Can the stagnation of incomes explain recent fertility trends in Europe?

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Abstract

Fertility rates declined in much of Northern, Western, and Southern Europe during the 2010s, whereas they remained stable or increased in many Central and Eastern European countries. In this study, we examine to what extent the unexpected fertility declines and divergent fertility trends across countries can be explained by differences in the income trajectories of young adults. We use country-level data on period total fertility rates (TFRs), differentiated by age and birth order, and tempo- and parity-adjusted total fertility (TFRp*). We analyse how these fertility indicators are associated with changes in real income, unemployment rates, consumer confidence, house prices and rent indices, and family spending policies, in 2007-2023. Within-between models show a strong positive association between changes in income and changes in fertility in 2007-2020, suggesting that the stagnation of young adults' incomes in much of Northern, Western, and Southern Europe can explain an important part of the fertility decline. Positive income effects are also found for tempo- and parity-adjusted fertility, for women over age 30, and for higher-order births, indicating that stagnating incomes are not only linked with postponement of births, but also with declines in the period quantum of fertility. In addition, rising real rent prices are associated with declining fertility in this period. However, income trends are not closely linked to the period TFR after 2020, suggesting that other explanations are needed for the fertility decline during and after the COVID-19 pandemic.

Introduction

Fertility has declined in much of Northern, Western, and Southern Europe during the 2010s (OECD, 2024; Human Fertility Database, 2025). During the same period, fertility has remained stable or increased in many Central and Eastern European countries (Sobotka and Fürnkranz-Prskawetz 2020), causing a break in long-standing cross-national fertility patterns identified by Rindfuss et al. (2016). However, the reasons for these contrasting fertility trends are not well understood. Up until the Great Recession, fertility trends often followed business cycles and were affected by changes in unemployment rates (e.g. Sobotka et al., 2011; Schneider, 2015; Comolli, 2017; Matysiak et al., 2021; Neels et al., 2024). Yet unemployment rates cannot explain more recent fertility declines, since fertility continued to fall in many countries during the 2010s and the early 2020s despite low and falling unemployment rates. The continuing declines in fertility after the Great Recession and, indeed, the absence of tangible fertility "recovery" in that period are therefore seen as a puzzle, signifying a new low-fertility era in Europe and many higher- and middle-income countries outside Europe (Hellstrand et al., 2022; Comolli, 2023; OECD, 2024; Kearney and Levine, 2025; Pardo et al., 2025).

Many studies have explored novel explanations of low fertility, going beyond structural-economic factors. These include changing reproductive preferences (Guzzo and Hayford, 2023; Bouchet-Valat

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and Toulemon, 2025), changing partnership and reproductive behavior (Hellstrand et al., 2022; Cantalini et al., 2024; Reimondos et al., 2025), rising infertility due to postponement of parenthood (Winkler-Dworak et al., 2024a), worries about the future in times of multiple crises (Guetto et al., 2022; Golovina and Jokela, 2024), more reliable contraception and fewer unwanted births (Buckles et al., 2025), and, more recently, the negative impact of the COVID-19 pandemic and the war in Ukraine.

Other studies have focused on the role of structural factors beyond unemployment, identifying inflation (Winkler-Dworak et al., 2024b), rising housing prices (Van Wijk, 2024a), and stagnating incomes among young adults (van Wijk and Billari, 2024) as important factors. More broadly, new research has called for an expansion of economic indicators beyond unemployment in order to capture the broader economic conditions and uncertain future prospects faced by today's young adults and their relation to fertility outcomes (Seltzer, 2019; Vignoli et al., 2020; Comolli and Vignoli, 2021; van Wijk and Billari, 2024).

Our paper contributes to the growing evidence on the important role of these formerly neglected structural-economic factors for fertility decisions in Europe. We focus especially on the role of income for fertility trends across European countries. As young adults' real incomes have stagnated or even declined in many European societies over the past decade (Hammer et al., 2022), it may have become more difficult for them to fulfil their material aspirations and preconditions to parenthood, potentially causing a postponement or even giving up on childbearing (van Wijk and Billari, 2024). However, little is known about the relationship between trends in income and fertility at the macro level. In particular, we lack insights into how differential developments in the incomes of young adults relate to diverging fertility trajectories between countries.

We use country-level data on income and fertility in 27 European countries in the period 2007-2023. Our study expands the previous research in several ways. First, we focus on young adults' incomes, which have been studied less often than other economic indicators such as unemployment rates. However, in times of tight labor markets and rising costs of living, young adults' incomes arguably provide a better indicator of their ability to fulfil the economic prerequisites of parenthood than unemployment rates. Second, we examine to what extent variation in average income levels between countries (*between-country effect*) as well as trends in income over time (*within-country effect*) can explain differences in fertility levels and trends between countries. While several recent studies have examined the impact of between-country or between-region variation in incomes on fertility (e.g. Fox et al., 2019; Campisi et al., 2023; Doepke et al., 2023), studies that investigate the influence of within-country changes in income over time are scarcer. Theoretical arguments generally stress the importance of relative rather than absolute incomes (Easterlin, 1976; van Wijk and Billari, 2024), suggesting that changes in income over time may be more important for fertility trends than the absolute level of income in a country. In addition, within-country associations between income and fertility trends have the advantage that they are not confounded by unobserved time-constant characteristics of countries, which makes a causal interpretation of the relationship between within-country changes in income and fertility more plausible. Third, we take into account several additional economic-structural characteristics that are expected to be linked to fertility trends but have not been included in most previous studies. These include – in addition to unemployment rates – levels of consumer confidence, house and rent prices, and spending on family policies. Fourth, we go beyond modelling fertility trends by using the conventional indicator of period fertility, the period

total fertility rate (TFR), and model the relationship between income trends and the tempo- and parity-adjusted TFR (TFRp*), as well as age- and parity-specific fertility rates. The inclusion of the TFRp* makes it possible to distinguish income effects on the period tempo (timing) and quantum (level) of fertility, investigating whether changes in young adults' incomes are mostly associated with shifts in the timing of childbearing or whether they are also impacting the underlying fertility levels and likely leading to changes in family size. Finally, our study includes data from the most recent period, which allows us to explore how the association between young adults' incomes and fertility changed after 2020, when the COVID-19 pandemic and the war in Ukraine may have altered the income-fertility relationships identified for the pre-2020 period.

Background: income and fertility

Before the 1980s, a negative relationship between income and fertility had been evident at the country level, with countries with higher incomes exhibiting lower fertility (Doepke et al., 2023). A prominent explanation for this negative association was the so-called "quantity-quality tradeoff", according to which higher income levels incentivize parents to invest more in fewer children, raising the cost of children and decreasing fertility (Becker, 1960). In addition, higher income levels were argued to increase the economic value of (particularly women's) time, which raises the opportunity costs of childrearing and decreases fertility (Butz and Ward, 1979; Becker, 1981). In a broader perspective, higher income at a country level is a marker of an advanced level of development, which was expected to lower fertility due to better health, education, urbanization, access to contraception, and higher women's employment (Heer, 1966; Myrskylä et al., 2009).

In recent decades, however, the negative association between income and fertility in higher-income countries flattened and, in some studies, even reversed (Doepke et al., 2023; Hopcroft et al., 2024; see also Myrskylä et al., 2009). For example, Doepke et al. (2023) show that the cross-country correlation between GDP per capita and the total fertility rate changed from negative to positive in OECD countries in the last two decades of the 20th century. Likewise, focusing on regional variation within European countries, Fox et al. (2019) found that the negative relationship between income levels and fertility weakened between 1990 and 2012, and a positive relationship emerged in some countries. Most authors have attributed these changing relationships to the improved compatibility of maternal employment and childrearing as a result of changes in family policies and gender norms, which reduces the opportunity costs of childbearing (Goldscheider et al., 2015). With opportunity costs of childbearing playing a less prominent role, countries with higher income levels may be expected to have higher fertility, as more couples in these countries will have the resources that are salient for raising a(n additional) child.

Most of the past research on macro-level variation in income implicitly assumes that it is differences in absolute income levels that matter for fertility decisions. We argue, however, that the income level that people view as appropriate for having children varies strongly between countries, over time, and between individuals. Therefore, it is not the absolute level of income that matters for fertility decisions, but the income relative to one's material aspirations and desired investments in children. These aspirations are affected by many different factors. First, it has been argued that one's material aspirations are shaped by childhood socialization, suggesting that the standard of living that young adults experienced in their family of origin when they were growing up set the standard they wish to achieve themselves before they have children (Easterlin, 1976). Second, evaluations of one's current

income may be influenced by income levels earlier in the life course, suggesting that fertility is influenced by the comparison of current and past incomes. If one's income has increased substantially over the past years, current income may be more likely to fulfil the prerequisites of parenthood, irrespective of its absolute level. Finally, societal norms may influence what levels and types of investments in children are perceived as necessary or appropriate. It has recently been argued that societal shifts to intensive parenting norms and to the conscious planning of one's life course have increased the income prerequisites that individuals wish to fulfil before becoming parents (van Wijk and Billari, 2024). This expectation is supported by recent individual-level studies, which have reported a strengthening of the positive association between income and fertility for both men and women in many affluent countries over the past decades (Hart, 2015; van Wijk, 2024b; van Wijk and Billari, 2024; Brini et al., 2025).

These theoretical arguments underline that it is not (only) the absolute level of income in a country at a given time point that matters for fertility decisions, but also the income level relative to one's aspirations. At the same time, younger generations have become increasingly uncertain about their economic prospects and their ability to achieve good living standards, stable employment, and housing. The long-term expectations in Western societies that young people will achieve greater prosperity and better living standards than their parental generation have eroded over time. Instead, a more negative narrative of an uncertain and less prosperous future has set in, implying that many younger people today expect their material aspirations will not be met, which might have a negative long-term impact on family formation. For instance, a 2017 survey of adults in Britain showed that almost one half of the respondents (48%) expected young people today will have a worse standard of life compared to their parents. This pessimistic outlook was more pronounced among people with a degree (Shrimpton et al., 2017).

The importance of relative income is captured better by investigating the impact of within-country changes in income over time than by looking at between-country differences in average income levels. In times of income growth, young adults will be much more likely to achieve an income that fulfils their material aspirations and allows them to make investments in children, which in turn may increase fertility. If, in contrast, young adults' incomes stagnate or decline, their income will lag behind their material aspirations, which may result in the postponement or even foregoing of childbearing. We therefore focus most of our analysis on the within-country association between changes in income and changes in fertility. The central hypothesis guiding our analyses is that in a period of increasing income prerequisites of parenthood, rising costs of living, and stagnation in young adults' incomes in many rich societies, income trends may become a particularly salient factor in understanding differences in fertility trends between countries.

Data

We use country-level data for 27 European countries.[3] Our main analyses focus on the period 2007-2020. In an additional analysis we also report preliminary findings for the recent period of 2019-2023.

[3] Countries included in the analyses are Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

We run separate analyses for these two periods because we expect that disruptions brought about by the COVID-19 pandemic and the war in Ukraine may have caused changes in the determinants of fertility.

Fertility data mostly come from the Human Fertility Database (HFD, 2025), which were complemented by data from Eurostat and national statistical offices in cases where HFD data were not available (see Appendix for a list of sources). Various indicators of fertility are analyzed as the dependent variable in different models. First, the period total fertility rate (TFR) is used to estimate how (changes in) income are associated with (changes in) period fertility. The period TFR has the benefit of being widely available, frequently used, and adjusted for the size and age distribution of the population. However, the period TFR is affected by changes in the timing of childbearing (fertility tempo) and therefore model results might be driven by both the changes in the underlying fertility level (quantum) and by changes in fertility tempo. In a second model, we therefore replace the period TFR with the tempo- and parity-adjusted TFRp*[4], which adjusts the period TFR for changes in the timing of childbearing and changes in the parity distribution of women of reproductive age (Bongaarts and Sobotka, 2012). TFRp* provides a measure of the period quantum of fertility, and has been shown to be closely associated with the completed fertility of cohorts of women who are at the peak of their childbearing years when TFRp* is measured (Bongaarts and Sobotka, 2012). As the calculation of TFRp* requires age- and order-specific counts of births and numbers of women at risk, it is only available for a smaller subset of 16 European countries, namely Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Finland, Hungary, Ireland, Lithuania, the Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. Where TFRp* is not available, we use the tempo-adjusted TFR (adjTFR; Bongaarts and Feeney, 1998), which is an alternative measure of the quantum of fertility that can be calculated from the mean ages at childbearing computed separately by birth order. The adjTFR is used for Germany, Iceland, Italy, Poland, and the United Kingdom (HFD, 2025b). We take the average value of the tempo-adjusted TFR in the past, current, and subsequent year, to adjust for the considerable year-to-year instability in this measure (Bongaarts and Sobotka, 2012).

Third, we run separate models for two broad age groups, distinguishing the TFR below age 30 and over age 30. This allows us to examine whether (changes in) the independent variables are associated mostly with fertility of younger or older women. Finally, we estimate separate models for the TFR for first (TFR1), second (TFR2), and third (TFR3+) births to allow the estimation of parity-specific effects. These parity-specific variables are not available for France and the UK.

Our main independent variable is a country's median equivalized household income for people aged 25-49, taken from Eurostat (2025a). Incomes are reported by Eurostat in purchasing power standards, which adjust for differences in the price levels of different countries. In addition, we adjust incomes for inflation, indexing them to 2015 prices using Eurostat's (2024) Europe-wide consumer price index. Incomes are missing in the Eurostat data for Croatia between 2007 and 2009 and in the UK between 2019 and 2022; for these country-years, we impute incomes using trends observed in

Other European countries were not included because of inconsistencies in the time series of the fertility data over time or between different sources (e.g. Romania; Slovakia).

[4] TFRp* is not directly calculated and published by HFD, but can be calculated from the published tables of Period fertility tables (*pft.txt), variables m(i,x) and w(i,x), and further adjusted for tempo effect using the table on Mean age at birth (*mabRRbo.txt).

data from national statistical offices (see Appendix). As we are not interested in absolute income differences, but in relative income differences between countries and within countries over time, we use the natural logarithm of income in our models.

In a robustness check, we reran our models using an alternative income variable that captures the annual net earnings that are obtained by a full-time single worker who earns an average wage. These data are also taken from Eurostat (2025b). The earnings variable differs from the income variable as (1) it is based on the full population of working age rather than on the younger population aged 25-49; (2) it uses the average rather than the median income; (3) it is measured at the individual rather than household level; (4) it includes only labor income and not income from other sources and transfers; and (5) it is not affected by changes in employment and working hours. We again adjust earnings for differences in price levels between countries and for inflation and take the natural logarithm of the earnings variable.

All models control for the unemployment rate, consumer confidence, house prices, rent prices, spending on family policies, and calendar year. The unemployment rate measures the share of persons who are unemployed as a percent of the labor force, and is based on data from the International Labor Organization (2025), which are available for all country-years in the data.

To measure consumer confidence, we use the composite indicator of consumer confidence available from Eurostat (2025c). This is a monthly indicator, from which we take the average value in the first three months of each year. Data on consumer confidence are missing for Iceland, Norway, Switzerland, and the UK.

As our preferred indicator of house prices we use the real house price index from the OECD (2025a), supplemented by data from Eurostat (2025d) for Bulgaria and Croatia. The house price index is missing for Croatia and Czechia in 2007, and we imputed the house price index in these country-years based on trends reported by national statistical offices (see Appendix). In addition, we also control for the real rent price index, taken from Eurostat (2025e). Rent prices are missing for the UK after 2019.

Unfortunately, data on absolute differences in house and rent prices between countries are not publicly available. Therefore, we only have information on indexed house and rent prices that capture the changes in prices in a country relative to a base year, which we set at the start of our study period (i.e., 2007=100 in the main analyses, and 2019=100 in the analyses of the most recent period).

Our indicator of spending on family policies comes from the OECD's (2025b) Family Database. We use the total of public spending on family benefits in cash and services, measured in per cent of GDP. We do not include spending on tax support for families – another indicator in the OECD Family Database – because it is highly unstable and is missing for many country-years in our analysis. Information on spending on family policies is not available for Bulgaria. As family spending data were not yet available for 2022 at the time of writing, we do not include this variable in our models for the 2019-2023 period.

Finally, we also include calendar year dummies, which control for the average time trend in the fertility indicators across the included countries.

The distribution of country-years across the variables in the models can be seen in Table A1.

Analytical approach

We start our analyses with a description of the trends in young adults' incomes and the different fertility indicators for all countries for which we have these data and indicators available. We then estimate a series of within-between models, with separate models for the different fertility indicators. The use of within-between models allows us to estimate both between-country effects of average levels of income (and other independent variables) on fertility, and within-country effects of changes in incomes (and other independent variables) over time on fertility (Bell et al., 2019). The within-country effects in these models are the same as those in a model that includes country fixed-effects, but the within-between model has the advantage that it also allows the inclusion of country characteristics that are constant over time.

To estimate the within-between models we follow Schunck's (2013) approach. In this approach, the between-effects capture the effect on fertility of the average level of an independent variable over the study period. The within-effects estimate the effects of changes over time in a given country, captured by the deviation from the country-specific average in a year.

Because data on absolute differences in house prices and rent levels between countries are not available, we only estimate within-country effects for these two variables.

In all models, the fertility outcome is measured one year after the independent variables to ensure that the independent variables approximate the time of conception. Therefore, in the main analysis the independent variables are measured in 2007-2019, and fertility is measured in 2008-2020. In the analyses of the most recent period, independent variables are measured in 2019-2022, and fertility is measured in 2020-2023. In the analysis of this later period we focus on the period TFR only, as adjusted, age-specific, and parity-specific TFRs are not (yet) available for the most recent years for many countries covered here.

The models that are reported in the text are adjusted for all control variables, and only include countries for which data are available on all these variables. In Table A2 in the Appendix, we report reduced models for the period TFR in which control variables are progressively added to the model. In these reduced models, more countries are included than in the full models, as countries with missing data on control variables can be included as well. We comment on differences in effects between the reduced and the full models in the text where they are apparent.

Descriptive findings

Figure 1 shows the development of income across all 27 countries in 2007-2019. The Figure illustrates how the median real incomes of people aged 25-49 stagnated in Northern, Western, and Southern Europe. Most countries in these regions saw median incomes increase by only around 10 per cent in 2007-2019, i.e., by less than 1 per cent per year. Other countries – including Greece, Iceland, Ireland, Italy, Spain, and the United Kingdom – even witnessed declines in the real incomes of young adults during this period. In contrast, most countries in Central and Eastern Europe experienced substantial increases in young adults' incomes, with real incomes increasing by around 30% in Czechia, Croatia, and Hungary, and by around 70% in the Baltic countries and by even more in Bulgaria and Poland.

Figure 1 also depicts the trends in period TFRs, which were backdated by one year to approximate the time of conception. A substantial drop in the period TFR is observed in many countries, with particularly strong declines – of over 0.3 children per woman – in Belgium, Finland, Iceland, Ireland, Norway, and the UK. By contrast, the period TFR remained relatively stable in several other European countries (e.g. Austria, Bulgaria, Lithuania, Poland, Portugal), and increased in Czechia, Germany, and Hungary. Finally, Figure 1 shows trends in TFRp* for countries where this measure is available. TFRp* was higher than the period TFR in nearly all country-years for which data are available, suggesting that the period TFR in European countries underestimated the quantum of fertility during this period as a consequence of distortions due to a later age at childbearing and changes in the parity distribution. Moreover, the time trends suggest that TFRp* generally declined less than the period TFR, suggesting that fertility declines in Europe in the 2010s were partly driven by postponement of parenthood to older ages. However, several countries (e.g. Finland, Norway, the UK) also saw substantial declines in TFRp*, particularly towards the end of the 2010s. These findings indicate that the falls in the TFR were partly driven by declining period quantum of fertility, potentially foreshadowing future declines in cohort fertility.

The trends in Figure 1 suggest that fertility declined during the 2010s especially in countries where young adults' real incomes stagnated, whereas fertility mostly remained stable or even increased in countries that witnessed strong increases in income – although there are also exceptions to this general pattern. To examine this relationship more directly, Figure 2 displays correlation plots for the association between changes in income in 2007-2019 and changes in fertility in 2008-2020, using different measures of fertility. As expected, a positive correlation (r=0.422, t=2.327) is found between changes in income and changes in the period TFR in these 27 European countries. On average, a 10% increase in income is associated with an increase in the period TFR of 0.024 children per woman. Moreover, changes in income are also positively associated with changes in TFRp*, the TFR for women over 30, and TFRs for second and third and later births, whereas no significant associations are found between changes in income and the TFR at younger ages and for first births. These findings suggest that the association between income stagnation and declining fertility is driven not (only) by a postponement of first births to older ages, but by a decline in the period quantum of fertility, fertility of older women, and higher-order births.

These descriptive findings provide initial evidence for our hypothesis that income stagnation is an important driver behind the European fertility decline. In the next section, we discuss the results of within-between models that test this hypothesis more formally and control for potential alternative explanations.

Model results

Table 1 shows the results of within-between models that control for the unemployment rate, consumer confidence, the real house price index, the real rent price index, spending on family policies, and calendar year dummies. The different columns in Table 1 report results for models that use different measures of fertility as the dependent variable. Results for the period TFR show that the within-country effect of income is positive and statistically significant (b=0.242; z=2.652). This implies that increases in income are associated with increases in the period TFR (or, alternatively, with weaker declines in the TFR), even after adjusting for the control variables. Specifically, a 10% increase in income is associated with an increase in the period TFR of 0.023 children per woman. In

contrast, Table 1 shows that there is no between-country association between income and the period TFR. These findings confirm our expectation that it is relative changes in income rather than absolute levels that matter for fertility decisions.

To illustrate the substantive meaning of the within-country effect of income, we have calculated predicted period TFRs based on the within-country income effect and the calendar year coefficients in the first model in Table 1. We use our model to predict the trend in the period TFR given three hypothetical situations: (1) a stagnation of young adults' real incomes (similar to the situation observed in e.g. Norway and Spain); (2) an increase in income of 30% (similar to the situation observed in Czechia, Croatia, and Hungary); and (3) an increase in income of 60% (an increase that is close to that observed in the Baltic countries and a bit smaller than that observed in Poland). We assume that this income increase happened gradually over the 2007-2019 period. We also add predicted TFRs at the average observed income trend. For illustration purposes, we use the average TFR in 2008 across all countries in the model (1.62) as the starting point for all hypothetical income trajectories. The result of this exercise, depicted in Figure 3, shows that considerable differences exist in the predicted development in the period TFR depending on a country's income trajectory. In the situation in which incomes stagnated, the TFR declined strongly after 2014, in line with the trend in many countries in Northern, Western, and Southern Europe. However, the predicted decline in period TFR was much less pronounced for countries where the incomes of young adults increased by 30%, and our model predicts fertility to remain more or less stable in countries that saw a strong (60%) increase in income. These findings illustrate how the stagnation of income can explain a substantial part of the fertility decline in the 2010s, although the exact contribution of income trends to the fertility decline depends on which income trajectory is chosen as a realistic counterfactual.

Moreover, as these predictions are averaged across countries, they hide substantial cross-country variation in fertility trajectories and the extent to which they can be explained by income trends. To illustrate this, Figure 4 plots the predicted change in the period TFR based on the observed income trend in each country. Predictions are based on the within-country income effect and calendar year coefficients in the first model in Table 1. In addition, Figure 4 shows the observed change in the period TFR. Figure 4 shows that for some countries, such as Bulgaria, Italy, and Latvia, the predictions based on the income trends and our model results fit the observed trends in period TFR relatively well. In other countries, however, the TFR decline was much stronger than predicted by our model (e.g. in Finland, Ireland, and Norway), suggesting that other factors than income are needed to explain the fertility decline in these countries. In addition, several other countries witnessed a stable or increasing period TFR despite a stagnation or decline in incomes (e.g. Austria, Greece, Portugal), which also contradicts our predictions. These tend to be countries where the period TFR was already at relatively low levels in 2008, perhaps preventing it from dropping further.

The other columns in Table 1 report the association between income and the other fertility measures. It is found that within-country changes in income are also positively associated with changes in TFRp* (b=0.242; z=2.819), suggesting that income stagnation is associated not (only) with a postponement of births but also with a decline in the period quantum of fertility.[5] Further, increases

[5] As TFRp* is not available for several countries, fewer countries are included in the models that use TFRp* as dependent variable compared to the period TFR models. In an additional analysis, we estimated the period TFR models for the 15 countries that are included in the models of TFRp*, in order to be able to compare the

in income are associated with increases in the TFR of women aged 30 or older and in TFRs for second births and third and higher-order births. In contrast, within-country changes in income are not associated with changes in the TFR for younger women and in the TFR for first births.

Finally, the coefficients of the control variables in Table 1 shed some light on the other factors that were associated with (changes in) fertility during the 2007-2020 period. The unemployment rate was not associated with fertility in any of the models, although it should be noted that the unemployment rate had the expected negative within-country association with the period TFR before controlling for consumer confidence (see Table A2 in the Appendix). A positive within-country effect of consumer confidence was found for the period TFR, indicating that increases in consumer confidence are associated with increases in fertility, in line with previous evidence (Schneider, 2015; Comolli, 2017). However, consumer confidence has no effect on TFRp*, suggesting that consumer confidence is related mostly to the timing rather than the period quantum of fertility. Increases in real house prices are associated with increases in TFRp*, TFRs of younger women, and TFRs for first births, which is in line with previous research that has found that fertility increased in response to rising house prices, potentially as a result of rising home equity among homeowners (Dettling and Kearney, 2014; but see van Wijk, 2024a, for contrasting findings). In contrast, rising rent prices are associated with a decline in TFRp* and declines in higher-order births. This finding points to rising rent prices as another potentially important factor behind the decline in fertility in Europe in the 2010s. Finally, spending more on family policies is associated with a higher period TFR, both when modelling between-country differences and changes within countries over time, confirming previous evidence (Kalwij, 2010). However, family spending has no effect on TFRp*, suggesting it is mainly associated with (changes in) the timing of births.

Extension to the 2020-2023 period

Table 2 reports the results of within-between models that predict period TFRs for the 2020-2023 period. The within-country effect of income has turned negative and statistically insignificant in this period, suggesting that the relevance of income developments in explaining fertility trends has vanished in the most recent years. The other independent variables also show no significant associations with the period TFR in this most recent period, except for a negative between-country association between the unemployment rate and the period TFR. This could be interpreted as evidence that many of the established predictors of fertility trends have lost their predictive capacity in the post-2020 period, and other factors need to be included to explain fertility developments. However, it should also be noted that the model in Table 2 focuses on a relatively short time period, during which changes in the independent variables may reflect short-term fluctuations rather than more structural trends. Therefore, future research should examine whether this change in the predictors of fertility trends is a temporary distortion or whether it reflects more structural changes in the drivers of fertility behavior, a point to which we shall return in the Discussion section below.

coefficients. Results show a stronger positive within-country effect of income on the period TFR when selecting only these 15 countries (b=0.571; z=3.915). This largely seems to be a result of the exclusion of Greece, a country where incomes declined but the period TFR remained more or less stable (see Figure 1). These findings indicate that income effects on the period TFR are larger than on TFRp*, suggesting that both the tempo and the quantum of fertility are associated with changes in income.

Robustness check with earnings

The measure of income used in our main models captures the median equivalized household income of people aged 25 to 49. This is our preferred income measure as it should capture the income of young adults who are in their childbearing years relatively well. However, using total household income implies that our income measure is likely affected by processes of household formation and dissolution as well as (changes in) working hours, which introduces the risk that incomes are affected by (expected) fertility rather than vice versa. As a robustness check, we therefore reran our models in Table 1 and 2 while replacing the income variable with a measure of the average earnings of a full-time worker. This measure captures (changes in) wage levels in a country's full population of working age. Results of these models are shown in Table A3 (for births in 2008-2020) and Table A4 (for births in 2020-2023). The results show that changes in average earnings were strongly and positively associated with the period TFR in the 2008-2020 period, with a within-country effect that is more than twice as strong as in the main models. In line with the results for income, increases in average earnings are associated with increases in the TFR for women over 30, for second and higher-order births, and with TFRp*, although the latter effect is smaller and more uncertain in these models than in the models using median incomes (b=0.157; z=1.784). Moreover, in contrast to the results of the main models, increases in earnings are also associated with the TFR of women under 30 and with first births. Furthermore, Table A4 shows that average earnings have a positive but statistically insignificant within-country association with the period TFR in the 2020-2023 period. Thus, although the direction of the within-country association between income and the period TFR in the 2020-2023 period depends on what income measure is used, the association is insignificant in both specifications.

To conclude, this robustness check provides additional support for the conclusion that changes in incomes are positively associated with changes in fertility in the 2007-2020 period, although the size of the effect depends on the measure of income that is used. Moreover, changes in income are related to changes in both the tempo and the period quantum of childbearing, and findings show consistent positive within-country income effects on TFRs for older women and higher-order births. Finally, the lack of significant income effects after 2020 suggests that income had lost its relevance as predictor of fertility trends in the most recent period, although it should be noted that this period may be too short to draw any definitive conclusions.

Discussion

The incomes of young adults have stagnated throughout the 2010s in much of Northern, Western, and Southern Europe, putting pressure on the financial position of young adults (Hammer et al., 2022). At the same time, the incomes of young adults in many Central and Eastern European countries grew, often quite substantially. Our results suggest that these trends in income were closely associated with fertility trends: fertility dropped strongly in countries where the incomes of young adults stagnated or declined, while it remained stable or even increased in countries with substantial income growth among young adults. Moreover, we found evidence that the stagnation of income is associated not only with changes in the timing of births, but also with declines in the period quantum of fertility. More specifically, stagnating income was related to declines in fertility at older ages, higher parities, and to declining tempo- and parity-adjusted fertility. These findings suggest that

stagnating income affects not only the decision when to have children, but also decisions regarding the family size.

The strong and consistent positive country-level associations between income and fertility suggests that stagnating or falling income offers an important explanation for the decline in fertility that has been observed in much of Northern, Western, and Southern Europe during the 2010s. It is difficult, however, to quantify the extent to which stagnating income can explain the recent fertility trends. We have shown that the strength of the income-fertility association depends on the income measure used in the models. Furthermore, the estimated contribution of stagnating income to the fertility decline depends on which income trajectory is chosen as plausible counterfactual, i.e. which income trend is considered "normal". This choice can be based on different criteria, such as historical trends in income or income trends in other countries, and the criterium that is chosen inevitably influences one's conclusions. With these limitations in mind, Figure 3 provides an illustration of predicted fertility trends for hypothetical countries with different income trajectories, and suggests that differential income trends across countries can play a substantial role in explaining recent fertility trends.

The macro-level evidence in our study resonates with previous individual-level findings that have documented the growing relevance of income and economic situations and expectations more broadly to fertility decision-making (Alderotti et al., 2021; Hellstrand et al., 2024; van Wijk and Billari, 2024). Our findings demonstrate the importance of relative rather than absolute income levels in fertility outcomes, supporting theoretical arguments that stress the importance of achieving an income level that fulfils one's material aspirations or prerequisites for parenthood before family formation (Easterlin, 1976; van Wijk and Billari, 2024).

At the same time, our results indicate that the association between income and fertility disappeared after 2020, as fertility started to decline also in countries where young adults' income continued to grow (e.g. Estonia; Poland). This change in macro-level correlations may have resulted from the substantial societal upheaval in the post-2020 period in Europe, as brought about by – among others – the COVID-19 pandemic, rising inflation, and the war in Ukraine. This suggests that other factors than stagnating incomes need to be taken into account to explain the fertility decline in the most recent years. Indeed, recent research has found that the initial shock of the COVID-19 pandemic (Fallesen and Cozzani, 2023; Sobotka et al. 2024), the onset of COVID-19 vaccination programs (Bujard and Andersson, 2024; Winkler-Dworak et al., 2024b; Jasilioniene et al., 2025), inflation (Winkler-Dworak et al., 2024b), and concerns and uncertainty about the future (Comolli, 2023; Golovina and Jokela, 2024; Ivanova and Balbo, 2024) are associated with declining fertility. Future research needs to take up the question to what extent the unfolding of different events and uncertainties in recent years has produced a temporary disruption of long-term fertility trends and predictors, and to what extent more lasting downward shifts in fertility preferences and fertility level are taking place.

Future research should also pay more attention to the role of the housing market in explaining fertility trends across countries. The sharp rise in housing price and lack of affordable housing in many European societies, especially in larger cities, provides another potential structural explanation for the observed fertility decline in many high-income countries since the Great Recession (van Wijk, 2024a; OECD, 2024; Japaridze and Sayour, 2024). Our finding that rising rent prices are associated

with declines in fertility offers some additional evidence for this expectation (see also van Wijk, 2024a). However, the link between housing and fertility is more complex than sometimes assumed. For example, we found that rising house prices are associated with increases in fertility in some model specifications, which may be a reaction to increases in housing wealth among existing homeowners (Dettling and Kearney, 2014). It should be noted, however, that we were limited by the availability of indicators of housing affordability, which were indexed figures that do not capture absolute differences in housing affordability between countries. Moreover, the role of housing market developments in fertility decisions likely varies across countries, depending, for example, on the importance attached to homeownership (Mulder and Billari, 2010; Brauner-Otto, 2023).

Furthermore, future work needs to address the question to what extent the link between stagnating incomes and declining fertility is a causal one. Previous studies in the United States that use exogenous shocks to income show at least some evidence for a causal effect of income on fertility (e.g. Kearney and Wilson, 2018; Cowan and Douds, 2022), but we are not aware of any recent studies that examine the causal direction behind the relationship between income and fertility in Europe.

To conclude, we found convincing evidence that the stagnation of young adults' incomes in many European countries in the 2010s is linked to declines in both the tempo and quantum of fertility. These findings highlight the importance of broader economic and structural conditions faced by today's young adults in explaining the recent fertility shifts in high-income societies.

Appendix

Country-specific data sources

Data on fertility come mainly from the Human Fertility Database (HFD, 2025) or from Eurostat's database (Eurostat, 2025f) (data for Croatia, Estonia, Greece, Hungary, Latvia, Lithuania, Luxembourg, and Slovenia). Data for Czechia were updated using data from the Czech Statistical Office (2024). TFR and TFRp* come mainly from HFD, and were estimated using the variables and tables described in footnote 2. TFRp* was available for 16 countries, for a further 5 countries (Germany, Iceland, Italy, Poland, UK) the tempo-adjusted Bongaarts-Feeney TFR was also taken from HFD, or estimated by us using the TFR and mean age of mothers by birth order. Fertility indicators by birth order 2001-2008 for Germany come from Kreyenfeld et al. (2011).

Incomes in the United Kingdom in 2019, 2020, 2021, and 2022 were imputed using data from the Office for National Statistics' (2025) median equivalized disposable household income. We took the average change in incomes for people age 25 to 34 and people aged 35 to 44. Incomes are reported for two-year intervals, and we assigned each value to the second year of the interval. This choice is motivated by a test that showed that income trends that take the second year of the interval provided the best fit with the trends in the Eurostat data. For Croatia, incomes in 2007, 2008, and 2009 were imputed using data from the Croatian Bureau of Statistics' (2010; 2011) Statistical Yearbook on the total available income, which we adjusted for inflation (incomes in the UK were already adjusted for inflation). We then used the trend in incomes in the national databases to impute the incomes in the missing years for Croatia and the UK.

To impute the house price index in Czechia in 2007, we used data from the Czech Statistical Office's (2010) Public database on the purchase prices of family houses per cubic meter. Prices are reported

for three-year intervals, which we converted to annual data using the mid-point of each year (e.g. we measure house prices in 2007 by taking the value for the 2006-2008 period). To impute the house price index in Croatia in 2007, we used data from the Croatian Bureau of Statistics' (2010) Statistical Yearbook on the average price of a new dwelling per square meter. After adjusting for inflation using Eurostat's consumer price index, we used the trend in house prices in the national databases between 2007 and 2008 to impute the house price index for Croatia and Czechia in 2007.

Tables

Table A1: descriptive statistics for the country-years in the models, for the period 2007-2020.

	Mean	Standard deviation	Minimum	Maximum
Dependent variables				
Period TFR	1.571	0.202	1.180	2.059
(Parity- and) tempo-adjusted TFR[b]	1.731	0.189	1.371	2.125
TFR, under 30	0.720	0.144	0.378	1.031
TFR, over 30	0.848	0.155	0.505	1.286
TFR, first births	0.729	0.064	0.573	0.888
TFR, second births	0.551	0.073	0.387	0.732
TFR, third and later births	0.270	0.092	0.127	0.548
Independent variables				
Within-country variation				
Median income (logged)	0	0.106	-0.375	0.353
Unemployment rate	0	2.938	-10.914	9.108
Consumer confidence	0	9.769	-29.954	26.779
Real house price index	0	0.123	-0.239	0.334
Real rent price index	0	0.143	-0.499	0.593
Spending on family policies	0	0.303	-0.986	1.368
Between-country variation				
Median income (logged)	9.650	0.371	9.003	10.279
Unemployment rate	8.777	3.696	5.120	18.630
Consumer confidence	-11.911	11.401	-51.215	4.387
Spending on family policies	2.307	0.738	1.242	3.654

Table A2: coefficients and Z-scores of within-between models at the country level, for models that progressively add control variables. Dependent variable: period total fertility rate. 2007-2019 for independent variables, 2008-2020 for dependent variables.[a]

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
	b	z	b	z	b	z	b	z	b	z
Within-country effects										
Median income (logged)	0.322	6.364	0.241	4.028	0.208	3.360	0.319	4.455	0.242	2.652
Unemployment rate			-0.006	-2.506	-0.002	-0.599	0.000	-0.092	0.000	0.077
Consumer confidence					0.003	3.786	0.004	4.195	0.005	5.263
Real house price index							0.086	1.608	0.075	1.341
Real rent price index							-0.178	-2.858	-0.116	-1.642
Spending on family policies									0.074	3.499
Between-country effects										
Median income (logged)	0.198	2.436	0.140	1.513	0.097	0.974	0.097	0.921	0.081	0.808
Unemployment rate			-0.014	-1.310	-0.003	-0.245	-0.003	-0.232	0.006	0.477
Consumer confidence					0.005	1.122	0.005	1.061	0.003	0.829
Spending on family policies									0.117	2.085
Constant	-0.241	-0.307	0.410	0.437	0.762	0.776	0.733	0.706	0.525	0.540
Sqrt. of between-country variance	0.173		0.173		0.162		0.172		0.145	
Sqrt. of within-country variance	0.089		0.088		0.081		0.080		0.080	
N observations	351		351		299		299		273	
N countries	27		27		23		23		21	

[a] All models control for calendar year dummies.

Table A3: coefficients and Z-scores of within-between models at the country level. Each model has a different version of the total fertility rate as the dependent variable. The income variable captures average net earnings. 2007-2019 for independent variables, 2008-2020 for dependent variables.[a]

Dependent variable	**Period TFR**		**TFRp***		**TFR, under 30**		**TFR, over 30**		**TFR, first births**		**TFR, second births**		**TFR, third and later births**	
	b	z	b	z	b	z	b	z	b	z	b	z	b	z
Within-country effects														
Average earnings (logged)	0.638	6.080	0.157	1.784	0.278	4.800	0.354	6.060	0.179	3.419	0.227	5.724	0.192	7.056
Unemployment rate	0.001	0.159	-0.003	-1.210	0.000	-0.045	0.000	0.276	0.001	0.324	0.000	0.286	-0.001	-0.793
Consumer confidence	0.004	4.497	0.000	0.526	0.003	5.050	0.002	3.880	0.002	3.874	0.002	4.704	0.001	3.717
Real house price index	0.122	2.304	0.106	2.676	0.086	2.924	0.068	2.305	0.099	3.704	0.026	1.286	0.021	1.534
Real rent price index	-0.224	-3.478	-0.085	-1.543	-0.181	-5.111	-0.106	-2.947	-0.055	-1.696	-0.130	-5.307	-0.086	-5.147
Spending on family policies	0.043	2.140	0.016	1.046	0.010	0.943	0.035	3.137	0.002	0.239	0.014	1.849	0.032	6.225
Between-country effects														
Average earnings (logged)	0.068	0.755	0.071	0.439	-0.188	-3.310	0.266	4.714	0.036	1.628	0.012	0.332	0.013	0.271
Unemployment rate	0.005	0.404	0.001	0.060	-0.005	-0.589	0.009	1.183	-0.003	-1.045	0.002	0.442	0.003	0.544
Consumer confidence	0.004	0.897	0.007	0.772	0.002	0.924	0.001	0.300	0.000	0.057	0.002	1.456	0.002	0.787
Spending on family policies	0.119	2.117	0.106	1.339	0.073	2.089	0.049	1.416	0.008	0.601	0.023	1.050	0.063	2.088
Constant	0.631	0.709	0.849	0.514	2.523	4.530	-2.013	-3.640	0.401	1.833	0.377	1.088	-0.014	-0.029
Sqrt. of between-country variance	0.147		0.191		0.092		0.091		0.034		0.056		0.078	
Sqrt. of within-country variance	0.076		0.050		0.042		0.042		0.037		0.028		0.020	
N observations	273		195		273		273		260		260		260	
N countries	21		15		21		21		20		20		20	

[a] All models control for calendar year dummies.

Table A4: coefficients and Z-scores of within-between model at the country level. Dependent variable: period total fertility rate. The income variable captures average net earnings. 2019-2022 for independent variables, 2020-2023 for the dependent variable.[a]

	b	Z
Within-country effects		
Average earnings (logged)	0.286	1.581
Unemployment rate	-0.012	-1.156
Consumer confidence	0.002	1.231
Real house price index	-0.172	-1.074
Real rent price index	-0.111	-0.634
Between-country effects		
Average earnings (logged)	0.021	0.190
Unemployment rate	-0.027	-2.409
Consumer confidence	-0.004	-0.787
Constant	1.409	1.265
Sqrt. of between-country variance	0.145	
Sqrt. of within-country variance	0.051	
N observations	92	
N countries	23	

[a] All models control for calendar year dummies.

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Tables

Table 1: coefficients and Z-scores of within-between models at the country level. Each model has a different version of the total fertility rate as the dependent variable. 2007-2019 for independent variables, 2008-2020 for dependent variables.[a]

Dependent variable	**Period TFR**		**TFRp***		**TFR, under 30**		**TFR, over 30**		**TFR, first births**		**TFR, second births**		**TFR, third and later births**	
	b	z	b	z	b	z	b	z	b	z	b	z	b	z
Within-country effects														
Median income (logged)	0.242	2.652	0.242	2.819	0.069	1.403	0.158	3.144	0.025	0.552	0.093	2.703	0.117	5.034
Unemployment rate	0.000	0.077	0.000	-0.111	-0.001	-0.486	0.001	0.436	-0.001	-0.308	0.000	0.283	0.000	0.318
Consumer confidence	0.005	5.263	0.001	1.154	0.003	5.519	0.003	4.828	0.002	4.168	0.002	5.453	0.001	5.110
Real house price index	0.075	1.341	0.110	2.827	0.061	1.999	0.045	1.456	0.080	2.944	0.010	0.472	0.012	0.876
Real rent price index	-0.116	-1.642	-0.137	-2.341	-0.118	-3.072	-0.057	-1.460	-0.005	-0.134	-0.096	-3.557	-0.076	-4.164
Spending on family policies	0.074	3.499	0.004	0.267	0.028	2.419	0.050	4.283	0.016	1.510	0.024	3.026	0.037	6.802
Between-country effects														
Median income (logged)	0.081	0.808	0.078	0.462	-0.198	-2.954	0.288	4.077	0.051	2.177	0.016	0.413	-0.001	-0.010
Unemployment rate	0.006	0.477	0.001	0.072	-0.007	-0.819	0.012	1.414	-0.003	-0.931	0.002	0.471	0.004	0.503
Consumer confidence	0.003	0.829	0.007	0.736	0.003	1.070	0.000	-0.029	0.000	-0.171	0.002	1.378	0.002	0.747
Spending on family policies	0.117	2.085	0.104	1.340	0.076	2.049	0.044	1.125	0.006	0.476	0.023	1.002	0.064	1.945
Constant	0.525	0.540	0.800	0.478	2.608	4.019	-2.197	-3.212	0.264	1.159	0.335	0.862	0.118	0.207
Sqrt. of between-country variance	0.145		0.187		0.097		0.103		0.032		0.057		0.085	
Sqrt. of within-country variance	0.080		0.049		0.044		0.044		0.038		0.030		0.021	
N observations	273		195		273		273		260		260		260	
N countries	21		15		21		21		20		20		20	

[a] All models control for calendar year dummies.

Table 2: coefficients and Z-scores of within-between model at the country level. Dependent variable: period total fertility rate. 2019-2022 for independent variables, 2020-2023 for dependent variable.[a]

	b	Z
Within-country effects		
Median income (logged)	-0.367	-1.768
Unemployment rate	-0.014	-1.272
Consumer confidence	0.002	1.102
Real house price index	-0.098	-0.587
Real rent price index	0.001	0.007
Between-country effects		
Median income (logged)	0.041	0.348
Unemployment rate	-0.027	-2.498
Consumer confidence	-0.005	-0.868
Constant	1.218	1.035
Sqrt. of between-country variance	0.140	
Sqrt. of within-country variance	0.051	
N observations	92	
N countries	23	

[a] All models control for calendar year dummies.

Figures

Figure 1: trends in income, period TFR, and TFRp* in 2007-2019.

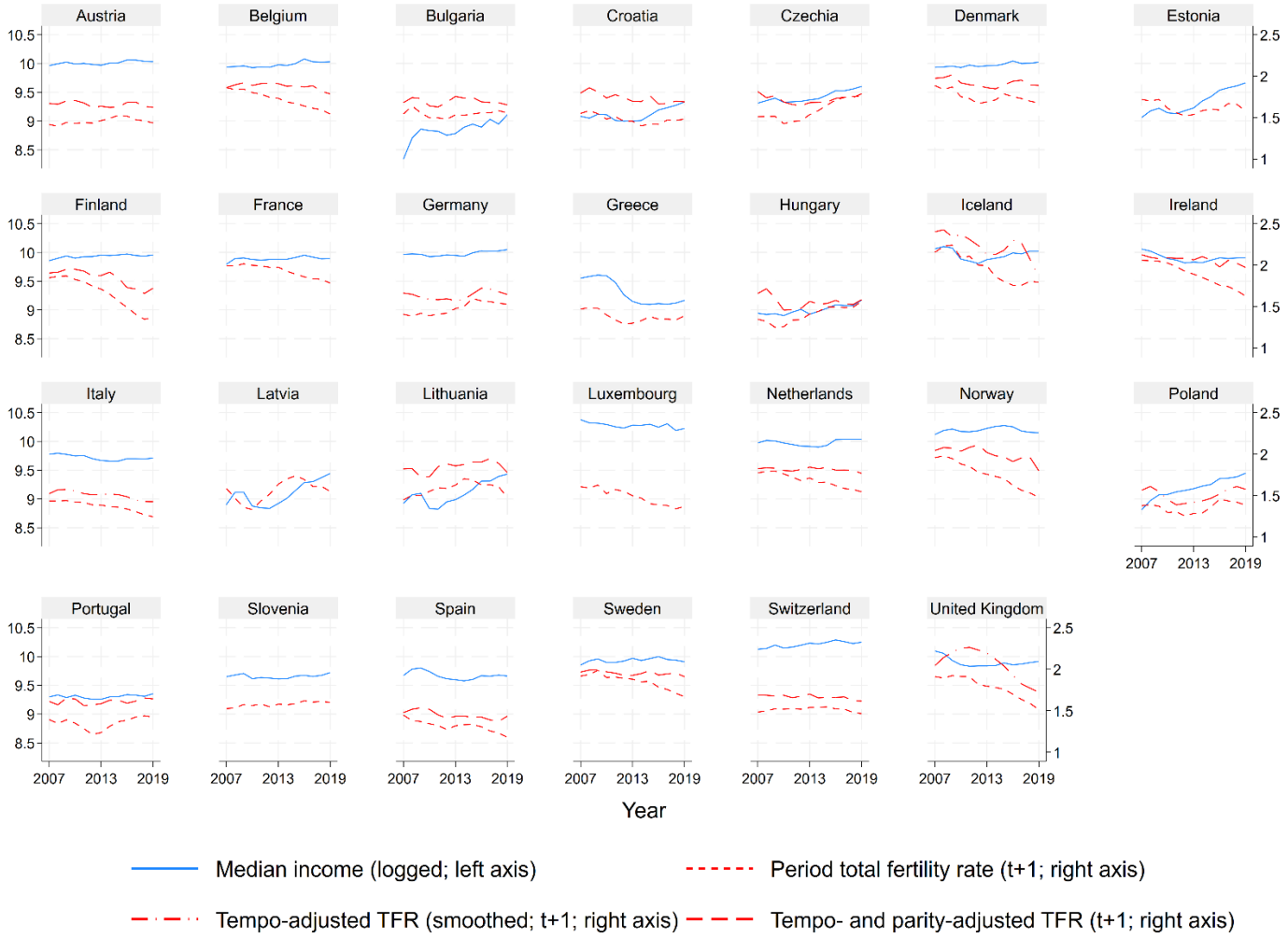

Figure 2: correlation between the relative change in income between 2007 and 2019 and the change in different fertility measures between 2008 and 2020.

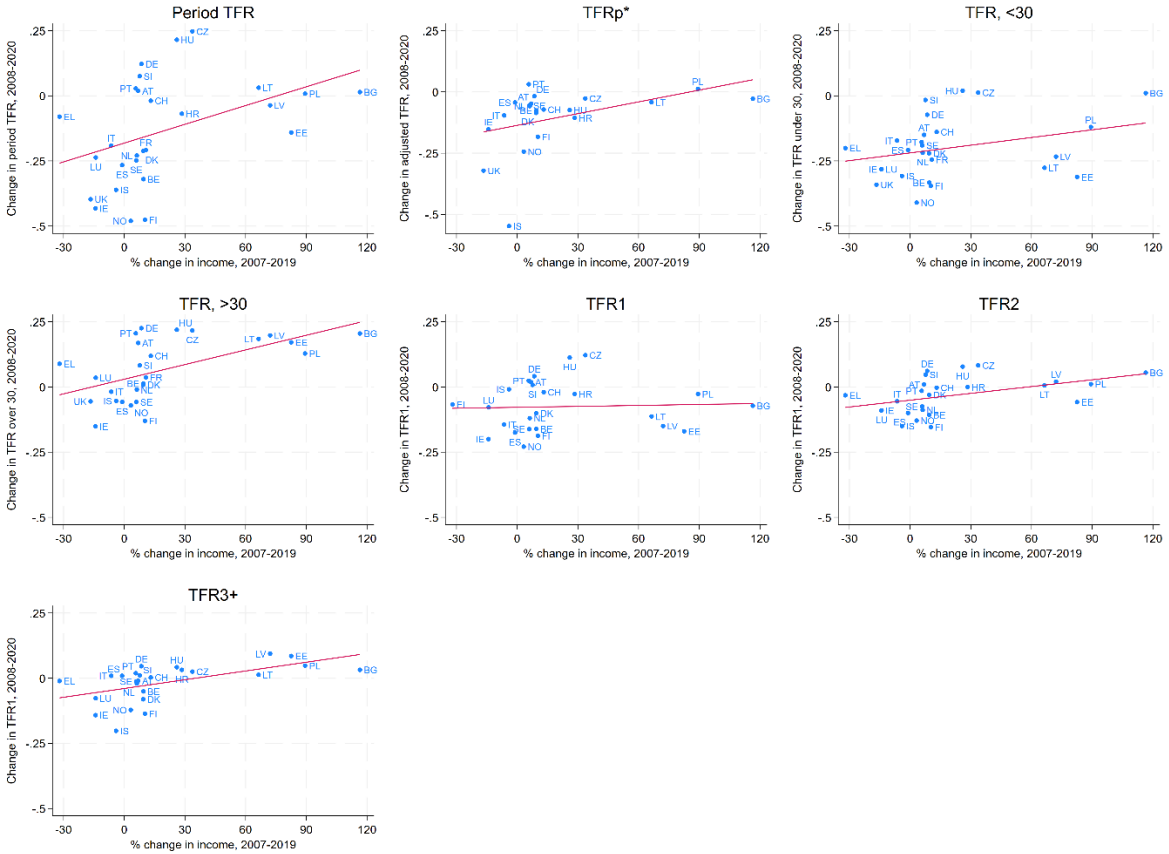

Figure 3: predicted period total fertility rates for countries with different income trajectories.

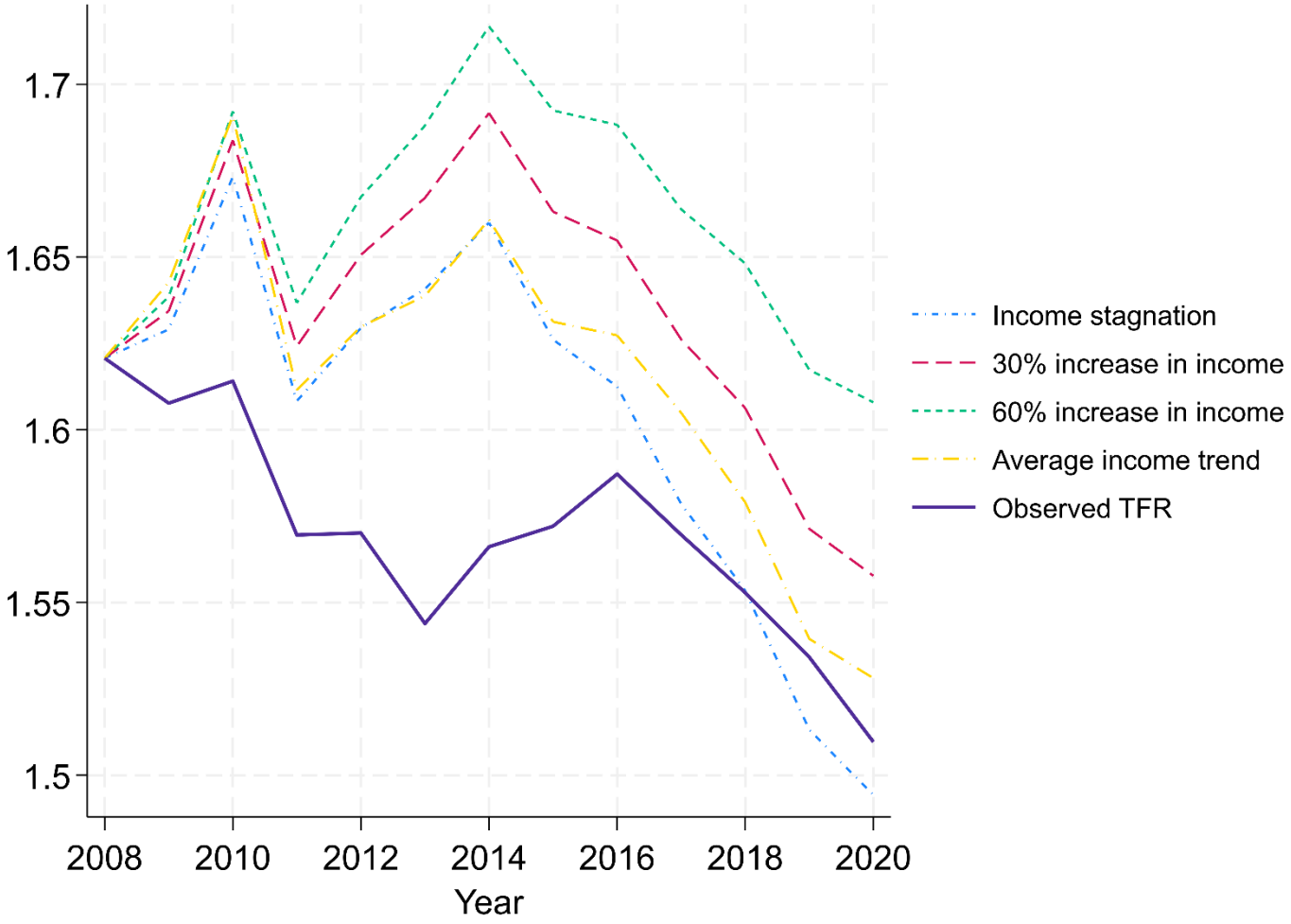

Figure 4: Predicted and observed changes in the period total fertility rate by country, 2008-2020. Predictions are based on observed income trajectories and the calendar year effects and the within-country income effect in the first model in Table 1.