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Borders and the Spatial Diffusion of Family Changes: An Analysis of Non-marital Births in the French-Belgian Border Region (1968–2017)

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ABSTRACT

In recent decades, many European countries have experienced significant family changes, including an increase in the proportion of non-marital births. To understand these family changes in European and Western societies, numerous theories have emerged, accompanied by a wealth of empirical literature. However, the spatial dimension of family change is less studied than other aspects. Moreover, borders can play a role in the diffusion process by acting as barriers. Very few studies have examined the relationship between borders and the spatial diffusion of family changes. This article fills this gap by investigating the role of borders in the spatial diffusion of non-marital births between Belgium and France. The border region between these countries is a key area for analysing these relationships. Using local vital statistics data, the study compares the barrier intensity of different borders (national and linguistic) by measuring the absolute difference in non-marital birth rates. The results indicate a spatial diffusion in both countries, with borders acting as barriers. The intensity of this barrier role varies over time, peaking in the mid-1990s. The national border is a stronger barrier than the language border, with the strongest barrier being the French-Belgian border in Flanders. By showing how borders influence the pace and the extent of spatial diffusion of non-marital births, this study contributes to a deeper understanding of the spatial dynamics of demographic behaviour in Western Europe.

1 | Introduction

In recent decades, many European countries have experienced profound family changes, including a decline in marriage, delayed marriage and childbearing, increasing prevalence of unmarried cohabitation and divorcee and persistently low fertility rates, which remain below the replacement level in large parts of Europe. In these countries, there has been a growing trend towards cohabitation, which has gradually emerged as a new family form, sometimes replacing marriage. Among the family changes that have occurred in Europe since the 1960s, the marked increase in non-marital births is often identified as a major socio-demographic change (Kiernan 2004). Some researchers consider the increase in non-marital births to be one of the most important phenomena of contemporary family change, particularly because it represents a break with previous family models (Perelli-Harris et al. 2011). Although non-marital births existed in Europe as early as the 19th century (Shorter et al. 1971), recent decades have seen a dramatic increase in this behaviour, reaching unprecedented levels with more than 50% of all newborn children being born to unmarried women (Kiernan 2004; Kok 2009). Almost 50 years ago, non-marital births were rare. However, social norms and institutional frameworks relating to cohabitation and non-marital births have

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evolved. In many countries, cohabiting couples now enjoy almost the same legal rights as married couples, reflecting broader shifts in societal acceptance and legal recognition of different family forms (Perelli-Harris et al. 2012).

To understand these family changes in European and Western societies, including non-marital births, numerous theories have emerged and with them a rich empirical literature (Zaidi and Morgan 2017). These include cultural theories such as the second demographic transition (Lesthaeghe and Van de Kaa 1986) or the developmental paradigm (Thornton 2001), economic theories (Becker 1981; Blossfeld et al. 2005; Perelli-Harris and Gerber 2011) and theories based on gender relations such as the gender revolution (McDonald 2000).

Compared to all aspects of family changes analysed in the existing literature, the spatial dimension of these phenomena is certainly one of the least studied, especially studies with a spatio-temporal approach. Studies have examined the spatio-temporal variation in family changes across Europe, showing that variation exists not only between countries but also within countries (Bleha and Ďurček 2019; Caltabiano et al. 2019; Doignon and Banerjee 2025; Doignon et al. 2022; Klüsener et al. 2013; Setz et al. 2025). Few studies have also attempted to explain the spatial diffusion of many family changes, in particular non-marital births (Vitali et al. 2015). These studies provide evidence of strong geographical divides of non-marital births along borders in Europe (Klüsener et al. 2013). However, the nature of the relationship between borders and the spatial diffusion of non-marital births remains poorly understood, despite clear evidence suggesting a link between the two.

In this article, we aim to fill this gap by examining the role of borders in explaining the spatial diffusion of non-marital births in two bordering countries: Belgium and France. The border region between these two countries provides a very relevant study area for analysing the links between borders and the spatial diffusion of non-marital births. We aim to gather evidence on the role of borders in the spatial diffusion process by measuring the absolute difference (Klüsener et al. 2013) in the share of non-marital births between neighbouring regions separated by national and/or linguistic borders, and how this difference evolves over time. To investigate this question, we use civil registration data at a local level for France and Belgium (and also the National register for Belgium). It should be emphasised here that the main innovative contribution of our analysis is the examination of different types of borders (national and linguistic) using spatially and temporally fine-grained data.

2 | Background: Borders and Spatial Diffusion of Non-marital Births in Europe

2.1 | State-of-the-Art

2.1.1 | What Is Spatial Diffusion?

An important question that arises when we study a change in behaviour from a geographical perspective is how that behaviour spreads across space. Although each phenomenon has its own characteristics as it spreads across space, there are common patterns and processes that shape how phenomena can diffuse. Many geographers have studied the process of spatial diffusion, that is, the way in which an element or phenomenon (idea, behaviour, etc.) spreads through space (Hägerstrand 1968; Saint-Julien 2007). A phenomenon emerges; it moves or spreads beyond the place of origin to change, *permanently or temporarily*, the character of other places (Morrill et al. 1988). This phenomenon spreads through two main mechanisms: direct contact, where neighbouring areas or people are the first to adopt (diffusion by geographical proximity, or 'contagious' diffusion) or spreading through key nodes (cities) before reaching less connected areas (hierarchical diffusion) (Saint-Julien 2007). Diffusion tends to be faster between larger nodes than between smaller ones. It often follows a downward path along the urban hierarchy—spreading from larger to smaller centres (but the reverse is also possible). However, diffusion can also occur simultaneously through both proximity and hierarchy channels (Cliff and Haggett 2006). In studying spatial diffusion, identifying the geographical patterns of family changes involves identifying key factors: the origins of new family behaviours (where they first emerge), the path and speed of their spread, areas that are resistant to these changes, potential barriers to diffusion and the ways in which these behaviours spread (whether through nearby regions or through a hierarchy from larger to smaller centres). These are the elements we will be looking for in the maps. However, there are some caveats to interpretation.

When interpreting a spatial diffusion observed on a map, it is important to remember that the level of analysis is aggregated. We must therefore avoid committing an ecological fallacy by concluding that there is social diffusion between individuals[1] (individual level) solely on the basis of aggregated results observed on maps. We can only conclude that we observe a spatial diffusion at this aggregate level, which may be indicative of social diffusion, but in no way proves it.

Spatial diffusion can then be seen very clearly on the maps, but this phenomenon can be caused by changes in the composition of the population or its behaviour. To determine what is due to the process of spatial diffusion and what is due to other explanatory factors, it is necessary to control for the latter using appropriate statistical models. However, we need to distinguish between observation and explanation. With a descriptive approach based on map interpretation, we can say that spatial diffusion is observed, bearing in mind that diffusion mechanisms are certainly not the only explanation for these spatial dynamics and that they may be due to other factors.

Finally, we can see from the maps that known borders, such as national or cultural borders, can act as a barrier to spatial diffusion. In other words, the diffuse stops or slows down when it reaches this border. In this case, this barrier characteristic is not necessarily related to the type of border. For example, a national border separates two different countries. If this border acts as a barrier, it should not necessarily be seen as a country effect. The border may also separate two populations that do not belong to the same country, but also have different socio-demographic or cultural characteristics. In other words, this border is a barrier, but we do not know whether this is due to a country effect or a

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composition effect (or both). To distinguish the effect of each factor, we need to go beyond descriptive analysis to a more detailed statistical analysis.

2.1.2 | Non-marital Births in Europe

In this article, we choose to focus on non-marital births. A study of the evolution of non-marital births in Europe between 1880 and 1940 found that non-marital births declined in most of the countries from the last quarter of the 19th century with regional patterns highlighting the cultural influence on this trend (Shorter et al. 1971). The decline in non-marital fertility in Europe in the mid-twentieth century has been attributed to improved access to contraception, expanding welfare policies and societal shifts towards the male breadwinner model, particularly after the economic crisis of 1929. During this period, which was characterised by low non-marital birth rate, women were largely dependent on their husbands for economic security (Ruggles 2015). However, this trend was reversed as the post-1945 generations matured, marking a willingness among women to become more active in the labour market and potentially rethink traditional family structures. Since the 1970s, researchers have observed an unprecedented increase in non-marital births in Europe, but there are large differences between countries. The increase in non-marital births has not been uniform. It has been observed that the increase in non-marital births occurred first in the Northern European countries and later in the Southern and Eastern European countries. It occurred at different times and at different rates, highlighting distinct regional patterns both between and within countries.

This increase in non-marital births in Europe is not random in space and time. On the contrary, it is often structured by a process of spatial diffusion, as in Norway (Vitali et al. 2015), in Belgium (Doignon and Banerjee 2025) and France (Doignon 2021). These studies highlight the importance of geographical proximity and urban hierarchy. The former implies that the increase in non-marital births in an area is facilitated by the fact that it is geographically close to another area where the non-marital birth rate has already increased. In addition, urban areas often lead the way, with generally higher levels of non-marital births than other areas. In France, there is even a pattern based on urban hierarchy: the larger the city, the earlier the increase in non-marital births (Doignon 2021). In particular, a shift in the urban hierarchy became apparent in the late 1980s, with secondary cities recording higher rates of non-marital births than primary cities.

However, the spatial diffusion of demographic behaviour is not a completely mechanical process, although it is structured by two mechanisms (geographical proximity and hierarchical diffusion) (Saint-Julien 2007). Other phenomena are also at work. For example, non-marital births seem to be favoured by women's education and men's unemployment in Norway (Vitali et al. 2015) and by secularisation in France (Doignon 2021). In this country, the more traditional regions with a more religious population have been the most resistant, although some of these regions (Brittany, Western France) are close to the pioneer regions (e.g., Normandy).

Thus, an increase in non-marital births in one region does not necessarily mean an increase in non-marital births in all neighbouring regions. Similarly, cities are often forerunners, but rural areas may also be forerunners. The spatial diffusion of non-marital births can thus be explained by a complex combination of mechanisms specific to this process (geographical proximity and hierarchical diffusion) and socio-demographic and political factors affecting the population of the regions. These different factors partly explain why non-marital births spread earlier (or later) and more quickly (or slower) in certain regions or countries.

The development of modern states has shaped population structures and behaviours through the establishment of standardised institutions, such as education and legal systems. State policies and welfare systems have played a central role in cultural and demographic convergence within states, and have influenced non-marital births (Klüsener 2015; Klüsener et al. 2013). However, spatial disparities still exist in Europe, particularly along borders. Borders can play a key role in spatial diffusion processes. They can act as barriers, slowing down diffusion and creating areas where the rate of non-marital births remains relatively low. Studies have shown that national and regional borders play a crucial role in explaining the demographic processes, as they can represent strong geographical divides in terms of jurisdictional, cultural and socioeconomic conditions (Bocquet-Appel and Jakobi 1996; Decroly and Vanlaer 1991; Decroly and Grasland 1993; Lesthaeghe and Neels 2002; Watkins 2014). In explaining trends in non-marital fertility across Europe since 1960, Klüsener et al. (2013) examined the role of states, regions and their borders in shaping spatial patterns of non-marital births. Borders are often spatial discontinuities in the sense that the similarity of regions on either side of the border decreases sharply. As a result, neighbouring regions or countries may have very different levels of non-marital fertility. Although the intensity of these spatial discontinuities has changed since 1960, nation-states and their borders remain very important for describing non-marital fertility, more so than internal borders (Klüsener et al. 2013).

2.2 | Knowledge Gap

The literature shows that there is a spatial diffusion of non-marital births (Doignon and Banerjee 2025; Vitali et al. 2015) and that national and regional borders represent spatial discontinuities in Europe (Klüsener et al. 2013). However, these two components are often studied independently and are rarely linked. Nevertheless, there are clear links between the two, especially when looking at them over time. As the increase in non-marital births spreads across space, borders may act as barriers that prevent the spatial diffusion from spreading further. In this way, spatial discontinuities may be created or existing ones reinforced. The role of borders as barriers may well diminish over time, reducing spatial discontinuities along them. For example, a border may be a spatial discontinuity for only one period. It is also possible that not all borders have the same effect on spatial diffusion, or that certain types of borders act more persistently as barriers. Similarly, it is possible that a border is not a spatial discontinuity along its entire length, but

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only along a part of it. These different types of information would, for example, make it easier to disentangle socio-economic, cultural and political factors in explaining the spatial dynamics of family changes in Europe. We can learn a great deal about family changes by analysing the interactions between the spatial diffusion of non-marital births and spatial discontinuities between countries and regions, and in particular how they shape each other.

However, to our knowledge, only the study by Bleha and Ďurček (2019) shows the effect of the border between Slovakia and the Czech Republic on the spatial diffusion of some family changes (nuptiality, divorce and non-marital birth rates). They clearly show that the border between the two countries is an obstacle to the spatial diffusion of the three family changes studied, but much less so for non-marital births.

Despite its analytical potential, it is surprising that this positioning has not been the subject of more research and remains a blind spot in the literature. There is very little evidence on the role of borders in the spatial diffusion of non-marital births. In our view, there are two main reasons for this. The first is that family changes are rarely analysed using a spatio-temporal approach. The main focus of existing studies on non-marital births is on identifying spatial structures and clusters of high and low rates of non-marital births, often linking these patterns to specific explanatory variables. However, these studies typically lack a dynamic temporal analysis, and usually only examine whether spatial clusters remain consistent over different time points. This approach overlooks the evolution and spatial dynamics of non-marital births.

The second reason is that a comprehensive understanding of the spatial diffusion of family changes and their links with borders requires a number of methodological conditions: a local geographical level, an extended temporal scope to include earlier stages of the diffusion process and at least two countries under study. However, these conditions are rarely met in existing studies of the spatial dynamics of family changes in general and of non-marital births in particular. Indeed, the choice of geographical level and time scale in many studies has proved insufficient to capture the spatial diffusion process. The geographical units used are often aggregated, combining urban and rural areas, which can obscure the diffusion dynamics. The time period studied is often too short and too late, that is, after the significant increase in non-marital births had already occurred. Finally, the vast majority of studies focus on a single country and do not allow us to analyse the effect of national borders on the spatial diffusion.

The aim of this article is to analyse in detail the relationship between borders and the spatial diffusion of non-marital births. To achieve this, we have chosen a relevant study area that meets all the methodological conditions outlined above.

2.3 | The Choice of the French-Belgian Cross-Border Area and the Originality of the Research

In this article, we have chosen the border region between France and Belgium. It is an ideal study area for analysing the relationship between borders and the spatial diffusion of non-marital births. First, this study area is original in that it contains three different types of borders within a small area (see Map 1).

Classically, there is the national border between France and Belgium and the linguistic border that divides Belgium into a French-speaking and a Flemish-speaking part. But there is also a third type of border, on the section of the border between France and Belgium that runs from the Channel to the Lille conurbation, which has the peculiarity of being both a national and a linguistic border. This section of the border separates two different countries, but the populations on either side do not speak the same language (French on the French side, Flemish on the Belgian side).

Secondly, there are studies on the spatial dynamics of family changes in these two countries (Lesthaeghe and Neels 2002). The pattern of spatial diffusion of non-marital births in France and in Belgium is already known in detail (Doignon 2021; Doignon and Banerjee 2025). The present study, therefore, builds on this previous work, which examined the spatio-temporal pattern of the increase in the share of non-marital births in these two countries.

Finally, the data available in these two countries make it possible to study non-marital births both at a local geographical level and over a period of almost half a century (since 1968). It makes it possible to include the beginning of the diffusion of the phenomenon in both countries.

This Franco-Belgian study area makes it particularly original in relation to the literature. It offers the ideal methodological conditions for testing original hypotheses on the relationship between borders and spatial diffusion.

2.4 | Research Questions and Hypotheses

Many elements can be analysed in this area of study. We have chosen to limit ourselves to the following research questions and hypotheses.

RQ1: What is the role of borders in the spatial diffusion of non-marital births in the French-Belgian cross-border area?

H1. *All borders act as barriers, but the national border is a stronger barrier than the linguistic one.*

H2. *This role of barrier creates spatial discontinuities. The stronger the barrier, the greater the spatial discontinuities.*

RQ2: How long does the role of the borders as a barrier last?

H3. *The role of borders as barriers decreases over time as spatial diffusion takes place.*

H4. *The border between France and Belgian Flanders serves as the strongest and most enduring barrier, as it is both a national and linguistic divide.*

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MAP 1 | Location map.

3 | Data and Methods

3.1 | Data

In this study, we have used several data sources: Civil Registries data from 1968 to 2017 for France; Civil Registries data from 1968 to 1997, and data from both the Belgian National Register and Civil Registries from 1997 to 2017 for Belgium. The Civil Registries of both countries and the Belgian National Register provide a unique and valuable data source for studying demographic trends due to their high quality, long-term coverage and detailed annual frequency. One of the main advantages of using these data is that they are available at a very detailed geographical level (municipalities). This allows researchers to carry out a detailed analysis of the demographic shifts in different geographical settings and to follow the spatial diffusion of demographic behaviours in a very precise way.

The indicator we used is the percentage of non-marital births among all live births. This measure is crude because it does not control for population structure, such as the age structure or the number of married and unmarried women in the regions (Klüsener et al. 2013). Unfortunately, we are forced to use this indicator because the data do not allow us to obtain a better indicator covering the whole period studied, such as the proportion of first births within cohabitation.

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The percentage of non-marital births is calculated at a local level for each country: the communes in Belgium, and the 'cantons-ou-villes' in France. Over the period, there have been changes in the administrative regional divisions. For both countries, the 2017 territorial breakdown is maintained for all previous years. This means that the territorial breakdown is constant over time and the number of territorial units remains the same throughout the study period. In Belgium, the number of municipalities has changed since the late 1960s, with a major merging of municipalities in 1977 reducing the number of municipalities from 2359 to 596. In this article, we use the geography of municipalities valid in 2017, that is, 589 units. France has a particularly large number of municipalities (around 35,000), most of which are sparsely populated. As a result, the number of births per municipality is very low, leading to a high degree of statistical variability over time in our non-marital births indicator. In addition, French municipalities are much smaller than Belgian municipalities. For these two reasons, we prefer the geographical level of 'cantons-ou-villes' (just over 2000 units), which are groupings of one or more whole communes. To further reduce statistical variability, annual data are aggregated over 5-year periods to form a data set covering 10 periods.

3.2 | Methods

3.2.1 | Mapping

We use a twofold approach to illustrate the spatial diffusion process: diffusion by geographical proximity and hierarchical diffusion. For the former, we use a series of 10 descriptive maps, each representing a 5-year interval for the whole of Belgium and the part of France that shares its border with Belgium. Each map is standardised using a common discretisation of values, which facilitates a comparative analysis between the different periods. As the distribution of non-marital birth rates is uniform for all time periods, we use the method of discretisation by equal amplitude classes, with two classes below 10% to better see the first step of spatial diffusion. The colour pattern remains the same for all periods.

For the hierarchical diffusion, we represent the urban hierarchy on the maps. We restrict ourselves to municipalities representing the central cities of urban areas with more than 100,000 inhabitants in 2017 (33 territories) (Doignon 2021; Doignon et al. 2020). We distinguish four levels of cities: those with more than 1 million inhabitants (level 1), those with between 500,000 and 1 million inhabitants (level 2), those with between 200,000 and 500,000 inhabitants (level 3) and those with between 100,000 and 200,000 inhabitants (level 4).

3.2.2 | Measurement of Spatial Discontinuities

We are also interested in describing the relationship between the borders and the spatial diffusion of non-marital births. To facilitate this, we have distinguished four borders: the national border between France and Belgium, the linguistic border between the Flemish-speaking area (i.e., Flanders) and the French-speaking area (Wallonia),[2] the French-Flemish border and the French-Walloon border.

To examine the role of borders as barriers, we measure spatial discontinuities. Here, we examine the first-order differences in non-marital births, which are defined as the absolute difference in the rate of non-marital births calculated as follows:

$$b_{ij} = |y_i - y_j|$$

where b denotes the absolute first-order difference for each pair of region i and neighbour region j.

We calculate this absolute difference for all regions in the French-Belgian border area, and we represent them on the maps by red lines whose thickness depends on the intensity of the spatial discontinuity.[3] This shows the extent to which spatial discontinuities are (or are not) found along the different boundaries defined above. The resulting synthesis maps thus represent both the mechanisms of the spatial diffusion process and the spatial discontinuities, providing a holistic view of the evolution of non-marital births in this border region between France and Belgium.

We then distinguish the absolute difference in the rate observed between regions divided by national borders as well as by the regional borders. Here, the border analysis takes into account the contiguous borders shared by a region. To identify which border is the strongest barrier to diffusion of non-marital births among all borders within the cross-border area (as defined above), we plotted the median of the absolute difference in non-marital births for each border from 1968 to 2017. This analysis also helps us to find the specific borders on the maps that play an important role in the pattern of spatial divides in non-marital births.

4 | Results

4.1 | National Trends

We show the evolution of non-marital births in both countries since 1960 (Figure 1).

The non-marital birth rate has always been higher in France than in Belgium. While the increase in the non-marital birth rate in France was rapid, the non-marital birth rate in Belgium did not increase until after 1987. Previous literature also shows that Belgium had experienced the changes in family dynamics much later than other European countries (Corijn 2014; Doignon et al. 2020; Kiernan 2004). There is therefore a time lag of about 10 years between the increase in non-marital births in France and that in Belgium. It is not easy to explain this time lag, as it is multifactorial. The two countries have similar levels of economic development, although the gap in GDP per capita has widened in favour of Belgium since the mid-2000s. On the other hand, unemployment was higher in Belgium until the end of the 1980s. Since then, it has almost systematically been lower in Belgium than in France. The unemployment rate for women, however, shows a marked difference. It used to be higher in

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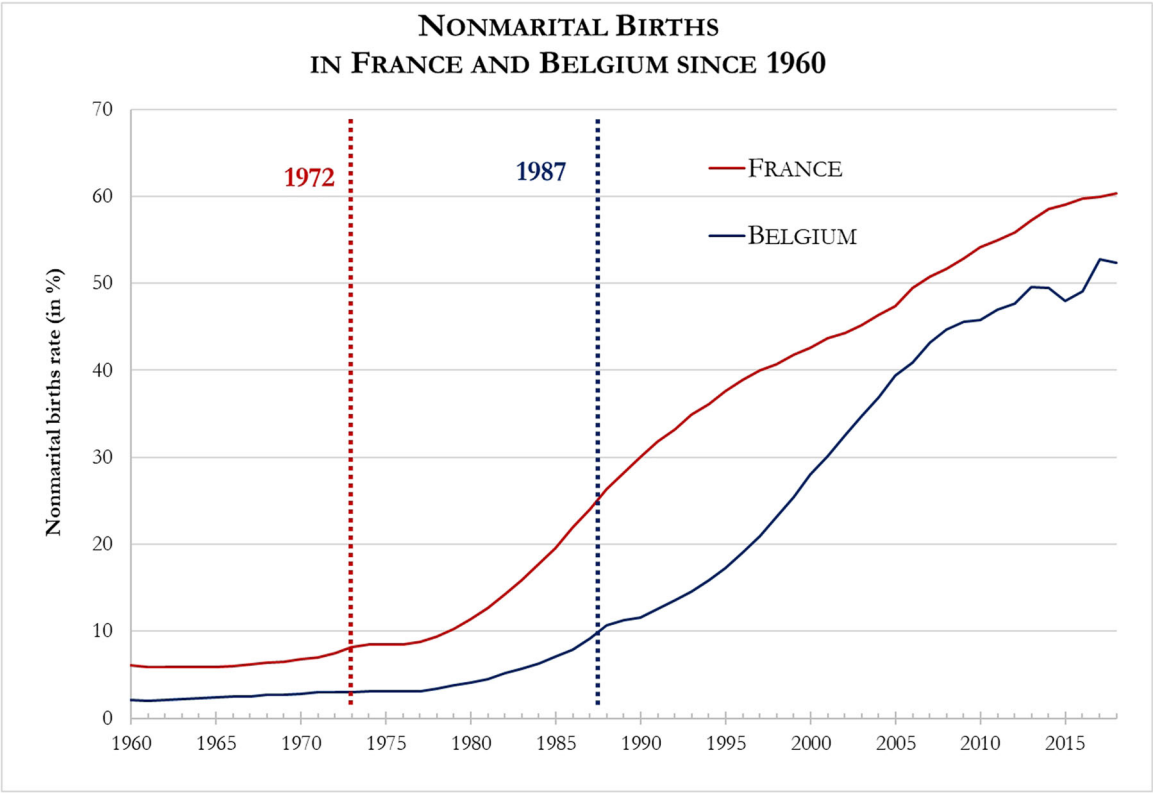

FIGURE 1 | Non-marital births in France and Belgium since 1960. *Source:* Eurostat.

Belgium, but since the 1990s, it has been the same in both countries. In the early 1980s, it was approximately 16% in Belgium and 11% in France. The difference in the increase in non-marital births between France and Belgium can also be explained by the laws that grant almost similar rights to children born within and outside marriage. The legal reform in France in 1972 gave children born out of marriage almost the same rights as children born in marriage, which may have accelerated the already slightly increasing non-marital birth rate (Knijn et al. 2007; Munoz-Perez and Prioux 2000). A similar law was passed in Belgium in 1987, 15 years after France. Some scholars argue that the European Court of Human Rights put pressure on the Belgian government to change some of its discriminatory laws, which led the Belgian government to amend its civil code, and thus the non-marital birth rate began to increase significantly thereafter (Klüsener et al. 2013). It is argued that in some countries, such as Belgium, Italy or Switzerland, conservative cultural attitudes and pro-marriage policies discouraged non-marital births (Goldhaber 2007). For example, the 1981 European Values Survey, conducted almost 40 years ago, showed that during that time the church attendance was twice as high in Belgium as in France (36% and 18%, respectively) and three times as high in the 18–29 age group (29% and 11%, respectively) (Lambert 2004). In the same survey, 31% of French respondents had said that marriage was an outdated institution, but only half as many in Belgium (18%) said the same. On the other hand, although Belgium is a small country, there is considerable regional heterogeneity. Flanders has been more religious than Wallonia and Brussels, with a church attendance rate of more than 50% compared to less than 30% for the other two regions (Dobbelaere and Voye 1990). These different elements could help us to understand the time lag, without claiming any proof.

4.2 | Spatial Diffusion and Spatial Discontinuities

We have produced a series of maps to show both the evolution of both non-marital births in the Franco-Belgian border area and the spatial discontinuities since 1968.

Map 2 shows the maps from 1968 to 1982, the first stages of the spatial diffusion when the non-marital birth rate was less than 10% in most of the French regions, and very low (less than 3%) in Belgium.

In 1968–1972, levels were rather low throughout the study area. This is not surprising, as the 1960s were still the 'golden age of marriage' in most European countries (Klüsener et al. 2013). The regions in which the proportion of non-marital births in France had reached more than 10% are easily identifiable and are scattered in a few local pockets, for example, in the largest cities such as Metz, Nancy, Lille and in cities at the top of the urban hierarchy (Saint-Quentin, Boulogne-sur-Mer). However, over the same period, the rates in Belgium were very low, with a maximum of around 10%. We observed that only a few regions, particularly those close to the cities, had a higher rate. There are a few spatial discontinuities, but none along a border. In France, they are only found around cities where the level is at least 10 percentage points higher than in neighbouring areas.

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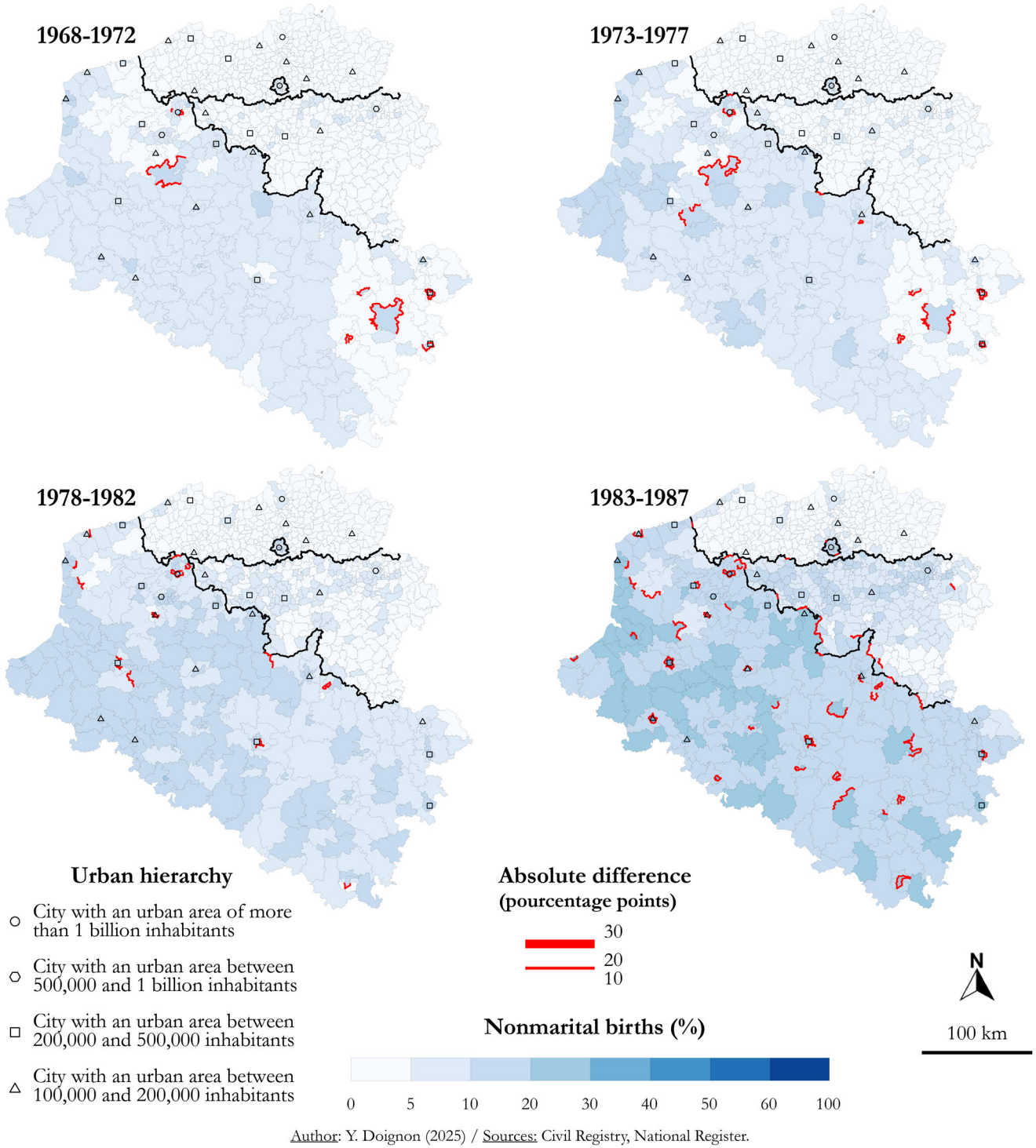
SPATIAL DIFFUSION AND DISCONTINUITIES OF NON-MARITAL BIRTHS IN THE FRENCH-BELGIAN BORDER REGION (1968-1987)



Author: Y. Doignon (2025) / Sources: Civil Registry, National Register.

MAP 2 | Spatial diffusion and discontinuities in non-marital births in the French-Belgian border area (1968–1987). *Source:* Civil Registry. For France: État Civil - Naissances 1968–2023, INSEE (producteur), PROGEDO-ADISP (diffuseur) (doi:10.13144/psm-0014).

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Since 1973–77 there has been a striking spatial pattern in the diffusion of non-marital births in France. During this period, regions with higher levels of non-marital births are in close proximity to each other and there is a clustering in the northern part of the study area in France. However, there was little change over the period in Belgium, where most regions had very low rates (below 5%). Only a few regions had a rate above 5%, and these are specific regions. These are the large Walloon cities (Namur, Tournai), particularly industrial ones (Charleroi, Liège), the entire Brussels agglomeration and the municipalities on the border with France (south of Tournai). The result is a combination of geographical proximity and hierarchical diffusion. There are still relatively few spatial discontinuities, the same as in the previous period. The borders still do not represent a spatial discontinuity.

The process of spatial diffusion continued between 1978 and 1982 in both France and Belgium. In France, urban areas are characterised by a higher rate than rural areas. The spatial pattern also suggests of an increase in the non-marital rate in the rural areas as well, which gives the impression that spatial diffusion has taken place from urban areas to neighbouring rural areas. Lille, the largest city in the study area, had the highest rate at around 23%. In contrast, the vast majority of municipalities in Brussels-Capital, the other largest city, have no more than 10% of non-marital births. During this period, the first stages of spatial diffusion can be seen in Belgium, with several areas where the rate of non-marital births has risen slightly to over 5%. They diffuse by geographical proximity in the industrial basins and in the northern half of Wallonia (French-speaking), especially from the large cities (Mons, Charleroi, Namur, Liège). These regions are among the most secularised and have the lowest levels of church attendance in the country. In Flanders, too, in the two main Flemish cities (Ghent and Antwerp) and along the coast, they are also beginning to rise to over 5%. Spatial discontinuities are still rare. They can only be found around certain French cities which have a significantly higher rate of non-marital births than their immediate neighbourhood. Some spatial discontinuities persist, such as in Lille, but new ones are appearing, especially around cities at the top of the urban hierarchy (Amiens, Calais, Boulogne-sur-Mer, Sedan). These trends show that, on the one hand, non-marital births have diffused to these cities but not to the surrounding countryside, widening the gap between the two and thus creating spatial discontinuities. Some spatial discontinuities are disappearing (around Metz, for example): non-marital births are increasing in the countryside, sometimes catching up with the urban level, thus reducing the gap and sometimes eliminating the spatial discontinuity previously created. There is also a spatial discontinuity along the Franco-Belgian border to the north of the Lille agglomeration.

During the period 1983–87, almost all the regions in France had a rate of over 10% and only a few regions had a rate of over 30%, particularly in urban areas. Levels of non-marital births of between 20% and 30% are found along the coast between Boulogne-sur-Mer and Dieppe, and in the rural Picardy and the Champagne region. The values are still low (< 10%) in rural Flanders, especially in the region between the coast and Lille/Béthune. In Belgium, non-marital births continue to diffuse in the northern half of Wallonia, around Brussels and along the French border. In Flanders, on the other hand, there is no real spatial diffusion, with the exception of the coast and secondary cities (Mechelen, Leuven). There is a clear contrast between the French-speaking and Flemish-speaking parts of Belgium, where the former has a higher level of non-marital births. It was during this period that spatial discontinuities began to appear in greater numbers. They are still to be found around the large French cities, but they are now also to be found around towns further down the urban hierarchy, with small and medium-sized towns such as Dieppe (on the coast) and Verdun (between Reims and Metz). Spatial discontinuities also appear along the border between France and Belgium, particularly on the French-Walloon border and very occasionally on the linguistic border in Belgium. The emergence of spatial discontinuities along borders highlights their role as barriers.

Between 1988 and 1992 (Map 3), France was no longer in the first phase of the diffusion of non-marital births, and it had spread to practically all areas.

Non-marital births continue to increase, following a pattern of spatial diffusion. In Belgium, we see non-marital births continued to increase around the Brussels agglomeration and in Wallonia, even in the more conservative south-eastern part of the country. In Flanders, it began to diffuse in the Ghent-Antwerp-Brussels triangle and to some extent in the cities of Limburg. The fact that the spatial diffusion of non-marital births in Flanders began to increase on a larger scale precisely in the period 1988–1992 is most likely to be related to the promulgation of the law establishing legal equality between legitimate and illegitimate children shortly before (1987). This law may have triggered a spatial diffusion in Flanders, whereas in the northern half of Wallonia, non-marital births had already started to increase before the law. In addition, the number of spatial discontinuities continues to increase. They exist around cities, both French and Belgian (Antwerp, Ghent, Ostend), but also along national and linguistic borders. The Flemish-French border, for example, is a spatial discontinuity along almost its entire length. Finally, there are significant spatial discontinuities (absolute difference of more than 20 percentage points), particularly around certain French cities (Sedan, Amiens, Dieppe, etc.) and along the southern part of the Franco-Belgian border. In the latter case, the high values in the French areas (> 30%) contrast sharply with the low values in the Belgian municipalities (< 10%). This situation is particularly striking in the areas of Charleville-Mézières and Sedan, for example.

In the following periods (Map 4), non-marital births continued to spread throughout the study area.

In Belgium, they have spread beyond the Antwerp-Ghent-Brussels triangle to West Flanders, Limburg and the border region with Luxembourg. These regions are more traditional and conservative and therefore more resistant to family changes than others. Previous research shows that in these regions, where the non-marital birth rate was low, secularisation was a minority phenomenon in those compared to the rest of Belgium (Doignon et al. 2020; Lesthaeghe and López-Gay 2013). High levels (> 60%) of non-marital births are gradually being reached in France, but also in Wallonia, over the period 2013–2017.

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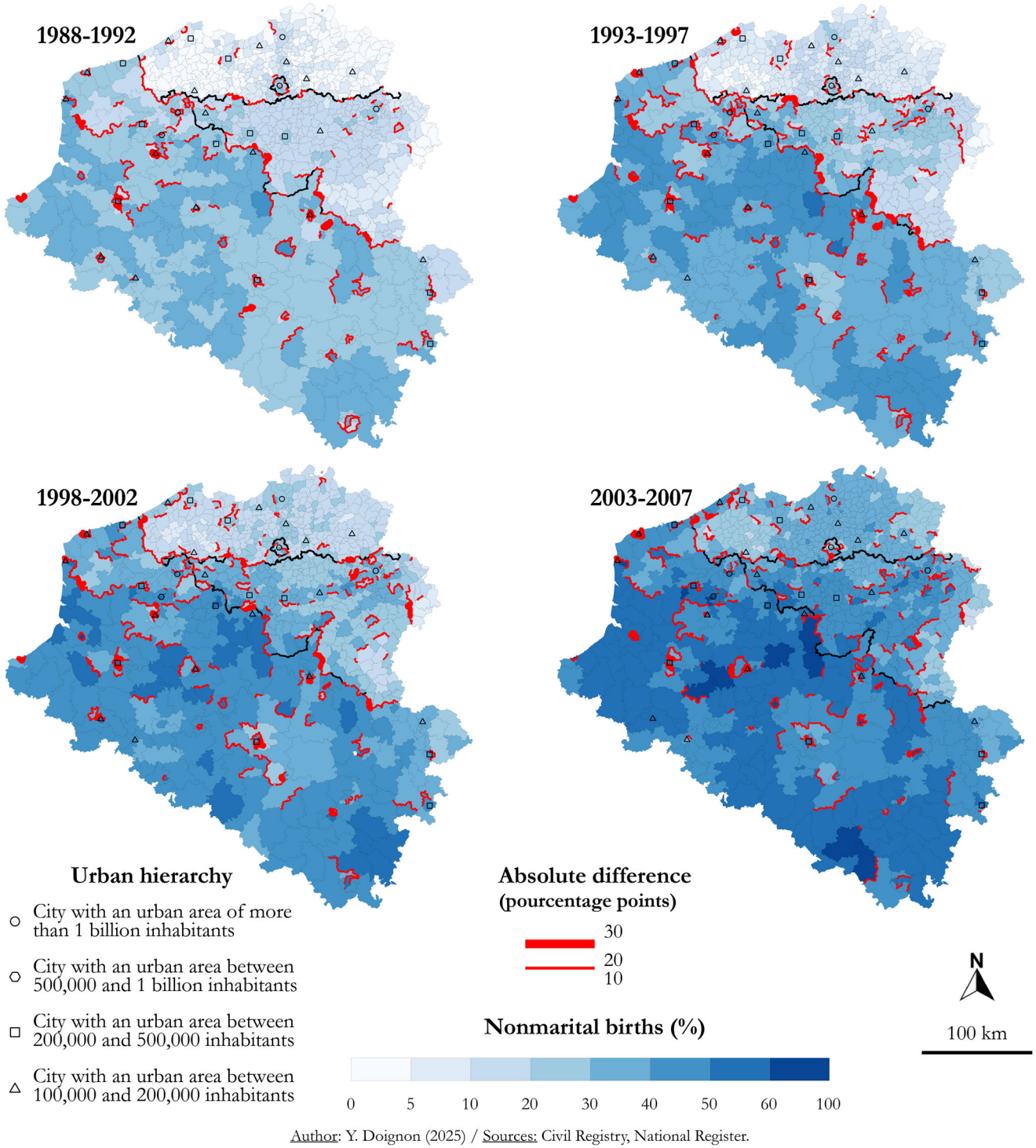
SPATIAL DIFFUSION AND DISCONTINUITIES OF NON-MARITAL BIRTHS IN THE FRENCH-BELGIAN BORDER REGION (1988-2007)



Author: Y. Doignon (2025) / Sources: Civil Registry, National Register.

MAP 3 | Spatial diffusion and discontinuities in non-marital births in the French-Belgian border area (1988–2007). *Source:* Civil Registry, National Register. For France: État Civil - Naissances 1968–2023, INSEE (producteur), PROGEDO-ADISP (diffuseur) (doi:10.13144/psm-0014).

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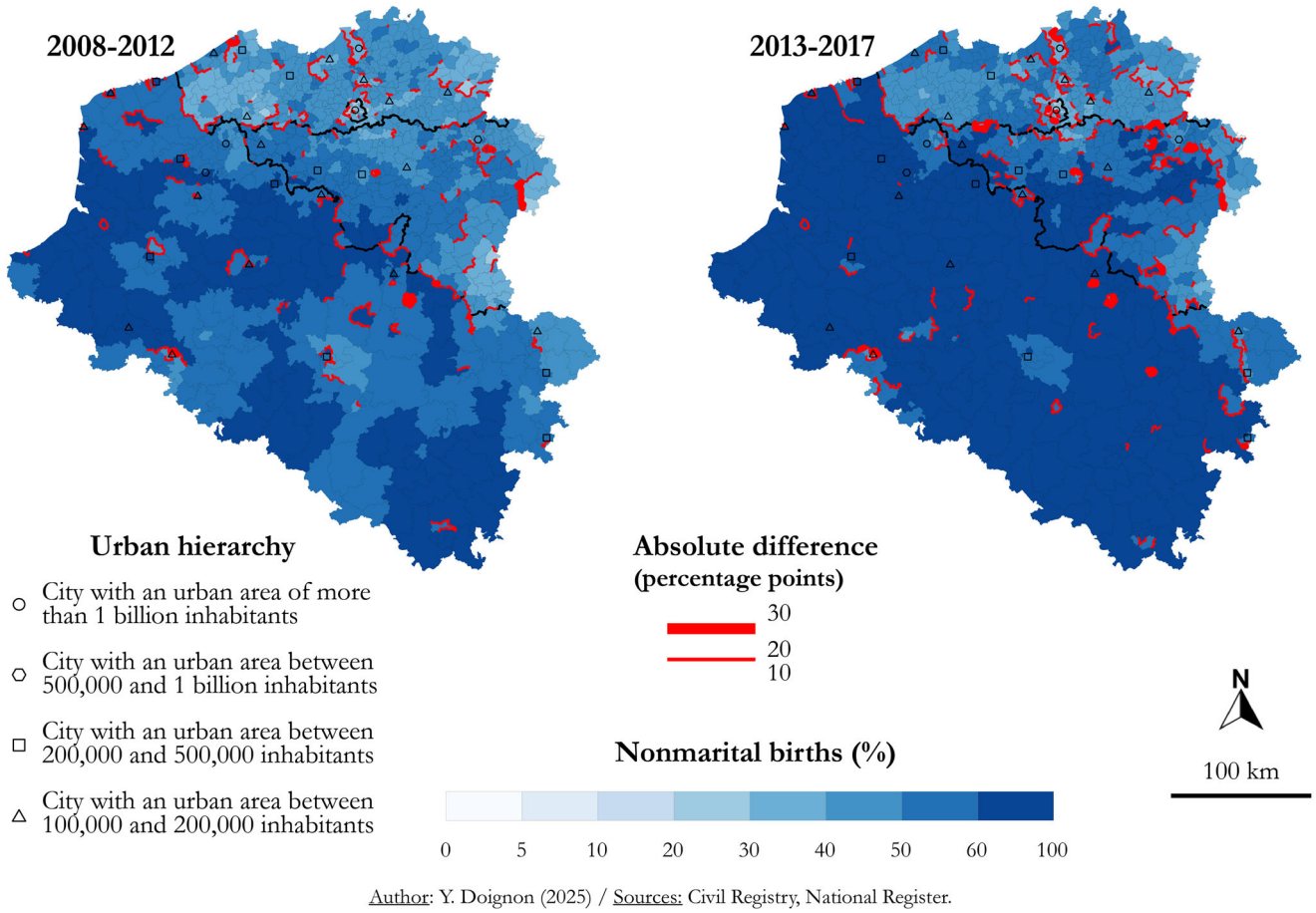

MAP 4 | Spatial diffusion and discontinuities in non-marital births in the French-Belgian border area (2008–2017). *Source:* Civil Registry, National Register. For France: État Civil - Naissances 1968–2023, INSEE (producteur), PROGEDO-ADISP (diffuseur) (doi:10.13144/psm-0014).

Overall, Belgium still has lower levels than France, and the same is true for Flanders and Wallonia, but the process of spatial diffusion is therefore still underway in the study area.

Similarly, spatial discontinuities are becoming more numerous and are still structured around cities and along borders, sometimes with significant intensity (absolute difference of more than 20 percentage points). There has also been a gradual reversal in the urban–rural relationship in both countries. For a long time, cities had higher rates of non-marital births than their rural peripheries, creating spatial discontinuities. This relationship is now being reversed, with cities generally having lower rates than rural areas (sometimes with absolute differences of more than 20 percentage points). This is particularly true of the two largest urban agglomerations in our study area (Lille and Brussels), but also of other large cities (Metz, Nancy, Antwerp, Charleroi, Mons, Creil etc.). This phenomenon is part of a general reversal of the urban hierarchy already observed for non-marital births in France (Doignon 2021) and for non-marital cohabitation in Belgium (Doignon et al. 2020). However, the spatial discontinuities began to diminish between 2003 and 2007, particularly along borders, as spatial diffusion became more widespread. The role of borders as barriers to spatial diffusion was only temporary. The only exception is the border between Flanders and France, which remains a spatial discontinuity in the latest period.

4.3 | Comparison of the Barrier Role of Different Borders

It is clear that the rate of non-marital births was earlier and higher in France than in Belgium. The above maps seem to show that the various borders have all acted as barriers to the spatial diffusion of non-marital births. However, it is difficult to determine from these maps exactly how long borders act as barriers or to compare this role across different borders. To do this, we calculated the median absolute difference for each 5-year period for all defined borders (the French-Belgian border, the French-Walloon border, the French-Flemish border and the language border in Belgium). We then plotted the evolution of these values over time between 1968 and 2017 (Figure 2).

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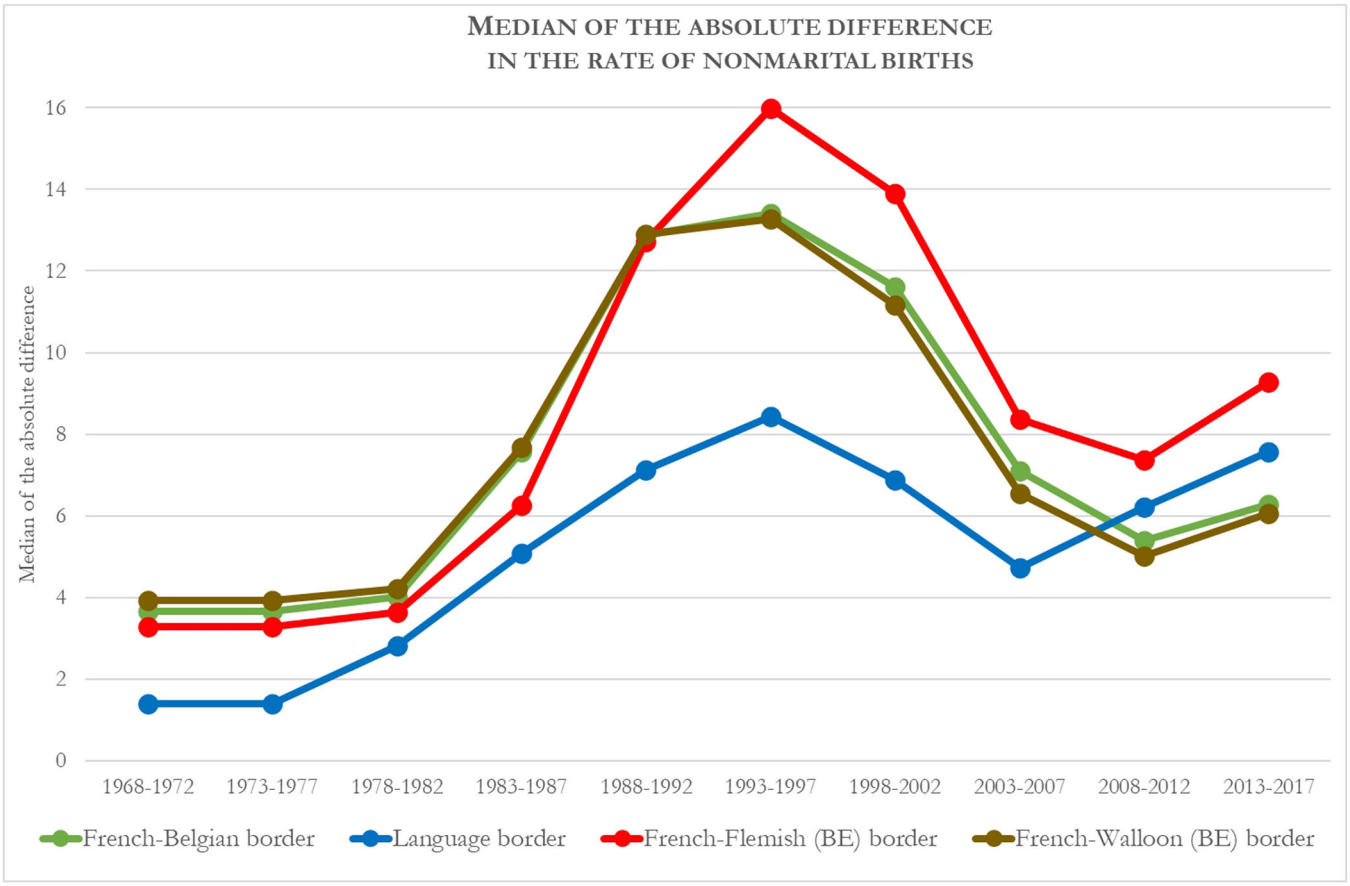

FIGURE 2 | Median of the absolute difference in the rate of non-marital births on the different borders. *Source:* Civil Registry, National Register. For France: État Civil - Naissances 1968–2023, INSEE (producteur), PROGEDO-ADISP (diffuseur) (doi:10.13144/psm-0014). *Reading aid:* Over the period 1993–1997, the median absolute difference for the French-Flemish border is around 16 percentage points: half of the segments along this border have an absolute difference of more than 16 percentage points, and half have an absolute difference of less than 16 percentage points.

First, there is the same bell-shaped pattern for all borders. The median absolute difference rises, peaks, falls and then rises again over the last 5–10 years. This trend reflects the borders as barriers to the spatial diffusion of non-marital births, thus confirming our first hypothesis. In simple terms, rates rise and diffuse earlier on one side of a border, for example, in France before Belgium, and in Wallonia and Brussels before Flanders. However, when spatial diffusion comes close to a border, it does not automatically cross it immediately. On the contrary, non-marital births may continue to increase on one side of the border, where spatial diffusion occurred earlier, and remain stable—or increase very little—on the other side of the border. This pattern would not be expected if borders did not influence the process of spatial diffusion[4] by acting as barriers, and if diffusion would have occurred solely through geographical proximity. In our case, the border seems to block (or slow down) this mechanism. From this point of view, borders are a barrier to spatial diffusion. This process tends to widen the gap between the rates of non-marital births in the areas on either side of a border. This creates strong spatial discontinuities and the median absolute difference increases as long as the border is a barrier, confirming our second hypothesis. Then, as the role of the border as a barrier diminishes, non-marital births increase on both sides of the border, reducing the intensity of spatial discontinuities, confirming the third hypothesis. Finally, there is an increase in the median absolute difference for all borders over the last 5–10 years. This may be due to a different pace of evolution of the rates on both sides of the border. For example, on the French-Flemish border, the number of non-marital births is increasing faster on the French side than on the Flemish side.

In a sense, we can assume that the greater the spatial discontinuity of a border, the stronger its role as a barrier. It is then possible to compare borders. From this point of view, it is clear that the language border was the weakest barrier and the French-Flemish border is the strongest (H4), with the French-Belgian and French-Walloon borders occupying an intermediate position.

The earliest increase in the median absolute difference on the language border occurred between 1978 and 1982, due to the earlier diffusion of non-marital births in Brussels and Wallonia, especially in the northern industrial areas. The language border acted as a barrier to the spatial diffusion of non-marital births, with Flanders experiencing the increase much later than French-speaking Wallonia. This barrier is also evident in other demographic phenomena, such as non-marital cohabitation (Doignon et al. 2020) and interregional marriages which have become rarer over time (Metzlar et al. 2023). The language border also represents a cultural divide between the historically less secularised Flanders and the more secular Wallonia.

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The median absolute difference for the French-Walloon and French-Belgian borders followed a similar trend, remaining stable until 1983–1987, peaking in 1993–1997 with higher non-marital birth rates on the French side, and then declining after 1998–2002. From the 1990s to the mid-2000s, the French-Walloon border difference was about 30% higher than the language border. This suggests that national borders, with different legal, normative and historical contexts—especially in terms of secularisation and religion—act as stronger barriers than language differences. From this point of view, the statistics on church attendance compiled by Fernand Boulard in the 1950s and 1960s in France (Isambert et al. 1980) and in the 1960s in Belgium (Service des Statistiques Religieuses de Belgique 1970) are very interesting. They show that in this cross-border area, and despite their geographical proximity, the Belgian populations are generally more religious than the French populations, even between France and Wallonia (which is more secularised than Flanders). The French-Belgian border thus reflects both political and religious discontinuities, particularly due to the history of secularisation in France.

The largest absolute difference in non-marital births is observed at the French-Flemish border. Until 1988–1992, the pattern was similar to that at the French-Belgian and Belgian borders, but between 1993 and 1997, the difference jumped to 16, indicating a significant barrier. Although the absolute difference has decreased since then, it remains the highest compared to other borders. This is because the border separates two different populations—different countries and different languages. As European integration reduced Franco-Belgian border distinctions, local contact had decreased, especially in the Dunkirk area, where the use of Flemish language declined (Hamez 2004, 2005). Paradoxically, there was more contact between these populations in the 1950s and 1960s than in the 2000s. This border has therefore become increasingly impermeable to local contact, and the neighbouring populations are mixing less and less. This is all the more surprising as the same language used to be spoken in this region. This state border has gradually become a linguistic border. On the Belgian side, Flemish nationalism has been built on the language issue, with the gradual abandonment of Flemish-French bilingualism. On the French side, the increase in the French-speaking population since the First World War and the assimilation of Flemish regionalism into local folklore have led to the virtual disappearance of the Flemish language. This means that in the 1960s, Flemish was spoken more widely on both sides of the border than it is today. Indeed, there were between 20,000 and 40,000 Flemish speakers in France in 2009. More specifically, only 5% of the total population of Dunkirk arrondissement (the border area) spoke Flemish on a daily basis in 2000 (Hamez 2004). This border also reflects discontinuities in religious practice (mass attendance) which were much stronger in Flanders in the 1960s.[5]

5 | Discussion and Conclusion

Using a spatio-temporal approach, this article explores the evolution of non-marital births in France and Belgium between 1968 and 2017. First and foremost, this article provides a comprehensive examination of the links between borders and the spatial diffusion of non-marital births in France and Belgium over a period of 50 years. To do so, we have used the local geographical level and a long time period in two countries with fine-grained data, which is a strong empirical originality of this article. Previous studies have found variation in non-marital births across Europe with a strong spatial divide (Klüsener 2015; Klüsener et al. 2013). To our knowledge, this is the first study to examine the links between different types of borders and the spatial diffusion of non-marital births, in particular by measuring spatial discontinuities along these borders over time at such a high level of spatial and temporal detail. We consider here the borders between Belgium and France (the French-Flemish border and the French-Walloon border), but also the linguistic border in Belgium. Thus, our study is unique in examining the spatial diffusion process along a wide range of border types with high spatial detail, focusing on a unique and well-suited region of Europe.

The main finding of the study is the analysis of the relationship between borders and the spatial diffusion process. All types of borders in the study area acted as barriers to the spatial diffusion of non-marital births (H1) and created significant spatial discontinuities (H2). This barrier effect was only temporary, as spatial discontinuities increased until 1993–1997 and then decreased, before increasing again recently (H3). However, the intensity of this barrier effect varies across borders. The national border was a stronger barrier than the linguistic border within Belgium (H1). The strongest barrier, however, has been the border between France and Belgian Flanders (H4), which is both a national border and a language border. Spatial diffusion from France stopped at the border with Belgian Flanders. In this region, the increase in non-marital births was not due to diffusion from France, but from Belgium. This is paradoxical, as the early increase in non-marital births in France and the proximity of Flanders to France could have led to a rapid diffusion in Flanders.

However, the role of a border as a barrier is merely a sign of underlying phenomena. The aforementioned developments and processes can be attributed to a number of interconnected factors. The emergence of spatial discontinuity along an international border would, at first glance, seem to suggest a national effect, such as national policies or laws. Indeed, the differences observed between France and Belgium could partly be explained by the time lag between the two countries' legal reforms concerning the rights of children born outside of marriage. This discrepancy may also reflect different degrees of traditionalism and secularisation in the two countries.

Borders can also divide populations with different social and cultural norms. Our results clearly highlight the role of language, as evidenced by the linguistic border within Belgium and between the French- and Flemish-speaking regions. Another cultural factor is secularisation, whereby one population is much more secular than another. Examples of this include Flanders and Wallonia in the 1960s, and France and Belgium in several areas along the international border. A border that acts as a barrier to spatial diffusion may also indicate limited interactions between the two populations. This would prevent behaviour from spreading between individuals who are geographically close.

In addition to these factors, the socioeconomic composition of regions on either side of a border should also be considered.

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Indeed, the ratio of non-marital births varies according to social class, education and the economic precariousness of individuals (Perelli-Harris and Gerber 2011). However, due to a lack of available local data, we have not incorporated this socio-economic dimension further into our analysis.

The spatial dynamics of non-marital births in France and Belgium over the last 50 years provide a fascinating study of how non-marital births have evolved over time and diffused across space. The evolution of the border, coupled with urban-rural disparities and the broader European socio-political context, has shaped the landscape of non-marital births in complex and varied ways. Understanding these patterns not only contributes to our knowledge of demographic and social change but also provides insights into the continuing evolution of family behaviours in Europe. It highlights the role of spatial diffusion, cultural shifts and policy frameworks in explaining the spatial dynamics of demographic behaviours, as discussed in previous studies (Costa et al. 2021; Dribe and Scalone 2014).

Our study covers only two countries with a limited number of borders, making it impossible to generalise our findings to all European borders or to the links between spatial diffusion and borders. Future studies should aim to include other family changes and extend the comparative framework to include other countries and types of borders, thereby increasing the generalisability and depth of the findings. This would provide a more detailed picture of the interplay between politics, culture and demographic behaviour on a broader scale. There is also a need for robustness tests using relative rather than absolute differences and a different territorial grid. Then, we have highlighted the pattern of the spatial diffusion of non-marital births in this cross-border study area. However, we have not taken into account influences that might affect this pattern from outside the study area, such as from nearby large cities like Paris, or from the social and mass media. Finally, an important aspect of future research should be an analysis using spatial modelling to explain the mechanisms through which cultural, economic and policy-related factors influence the spatial diffusion and increase of non-marital births in different regions.

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Conflicts of Interest

The authors declare no conflicts of interest.

Endnotes

[1] Spatial diffusion is the spread of a phenomenon from one area to other areas (aggregate level). Social diffusion is the spread of an element (idea, behaviour, etc.) from one individual to others through mechanisms such as learning and social influence. This has been shown, for example, in the spread of contraception and birth control during the fertility transition (Casterline 2001).

[2] To define this linguistic border, we used the administrative border between the Flemish and Walloon regions. In addition, as the Brussels region is predominantly French-speaking, we considered the border between the Brussels-Capital region and Flanders as a part of the linguistic border.

[3] For the sake of readability, absolute differences of less than 10 percentage points are not shown on the map.

[4] Since this is a descriptive article that does not consider the compositional characteristics of the population, we cannot determine whether the observed patterns are due solely to the borders or to those population characteristics as well.

[5] This is shown by the maps in the investigation file of Canon Fernand Boulard in the archives of the Catholic Church in Paris, France.

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