlling for: Age at first birth, Years since first birth



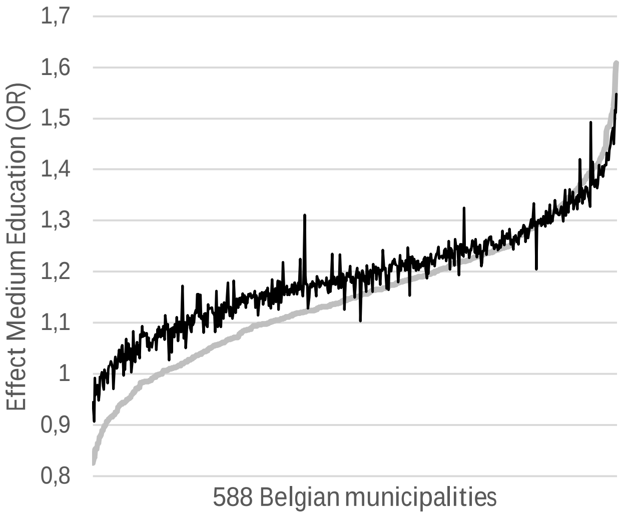
Model 2

Controlling for: Age at first birth, Years since first birth, Origin group



Model 3

Controlling for: Age at first birth, Years since first birth, Origin group, Median income, Childcare coverage



Model 4

Controlling for: Age at first birth, Years since first birth, Origin group, Median income, Childcare coverage, selective migration

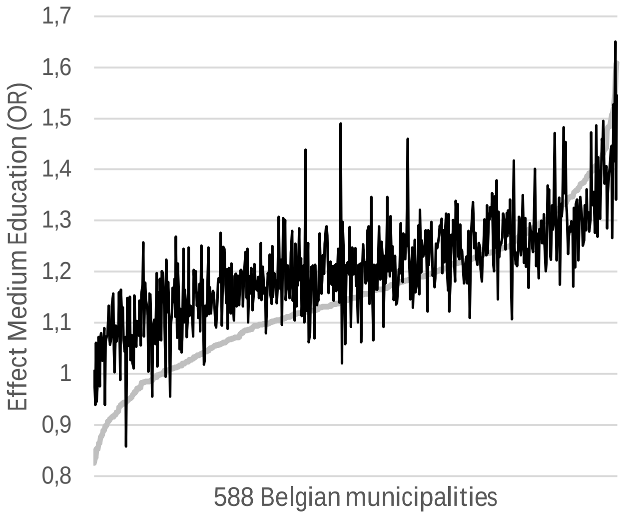
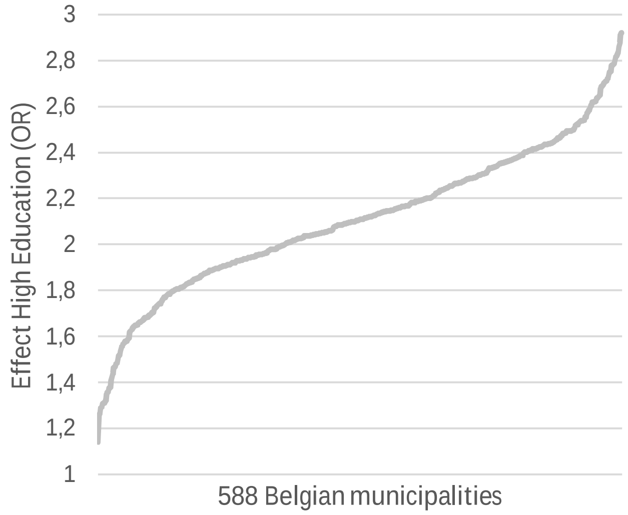


Fig. 2: Municipality-specific effects (odds-ratio) of high education (low education is reference) on 2nd birth hazards, 588 Belgian municipalities, 2002-2005

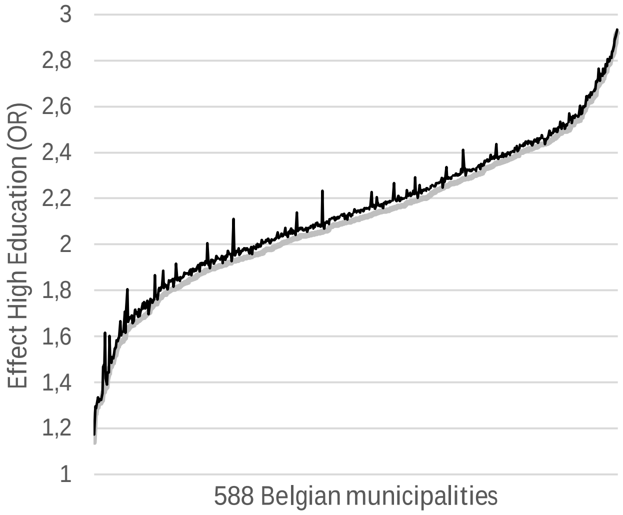
Model 1

Controlling for: Age at first birth, Years since first birth



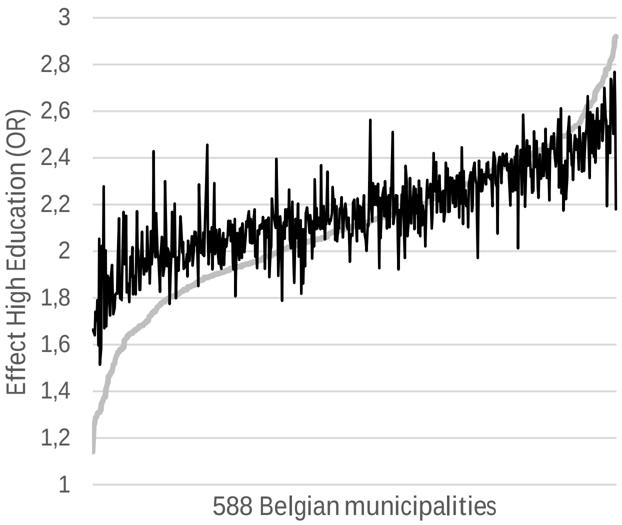
Model 2

Controlling for: Age at first birth, Years since first birth, Origin group



Model 3

Controlling for: Age at first birth, Years since first birth, Origin group, Median income, Childcare coverage



Model 4

Controlling for: Age at first birth, Years since first birth, Origin group, Median income, Childcare coverage, selective migration

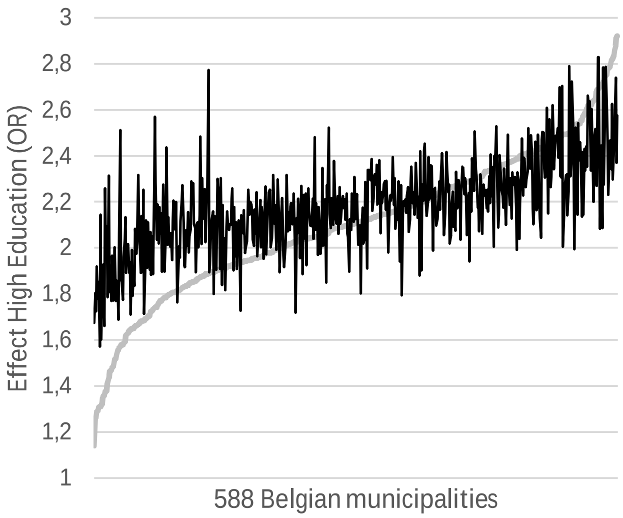
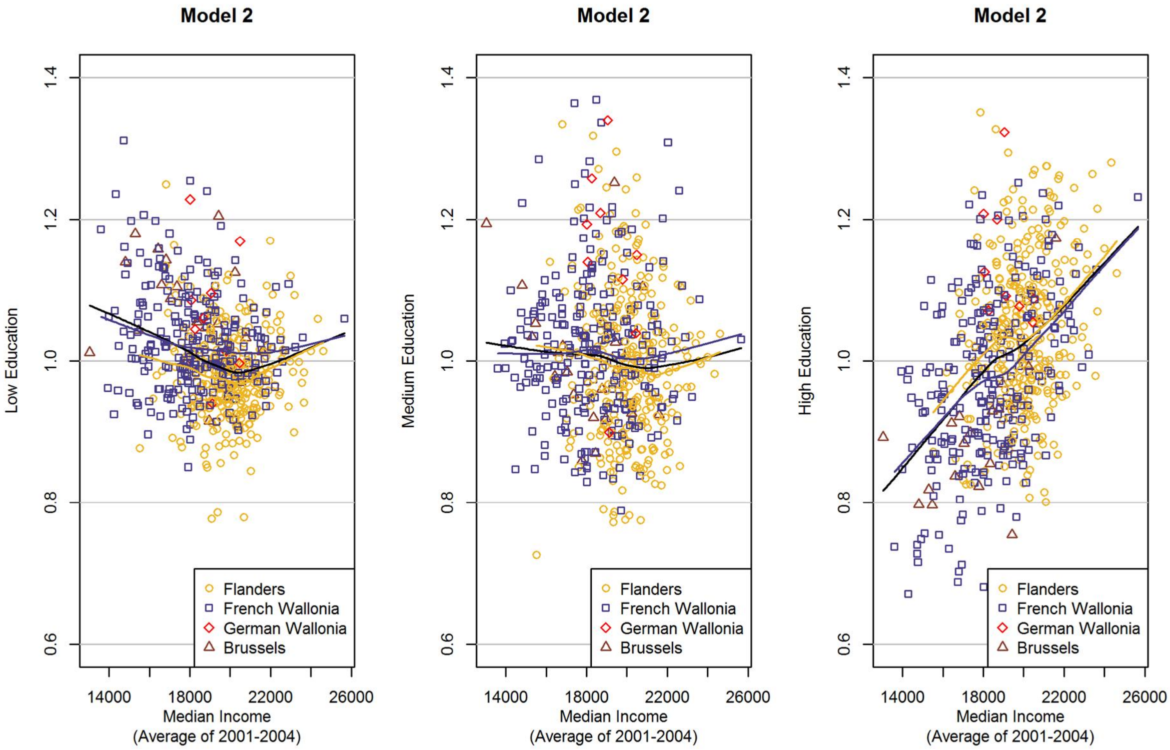


Fig. 3: Random effects by education and municipality (Model 2) on second birth hazards, by median income and childcare coverage at the municipal level, 588 Belgian municipalities, 2002-2005

A. Random effects by median income, smooth curve fitted by lowess



B. Random effects by childcare coverage, smooth curve fitted by lowess

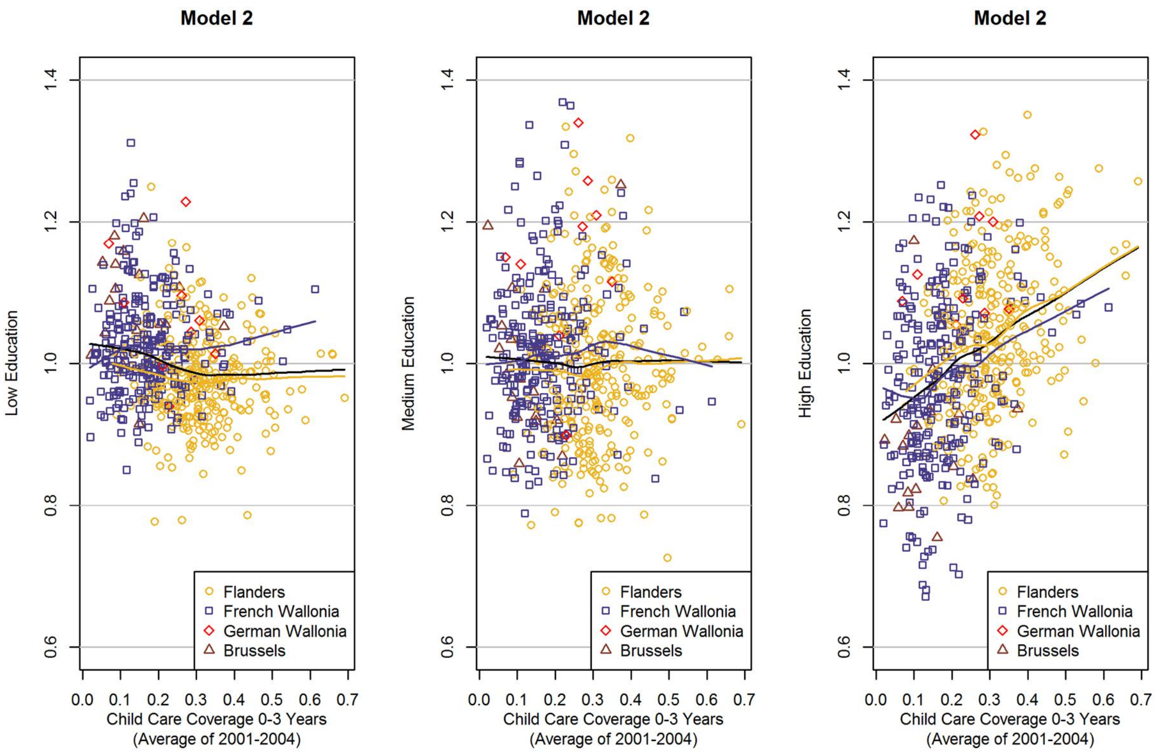


Table 3: Test for spatial autocorrelation for different spatial weight matrices – consistency checks

Description	N	FOQ	NN3	NN4	NN5	NN6	NN7
Observed 2nd birth hazards and residuals							
Models 1-3 - Observed 2nd birth hazard	38	.260**	.270*	.184*	.126	.125	.087
Model 4 - Observed 2nd birth hazard	38	.236**	.228*	.127	.105	.103	.085
Model 1 - Residuals 2nd birth hazard	38	.373***	.340**	.338***	.273***	.262***	.239***
Model 2 - Residuals 2nd birth hazard	38	.396***	.368***	.360***	.290***	.279***	.251***
Model 3 - Residuals 2nd birth hazard	38	.172*	.153	.123	.075	.073	.062
Model 4 - Residuals 2nd birth hazard	38	.079	.099	.036	-.004	.006	-.012
Random intercepts							
Model 1 - Low education	38	.322***	.297**	.265**	.193*	.217**	.222***
Model 1 - Medium education	38	.136	.158	.043	-.022	.010	-.008
Model 1 - High education	38	.399***	.409***	.373***	.326***	.302***	.261***
Model 2 - Low education	38	.444***	.401***	.391***	.333***	.346***	.318***
Model 2 - Medium education	38	.263**	.315**	.211*	.165*	.189**	.144*
Model 2 - High education	38	.387***	.397***	.365***	.321***	.298***	.264***
Model 3 - Low education	38	.294**	.163	.223*	.172*	.198**	.194**
Model 3 - Medium education	38	.239**	.280**	.183*	.140	.159*	.110
Model 3 - High education	38	.197*	.202*	.139	.128	.112	.097
Model 4 - Low education	38	.114	.105	.138	.085	.106	.081
Model 4 - Medium education	38	.169	.200	.123	.103	.124	.083
Model 4 - High education	38	.088	.113	.016	.008	.007	-.018

FOQ: First order queen adjacency, NNn: n-nearest neighbors
Source: Belgian 2001 census & register data, calculations by authors
Significance levels: p < .05 (*), p < .01 (**), p < .001 (***)