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Fertility, Employment, and Family Policy

A cross-country panel analysis

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Abstract

This paper analyses the association of labour market outcomes and family policies with fertility trends between 2002 and 2019 in 26 OECD countries. While the average age of mothers at birth of their children continued to increase over the entire period, these years have been marked by an initial catching-up of total fertility rates after marked declines in previous decades. Furthermore, after peaking in 2008, total fertility rates declined substantially, fuelling concerns about long-term demographic, economic and fiscal implications. Using panel data models and building on prior work, this paper links these changes in fertility outcomes to changes in the labour market position of men and women of childbearing age as well as with changes in family policy provisions, such as parental leaves, early childhood education and care, and universal family allowances. Additional models further explore the associations at different birth parities, potential changes in fertility drivers after the 2008 financial crisis and the importance of changes in household consumption expenditure, particularly housing, for fertility outcomes. This paper provides insights into the complex dynamics between family policies, including through tax/benefit systems, labour markets, housing costs and fertility trends, shedding light on the factors influencing overall population dynamics in OECD countries.

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1 Introduction and main findings

1. The average total fertility rate (TFR) across OECD countries has been declining - largely steadily since records began in 1960. However, after 2002 fertility rates briefly recovered, with the TFR rising from 1.65 to 1.76 children per women by 2008, only to resume a continuous downward trend, reaching a level of 1.59 children per woman in 2020. Today, OECD countries exhibit the lowest ever recorded TFR, which is now far below the "replacement level" of 2.1 children per woman. At the same time, women have their children increasingly later in life, with the average childbearing age rising from 29 to 31 years between 2002 and 2020. Such developments do not only matter for demographic dynamics, but also for future economic growth and public finances (see e.g. OECD (2023[1]) and Ziemann (2015[2])).

2. These fertility trends have concurred with major economic and social developments on OECD countries, some of which may have been one of the driving factors behind the changes in fertility behaviour. For example, increasing educational attainment among women, growing autonomy and agency in family planning may partially account for declining fertility and advancing of maternal age. The male breadwinner model is no longer the prevailing pattern in many countries and a growing prevalence of dual-earner households, and the expansion of public family supports may have helped to sustain fertility rates in recent decades. At the same time, recent years have been marked by a rapid rise in housing cost, which can lead to financial uncertainty that may depress fertility. External economic shocks can also play a role and the change in fertility trends that occurred in 2008, may suggest that the global financial crisis (GFC) may have played a role in these fertility trends too.

3. Following earlier approaches - amongst others in Ahn and Mira (2002[3]), d'Addio and Mira d'Ercole (2005[4]), Luci-Greulich and Thévenon (2013[5]), Adema, Ali and Thévenon (2014[6]) and OECD (2019[7]) - this paper assesses the role of family polices and aggregate labour market outcomes of men and women for recent trends in fertility in 25 OECD countries between 2002 and 2019 using panel data models. In particular, this paper employs a two-way-fixed-effects model controlling for time-invariant and unobserved heterogeneity between included countries as well as for linear within-country time trends and common temporal shocks to fertility outcomes. As such, the model measures the association between the independent regressors and the changes in fertility outcomes across countries after accounting for within country trends in the outcomes. This paper also considers the mean age of childbearing among mothers (MAB) as an outcome variable of interest.

4. The main focus of the analysis concerns how labour market outcomes and family policies, such as parental leaves and early childhood education and care (ECEC) systems, affect fertility trends. Stable employment is an important determinant of fertility - particularly for women (Greulich, Thévenon and Guergoat-Larivière, 2016[8]) – but it also creates considerable opportunity costs when becoming a parent (Bergsvik, Fauske and Hart, 2021[9]). Family policies are designed to support parents in bringing up a child, but often also to help them combine parental responsibilities with labour market careers, which is another key determinant of fertility behaviours (Doepke et al., 2022[10]).

5. The results of the baseline regression are presented in Table 1, but additional models also included in this paper aim to ascertain the associations between labour market outcomes and family policies across different birth parities, as well as potential changes in associations after the GFC, the role of employment security and the importance of changes in household consumption expenditure, particularly on housing, for fertility outcomes. The main findings of this paper include:

- Family policy and labour market outcomes remain an important factor for fertility outcomes. For example, changes in public expenditure on parental leave are associated with positive changes in the TFR and negative changes in the MAB. However, the magnitude of this association is relatively small. Prior to 2008, changes in public expenditure on parental leave were not related to changes in the TFR, but they have become the associations from 2008 onwards has become relatively strong and significant. Public expenditure on parental leave is also not significant for the first birth but becomes particularly important for second and third births. The length of parental leaves available to mothers appears to be weakly associated with changes in the TFR and not important for birth timing.
- Increasing public expenditure on ECEC has a significant and positive association with changes in the TFR, albeit of a relatively weak magnitude. This association is relatively strong before 2008, but it loses significance afterwards. In contrast to other related papers in the literature, we do not find that ECEC-enrolment rates are strongly associated with changes in the TFR or MAB in any of the regressions.

Table 1. Regression summary

Summary table for the main baseline two-way fixed-effects model with linear country time trends and panel-corrected standard errors, 26 OECD countries, 2002 to 2019

	LN (TFR)	LN (MAB)
Baseline regression:		
Public spending on parental leaves per child aged 0-5	+ ***	…
Public spending on ECEC per child aged 0-5	+ ***	- ***
Public spending on family allowances per child aged 0-17	+ **	- **
ECEC enrolment rate 0-2 years	…	…
ECEC enrolment rate 3-5 years	…	…
Weeks of paid leave available to mothers	+ **	…
Weeks of paid and earmarked leave for fathers	…	- *
Employment rate of women	+ ***	- **
Employment rate of men	+ **	…
Share of part-time employees among women	…	…
Hours worked by women in full-time jobs	…	…
Hours worked by men in full-time jobs	…	…
Selected coefficients from three separate supplementary regressions: *		
Private expenditure towards housing	- ***	+ ***
Unemployment rate	- ***	…
Employment protection	…	- **

Note: The table presents coefficient sign and significance level for significant coefficient estimates in the main baseline model of this paper (see Table 4 and Table 5) as well as selected coefficients from three separate regression (Annex Table 5.B.4 as well as Annex Table 5.B.9 and Annex Table 5.B.10). All specifications are a two-way fixed-effects model with linear country time trends and controls for average years of schooling and log GDP. It is estimated over the period 2002 to 2019 using country-level data from Austria, Canada, the Czech Republic, Denmark, Finland, Germany, Hungary, Italy, Korea, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models). ***, ** and * represent significance at 1%, 5% and 10% level, respectively. + stand for a positive sign of a significant point estimate and – stands for a negative sign.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.·

- In terms of labour market outcomes, changes in male and female employment rates appear to have important associations with fertility outcomes. The coefficient on women's employment rates is over two times larger than that for men's employment rates, indicating the important role of

women's employment in co-determining fertility trends. At the same time, the MAB appears to fall with greater employment rates among women. Full-time working hours and the incidence of part-time employment among women do not appear to have a significant bearing on fertility outcomes.

- Looking at a longer horizon in a separate regression, this paper confirms previous findings that the association between female employment and fertility changed over the 1980s, when increasing employment rates among women were no longer linked to lower fertility outcomes, but instead led to a higher TFR.
- A supplementary analysis shows that while increased employment protection isn't significantly related to changes in the TFR, but it does reduce the MAB, suggesting its importance for fertility timing, while its effect on fertility quantum is uncertain. A rise in unemployment rates negatively correlates with changes in the TFR, emphasizing the significance of financial security in childbearing decisions.
- Regression models that additionally account for changes in household consumption expenditure find that increasing spending on housing has a negative and significant link to TFRs, whereas increasing expenditure on food and clothing has a positive and significant link. By decreasing the MAB, changes in the expenditure on health are the only expenditure category linked to the age of mothers at births.
- Despite the importance of family policy and labour market outcomes, much of the fertility trends between 2002 and 2019 are determined by unobserved heterogeneity between countries as well as distinct temporal trends that affect fertility in each country. Among others (e.g., fertility drivers that are not included here), this may be attributable to differences in social norms around family formation and changes in attitudes towards childbearing over time that cannot be directly linked to changes in family policy and the labour market.

2 Data and trends

6. This paper analyses recent trends in fertility rates between 2002 and 2019 in OECD countries. The data for this analysis is obtained from various OECD databases as well as external sources (see below). As some variables have a noticeable degree of missing observations for some countries, and/or some countries are outliers at different stages of their demographic development, some countries were dropped from the analysis sample. Countries that became OECD members from 2010 and onwards are not included (Chile, Costa Rica, Colombia, Estonia, Israel, Latvia, Lithuania, and Slovenia), as well as some other countries that are outliers in terms of their fertility rates (Mexico and Türkiye). Iceland and Japan are excluded from the analysis for the lack of one of the exogenous variables described in detail below. Data for the remaining 26 OECD countries were included in the analysis: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

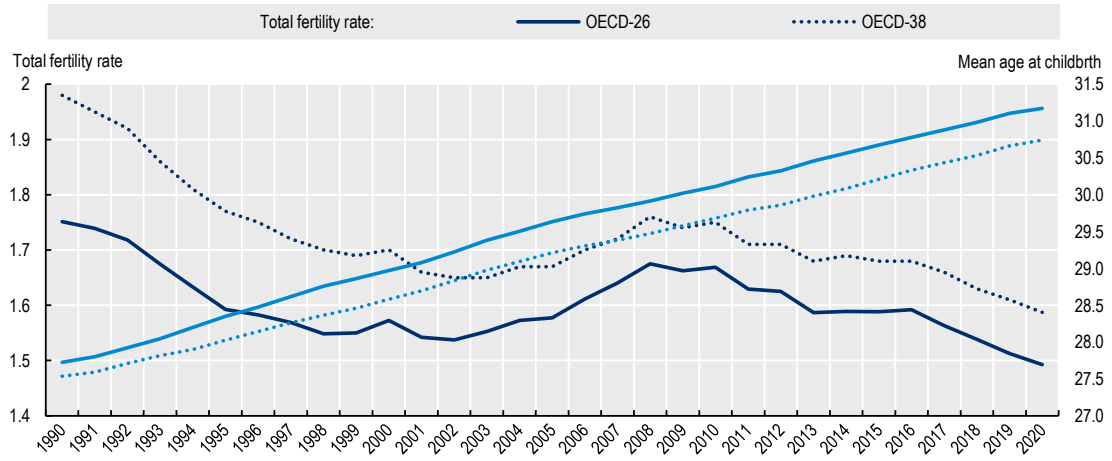
7. The main outcome measures of this working paper are the *Total Fertility Rate* (TFR) and the *Mother's Mean Age at Birth of their Children* (MAB), both obtained from the OECD Family Database. The TFR represents the expected number of children a woman would have, based on the age-specific fertility rates of a given year. The MAB for a given year is defined the average age of women giving birth in that year. Both these measures provide an overview of birth patterns, capturing differences in when and how often women have children, making them valuable for studying changes in fertility over time.

8. The period between 2002 and 2019 is particularly suited for an analysis of factors affecting fertility trends. Prior to 2002, the average TFR across the 26 analysed countries was already on a long-term downward trajectory, culminating in an average TFR of 1.54 children per women in 2002. However, the preceding years, for which no sufficient data on exogenous variables in the analysis is available, were marked by a postponement of first births, leading to a fertility rebound in the 2000s that culminated in a peak TFR of 1.68 in 2008 (see e.g. Burkimsher (2015[11]) and Beaujouan (2020[12])). The following years saw a new decline in the average TFR, falling to a new all-time low of 1.51 by 2019 (Figure 1). At the same time, the mean childbearing age of mother's increased monotonously over the entire period, rising from 29.23 in 2002, to 31.10 in 2019. These trends have not subsided, with the TFR declining further beyond 2019, while the MAB continued to increase, though a lack of sufficient data prohibits an inclusion of these years in the regression analysis. Broadly, the fertility trends among included countries are in line with the trends among all OECD countries, even though OECD-38 average for TFRs is larger than for the selected countries (mainly for the exclusion of fertility outliers), while the MAB is among included countries is larger than for the OECD-38 average (Figure 1).

9. To analyse the potential drivers underlying declining fertility rates among OECD countries in recent years, this paper considers family policy measures and labour market outcomes as exogenous variables in the regression analysis. Both family policies and labour market outcomes have been identified as important drivers of fertility outcomes in past research on OECD countries, among others, see e.g., Ahn and Mira (2002[3]), d'Addio and Mira d'Ercole (2005[4]), Luci-Greulich and Thévenon (2013[5]), Adema, Ali and Thévenon (2014[6]) and OECD (2019[7]).

Figure 1. Simultaneous trends of fewer and later births

Total fertility rate (left axis) and mother's mean age at childbirth (right axis), 1990 to 2020, OECD average*



Note: The total fertility rate in a specific year is defined as the total number of children that would be born to each woman if she were to live to the end of her child-bearing years and give birth to children in alignment with the prevailing age-specific fertility rates. OECD averages are unweighted averages. The OECD-25 average includes Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States.
Source: OECD Family Database

10. The inclusion of family policy variables in the analysis is motivated by the fact that family policies have been identified to influence fertility decisions by affecting the costs and benefits of childbearing and childrearing (Bergsvik, Fauske and Hart, 2021[9]). For example, public expenditure on childcare, parental leaves, and family allowances can reduce the direct costs of having children – which can raise fertility rates - while parental leave entitlements for both mothers and fathers as well as investment in childcare can promote more gender equality in the care for children at home – which has also been found to influence fertility intentions (see e.g. Raybould and Sear (2020[13]), Doepke and Kindermann (2019[14]), Neyer, Lappegård and Vignoli (2013[15])). Public investment in ECEC is also important in facilitating parents' participation in the labour market (see e.g. Bergsvik, Fauske and Hart (2021[9]), Gray et al. (2022[16])). For this reason, the main analysis considers three different types of public expenditure, all expressed in USD PPP - public expenditure on ECEC per child under age three, public expenditure on parental leaves per child under age three and public expenditure on family allowances per child under age of 18 – all calculated from the OECD Social Expenditure Database and the UN World Population Prospects. In addition, the panel includes information from the OECD Family Database: paid parental leave entitlements for mothers and fathers in weeks (including maternity and paternity leaves, but excluding homecare leave entitlements[1]) and enrolment rates for 0–2-year- and 3-5-year-olds in early childhood education and care.

11. Labour market outcomes are included because they reflect the economic opportunities and constraints that prospective parents face which can affect their decisions regarding family formation (Doepke et al., 2022[10]). At the same time, previous research has also identified the importance of employment security for fertility behaviours – especially around times of economic crisis (Bastianelli, Guetto and Vignoli, 2023[17]; OECD, 2019[7]; Luci-Greulich and Thévenon, 2013[5]). While ideally, a broader

[1] Paid homecare leave entitlements are an exception in OECD countries and are comparatively low paid. Over the analysis period, they have only been granted in Finland, Hungary and Norway between 2002 and 2019 among countries included in this paper (OECD Family Database).

spectrum of labour market and employment security outcomes would be incorporated into the analysis, this could pose a risk of multicollinearity and/or overfitting, leading to potentially biased results.

12. In this paper, we have therefore opted to mainly focus on the extensive and intensive margin of labour market engagement as the most tangible labour market outcome directly affecting the of opportunity costs of parenthood. For this reason, the analysis includes employment rates for men and women, the share of part-time employees among women as well as the average usual full-time working hours of men and women – all obtained from the OECD Employment Database for the age group of 25- to 54-year-olds and excluding Japan for a lack of comparable data on average usual working hours in full-time employment. Nonetheless, given the potential significance of employment security, we have included supplementary analyses considering such factors, leaving a more thorough exploration for future research.

13. In addition, the analysis controls for the average years of schooling of men and women, as educational attainment can be an important factor in the postponement of having children and fertility rates in general (see e.g. Nitsche et al. (2018[18])). These data for women and men aged 25 and above are obtained from the UNESCO UIS Database. Because no sufficient data on average years of schooling is available for the analysis period, Iceland is excluded from the regressions. GDP per capita (expressed in log terms as well as squared log terms, following Thévenon and Luci (2013[19]) to control for potential non-linearity in the association between economic output and fertility) from the OECD National Accounts is included to account for economic fluctuations that may affect fertility outcomes. There are a number of other labour market factors that may affect childbearing, that are not covered in the present analysis (e.g., lack of sufficient data, overfitting and/or potential multicollinearity).

14. Changes in recent fertility trends have also been linked to change in the direct and indirect costs of parenthood, as potential parents find it harder to stem the costs of having children or are unwilling to face the potential labour market opportunity costs parenthood might entail (Doepke et al., 2022[10]; Egger and Radulescu, 2012[20]). Following D'Addio and Mira d'Ercole (2005[21]), the costs of parenthood in relation to taxes and benefits are approximated using the OECD Tax and Benefit Model. This model simulates net equivalised household incomes (equivalised using square root of family size) for families in different labour-market situations accounting for family benefits, in-work benefits, social assistance and housing benefits as well as income taxes and social security contributions.

- The *direct costs of parenthood* proxy the changes in net equivalised household income of parents relative to similar households of non-parents. This is approximated as the difference in net equivalised household incomes for a two-earner couple without children and a two-earner couple with two children (2 & 3 years old). In both cases, the first adult earns two-thirds of the national average wage at full time, while the second adult earns two-thirds of the national average wage at 50% of full time. This measure is expressed relative to the national average wage.
- The *indirect costs of parenthood* proxy the potential opportunity costs of parenthood when one parent leaves the labour market. This is approximated as the difference in net equivalised household incomes between different couple households without children. In the first household, both partners are employed with one adult earning the national average wage, while the second adult earns two-thirds of the national average wage. In the second households, only the first parent is employed and earns the national average wage. This measure is expressed relative to the national average wage.

15. These measures are incomplete and only roughly approximate direct and indirect costs of parenthood using model households that may not necessarily reflect the actual monetary costs parents face (e.g. for food and clothing), nor the opportunity costs they are subject to on the labour market (e.g. wages). For example, while the OECD Tax and Benefit Model also models out-of-pocket cost of childcare, it does so only for some of the years of interest, which is why this cost factor is excluded from the measure. In addition, where several sub-national jurisdictions have authority over aspects of the Tax-Benefit system, the calculations on net equivalised household incomes seek to approximate typical settings in each country

(OECD, 2022[22]). For these reasons, direct and indirect costs are not included in the baseline analysis, and only used to supplement and explain the main findings.

Table 2. Summary statistics

Summary statistics for 25 OECD countries, 2002–2019

	Mean	Std. Dev.	Min	Max	N
Total fertility rate	1.60	0.25	0.92	2.19	468
Mean age at childbirth	30.09	1.24	26.30	33.00	468
Public spending on parental leaves (USD PPP per child aged 0-5)	1785.35	1797.64	0.00	9651.01	467
Public spending on ECEC (USD PPP per child aged 0-5)	3914.53	3180.08	0.00	14782.91	468
Public spending on family allowances (USD PPP per child aged 0-17)	1992.70	2013.65	1.54	11987.12	468
Weeks of paid maternity and parental leave available to mothers	47.71	41.62	0.00	214.00	468
Weeks of paid paternity and earmarked parental leave for fathers	7.03	11.73	0.00	54.00	468
ECEC enrolment rate 0-2 years (%)	32.18	17.55	0.00	67.00	332
ECEC enrolment rate 3-5 years (%)	81.84	16.86	33.15	100.10	401
Employment rate of women	72.53	7.15	51.36	84.22	468
Employment rate of men	86.08	4.17	70.44	95.29	468
Share of part-time employees among women	22.47	13.30	1.97	58.11	468
Hours worked by women in full-time jobs	39.87	2.24	36.22	52.75	465
Hours worked by men in full-time jobs	42.95	2.32	39.24	54.94	465
Average years of schooling among women aged 25+	11.68	1.51	6.83	13.80	270
Average years of schooling among men aged 25+	12.00	1.49	7.11	14.52	270
Log GDP per capita	10.46	0.58	8.91	11.63	468
Direct costs of parenthood (relative to average wage)	0.12	0.03	-0.02	0.19	468
Indirect costs of parenthood (relative to average wage)	0.34	0.04	0.23	0.44	468

Source: OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Model, and UN World Population Prospects.

16. Table 2 displays summary statistics for the main dependent and independent variables included in the analysis. As evident in the table and Annex Figure 5.B.1, most data that enter the regression are generally widely available for the included countries, particularly for those that are based on labour force surveys. However, there is a substantial degree of missing data for ECEC enrolment rates among 0- to 2 and 3- to 5-year-olds, as well as for the average years of schooling of men and women, which are important control variables. To address these issues, missing data on ECEC enrolment rates and average years of schooling are imputed using a multiple imputation approach (e.g., van Buuren (2018[23])). Table 3 shows that there are only small differences in the summary statistics of the datasets with imputed observations and the one which only includes the observed data. Nevertheless, all results that include the imputed data must be regarded with the necessary caution. More detail on the imputation approach is available in Annex 5.A.

Table 3. Comparison of non-imputed and imputed variables

	Non-imputed		Imputed	
	Mean	Std. Dev.	Mean	Std. Dev.
ECEC enrolment rate 0-2 years	32.18	17.55	31.23	16.91
ECEC enrolment rate 3-5 years	81.84	16.86	80.58	17.64
Average years of schooling among women aged 25+	11.68	1.51	11.70	1.39
Average years of schooling among men aged 25+	12.00	1.49	12.00	1.35

Source: OECD calculations based on OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and UN World Population Prospects.

3 Empirical specification

17. The analysis focuses on the link between changes in fertility outcomes and changes in family policy and/or labour market variables. As the data are a panel with multiple annual observations for several countries, a few methodological challenges arise. First and foremost, the panel only includes annual aggregate observations for each included country and does not allow for the inclusion of individual level fertility choices following changes in policy or individual labour market outcomes. Thus, all results only estimate the link between national fertility outcomes and changes in aggregate policy and labour market indicators. It may well be that changes in labour market status affect individuals in a given country differently. For example, entering the labour force may make it easier for some to afford parenthood, while others may find the prospect of dual family and labour market commitments impossible to manage.

18. Further, the panel has no information on time-invariant country-specific factors that could theoretically affect fertility outcomes, such as strongly embedded and persistent cultural factors and social norms. At the same time, there can be general country-specific trends in the outcome variable as well as in policies, cultural factors and social norms over time. For example, it is not unreasonable to assume that attitudes towards parenthood which affect fertility outcomes have changed over time without necessarily being driven by changes in family policy or labour market outcomes. In addition, temporary shocks may also have affected fertility outcomes, such as the effects of the 2007–2008 financial crisis.

19. To account for these methodological challenges, the main empirical specification is based on a two-way fixed-effects model, including country fixed-effects (α_i) to capture time-invariant country level unobservables and year fixed effects (δ_t) to account for temporal shocks that may affect fertility in a similar manner across countries. Separate linear trends for each country ($t \cdot \mu_i$) aim to capture heterogenous underlying trends that have an influence on fertility outcomes. A Hausman test (p = 0.000) confirms that the hypothesis of random effects does not hold in the data (Hausman, 1978[24]). Moreover, in a Lagrange Multiplier Test for unbalanced panels (p = 0.000), country and year fixed effects are significant (Baltagi and Li, 1991[25]). Both tests suggest that a fixed-effects approach is indeed preferable to a random-effects or a pooled-OLS model. The baseline empirical specification that estimates the effect of changes in family policy and labour market outcomes (X_{it}) on changes in fertility outcomes (Y_{it}) is then:

$$Y_{it} = \alpha_i + \beta X_{it-1} + \delta_t + \mu_i \cdot t + \epsilon_{it}$$

where i is the respective country and t the respective year. Explanatory variables X_{it} on the right-hand side of the equation are lagged by one year to avoid contemporaneous reverse causality and to account for the temporal difference in fertility decisions and fertility outcomes. It is, for example, likely to assume that policy and labour market outcomes in year t are more important for fertility outcomes in year $t+1$ than for year t. The lagged explanatory variable approach can be a good way to deal with contemporaneous reverse causality and endogeneity if there is no unobserved confounding (Bellemare, Masaki and Pepinsky, 2017[26]). As it is impossible to test for unobserved confounding, results with non-lagged exogenous variables are reported in the Annex as well.

20. Fertility outcomes in this model are expressed in log-levels to capture the effect of a unit change in the independent variable on the percentage change in the respective fertility outcome, similar to Adema, Ali and Thévenon (2014[6]) and d'Addio and Mira d'Ercole (2005[4]). Annex Figure 5.B.4 plots the

distribution of residuals for the model with fertility outcomes in log-levels and for a model with no log-transformation. Both are approximately normal-distributed and against fitted values, residuals in both models are scattered randomly around 0, so an assumption of linearity holds in either case. As the baseline model accounts for unobserved and time-invariant heterogeneity between countries, as well as trends within countries and temporal shocks affecting all countries in the sample, the resulting regression coefficients can be interpreted as the variation from the country mean in fertility outcomes following changes in family policies and labour market outcomes, net of the effects of unobserved country and time-specific factors.

21. While the overall two-way fixed-effects approach taken here is comparable to earlier approaches – such as in Luci-Greulich and Thévenon (2013[5]), Adema, Ali and Thévenon (2014[6]) and OECD (2019[7]), among others – there are several problems that arise from the small panel size at hand. For example, the two-way fixed-effects model assumes that the effects of changes in policy and labour market outcomes are similar across countries, which is unlikely to be the case given the diversity of included countries and policy environments. To account for possible varying effects of policy instruments, Pesaran and Smith (1995[27]) suggest estimating the regression on each country and to average the coefficients across countries. While this may be reasonable with large panel datasets - in particular, those with a large number of observations over time - inference on smaller datasets, such as the one used in this working paper, would be complicated. In addition, a more commonly used way to deal with endogeneity and reverse causality would be to employ a generalized method of moments (GMM) approach, as for example used in D'Addio and Mira d'Ercole (2005[21]) or Gauthier and Hatzius (1997[28]). However, in smaller panels such as ours, this approach is susceptible to over-identification and bias (Wooldridge, 2010[29]). Other papers use a lagged endogenous variable as an instrumental variable (e.g., Adema, Ali and Thévenon (2014[6])), but this strategy introduces biased estimates through the correlation between the lagged endogenous variable and the error term, particularly in panels with few observations over time (Leszczensky and Wolbring, 2019[30]).

22. As laid out in Adema, Ali and Thévenon (2014[6]), panel regressions typically suffer from non-constant error variances across countries and years (i.e., heteroskedasticity) and autocorrelation. Indeed, a Breusch-Pagan test ($p = 0.0268$) confirms a heteroskedastic distribution of residuals in the baseline specification (Breusch and Pagan, 1979[31]). To account for this, the standard errors used in the regressions are heteroskedasticity- and panel-corrected following the approach laid out by Driscoll and Kraay (1998[32]). Because the panel consist of data for several countries, it would be ideal to estimate cluster robust standard errors. However, with several countries not included because of data issues and an overall small (26) number of countries (a number of 40 clusters is a commonly cited minimum threshold, see e.g. Cameron, Gelbach and Miller (2008[33])), cluster robust standard errors are unlikely to converge towards true standard errors, so that inference using the cluster robust estimator may be incorrect more often than when using the simple robust estimator (Esarey and Menger, 2018[34]). For this reason, the regressions do not correct for within-country correlation and only report inference based on heteroskedasticity-robust panel-corrected standard errors.

23. For the reasons stated above, the results of the analysis in this paper must be interpreted with the necessary caution. The results do not provide evidence of a causal relationship between these measures, but nonetheless provide insights on changes in which factors may be more likely to affect birth rates than others. The Annex presents robustness of the results in relation to different approaches in the empirical specifications.

4 Regression results

24. The results of the main two-way fixed-effects regression with linear country time-trends as well as pooled OLS estimates for comparison are presented in Table 4 and Table 5. The two-way fixed-effects model (column 5) with country-specific time trends is the preferable choice of model here, as it is more adept at separating the impact of changes in family policies and labour market outcomes over time from country-specific characteristics that remain constant while also accounting for country-specific trends in fertility.

25. While many of the coefficients in the pooled regression are significant (column 1), many of the coefficients loose significance once fixed-effects for countries and years as well as linear time-trends for each country are included. This suggests that much of fertility outcomes between 2002 and 2019 are determined by unobserved heterogeneity between countries as well as distinct temporal trends that affect fertility in each country. In addition, except for public expenditure on parental leave, all policy and labour market coefficients lose significance in a between-effects model (Annex Table 5.B.1 and Annex Table 5.B.2 column 2), which also suggests that within-country and time-specific factors, which are not sufficiently accounted for in the between-effects model, explain most of the variation in fertility outcomes.

26. Even though within-country time trends may capture a critical driver of recent fertility dynamics – such as changing norms and attitudes (see OECD (2023[35])) - it is important to note that the inclusion of country-specific time-trends can "soak up" variation that should instead be attributed to the other regressors in the model. For this reason, column 4 in Table 4 and Table 5 also reports a version of the baseline model that excludes the country-specific time-trends from the model. Even though some regressors retain their significance and sign, this different model specification induces some important changes, pertaining particularly to public family expenditure and working time of men and women. While this could mean that some of the variation in the data should be attributed to these regressors rather than the country-specific time-trends, the substantial drop in the R^2-statistic relative to column 5 suggests that the country-specific time-trends are nevertheless capturing some important variation in the data. Even though some degree of overcontrolling through the time trends cannot be ruled out, the stark drop in explained variation suggest that the exclusion of time trends may lead to omitted variable bias, leading to changes in sign and to spurious significance of some regressors (see e.g. Oster (2017[36])). This pattern is even stronger for the MAB model, suggesting that country-specific time-trends play a key role for birth timing in particular, which may also explain why MAB is almost linearly increasing over the considered period (with heterogeneity across countries).

27. Regardless, changes in a few key family policy and labour market outcomes are still significant determinants of changes in fertility outcomes and capture a large part of the variation in fertility outcomes within countries in the baseline two-way fixed-effects model (Table 4 and Table 5). Nevertheless, other unobserved factors that are not fully captured through family policy and labour market outcomes or fixed-effects and linear time trends, such as differences and changes in attitudes and norms around family formation over time and within each county, may have driven a noticeable part of the observed fertility trends for some countries in recent years, particularly for birth timing (see e.g. OECD (2023[35])).

28. The differences of the baseline model in comparison to other alternative model specifications are (in most cases) fairly minor (Annex Table 5.B.1 and Annex Table 5.B.2). Estimates are relatively robust to the exclusion of imputed variables (column 3), which suggests that the multiple imputation approach does

not do more harm than good. Instead, as the adjusted R^2-statistic shows, the inclusion of the imputed variables further increases the explained variation in fertility outcomes. For most coefficients - except for the coefficients on ECEC expenditures and working times in the TFR regression (more below) - the model is also not particularly sensitive to using non-lagged instead of lagged explanatory variables (column 4). This suggests that lagging explanatory variables to control for endogeneity and reverse causality may be a sensible approach given the temporal difference in fertility decisions and fertility outcomes. Not log-transforming the dependent variable (column 5), also retains the results.

The role of family policy in fertility trends

29. The two-way fixed-effects regressions in Table 4 and Table 5 suggests that family policy plays some role for changes in fertility outcomes. For example, in the baseline model (column 5), coefficients on all three family policy expenditure categories are positive and significant, which suggests that increasing public support to families through parental leave benefits, the childcare system and family allowances[2] can increase fertility rates. With the coefficients ranging between 0.010 and 0.016, an increase of expenditure in these categories by USD PPP 1 000 per child is associated with an increase of about 1.0-1.6% in the TFR. At the same time, increases in public expenditure on ECEC and family allowances have an association with decreases in the MAB, but the magnitude of the coefficients is weak.

30. Overall, these results map well to findings in the quasi-experimental literature. While benefits, allowances and financial supports to families can theoretically raise fertility by reducing the (opportunity-) costs of childbirth, the actual effect is not necessarily clear as having more resources could lead parents to increased spending, thereby reducing the demand for children (Bergsvik, Fauske and Hart, 2020[37]). Indeed, most research indicates that cash transfers for families with children have only moderately positive effects on fertility (Skirbekk, 2022[38]; Bergsvik, Fauske and Hart, 2020[37]).

31. The baseline model in column 5 already controls for aggregate labour market outcomes. This means that changes in the financial support to families may be less important for fertility outcomes as main labour market variables are already accounted for. For example, financial supports may not be very important in countries that have many men and women in employment, and who may find it easier to afford having children. At the same time, strong labour market outcomes for men and women may require high-quality and affordable ECEC to allow for a combination of parental responsibilities with labour market careers. Indeed, when only considering family policy variables as well as GDP and educational attainment controls in the regression (column 2), the effect size of ECEC supports is noticeably larger than in the baseline regression (column 5).

32. When also accounting for the direct and indirect costs of parenthood (column 6), public expenditure on childcare is the only expenditure category that remains significant, while the size of the coefficient changes little. When including these costs in the baseline regression, the model aims to control for the additional expenses and opportunity costs incurred through parenthood. In effect, it therefore strips away the mediating effect of the costs of parenthood from the other coefficient estimates, which may be why public expenditure on parental leaves and family allowances – both of which provide direct financial transfers to families – loses significance. Indeed, when controlling for the costs of parenthood, financial supports are likely less important for fertility intentions. Instead, the main factor standing in the way of having a(nother) child is then the ability to balance work and family responsibilities. These results therefore suggest that, in contrast to financial family supports, a well-funded ECEC-system allows for a better balance of work and family responsibilities, and thus affect fertility decisions (Doepke et al., 2022[10]).

[2] Family allowance here refer to allowances paid to the family on a regular basis throughout childhood, rather than so-called "baby-bonuses" that are paid as a lump-sum upon birth (Adema and Fron, 2019[81]).

Table 4. Regression results: Total fertility rates

	LN (TFR)					
	Pooled	Fixed Effects Policy	Fixed Effects Labour	Fixed Effects No Trends	Fixed Effects Baseline	Fixed Effects Costs
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-3.674* (2.041)					
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	-0.023*** (0.006)	0.012*** (0.002)		0.010 (0.010)	0.012*** (0.004)	0.006 (0.004)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.008* (0.004)	0.016*** (0.003)		-0.003 (0.003)	0.010*** (0.003)	0.007*** (0.002)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.008* (0.004)	0.015* (0.008)		0.022** (0.009)	0.016** (0.006)	0.003 (0.005)
ECEC enrolment rate 0-2 years	-0.002*** (0.001)	0.001 (0.000)		0.000 (0.001)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.002*** (0.000)	0.000 (0.001)		0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Weeks of paid leave available to mothers	-0.001*** (0.000)	0.000** (0.000)		-0.001** (0.000)	0.0004** (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Employment rate of women	0.002 (0.001)		0.008*** (0.002)	0.006** (0.003)	0.008*** (0.002)	0.008*** (0.002)
Employment rate of men	0.007*** (0.001)		0.003** (0.002)	0.006*** (0.002)	0.004** (0.002)	0.003** (0.002)
Share of part-time employees among women	-0.003*** (0.001)		-0.003 (0.003)	0.008*** (0.001)	-0.003 (0.004)	-0.004 (0.004)
Hours worked by women in full-time jobs	-0.061*** (0.011)		-0.045 (0.031)	0.026** (0.013)	-0.042 (0.033)	-0.051 (0.032)
Hours worked by men in full-time jobs	0.043*** (0.009)		0.009 (0.011)	-0.015* (0.008)	0.010 (0.013)	0.015 (0.013)
Log GDP per capita	0.667 (0.408)	1.191 (1.429)	0.806 (0.991)	1.919*** (0.511)	0.891 (0.931)	0.993 (0.982)
Log GDP per capita (squared)	-0.028 (0.020)	-0.049 (0.069)	-0.047 (0.048)	-0.095*** (0.026)	-0.050 (0.045)	-0.054 (0.047)
Average years of schooling among women	0.105*** (0.018)	-0.009 (0.017)	-0.016 (0.015)	0.016 (0.022)	-0.008 (0.015)	-0.015 (0.015)
Average years of schooling among men	-0.095*** (0.017)	0.006 (0.023)	0.024 (0.018)	-0.021 (0.028)	0.011 (0.019)	0.022 (0.020)
Direct costs of parenthood						-0.895*** (0.103)
Indirect costs of parenthood						0.380* (0.195)
N	464	464	464	464	464	464
Country-specific time trends	No	Yes	Yes	No	Yes	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.670 (overall)	0.609 (within)	0.667 (within)	0.368 (within)	0.679 (within)	0.709 (within)

Note: The model is estimated for the period 2002 to 2019 using country-level data from Australia, Austria, Canada, the Czech Republic, Denmark, Finland, Germany, Hungary, Italy, Korea, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

33. The coefficients on ECEC enrolment rates for 0-to-2- and 3-to-5-year-olds (which are a proxy for the availability of ECEC) are not significant in any of the regressions. As public expenditure on the ECEC-system affects multiple key issues – accessibility and intensity of use as well as affordability and quality - one may think that any potential effect of ECEC availability is already captured by the coefficient on public ECEC expenditure. However, when running regressions excluding public expenditure on ECEC, excluding female employment rates or log-transforming ECEC enrolment to reduce the impact of measurement error, the coefficients on ECEC enrolment rates remain insignificant (Annex Table 5.B.3). In the international literature, the availability of ECEC is often linked to increasing fertility, particularly for second and third births (Bauernschuster, Hener and Rainer, 2015[39]; Wood and Neels, 2019[40]).

34. In addition to the moderately positive effects of the public expenditure on parental leave in the baseline model (column 5), changes in the length of maternity- and parental leave available to mothers also have a positive and significant – albeit weak - effect on the TFR, but not on the timing of births. This would mean that, all else equal, increasing paid leave available to mothers by 10 weeks could increase the TFR by about 0.4%. Even though this is a small link, there seem to some support for small to moderate positive effects of parental leave reforms on subsequent fertility rates in the international literature (Thomas et al., 2022[41]; Lalive and Zweimüller, 2009[42]).

35. On the other hand, changes in parental leave entitlements for fathers have had no measurable effect on fertility outcomes in the baseline regression (column 5). The literature finds ambiguous effects in this regard. For example, some authors find that leave use by fathers is associated with a higher likelihood of having a second child, although the results for the likelihood to have a third child are inconclusive (Duvander et al., 2019[43]; Duvander, Lappegård and Andersson, 2010[44]). Others find that extensions of leave entitlements for fathers have no association with fertility (Hart, Andersen and Drange, 2022[45]) or that fathers leave use is associated with lowered fertility intentions and delayed subsequent fertility (Farré and González, 2019[46]; Lee, 2022[47]). In addition to this, earmarked parental leave entitlements to fathers have only recently been introduced in many countries, and may therefore only noticeably affect fertility over the coming decade (see Fluchtmann (2023[48])).

The role of labour market participation in fertility trends

36. Individual labour market situations are an important determinant for fertility behaviour. This is because it helps determine whether prospective parents have the necessary means to afford the direct costs of parenthood, and it also affects the opportunity costs of having children, as becoming a parent often comes with career interruptions and changes in working time, especially for women (Adema, Fluchtmann and Patrini, 2023[49]). While Table 4 and Table 5 do not reflect the impact of individual labour market situations on fertility decisions, they show that aggregate labour market outcomes have an important bearing on fertility outcomes and explain more of the within-country variation in fertility outcomes than the included family policy variables (indicated by the adjusted R2-statistic).

37. Aggregate employment of men and women is significantly and positively associated with the TFR (Table 4), but for women, this has only been the case since OECD countries started to introduce family supports and workplace flexibility measures (Box 1).[3] With only marginal differences in effects size, there

[3] The fact that the coefficient on female employment rates does not change when accounting for family policies (column 3 and 5 in Table 4), may suggest that increased availability of family supports does not necessarily account for the positive relationship between female employment and fertility (see Box 1). However, when excluding family policy controls, variations related to these are likely (to some degree) absorbed by the country-specific time trends in our analysis. Also, several OECD countries with TFRs relatively close to 2 children per women, already had established comprehensive family support systems and high female LFP before our sample period (e.g. in Denmark and Sweden).

is no qualitative difference in these results across regressions that do and do not control for family policies, and the model specification that also controls for the direct and indirect costs of parenthood. The coefficient estimate on women's employment rates is more than twice as large as the one on men's employment in the fixed effects model specifications, suggesting that women's employment is a particularly important driver of fertility outcomes. At the same time, the only significant labour market coefficient in Table 5 suggests that higher employment rates among women are associated with a slightly lower mean age at birth, but the size of the coefficient is very small. These results are consistent with the previous findings that identified a positive association between women's employment rates and fertility rates (see more in Table 6). The positive link between the employment rate of men and fertility is, for example, corroborated by Hanappi et al. (2017[50]).

38. Typical working hours can be another important factor for the timing and number of births. Indeed, the international literature identifies a negative link between worked hours and fertility choices (Maralani and Stabler, 2018[51]; Liu and Hynes, 2012[52]; Cooke, 2009[53]), while excessively long working hours may even affect reproductive health itself (see e.g. Ahn et al. (2021[54]) and Gaskins et al. (2015[55])). However, neither the baseline regressions in Table 4 and Table 5 establish a significant link between the working hours in full-time jobs or the incidence of part-time employment (less than 30 hours per week).[4] A possible reason for this may be that, at an aggregate level, average usual weekly working hours of men and women have changed very little over the sample period. Quality issues regarding the measurement of working time in labour force surveys may be another reason (see e.g. Eurostat (2018[56])).

39. When controlling for the direct and indirect costs of parenthood, the coefficients in column 6 of Table 4 and Table 5 show that changes in the direct costs of parenthood primarily reduce the TFR, whereas changes in the indirect costs of parenthood primarily affect the timing of parenthood by decreasing the average age of mothers at childbirth. While the effects of direct costs on fertility follow what theory prescribes, the association between indirect costs of parenthood and birth timing does not (Doepke et al., 2022[10]). It isn't immediately obvious why this result comes about. However, as laid out previously, our measure only approximates the indirect costs of parenthood and is an incomplete representation of the actual opportunity costs involved when having a(nother) child. Many monetary and non-monetary factors are involved in the trade-off between parenthood and careers, such as the long-term consequences of having children as well as the subjective valuation of careers and parenthood, among others. It is complicated to measure these costs empirically, which is why empirical literature linking explicit measures of opportunity costs to fertility outcomes are rare, especially when it comes to birth timing.

40. Adding to the main analysis, we also explore the implications of labour market security on fertility, as presented in Annex Table 5.B.4. For this, we separately introduce additional regressors related to labour market security to the model, motivated by findings that show that labour market security also plays an important role for fertility dynamics (Bastianelli, Guetto and Vignoli, 2023[17]; OECD, 2019[7]; Luci-Greulich and Thévenon, 2013[5]). While our paper predominantly focusses on the extensive and intensive margin of labour market engagement this supplementary exercise — mindful of potential collinearity issues from including numerous related labour market variables — offers an additional perspective to our analysis.

[4] When using contemporaneous instead of lagged independent variables in the regression, the coefficients on working hours of full-time employees become significant – negative for women and positive for men – while the coefficient on the female share working part-time becomes significant and negative (Annex Table 5.B.8 column 3). Even though a part of this may be due to the anticipation of future adjustments of working time after childbirth, it also be a result of reverse causality or endogeneity issues. As these cannot be easily disentangled from the anticipation effects, we continue to consider lagged rather than non-lagged regressors in the analysis.

Box 1. The association between women's employment rate and fertility over time

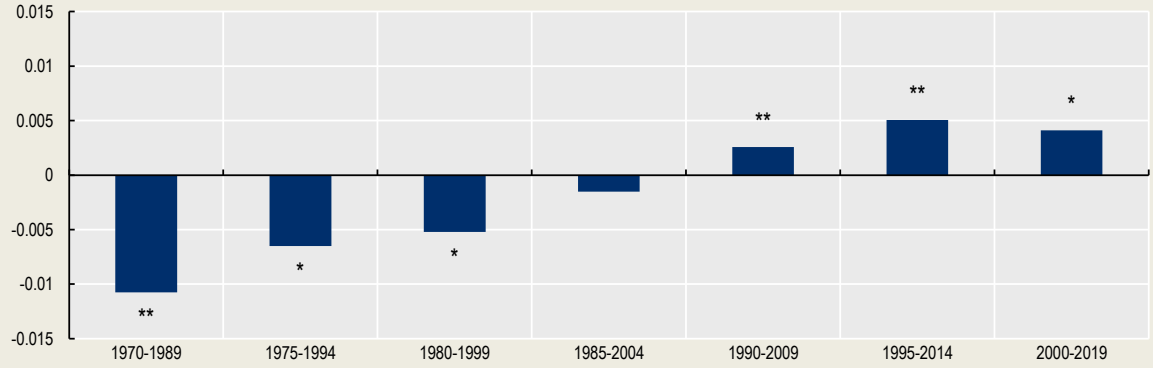
For mothers, parenthood and career aspirations may be competing life goals. The ensuing considerations on opportunity costs of parenthood have become more important as women's employment rates have risen markedly since the second half of the 20th century. Increased employment participation can mean that parenthood is postponed or foregone entirely. However, with more women in employment, most OECD countries have developed family supports, including paid maternity and parental leaves as well as ECEC systems, that have eased the combination of family responsibilities and career aspirations. With these supports, secure labour market attachment can help prospective parents bear the financial costs of childbirth.

Figure 2 presents the results of a regression that looks at the link between women's employment rates and TFRs over a longer horizon than the main analysis of this paper. Because of a limited availability of other data over this period and following Oshio's (2019[57]) work on female labour force participation, this regression only considers female employment rates as regressors, along with year and country fixed-effects as well as linear time trends for each country.

Similar to Oshio (2019[57]), Figure 2 shows that until the 1980's, higher female employment rates were negatively associated with fertility, after which it changed to the positive association. We also find such a positive link in Table 4, along with the positive associations with family supports. Female employment now seems to be more conducive to family formation as adults in households are better able to navigate both parenthood and careers in a manner that suits their individual circumstances and aspirations. However, the association seems to have weakened somewhat in recent years, as other (unobservable) factors, are seemingly playing an increased role in family formation (OECD, 2023[35]).

Figure 2. A changing link between fertility and women's employment rate

Coefficient estimates for female employment rates on log-transformed TFRs over different sample periods



Note: The figure shows regression coefficients that capture effects of within-country, over time variation between lagged female employment rates and the log-transformed TFR. Estimates are based on a two-way fixed-effects regression, with year and country fixed-effects as well as linear time trends for each country. No other regressors or controls enter this regression. The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. ***, ** and * represent significance at 1%, 5% and 10% level, respectively, based on heteroskedasticity- and panel-corrected standard errors.
Source: OECD calculations based on data from OECD Family Database and the OECD Employment Database.

Table 5. Regression results: Mothers mean age at birth of their children

	LN (MAB)					
	Pooled	Fixed Effects Policy	Fixed Effects Labour	Fixed Effects No Trends	Fixed Effects Baseline	Fixed Effects Costs
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.748 (0.526)					
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.004** (0.002)	-0.001 (0.001)		0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.004*** (0.001)	-0.002*** (0.000)		0.001 (0.001)	-0.002*** (0.000)	-0.002*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.003** (0.001)	-0.001 (0.001)		0.002 (0.001)	-0.001** (0.000)	0.000 (0.001)
ECEC enrolment rate 0-2 years	0.001*** (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	-0.001*** (0.000)	0.000* (0.000)		0.000* (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Employment rate of women	-0.001*** (0.000)		-0.001** (0.000)	0.000 (0.000)	-0.001** (0.000)	-0.001** (0.000)
Employment rate of men	-0.003*** (0.000)		0.000 (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000 (0.000)
Share of part-time employees among women	0.002*** (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Hours worked by women in full-time jobs	0.026*** (0.003)		-0.002 (0.002)	-0.008*** (0.001)	-0.002 (0.002)	-0.001 (0.002)
Hours worked by men in full-time jobs	-0.018*** (0.002)		0.001 (0.001)	0.006*** (0.001)	0.001 (0.001)	0.001 (0.001)
Log GDP per capita	0.810*** (0.104)	0.283** (0.128)	0.266*** (0.103)	0.250*** (0.054)	0.276** (0.109)	0.275*** (0.105)
Log GDP per capita (squared)	-0.040*** (0.005)	-0.013** (0.006)	-0.011** (0.005)	-0.012*** (0.002)	-0.011** (0.005)	-0.011** (0.005)
Average years of schooling among women	0.014*** (0.005)	0.000 (0.002)	0.000 (0.002)	-0.001 (0.004)	0.000 (0.002)	0.000 (0.002)
Average years of schooling among men	-0.015*** (0.005)	0.000 (0.003)	0.001 (0.003)	0.005 (0.005)	0.001 (0.003)	0.000 (0.003)
Direct costs of parenthood						0.036 (0.041)
Indirect costs of parenthood						-0.048** (0.023)
N	464	464	464	464	464	464
Country-specific time trends	No	Yes	Yes	No	Yes	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.632 (overall)	0.683 (within)	0.682 (within)	0.287 (within)	0.693 (within)	0.695 (within)

Note: See notes to Table 4.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

41. In these models, an increasing degree of employment protection – as measured by the strictness of dismissal regulation for workers on regular contracts (both individual and collective dismissals) in the OECD Indicators of Employment Protection (Version 2) – is not significantly related to changes in the TFR (Annex Table 5.B.4), similar to findings in Luci-Greulich and Thévenon (2013[5]). However, stronger employment protection seems linked to a decreasing MAB, which may suggest that employment security is especially important for fertility timing. Similar to Luci-Greulich and Thévenon (2013[5]), we also find that changes in the unemployment rate have a negative association with changes in TFRs, which suggests

that financial and labour market security is important in deciding to have a(nother) child (see also Greulich et al. (2018[58])). However, contrary to OECD (2019[7]), the share of temporary employment is not associated with the TFR. While the sign and significance of the other coefficients remain generally similar to the baseline model on fertility rates (Table 4), significance on male employment rates disappears when introducing employment protection or temporary employment to the model (Annex Table 5.B.4). When introducing unemployment rates, the coefficient on male employment rates becomes (borderline) significant and negative. These findings could suggest that once employment security is controlled for, employment participation of (potential) fathers is less important for fertility decisions.

Does birth order matter?

42. The effect of changes in family policies and labour market outcomes may differ by birth-order. For example, quasi-experimental studies often find differential effect sizes for first and subsequent births (Bergsvik, Fauske and Hart, 2020[37]). For example, prior to their first birth, mothers tend to underestimate the (employment) costs of parenthood (Kuziemko et al., 2020[59]).

43. This subsection considers the effects family policies and aggregate labour market outcomes on fertility outcomes by birth order using data from the Human Fertility Database. In contrast to previous regressions, this approach does not include data on Australia, Belgium, France, Greece, Ireland, Luxembourg, and New Zealand as information on the order of births is missing. The TFR for second births is conditional on having had a first child (and for third births on a second birth), so each birth parity addresses fertility outcomes of a different population. This also means there is less variation in the dependent variables for higher-order births, potentially making it harder to identify significant associations with the independent variables. For these reasons, any results in this subsection should not be directly compared to previous results.

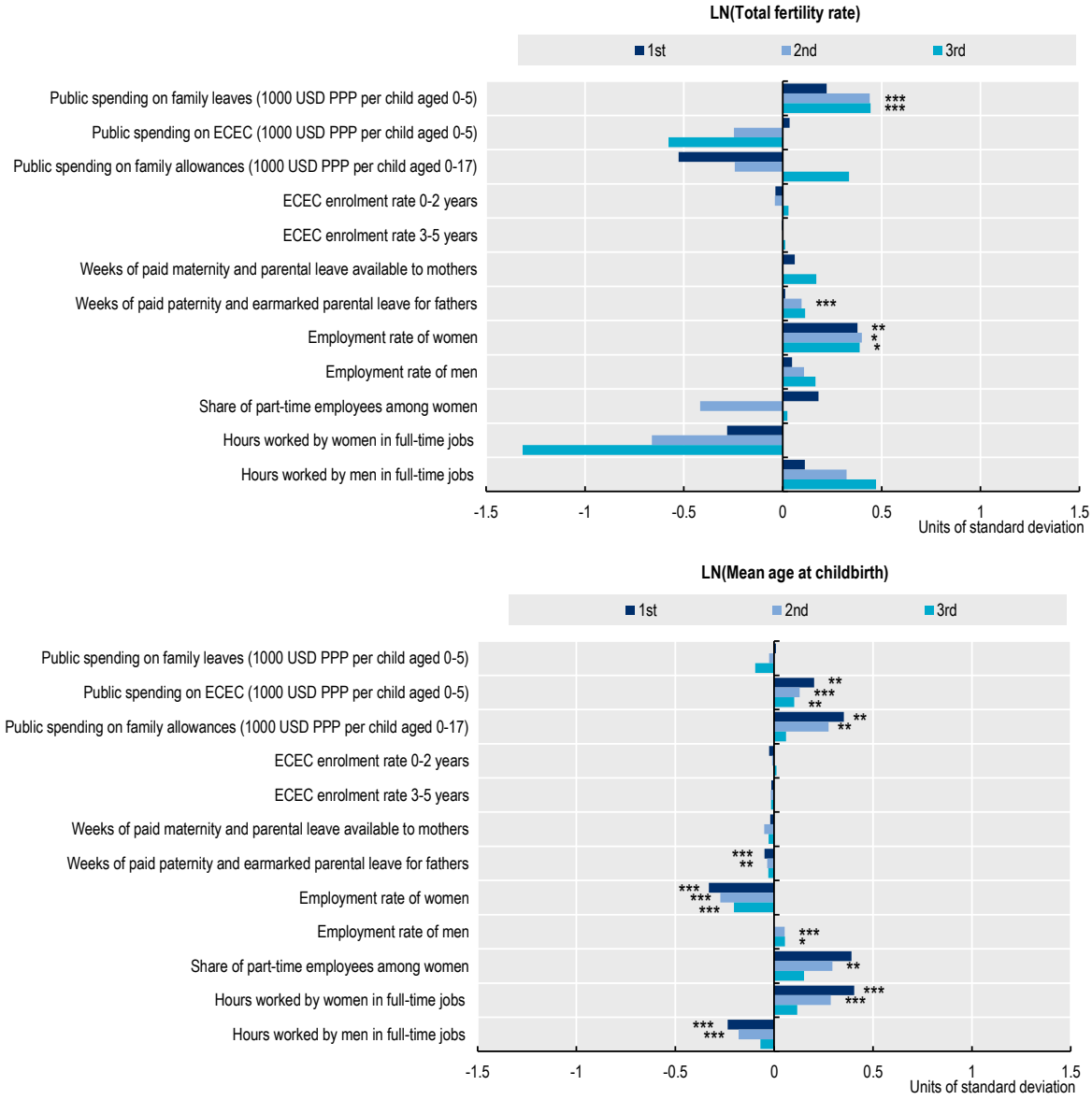
44. Figure 3 shows standardized coefficients (expressed in units of standard deviation) of the main baseline regression across TFRs and MABs for first, second and third births, while unstandardized coefficients are available in Annex Table 5.B.5. Annex Table 5.B.6 shows a similar regression that also controls for the direct and indirect costs of parenthood. With small differences in the significance of coefficients on public expenditures on ECEC and family allowances, the results are qualitatively similar.

45. It appears that changes in public expenditure on parental leave is not only associated with changes for first births but have a strong significant and positive association with second and third order births and no association with changes in the MAB at any parity. This maps well with Raute (2019[60]), who found particularly strong effects second births after a change from flat rate to earnings-related parental leave benefits in Germany.

46. The effects of changes in public expenditure on ECEC and family allowances on the TFR across birth parities are not significant, but both raise the MAB for first and second births (increases in ECEC spending also raise the MAB for third births). Any differences in coefficients and significance in comparison to Table 4 and Table 5 here can stem from a smaller sample size with fewer included countries as well as less variation in the dependent variables, both of which can affect the regression coefficients and the part of variation that is captured by fixed-effects and time trends.

47. When controlling for the direct and indirect costs of parenthood (Annex Table 5.B.6), changes in public ECEC-spending per child have a negative and significant association on the TFR for third births and changes in expenditure on family allowances have significant negative effect on the TFR for first births. While the former may be a result of a different sample compared to the baseline regressions in Table 4, the latter may be related to a significant increase in mean age at birth through increases in family allowances – which has also been identified in individual-level data by Groves and Lopoo (2018[61]) and Riphahn and Wiynck (2017[62]).

Figure 3. Regression results by birth order (standardized)



Note: The figure shows standardised regression coefficients of the baseline two-way fixed-effects model with linear country time-trends. Non-standardized regression coefficients are available in Annex Table 5.B.5. Each model is estimated over the period 2002-2019 using country-level data from Australia, Austria, Canada, the Czech Republic, Denmark, Finland, Germany, Hungary, Italy, Korea, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. The sample contains 290 observations. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected. ***, ** and * represent Bonferroni-corrected significance at 1%, 5% and 10% level, respectively.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects

48. Changes in paid leave entitlements reserved for fathers have a small positive and strongly significant link with second births when accounting for the direct and indirect costs of parenthood (Annex Table 5.B.6). This may be caused by changes to intra-household gender equality and greater involvement in unpaid work at home through paternal leave taking – which only happens after the first birth, but can be important for subsequent fertility plans (e.g., Raybould and Sear (2020[13]), Doepke and Kindermann (2019[14]), Neyer, Lappegård and Vignoli (2013[15])). Increases in leave entitlements for fathers are also associated with lower MAB for first and second births.

49. In terms of labour market variables, changes in female employment rates have a (weakly) significant and positive association with changes in TFRs and a significant and negative associations with the MAB at all birth-parities. Alongside the role of changing attitudes and norms, the latter finding may be explained by a higher correlation between fertility and female employment outcomes at younger childbearing ages in OECD countries. Particularly for women aged 35 to 39, increases in labour force participation are associated with lower fertility rates, whereas labour force participation among women aged 20 to 34 has a positive correlation with fertility (Brehm and Engelhardt, 2015[63]; OECD, 2023[35]). Increases in female part-time employment are linked to higher ages at second births, while longer full-time working hours of women are associated with a higher age at first and second births. In contrast, for men's working hours, the latter effects are negative.

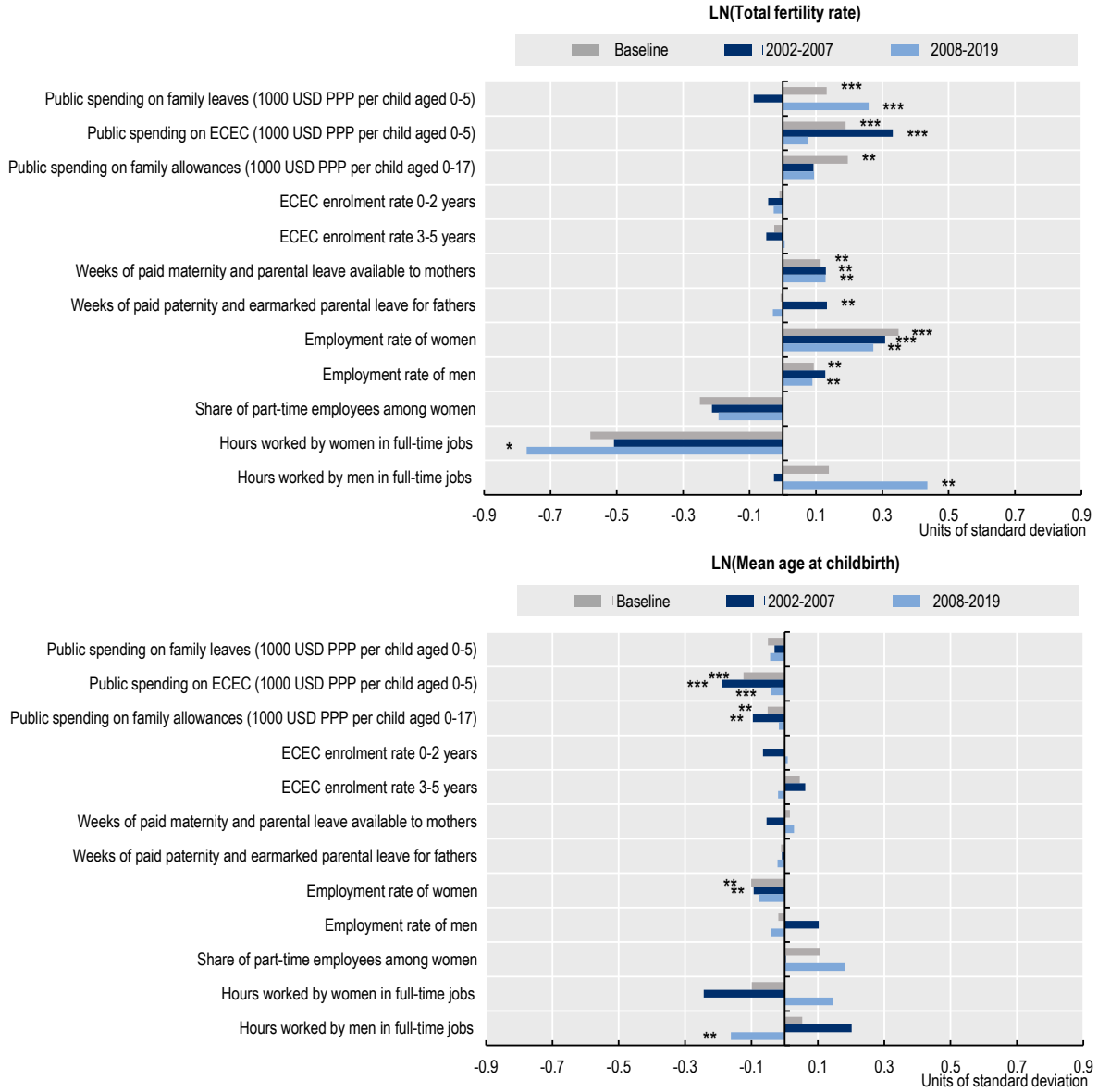
Changes in the determinants of fertility in the OECD

50. As evident in Figure 1, fertility trends across the OECD are marked by a return to the previous long-term fertility declines around 2008-2010 (see also Box 1 on a slight weakening of the role of female employment). After a few years of increasing TFRs – which can be explained by a catching-up of fertility rates after previous trends of birth postponement since the 1990s (Thevenon, 2015[64]) – fertility dropped substantially, by 2019 roughly erasing all increments in the TFR since 2002. What caused the trend change, and what - given the timing of events, may have been the role of great financial crisis (GFC) that unfolded in 2007-2008? Indeed, several studies have explored the relation between the GFG and fertility and found that the resulting financial uncertainty has suppressed TFRs, even beyond the direct labour market effects of the GFC (e.g., Comolli (2017[65]) for evidence on Europe and the United States).

51. To explore the issue, this subsection considers two distinct period interactions to all the independent variables included in the main baseline regression. In practice, each regressor is interacted once with a dummy for the years 2002 to 2007 and once with a dummy for the years 2008 to 2019. In this manner, the analysis aims to identify whether there have been any distinct changes in the association between the independent variables and fertility outcomes over these two periods. Figure 4 and Annex Table 5.B.7 show the results of exercise along with the results of the baseline regression for comparison, while Annex Table 5.B.8 shows a similar regression that also controls for the direct and indirect costs of parenthood.

52. There appears to have been an important shift in how changes in public expenditure on parental leave relate to the TFR. While the association between the two is insignificant for the period 2002 to 2007, the coefficient becomes positive and significant for 2008 to 2019. At the same time, the coefficient on parental leave available to mothers has a positive and significant association with fertility over the whole period but loses significance once controlling for the direct and indirect costs of parenthood (Annex Table 5.B.8) – similar to the baseline regression in Table 4 column 6.

Figure 4. Regression results for two different periods (standardized)



Note: The figure shows standardised regression coefficients of the baseline two-way fixed-effects model with linear country time-trends. The grey bars show the standard baseline model as shown in Table 4 column 5 and Table 5 column 5, whereas the light and dark blue bars show a model that interacts each regression coefficients with a dummy for the period 2002-2007 and a dummy for the period 2008-2019. Non-standardized regression coefficients are available in Annex Table 5.B.7. Each model is estimated over the period 2002-2019 using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects

53. One interpretation of the shift in the importance of parental leave expenditure could be that the level of replacement rates, rather than the length of leave, has become more important for parents as economic uncertainty increased in the aftermath of the GFC. The years after the GFC were marked by austerity measures in many OECD countries, some of which included a reduction in parental leave replacement rates (Nygård, Campbell-Barr and Krüger, 2013[66]).[5] Across countries included in the analysis sample, public expenditure on parental leave per child aged 0 to 5 roughly dropped by 5% between 2009 and 2013, after having increased steadily over previous years.

54. For ECEC expenditure, the size of the positive coefficient drops substantially and loses significance between the two periods. Aside from the potential of non-linearities and interactions with other regressors, the mechanism underlying these changes is not immediately obvious, particularly since average public expenditure on ECEC per child continued to increase throughout the period of analysis.

55. While the association between employment rates of men and women and fertility does not change between these periods, the negative coefficient on female working hours in full-time employment becomes weakly significant between 2008 and 2019. Lastly, while changes in the working hours of full-time working men were not significantly associated with fertility outcomes between 2002 and 2007, they become a positive and weakly significant determinant of changes in TFRs and negative significant determinant for MAB between 2008 and 2019. Other than this, there are no noteworthy changes in the link between family policy variables and labour market outcomes on fertility outcomes between these two periods.

Do changing household expenditures affect fertility?

56. Raising children is expensive and involves, among other expenses, the costs of childcare, food, housing, and education. Indeed, the previous sections and earlier research (e.g. OECD (2019[7])) identified that increasing overall costs of parenthood have a negative effect on fertility. As such, changes in specific household expenditure categories between 2002 and 2019 may be associated with changing fertility outcomes over the same period as they may have changed whether prospective parents consider it affordable to have a(nother) child. For this reason, Figure 5 presents regression coefficients on household expenditure items, when controlling for the other regressors in the baseline two-way fixed effects model with linear time-trends for each country. Annex Table 5.B.9 and Annex Table 5.B.10 show full regression tables, including alternative model specifications for which the results remain qualitatively similar.

57. Data on household expenditures are derived from the *Final consumption expenditure of households* in the OECD National Accounts, adjusted for inflation using constant prices. In contrast to the approach taken by OECD (2019[7]), where household expenditure is presented as a share of total household expenditure in each category (which we report in Annex Figure 5.B.5), our regressions express annual household expenditure relative to the respective expenditure in 2002. This method offers the advantage of avoiding potential spurious associations that may arise from factors unrelated to actual changes in household expenditure for specific items.[6]

58. Our approach in Figure 5 shows that particularly changes in household expenditure on housing had a significant and negative effect on TFRs. Over the period 2002 to 2019, expenditure on housing

[5] While Iceland is not included in the analysis sample, Einarsdóttir (2021[84]) found a significant negative effect of temporary leave replacement rate reductions on post-GFC fertility in Iceland, controlling for GDP and unemployment.

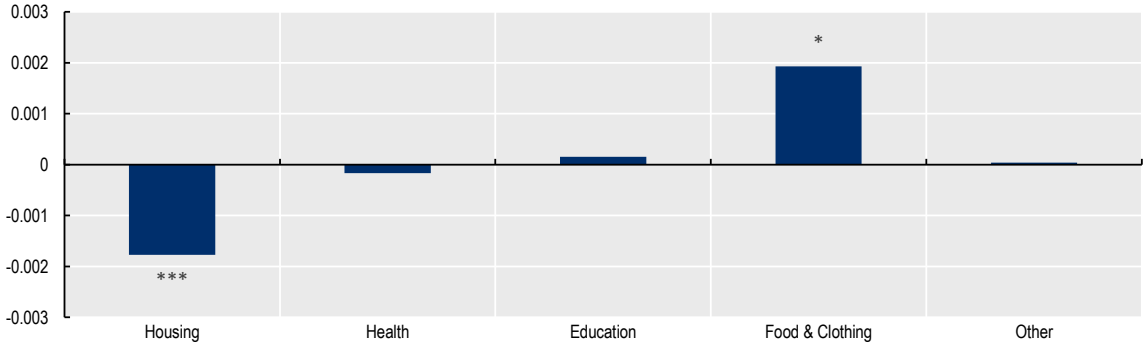
[6] For example, Annex Figure 5.B.5 shows that an increases in household expenditure on housing are associated with a decreasing TFR, while those on food and clothing are associated with an increasing TFR. However, as the share of household expenditure on housing increases, the share of expenditure on other items decreases mechanically, all else equal. Therefore, it becomes unclear whether significant coefficients reflect actual changes in household expenditure or merely mechanical effects caused by shifting expenditure patterns.

across included countries increased by almost 30%, while already making up the largest part of overall expenditure on average over these years (about 23%). The coefficient on food and clothing expenditure – which also grew by about 30% over the same period (an average of 17% of total expenditure) - is of a similar size, but positive and only borderline statistically significant. In contrast to OECD (2019[7]), which considers a slightly different time period (2000 to 2016), changes in household expenditure on education are not significant in Figure 5, nor Annex Figure 5.B.5. In terms of MAB, it is only expenditure on health that is related to changes in birth timing, reducing it marginally (Annex Table 5.B.10).

59. Overall, these findings suggest that increasing expenditure on housing may have made it harder to have children, which often incurs an increase in expenditure through moves to bigger housing space to accommodate a larger family size. The international literature has identified different mechanisms out how changes in rents and house prices affect fertility among homeowners - who typically benefit from increasing house prices - and tenants – who suffer under increasing rents. In Korea, for example, tenants are less likely to have a first child (OECD, 2019[7]). These patterns have led to differential effects of house price increases in fertility outcomes between both homeowners and tenants (e.g., Aksoy (2016[67])). However, recent evidence suggests that homeowners and renters now have similar fertility patterns (Tocchioni et al., 2021[68]). In general, increasing housing cost pressures are therefore likely to negatively affect fertility (especially for younger couples), which is in line with the findings of this paper. Government support that reduces the housing cost burden for families, such as the provision of social housing or housing allowances, has also been found to have a positive association with fertility in OECD countries (OECD, 2019[7]).

Figure 5. Increases in housing expenditure are associated with lower TFRs

Coefficient estimates on annual household consumption expenditure relative to 2002 expenditure (2002 = 100) on log transformed TFRs, 2002 to 2019



Note: Household consumption expenditure is indexed so that household consumption expenditure for each year is expressed as relative to the respective expenditure in 2002, based on OECD National Accounts data. The model controls for all regressors and fixed-effects included in the baseline regression (Table 4 column 5) and is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. The standard errors are heteroskedasticity- and panel-corrected and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects

5 Discussion

60. To situate the results of this paper with the previous literature on the drivers of changes fertility outcomes in OECD countries, Table 6 presents the sign of significant regression coefficients from comparable approaches in related studies. As most of these studies present multiple regressions, Table 6 compares our results to the main (baseline) regressions in the respective studies, or the ones that are most closely related in terms of included regressors. For example, Luci-Greulich and Thévenon (2013[5]) mainly focus on the role of family policies for fertility outcomes, but supplementary results also introduce labour market outcomes, including female employment rates and working hours. For this reason, the latter is chosen here. It is important to note that the approaches in these papers differ partially in terms of estimation procedures, but also in terms of country and time coverage – which is one of the main reasons for the differences in sample size across studies included in Table 6. Importantly, and in contrast to other papers, our approach uses multiple imputation for some variables of interest, which avoids listwise deletion of observations with missing data.

Table 6. Comparison with related cross-national studies for OECD countries

	D'Addio & Mira d'Ercole (2005)	Luci-Greulich & Thévenon (2013)	Adema, Ali & Thévenon (2014)	OECD (2019)	This paper
Dependent variable	LN (TFR)	TFR	LN (TFR)	TFR	LN (TFR)
Period	1980-1999	1982–2007	1980-2007	1995-2016	2002-2019
Number of countries	16	16	30	28	26
Observations	not reported	228	169	473	464
Method	GMM-SYS / PMG[1]	2-way-FE	2-way-FE	2-way-FE	2-way-FE
Public spending on parental leaves	- / n. s.	+	+	n. i.	+
Public spending on ECEC	n. i.	+	n. s.	n. i.	+
Public spending on family allowances	n. s. / -	+[2]	+	n. i.	+
ECEC enrolment (0-2 years)	n. i.	+	+	n. i.	n. s.
ECEC enrolment (3-5 years)	n. i.	n. i.	+	n. i.	n. s.
Maternity/parental leave for mothers	-	+	+	n. i.	+
Paternity/parental leave for men	n. i.	n. i.	+	n. i.	n. s.
Employment rate of women	+ / +	n. s.[3]	+	+	+
Employment rate of men	n. i.	n. i.	n. i.	+	+
Part-time employment of women	+	n. i.	n. s.	+	n. s.
Hours worked by women	n. i.	-	n. i.	n. i.	n. s.
Hours worked by men	n. i.	n. i.	n. i.	n. i.	n. s.

Note: This table presents the sign of significant regression coefficients on regressors comparable to the ones included in this paper. As most of the presented papers present multiple regressions models, this table only presents those that are most comparable to the regression model used here. n.i.: regressor not included; n.s.: regressor not significant.
1.) This paper presents two main models, which are both included here and distinguished with a "/". 2.) Here refers to spending per birth around childbirth. 3.) Positive and significant when not controlling for working hours

61. Similar to our results, Luci-Greulich and Thévenon (2013[5]) and Adema, Ali and Thévenon (2014[6]) found a positive and significant coefficient on the public expenditure on parental leave as well as on family allowances – both of which express it as spending per birth/child as a share of GDP per capita. However,

the pre-2008 coefficient on parental leave in Figure 4 and Annex Table 5.B.7 is non-significant, which is notable as both papers partially cover a similar time period that ends in 2007 (though they start considerably earlier). Regardless, the significance level in both studies is low, and the list of countries and regressors included differs as well. The regression coefficient in Adema, Ali and Thévenon (2014[6]) also loses significance when focussing on EU-19 countries. D'Addio and Mira d'Ercole (2005[21]) find a negative and significant coefficient on the public expenditure on parental leaves using a GMM-SYS approach – which may suffer from over-identification and bias in small samples - but the time covered differs strongly from this paper and their regressions include a measure for replacement rates during parental leaves, which has a positive and significant coefficient in the PMG model. This regressor likely captures much of what we measure through expenditure on leaves alone in the absence of sufficient information on parental leave replacement rates.

62. In terms of sign and significance, the findings on parental leave entitlements in general are again consistent with Luci-Greulich and Thévenon (2013[5]) and Adema, Ali and Thévenon (2014[6]), but not with D'Addio and Mira d'Ercole (2005[21]) (their PMG approach). Our results indicate that, all else equal, increasing paid leave available to mothers by 1 week could increase the TFR by about 0.05%, which is a bigger increase than the effect size (not measured in log-levels) in Luci-Greulich and Thévenon (2013[5]), but relatively close to the Adema, Ali and Thévenon (2014[6]). The latter paper is also the only one in Table 6 that also includes paid leave entitlements for fathers, but it shows up as significant and positive in contrast to our results. However, by covering a longer period, their panel also includes the introduction of earmarked parental leave for fathers in a few countries, such as Denmark, Iceland, Norway, and Sweden.

63. Public expenditure on ECEC is also significant and positive in Luci-Greulich and Thévenon (2013[5]), but Adema, Ali and Thévenon (2014[6]) found no significance on this coefficient. However, for both of these papers, the coefficient on ECEC enrolment rates is positive and significant – something that we did not identify in our regressions. As argued above, it is not necessarily clear what the precise reason for this is, but the non-significance holds across all regressions in this paper. Only in the pooled OLS version do ECEC enrolment rates show up as positive and significant (ages 0 to 2) or negative and significant (ages 3 to 5) (see Table 4).

64. In terms of female employment, there is general overlap between the studies. For example, the coefficient on female employment is significant and positive in all included studies except for Luci-Greulich and Thévenon (2013[5]). However, their regressions do not control for the average years of schooling – which is an important determinant of employment for both men and women. Their regressions also recover a positive coefficient on female employment rates once women's average working hours are dropped. The coefficient in our regressions is remarkably close to the one found by Adema, Ali and Thévenon (2014[6]). For male employment, it is only OECD (2019[7]) that includes this regressor. While family policy variables are not included (and a wider range of labour market outcomes is used), these results also find a positive and significant coefficient on male employment, also like Table 4 column 3, which drops family policy variables from the regression.

65. In terms of female working hours, it is only Luci-Greulich and Thévenon (2013[5]) that include a similar measure, even though their measure refers to working hours of women in full- and part-time employment,. In contrast to our results, the coefficient here is significant and negative. It is important to note that the point estimates on female working hours are particularly large and negative in our regressions, even though the coefficient is insignificant. At the same time, D'Addio and Mira d'Ercole (2005[21]) and OECD (2019[7]) estimate a positive and significant coefficient on the share of women working in part-time employed. Importantly, the model employed in OECD (2019[7]) does not include country-specific time trends. When comparing these results to our model that excludes these trends (Table 4 column 4), we also find a positive and significant association between part-time employment and fertility rates. In Adema, Ali and Thévenon (2014[6]), this coefficient is insignificant, similar to our baseline results.

66. All in all, the results of this paper highlight the complex interplay of factors influencing fertility development in OECD countries. Labour market outcomes and family policies have a pronounced impact on fertility, suggesting that employment of both partners as well as comprehensive public family support systems can be critical factors in the decision to have a(nother) child. Fertility dynamics are also influenced by distinct within-country trends and between-country heterogeneity - such as differences and changes in social norms and attitudes towards fertility – which can also be shaped by family supports and other policies (see e.g. OECD (2023[35])). Moreover, the surge in housing expenditures seems to correlate with the decline in fertility across many OECD countries in recent years. Earlier findings indicate that public expenditure on housing correlates positively with fertility in these countries, emphasizing the potential role of governments in fostering fertility by alleviating housing cost pressures (OECD, 2019[7]). However, future research needs to further explore the intricate linkage between housing and fertility.

67. There are a few areas that this paper did not (sufficiently) address, and which may nevertheless be factors that substantially shaped fertility dynamics in the OECD. For example, while we present a few regressions on the role of employment security, recent evidence on the matter may warrant a more thorough exploration of the associations with fertility trends on OECD countries (Bastianelli, Guetto and Vignoli, 2023[17]; OECD, 2019[7]). In addition, there is further scope to deepen the analysis of the role that tax systems play in the decision to have a(nother) child beyond what is used in this paper. Additional research on the effects of tax provisions on fertility, for example by further isolating specific provisions in the OECD Tax-Benefit Models, would therefore be a valuable avenue to better understand the complex intricacies of fertility dynamics.

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Annex 5.A. Imputation of missing observations

68. As shown in Table 2 and Annex Figure 5.B.1, the analysis sample has a substantial degree of missing data for ECEC enrolment rates among 0- to 2 and 3- to 5-year-olds, as well as for the average years of schooling of men and women, which are important control variables. A Little (1988[69]) test rejects the null-hypothesis (p = 0.000) of errors missing at random (MCAR) and the sample size is already relatively small, thus a listwise-deletion process (i.e., dropping observations with any missing data entirely from the regression) or dummy variable adjustment could introduce bias in the estimates and/or substantially reduce the sample size and statistical power (Pigott, 2001[70]).

69. To address these issues, missing data on ECEC enrolment rates and average years of schooling are imputed using a multiple imputation approach (e.g., van Buuren (2018[23])). This non-parametric approach uses the distribution of the observed variables to estimate multiple possible values for the missing observation, therefore allowing to account for the uncertainty around the true value for which data is missing. With this approach, the available statistical information and the number of observations that enter the analysis are maximized, which is especially important in this small-sample cross-country setting. The resulting estimates are consistent, asymptotically normal, and close to being asymptotically efficient (Kropko et al., 2014[71]).

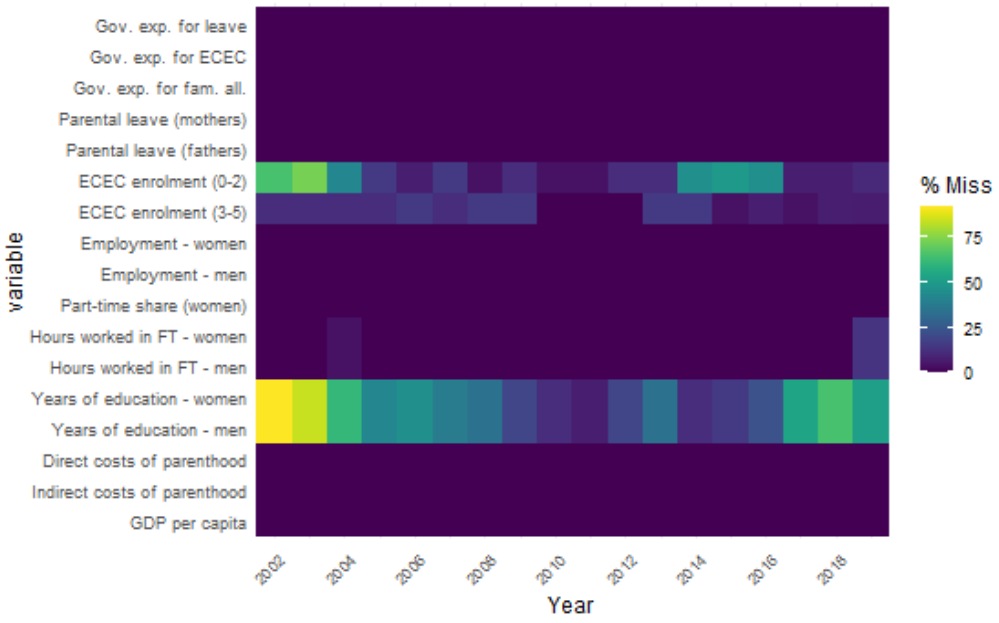
70. In practice, the multiple imputation model replaces the missing observations using predictive mean matching. As a first step, this process estimates a predicted value for the missing observation using the information in the remaining dataset and selects a set of 5 complete observations with predicted values that are closest in absolute distance to the predicted value for the missing observation. Assuming that the missing observation is based on the same distribution as these 5 observations, one of these observations is drawn at random to replace the missing observation in the dataset. This process is repeated 5 times, forming 5 separate datasets with imputed data for the missing observation on which the statistical analyses are performed. The resulting coefficients are then pooled, while adjusting the standard errors for the uncertainty that is produced by the imputation method (van Buuren, 2018[23]).

71. Annex Figure 5.B.2 shows a schematic illustration of the multiple imputation process and Annex Figure 5.B.3 shows the results of the imputation exercise for the ECEC enrolment rates of 0–2-year-olds. In the majority of cases, these imputed observations follow the trends of the actual data very well and also map, for example, the recent expansion of ECEC in Canada (Employment and Social Development Canada, 2021[72]). Table 3 also shows that there is only a marginal difference in the summary statistics of the datasets with imputed ECEC enrolment rates and the one which only includes the observed data. This is also true for average years of schooling, which enter the regression exercise as control variables, but are based on fewer observations than enrolment rates. Nevertheless, all results that include the imputed data must be regarded with the necessary caution.

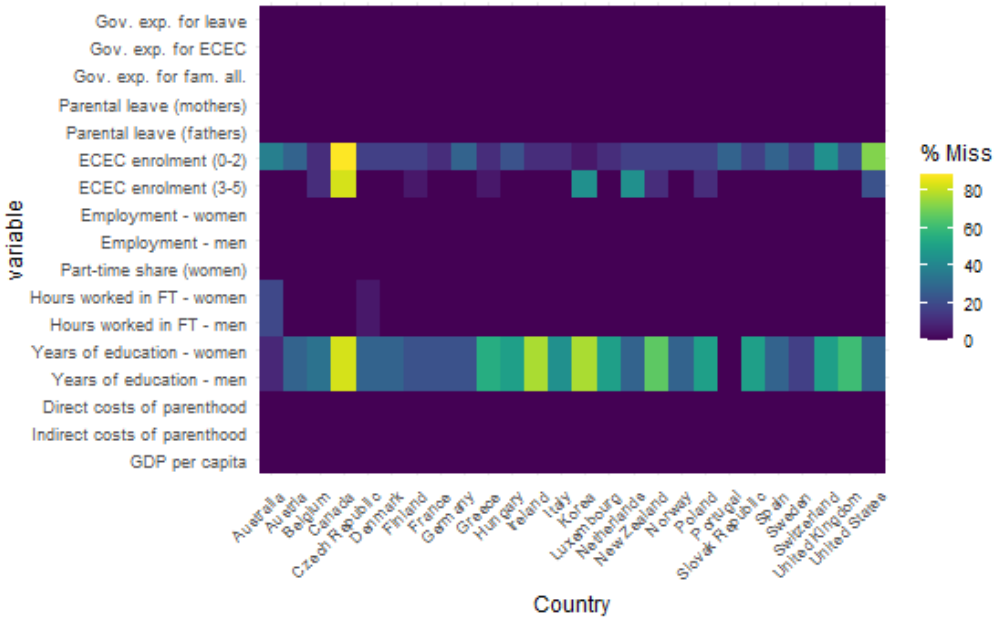
Annex 5.B. Additional Tables and Figures

Annex Figure 5.B.1. Degree of missing data

a. Share of missing variables, by year

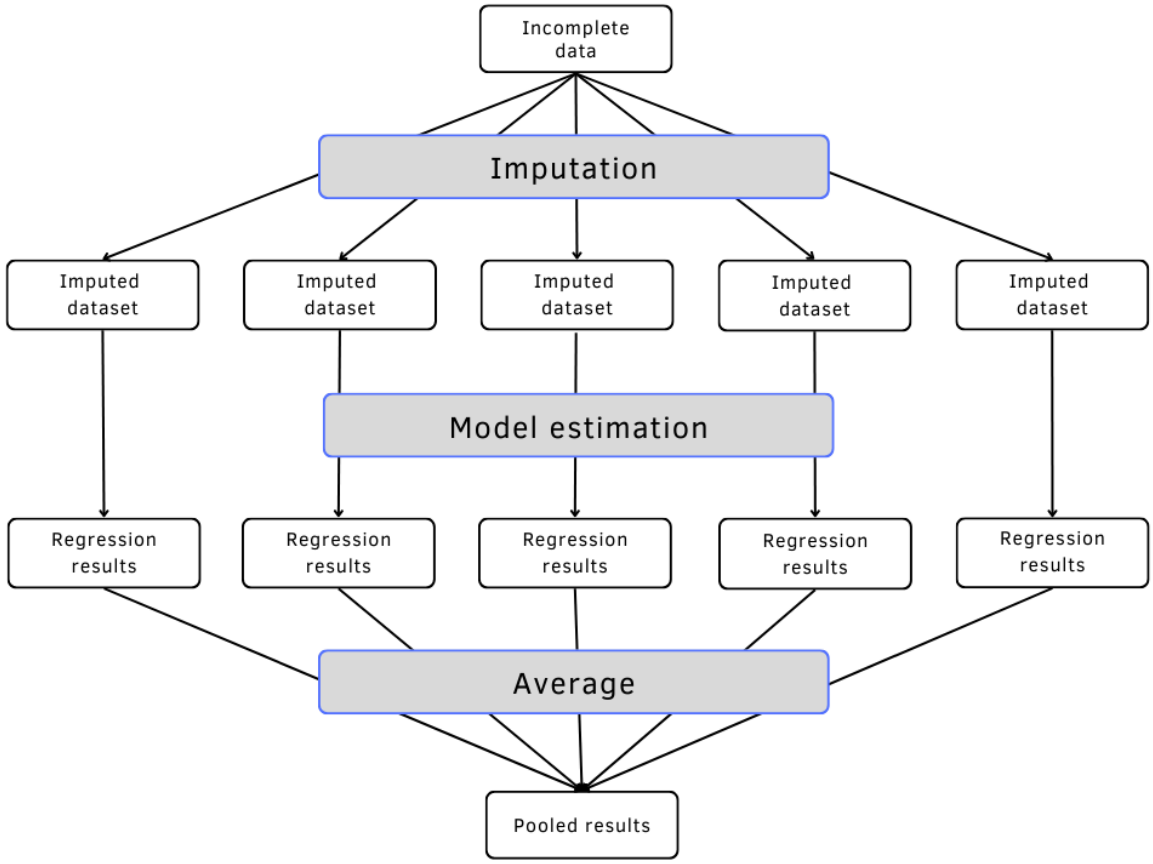


b. Share of missing variables, by country



Note: The figure plots the share of missing data by year/country for the analysis sample.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

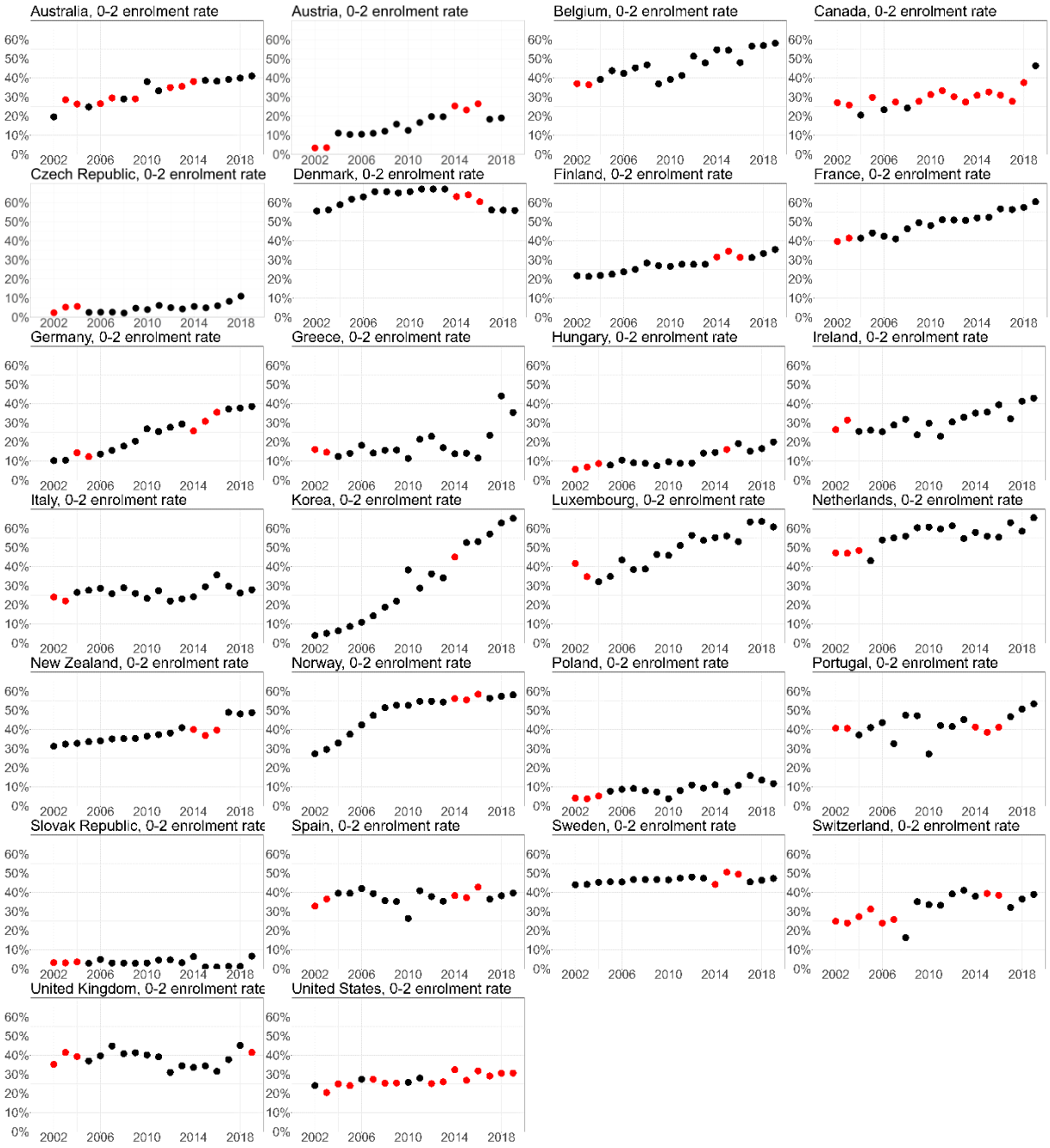
Annex Figure 5.B.2. Schematic multiple imputation process



Note: For a more detailed description of the multiple imputation mechanism see van Buuren (2018[73]).

Annex Figure 5.B.3. Imputation results for ECEC enrolment (0-2 years)

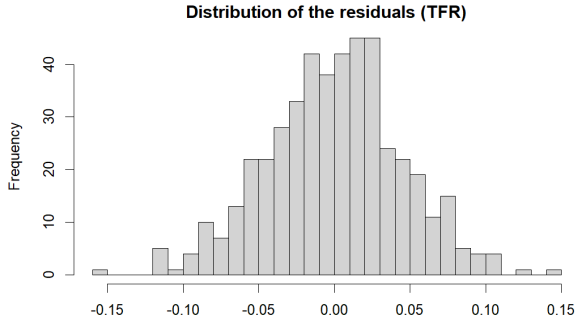
Actual (black dots) and pooled imputed data (red dots)

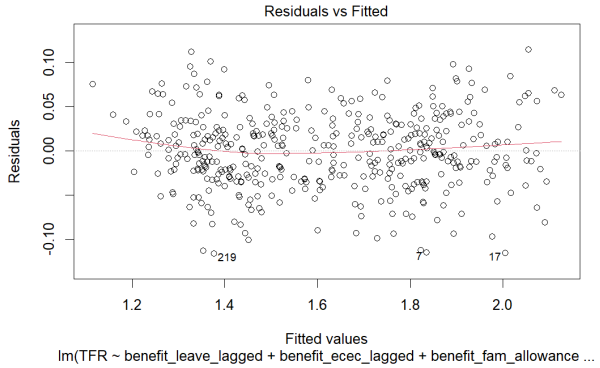


Note: Imputed values are obtained through multiple imputation, using five iterations of predictive mean matching (see van Buuren (2018[73])).
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

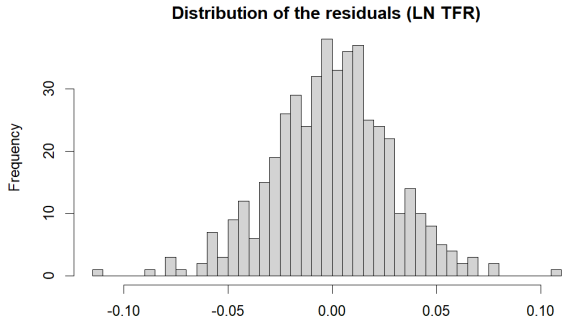
Annex Figure 5.B.4. Model diagnostics for the baseline model

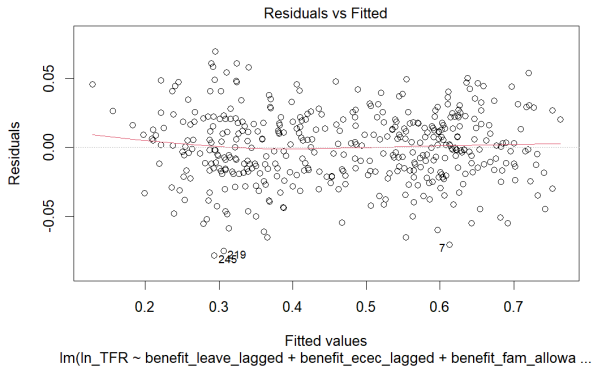
a. Non-transformed dependent variable





b. Log-transformed dependent variable



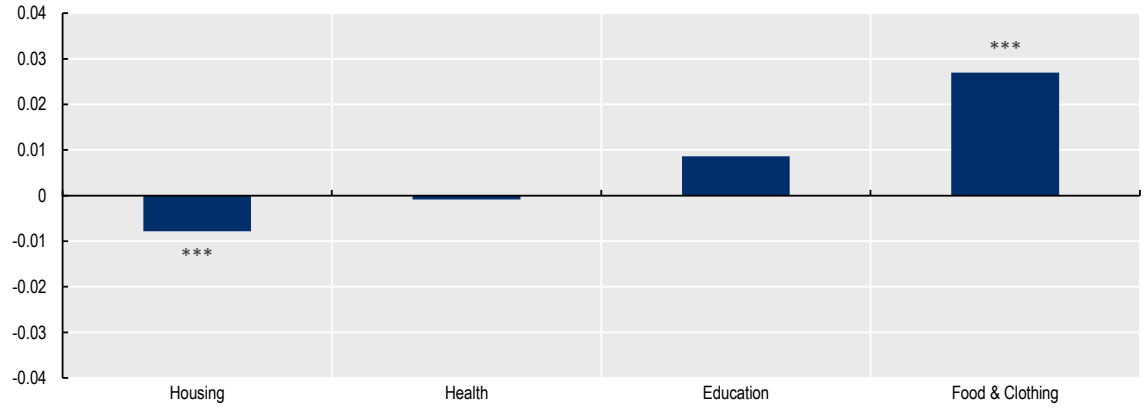


Note: The model in a.) corresponds to Annex Table 5.B.1 column 5 and the model in b.) corresponds to Table 4 column 5.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Figure 5.B.5. Alternative approach to household expenditure estimates

Coefficient estimates on shares of household consumption expenditure categories (relative to total consumption expenditure) on log transformed TFRs, 2002 to 2019



Note: Household consumption expenditure categories are included in the model as a share of total household consumption expenditure, based on OECD National Accounts data. The model controls for all regressors and fixed-effects included in the baseline regression (Table 4 column 5) and is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The standard errors are heteroskedasticity- and panel-corrected and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.1. Regression results: Model sensitivity checks (TFR)

	LN (TFR)				TFR
	Baseline	Between effects	Non-imputed	Non-lagged	Non-logged
	(1)	(2)	(3)	(4)	(5)
Constant		4.313 (13.845)			
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.012*** (0.004)	-0.055* (0.029)	0.013*** (0.004)	0.016*** (0.004)	0.018** (0.007)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.010*** (0.003)	0.015 (0.024)	0.009*** (0.003)	0.005 (0.004)	0.020*** (0.006)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.016** (0.006)	-0.002 (0.026)	0.017*** (0.006)	0.019** (0.009)	0.031*** (0.010)
ECEC enrolment rate 0-2 years	0.000 (0.000)	-0.003 (0.003)		0.000 (0.000)	0.000 (0.001)
ECEC enrolment rate 3-5 years	0.000 (0.001)	0.003 (0.002)		0.000 (0.000)	0.000 (0.001)
Weeks of paid maternity and parental leave available to mothers	0.000** (0.000)	-0.001 (0.001)	0.000** (0.000)	0.000* (0.000)	0.001** (0.000)
Weeks of paid paternity and earmarked parental leave for fathers	0.000 (0.000)	0.003 (0.004)	0.000 (0.000)	0.000 (0.000)	-0.001 (0.001)
Employment rate of women	0.008*** (0.002)	-0.002 (0.005)	0.008*** (0.002)	0.008*** (0.002)	0.011*** (0.003)
Employment rate of men	0.004** (0.002)	0.016 (0.015)	0.004** (0.002)	0.002 (0.001)	0.007*** (0.002)
Share of part-time employees among women	-0.003 (0.004)	-0.006 (0.004)	-0.003 (0.004)	-0.007*** (0.002)	-0.007 (0.005)
Hours worked by women in full-time jobs	-0.042 (0.033)	-0.095 (0.076)	-0.040 (0.032)	-0.070** (0.029)	-0.052 (0.046)
Hours worked by men in full-time jobs	0.010 (0.013)	0.061 (0.068)	0.009 (0.012)	0.025** (0.012)	0.008 (0.019)
Log GDP per capita	0.891 (0.931)	-0.926 (2.691)	0.939 (0.950)	1.937 (1.232)	0.182 (1.479)
Log GDP per capita (squared)	-0.050 (0.045)	0.051 (0.136)	-0.053 (0.046)	-0.100* (0.059)	-0.027 (0.072)
Average years of schooling among women	-0.008 (0.015)	0.164* (0.097)		0.009 (0.012)	-0.002 (0.024)
Average years of schooling among men	0.011 (0.019)	-0.140 (0.090)		-0.010 (0.012)	0.004 (0.031)
N	464	464	464	466	464
Country-specific time trends	Yes	No	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	Yes	Yes
Country fixed effects	Yes	No	Yes	Yes	Yes
Adjusted R^2	0.679 (within)	0.634 (between)	0.649 (within)	0.702 (within)	0.669 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Except for model (4), missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.2. Regression results: Model sensitivity checks (MAB)

	LN (MAB)				MAB
	Baseline (1)	Between effects (2)	Non-imputed (3)	Non-lagged (4)	Non-logged (5)
Constant		-3.680 (3.238)			
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	-0.001 (0.001)	0.007 (0.007)	-0.001* (0.001)	-0.001 (0.001)	-0.028 (0.022)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	-0.002*** (0.000)	0.009* (0.006)	-0.002*** (0.000)	-0.001*** (0.000)	-0.047*** (0.009)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	-0.001** (0.000)	0.008 (0.006)	-0.001** (0.000)	0.000 (0.001)	-0.033** (0.014)
ECEC enrolment rate 0-2 years	0.000 (0.000)	0.001** (0.001)		0.000 (0.000)	0.000 (0.002)
ECEC enrolment rate 3-5 years	0.000 (0.000)	-0.001*** (0.000)		0.000 (0.000)	0.003 (0.002)
Weeks of paid maternity and parental leave available to mothers	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)
Weeks of paid paternity and earmarked parental leave for fathers	0.000 (0.000)	-0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	-0.001 (0.001)
Employment rate of women	-0.001** (0.000)	-0.001 (0.001)	-0.001* (0.000)	0.000 (0.000)	-0.019** (0.008)
Employment rate of men	0.000 (0.000)	-0.005 (0.003)	0.000 (0.000)	0.000 (0.000)	-0.005 (0.007)
Share of part-time employees among women	0.000 (0.000)	0.004*** (0.001)	0.000 (0.000)	0.000 (0.000)	0.010 (0.009)
Hours worked by women in full-time jobs	-0.002 (0.002)	0.045** (0.018)	-0.002 (0.002)	0.001 (0.003)	-0.044 (0.051)
Hours worked by men in full-time jobs	0.001 (0.001)	-0.031* (0.016)	0.001 (0.001)	0.000 (0.001)	0.024 (0.019)
Log GDP per capita	0.276** (0.109)	1.420** (0.629)	0.272** (0.106)	0.215** (0.094)	7.550** (3.112)
Log GDP per capita (squared)	-0.011** (0.005)	-0.071** (0.032)	-0.011** (0.005)	-0.009* (0.005)	-0.311** (0.150)
Average years of schooling among women	0.000 (0.002)	0.013 (0.023)		0.000 (0.001)	-0.002 (0.060)
Average years of schooling among men	0.001 (0.003)	-0.017 (0.021)		0.000 (0.001)	0.019 (0.080)
N	464	464	464	466	464
Country-specific time trends	Yes	No	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	Yes	Yes
Country fixed effects	Yes	No	Yes	Yes	Yes
Adjusted R^2	0.690 (within)	0.907 (between)	0.657 (within)	0.671 (within)	0.717 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Except for model (4), missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.3. Regression results: ECEC enrolment sensitivity

	LN (TFR)			LN (MAB)		
	No ECEC expenditure	No women's employment	Logged enrolment	No ECEC expenditure	No women's employment	Logged enrolment
	(1)	(2)	(3)	(4)	(5)	(5)
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.011*** (0.004)	0.014*** (0.004)	0.012*** (0.004)	-0.001 (0.001)	-0.001* (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)		0.013*** (0.003)	0.010*** (0.003)		-0.002*** (0.000)	-0.002*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.016** (0.006)	0.011** (0.005)	0.016** (0.007)	-0.001** (0.000)	-0.001 (0.000)	-0.001** (0.000)
ECEC enrolment rate 0-2 years	0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)	
ECEC enrolment rate 3-5 years	0.000 (0.001)	0.000 (0.001)		0.000 (0.000)	0.000 (0.000)	
Log ECEC enrolment rate 0-2 years			0.000 (0.007)			0.002 (0.002)
Log ECEC enrolment rate 3-5 years			-0.023 (0.036)			0.007 (0.005)
Weeks of paid leave available to mothers	0.000** (0.000)	0.001** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)
Employment rate of women	0.008*** (0.002)		0.008*** (0.002)	-0.001*** (0.000)		-0.001** (0.000)
Employment rate of men	0.003** (0.002)	0.009*** (0.001)	0.004** (0.002)	0.000 (0.000)	-0.001*** (0.000)	0.000 (0.000)
Share of part-time employees among women	-0.004 (0.003)	0.000 (0.003)	-0.003 (0.004)	0.001* (0.000)	0.000 (0.000)	0.000 (0.000)
Hours worked by women in full-time jobs	-0.043 (0.033)	-0.038 (0.035)	-0.042 (0.032)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Hours worked by men in full-time jobs	0.010 (0.013)	0.007 (0.014)	0.009 (0.012)	0.001 (0.001)	0.001* (0.001)	0.001 (0.001)
Log GDP per capita	1.003 (0.890)	0.578 (1.090)	0.914 (0.938)	0.257** (0.106)	0.300*** (0.111)	0.263** (0.103)
Log GDP per capita (squared)	-0.057 (0.043)	-0.036 (0.053)	-0.051 (0.045)	-0.010** (0.005)	-0.013** (0.005)	-0.011** (0.005)
Average years of schooling among women	-0.007 (0.015)	-0.013 (0.016)	-0.008 (0.015)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
Average years of schooling among men	0.010 (0.019)	0.016 (0.021)	0.012 (0.019)	0.001 (0.003)	0.000 (0.003)	0.001 (0.003)
N	464	464	464	464	464	464
Country-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.677 (within)	0.666 (within)	0.679 (within)	0.685 (within)	0.687 (within)	0.688 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent Bonferroni-corrected significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.4. Regression results: Additional labour market regressors

	LN (TFR)			LN (MAB)		
	Employment Protection	Temporary Employment	Unemployment	Employment Protection	Temporary Employment	Unemployment
	(1)	(2)	(3)	(4)	(5)	(5)
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.009*** (0.003)	0.010** (0.004)	0.013*** (0.003)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.004 (0.003)	0.006*** (0.002)	0.012*** (0.003)	-0.001*** (0.001)	-0.001*** (0.000)	-0.002*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.026*** (0.008)	0.011* (0.007)	0.015** (0.007)	-0.001 (0.001)	-0.001** (0.001)	-0.001** (0.001)
ECEC enrolment rate 0-2 years	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000** (0.000)	0.000 (0.000)
Log ECEC enrolment rate 0-2 years	0.000* (0.000)	0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Log ECEC enrolment rate 3-5 years	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000** (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.009*** (0.002)	0.009*** (0.002)	0.006** (0.002)	-0.001** (0.000)	-0.001*** (0.000)	-0.001* (0.000)
Weeks of paid and earmarked leave for fathers	0.003 (0.002)	0.004 (0.002)	-0.007* (0.004)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Employment rate of women	-0.004 (0.004)	-0.002 (0.004)	-0.003 (0.003)	0.000 (0.000)	0.001** (0.000)	0.000 (0.000)
Employment rate of men	-0.050 (0.033)	-0.045 (0.034)	-0.043 (0.029)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Share of part-time employees among women	0.011 (0.014)	0.013 (0.014)	0.008 (0.012)	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)
Index of employment protection	-0.006 (0.025)			-0.006** (0.003)		
Share of temporary employment		-0.005 (0.004)			0.000 (0.000)	
Unemployment rate			-0.014*** (0.005)			0.000 (0.001)
Log GDP per capita	0.412 (1.069)	1.189 (0.935)	-0.065 (1.141)	0.313*** (0.088)	0.267*** (0.083)	0.303*** (0.114)
Log GDP per capita (squared)	-0.026 (0.052)	-0.068 (0.046)	-0.007 (0.055)	-0.013*** (0.004)	-0.011*** (0.004)	-0.013** (0.005)
Average years of schooling among women	-0.010 (0.016)	-0.008 (0.019)	-0.003 (0.015)	0.000 (0.002)	0.001 (0.002)	0.000 (0.002)
Average years of schooling among men	0.016 (0.021)	0.012 (0.023)	0.007 (0.018)	0.001 (0.003)	0.000 (0.003)	0.001 (0.003)
N	457	425	464	457	425	464
Country-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.673 (within)	0.683 (within)	0.693 (within)	0.671 (within)	0.717 (within)	0.690 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent Bonferroni-corrected significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.5. Regression results by birth order

Birth order	LN (TFR)			LN (MAB)		
	1st	2nd	3rd	1st	2nd	3rd
	(1)	(2)	(3)	(4)	(5)	(5)
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.020 (0.010)	0.039*** (0.010)	0.040*** (0.013)	0.000 (0.001)	-0.001 (0.001)	-0.002 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.002 (0.009)	-0.013 (0.008)	-0.029 (0.015)	0.003** (0.001)	0.002*** (0.000)	0.001** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	-0.042 (0.026)	-0.019 (0.033)	0.027 (0.074)	0.007** (0.003)	0.006** (0.002)	0.001 (0.001)
ECEC enrolment rate 0-2 years	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.000 (0.000)	0.000 (0.000)	0.001 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.000 (0.000)	0.001*** (0.000)	0.002 (0.001)	0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)
Employment rate of women	0.009** (0.003)	0.009* (0.004)	0.009* (0.004)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)
Employment rate of men	0.002 (0.003)	0.004 (0.004)	0.006 (0.004)	0.000 (0.000)	0.001*** (0.000)	0.001* (0.000)
Share of part-time employees among women	0.002 (0.004)	-0.005 (0.004)	0.000 (0.005)	0.001 (0.001)	0.001** (0.000)	0.000 (0.000)
Hours worked by women in full-time jobs	-0.020 (0.033)	-0.048 (0.037)	-0.095 (0.051)	0.008*** (0.002)	0.005*** (0.002)	0.002 (0.002)
Hours worked by men in full-time jobs	0.008 (0.013)	0.022 (0.015)	0.033 (0.021)	-0.004*** (0.001)	-0.003*** (0.001)	-0.001 (0.001)
Log GDP per capita	-1.241 (1.273)	-0.244 (1.536)	-5.187 (2.740)	0.625*** (0.206)	0.449* (0.197)	0.356 (0.187)
Log GDP per capita (squared)	0.075 (0.072)	0.025 (0.083)	0.283 (0.148)	-0.026** (0.010)	-0.020 (0.010)	-0.015 (0.010)
Average years of schooling among women	0.014 (0.016)	0.005 (0.016)	0.002 (0.025)	-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.002)
Average years of schooling among men	-0.011 (0.016)	-0.001 (0.017)	0.003 (0.026)	0.001 (0.001)	0.001 (0.002)	0.002 (0.002)
N	290	290	290	290	290	290
Country-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.823 (within)	0.721 (within)	0.549 (within)	0.861 (within)	0.844 (within)	0.796 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent Bonferroni-corrected significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.6. Regression results by birth order when controlling for costs

Birth order	LN (TFR)			LN (MAB)		
	1st	2nd	3rd	1st	2nd	3rd
	(1)	(2)	(3)	(4)	(5)	(5)
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	0.017 (0.010)	0.035*** (0.009)	0.036** (0.015)	0.000 (0.001)	-0.001 (0.001)	-0.002 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.000 (0.009)	-0.016 (0.008)	-0.035** (0.013)	0.003** (0.001)	0.002*** (0.000)	0.001** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	-0.064** (0.023)	-0.051 (0.025)	-0.003 (0.070)	0.008** (0.003)	0.006** (0.002)	0.000 (0.001)
ECEC enrolment rate 0-2 years	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.000 (0.000)	0.000 (0.000)	0.001 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.000 (0.000)	0.001*** (0.000)	0.002 (0.001)	0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)
Employment rate of women	0.008*** (0.003)	0.008* (0.003)	0.008** (0.003)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)
Employment rate of men	0.002 (0.003)	0.004 (0.003)	0.006 (0.003)	0.000 (0.000)	0.001*** (0.000)	0.001* (0.000)
Share of part-time employees among women	0.002 (0.004)	-0.006 (0.004)	-0.002 (0.005)	0.001 (0.001)	0.001*** (0.000)	0.000 (0.000)
Hours worked by women in full-time jobs	-0.028 (0.029)	-0.058 (0.035)	-0.100 (0.049)	0.008*** (0.002)	0.005*** (0.002)	0.001 (0.002)
Hours worked by men in full-time jobs	0.013 (0.011)	0.029* (0.013)	0.035 (0.021)	-0.005*** (0.001)	-0.003** (0.001)	-0.001 (0.001)
Log GDP per capita	-1.290 (1.263)	-0.292 (1.541)	-5.130 (2.625)	0.637*** (0.209)	0.445* (0.198)	0.335 (0.183)
Log GDP per capita (squared)	0.076 (0.070)	0.027 (0.082)	0.285 (0.143)	-0.026** (0.010)	-0.019 (0.010)	-0.015 (0.009)
Average years of schooling among women	0.014 (0.015)	0.005 (0.015)	0.004 (0.026)	-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.002)
Average years of schooling among men	-0.012 (0.015)	-0.001 (0.015)	0.001 (0.026)	0.000 (0.001)	0.001 (0.002)	0.002 (0.002)
Direct costs of parenthood	-0.759*** (0.171)	-1.099*** (0.255)	-1.199*** (0.256)	0.030 (0.034)	-0.010 (0.023)	-0.054* (0.023)
Indirect costs of parenthood	0.355 (0.226)	0.333 (0.278)	-0.516 (0.586)	-0.050 (0.048)	-0.012 (0.023)	0.044 (0.028)
N	290	290	290	290	290	290
Country-specific time trends	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.837 (within)	0.757 (within)	0.582 (within)	0.862 (within)	0.843 (within)	0.800 (within)

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent Bonferroni-corrected significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

Annex Table 5.B.7. Regression results for two different periods

	LN (TFR)		LN (MAB)	
	Fixed Effects Baseline		Fixed Effects Baseline	
	(1)		(2)	
Interaction with year dummy	2002-2007	2008-2019	2002-2007	2008-2019
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	-0.008 (0.006)	0.023*** (0.005)	-0.001 (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.017*** (0.004)	0.004 (0.004)	-0.002*** (0.001)	-0.001*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	0.007 (0.008)	0.008 (0.008)	-0.002*** (0.001)	0.000 (0.001)
ECEC enrolment rate 0-2 years	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.001** (0.000)	0.001** (0.000)	0.000* (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.002** (0.001)	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)
Employment rate of women	0.007*** (0.002)	0.006** (0.003)	-0.001 (0.000)	0.000 (0.000)
Employment rate of men	0.005* (0.003)	0.003** (0.001)	0.001*** (0.000)	0.000 (0.000)
Share of part-time employees among women	-0.003 (0.003)	-0.002 (0.004)	0.000 (0.000)	0.001 (0.000)
Hours worked by women in full-time jobs	-0.037 (0.032)	-0.056* (0.030)	-0.005*** (0.002)	0.003 (0.002)
Hours worked by men in full-time jobs	-0.002 (0.012)	0.030** (0.013)	0.004*** (0.001)	-0.003** (0.001)
Log GDP per capita	0.857 (1.255)	1.733* (0.955)	0.096 (0.111)	0.205** (0.092)
Log GDP per capita (squared)	-0.047 (0.060)	-0.087* (0.045)	-0.002 (0.005)	-0.008* (0.004)
Average years of schooling among women	-0.010 (0.025)	0.005 (0.018)	0.001 (0.003)	-0.002 (0.002)
Average years of schooling among men	0.016 (0.031)	-0.001 (0.021)	0.000 (0.004)	0.002 (0.003)
N	464		464	
Country-specific time trends	Yes		Yes	
Year fixed effects	Yes		Yes	
Country fixed effects	Yes		Yes	
Adjusted R^2	0.728 (within)		0.764 (within)	

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, and the UN World Population Prospects.

Annex Table 5.B.8. Regression results for two different periods when controlling for costs

	LN (TFR)		LN (MAB)	
	Fixed Effects Baseline		Fixed Effects Baseline	
	(1)		(2)	
Interaction with year dummy	2002-2007	2008-2019	2002-2007	2008-2019
Public spending on parental leaves (1000 USD PPP per child aged 0-5)	-0.012* (0.006)	0.017*** (0.006)	0.000 (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)	0.012*** (0.004)	0.003 (0.005)	-0.003*** (0.001)	-0.001*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)	-0.005 (0.006)	-0.002 (0.006)	-0.002* (0.001)	0.000 (0.001)
ECEC enrolment rate 0-2 years	-0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid leave available to mothers	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Weeks of paid and earmarked leave for fathers	0.002* (0.001)	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)
Employment rate of women	0.007*** (0.002)	0.007*** (0.002)	-0.001* (0.000)	0.000 (0.000)
Employment rate of men	0.005* (0.004)	0.003*** (0.001)	0.001*** (0.000)	0.000 (0.000)
Share of part-time employees among women	-0.003 (0.003)	-0.003 (0.004)	0.000 (0.000)	0.001 (0.000)
Hours worked by women in full-time jobs	-0.040 (0.030)	-0.056** (0.028)	-0.004** (0.002)	0.003 (0.002)
Hours worked by men in full-time jobs	0.004 (0.012)	0.027** (0.012)	0.003** (0.002)	-0.003** (0.001)
Log GDP per capita	0.657 (1.294)	1.729* (1.031)	0.076 (0.123)	0.190* (0.105)
Log GDP per capita (squared)	-0.036 (0.062)	-0.088* (0.049)	-0.001 (0.006)	-0.007 (0.005)
Average years of schooling among women	-0.010 (0.026)	-0.004 (0.018)	0.001 (0.002)	-0.001 (0.003)
Average years of schooling among men	0.015 (0.032)	0.012 (0.022)	-0.001 (0.004)	0.002 (0.003)
Direct costs of parenthood	-0.782*** (0.172)	-0.762*** (0.152)	-0.018 (0.062)	0.025 (0.048)
Indirect costs of parenthood	0.038 (0.395)	0.358 (0.299)	-0.038 (0.029)	-0.035 (0.024)
N	464		464	
Country-specific time trends	Yes		Yes	
Year fixed effects	Yes		Yes	
Country fixed effects	Yes		Yes	
Adjusted R^2	0.751 (within)		0.764 (within)	

Note: The model is estimated over separate periods using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.

Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

Annex Table 5.B.9. Regression results including consumption expenditure (TFR)

	LN (TFR)			
	Simple	Labour	Baseline	Cost
	(1)	(2)	(3)	(4)
Household expenditure towards housing (2002 = 100)	-0.001 (0.001)	-0.001** (0.001)	-0.002*** (0.001)	-0.002** (0.001)
Household expenditure towards health (2002 = 100)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Household expenditure towards education (2002 = 100)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Household expenditure towards food and clothing (2002 = 100)	0.003** (0.001)	0.002 (0.001)	0.002* (0.001)	0.002** (0.001)
Household expenditure towards other things (2002 = 100)	0.001*** (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Public spending on family leaves (1000 USD PPP per child aged 0-5)			0.013** (0.005)	0.007 (0.005)
Public spending on ECEC (1000 USD PPP per child aged 0-5)			0.011*** (0.003)	0.008*** (0.002)
Public spending on family allowances (1000 USD PPP per child aged 0-17)			0.016** (0.007)	0.002 (0.006)
ECEC enrolment rate 0-2 years			0.000 (0.000)	-0.001 (0.001)
ECEC enrolment rate 3-5 years			0.000 (0.001)	-0.001 (0.000)
Weeks of paid maternity and parental leave available to mothers			0.000* (0.000)	0.000 (0.000)
Weeks of paid paternity and earmarked parental leave for fathers			0.000 (0.000)	0.000 (0.000)
Employment rate of women		0.008*** (0.003)	0.008*** (0.003)	0.008*** (0.003)
Employment rate of men		0.002 (0.002)	0.002 (0.002)	0.002 (0.002)
Share of part-time employees among women		-0.002 (0.003)	-0.002 (0.004)	-0.003 (0.004)
Hours worked by women in full-time jobs		-0.037 (0.029)	-0.037 (0.030)	-0.047* (0.028)
Hours worked by men in full-time jobs		0.004 (0.010)	0.007 (0.011)	0.013 (0.011)
Log GDP per capita	0.584 (1.078)	0.820 (0.851)	1.112 (0.739)	1.238* (0.697)
Log GDP per capita (squared)	-0.033 (0.055)	-0.053 (0.040)	-0.067* (0.035)	-0.072** (0.032)
Average years of schooling among women		-0.011 (0.016)	-0.003 (0.016)	-0.011 (0.016)
Average years of schooling among men		0.017 (0.019)	0.003 (0.019)	0.015 (0.020)
Direct costs of parenthood				-0.914*** (0.106)
Indirect costs of parenthood				0.549*** (0.195)
N	468	464	464	464
Country-specific time trends	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.631 (within)	0.674 (within)	0.688 (within)	0.720 (within)

Note: The model is estimated for the period 2002 to 2019 using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Household consumption expenditure categories are included relative to the respective expenditure in 2002, based on OECD National Accounts data. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.

Annex Table 5.B.10. Regression results including consumption expenditure (MAB)

	LN (MAB)			
	Simple	Labour	Baseline	Cost
	(1)	(2)	(3)	(4)
Household expenditure towards housing (2002 = 100)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Household expenditure towards health (2002 = 100)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Household expenditure towards education (2002 = 100)	0.000 (0.000)	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)
Household expenditure towards food and clothing (2002 = 100)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Household expenditure towards other things (2002 = 100)	0.000* (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)
Public spending on family leaves (1000 USD PPP per child aged 0-5)			-0.001** (0.001)	-0.001 (0.001)
Public spending on ECEC (1000 USD PPP per child aged 0-5)			-0.001*** (0.000)	-0.001*** (0.000)
Public spending on family allowances (1000 USD PPP per child aged 0-17)			-0.001** (0.001)	-0.001 (0.001)
ECEC enrolment rate 0-2 years			0.000 (0.000)	0.000 (0.000)
ECEC enrolment rate 3-5 years			0.000 (0.000)	0.000 (0.000)
Weeks of paid maternity and parental leave available to mothers			0.000 (0.000)	0.000 (0.000)
Weeks of paid paternity and earmarked parental leave for fathers			0.000 (0.000)	0.000 (0.000)
Employment rate of women		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Employment rate of men		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Share of part-time employees among women		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Hours worked by women in full-time jobs		-0.002 (0.002)	-0.003 (0.002)	-0.002 (0.002)
Hours worked by men in full-time jobs		0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Log GDP per capita	0.389** (0.156)	0.427*** (0.158)	0.418*** (0.158)	0.411*** (0.157)
Log GDP per capita (squared)	-0.018** (0.008)	-0.019** (0.008)	-0.019** (0.008)	-0.018** (0.008)
Average years of schooling among women		0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
Average years of schooling among men		-0.001 (0.002)	-0.001 (0.003)	-0.001 (0.003)
Direct costs of parenthood				0.034 (0.037)
Indirect costs of parenthood				-0.033 (0.026)
N	468	464	464	464
Country-specific time trends	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.685 (within)	0.700 (within)	0.707 (within)	0.708 (within)

Note: The model is estimated for the period 2002 to 2019 using country-level data from Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Household consumption expenditure categories are included relative to the respective expenditure in 2002, based on OECD National Accounts data. Missing values for average years of schooling and ECEC enrolment rates are handled through multiple imputation, using five iterations of predictive mean matching. The standard errors are heteroskedasticity- and panel-corrected (for fixed effects models) and shown in parenthesis. ***, ** and * represent significance at 1%, 5% and 10% level, respectively.
Source: OECD calculations based on data from OECD Family Database, OECD Employment Database, OECD Social Expenditure Database, OECD National Accounts, UNESCO UIS Database, OECD Tax and Benefit Models and the UN World Population Prospects.