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THE GREAT RECESSION AND FERTILITY IN EUROPE: A SUB-NATIONAL ANALYSIS

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Abstract

This study investigates how the changes in labour market conditions and economic growth affected fertility before and during the recent economic recession in Europe. To this end, we use data for 258 European regions in 28 European Union (EU) member states and Iceland. We apply three-level growth-curve models which allow for a great deal of flexibility in modelling temporal change and handling hierarchically structured data. Our findings show that fertility decline was strongly related to unemployment increase and that this relationship was significant at all ages. Fertility responded to worsening economic conditions especially in Southern Europe and in Central and Eastern Europe, i.e. two broad regions which were considerably affected by the recession and where welfare policies provided lowest support against poverty and unemployment.

Keywords

Fertility, economic uncertainty, economic recession, Europe, regional differences, unemployment.

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The Great Recession and Fertility in Europe: A Sub-National Analysis

Anna Matysiak, Tomáš Sobotka, Daniele Vignoli

1. Introduction

The global *Great Recession* that started in autumn 2007 in the United States hit eventually almost all European countries, with many experiencing plummeting Gross Domestic Product (GDP) and rising unemployment for most of the 2008-2013 period. The recession has destroyed many jobs, put a downward pressure on wages and induced a huge strain on government budgets, often resulting in cuts to spendings on social policies and families (OECD 2014). Previous economic recessions frequently led to fertility declines and stimulated fertility postponement (Sobotka et al. 2011, Cherlin et al 2013). Especially rising unemployment rates were associated with fertility declines that often took place with a time lag of one to two years (Simó Noguera et al. 2005, Berkowitz King 2005, Aaberge et al. 2005: 150, Adserà 2005, 2011, Neels et al. 2013).

Most of the evidence on fertility changes in Europe after 2008 is in line with the past findings (Sobotka et al. 2011; Goldstein et al. 2013; Lanzieri 2013; Sobotka 2013; Comolli 2017). The increase in the period total fertility rates (TFR) that started around the turn of the century has peaked in 2008-10; thereafter fertility rates declined or levelled off in most European countries, especially among young women below age 25 (Sobotka et al. 2011; Goldstein et al. 2013; Lanzieri 2013; Sobotka 2013; Sobotka et al. 2015). Altogether, 16 countries experienced a TFR decline by 0.1 child or more between the year the TFR peaked in 2008-11 and 2013. The fertility decline has been more pronounced in countries and regions that experienced stronger economic downturns and faster increases in unemployment, especially in Southern Europe (Lanzieri 2013).

Most studies on the consequences of the last economic recession on fertility in Europe have been descriptive (Lanzieri 2013) or confined to single countries (e.g. Pailhé and Régnier-Loilier 2015; Cazzola et al. 2016; Dommermuth and Lappegård 2016; Kotzamanis et al. 2017). Few studies adopted a broader comparative perspective, but remained limited to country-level data. Bellido and Marcén (2016) investigated changes in total fertility in response to an increase in unemployment using a pooled sample of 30 European countries over the period 1991 to 2013. Goldstein et al. (2013) looked, in addition, at changes in age-specific fertility rates by birth order, but covered only the first stage of the economic recession until 2010. Comolli (2017) extended the study by Goldstein et al (2013) using longer time series and a wider selection of economic indicators. These studies demonstrated that an increase in unemployment during the economic recession was associated with declining fertility rates in Europe, especially at younger ages. In addition,

Comolli (2017) showed that fertility responded negatively to changes in consumer confidence and Testa and Basten (2014) reported an increase in the proportion of individuals who were uncertain about realising their lifetime fertility intentions during the recession. However, the impact of other relevant labour market developments (such as increase in unemployment persistence or social disengagement of the youth) on fertility in Europe has not yet been investigated. Compared to Europe, changes in fertility expectations, intentions and in actual fertility, childlessness as well as in marriage and divorce have been analysed in the United States on a much greater scale using a wide array of indicators of economic uncertainty (e.g., Schneider 2015 and 2017; Currie and Schwandt 2014; Comolli and Bernardi 2015; Cohen 2014; Schneider and Hastings 2015; Cherlin et al. 2013).

Our study aims to expand the understanding of the links between deteriorating economic conditions and fertility rates during the recent recession in Europe. We are particularly interested in exploring how the dynamics of changes in economic uncertainty impacted total fertility and its age profile and whether this impact differed by broader welfare state groupings. We analyse changes in the TFR and in age-specific fertility rates (ASFRs) for major age groups over the period 2001-2013 (with fertility data studied up to 2014) in 28 EU member states and Iceland. We extend the previous cross-European research on the topic in several ways. First, instead of performing the analysis at the country level we make use of the information for 258 subnational units (NUTS-2 regions). Such approach allows us to better capture changes in local employment and economic conditions than the country-level analysis (Bruno et al. 2016). In addition, subnational regions are more comparable in terms of population size than European countries and are often used for monitoring and assessing social cohesion and application of regional policies. Second, we expand the comparative European research on the topic by using a wider array of economic and labour market indicators than the previous studies. Even though we were heavily restricted by the availability of economic indicators at the subnational level we used two other labour market indicators which may signal economic uncertainty during economic downturn —the share of long-term unemployed and the share of self-employed — besides the commonly used total and youth unemployment rate. We also included the indicator of changes in GDP as a proxy of the changes in the overall economic performance of the region, and the share of young people not in employment, education, or training (NEET), in order to capture the phenomenon of the "youth left behind" (Scarpetta et al. 2010) and its potential link to fertility. We differentiate in our analysis between the recession (2008-2013) and the pre-recession (2001-2007) periods. This approach allows us to investigate whether fertility reactions to changing economic conditions are stronger in periods characterized by a general increase of economic uncertainty. We then cluster countries and subnational regions into six broader European regions to investigate whether fertility responses to economic recession were weaker in countries which provide more generous welfare and safety nets. Finally, we estimate the actual impact of the deteriorating economic and employment conditions during the recent economic crisis on regional fertility and establish which changes in

economic and employment conditions contributed most strongly to fertility decline during the recession.

2. Economic Downturns and Their Effects on Fertility

The research on the impact of social and economic crises on population processes has a long history (Malthus [1798] 2008; Easterlin 1987; Livi Bacci 2011) and it clearly demonstrates that economic uncertainty matters for fertility, although it is not very clear whether it affects only the timing of events or their quantum as well. Studies on the effects of the *Great Depression* of the 1930s demonstrated that a rapid surge in unemployment was followed by a drastic fall in fertility (Kiser and Whelpton 1953). Some of the births presumably postponed during that era have actually never taken place (Cherlin et al. 2013).

Deteriorating economic conditions are usually manifested by declining economic activity, as captured by a fall in the GDP, falling consumer confidence and adverse labor market trends. The latter are usually reflected in stagnating or declining wages, higher incidence and persistence of unemployment and a spread of more uncertain employment forms, such as time-limited contracts and involuntary self-employment. The latter is typical of countries with strongly regulated labor markets where employers often outsource work to the so called "dependent self-employed" to flexibly adjust the labour force to their needs and cut down on firing costs and social security expenditures (Adserà 2004, Román et al. 2011). All these developments directly affect many families and individuals by lowering their income, but also by fueling general perceptions of uncertainty about future economic conditions (Kreyenfeld 2010; Kreyenfeld et al. 2012; Kreyenfeld 2015; Vignoli et al. 2012; 2016), even among those who are not directly affected by massive lay-offs or company bankruptcy (Sobotka et al. 2011; Hofmann et al. 2017). Young adults are usually hit the hardest by worsening economic conditions as they have lower qualifications, little work experience and poorly protected work contracts (Bruno et al. 2016). Discouraged by a general perception of economic uncertainty some people give up searching for a job altogether, expanding the ranks of people who neither work for pay nor participate in educational or training schemes (Scarpetta 2010). Especially in Southern and Eastern Europe, non-employed and marginalized young adults, but also women, often participate in the grey economy, working long hours without any job protection or social security.

Previous research has demonstrated that public policies play an important role in altering the effects of economic uncertainty on families (Vikat 2004; Neyer and Andersson 2008; Sobotka et al. 2011). By providing monetary support or lowering the opportunity costs of childbearing, these policies offer people some financial security and thus support them in realising their fertility desires despite adverse economic conditions in the country. Besides family policies, labour market policies (such as assistance in job search, the level of employment protection) also influence unemployment dynamics and its duration

(Adserà 2004, 2005, OECD 2006, Caroleo and Pastore 2007). For instance, in countries with higher labour market flexibility workers lose their jobs more often but they are also more likely to find another job. In contrast, employers are much more careful with employing new staff on a permanent basis in countries where the employment protection is strong, which leads to the spread of temporary employment and involuntary self-employment as well as persistent unemployment (ibid).

Among European countries, Nordic countries are known for providing strong support for individuals in need, reducing opportunity costs of parenting as well as implementing active labour market policies that facilitate labour market entry (Esping-Andersen 1999; Thévenon 2011). Western Europe (Austria, Belgium, France, Germany, Luxembourg and the Netherlands) also provides strong financial support for the unemployed and has generous family policies, but this region (in particular Austria and Germany) still lags behind the Nordic countries when it comes to offsetting the opportunity costs of childbearing (Gauthier 2002; Misra et al. 2007; Thévenon 2011). The support for families in the United Kingdom and Ireland is, in turn, weaker and directed only to those in the highest need (Barbieri and Bozzon 2016). At the same time, these two countries are characterised by highly flexible labour markets with relatively short unemployment spells and low temporary employment (Adserà 2004; Caroleo and Pastore 2007). Finally, the system of social protection for families and the unemployed is least generous in Southern Europe and in the post-socialist countries of Central and Eastern Europe (CEE) (Esping-Andersen 1999, Caroleo and Pastore 2007, Javornik 2014). Barbieri and Bozzon (2016) showed that the risk of entering poverty at childbirth is particularly high in Southern Europe compared to other parts of the European Union, especially for single-earner families and dual-earner families with precarious jobs or who are unemployed. In addition, Southern Europe is known for high employment protection (mostly among the more senior workers) and the resulting phenomena of high youth unemployment, high temporary employment and high involuntary self-employment (Venn 2009, Adserà 2011).

3. Economic Decline and Fertility Change in Europe in 2007-13

3.1. Changing Economic and Labour Market Conditions

The economic recession that started in 2007-2008 affected the whole continent. In its first phase, in 2007-2009, the economic output fell sharply in all parts of Europe. Subsequently, the economic trends varied between countries and regions. In some countries, a gradual economic recovery has taken hold since 2010, while other countries, especially in Southern Europe, experienced renewed economic downturn in 2010-2013. This second phase of the recession was partly fuelled by government austerity measures (House et al. 2017), which were motivated by declining tax incomes and rapidly rising levels of public debt during the recession.

The economic downturn was particularly severe in Southern Europe and in some CEE countries (especially in the Baltic countries, Hungary and Romania), where it was either very strong initially (especially in Estonia, Latvia, and Greece) or lasted particularly long. Economic output also fell sharply in Iceland and Ireland. In four Southern European countries (Cyprus, Italy, Greece, and Spain), GDP per capita contracted by over 10% in the period 2007-2013. Similar economic contraction was also recorded in Ireland, and somewhat smaller ones, by 8-9%, in Croatia and Slovenia (Eurostat 2017). A list of countries receiving financial bailouts by the International Monetary Fund (IMF) or via European Union mechanism (ESFS/ESM schemes), published on Wikipedia (2017), also allows identifying most of the hardest-hit countries. This list includes four Southern European countries (Cyprus, Greece, Portugal, and Spain), three CEE countries (Hungary, Latvia, and Romania), as well as Ireland. The falling economic output had severe repercussions for the labour market. Unemployment rates rose sharply in many countries between 2007 and 2012, with the three Baltic countries (Latvia, Lithuania and Estonia), three Southern European countries (Cyprus, Greece, and Spain) and Ireland experiencing double digit increase in unemployment rate between 2007 and the year when unemployment peaked in 2010-2013, compared with the EU-wide increase in unemployment of 4%. Moreover, the average time spent in unemployment increased substantially. The proportion of persons who remained unemployed for longer than 12 months grew strongly in Southern Europe, Baltic countries as well as in Iceland, Ireland and in the United Kingdom.

Young adults below age 25 were hardest-hit by employment uncertainty. Their unemployment rate increased abruptly and even doubled or tripled in some of the countries, mainly in Southern Europe and in Central and Eastern Europe (i.e., in the Baltic countries, Croatia, Slovenia), Iceland and Ireland (OECD 2014 and 2016). The worsening situation of young adults is also reflected in an increase in the proportion of youth who were not in education, employment or training (NEET; see, e.g. OECD 2016). In Cyprus, Spain and Ireland this proportion nearly doubled, but it also increased substantially in other Southern European and some of the CEE countries (Hungary, Romania, Lithuania, Croatia). The cuts in government spending further worsened the situation of many vulnerable groups. Typically, these cuts disproportionally lowered spending on younger people and contributed to increases in poverty among children and young adults (aged 18-25) in the majority of rich OECD countries (OECD 2014: 112-113). Remarkably, the indicator of self-employment, which could also signal deteriorating labour market opportunities, remained stable in most EU countries after 2008.

In contrast, some European countries were relatively unscathed by the recession. Among them Poland did not experience a single year of declining GDP in 2007-2013, three out of the five Nordic countries (Finland, Norway, and Sweden), Belgium, Luxembourg and Malta saw only minor increases in unemployment and the three German-speaking countries (Austria, Germany, and Switzerland) recorded a very mild recession as measured by unemployment and GDP changes. Germany even recorded a decline in unemployment during the recession period.

Taking different indicators of employment and economic hardship together shows that economic recession in Europe affected most the countries in Southern Europe (Cyprus, Greece, Italy, Portugal, Spain), in parts of Central and Eastern Europe (Baltic countries, Croatia, Hungary, Romania, Slovenia), Iceland, and Ireland. However, Ireland and the Baltic countries also saw sizeable economic recovery starting in 2010-2013, whereas Greece and Spain experienced long-lasting and massive labour market downturns. In addition, there was large within-country variation in the impact of the recession on employment, wages, living standards and economic growth in Europe, which has not been reflected much in the literature, partly owing to the lack of reliable and detailed comparative data. Our study addresses this research gaps and sheds light on the links between economic and labour market changes and fertility dynamics at a sub-national level across different countries, taking thus into account the variation in the duration and the severity of the *Great Recession* across Europe.

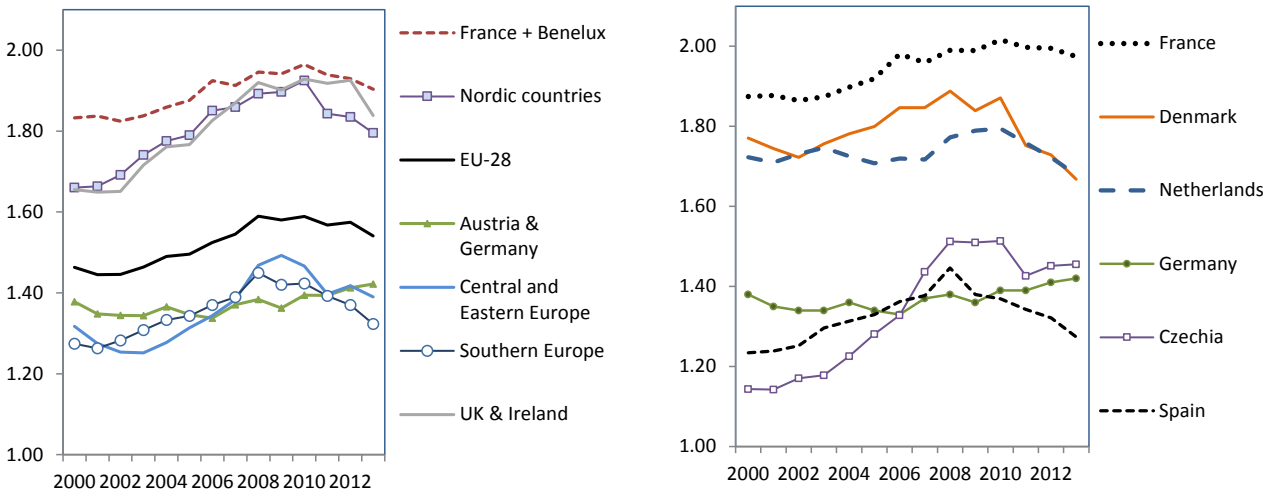
3.2. Trend Reversals in Fertility after 2007

Fertility rates in the European Union and Iceland did not change as abruptly after 2007 as economic and labour market indicators. However, the period since 2008 marked a clear departure from the previous trend of rising fertility that started around the turn of the century. In most countries, the rise in fertility ceased or reversed during the recession period, but specific fertility trends varied greatly across countries and regions (see also Comolli 2017). Fertility fell especially in the Nordic countries and in Southern Europe, whereas it levelled off in France, and slightly increased in the three predominantly German-speaking countries (Austria, Germany, Switzerland; see Figure 1 for selected countries and regions).

In many countries, fertility trends seem to be closely affected by the timing and severity of economic downturn (e.g., in Spain and in the Czech Republic), but in other countries including Denmark and France this connection is far from obvious. The drop in fertility in the Nordic countries is especially puzzling, given that except for Denmark, these countries saw rather mild economic declines during the recession and they also provide extensive welfare and family policies that improve economic security of families with children.

Postponement of births further accelerated during the economic crisis. This is similar to the findings about the past recessions in Europe (Sobotka et al. 2011) and the recent recession in the United States (Currie and Schwandt 2014; Schneider 2017). Across the European Union, fertility rates among women aged 15-24 were flat five years before the onset of the recession (2003-2008), whereas they fell sharply (by 24% at age 15-19 and by 16% at age 20-24) five years into the recession, between 2008 and 2013 (Figure 2). After 2008, fertility rates continued increasing among women aged 35-44, although their growth slowed down sharply compared with the pre-recession period. The age gradient in fertility changes during the recession period was even more pronounced in some of the strongly affected countries, including Spain (Figure 2).

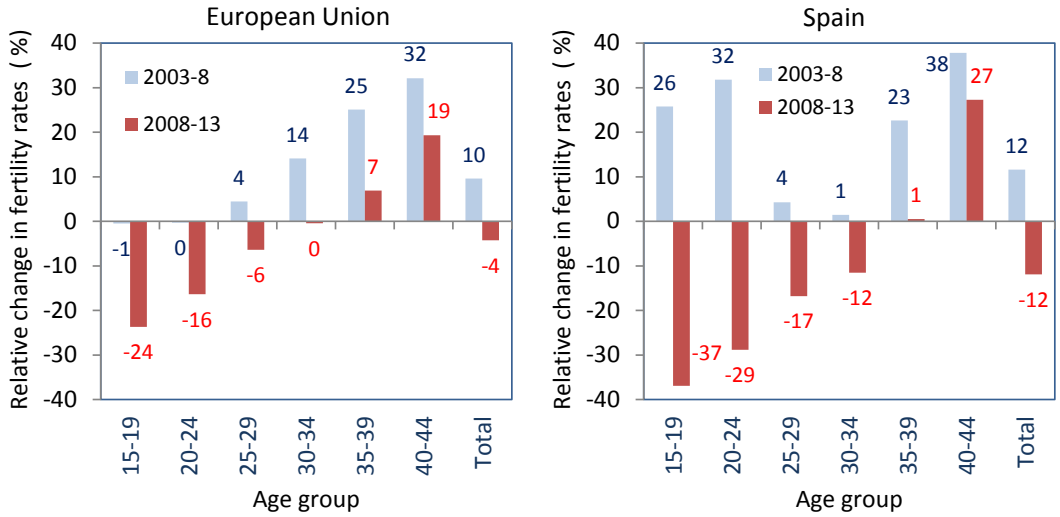
Figure 1: Period TFR in selected broad European regions and countries, 2000-2013



Source: Eurostat (2017)

Note: Regional data are population-weighted averages for the countries and regions listed in Section 5.

Figure 2: Change in age-specific fertility rates five years before (2003-2008) and five years since the onset of the recession (2008-13) in the European Union and in Spain



Source: Own computations based on Eurostat (2017) data

4. Data and Indicators

The selection of data and indicators included in the analysis aimed to provide a wide coverage of European countries and sub-national regions in order to capture the effects of the changes in local economic conditions on fertility. We opted for using NUTS-2 regional data available for 28 EU member states, Iceland, Norway and Switzerland for the period 2001-2014. The NUTS-2 classification divides the EU territory into roughly equally populated regions for the purpose of collecting data at the regional level and performing socio-economic analyses of the regions. NUTS-2 are defined by Eurostat as the basic regions for monitoring social cohesion and application of regional policies (e.g. labour market policies). The population of NUTS-2 regions ranges from 0.8 to 3 million inhabitants and they are the smallest regions for which we could access comparable and reliable data on fertility and economic conditions for the studied countries. As of January 2017 there were 276 NUTS-2 regions in the 28 EU countries and the number increases to 291 when including Switzerland, Norway and Iceland.

We first collected data for all the 291 NUTS-2 regions. From this database, we dropped the territories outside Europe, which often differ widely in their cultural and institutional setups from the European regions. In total, we excluded ten overseas regions and territories belonging to Portugal, Spain, and France (Azores and Madeira, Canary Islands, Ceuta and Melilla, French Guiana, Guadeloupe, Martinique, Mayotte and Réunion). Further, we excluded seven British regions due to the boundary shifts during the observation period (Cheshire, Merseyside, and five regions covering Inner and Outer London), one Finnish region (Aland) and all the seven Swiss and seven Norwegian regions as they lacked data on some of the economic indicators we selected for our analysis. Finally, for Slovenia we used data for the whole country instead of for the two NUTS-2 regions because of the boundary shifts. Overall, our sample got reduced to 258 NUTS-2 regions, nested within 29 countries (EU-28 member states and Iceland).

To measure fertility, we used the TFR, complemented by its age-specific components—cumulative ASFRs computed for the age groups 15-19, 20-24, 25-29, 30-34, and 35+. These data, published by Eurostat, are computed by combining national vital statistics on births by age of mother and official data and estimates on female population by age. While birth registration is complete or almost complete in Europe, the fertility rates may be underestimated and the fertility time series can be distorted by series breaks and jumps in some countries due to incomplete registration of migration (especially outmigration) and inconsistent and changing rules on the registration of births to women who left the country. These problems are most pertinent in the CEE countries with sizeable outmigration (especially Bulgaria, Romania, Poland, Hungary, Slovakia, and the three Baltic countries) and thus our findings for these countries should be interpreted with caution.[1]

[1] The literature discussing birth and population data reliability in Europe is very limited, often discussing data issues in individual countries within the context of a broader analysis of

Our selection of explanatory variables was guided by the past findings on the economic and labour market factors that affect fertility during economic downturns, but also by the considerations about data availability and reliability. First, we considered a range of labour market measures which indicate instability of employment and persistence of joblessness, such as unemployment rate (overall unemployment as well as youth unemployment at ages below 25), long-term unemployment (unemployment lasting 12 months or more), and the proportion in self-employment. All these indicators originate from the European Labour Force Survey (ELFS), which is a comparative large-sample survey designed for collecting labour market data of high quality. These data are available in Eurostat Statistics Database as annual aggregate indicators provided for the NUTS-2 level for all the 28 EU member states, Norway, Iceland and Switzerland for the period since 1999. Unfortunately, the database did not provide data on temporary employment at the NUTS-2 level. Second, we accounted for the proportion of young adults (aged 18-24) not in employment, education or training (NEET), also collected in ELFS. The strong concentration of the NEETs in the region is a marker of poor economic prospects and accumulation of disadvantages. Likewise, an increase in the proportion of NEETs may reflect an increase in the disengagement, caused by long-lasting unemployment, and lack of perspectives for the future, and may signal a decline of the human capital of the region and an increase in poverty.[2]

Third, we also considered to use indicators of economic deprivation and social exclusion which measure actual financial situation of the households. However, we did not do it as the poverty and social exclusion measures (i.e., severe material deprivation, the proportion of people at risk of poverty and social exclusion or at-risk-of-poverty rate) are not published by Eurostat for many EU member states at the NUTS-2 level for the whole analysed period. In addition, they are based on small survey samples and show considerable year-to-year fluctuations, making them unsuitable for our analysis.

Finally, we included the annual rate of GDP growth as it can be considered as a proxy of the general economic prosperity and economic trends. However, annual relative GDP growth is not available as a standardised indicator for the NUTS-2 regions across the EU. Rather, we had to compute it using the data on GDP at current prices in EUR available in

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population trends, census results etc. One of the most valuable sources of information on data quality issues and series breaks in births and population estimates are the country documentation reports in the Human Mortality Database (HMD, www.mortality.org) and in the Human Fertility Database (HFD, http://www.humanfertility.org).

[2] The NEET indicator was criticised in the literature for being heterogeneous and consisting of not only the unemployed and disengaged, but also young care providers, persons with health problems and disabilities as well as persons who are actively involved in artistic activities or self-directed training (Eurofund 2012, Cavalca 2016). In our view, however, an increase in the NEET, observed during the economic recession, clearly signals an increase in youth disengagement during that time. Furthermore, even if persons classified as NEET are diverse, they participate neither in formal education nor in the labour market, which makes them more exposed to insecure and low wage employment in the future (Furlong 2006).

Eurostat since 2000. We converted it into local currencies using the average annual exchange rates and adjusted it for inflation using the harmonised index of consumer prices (both indicators available in the Eurostat database). Next, we computed relative annual regional growth rates for the years 2001-2014, which were then used in our analysis. The GDP data come from the national accounts and are almost fully complete apart from Switzerland and Norway for which no long-term series were available.

We decided to lag the economic and labour market indicators by one year when modelling the change in fertility indicators to reflect the factors affecting couples' decision-making around the time of conception and the additional time couples may need to adjust their fertility plans to changing economic conditions. Our dataset therefore consists of the series of labour market and economic indicators for the years 2001-2013 and the series of fertility indicators for the period 2002-2014. In this dataset, some values are missing and some are classified as low reliability values[3]. The incidence of missing and low reliability values is, however, below 10% per variable, except for variables based on small populations, i.e., the youth unemployment rate, long-term unemployment and the share of NEETs, which contain more missing values (13-15% of all observations) and low reliability values (20%) (For details, see Table A1 in the Appendix). In order to minimise the number of missing values in the data we performed data imputation for the missing values by using a cubic spline interpolation. We performed this imputation only if there were no more than four missing values in a row and if they were part of the time series, preceded and followed by known values.

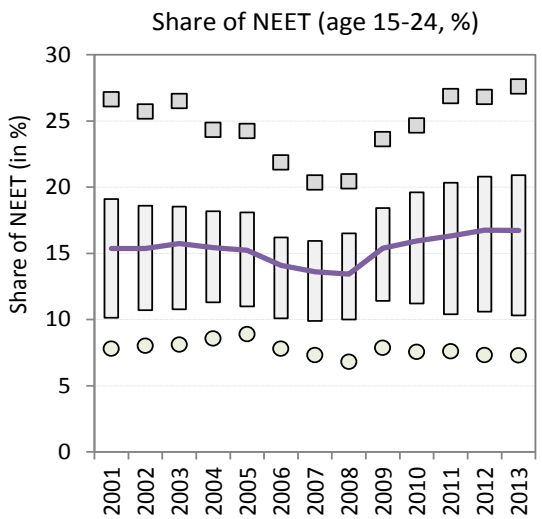
Figure 3 charts the dynamics in the economic and labour market indicators analysed here across all the regions and for the whole period studied. Each graph displays selected percentiles (10, 25, 75, and 90) and the mean value of each indicator. Except for self-employment, which did not change since the onset of the recession, all indicators show a sharp deterioration in economic conditions after 2007, especially in 2009 (Figures 3a-e). Furthermore, we also observe widening disparities between regions during the recession period: with the exception of 2009, unemployment tended to decline and the GDP increased in the best-performing regions, while these indicators deteriorated for many years in the less successful regions. The regional disparities grew fastest in the indicators pertaining to young adults—youth unemployment and the share of the NEET. According to the conventional indicator of GDP growth, the economic recession was over by 2013, with more than half of the regions registering positive GDP change. However, the labour market indicators such as unemployment rate and long-term unemployment still increased in most regions in that year. The last graph, Figure 3f, shows changes in the period TFR for NUTS-2 regions and further confirms the reversal of fertility trends after 2007. Whereas both mean and median value of the TFR across the 258 regions analysed

[3] Eurostat employs two reliability thresholds, which restrict the data that can be published in its database. The indicator is not published and is reported as missing if the number of responses falls below the first reliability threshold. The indicator value is published with an annotation 'low reliability' if the number of responses exceeds the first reliability threshold but falls below the second reliability threshold.

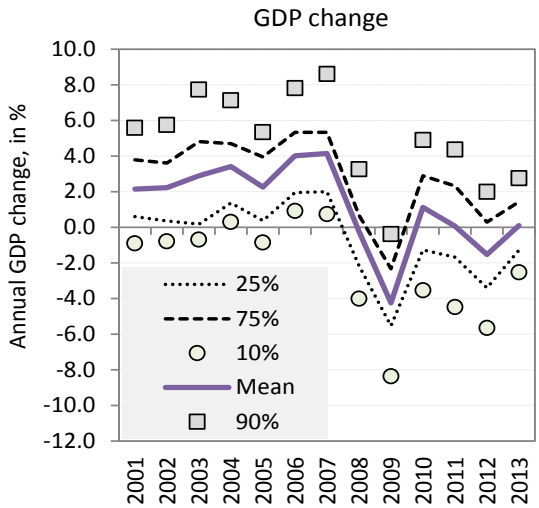
here had increased every year from 2003 to 2008, they fell or stagnated in 2009 and in 2011-13. However, in contrast to the indicators of unemployment and non-employment, fertility did not become more differentiated across regions during the economic downturn.

Figure 3: Distribution of the analysed economic indicators (2001-2013) and the TFR (2001-2014) across the NUTS-2 regions (mean value and 10, 25, 75, and 90% of the distribution)

(e)



(f)



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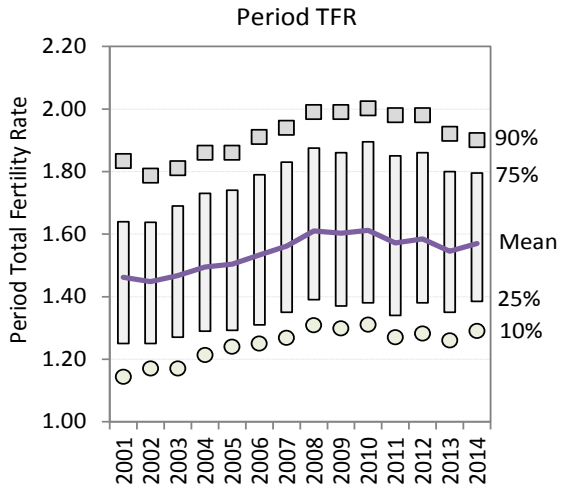


Source: Eurostat (2017)

5. Methods

Our data has a hierarchical structure. Year-observation units are nested within regions and regions are nested within countries. Using these data, we estimated three-level growth-curve models (GCM) with regional total fertility and age-specific fertility rates as dependent variables. The GCM offer a flexible way of modelling change in the dependent variable after accounting for the interdependency of observations nested within the higher-level units (Rabe-Hesketh and Skrondal 2012). The functional form of the pattern of change in the dependent variable and the parameters describing the change (intercepts

and slopes) can be set to vary across the studied subjects. Furthermore, the GCM allow for investigating the effects of the subjects' characteristics (both time-constant and time-varying) on the rate of change in the dependent variable (Duncan et al. 2011). This means that using the GCM we can model the effects of the change in regional economic conditions on the developments in regional fertility by allowing the trend parameters to vary across regions and countries and accounting for the dependency of the observations within NUTS-2 regions and countries. Our growth curve model is formulated in two steps. At the first step, it takes the following form:

$$FR_{crt} = (\beta_0 + \mu_{0c} + \mu_{0r}) + \sum_{j=1}^{m}(\beta_j + \mu_{jc} + \mu_{jr}) \cdot t + \sum_{i=1}^{n} \gamma_i \cdot X_{icrt-1} \quad + \varepsilon_{crt} \qquad (1)$$

where:
FR_{crt} denotes TFR or cumulated ASFRs in country *c*, region *r* at time *t*, β_0 and β_j stand for the overall intercept and the slopes in the piecewise linear spline which is used for modelling the time trend in fertility in j a priori defined intervals and $\mu_{0c}, \mu_{0r}, \mu_{jc}, \mu_{jr}$ represent region- and country-specific deviations from the overall intercept β_0 and the slopes β_j. We set the nodes of the piecewise linear splines at the end of 2003, 2006, 2008 and 2010, i.e. at the time points when we observed a change in fertility trend in most of the analysed countries. Furthermore, X_{icrt-1} denotes the economic or labour market indicator *i* measured in country *c*, region *r* at the time *t-1*, i.e. lagged by one year. In all models X_{icrt-1} represent the proportion of self-employed and long-term unemployed, the share of NEET as well as the GDP growth. In addition, the unemployment rate at ages 20-64 enters the model for the TFR, the youth unemployment rate (ages 15-24) is included the models for ASFR at ages 15-19 and 20-24 and the unemployment rate of persons aged 25-64 in the models for ASFR at ages 25-29, 30-34 and 35+. All economic indicators are centred at the sample grand mean to facilitate the interpretation of our findings. Finally, ε_{crt} constitutes the level-1 residual and is assumed to be independent from the residual of the previous year, ε_{crt-1}. Autocorrelation of the level-1 error term is often present in time series analyses and may bias the standard errors if not accounted for. Unfortunately, we could not employ correction for the autocorrelation, as our models then failed to converge.

The first model (equation 1) informs us how the overall variation in economic conditions (within regions, between regions within each country and between countries) is correlated with the overall variation in fertility rates, but does not allow us answering the question how the within-region change in economic conditions affects the change in regional fertility. In order to provide the answer to the latter question we decomposed the variation in a given variable X_{icrt-1} into the within-region variation $(X_{icrt-1} - \overline{X_{icr\cdot}})$, between-region within-country variation $(\overline{X_{icr\cdot}} - \overline{X_{ic\cdot\cdot}})$ and between-country variation $\overline{X_{ic\cdot\cdot}}$:

$$X_{icrt-1} = (X_{icrt-1} - \overline{X_{icr\cdot}}) + (\overline{X_{icr\cdot}} - \overline{X_{ic\cdot\cdot}}) + \overline{X_{ic\cdot\cdot}} \qquad (2)$$

where $\overline{X_{\imath cr\cdot}}$ denotes average level of variable X_i in a country c and region r (regardless of time) and $\overline{X_{\imath c\cdot\cdot}}$ stands for the average level of variable X_i in a country c.

Implementing equation (2) into (1) gives:

$$FR_{crt} = (\beta_0 + \mu_{0c} + \mu_{0r}) + \sum_{j=1}^{m}(\beta_j + \mu_{jc} + \mu_{jr}) \cdot t + \\ + \sum_{i=1}^{n}[\gamma^{WR}{}_i(X_{icrt-1} - \overline{X_{\imath cr\cdot}}) + \gamma^{BRWC}{}_i(\overline{X_{\imath cr\cdot}} - \overline{X_{\imath c\cdot\cdot}}) + \gamma^{BC}{}_i\overline{X_{\imath c\cdot\cdot}}\ ] + \varepsilon_{crt} \quad (3)$$

$\gamma^{WR}{}_i$ constitutes the main coefficient of our interest. It denotes the within-region effect of economic conditions on fertility and informs us how the change in economic conditions is associated with a change in fertility. The remaining two coefficients, $\gamma^{BRWC}{}_i$ and $\gamma^{BC}{}_i$, refer to the spatial variation in fertility and economic conditions. They inform us how the between-region within-country and between-country variation in economic conditions relate to the within-country and between-country variation in fertility rates.

The model specified by equation (3) (we call it M1) allows us to investigate the effects of economic conditions on fertility in all analysed countries and regions over the whole period 2001-2014. In our study we are, however, also interested in examining whether:

(a) these effects were stronger during the economic recession;
(b) the effects of the changes in economic conditions during the recession vary by country group.

To answer the first question we interacted the within-region indicators of economic change ($X_{icrt-1} - \overline{X_{\imath cr\cdot}}$) and an indicator of the economic recession which assumes value 1 in the years 2009-2014 and 0 otherwise (model specification M2). To answer the second question, we first grouped the analysed countries into six groups which reflect the long-standing contrasts in economic development, welfare policies and labour markets as well as the severity of the recent recession:

- *Nordic countries:* Denmark, Finland, Iceland, and Sweden (18 NUTS-2 regions included in our analyses);
- *France and Benelux countries*: Belgium, France, Luxembourg, and the Netherlands (46 NUTS-2 units);
- *United Kingdom and Ireland* (35 NUTS-2 regions included in our analyses);
- *Austria and Germany* (the "German-speaking countries" cluster; 47 NUTS-2 units);
- *Southern Europe:* Cyprus, Greece, Italy, Malta, Portugal, and Spain (57 NUTS-2 units included);
- *Central and Eastern Europe:* Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia (55 NUTS-2 regions included).

Using this country grouping we tested two model specifications: M3 and M4. The M3 is an extension of M2 and it includes a two-way interaction between ($X_{icrt-1} - \overline{X_{\imath cr\cdot}}$) and the country group in addition to the interaction between ($X_{icrt-1} - \overline{X_{\imath cr\cdot}}$) and the recession dummy. The M4 contains a three way interaction between ($X_{icrt-1} - \overline{X_{\imath cr\cdot}}$), the recession

dummy and the county group instead of the two two-way interactions. The M3 thus assumes a uniform and M4 a differential moderating effect of the country group on the relationship between the economic conditions and fertility before and during the economic recession. The Bayesian Information Criterion (BIC) provided us with no evidence for rejecting the assumption that the moderating effect is uniform. Therefore, we opted for presenting the findings from the more parsimonious model M3. We also compared the findings from M3 and M4 and found only unimportant differences. The estimates of M4 are available upon request.

6. Empirical Findings

Our presentation of empirical findings is divided into four parts. First, we discuss how the variation in economic conditions between regions translates into cross-regional differences in fertility (Section 6.1). Our conclusions are drawn on the basis of the between-region within-country effects $\gamma^{BRWC}{}_i$ (see equation (3) in M1). Next, we analyse within-region effects ($\gamma^{WR}{}_i$) to discuss the link between changing economic conditions and fertility in 2001-2014 (model M1, Section 6.2). In Section 6.3 we examine whether these effects differed before and during the economic recession (model M2) and in Section 6.4 we investigate whether and how they varied by broader country groups (model M3). To provide a comparable perspective on the effects of individual components of economic and labour market changes analysed here, we present average annual changes in fertility rates which would be observed in a hypothetical situation if unemployment rate, share of long-term unemployed, proportion of self-employed and the share of NEET increased by 10 percentage points (pp.) or if the GDP declined by 10 pp in a year.

6.1. Cross-Regional Association between Economic Conditions and Fertility

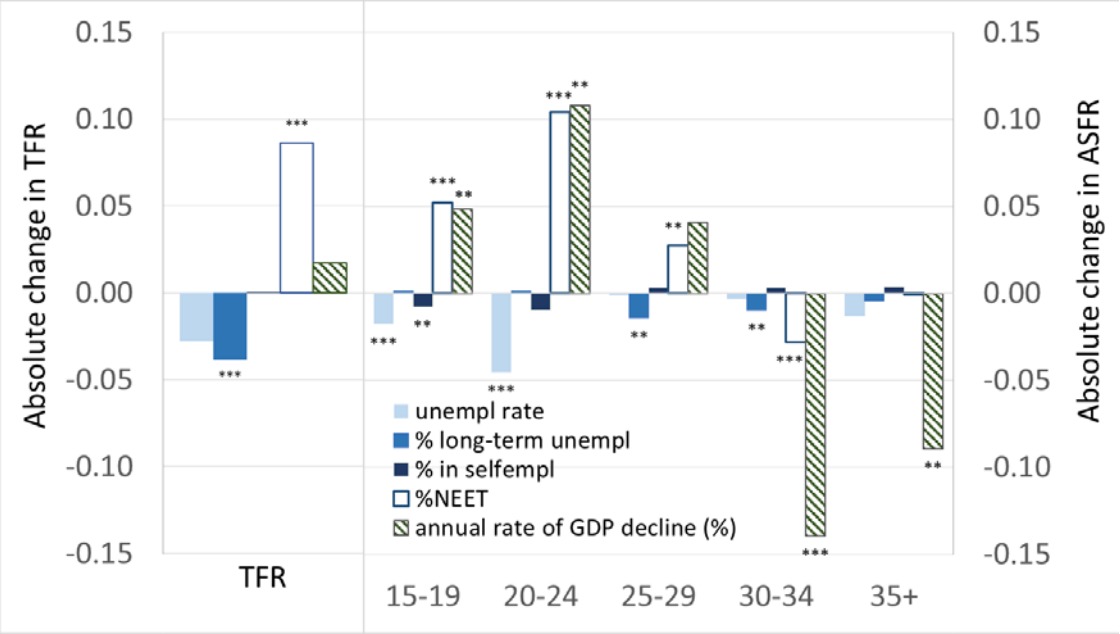
Figure 4 presents the between-region within-country effects of economic conditions on total and age-specific fertility ($\beta^{BRWC}{}_i$), resulting from 10pp. differences in each of the considered economic indicators. The bars fall below zero when poor economic conditions correlate with lower fertility or when good economic conditions correlate with higher fertility.

Regional total fertility is significantly higher in regions with high proportion of youth who are neither in employment nor in education or training. Net of the NEET, TFR is lower in regions characterised by long-term unemployment. No other economic factors correlate significantly with the TFR at the NUTS-2 level.

Fertility timing, in turn, varies strongly across regions depending on their economic conditions. Regions characterised by lower economic decline or economic growth and lower levels of economic inactivity and disengagement among the youth (as measured by the share of young adults NEET) are characterised by lower fertility at young ages (15-19 and 20-24) and higher fertility at ages 30+. These are most likely regions that cover larger

cities with high proportions of highly educated women who often postpone family formation into late reproductive ages. At the same time, regions characterised by strong disengagement among the youth (indicated by high share of the NEETs) and slow economic growth display higher fertility at younger ages (15-19, 20-24 and partly 25-29). These are most likely the more peripheral regions where lack of opportunities leads young people to have children at younger ages. However, we also found that regions with high unemployment display low fertility at young ages, net of the share of NEET or economic growth.

Figure 4: Absolute differences in Total Fertility Rate (left panel) and in cumulated age-specific fertility rates (right panel) resulting from between-region within country 10pp. differences in economic conditions. NUTS-2 regions in EU-28 and Iceland 2001-2014

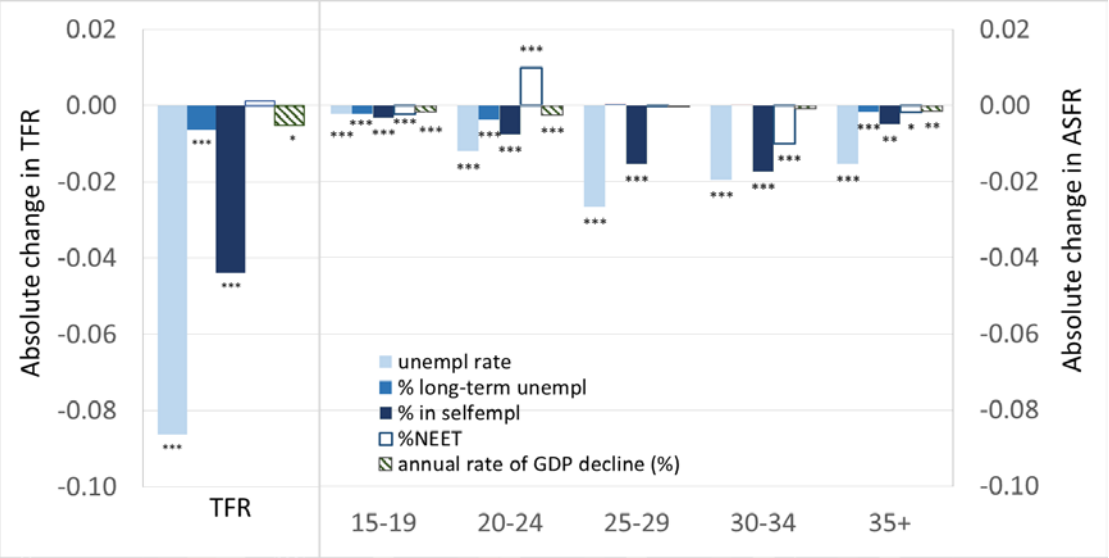


Note: The bars fall below zero if poor economic conditions correlate with lower fertility or when good economic conditions correlate with higher fertility. Unemployment rate in the model for the TFR refers to the age group 20-64, in the models for fertility at ages 15-19 and 20-24 to the age group 15-24 and in the models for fertility at ages 25+ to the age group 25-64. P-value: * - 0.1, ** - 0.05, *** - 0.01.

6.2. Changes in Economic Conditions and Fertility

In contrast to the cross-regional associations between economic conditions and fertility, which varied in direction depending on the indicator and age group, the associations between economic dynamics and fertility change within regions are unidirectional (Figure 5). With one exception, deterioration in economic and labour market conditions is negatively related with changes in both total as well as age-specific fertility across all ages, including at higher reproductive ages when women face rising infertility.

Figure 5: Absolute change in Total Fertility Rate (left panel) and cumulated age-specific fertility rates (right panel) resulting from the 10 pp. worsening of economic conditions. NUTS-2 regions in EU-28 and Iceland, 2001-2014



Note: The findings show absolute changes in fertility rates resulting from a 10 pp. increase in unemployment rate, long-term unemployment, self-employment and NEET share and a 10pp. decline in GDP per capita. Unemployment rate in the model for total fertility refers to the age group 20-64, in the models for fertility at ages 15-19 and 20-24 to the age group 15-24 and in the models for fertility at ages 25+ to the age group 25-64. P-value: * - 0.1, ** - 0.05, *** - 0.01.

Among the analysed variables unemployment dynamics clearly shows the strongest association with the fertility change at all ages and, consequently, also with total fertility. It is followed by self-employment. A hypothetical increase in unemployment rate by 10 percentage points (pp.) would lead, on average, to a decline in total fertility by nearly 0.09 children, holding all other factors constant. A similar increase in the incidence of self-employment would cause a fall in total fertility by 0.04 children.

The within-region change in the remaining indicators considered here shows weaker correlation with fertility developments. A hypothetical increase in the share of long-term unemployed by 10 pp. or a fall in GDP by 10 pp. imply a decline in total fertility by less than 0.01 children, although the 10pp change in the latter indicator means a huge downward economic shock. Looking at the age-specific fertility, changes in these two indicators show a moderate association with changes in fertility only at the youngest (15-19 and 20-24) and at the oldest reproductive ages (35+). Finally, an increase in the share of NEET does not appear to be significantly related with changes in total fertility. However, it is associated with age-specific fertility in a somewhat unexpected way: an increase in disengagement among the youth goes hand in hand with a decline in fertility at age 30-34, but, surprisingly, with an increase at age 20-24—the only indicator where we found some "counter-cyclical" effect of changing economic conditions on fertility at a regional level.

6.3. Effects of Economic Conditions before and During the Great Recession

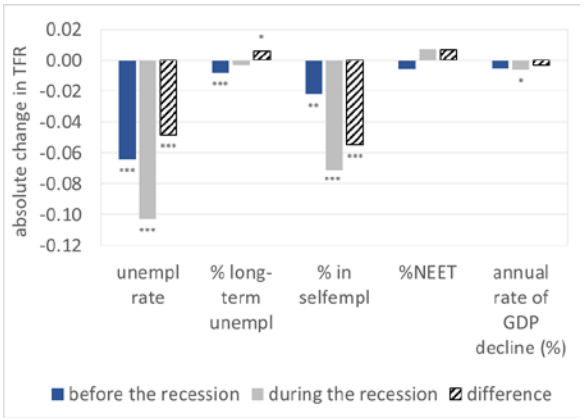
An increase in unemployment and self-employment was associated with a stronger decline in total and age-specific fertility during the period of economic recession (Figure 6a-d). For instance, the negative effect of changes in unemployment on total fertility, estimated in Model M2, was 60% stronger during the recession than prior to it and the effect of self-employment change on total fertility was three times stronger during the economic downturn. In other words, holding all factors constant, a hypothetical increase in unemployment rate by 10 pp. would lead to a decline in total fertility by 0.10 children if it took place during the recession period in Europe, but only by 0.06 if it took place in the pre-recession years 2001-2007. Likewise, a 10 pp. increase in the proportion of self-employed would depress total fertility by 0.07 children during the recession period and only by 0.02 in the pre-recession years. The negative associations between fertility and unemployment and fertility and self-employment intensified most at younger ages (20-24), i.e., ages at which people have more space for postponing childbearing and their labour market situation is most fragile, making them especially vulnerable to the massive rise in economic insecurity after 2007.

Furthermore, we observed a change in the association between the GDP decline and fertility, which was insignificant before the recession, but turned negative after 2008. In contrast, the association between the trends in the share of NEET and long-term unemployment and fertility, weakened or reversed and ceased to be significant in the recession period.

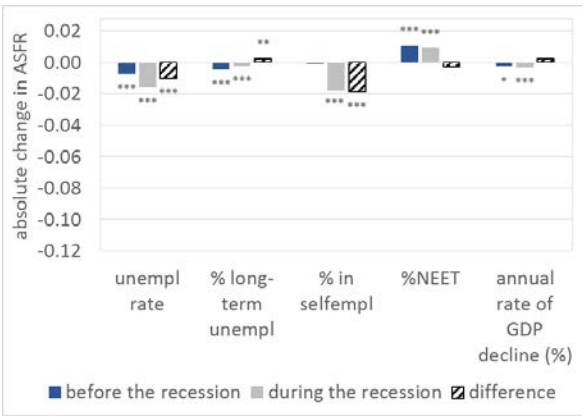
In addition, we investigated yet finer period splits, dividing the recession period into two sub-periods to distinguish the years of the financial and economic crisis (2009-2010) from the Eurozone sovereign debt crisis that was accompanied by an implementation of austerity measures (2011-2014). Our findings (not shown here, but available upon request) demonstrate that the within-region negative associations between unemployment as well as self-employment dynamics and fertility were weaker in 2009-2010 than in 2011-2014. Furthermore, the decline in the GDP per capita turned out to be associated with an increase in total fertility in 2009-10 and a decline in 2011-2014.

Figure 6: Absolute change in Total Fertility Rate and age-specific fertility rates resulting from the 10 pp. worsening of economic conditions within NUTS-2 regions in two periods: before (2001-2008) and during (2009-2014) the economic recession

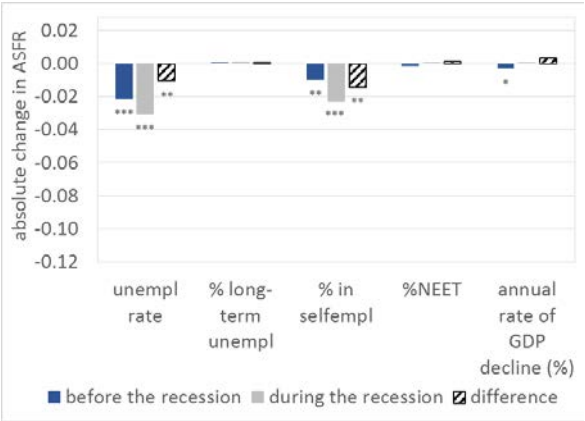
a) TFR



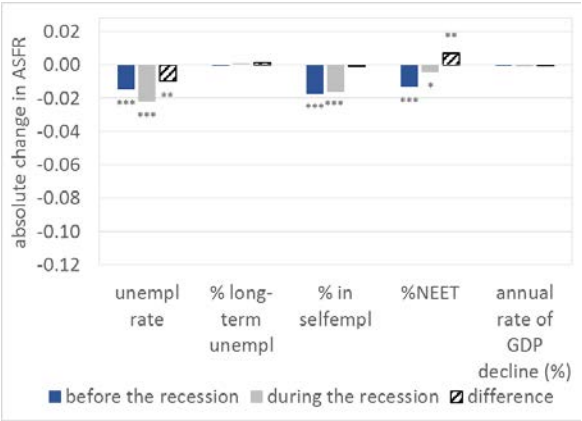
b) ASFR 20-24



c) ASFR 25-29



d) ASFR 30-34



Note: See Figure 5.

6.4. Effects of Economic Conditions on Fertility by Country Group

The within-region associations between changing economic conditions and fertility differ by country group (Figure 7 a-f). To some extent, this link is stronger in country groups that were hardest hit by the economic recession. We found sizeable and significantly negative correlations between changing economic conditions and fertility in Southern Europe and Central and Eastern Europe, two country groups where unemployment rates went up quickly after 2008, where the practices of outsourcing labour to self-employed individuals have been widely documented. In contrast, we found very few significant

associations between deteriorating economic conditions and fertility change in the Nordic countries where the recent recession was relatively mild and short (except in Denmark and Iceland). We also found changes in economic conditions to be weakly associated with fertility change in the country cluster composed of the United Kingdom and Ireland, which was quite strongly hit by the recession. Finally, our findings suggests that economic conditions matter strongly for fertility in Austria and Germany. However, in contrast to the other regions, many regions in Germany experienced a slight improvement in labour market conditions after 2008.

The within-region change in unemployment is significantly negatively linked with a change in fertility in four out of six country groups analysed: the post-socialist countries, Austria and Germany cluster, France and Benelux and Southern Europe. In these country groups except for Southern Europe unemployment dynamics turned out to be the most important correlate of fertility trends out of the five economic indicators we considered. Unemployment rise was most strongly related to fertility change in Central and Eastern Europe, where our models predict a decline in total fertility by 0.18 children following a hypothetical increase in unemployment by 10 pp and holding all other factors constant. Unemployment is also strongly negatively related to fertility change in Austria and Germany (a hypothetical decline by 0.15 children). The negative relationship between rising unemployment and fertility is less pronounced in Southern Europe (0.05 children) and in France and Benelux (0.08 children). In the CEE region, Austria and Germany and in Southern Europe rising unemployment is associated with fertility decline at nearly all ages and most strongly at ages 25-29 and 30-34.

An increase in self-employment is significantly related with fertility decline in three country groups—in Southern Europe, Central and Eastern Europe, and in Austria and Germany. This link is most pronounced in Southern Europe where self-employment dynamics relates to fertility change at all ages and where this relationship was the strongest among the indicators of economic conditions considered here. Our models predict that total fertility in Southern Europe would decline by 0.12 children if the proportion of self-employed increased by 10 pp, holding all factors constant. Self-employment dynamics ranked as the second most important factor after unemployment in the CEE countries and in Austria and Germany, where it was associated with fertility mostly at ages 25+.

Changes in long-term unemployment turned out to be most important for fertility in the United Kingdom and Ireland and in the Nordic countries, where rising long-term unemployment shows the largest negative effect on total fertility of all the indicators considered. Our models predict that a hypothetical increase in long-term unemployment by 10 pp. would lead to a decline in TFR by around 0.04 children in the two groups. In Austria and Germany, France and Benelux the effect of long-term unemployment is weaker, in Southern Europe it is insignificant and in Central and Eastern Europe it is even positive (but small).

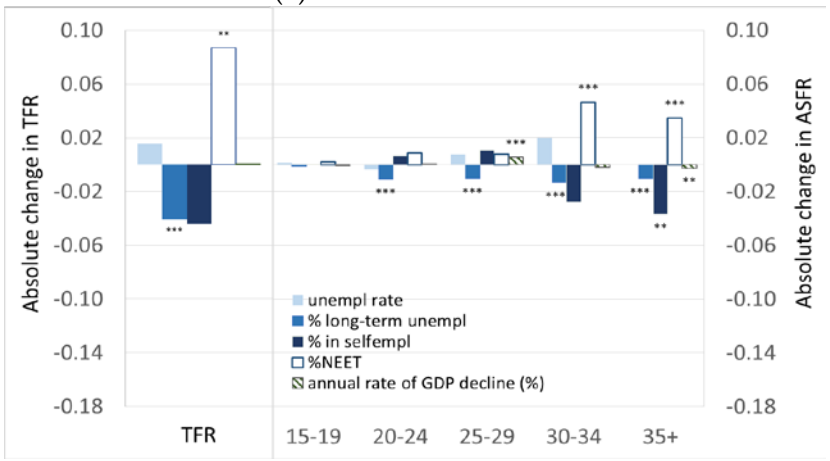
The deterioration of the region's economic conditions, as measured by declines in the GDP, turned out to be related with falling total fertility—net of the other indicators

analysed—only in Southern Europe and in Central and Eastern Europe. A hypothetical decline in GDP by 10 pp. would lead to a fall in total fertility by 0.02 children in the CEE countries and by 0.03 children in Southern Europe. This relationship is observed at nearly all ages.

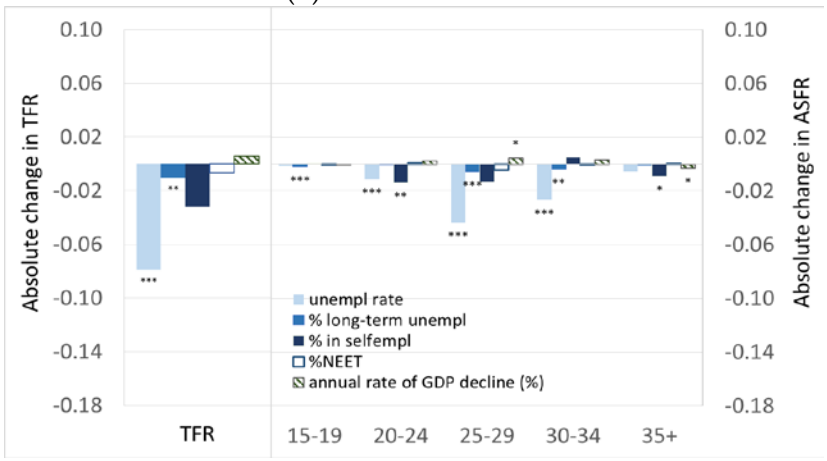
Finally, the rising share of NEETs was significantly related to total fertility in all country clusters except France and Benelux. This association is not unidirectional, however. It is negative in Austria and Germany group and in Southern European countries, but positive in the cluster composed by the United Kingdom and Ireland, the Nordic countries and in Central and Eastern Europe. The share of NEETs is associated with fertility across most age groups only in Southern Europe, whereas in the other country clusters this association is significant either at younger (in the CEE countries) or at older reproductive ages (in the Nordic countries and German-speaking countries).

Figure 7: Absolute change in Total Fertility Rate and cumulative age-specific fertility rates resulting from the 10 pp. worsening of economic conditions within NUTS-2 regions by broader country group, 2001-2014

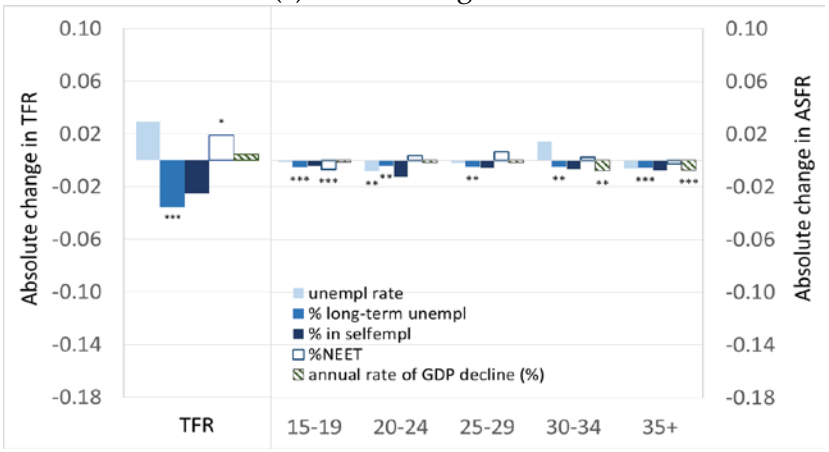
(a) Nordic countries



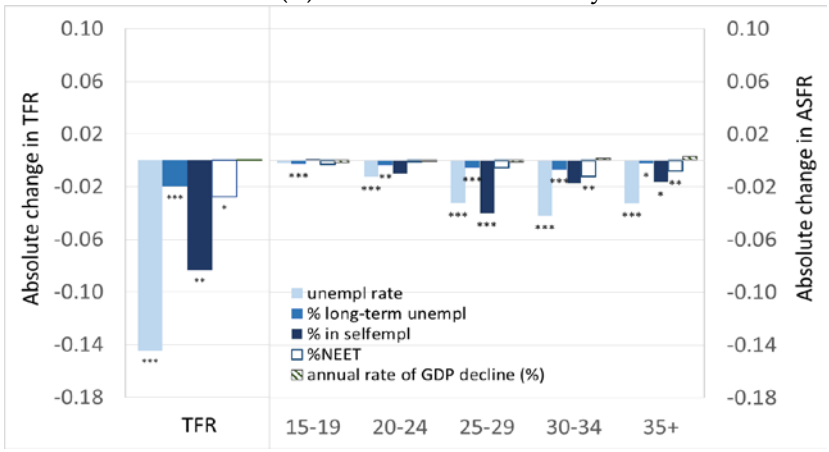
(b) France and Benelux



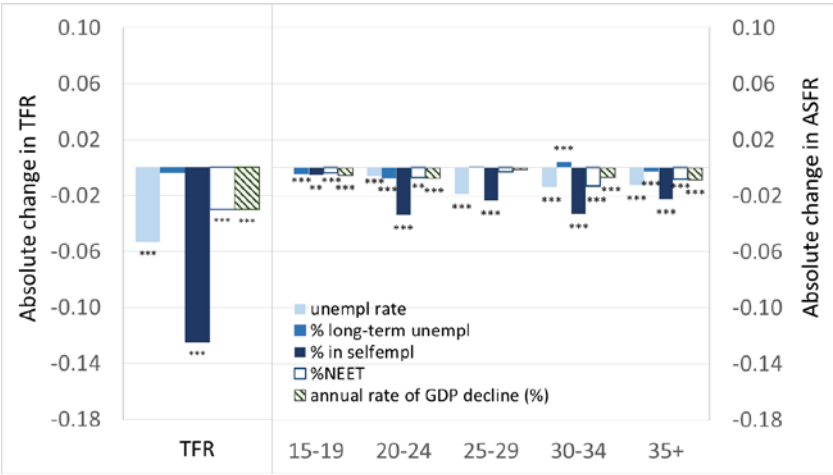
(c) United Kingdom and Ireland



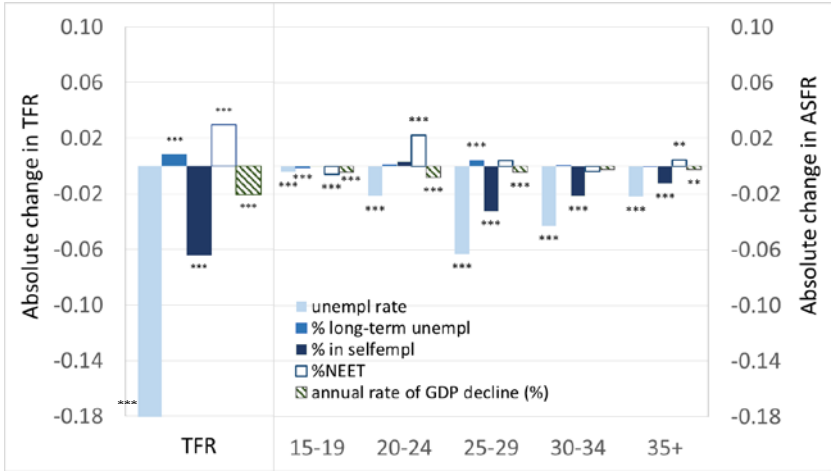
(d) Austria and Germany



(e) Southern Europe



(f) Central and Eastern Europe



Note: See Figure 5.

7. Effects of the Actual Change in Economic Conditions on Total Fertility

So far our analysis has focused on discussing how fertility rates react, on average, to a hypothetical 10pp. worsening in each of the indicators of economic conditions we considered. Such hypothetical changes often differ widely from the actual dynamics in economic and employment conditions in individual regions. To obtain a more realistic picture we used model M3 to predict total fertility in the years 2008–2014 under six scenarios, out of which the first five are hypothetical:

S1: 'No recession scenario' in which all five indicators of economic conditions we considered remained constant at the 2007 level (prior to the economic recession);

S2 'Unemployment' in which we keep all indicators at the pre-recession level except for unemployment which follows the actual values;

S3 -'Unemployment & self-employment' - only unemployment and self-employment follow the actual values, the remaining indicators remain at the 2007 level;

S4 -'Unemployment, self-employment & long-term unemployment,' where in addition to the previous scenario long-term unemployment changes in line with the actual data;

S5 -'Unemployment, self-employment, long-term unemployment and GDP change' – in addition, we allow the GDP to change consistently with the real data;

S6 -'Full model: unemployment, self-employment, long-term unemployment, GDP change and the NEET' – which predicts change in total fertility based on the observed changes in the complete set of indicators analysed. This scenario is computed for the years 2001-2014.

Under each scenario, we predicted the TFR for each NUTS-2 region. Next, we averaged the predicted values over all NUTS-2 regions within each country cluster. This gave us an average TFR in every macro region. We present these regional averages in Figure 8 a–f. A comparison of the observed TFR with the TFR predicted from the "Full model" S6 allows us evaluating how well the model predicts the actual TFR change observed across the regions.

Our model predicts the TFR quite well. The best fit is achieved in Southern Europe, Nordic countries and the CEE countries where the observed and the predicted TFRs stay close to each other before as well as during the recession period. The model performs less efficiently in the remaining three country groups: it underestimates the TFR prior to the recession in Austria and Germany and overestimates it in France and Benelux as well as in Ireland and the United Kingdom. It also underestimates the shifts in the TFR in the last year or two in Austria and Germany and in Ireland and United Kingdom. However, the difference between the observed and fitted values is rarely larger than 0.03. We also obtained similarly good fit for age-specific fertility rates.

Which factors were most important in predicting the actual fertility trends? A comparison of scenarios S1 and S6 suggests that total fertility in 2014 would be considerably higher in all country clusters except Austria and Germany if the economic conditions did not worsen after 2007. As of 2014 the difference between the TFR predicted

under the 'no recession' scenario and the TFR under the 'Full recession' scenario is largest in Southern Europe (0.12 children), followed by the CEE region (0.06 children). In Austria and Germany, in turn, total fertility would be lower under S1 than it is under S6, because it is the only country cluster where the unemployment declined after 2007.

A comparison of scenarios S1 and S2 confirmed our previous findings that unemployment played a crucial role in the TFR change in four country clusters. In Central and Eastern Europe, rising unemployment explained the entire predicted decline in total fertility (by 0.05 children on average) between 2008 and 2014. In France and Benelux cluster rising unemployment accounted for 88% of the predicted fertility decline, and in Southern Europe for 60%. In contrast, in the cluster of Austria and Germany, the model suggests that total fertility did not decline after 2008 because unemployment rates fell there, sustaining a slight rise in fertility. Only in Ireland and United Kingdom do the lines S1 and S2 in Figure 8c) overlap, which suggests that unemployment dynamics did not contribute to a change in total fertility during the recession. This finding is also consistent with our earlier finding that unemployment was not a significant determinant of fertility in this country group.

Although rising self-employment was closely linked with fertility decline (see previous section), our models show that it did not impact fertility trends after 2008: the results of S3 largely overlap with S2 in all country clusters. This seemingly unexpected result boils down to the finding that self-employment remained stable during the economic recession across all analysed countries (Figure 3 above).

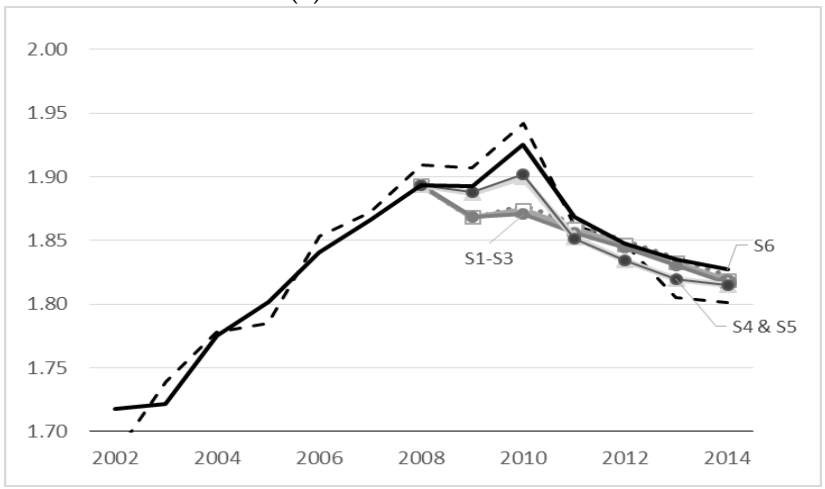
The comparison of scenarios S4 and S5 suggests that rising long-term unemployment was the key correlate of fertility decline for the United Kingdom and Ireland. In this country group long-term unemployment nearly doubled during the recession and this explained a decline in the TFR by nearly 0.05 children by 2014. No other indicator considered in our study explains additional reduction in the TFR in this country group, although a good deal of fertility decline remains unexplained there. Increase in long-term unemployment also contributed to a decline in total fertility in the Nordic countries.

While the previous section showed that GDP decline was negatively associated with fertility in Southern Europe and in CEE countries, its actual effect turned out to be small, amounting to 0.02 children.

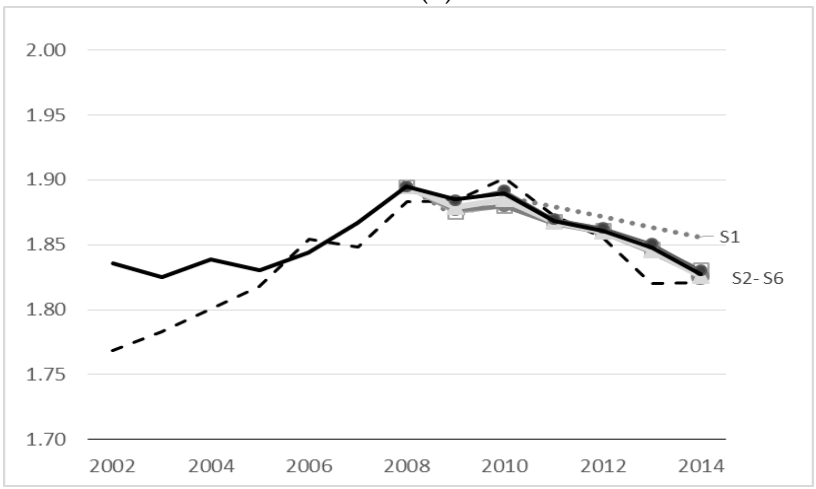
Finally, the rising share of NEET among young adults has contributed to a decline in total fertility (by nearly 0.03 children) only in Southern Europe.

Figure 8. Observed and predicted Total Fertility Rate under scenarios S1-S6 by country group, 2002-2014

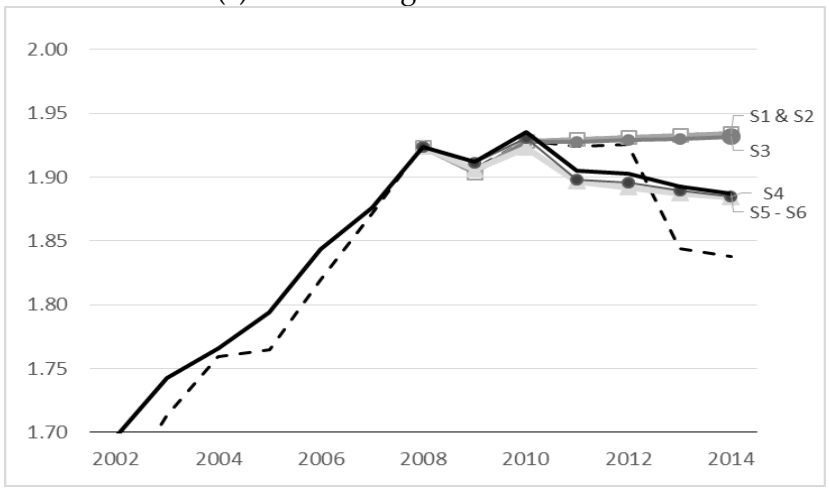
(a) Nordic countries



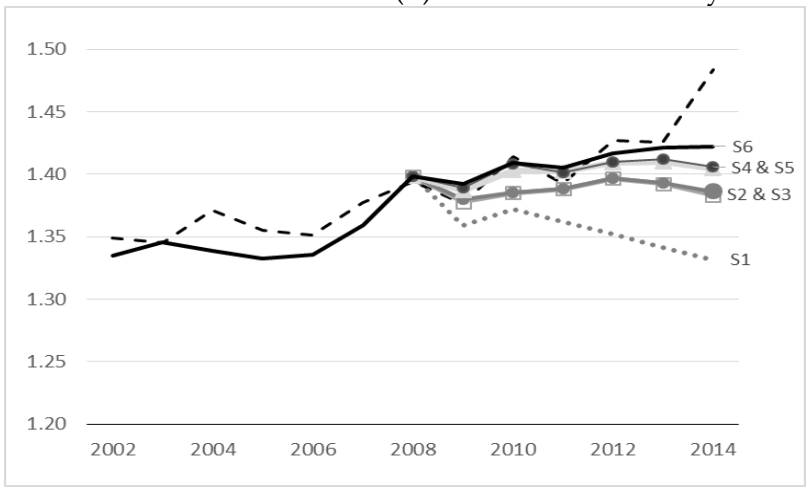
(b) France and Benelux



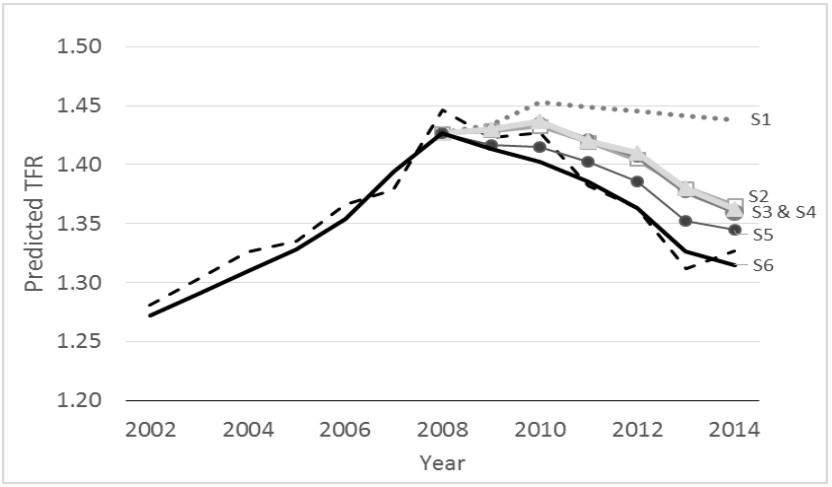
(c) United Kingdom and Ireland



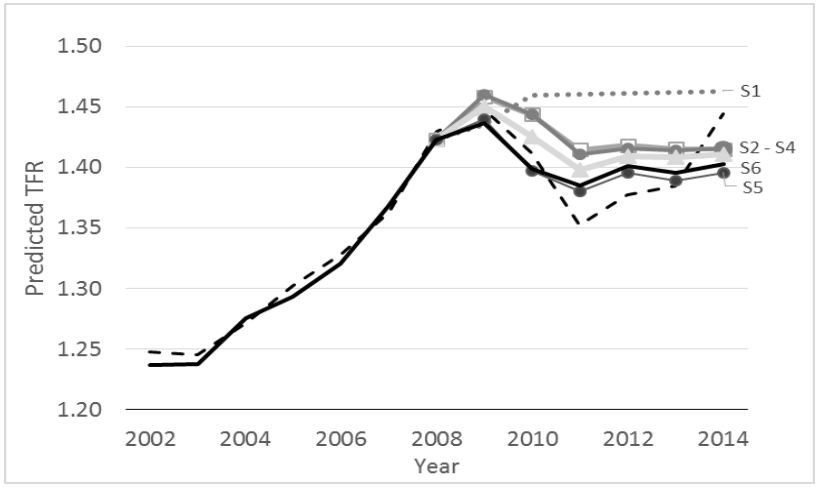
(d) Austria and Germany



(e) Southern Europe



(f) Central and Eastern Europe



Note: The values on the Y-axis vary across figures, but the range is set constant at 0.3

7. Concluding Discussion

The "Great Recession" had a far-reaching impact on income, employment, health, well-being and family behaviour of Europeans. Our study provides the first in-depth analysis of the fertility responses to the recent economic downturn at a sub-national level in Europe. Our main focus was on investigating how economic and labour market dynamics impinge on fertility dynamics while controlling for the variation in economic conditions between regions in each country and between countries. Our study thus differs from a number of studies that provided a more static picture of the relationship between economic conditions and fertility. We have also aimed to cover a range of economic and labour market indicators that allowed us capturing more broadly the multifaceted impact of the economic recession and exploring huge sub-national variation in its progression. While the number of indicators we could use was more limited at sub-national level, we have incorporated some that were not commonly used in the past, including self-employment and the share of young adults who are not in education, employment or training. Our models, including the full set of indicators, provided a close fit to the actual fertility trends in most of the broader regions in Europe.

Three general findings are consistent across different groups of countries and also in line with the past findings reported at a national level. First, the periods of economic downturns are associated with negative fertility dynamics across the countries and regions analysed, irrespective of their family policy and welfare setup. With the exception of the NEET indicator, worsening in each of the economic and labour market indicators we studied (unemployment rate, long-term unemployment, self-employment, and GDP change) was associated with fertility decline. Remarkably, the negative effect of unemployment and self-employment was more pronounced during and shortly after the recession period, in 2008-2014. This may reflect a specific period effect, perhaps fuelled by negative expectations and declining confidence about the future, not captured in our data. Likewise, this effect could also signal that our indicators might have tapped into the more specific factors we could not capture in our models and which rose to prominence during the recent recession, such as rising poverty and economic deprivation, lower income, rising employment uncertainty and the spread of temporary work contracts. Second, our analysis confirms the key role of unemployment dynamics in accounting for the recent fertility downturn. Unemployment showed the strongest link to fertility change across all ages beyond 25: an increase in unemployment rate by 10 percentage points was associated, on average, with a decline in total fertility by nearly 0.09 children in absolute terms. A comparison of different fertility scenarios based on our model results confirmed that unemployment played a crucial role in the fertility change in four out of six analysed country clusters. In Central and Eastern Europe rising unemployment explained the entire decline in total fertility (by 0.07 children on average) between 2008 and 2014. In two country groups where general unemployment trend was not the most important predictor of fertility—Nordic countries and in Ireland and the United Kingdom cluster—rising long-term unemployment was the most important factor associated with fertility downturn. Third, fertility rates were negatively affected by deteriorating economic conditions across the whole range of childbearing ages, including late reproductive ages when couples risk infertility when postponing their childbearing plans. The latter finding

suggests that economic recession might have affected not only the timing of fertility, but also its quantum.

We were able to provide a finer picture of the factors associated with fertility dynamics in broader country groups in Europe. These findings are most informative for the regions that experienced most severe economic setbacks and which offer lower level of social protection. Both conditions were met in Southern Europe as well as in parts of Central and Eastern Europe. In Southern Europe the average TFR across the regions studied fell from 1.45 to 1.33 between 2008 and 2014. Our model predicted a decline of a similar magnitude (-0.12), accounted largely by increasing unemployment (-0.07) and the rising share of NEETs (-0.03). In contrast, our model was not able to explain well the similarly steep fall in fertility in the Nordic countries, where the average TFR across all analysed subnational regions fell from 1.94 in 2010 to 1.80 in 2014. Our model predicted a smaller TFR decline in that period (by -0.09), fuelled mainly by the general period trend and "explained" only partly (-0.03) by rising unemployment and long-term unemployment. The fall in fertility in the Nordic countries which continued for several years after the recession ended still remains a puzzle to understand, which should motivate future research. In the only analysed group of countries that bucked the trend of declining period TFR after 2008, the cluster of Austria and Germany, our model did not predict the full extent of the observed average fertility increase, but signalled that falling unemployment significantly contributed to this increase.

Among the few unexpected results, we find most puzzling the positive association between the rising share of NEETs among young adults and rising fertility in some regions, concentrated especially at younger ages. These links between fertility and the prevalence of NEET people are hard to assess. On the one side, uncertainty about the future may lead younger people to postpone childbearing to better, less uncertain, times (Ranjan 1999). On the other side, the uncertainty reduction theory formulated by Friedman et al. (1994), suggests having children may serve as a strategy to reduce uncertainty among individuals with limited options in the labour market. From this perspective, people who are not in education and employment, may favour parenthood as a strategic choice to structure their otherwise uncertain life course, also to provide "some meaning in life" (McDonald 2010: 10).

Our study has limitations. First, it is difficult to evaluate whether the observed fertility declines were mostly driven by the temporary postponement of childbearing during uncertain times or rather by a fall in the underlying level (quantum) of fertility that will also depress completed family size of women who were in prime reproductive ages around 2010. Even though the declines in fertility of women aged 35+ suggests some lasting influence on fertility levels among the women approaching the end of their reproductive lives, these effects are rather small. The recession effects on completed family size will mostly depend on whether women in prime reproductive ages have only postponed their childbearing during uncertain times and would eventually have their children after the recession ends, which cannot be predicted with our data. A limited range of fertility indicators at our disposal and the lack of cohort fertility data for sub-national regions did not allow us to investigate this question. Second, also the range of available economic and labour market indicators is more restricted at a sub-national level, preventing us from delving deeper into different possible links between economic

downturn and fertility. In addition, some survey-based indicators turned out to be too uncertain and unstable at the level of NUTS2 regions. Third, our study does not consider the role of education as a potent moderator of the association between adverse economic circumstances and fertility trends. Clearly, the idea that all social groups are equally vulnerable to economic uncertainty is both logically thin and empirically tenuous (Kreyenfeld 2015). Finally, it is necessary to avoid extrapolating our findings at the aggregate level to the individual-level when drawing general conclusions and interpretations.

The role of economic uncertainty in fertility-decision making cannot be solely ascribed to the Great Recession. In many countries, an increasing number of people – the emerging class of "precariat" – are facing uncertain lives, moving in and out of low-paid "stopgap" jobs that may give little meaning to their lives (Standing 2011). Economic uncertainty has become an intrinsic feature of contemporary globalizing world, and the relationship between economic conditions and family dynamics is to remain a major topic of public interest in the years to come. The challenge for future research will be to integrate better macro- and micro-level evidence on the impact of economic uncertainty on family behaviour and to address the economic uncertainty/fertility nexus from a life course perspective. This also means recognizing that family behaviours are intertwined with other life course events, and, especially that fertility does not occur in isolation, but within relationships.

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Appendix

Table A1: Sample description: sample size, reliability and completeness, mean and standard deviation of the economic and fertility indicators for 258 NUTS-2 regions, 2001-2014

Indicator (1)	Years (2)	N (3)	% with low reliability [a] (4)	% missing before imputation [b] (5)	% missing after imputation (6)	Mean (7)	St dev (8)
TFR	2002-2014	3016	NA	1.3	1.3	1.55	0.276
ASFR 15-19	2002-2014	2914	NA	3.3	3.3	0.659	0.048
ASFR 20-24	2002-2014	2914	NA	3.3	3.3	0.254	0.086
ASFR 25-29	2002-2014	2952	NA	3.3	3.3	0.479	0.121
ASFR 30-34	2002-2014	2952	NA	3.3	3.3	0.474	0.114
ASFR 35+	2002-2014	2952	NA	3.3	3.3	0.267	0.090
Unemployment rate 20-64	2001-2013	3309	4.8%	3.8	2.8	8.1	4.9
Unemployment rate 15-24	2001-2013	3066	23.6%	11.9	8.2	19.8	11.3
Unemployment rate 25+	2001-2013	3178	7.3%	4.1	3.3	7.2	4.5
% long-term unemployment	2001-2013	2975	22.3%	13.4	10.8	39.6	14.0
% self-employment	2001-2013	3243	0.7%	2.6	2.6	15.6	7.4
% NEET	2001-2013	3050	11.7%	6.2	5.0	15.4	7.1
GDP growth	2001-2013	3243	NA	1.7	1.7	1.2	4.2

[a] The number of observations the value is based on exceeds the first but not the second reliability threshold of Eurostat (the indicator is published but characterised by low reliability)

[b] Missing values may be due to low reliability (the number of observations the value is based on does not exceed the first reliability threshold of Eurostat)

Table A2. M1 model estimates, EU-28, Norway and Iceland 2001-2014

Covariates		**TFR**	**ASFR 15-19**	**ASFR 20-24**	**ASFR 25-29**	**ASFR 30-34**	**ASFR 35+**
Calendar year (spline)	2001-2003	0.016***	-0.002***	-0.008***	0.000	0.013***	0.010***
		(0.005)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
	2004-2006	0.015***	-0.001***	-0.006***	-0.001	0.012***	0.010***
		(0.003)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	2007-2008	0.024***	0.000	-0.001	0.001	0.011***	0.012***
		(0.003)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	2009-2010	0.001	-0.003***	-0.008***	-0.005***	0.005***	0.009***
		(0.003)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	2011-2014	-0.004	-0.001***	-0.006***	-0.004***	0.003**	0.007***
		(0.003)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Macro region (ref = Nordic)	Austria and Germany	-0.517***	-0.011	-0.050	-0.200***	-0.204***	-0.140***
		(0.061)	(0.019)	(0.034)	(0.043)	(0.030)	(0.043)
	Ireland and UK	-0.020	0.003	0.052	-0.104**	-0.005	0.022
		(0.055)	(0.018)	(0.032)	(0.042)	(0.029)	(0.042)
	France and Benelux	-0.082	-0.004	-0.010	-0.007	-0.049*	-0.065
		(0.053)	(0.016)	(0.028)	(0.042)	(0.029)	(0.041)
	Southern Europe	-0.530***	0.003	-0.090***	-0.241***	-0.146***	-0.107**
		(0.063)	(0.018)	(0.032)	(0.044)	(0.03)	(0.042)
	CEE	-0.548***	0.017	-0.046	-0.152***	-0.199***	-0.204***
		(0.069)	(0.021)	(0.036)	(0.050)	(0.035)	(0.050)
Unemployment rate	within region	-0.009***	0.000***	-0.001***	-0.003***	-0.002***	-0.002***
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	between region within country	-0.003	-0.002***	-0.005***	0.000	0.000	-0.001
		(0.004)	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)
	between country	-0.004	-0.003***	-0.001	-0.001	0.001	-0.001
		(0.005)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)
% in long-term unemployment	within region	-0.001***	0.000***	0.000***	0.000	0.000	0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	between region within country	-0.004***	0.000	0.000	-0.001**	-0.001**	0.000
		(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
	between country	0.001	0.000	-0.001	0.001	0.001	0.000
		(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
% in self-employment	within region	-0.004***	0.000***	-0.001***	-0.002***	-0.002***	-0.001**
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	between region within country	0.000	-0.001**	-0.001	0.000	0.000	0.000
		(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	between country	-0.003	-0.001	0.000	0.000	-0.002	0.002
		(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
% not in employment, education or training	within region	0.000	0.000***	0.001***	0.000	-0.001***	0.000*
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	between region within country	0.009***	0.005***	0.010***	0.003**	-0.003***	0.000
		(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	between country	0.004	0.008***	0.007***	-0.003	-0.005	-0.001
		(0.004)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)
GDP growth	within region	0.001*	0.000***	0.000***	0.000	0.000	0.000**
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	between region within country	-0.002	-0.005**	-0.011**	-0.004	0.014***	0.009**
		(0.012)	(0.002)	(0.005)	(0.006)	(0.004)	(0.005)
	between country	-0.001	0.008**	0.011*	-0.004	-0.017***	0.000
		(0.012)	(0.003)	(0.006)	(0.008)	(0.006)	(0.008)
Constant		1.82***	0.071***	0.330***	0.629***	0.543***	0.316***
		(0.049)	(0.015)	(0.026)	(0.034)	(0.025)	(0.033)

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