

Formal Childcare Provision and Birth Trends: Evidence from Italy

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Abstract

Using a counterfactual framework based on municipal data, we examine the effect of variations in the provision of Early Childhood Education and Care (ECEC) services for children below three years of age on births in Italy. We find that an increase in the availability of ECEC services has a positive and statistically significant effect on the number of births at the municipal level. However, these significant effects on births require two conditions. First, the increase in the coverage rate must be sufficiently large, rather than the result of very gradual incremental growth. Second, minimum initial levels of ECEC coverage (of at least 10%) must already be present. At the same time, we find no “saturation effect” when coverage increases starting from an already relatively high level of ECEC coverage. Findings are consistent with the idea that the insufficient availability of formal childcare represents one of the barriers to the realization of couples’ reproductive plans. At the same time, the present study provides a cautionary tale on what can be expected in terms of fertility outcomes thanks to investments in ECEC provision in countries with very low fertility rates: mainly due to the “fertility trap”, policy interventions through an expansion of ECEC slow the decline in births, but do not manage to fully offset it.

Keywords Fertility · Early childhood education and care (ECEC) · Births · Family policies · Italy

1 Introduction

Below replacement level fertility is a concern in all so-called “advanced” societies. Low fertility is not simply the result of individuals’ desires, but also of the existence of structural barriers (UNFPA, 2025; Fluchtmann et al., 2023). In many countries there is a gap between fertility intentions and realized fertility, with individuals desiring more children than they actually have (Beaujouan & Berghammer, 2019). Increasingly, policy makers intervene with the goal to augment fertility (Sobotka et al., 2019; Luci-Greulich & Thévenon, 2013) by removing barriers. One potential key lever for facilitating the realization of desired fertility is to allow for an adequate reconciliation of work and family care duties and thereby reducing the (opportunity) costs of children. In this respect, there is an ongoing debate whether the provision of formal childcare services for children below the age of 3 (the so-called Early Childhood Education and Care - ECEC) can contribute to increasing births (Sobotka et al., 2019),

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and under what conditions the effect is sizable. Relatively recent reviews on previous studies show mixed results, and that it is often difficult to compare findings due to the use of different methods as well as different measures of both fertility and ECEC provision (Bergsvik et al., 2021; Scherer et al., 2024).

We assess possible fertility effects of ECEC through a dynamic analysis focusing on the changes in ECEC coverage at the municipal level. To identify and estimate this causal effect, we adopt a counterfactual approach based on an innovative non-parametric generalization of the Difference-in-Differences estimator, following Imai et al. (2023), which allows to isolate the impact of childcare provision from confounding demographic and socio-economic factors. This implies comparing birth trends in municipalities with increased ECEC coverage to “identical” municipalities, within the same region, but without such increase, thereby isolating the effect of formal childcare provision from confounding demographic and socioeconomic factors. We do so for Italy, which is an interesting case: the country has a fertility rate that has been for decades among the lowest in Europe (1.18 children per woman in 2024) and, at the same time, it has traditionally had one of the lowest ECEC coverage rates in Europe. The evidence from the Italian context and the methodology adopted for Italy may offer useful insights for - and could be replicated in - several other European countries (from many Central-Eastern European ones to Ireland, Austria, Germany, Switzerland, and Greece). These countries shared in the last decade with Italy a relatively contained childcare attendance rate below the EU-27 average *and* below replacement level fertility rates. Some of them followed a similar (if not stronger) path as the Italian one with an increase in attendance rates from low levels to medium-low levels (e.g. Switzerland, Germany, Ireland, Estonia), while others increased only marginally attendance rates (e.g. several Central-Eastern European countries, Greece, etc.) (authors’ own calculation on Eurostat online database for “Children in formal childcare” - indicator: `ilc_caindformal`).

2 Background

ECEC services, if offered at affordable prices for families, can significantly reduce the direct and indirect costs associated with raising children and thus increase fertility (Doepke et al., 2023). Sociological and demographic literature underlines the relevance of ECEC services to help women (and men) to assume more equitable roles within their families and in society, which in turn helps to increase fertility (Esping-Andersen & Billari, 2015; Goldscheider et al., 2015). In order to have a positive impact on fertility, policies are (slowly) moving from passive support, mainly through cash benefits and leaves (for the traditional family), to so-called “social investment” policies, based also on the expansion of ECEC provision (Billingsley et al., 2022; Korpi et al., 2013), with the idea to remove structural barriers to fertility decisions, rather than providing immediate economic incentives. Evidence from maternal employment studies (Del Boca & Vuri, 2007; Wrohlich, 2006) suggests that, in countries with limited formal childcare, increasing the number of early education slots may influence fertility decisions more than reducing costs.

Empirical research on the effects of ECEC provision on fertility has provided some support for the theoretically predicted positive effect. A recent literature review by Hart et al. (2024) suggests childcare expansions to have a lasting impact on fertility, while the review by Gauthier and Gietel-Basten (2024) underlines the overall limited effects and Scherer et al. (2024) emphasize the presence of mixed results.

Effects of ECEC on fertility are also context-dependent (Fluchtmann et al., 2023), depending on countries characteristics and the specific path that led to variations over time of ECEC provision. A long-term trend is discernible in most high-income countries toward an increase in formal childcare coverage (OECD, 2025), occurring either through major ECEC reforms that suddenly introduce new rights or through more gradual, incremental expansions. While a number of studies document a positive association between the availability of formal childcare and fertility outcomes (e.g., Del Boca 2002; Rindfuss et al. 2010; Luci and Thévenon 2011), these effects tend to emerge primarily in contexts where services are sufficiently widespread and accessible. In settings characterized by low (initial) coverage, the limited availability may fail to relax the structural constraints faced by potential parents, thereby weakening or nullifying the impact on fertility behaviour (Hank & Kreyenfeld, 2003).

In this perspective, small increases in childcare provision may be insufficient to generate measurable effects, as they do not substantially alter access conditions nor reduce uncertainty regarding service availability. Moreover, the effectiveness of childcare policies is linked to their degree of social acceptance: where formal childcare is not yet fully institutionalized, parents may be less likely to perceive it as a reliable substitute for informal care (Van Lancker & Ghysels, 2016; Esping-Andersen, 2009). In this perspective, increases starting from very low levels might (initially) have limited effects. Consistently, both empirical and theoretical contributions suggest that observable changes in fertility decisions require both a minimum level of childcare coverage and sizable expansions in coverage capable of significantly improving accessibility and salience (Thévenon, 2011; UNFPA, 2019).

Building on the findings from previous research, this contribution aims to add some nuance to the discussion of the relationship between ECEC provision and fertility by using a new approach, i.e. the counterfactual framework, and analysing the Italian context.

3 The Italian Institutional Setting

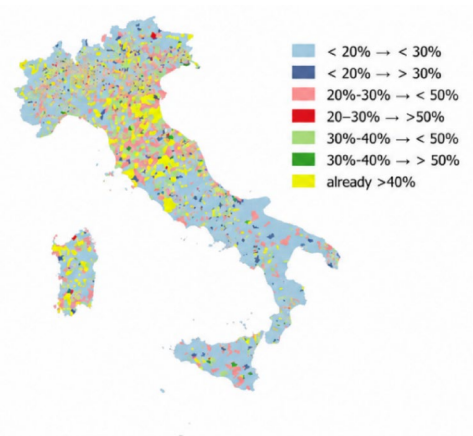
In Italy, municipalities are primarily responsible for providing early childhood care and education (ECEC) services, often acting as direct public service providers or supporting the private sector through partnerships or fee payments to families. Over the past years, Italy has introduced several policies to increase the coverage of ECEC. The first major systemic intervention to increase supply was the National Extraordinary Plan for the Development of Socio-Educational Services (2007–2009), which allocated resources to create new nursery places, with the aim of reaching the EU target of 33% coverage (Lisbon Agenda). The 2007 Budget Law (Law 296/2006) established financial support for a three-year special public funding program for the PSSSPI, with the objective to subsidize the development of both public and private early childhood care services, and to reduce disparities South and the Centre-North. The primary beneficiaries of the program are providers of early childhood care services, which can be both public and private. Typical beneficiaries include municipalities and private entities that operate daycare centers and provide supplementary services for children aged 0–2. From 2007 to 2013 the central government invested about €472 million in the programme, integrated by €572 million from the regional governments (Giorgetti & Picchio, 2021).

The objectives of expanding provision were also pursued in subsequent years through state, regional, and municipal funds, as well as European financing, but also through a broader model of provision based on the spread of supplementary and innovative services compared to traditional nurseries (such as family-based childcare services). Integration between the public and private sectors was also encouraged, in its various forms (agreements, workplace nurseries). An important structural reform was the creation of the Integrated Education and Care System for children aged 0–6 (the 0–6 education system), introduced through Legislative Decree 65/2017. New funding for increasing places was established. Moreover, in 2017, a financial benefit was established for families using these services, with the aim of supporting them in covering tuition fees (Law No. 232 of 11 December 2016).

Nevertheless, the coverage rate (including both public and private sectors) stood at 23% in 2014, 10% points below the level required to meet the European Barcelona target set for 2010 (33% participation for children under the age of three). ECEC provision increased only modestly in the following years (25.7% in 2018 and 30% in 2022) and remained highly uneven across the country (Fig. 1). In 2018, coverage was substantially higher in the Centre-North (32.2%), exceeding 33% in several regions and surpassing 45% in some provincial capitals such as Bologna, while remaining much lower in the South and Islands (13.7% on average), with most areas below 20% (Istat).

More recent interventions, beyond the period analysed in this paper, include the National Program for Resilience and Recovery, which allocated substantial funding to expand ECEC provision, and the introduction of a minimum coverage standard, aiming to secure places for 33% of children aged 0–2 (Law No. 234, 30 December 2021). Recent statistical surveys show that demand for ECEC services is rising across all areas. While financial

Fig. 1 Levels and variation in ECEC service coverage rates, 2014–2018



contributions have reduced the cost burden on families and stimulated demand, including for private provision, attendance remains constrained by limited availability in both public and private services (Istat, 2026). In 2023, over half of private providers and nearly 70% of public ones lacked sufficient capacity to meet demand, leaving a substantial number of children on waiting lists (Istat et al., 2025). ECEC costs remain a significant barrier, exceeding €2,000 per year for families and being substantially higher in the private sector. Municipal allocation criteria prioritize children with two working parents, supporting work-family reconciliation but often excluding single-income households with fewer means to offset the limited availability of public places. At the same time, the close interconnection between public and private sectors in Italy - where around 60% of private services are affiliated with municipalities - along with central and local subsidies that partially offset fees, underscores the need to include both types of services to provide a comprehensive view of ECEC provision.

Selecting the appropriate unit of analysis in Italy is challenging, as ECEC services are partially managed through approximately 700 supra-municipal Social Territorial Areas (ATS). Residents of small municipalities can use ECEC services in neighbouring municipalities, which may obscure the effect of increased provision in one municipality when compared with a neighbouring municipality benefiting from the same increase. Using ATS as the unit would limit the capture of municipal-level variation, and their annual reconfiguration makes dynamic analysis imprecise. Aggregating data at the provincial level would flatten key differences - for instance, between provincial capitals and surrounding municipalities, such as Rome, where coverage exceeds twice that of the rest of the province - potentially introducing confounding factors. Considering all factors, we conducted the analysis at the municipal level, accepting a possible reduction in statistical significance in smaller municipalities, which constitute the majority of municipalities in Italy but represent a smaller share of the population and of children aged 0–2.

4 Research Question

This brief report investigates whether a (large enough) expansion of ECEC provision leads to a change in the subsequent trend of births, compared to its counterfactual. This also implies to define what constitutes a policy-relevant discontinuity in ECEC for fertility effects to emerge: we define changes of at least 10% points (p.p.). During the period covered by this study, coverage was not only initially low, but also growth was limited, as shown in Fig. 1: the vast majority of municipalities had coverage below 20% in 2014 (5,353), and by 2018 most of these still fell below 30% (5,095 municipalities shaded light blue in Fig. 1), with only a small share moving into the 20–30% category. Our first analysis focuses on those municipalities that, starting from below 20%, experienced an increase above 30% between 2015 and 2018 (264 municipalities shaded in blue), approaching or exceeding

the European Barcelona target. We then further split this group according to their initial levels, distinguishing between those municipalities starting from coverage levels below 10% and those from at least 10%.

A further question concerns the effects of ECEC-expansion once higher levels of coverage have been reached. As supply increases, demand may grow accordingly, potentially creating new shortages of available places. To investigate this, we focus on the second and third largest groups of Italian municipalities in 2014, with coverage rates of 20–30% (1,007 municipalities) and 30–40% (616 municipalities), respectively. By 2018, over half of the municipalities in both groups remained below these ranges, although some exceeded 40% or 50% coverage. These cases are examined in the second set of analyses, which consider different initial levels of ECEC coverage and a minimum expansion of 10% points to test for potential heterogeneous effects.

It is important to note that in the Italian demographic context, where previous declines in fertility have significantly reduced the number of women of reproductive age, we do not expect that increases in ECEC provision alone could reverse the downward trend in natality (number of children born), but it may slow the pace of decline. In other words, a potential positive effect does not necessarily imply a higher number of births compared to previous years, but relative to similar municipalities that have not experienced such an increase in ECEC provision.

5 Data and Method

To investigate the effects of ECEC coverage on fertility, the research adopts a counterfactual approach studying the number of births at the municipal level in Italy and its variation over time.¹ Analyses are based on data collected by the Italian National Institute of Statistics (Istat) covering all Italian municipalities (approximately 7,900) from 2013 to 2022. Births are measured as the number of live births in each municipality for the various years (Istat Database on Demographic Statistics). Information on ECEC provision comes from an annual Istat survey, which has collected municipal-level data since 2013 on coverage rates for children under 3 years of age. The data include both public and private services and encompass nurseries as well as integrated early childhood services, such as play areas, parent–child centres, and home-based educational services.

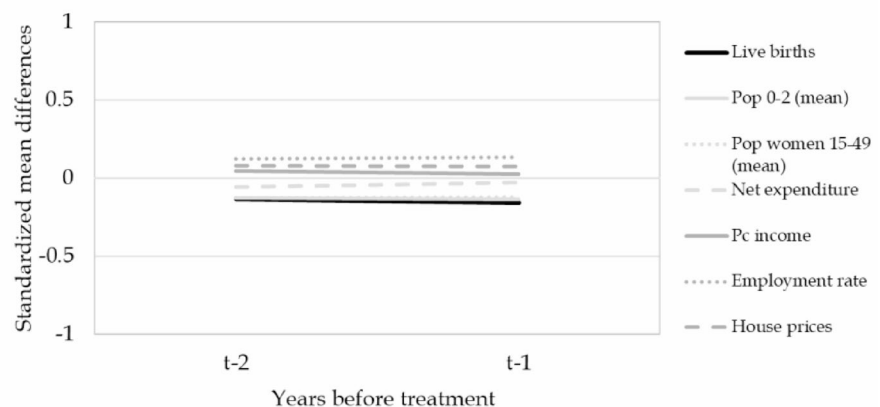
Treatment is defined as the change in ECEC coverage from one year to the next. A municipality is defined as first treated in year t if it experiences a coverage increase above the specified threshold in that year, having experienced no such increase in the two preceding years ($t-1$ and $t-2$). The treatment indicator switches from 0 to 1 in year t , and municipalities are then followed over subsequent post-treatment horizons. We define a set of binary treatment variables, constructed based on annual changes in coverage during 2015–2018, distinguishing the size of the increase and the initial level. The treatment scenarios are designed to capture policy-relevant movements across ECEC coverage levels. Because the baseline strata and target thresholds imply different minimum percentage-point increases, comparisons across scenarios may partly reflect differences in the size of the coverage expansion as well as differences in initial coverage levels. We therefore interpret heterogeneity across scenarios as differences across policy-relevant expansion profiles, rather than as isolating the effect of baseline coverage alone. We define the following treatment scenarios: (1) $<10 \rightarrow 30+$, $10/20 \rightarrow 30+$, $0/20 \rightarrow 30+$; (2) $20/30 \rightarrow 40+$, $20/30 \rightarrow 50+$, $30/40 \rightarrow 50+$. To characterize these comparisons, Table D1 of Appendix D reports baseline characteristics of treated municipalities and matched controls across the treatment scenarios, using demographic, socio-economic, ECEC-service, and geographic indicators measured in 2014, before the beginning of the treatment window. The treatment window is determined by the requirement of observing at least two pre-treatment years and up to four post-treatment years within the 2013–2022 panel. As treatment may occur at different moments in time for different municipalities within the identified time span, we use a recent econometric method developed by Imai et al. (2023), following their original framework. This method is based on the nonparametric

¹ We focus on the number of births rather than fertility rates because rates can be highly volatile in small municipalities. By matching on demographic structure and previous fertility, we ensure comparability in population composition while estimating absolute changes in births associated with ECEC expansions.

generalization of the Difference-in-Differences (DiD) estimator that accounts for staggered treatment adoption, meaning that the matching procedure is implemented separately for each treatment cohort.² For a municipality first treated in year t with $t = 2015, 2016, 2017$ or 2018 , the matched set includes only municipalities that are not treated in years $t-2$ and $t-1$, for which we control. The counterfactual approach allows separating treatment effects from other factors that influence birth trends at the municipal level. For each municipality first treated in year t , treatment effects at horizon F are computed as Difference-in-Differences in the number of births between the treated unit and its matched not-yet-treated controls, relative to the last pre-treatment year ($t-1$). Estimation proceeds by constructing cohort-specific matched sets and applying a weighted DiD estimator within each set.³ The formal definition of the ATT(F, L) parameter and the corresponding estimator are provided in Appendix C. Our identification relies on three assumptions. Let F denote the number of periods after treatment (post-treatment horizon) and L the number of pre-treatment periods used for conditioning. First, potential outcomes may depend on past treatment status only up to L pre-treatment periods (no carryover beyond L). Second, birth outcomes in a given municipality are assumed not to be directly affected by ECEC expansions in other municipalities (no interference). Third, conditional on treatment history, lagged outcomes, and observed covariates, treated and not-yet-treated municipalities would have followed parallel trends in the absence of treatment. We assess the performance of the matching procedure through pre-treatment balance diagnostics on outcomes and covariates (Fig. 2), which show no systematic differences prior to treatment. These diagnostics evaluate whether treated and matched control municipalities are similar with respect to the observed histories included in the conditioning set. While they do not constitute an independent test of the conditional parallel trends assumption, they provide evidence that the matching design achieves balance on the observed pre-treatment information used for identification.

The methodological approach presents several advantages (Imai et al., 2023): (i) the assumptions on which it is based are less stringent than most commonly used methods, such as two-way fixed-effects models, dynamic models or conventional DiD estimators; (ii) the estimator is consistent even in the presence of few treated units; (iii) compared to estimators recently proposed in the literature - e.g., the DiD estimators with multiple periods proposed by others (Callaway & Sant'Anna, 2021), it allows to assess balance in pre-treatment outcomes and covariates between treated and matched control units; (iv) it does not rely on parametric assumptions; and, as

Fig. 2 Balance of pre-treatment covariates across treated and control observations. The y-axis refers to the standardized mean differences between treated and untreated (matched) observations



² Matching is performed on lagged outcomes and covariates measured separately at $t-1$ and $t-2$ (rather than on pre-treatment averages). Control municipalities may serve as matches for multiple treated units across cohorts, exploiting matching with replacement.

³ Operationally, for each treatment cohort we compute a Difference-in-Differences contrast between the treated municipality and its matched not-yet-treated controls, using the last pre-treatment year ($t-1$) as the baseline. The reported estimates correspond to weighted averages of these cohort-specific DiD contrasts across treated municipalities.

stated above, it is particularly suitable in case of staggered treatment adoption. Further technical details are provided in Appendix C. Our analysis conditions on two lagged pre-treatment years for each treatment cohort and looks at the dynamics of the impact up to four years after treatment. While an increase in pre- and post-treatment periods increases the credibility of the assumptions, it reduces the efficiency of the estimates by reducing the number of potential “fits” between treated and untreated cases in the matching procedure.

To define a proper counterfactual for treated municipalities, we identify control (untreated) municipalities that are as similar as possible in the pre-treatment years to the treated ones on several crucial factors, except for the treatment, i.e. the increase in ECEC coverage. In particular, the matching procedure uses the following municipality-level information: female population of childbearing age (defined as the number of resident women aged 15–49), resident population of children aged below 2 years (which also rules out the risk that treatment results from a dip in the number of children), number of live births, public spending by municipalities on ECEC, employment rate, average income, and housing price. All variables are collected by Istat, apart from the latter two, which have been respectively retrieved from the Ministry of Finance database, and from Real Estate Market Observatory (OMI). In addition, to better account for context-dependent factors, omitted variables (local economic/cultural factors affecting both ECEC and fertility), and to strengthen our counterfactual approach, the matching of treated and control cases is done *within* the same region (20 regions are present in Italy with an average population of around 3 million inhabitants). We refine this matched set - M_i , by using the Mahalanobis distance measure, which assigns a positive weight to the ten control units within M_i more similar to the treated unit in terms of pre-treatment trends of the outcome and control covariates. Detailed inspection of the pre-treatment years is presented in Fig. 2, which reports standardized mean differences for all variables included in the conditioning set, before and after cohort-specific matching. These diagnostics indicate that the matching procedure substantially improves balance between treated and matched control municipalities on pre-treatment covariates and lagged outcome trajectories. This supports the credibility of the matching design with respect to observed pre-treatment characteristics. In this matching-based framework, pre-treatment dynamics are assessed through balance on lagged outcomes rather than through separate event-study lead coefficients.

To further characterize the matched samples, Table D2 of Appendix D provides an additional baseline comparison on pre-treatment characteristics not included in the matching algorithm, measured in 2014 before the treatment window.⁴

6 Results

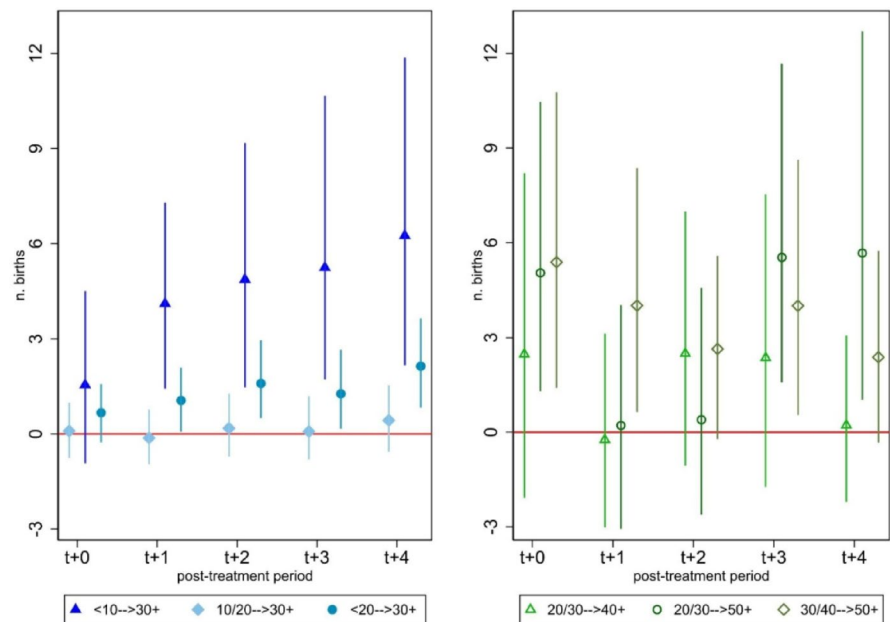
6.1 Does the Increase of ECEC Provision Come with Higher Fertility?

6.1.1 Municipalities Starting from Coverage Below 20%

The first analysis revealed substantial and statistically significant effects of the increase in ECEC coverage on births, as reported in Fig. 3 (see Table A1 in the Appendix A for details): the 264 municipalities that, starting from below 20%, exceeded 30% coverage during the 2015–2018 period experienced a significantly higher number of births in the four years following the intervention compared with identical, untreated municipalities (blue dot, left panel). These are mostly smaller municipalities compared with all Italian municipalities. Effect sizes increase over the four years following treatment, with treated municipalities experiencing an average of 2.14 births more by year four after the ECEC expansion than the non-treated. With a pre-intervention average of 25 births in 2014, this increase corresponds roughly to 8.6%, providing an order-of-magnitude estimate rather than the exact percentage difference relative to control municipalities.

⁴ Table D2 is intended to further characterize the matched samples and should not be interpreted as a formal test of the conditional parallel trends assumption.

Fig. 3 Increase in ECEC coverage and number of births. The Figure shows the point estimates as well as the confidence intervals at the 5% level of significance. The Y-axis shows the dependent variable, whereas the X-axis shows the post-treatment time periods considered



A disaggregated analysis of these municipalities reveals interesting patterns. Distinguishing between very low coverage (0–10%) and low coverage (10–20%) reveals that for those starting from very low coverage, there is no significant effect of increased ECEC provision on fertility over the four years following the intervention (blue diamond, left panel Fig. 3). This result remains statistically non-significant also when the minimum expansion threshold is reduced to 10% points, that is, for municipalities moving from 0 to 10% to above 20% coverage (not reported). The subgroup comprises 187 municipalities, mostly rural (79%) and some small towns or suburbs (21%). Only 6% have more than 5,000 inhabitants, with an average of 17 live births in 2014. By contrast, for municipalities that went from a low level of coverage (10–20%) to a level of 30% or higher we estimated 6.25 more births on average at time t+4 (blue triangle, left panel Fig. 3). This subgroup comprises relatively larger municipalities compared with the previous analysis. The average number of live births was 50.7 in 2014, and the estimated increase at time t+4 corresponds to approximately 12.3% relative to this baseline. Given the smaller number of cases entering the analysis, confidence intervals are rather large.

These analyses suggest that effects of the change from below 20% coverage to above 30% are entirely driven by the subgroup of municipalities that increased their coverage from 10 to 20% to above 30%. This finding supports the hypothesis that even substantial expansions produce measurable effects only when they build on a minimum initial level of coverage.

6.2 Municipalities Starting from Higher Coverage

We then ask whether higher initial levels make further increases relatively less effective in influencing birth outcomes and analyse municipalities with higher initial coverage, focussing on municipalities with initial coverage of 20–30% and 30–40%. For both groups we examine the effects of a minimum expansion of 10% points. Results are reported in the right panel of Fig. 3. Among municipalities with initial coverage between 20% and 30%, increases leading to coverage levels of at least 40% are associated with positive but statistically non-significant effects on births (green triangle), whereas exceeding 50% is associated with positive and statistically significant effects (green dot). The latter result is also observed among municipalities starting from 30 to 40% coverage (green diamond). In both groups, effects emerge with the second year after the intervention (t+2) and peak at t+4, with estimated increases of 5.67 and 5.38 births per municipality, respectively, compared to controls, corresponding to 15.7% and 10.1% increases relative to the pre-intervention average. The group starting from 20

to 30% is predominantly rural (72.7%) with 1,000–5,000 inhabitants, averaging 36 live births in 2014, while the municipalities starting from 30 to 40% are predominantly larger towns and cities (over 5,000 inhabitants), averaging 53 live births in 2014. The smaller number of treated municipalities in these analyses (33 in the first group and 48 in the second) results in relatively high uncertainty of the estimates.

Overall, there is no support for the idea that there would be any saturation effect, i.e. a level beyond which further increases in the coverage of services would not have any effect on births. However, in Italy, assessing the effects of very high coverage levels, like in those countries where saturation-effects were reported, encounters limitations due to the overall limited presence of municipalities with high coverage-levels.

6.3 Robustness Checks

We performed various robustness checks. First, to rule out that higher birth numbers result from persons migrating to high ECEC coverage municipalities we use the share and the number (absolute value) of women of reproductive age (15–49) as the outcome. If the increase in births were due to the attractiveness of municipalities that experience an expansion of services toward women of childbearing age, rather than an increase in the fertility of the already resident population, we should observe an effect of the treatment on the number (and their share in the population) of women of childbearing age. For all analyses, the impact is never statistically significant, indicating that the effect of increased provision of services on births is not due to young couples relocating to these more attractive municipalities (see Table B1 and B2 in Appendix B for details). Second, we re-run the analysis basing the matching on the number and trend of women aged 25–39 (rather than 15–49), as most births occur in this age range. Results are in line with the main analysis (see Table B3 in Appendix B for details).

Third, we implement a placebo test by assigning treatment four years earlier to units treated in 2017–2018, ensuring that the placebo intervention falls entirely outside the actual treatment period and does not overlap with subsequent dynamics. The estimated effects are close to zero and statistically insignificant across all leads, supporting the validity of our identification strategy (see Table B4 in Appendix B).

Finally, we assess the sensitivity of the main analysis by employing different matching and weighting methods to refine the matched set of control units: we use the propensity score matching (PSM) proposed by Rosenbaum and Rubin (1983) and the covariate balancing propensity score weighting (Imai & Ratkovic, 2014). The point estimates from all these estimators are presented in Table B5 of Appendix B. All these tests are broadly consistent with the baseline results in both magnitude and temporal pattern. In particular, the effects remain positive and increase over time, with statistically significant impacts emerging from the first post-treatment periods onward. Minor differences across specifications do not alter the overall interpretation of the findings.

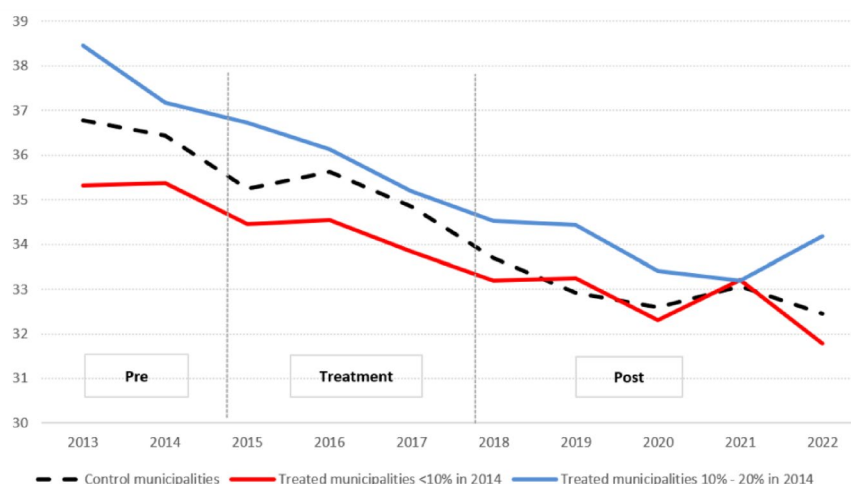
7 Discussion and Conclusion

This paper contributes to the literature on the relationship between ECEC provision and fertility by conducting a counterfactual analysis of Italian municipalities, showing that increases of 10% points or more in coverage rates lead to significantly more births compared to similar municipalities without such increases.

Small and gradual increases in ECEC coverage may still matter in the long run, but our design is better suited to identifying the effects of substantial and clearly observable changes in service provision. Conceptually, a small change would likely be insufficient to rebalance the relationship between the supply and demand for ECEC, or to be perceived by prospective parents as the removal of a constraint. Indeed, uncertainty about the availability of educational and care services for children in their first years of life - combined with the economic, employment, and housing instability that often affects young people in Italy - can negatively influence the decision to have a child.

We examined several policy-relevant expansion scenarios to assess whether effects vary by initial and target coverage levels. Across the scenarios in which significant effects emerge, point estimates range between roughly

Fig. 4 Number of births per year by 1000 women (aged 15–49) among treated and control municipalities (treatments: 0–10% → 30%+ and 10–20% → 30%+ ECEC coverage)



two and six additional births compared with similar municipalities without such expansions. Effects tend to increase over time and are largest four years after treatment, consistent with the idea that families may need time to become aware of changes in service availability and to adjust fertility decisions.

Although these effects may appear modest in absolute terms, they are meaningful relative to the average pre-treatment number of births in the municipalities analysed. For instance, the estimated increase, four years after treatment, in the scenario starting from 10 to 20% of ECEC coverage rate to over 30% is about 6 births. The average number of live births was 51 before treatment, which implies an increase on the order of approximately 12%, though this is an indicative magnitude rather than the actual estimated percentage increase over what would have occurred in the absence of the coverage increase.

To further substantiate results of our contribution, Fig. 4 reports the descriptive differences between treated and non-treated municipalities in the number of live births per 1000 women in pre- and post-treatment periods for two of the analysed treatments (an increase from below 10% or 10–20% ECEC coverage to above 30%).

Public debates about birth trends are often framed in terms of increasing fertility and in fact we too comment on “positive” effects. However, in this analytical setting, point estimators indicate the *difference* in the number of live births between treated and non-treated municipalities, which in a context of generally declining births implies that the policy intervention manages to slow down the decline for those contexts with investment in ECEC, but does not manage to fully offset it, which becomes clear from Fig. 4.

A reversal of the declining trend in the number of births seems, in the current situation, rather unrealistic, even if fertility *rates* would start to increase – a fact also referred to as the fertility trap, as the number of women in fertile ages (the potential mothers) has declined because of previously low fertility. Therefore, we argue the reported effect sizes still present a rather encouraging signal. In countries with higher fertility levels, and with less influence from other factors contributing to low fertility as observed in Italy, additional births relative to the potential trend without interventions could be even greater, although this would need to be examined through further analyses.

In conclusion, faced with the need to address declining births and the related population aging, public decision-makers are looking for tools to halt this trend. Favouring the conciliation of (continuous) employment with family formation, thus lowering the economic and social costs of children figures high on the political agenda of many governments. Especially the extension of early childhood education and care is expected to favour fertility decisions among the young generations. This does not imply that increasing births was the only or main purpose of ECEC services. This kind of social investment policies offers additional benefits in terms of women’s employment, especially for women with lower education, greater gender equality – in the long run, and can support the development of children’s abilities.

Beyond reducing the direct and opportunity costs of children, visible and reliable ECEC provision may also shape expectations. A sufficiently developed local service system can increase confidence that public support will be available when families need it, thereby making childcare a more credible component of fertility planning. In fact, we found no evidence suggesting the presence of “saturation” effects, meaning that also at higher coverage levels additional increase still produced an effect -we should note, however, that the limited service-coverage in Italy does not allow to assess the impact of very high availability.

Initial coverage appears particularly relevant at the lower end of the distribution. Municipalities with no or very low initial coverage, below 10%, do not show significant fertility responses even after sizable expansions. One possible explanation is that, where formal childcare is scarcely available, families may not yet perceive ECEC as a reliable component of work-family reconciliation or fertility planning. In such contexts, low provision may reinforce low familiarity and weak demand, contributing to a self-reinforcing local equilibrium. Local childcare environments may therefore form part of the institutional conditions that sustain low-fertility traps. Cross-border access to ECEC may also play a role, especially in smaller municipalities, where families may rely on facilities in neighbouring areas.

The analysis also underlined that policy consequences develop in context and are sensitive to previous levels, making clear how positive (or negative) feedback-loops might lead to the emergence of more positive or more dire demographic situations.

Our findings indicate that increasing early childhood education and care (ECEC) increases the number of births only where supply is already developed. Municipalities with coverage below 10% - still 49% in Italy in 2023, some with no ECEC at all - show no effect and urgently need both service expansion and confidence-building in formal childcare. In contrast, municipalities with existing provision can further expand access, producing progressively positive effects on births. Therefore, there is a need to support the start-up of a supply system where it is still non-existent, and more generally to support the achievement of levels to meet demand.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

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