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## Abstract

The expansion of public childcare and increases in female labor force participation (FLP) are major developments in European societies. Though studies, in general, suggest the existence of effects of childcare on FLP, the results are very heterogeneous across different studies. This heterogeneity may well be driven by the lack of accounting for heterogeneous time trends and regional differences. Based on a fully balanced panel of German counties from 2007 to 2017, the effects of an increase in overall and full-time childcare places for children aged 0-2 and 3-5 on FLP are estimated. We add novel empirical insights by using fixed effect (FE) and fixed effect individual slope models (FEIS) to control for selection on trends, and by differentiating across different regional types. In most cases, we find conventional FE models to be biased due to heterogeneous time trends. In West Germany, increases in overall and full-time childcare places for children aged 3-5 years foster FLP. For toddlers (0-2), we find no effect on FLP in West Germany once selection on trends is taken into account. When further differentiating by region type, we identify a strong impact of full-time care for the age group 0-2 on FLP in urban, agglomeration and rural counties, but not in metropolitan areas. Our results highlight how the returns in FLP to public childcare differ between regional contexts and provide evidence for catch-up processes in childcare enrollment and FLP for rural areas.

**Keywords:** Childcare, Female Labor Force Participation, fixed effect individual slope models (FEIS), Germany

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# 1 Introduction

The provision of public childcare is an essential topic for family policies in many countries (Immervoll and Barber, 2006). For decades, the percentage of children in day-care facilities has increased in all OECD countries, with Germany recording one of the steepest rises (OECD, 2017). Several European countries followed a "child-centered social investment strategy" (Esping-Andersen, 2002: p. 26), whereby public childcare was supposed to raise female labor force participation (FLP) to increase fertility and to foster child development. Moreover, FLP has increased in the last decades (Thévenon, 2013). Both developments – increases of childcare policies and FLP – are strongly related; together with female education and egalitarian gender attitudes, they can be interpreted as a part of a gender revolution (England, 2010), which occurred at different paces between and within countries. A crucial question thereby is to identify causal effects between childcare policies and FLP. This paper focuses on the effect of the rise in public childcare enrollment on female employment rates, as proposed by the economic model of the family (e.g. Blau, 2003) and the structural model of welfare state changes (Esping-Andersen, 2002).

The childcare reforms in Germany are well suited for analyzing effects of childcare policies on FLP for three reasons: (1) Childcare places for toddlers (0-2) more than doubled within the analyzed decade (2007-2017) in West Germany. (2) The full-time enrollment for childcare of children aged 3-5 increased by 57% in this decade. (3) Germany is a federal country including heterogeneous regions with vastly different enrollment rates for childcare, and rich data on that. Thus, there is a wide range of literature studying the extensive and intensive margins of public childcare in Germany (Boll and Lagemann, 2019; Müller and Wrohlich, 2020; Schober and Spieß, 2015; Zoch, 2020; Zoch and Hondralis, 2017), including research on the moderating effects of policy reforms, costs, quality of care, availability and the influence on gender ideologies (Zoch and Schober, 2018). Studies usually utilize individual data, while some more recent studies utilize within-country variation in macro data panels. These macro-data approaches (Boll and Lagemann, 2019: Müller and Wrohlich, 2020) extend existing knowledge by showing the macro-level returns to changes in public childcare over time. However, they lack controlling for heterogeneous trends biasing classical fixed effect (FE) models and disregard regional differences.

To close this research gap, we utilize more advanced fixed effects individual slope (FEIS) models (Brüderl, 2015; Rüttenauer and Ludwig, 2020; Wooldridge, 2015). We use a full balanced panel on county-level data in Germany over 11 years including information on childcare enrollment (any place) and full-time enrollment (with a care time of 7 and more hours per day) both for toddlers (age group 0-2) and kindergarten (age group 3-5) enrollment. Thereby, we cover four indicators of the entire sector of early childhood care. This allows estimating the within-county effect of changes across the entire

early childcare system on the FLP rate. By focusing on the intensive margin of FLP on the county level, we provide reliable estimates based on almost every German county from 2007 to 2017, which enables us to evaluate the total societal effect of increases in the provision of childcare.

We contribute to the literature in the following ways: First, we replicate research on childcare and female employment, using official administrative data at the county level, and enrich it by four different indicators of childcare. Second, we utilize FEIS models to account for heterogeneous time trends in FLP and childcare provision between counties. Third, we examine differences along the historical divide in childcare systems between West and East Germany and scrutinize heterogeneous effects between counties with different degrees of urbanization.

In line with previous research, we find a positive effect of increasing childcare enrollment on FLP in West Germany when using FE Models. But our results indicate that conclusions from FE models are partly driven by differences in the time trends across counties. By differentiating between regions, our paper highlights that increases in childcare provisions exhibit heterogeneous effects: it is mostly the provision of full-time childcare in more rural areas which benefits the female labor force participation. With this differentiation, we provide an example of how to deal with regionally different time-paths when analyzing the effect of childcare enrollment on FLP with panel data.

## 2 Public childcare and female employment

### Policy reforms and the development of public childcare

Traditionally, Germany is a country with low fertility and low labor force participation of mothers and is historically characterized by a strong regional heterogeneity. In former West Germany (Müller and Wrohlich, 2020), social norms and tax systems favor a classical male breadwinner model for families. In former Eastern Germany, women were more frequently employed and the availability of childcare enrollment was higher, thus Western Germany was faced with an enormous need to catch up. The expansion of public childcare was part of a paradigm shift in family policy including changes in family law and the introduction of a generous parental leave in 2007, which influenced mothers' work behavior and preferences (Gangl and Ziefle, 2015). In 2004, the 'daycare expansion law' (Tagesbetreuungsausbaugesetz, TAG) explicitly addressed the expansion of daycare for children under the age of three, formulating quality standards for child-minders. In 2008, the 'childcare funding act' (Kinderförderungsgesetz, KiFöG) prescribed a gradual expansion of childcare for children under the age of three,

denominating the 1 August 2013 as the deadline for when supply had to meet the demand. Since August 2013, each child under the age of three is legally entitled to have access to a public childcare place. In the wake of these laws, Germany succeeded in one of the steepest increases in public childcare in all OECD countries (OECD, 2017). Childcare enrollment rates for children aged 0-2 were boosted from 9.4% to 27.1% between 2007 and 2017 in West Germany. The increase in Eastern Germany was weaker but started from a higher level (from 41.9% in 2007 to 54.3% in 2017, own calculations). At the same time, full-time enrollment rates for children aged 0-2 increased from 2.5% to 11.1% in West and from 27.7% to 43.8% in East Germany (see appendix Tables A6, A7).

Childcare enrollment for children aged 3-5 is on a high level and does not change much (90.8% to 90.6% in West Germany in the period 2007-2017), but we can observe an increase from 16.3% to 34.4% regarding full-time places for children aged 3-5. For East Germany, childcare enrollment for ages 3-5 decreased from 94.6% to 93.4% but enrollment in full-time places increased from 62% to 76.4%. The slight decrease in the share of enrolled children aged 3-5 stems from decreases in enrollment rates in the years 2016 and 2017. This decline is well known and assumed to be a consequence of increasing birth rates in previous years and higher immigration rates in 2015, both leading to an increase in the number of children in 2016 and 2017 (BMFSFJ, 2018)[4]. At the same time, female employment rates increased from 44.1% to 55.2% in West and from 49.9% to 62.7% in East Germany (2007-2017, own calculations, change in the percentage of employed women aged 15 to 65).[5]

Overall, German social policy created favorable conditions for the reconciliation of family and work, which lead to a noticeable relief for parents and an overall increase of the quality of life of German mothers and fathers (Preisner et. al. 2020; 2018). Moreover, less affluent households have been extricated from the costs (Schmitz, Spieß and Stahl, 2017). Due to these cost exemptions, fees do not play a major role in the decision for or against childcare usage, as only 23% (age group 0-2) and 20% (age group 3-5) of the non-users mention fees as reason for their non-utilization (Alt et al., 2017).

These achievements look impressive at first glance, but the vast majority of children aged 0 to 2 in West Germany and around half of the children of that age group in East Germany are still in an informal care arrangement. They are at home with their mothers, being cared for by their grandparents or in other private care arrangements. The situation is quite different when it comes to children aged 3-5. Here, the majority uses professional care arrangements, whereby there is still unmet demand for full

[4] Note that our rates differ slightly from those in the report, as we report aggregates from the share per county instead of shares based on the overall population.

[5] Graphical presentations of the regional development of employment and childcare can be found in the Appendix Figure A2-A6.

daycare places (Alt et al., 2017). In the following, we will provide a brief review of existing literature on the topic.

## Empirical approaches on public childcare and female employment

The link between subsidized childcare and an increase of female employment has been tested in various studies (for a detailed overview of the literature, see e.g. Morrissey, 2017; Zoch and Hondralis, 2017). Most empirical studies in the field identify a positive effect of early childcare on parental labor force participation, but previous literature also demonstrates that findings vary by individual characteristics and context (Cascio, Haider and Nielsen, 2015; Morrissey, 2017). On the individual level, effects seem more pronounced for single mothers (Morrissey, 2017), mothers with more children (Givord and Marbot, 2014; Nollenberger and Rodriguez-Planas, 2015; Zoch and Hondralis, 2017) and those with lower incomes (Geyer, Haan and Wrohlich, 2015). On the contextual level, Zoch and Hrondalis (2017), for instance, find pronounced effects of childcare expansion in West, but not in East Germany. Brilli, Boca and Pronzato (2016) further demonstrate that large effects on mother`s labor force participation are usually found where only a few places were available. Others have also shown that benefits from childcare expansions are stronger in contexts with historically low female employment levels (Cascio et al., 2015; Nollenberger and Rodriguez-Planas, 2015), or depend on the opportunities of informal childcare arrangements (e.g. Asai, Kambayashi and Yamaguchi, 2015). Thus, previous research indicates a strong heterogeneity in how female labor force participation benefits from public child arrangements.

In terms of research design, studies on childcare and female employment can be differentiated with regards to content, either focusing on rising or falling prices of childcare places (Lundin, Mörk and Öckert, 2008), or on the increasing availability of public places (Zoch and Hondralis, 2017). Further, research can be differentiated in terms of methodology, considering the type of data used for analysis. Without panel data at hand, researchers exploited the so-called 'between'-variance of cross-sectional studies to identify the effect of childcare on female employment. For instance, Kreyenfeld and Hank (2000) found no significant correlation between childcare and mother's employment in West Germany, while others (e.g. Büchel and Spieß, 2002) did. Nowadays, cross-sectional analyses usually take flak for ignoring the endogeneity of regional differences, as this strand of research cannot rule out potential biases due to selection on levels. For instance, day care providers may favor regions with high female employment or families with young children may move to regions with a high rate of subsidized childcare places.

To minimize this bias, contemporary research tends to utilize panel data. Since 2006, the German Statistical Office provides data on the enrollment of subsidized childcare for toddlers aged 0-2 and for

older children aged 3-5 (Hüsken, 2011). This data is provided per year, but only as macro data aggregated at the county level. Indicators for overall enrollment and full-time enrollment are available since 2007. With the availability of this data, a growing body of literature emerged, usually linking macro information on childcare enrollment with microdata drawn from other studies, e.g. the micro census (MC) or the Socio-Economic Panel (SOEP). With panel data at hand, researchers usually exploit the so-called 'within'-variance by using multi-level panel approaches. By design of the data, these studies often distinguish between overall childcare places and full-time places.

Using microdata from SOEP and event history models, Zoch and Hondralis (2017) found that higher childcare enrollment (overall ratio) levels were modestly associated with shorter employment interruption of mothers. Boll and Lagemann (2019), by merging childcare data with the MC and using a multilevel panel model on the federal state level from 2006 to 2014, show that an increase in childcare places goes hand in hand with an increase in mothers' weekly working hours, hence an increase in the intensive margin, while the extensive margin, FLP, was rather unaffected. Distinguishing between overall enrollment and full-time enrollment, they report significant effects for changes in the overall enrollment care rate only. Further analyzing the impact of various policy indicators, e.g. the introduction of a legal entitlement for a place in a daycare center from the age of one, they found rather weak effects when state-fixed effects were introduced into their specification. Müller and Wrohlich (2020) – relying on childcare data with the MC and multi-level-panel models with county-fixed effects for the time-span 2007 to 2014, and focusing on the extensive margin only – found that a 1% increase of childcare enrollment for children under the age of 3 increases the FLP rates of mothers by 0.2%. They state that this increase can mainly be attributed to an increase in part-time employment. Distinguishing between changes in full-time places and overall enrollment, results indicate that the effect is driven by changes in the overall enrollment rates only, while full-time enrollment remains insignificant. Including county-specific time trends instead of fixed effects, the overall effect turns insignificant, while the effect of full-time care, controlled for trends, is not reported (Müller and Wrohlich, 2020, Table A5). Zoch (2020), by combining the childcare data with micro data from the SOEP and drawing on multinomial models with an entropy matching procedure, reports a positive relationship between the availability of full-time enrollment for toddlers and maternal employment.

All studies mentioned above focus on childcare for toddlers aged 0-2, assumably because the expansion of these places was the focus of recent politics. Regarding the age range 3-5, the kindergarten, contemporary research utilizing the childcare data from the German Statistical Office is rather sparse. Research on childcare expansion in Germany for the age group 3-5 tends to focus on the late 90s, as the legal entitlement to a place in the kindergarten was introduced in 1996. Based on differences-in-

differences analyses, Bauernschuster and Schlotter (2015), for instance, provide causal evidence that the introduction of this entitlement in 1996 had a positive effect on FLP.

Overall, results suggest that an increase in childcare increases FLP, but it remains rather unclear whether the overall number of places in general or the number of full-time places is more important for increasing FLP, especially when it comes to childcare for toddlers aged 0-2. Hence, based on the current literature, we can derive the following hypothesis considering the direction of the effect:

H1**:** An increase in any kind of childcare enrollment rate has a positive effect on FLP.

Obviously, there may be differences in how various types of childcare influence FLP. It seems reasonable that full-time childcare slots allow for a more flexible non-care-related time use and thus have a more beneficial effect on FLP. Accordingly, research in Germany has identified particularly strong effects of full-time care on FLP in general (Boll and Lagemann, 2019; Büchel and Spieß, 2002). Similarly, full-time care was found to increase the likelihood of full-time employment (Zoch, 2020) and part-time employment with long working hours (20 – 35 hours) in West Germany (Müller and Wrohlich, 2020). Even though the relative importance (in terms of effect magnitude) of full-time care compared to general care provision is not without question (e.g. Boll and Lagemann 2019; Müller and Wrohlich, 2020), we assume that full-time slots, in general, make it easier to reconcile work and family, and offer greater labor market opportunities above general care provision. Hence, we further derive:

H2: An increase in the share of full-time childcare slots has an additional effect on FLP above increasing childcare rates per se.

### Selection on trends in FE models

As mentioned earlier, one major advantage in the previous literature examining the effect of childcare provision on FLP has been the shift from a between- to a within-unit comparison. The latter ensures that unmeasured time-constant differences between the units of observation (e.g. counties) are controlled for and do no longer bias the estimates. When comparing East and West Germany, we observe that childcare provision, as well as FLP, is higher in East Germany, imposing a positive correlation driven by historic path-dependencies. Further explaining differences at the federal level, Andronescu and Carnes (2015) found that German federal states with large Catholic populations tend to have fewer childcare places for children aged 0-2, while a traditionally high FLP in hand with long-standing social democratic government evolvement is associated with a high childcare enrollment. However, the positive correlation between the two measures of interest does not necessarily identify a causal relationship of childcare provision on FLP. To overcome this problem, the best practice nowadays is usually to

employ fixed-effects models, which account for all time-constant differences between observations by 'de-meaning' the data, hence control for any unobserved differences or unit-specific characteristics.

Still, in many cases, it has been recognized that unobserved differences or unit-specific characteristics might not only affect the time-constant levels but also time-varying trends (Dynarski, Jacob and Kreisman, 2018; Kneip and Bauer, 2009; Ludwig and Brüderl, 2018; Noelke, 2016). Referring to this trend-argument is not new in the field of childcare and FLP. For instance, Müller and Wrohlich (2020) state: "A crucial assumption for the causal interpretation of these estimates is that there are no region-specific time trends that drive, both, mothers' labor supply and the expansion of subsidized childcare." However, the main results are based on this theoretical assumption without controlling for region specific time trends. Supplementary analyses nevertheless indicate that the effect of childcare enrollment is not distinguishable from zero once heterogeneous trends are controlled for in the FE models. It is not absolutely clear, however, whether their approach can account for all confounding factors due to trends, as the estimate also relies on the individual between-person variance within counties. A straight-forward way of controlling for correlated trends in panel regression are fixed effects individual slopes (FEIS) models (e.g. Brüderl, 2015; Rüttenauer and Ludwig, 2020; Wooldridge, 2015; see method section). In the following, we discuss the issue of selection on trends in the case of childcare and FLP.

Different theoretical reasons illustrate why it is important to account for heterogeneous time trends when investigating the effect of increasing childcare enrollment on FLP. As mentioned above, there can be a positive correlation and hence a selection on trends if the expansion of daycare facilities is focused on areas with a steeper trend in female employment, as daycare suppliers rely on growing sales markets. This leads to an upwardly biased estimate of the effect of childcare provision on FLP in FE models. On the other hand, a negative selection is possible if the increase in female employment outruns available daycare places, e.g. when regions fail to provide enough new daycare places for their growing economies. This would be the case if, for instance, metropolitan areas experience a strong increase in FLP but because of their high baseline demand and a high absolute number of children cannot increase the provision of childcare per child in a similar pace as less prosperous regions with a slower increase (or a decrease) in the number of children. This negative correlation of trends would lead to a downwardly biased estimate in FE models when compared to FEIS.

As a starting point, the supplementary results by Müller and Wrohlich (2020) already indicate that the effect of childcare provision for toddlers is reduced once region-specific trends are taken into account. Hence, there already is empirical evidence that the effect of childcare for children aged below 3 is overestimated in conventional FE models, meaning that there is a positive correlation between the increase in FLP and the childcare enrollment rate for ages 0-2. Unfortunately, Müller and Wrohlich

(2020) restrict their sample to West Germany. Thus, the questions remain how we can explain the correlating trends in West Germany and what we could expect for East Germany.

Following a simple offer demand logic, we assume that areas with high increases in FLP and hence, in demand, are likely to react with a steeper increase in the supply of childcare. We know that there is an excess demand for childcare provision in general, indicating that communities tend to lag behind, and that this unmet demand is much higher in West Germany (BMFSFJ, 2018). Assuming that the take-up rate of newly established childcare slots is driven by this demand (Boll and Lagemann 2019, p. 3), we suppose that new childcare places translate more directly into FLP in areas where the demand is higher, hence, in West Germany.

We further know that the increase in childcare enrollment for ages 0-2 was much steeper (from 9.4% to 27%) in West Germany compared to East Germany (from 41.9% to 54.3%, see appendix Tables A6, A7). The increase in FLP was almost the same in absolute, but a bit steeper in relative values in West Germany (44.1% to 55.2%) compared to East Germany (49.9% to 62.7%). Hence, considering East-West differences, we expect the correlation on trends being much more pronounced in West Germany, as daycare providers have been likely to focus on areas with particularly high demand. This reasoning would theoretically indicate a more upwardly biased effect of childcare for toddlers in conventional FE models in West Germany, as already indicated in the supplement of Müller and Wrohlich (2020). Following this line of thought, we can also assume that this bias is smaller in East Germany, as the relative increase in childcare was smaller and baseline levels much higher.

Similar to childcare enrollment at ages 0-2, the full-time enrollment of toddlers aged 0-2 also rose stronger and started from a lower level in West Germany. The same picture applies to full-time enrollment for children aged 3-5, but not for the share of childcare enrollment at ages 3-5, which was generally high in both parts and does not follow a clear trend (See Tables A6, A7). Hence, we can formulate hypotheses on differences in the effect sizes in East and West Germany and expectations on the possible biases due to selection on trends:

H3: We expect the effects for childcare enrollment 0-2, fulltime childcare 0-2 and full-time childcare 3-5 to be stronger in West Germany, as the unmet demand is higher, and the starting levels are lower.

H4: Due to a positive correlation of time-trends, we expect the effects for childcare enrollment 0-2, fulltime childcare 0-2 and full-time childcare 3-5 to be upwardly biased in conventional FE models, particularly in West Germany (and to a lesser degree in East Germany).

## Effect heterogeneity across regions in Germany

As we argue above, it is not only the differences along the historical divide line between East and West but also the differences between regions (Andronescu and Carnes, 2015) in Germany that may exhibit different time trends in FLP and childcare, thereby urging for the application of more advanced panel models. Beyond identifying the existence of such heterogeneity, research in this field would substantially profit from identifying potential reasons for this regional heterogeneity. Particularly, not only may time trends vary across regional areas but the effect of childcare on FLP could differ areas as well. Recent research (Daniel et al., 2019), for instance, points to the important distinctions across different regional types like rural and urban areas, which have been hardly considered in childcare research so far. In the following, we thus derive several possible explanations for heterogeneous effects of childcare enrollment, varying by the grade of urbanization.

In Germany, families increasingly rely on a double income to bear the costs of living (Neuberger, Schutter and Preisner, 2019). This is particularly the case in more urban regions, as the rents and costs of living are comparably higher (Weinand and von Auer, 2020) and attitudes towards female employment are likely to be more positive in more urban areas due to the "rural ideology of gender conservatism" (Dirksmeier, 2015). Further, it is known that childcare usage, as well as the demand for childcare, are higher in Germany's more urban regions (Alt et al., 2017; Hubert, Lippert and Alt, 2019).

One possible difference might result from the varying availability of alternative ways of childcare. Grandparental care, for instance, provides a useful way of informal childcare provision. This, however, seldom allows for a constant part-time or even full-time employment, as only 11% of German grandparents provide intense (24.7 hours a week on average) grandchild care (Di Gessa et al., 2016). Grandchild care thus is rather considered as a supplement to professional childcare providers, and a huge majority of mothers in Germany has to rely on other forms of formal or informal childcare. Given the finding that children in more rural areas are more likely to live close to caring grandparents (García-Morán and Kuehn, 2017), we assume that working mothers in urban areas already need to rely stronger on other private or informal childcare arrangements. Consequently, the range of already existing alternatives to public care is greater in metropolitan and urban areas. Hence, we partly expect a crowding-out of already existing informal or private care arrangements with increasing availability of public childcare slots.

H5: We assume that childcare enrollment has stronger effects on FLP in rural areas or agglomerations then in urban or metropolitan areas.

Commuting times may also influence the effectiveness of childcare arrangements. Previous research has shown that mothers suffer from pronounced negative effects of commuting distances on their labor force supply, and thus on average take up jobs with lower commute times than their male counterparts (Chidambaram and Scheiner, 2020; Kawabata and Abe, 2018). Moreover, the negative association between commuting distance and labor supply is most pronounced for mothers with young children (Farré, Jofre-monseny and Torrecillas, 2020; Kawabata and Abe, 2018). Together, this indicates that childcare and housework at least partly constrain female labor force opportunities by reducing the spatial mobility and flexibility of mothers, and these constraints are most severe for mothers with young children. Following this strand of reasoning, we would expect an increase of formal childcare to have more positive effects on FLP in rural areas, as required commuting times increase with the level of rurality (Dauth and Haller, 2020). It further seems reasonable that this effect in rural areas is particularly driven by the provision of full-time childcare. Longer commuting times add to the time parents require their children to be in formal care while spending their time at work (Daniel et al., 2019), thereby increasing the need for long-hours childcare. Based on these arguments, we further derive the following hypothesis on the effect strength:

H6: We assume that full-time childcare enrollment has stronger effects on FLP in rural areas or agglomerations then in urban or metropolitan areas.

To our best knowledge, no previous research has tested the differential childcare benefits on FLP by region type or urbanity in Germany. Still, as outlined above, the divide along the urban-rural axis might not only be a source of heterogeneous time trends, e.g. due to the different starting levels in childcare as discussed above, and thus urge for advanced panel models. It might also constitute a source of heterogeneity, which yields important implications for research and policy.

In what follows, we provide results from FE and FEIS models, test for possible selection bias and further show east-west differences in the effects of childcare expansion on FLP. By further differentiating between region types while also controlling for the possibility of correlated time trends, we seek to provide a detailed account of the link between increases in childcare and changes in female employment and offer new insights on how the general association varies across different regional contexts.

# 3 Empirical approach

## Data

To investigate the impact of childcare provision on FLP on the societal level, this paper uses macro data on the county level for 401 counties. We use data from "Indicators and Maps on the Spatial Development" (INKAR, see Helmcke, 2008), provided by the German Federal Office for Building and Regional Planning. The data comprise annual information from different data sources on all German counties. The indicators used in this study are described below. Information on the enrollment of childcare to a greater extent is available at the level of counties in Germany since 2007 and provided on an annual basis. Childcare data is available for several types of care and different age groups. The indicators are defined as the percentage of all children using subsidized childcare per county per year. We can utilize a set of four indicators, namely the overall share of children in any type of state-subsidized childcare per county, differentiated by age groups 0-2 and 3-5 (childcare enrollment 0-2, childcare enrollment 3-5). Further, we use the share of full-time places per age group (with a care time of 7 and more hours per day, full-time enrollment 0-2, full-time enrollment 3-5). These indicators are currently only available until 2017.

To measure FLP, we use the percentage of women aged 15 to 65 who are employed in jobs that are subject to compulsory social insurance as provided by INKAR. This concerns about 70% of the overall female workforce.

Note that we only have information on childcare enrollment rates rather than available slots. In Germany, however, the childcare market is known to be a seller's market, and childcare places are in the first place a matter of supply and not of demand or price (Kreyenfeld and Hank, 2000). Recent reports still show an unmet demand of 26.7% for childcare places for children aged 0-2 and 3,3% for children aged 3-5. The supply gap is larger in West Germany, but there is no single federal state managing to meet the needs (BMFSFJ, 2018). Hence, and in line with Boll and Lagemann (2019, p. 3), we can assume "a full take up of newly established childcare slots" for children aged 0-2, and less so for the ages 3-5. Nevertheless, we control for the demand side by adding the number of children aged 0-2, 4-6 and 6-18, as well as the fertility rate per county.

Moreover, our dependent variable measures FLP in total. The age structure of the female population might thus influence the labor force participation rate, as well as the rate of childcare provision. Thus, we add the percentage of women aged 18-24, the percentage of women aged 25-64, and the percentage of women being 65 and older as control variables. Moreover, we control for a range of educational

and economic indicators, which might be important for the current labor market situation and thus influence the rate of FLP. Those include the percentage of people who have a university entrance qualification, the percentage of people leaving school without a certificate, the percentage of students and the percentage of female students. Additionally, we control for the number of apprentice positions, rental prices, and pay tax returns to monitor changes in the economic situation.

All information is available for every county in East and West Germany for the period from 2007 to 2017. We are only missing data on childcare for a very small number of counties in some years. The counties "Kleve", "Mettman", and "Wesel" have missing data in 2017. Furthermore, "Mühldorf am Inn" has missing data in 2015. Thus, we end up with 4407 county years for 401 counties; hence, we have an almost full balanced macro panel for Germany without attrition and only 4 missing case-years. Further, we have 176 county/years with enrollment rates slightly over 100% for 3-5-year-olds, which are all set to 100%.[6]

To analyze regional effect heterogeneity, we utilize the well-known East-West difference and further use a county-typology provided by INKAR to separate between different area types, namely independent metropolitan counties (metro), urban counties (urban), rural counties with agglomeration approaches (agglomeration) and populated rural counties (rural). This differentiation captures regional heterogeneity regarding population density and labor market options and is also used by other researchers (e.g. Boll 2019, p. 10). Descriptive information can be found in Figure A1-A6 and Table A5-A11 of the Appendix.

## Micro Macro Problem

We apply a macro data approach because the information on the availability of childcare places is provided at the county level. Some studies integrate this macro information in survey data such as the Socio-Economic Panel (SOEP) or the Micro Census (MC). This has the advantage of testing individual factors such as age or education. However, the cases are unevenly distributed among the German counties, as they are not designed to be representative of a small regional unit. E.g. the SOEP is not even representative of the federal state level, and the MC is not representative when it comes to county units. Multilevel contextual-effects models, as used in the literature (e.g. Müller and Wrohlich, 2020), handle the problem of different numbers of observations (N) per unit with a mechanism called shrinkage (e.g. Gelman and Hill, 2007, p. 258). Units with lower N have a smaller influence on the

[6] This bias results from fuzzy areas in the data concerning age groups used to calculate the percentages, children using care arrangements in neighboring counties and refugee children registered in the institution, but not in the local data on the number of children.

overall effect than units with bigger N. Hence, estimation of the effects is mainly based on counties with high N. Context effect estimates from these models are driven by those counties with large N, which are mostly metropolitan or other populous counties. By design, these models neglect the variance from e.g. thinly populated rural counties. While it is obvious that we cannot explain individual behavior based on macro data, we can at least produce comparable estimates for the context effect of interest. The coefficients found in macro-level within-countries regression tend to be alike the context effect coefficients from traditional multi-level context effect regression, as both are hidden twins (Kögel, 2017).

What we get in return for ignoring the micro information is a full balanced panel with macro data for an eleven-year period for virtually all counties in Germany. Hence, we are not restricted to West Germany and we can dig deeper into regional differences, using all the variance in the childcare data. This spatial depth of field is one of the major contributions of our paper, allowing us not only to generate a model for all counties in Germany but also to estimate several models for different urban-rural area types to paint a more colorful picture in terms of spatially effect heterogeneity.

**Fixed Effect Individual Slope (FEIS) Models**

We apply FEIS models (Brüderl, 2015; Rüttenauer and Ludwig, 2020; Wooldridge, 2015), which allow for unit specific differences in levels (equal to conventional FE) and further for unit-specific slopes or trends over time. Thus, FEIS models do not only 'de-mean' but also 'de-trend' the data by subtracting the predicted time trend for each individual observation. Formally, the model is given by:

$$\widetilde{\boldsymbol{y}}_i = \widetilde{\boldsymbol{X}}_i\boldsymbol{\beta} + \tilde{\boldsymbol{\varepsilon}}_i \quad (1)$$

for each *i* = 1, ..., *N* areas or units, where the $T \times 1$ vector $\widetilde{\boldsymbol{y}}_i = \boldsymbol{y}_i - \widehat{\boldsymbol{y}}_i$, each column vector of $\widetilde{\boldsymbol{X}}_i$ is $\widetilde{\boldsymbol{x}}_{ik} = \boldsymbol{x}_{ik} - \widehat{\boldsymbol{x}}_{ik}$, and $\tilde{\boldsymbol{\varepsilon}}_i = \boldsymbol{\varepsilon}_i - \hat{\boldsymbol{\varepsilon}}_i$, with $\widehat{\boldsymbol{y}}_i$, $\widehat{\boldsymbol{x}}_{ik}$, $\hat{\boldsymbol{\varepsilon}}_i$ being the predicted values of $\boldsymbol{y}_i$, $\boldsymbol{x}_{ik}$, and $\boldsymbol{\varepsilon}_i$ respectively. The prediction is based on several pre-defined slope variables, like time. Similar results can be obtained by including an interaction between unit-specific dummies and the slope variables (e.g. Rüttenauer and Ludwig, 2020; Wooldridge, 2015). In our case, we model the heterogeneous slopes by year, year squared and a recession dummy (2008 and 2009). This seems to fit the time trends in female labor force participation (see Table A5). Adding higher polynomials does not improve performance.

As outlined earlier, conventional FE models rely on the assumption that time trends run parallel in 'treatment' and 'control' group. Consequently, a correlation between the steepness or slope of the time trend in female labor force participation and the 'treatment' of new childcare provision would bias the estimates of conventional FE models. It is thus crucial to empirically test the possibilities of

time trends being correlated with the variable of interest. Rüttenauer and Ludwig (2020) proposed an Artificial Regression Test, which constitutes an extension of the well-known Hausman test, and is able to detect confounding due to slope heterogeneity. By applying this test to the conventional FE models, we can investigate whether FE suffers from bias due to heterogeneous slopes. This matter is further discussed in the result section.

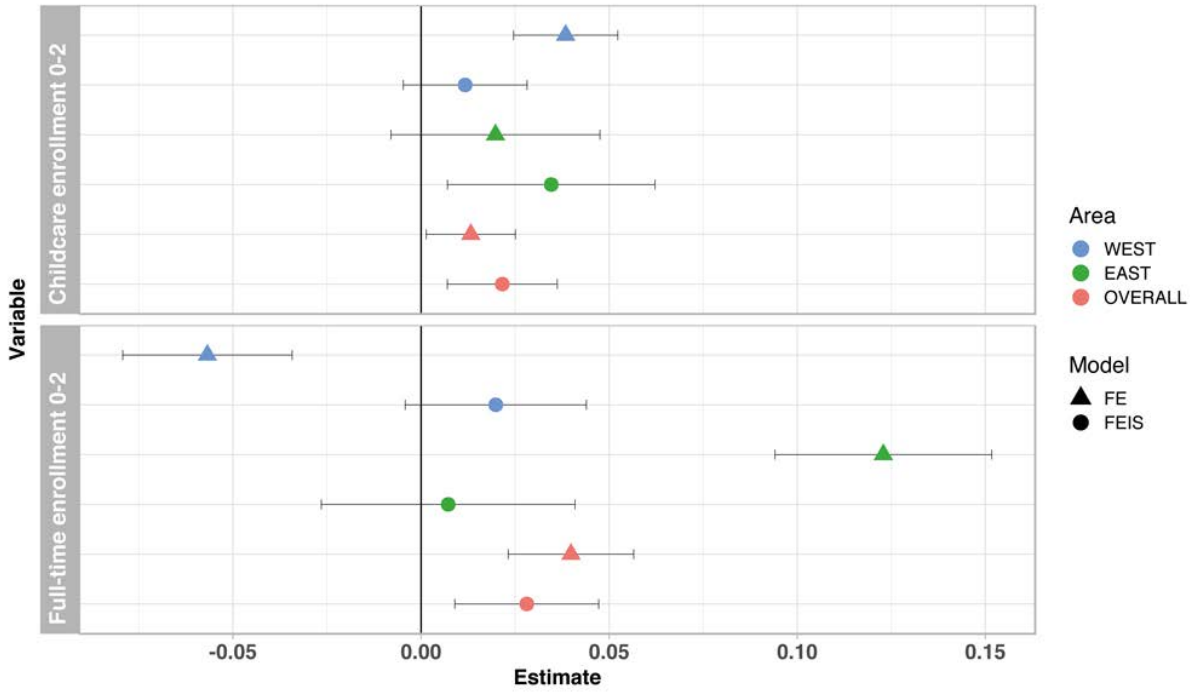
In what follows, we provide results from FE and FEIS models, test for possible selection bias and further show east-west as well as area-type differences in the effects of childcare expansion on FLP.

# 4 Results

## Fixed Effect (FE) and Fixed Effect Individual Slope (FEIS) Models for whole Germany, East and West

Figure 1 contains forest plots of FE and FEIS estimates for childcare enrollment 0-2 and full-time enrollment 0-2 for West and East, as well as an Overall Model for entire Germany. Point estimates from FE models are indicated with a triangle, FEIS estimates with a dot. Error bars indicate 95% percent confidence intervals: if they include the vertical black zero line, the estimate is insignificant. Considering West Germany, the FE model (blue triangle) estimates a significantly positive effect. However, the FEIS model (blue dot) indicates a positive but insignificant effect for childcare enrollment 0-2. For full-time enrollment for ages 0-2, the FE provides a significantly negative effect for an increase of full-time enrollment 0-2 on FLP. Contrary to the FE, the FEIS estimate is positive but insignificant. Hence, in West Germany, deviations between FE and FEIS suggest that we have a positive selection on trends in childcare enrollment 0-2 and a negative selection process in full-time enrollment 0-2, both biasing the FE estimates.

Figure 1: Forest Plot of Childcare enrollment 0-2 and Full-time enrollment 0-2 Coefficients: West, East and Overall Model




Note: All models contain covariates and time and county fixed effects. Full models with all coefficients could be found below in Tables A1 and A2. All FEIS models contain quadratic terms for county time trends. Tests for selection on trends could be found in Table 1, own calculations.

Source: German Statistical Office: data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.

Table 1: Artificial Regression Tests for Childcare enrollment 0-2 and Fulltime enrollment 0-2 for Overall Model, East and West

| | $\chi^2$ | df | P(> $\chi^2$) | Model |
|---|---|---|---|---|
| 1 | 28.21 | 4.00 | 0.00 | West |
| 2 | 21.71 | 4.00 | 0.00 | East |
| 3 | 28.41 | 4.00 | 0.00 | Overall |

Note: FEIS vs. FE, see Table A3 and A4 for corresponding models, tests for correlation of trends of childcare variables children aged 0-2 and female labour force participation; own calculations.

In East Germany, FEIS models provide a significant positive effect for childcare enrollment 0-2 but not for full-time enrollment 0-2. FE models would find an insignificant positive effect for childcare enrollment 0-2 and a huge positive effect for full-time enrollment 0-2, which stems from a bias on selection on trends. In the combined model for Germany (Overall), estimates are all small but positive. FE and FEIS point estimates differ only slightly: as we observe contradicting biases in East and West Germany

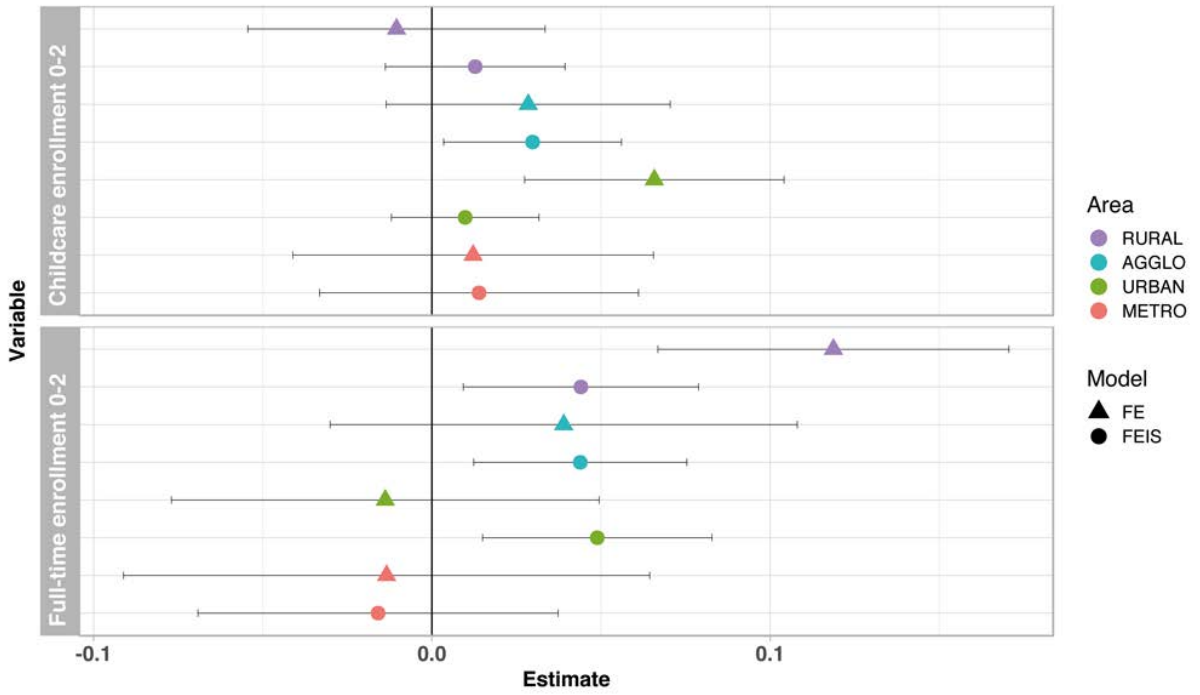
for both general enrollment and full-time enrollment, the overall bias is somewhat reduced when pooling East and West Germany. Hence, researchers without any regional differentiation in Germany would report seemingly plausible aggregated results, whereas the underlying selection biases tend to cancel out each other. Corresponding models for the estimates shown in the Figures can be found in the Appendix (Table A1-A4).

As outlined earlier, conventional FE models rely on the assumption that time trends run parallel in 'treatment' and 'control' group. Consequently, a correlation between the steepness or slope of the time trend in FLP and the 'treatment' of new childcare provision would bias the estimates of conventional FE models. Test results of the artificial regression test for selection on trends for the estimates shown in Figure 1 are shown in Table 1. We provide results of a combined test for childcare enrollment 0-2 and full-time enrollment 0-2 but separated for West, East, and whole Germany (Overall). A highly significant $Chi^2$ of 28.21 in West, 21.71 in East and 28.41 in the Overall Model tells us that the county-specific time trends in childcare provision are significantly correlated with time trends in FLP in all models in Figure 1. This provides a strong motivation to take heterogeneous time trends into account, hence, to trust in the FEIS estimates, as FE estimates are very likely to be biased.

To derive at a more detailed picture of the spatial heterogeneity, Figure 2 shows the point estimates for the different regions, starting with rural areas in the top, then agglomerations, urban and metropolitan areas. The corresponding artificial regression tests in Table 2 indicate significant selection in rural and urban areas, while selection does not seem to play a major role in the agglomeration and metropolitan regions. A look at the graphics confirms these findings, as the FEIS and FE estimates in agglomeration (blue) and metropolitan (red) regions hardly differ. Considering childcare 0-2, the only significant positive FE estimate for childcare enrollment 0-2 is for urban areas, which turns out to be insignificant in the FEIS. FEIS only provides one significant estimate for agglomeration areas, which – as FE and FEIS estimates are almost the same and the artificial regression test is not significant – seems to be unbiased by heterogeneous trends.

Turning to full-time enrollment 0-2, we see an interesting pattern: While the FE finds significantly positive effects only for full-time enrollment 0-2 in rural areas, FEIS estimates of rural, agglomerations and urban areas are significantly positive. Hence, when controlling for trends, increases in full-time enrollment for toddlers increase FLP everywhere, except in metropolitan areas.

Figure 2: Forest Plot of Childcare enrollment 0-2 and Full-time enrollment 0-2 Coefficients: Rural, Agglo, Urban and Metropolitan Areas




Note: All models contain covariates and time and county fixed effects. Full models with all coefficients could be found in Appendix Tables A3 and A4. Tests for selection on trends could be found in Table 2.

Source: German Statistical Office: data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.

Table 2: Artificial Regression Tests for Childcare enrollment 0-2 and Fulltime enrollment 0-2 Area Type Models

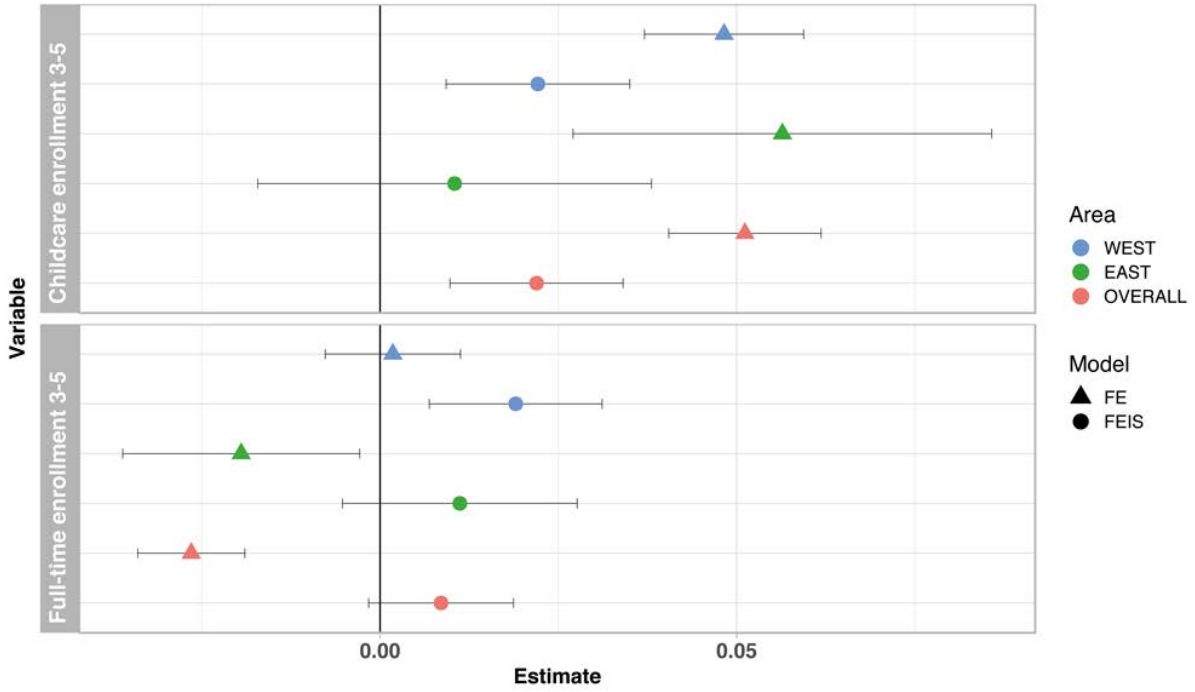
| | $x^2$ | df | P(> $x^2$) | Model |
|---|---|---|---|---|
| 1 | 15.33 | 4.00 | 0.00 | Rural |
| 2 | 7.66 | 4.00 | 0.10 | Agglo |
| 3 | 20.36 | 4.00 | 0.00 | Urban |
| 4 | 8.10 | 4.00 | 0.09 | Metro |

Note: FEIS vs. FE, see Table A3 and A4 for corresponding models, tests for correlation of trends of childcare variables children aged 0-2 and female labour force participation; own calculations.

Considering childcare enrollment 3-5 in West and East Germany, depicted in Figure 3, FE and FEIS estimates tend to follow distinctive patterns. First, we find a significant positive effect of childcare enrollment 3-5 in West Germany and the Overall Model in both, FE and FEIS models, whereas the effect for East Germany is positive, too, but insignificant when estimated with FEIS. Second, we can see a bias

due to a positive selection in trends in all childcare enrollment 3-5 models, as the FEIS estimate is always smaller than the FE estimate.

Figure 3: Forest Plot of Childcare enrollment 3-5 and Full-time enrollment 3-5 Coefficients: West, East and Overall Model




Note: All models contain covariates and time and county fixed effects. Full models with all coefficients could be found below in Tables A1 and A2. All FEIS models contain quadratic terms for county time trends. Tests for selection on trends could be found in Table 3, own calculations.

Source: German Statistical Office: data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.

Table 3: Artificial Regression Tests for Childcare enrollment 3-5 and Fulltime enrollment 3-5 for Overall Model, East and West

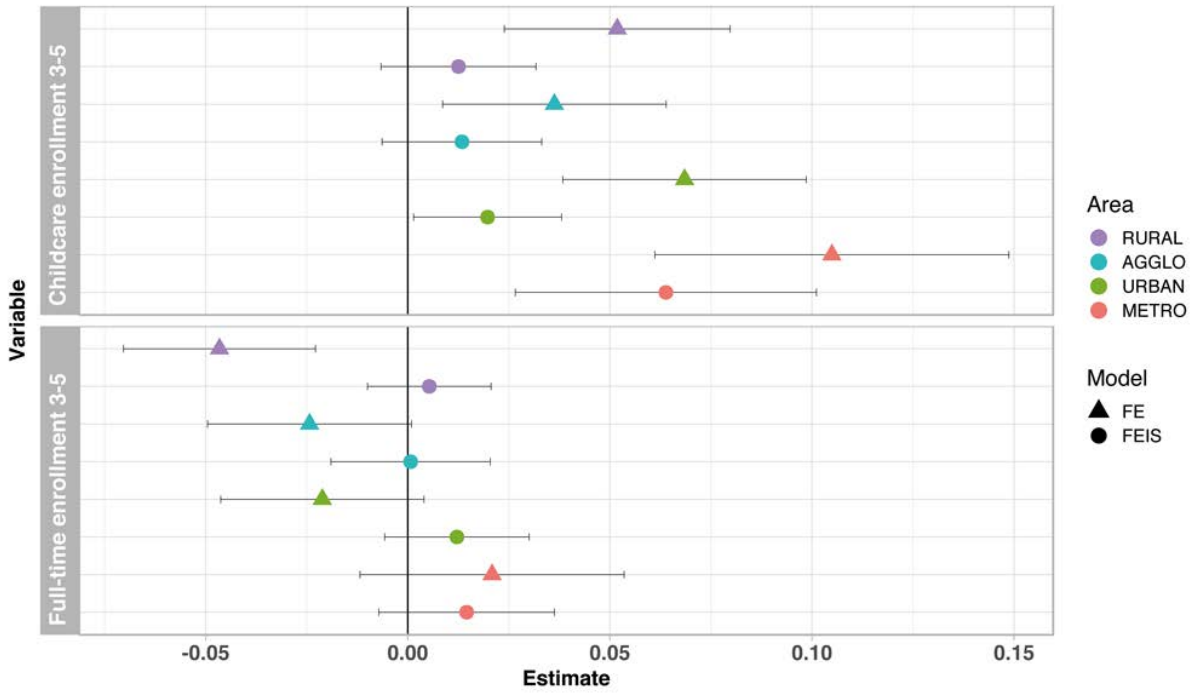
| | $x^2$ | df | P(> $x^2$) | Model |
|---|---|---|---|---|
| 1 | 11.93 | 2.00 | 0.00 | West |
| 2 | 3.00 | 2.00 | 0.22 | East |
| 3 | 23.73 | 2.00 | 0.00 | Overall |

Note: FEIS vs. FE, see Table A3 and A4 for corresponding models, tests for correlation of trends of childcare variables for children aged 3-5 and female labour force participation; own calculations.

Considering full-time enrollment 3-5, the opposite holds true: We can see a negatively biased FE estimate in all models compared to FEIS. Remarkably, the FE models show significant *negative* effects for East Germany and for the Overall Model, which at first contradicts all expectations. However, the FEIS show positive associations, with only the full-time enrollment 3-5 effect in West Germany being significant. Regression tests (Table 3) are significant in the West and the Overall Model, but not in East Germany, where estimates differ, but the artificial regression test is insignificant. As we test for heterogeneity in both effects simultaneously, this might occur in the rare case when the variance in the independent variable is low while the variance in the slope variables is high, which naturally occurs when using time as slopes (Rüttenauer and Ludwig, 2020). Summing up, we find a strong indication of a positive effect for childcare enrollment 3-5 in West Germany, while the effect in East Germany results from selection bias. Considering full-time enrollment, we only find a positive effect in the West when considering FEIS estimates.

Turning to childcare enrollment 3-5 in Figure 4, we see a clear regional pattern again: First, all childcare enrollment estimates 3-5 are positive and all FE estimates suffer a visible bias from a positive selection in trends, as FEIS estimates are always smaller than FE estimates. Second, we see a clear gradient in the effect size due to the regional area: Effects are strongest in metropolitan areas, and decrease with rurality, turning insignificant for agglomeration and rural areas. For full-time enrollment 3-5, we see a clear pattern again: FE provides more negative estimates than FEIS but all FEIS are insignificant. These differences between FE and FEIS are mirrored by the significant test results, pointing towards the need for accounting for heterogeneous time trends.

Figure 4: Forest Plot of Childcare enrollment 3-5 and Full-time enrollment 3-5 Coefficients: Rural, Agglo, Urban and Metropolitan Areas




Note: All models contain covariates and time and county fixed effects. Full models with all coefficients could be found in Appendix Tables A3 and A4. Tests for selection on trends could be found in Table 4.

Source: German Statistical Office: data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.

Table 4: Artificial Regression Tests for Childcare enrollment 3-5 and Fulltime enrollment 3-5 Area Type Models

| | $x^2$ | df | P(> $x^2$) | Model |
|---|---|---|---|---|
| 1 | 15.15 | 2.00 | 0.00 | Rural |
| 2 | 4.90 | 2.00 | 0.09 | Agglo |
| 3 | 11.37 | 2.00 | 0.00 | Urban |
| 4 | 7.15 | 2.00 | 0.03 | Metro |

Note: FEIS vs. FE, see Table A3 and A4 for corresponding models, tests for correlation of trends of childcare variables children aged 3-5 and female labour force participation; own calculations.

Considering our hypothesis, we find confirming evidence for H1: in Germany, an increase in childcare enrollment is associated with an increase in FLP. However, when considering heterogeneous trends, we see that this positive effect is driven by childcare of children 0 – 2 in East Germany, but by childcare of older children in West Germany. This also means that we cannot confirm our hypothesis H3: We do

not observe a clear pattern in the sense that childcare has a more beneficial effect in West Germany. Furthermore, we find a considerable variation of the FEIS effects by urbanization, suggesting that the effects of childcare enrollment on FLP strongly depend on the regional context.

H2 also seems to hold true only partly. While the FEIS effects for full-time enrollment 0-2 are positive in the overall model, they are not when separating for East and West Germany. Considering the different rural types in Fig. 2, it becomes clear that the overall significant positive estimate for full-time enrollment 0-2 in the overall model in Fig. 1 could not be explained by East and West differences, but stems from rural, agglomeration and urban areas. In those areas, increases in full-time enrollment 0-2 showed significant effects on FLP, while there are no significant effects for metropolitan areas. Full-time enrollment for children 3-5 only has a significantly positive impact on FLP in West Germany (Fig. 3).

Considering the direction of the bias due to selection of trends, there is support for hypothesis H4. We do find the effect of childcare enrollment 0-2 to be upwardly biased in West Germany, as the FE founds a significant positive effect, while the FEIS does not. In East Germany, on the contrary, the FEIS founds a significant effect, while FE does not. Hence, we find a positive selection bias in West Germany and a negative one in East Germany. For full-time enrollment 0-2, we find FE models to be biased due to a negative selection bias in West Germany and a positive selection bias in East Germany (Fig. 1). Coming to childcare enrollment 3-5 (Fig. 3), we find all FE models for childcare enrollment 3-5 to be upwardly biased due to a positive selection on trends. The opposite holds true for the full-time enrollment 3-5: here, all FE models are downwardly biased.

Considering the area types, we do find our hypotheses H5 and H6 tends to be true when it comes to childcare for toddlers aged 0-2. While we do only find a significant effect of childcare enrollment 0-2 in agglomeration areas, we do find significant effects for full-time enrollment 0-2 in all regions except metropolitan areas. Hence, childcare for toddlers tends to have larger effects in more rural areas (Fig. 2). However, considering childcare 3-5, we find the opposite. Considering childcare enrollment 3-5, we find the effect to be stronger in more urban area, and strongest in metropolitan areas. For full-time enrollment 3-5, the estimates of the FEIS models are not statistically differentiable from zero (Fig. 4).

# 5 Discussion

We investigate the effects of various indicators of childcare on FLP in a macro panel data set containing data for whole Germany 2007-2017 using FE and FEIS models, taking into account possible biases due to selection on trends. Artificial Regression Tests show that we face issues with selection on trend, even when separating by East and West or by region type. Thus, we used both FE as well as FEIS models as a best practice approach when macro data is used (e.g. Dynarsky, Jacob and Kreismann, 2017). Thereby, we can assess to what extent previous results are determined by selection on growth or trends and provide findings adjusted for these biases.

Regarding the effect of childcare 0-2 on FLP, we replicate previous findings for conventional FE models: an increase in childcare provision correlates with an increase in FLP in West Germany (Müller and Wrohlich, 2020). As our FEIS analysis proves, this positive effect in West Germany is to a large extent determined by selection on different time trends. This is in line with the supplementary analyses conducted by Müller and Wrohlich (2020), who found no significant effect of overall childcare 0-2 in West Germany, once they controlled for region-specific trends. Nonetheless, we still see a positive effect of changes in toddler's childcare provision on FLP in East Germany.

In addition, our spatially detailed analysis reveals that increases in full-time care 0-2 also increases FLP in the rural, agglomeration and urban areas. This conclusion extends results by Zoch (2020), who concluded that particularly increases in the share of full-time places are related to increases in female employment. Though the overall size of the effect is moderate in our analysis, we demonstrate that the association between increasing the provision of full-time childcare enrollment for toddlers aged 0-2 and increasing FLP is mainly due to childcare's beneficial effect in urban, agglomeration and rural areas, but not in metropolitan areas. For those novel findings, we assume three interpretations: First, in metropolitan areas, there are crowding-out processes and public childcare only displaces other forms of care arrangements. Second, only full-time care allows for longer commuting distances for mothers living in more rural areas and thus increases the compatibility of FLP and toddler's care. Third, it also reflects the cultural lag, since the catch-up process of both childcare and FLP in more conservative rural regions allows for a steeper increase in childcare enrollment and FLP, as policy options are more heterogeneous.

Regarding the care of children aged 3-5, we find a reduction of the positive effect of increasing childcare enrollment for children aged 3-5 on FLP in FEIS compared to conventional FE models. Correcting for time trends by FEIS comminutes the strong positive effect in East Germany. However, there is still a positive effect in West Germany. Further separation by area types indicates that childcare enrollment

(3-5) is especially beneficial for the FLP in metropolitan areas. The effect dissipates with decreasing level of urbanicity. This finding could be explained by the scarcity of childcare places due to population growth in metropolitan areas, which further increased due to immigration. In Germany, there was a strong population growth because of migrants in the larger cities in the last decade, which affected both childcare demand and FLP statistics. However, to explain this unexpected finding, further research is needed, taking an in-depth look at different population groups in metropolitan areas, which would go above the scope of our paper. Regarding the full-time care of children aged 3-5, we find a significant effect in West Germany, which again underlines the importance of full-time childcare. While research on childcare is often focused on toddlers, our findings provide evidence that childcare provision for children aged 3-5 is also relevant for maternal employment.

Our findings have political implications for the childcare policy in Germany, as our results suggest that it is not the increase in overall enrollment rates 0-2 but the increase in full-time places 0-2 in more rural areas that fosters FLP. The high differences in childcare and FLP trends, especially in more rural areas, suggest the important role of policymakers in rural German states and communities. Considering childcare for children aged 3-5, our results show that despite the good enrollment rate, we still find substantial effects on FLP in West Germany and metropolitan areas. This is highlighting that, despite all the recent political attention given to the expansion of places for the age group 0-2, improvements in the care arrangements for children 3-5 should not be neglected when it comes to implementing measures that increase FLP.

Our study has several limitations. First, we are fully aware that our results are based on observational data and not experimental settings. Though we advance on previous findings by controlling for an additional source of bias, we cannot be sure that our data does not suffer from additional sources of endogeneity. Second, contrary to other studies who use rich individual data, our macro analysis lacks the depth of field in terms of individual circumstances: We do not have information about the individual women, e.g. their number of children or educational background. Further, we only have limited information on FLP. Readers of this study have to keep in mind that our FLP only covers the extensive margin of women with jobs compulsory to social insurance. However, considering the micro-mechanisms at work, we do not have reasons to assume that these are substantially different from similar studies based on microdata and tend to follow Müller and Wrohlich`s (2020) and Zoch (2020) findings that the effects on the extensive margin are mainly driven by an increase in large part-time employment (20-35 hours) of better-educated mothers.

The findings presented here underline that the expansion of childcare caused an increase in FLP, but it enriches previous knowledge by several differentiations regarding childcare indicators, time trends

and regions. Especially, it highlights the impact of full-time childcare for toddlers in more rural regions. Because of the considerable differences between the FE and the FEIS results as well as between different area types, we recommend that future research on the topic conducts analysis sensitive to selection on level as well as on trend, and further, to account for spatial differences in the effect of childcare on FLP.

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## Appendix

Table A1: Fixed Effect (FE) Models for West, East Germany and Overall Model

| | West | East | Overall |
|---|---|---|---|
| Childcare enrollment 0-2 | $0.04^{***}$ | $0.02$ | $0.01^{*}$ |
| | $(0.01)$ | $(0.01)$ | $(0.01)$ |
| Full-time enrollment 0-2 | $-0.06^{***}$ | $0.12^{***}$ | $0.04^{***}$ |
| | $(0.01)$ | $(0.01)$ | $(0.01)$ |
| Childcare enrollment 3-5 | $0.05^{***}$ | $0.06^{***}$ | $0.05^{***}$ |
| | $(0.01)$ | $(0.01)$ | $(0.01)$ |
| Full-time enrollment 3-5 | $0.00$ | $-0.02^{*}$ | $-0.03^{***}$ |
| | $(0.00)$ | $(0.01)$ | $(0.00)$ |
| Nr. of children 0-2 | $-0.25$ | $1.42^{***}$ | $-0.00$ |
| | $(0.20)$ | $(0.39)$ | $(0.17)$ |
| Nr. of children 3-6 | $0.47^{*}$ | $0.69$ | $0.38^{*}$ |
| | $(0.20)$ | $(0.37)$ | $(0.18)$ |
| Nr. of children 6-18 | $-0.91^{***}$ | $0.11$ | $-0.74^{***}$ |
| | $(0.05)$ | $(0.13)$ | $(0.04)$ |
| % of females 18+ | $-0.12^{***}$ | $-0.08^{**}$ | $-0.10^{***}$ |
| | $(0.02)$ | $(0.03)$ | $(0.02)$ |
| % of females 25+ | $-0.02$ | $0.02$ | $0.01$ |
| | $(0.02)$ | $(0.03)$ | $(0.02)$ |
| % of females 65+ | $-0.07$ | $-0.11$ | $-0.16^{***}$ |
| | $(0.04)$ | $(0.10)$ | $(0.04)$ |
| Fertility rate | $1.93^{***}$ | $2.80^{***}$ | $2.30^{***}$ |
| | $(0.23)$ | $(0.36)$ | $(0.20)$ |
| % university entrance qual. | $-0.00$ | $-0.01^{*}$ | $-0.01^{***}$ |
| | $(0.00)$ | $(0.01)$ | $(0.00)$ |
| % without formal qual. | $0.01$ | $0.02$ | $0.03^{***}$ |
| | $(0.01)$ | $(0.02)$ | $(0.01)$ |
| % students | $0.00^{**}$ | $-0.01^{***}$ | $-0.00$ |
| | $(0.00)$ | $(0.00)$ | $(0.00)$ |
| % female students | $0.00$ | $0.00$ | $0.00$ |
| | $(0.00)$ | $(0.00)$ | $(0.00)$ |
| Apprentice positions | $-0.00$ | $-0.00$ | $0.00$ |
| | $(0.00)$ | $(0.01)$ | $(0.00)$ |
| GDP | $0.05^{***}$ | $0.10^{***}$ | $0.04^{***}$ |
| | $(0.00)$ | $(0.02)$ | $(0.00)$ |
| Unemployment rate | $-0.41^{***}$ | $-0.50^{***}$ | $-0.57^{***}$ |
| | $(0.03)$ | $(0.04)$ | $(0.02)$ |
| $R^2$ | $0.28$ | $0.47$ | $0.31$ |
| Adj. $R^2$ | $0.20$ | $0.40$ | $0.24$ |
| Num. obs. | $3560$ | $847$ | $4407$ |

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. Cluster robust standard errors, own calculations.

Table A2: Fixed Effect Individual Slope (FEIS) Models for West, East Germany and Overall Model

| | West | East | Overall |
|---|---|---|---|
| Childcare enrollment 0-2 | 0.01 | 0.03* | 0.02** |
| | (0.01) | (0.01) | (0.01) |
| Full-time enrollment 0-2 | 0.02 | 0.01 | 0.03** |
| | (0.01) | (0.02) | (0.01) |
| Childcare enrollment 3-5 | 0.02*** | 0.01 | 0.02*** |
| | (0.01) | (0.01) | (0.01) |
| Full-time enrollment 3-5 | 0.02** | 0.01 | 0.01 |
| | (0.01) | (0.01) | (0.01) |
| Nr. of children 0-2 | −0.25 | 0.48 | 0.07 |
| | (0.19) | (0.34) | (0.17) |
| Nr. of children 3-6 | 0.87*** | 0.88* | 0.72*** |
| | (0.23) | (0.37) | (0.20) |
| Nr. of children 6-18 | 0.96*** | −0.17 | 0.32** |
| | (0.14) | (0.18) | (0.11) |
| % of females 18+ | 0.02 | 0.01 | 0.02 |
| | (0.03) | (0.04) | (0.02) |
| % of females 25+ | −0.01 | 0.02 | −0.01 |
| | (0.03) | (0.04) | (0.02) |
| % of females 65+ | 0.36*** | 0.48* | 0.38*** |
| | (0.09) | (0.24) | (0.08) |
| Fertility rate | 0.20*** | −0.10 | 0.15*** |
| | (0.03) | (0.09) | (0.03) |
| % university entrance qual. | −0.00 | −0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) |
| % without formal qual. | −0.02* | 0.02 | 0.00 |
| | (0.01) | (0.01) | (0.01) |
| % students | 0.01*** | −0.01 | 0.01* |
| | (0.00) | (0.00) | (0.00) |
| % female students | −0.00 | −0.00 | −0.00 |
| | (0.00) | (0.00) | (0.00) |
| Apprentice positions | −0.00 | 0.02* | 0.00 |
| | (0.00) | (0.01) | (0.00) |
| GDP | 0.04** | 0.08* | 0.04** |
| | (0.01) | (0.03) | (0.01) |
| Unemployment rate | −0.30*** | −0.32*** | −0.37*** |
| | (0.03) | (0.05) | (0.03) |
| $R^2$ | 0.31 | 0.32 | 0.27 |
| Adj. $R^2$ | 0.31 | 0.31 | 0.27 |
| Num. obs. | 3560 | 847 | 4407 |
| Num. groups: id | 324 | 77 | 401 |
| RMSE | 0.33 | 0.36 | 0.34 |

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. Cluster robust standard errors. Slopes: year, year$^2$, recession, own calculations.

Table A3: Fixed Effect (FE) Area Type Models

| | Rural | Agglo | Urban | Metro | Overall |
|---|---|---|---|---|---|
| Childcare enrollment 0-2 | $-0.01$ | $0.03$ | $0.07^{***}$ | $0.01$ | $0.01^{*}$ |
| | $(0.02)$ | $(0.02)$ | $(0.02)$ | $(0.03)$ | $(0.01)$ |
| Full-time enrollment 0-2 | $0.12^{***}$ | $0.04$ | $-0.01$ | $-0.01$ | $0.04^{***}$ |
| | $(0.03)$ | $(0.04)$ | $(0.03)$ | $(0.04)$ | $(0.01)$ |
| Childcare enrollment 3-5 | $0.05^{***}$ | $0.04^{*}$ | $0.07^{***}$ | $0.10^{***}$ | $0.05^{***}$ |
| | $(0.01)$ | $(0.01)$ | $(0.02)$ | $(0.02)$ | $(0.01)$ |
| Full-time enrollment 3-5 | $-0.05^{***}$ | $-0.02$ | $-0.02$ | $0.02$ | $-0.03^{***}$ |
| | $(0.01)$ | $(0.01)$ | $(0.01)$ | $(0.02)$ | $(0.00)$ |
| Nr. of children 0-2 | $0.04$ | $0.62$ | $-0.47$ | $2.30^{***}$ | $-0.00$ |
| | $(0.55)$ | $(0.56)$ | $(0.61)$ | $(0.63)$ | $(0.17)$ |
| Nr. of children 3-6 | $0.36$ | $-0.59$ | $1.15^{*}$ | $3.00^{***}$ | $0.38^{*}$ |
| | $(0.48)$ | $(0.49)$ | $(0.48)$ | $(0.60)$ | $(0.18)$ |
| Nr. of children 6-18 | $-0.78^{***}$ | $-0.56^{***}$ | $-0.37^{**}$ | $-0.59^{*}$ | $-0.74^{***}$ |
| | $(0.14)$ | $(0.13)$ | $(0.14)$ | $(0.23)$ | $(0.04)$ |
| % of females 18+ | $-0.10$ | $0.02$ | $-0.19^{*}$ | $-0.08$ | $-0.10^{***}$ |
| | $(0.06)$ | $(0.06)$ | $(0.09)$ | $(0.09)$ | $(0.02)$ |
| % of females 25+ | $-0.01$ | $-0.01$ | $0.08$ | $-0.14$ | $0.01$ |
| | $(0.05)$ | $(0.05)$ | $(0.05)$ | $(0.10)$ | $(0.02)$ |
| % of females 65+ | $0.06$ | $-0.23$ | $-0.47^{**}$ | $0.42^{*}$ | $-0.16^{***}$ |
| | $(0.18)$ | $(0.17)$ | $(0.16)$ | $(0.20)$ | $(0.04)$ |
| Fertility rate | $1.31^{***}$ | $1.72^{***}$ | $2.05^{***}$ | $1.96^{**}$ | $2.30^{***}$ |
| | $(0.38)$ | $(0.46)$ | $(0.32)$ | $(0.64)$ | $(0.20)$ |
| % university entrance qual. | $-0.01$ | $-0.01$ | $-0.00$ | $-0.01$ | $-0.01^{***}$ |
| | $(0.01)$ | $(0.01)$ | $(0.00)$ | $(0.01)$ | $(0.00)$ |
| % without formal qual. | $0.03$ | $0.03$ | $0.04$ | $-0.01$ | $0.03^{***}$ |
| | $(0.02)$ | $(0.02)$ | $(0.02)$ | $(0.03)$ | $(0.01)$ |
| % students | $-0.02^{*}$ | $-0.01$ | $0.00$ | $0.01$ | $-0.00$ |
| | $(0.01)$ | $(0.01)$ | $(0.01)$ | $(0.01)$ | $(0.00)$ |
| % female students | $0.00$ | $0.00$ | $0.00$ | $-0.02^{**}$ | $0.00$ |
| | $(0.00)$ | $(0.00)$ | $(0.00)$ | $(0.01)$ | $(0.00)$ |
| Apprentice positions | $0.00$ | $-0.01$ | $0.00$ | $0.01$ | $0.00$ |
| | $(0.00)$ | $(0.00)$ | $(0.00)$ | $(0.02)$ | $(0.00)$ |
| GDP | $0.09^{*}$ | $0.08^{***}$ | $0.04$ | $0.03^{*}$ | $0.04^{***}$ |
| | $(0.04)$ | $(0.02)$ | $(0.02)$ | $(0.01)$ | $(0.00)$ |
| Unemployment rate | $-0.45^{***}$ | $-0.60^{***}$ | $-0.47^{***}$ | $-0.48^{***}$ | $-0.57^{***}$ |
| | $(0.07)$ | $(0.09)$ | $(0.09)$ | $(0.07)$ | $(0.02)$ |
| $R^2$ | 0.31 | 0.33 | 0.30 | 0.45 | 0.31 |
| Adj. $R^2$ | 0.22 | 0.24 | 0.22 | 0.36 | 0.24 |
| Num. obs. | 1121 | 1111 | 1438 | 737 | 4407 |

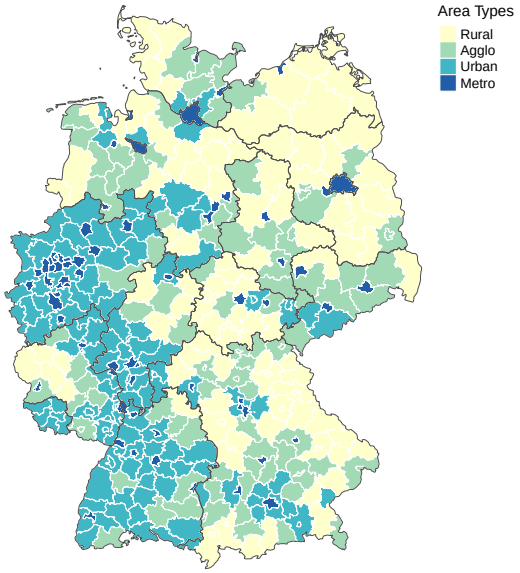
$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. Cluster robust standard errors, own calculations.

Table A4: Fixed Effect Individual Slope (FEIS) Area Type Models

| | Rural | Agglo | Urban | Metro | Overall |
|---|---|---|---|---|---|
| Childcare enrollment 0-2 | 0.01 | 0.03* | 0.01 | 0.01 | 0.02** |
| | (0.01) | (0.01) | (0.01) | (0.02) | (0.01) |
| Full-time enrollment 0-2 | 0.04* | 0.04** | 0.05** | −0.02 | 0.03** |
| | (0.02) | (0.02) | (0.02) | (0.03) | (0.01) |
| Childcare enrollment 3-5 | 0.01 | 0.01 | 0.02* | 0.06*** | 0.02*** |
| | (0.01) | (0.01) | (0.01) | (0.02) | (0.01) |
| Full-time enrollment 3-5 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Nr. of children 0-2 | −0.12 | 0.07 | −0.58* | 1.07** | 0.07 |
| | (0.31) | (0.29) | (0.23) | (0.40) | (0.17) |
| Nr. of children 3-6 | 0.32 | 0.42 | 0.11 | 2.14** | 0.72*** |
| | (0.30) | (0.36) | (0.30) | (0.65) | (0.20) |
| Nr. of children 6-18 | 0.12 | −0.01 | 0.75** | 0.72** | 0.32** |
| | (0.16) | (0.21) | (0.23) | (0.28) | (0.11) |
| % of females 18+ | −0.00 | 0.06 | −0.02 | 0.03 | 0.02 |
| | (0.03) | (0.04) | (0.04) | (0.05) | (0.02) |
| % of females 25+ | 0.04 | −0.02 | −0.05 | −0.03 | −0.01 |
| | (0.03) | (0.04) | (0.04) | (0.08) | (0.02) |
| % of females 65+ | 0.17 | 0.05 | 0.31** | 0.78*** | 0.38*** |
| | (0.15) | (0.19) | (0.12) | (0.16) | (0.08) |
| Fertility rate | 0.23*** | 0.19** | 0.12* | −0.17 | 0.15*** |
| | (0.06) | (0.06) | (0.05) | (0.09) | (0.03) |
| % university entrance qual. | −0.01 | −0.00 | 0.01* | 0.01 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| % without formal qual. | −0.00 | 0.01 | −0.01 | 0.01 | 0.00 |
| | (0.01) | (0.02) | (0.01) | (0.02) | (0.01) |
| % students | 0.02 | −0.00 | 0.01 | 0.01* | 0.01* |
| | (0.01) | (0.01) | (0.00) | (0.00) | (0.00) |
| % female students | −0.00 | −0.00 | 0.00 | −0.00** | −0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Apprentice positions | −0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.01) | (0.00) |
| GDP | 0.11*** | 0.06** | 0.08*** | 0.01* | 0.04** |
| | (0.02) | (0.02) | (0.01) | (0.00) | (0.01) |
| Unemployment rate | −0.39*** | −0.31*** | −0.28*** | −0.32*** | −0.37*** |
| | (0.04) | (0.05) | (0.04) | (0.06) | (0.03) |
| $R^2$ | 0.28 | 0.20 | 0.38 | 0.46 | 0.27 |
| Adj. $R^2$ | 0.27 | 0.19 | 0.38 | 0.44 | 0.27 |
| Num. obs. | 1121 | 1111 | 1438 | 737 | 4407 |
| Num. groups: id | 102 | 101 | 131 | 67 | 401 |
| RMSE | 0.35 | 0.34 | 0.29 | 0.36 | 0.34 |

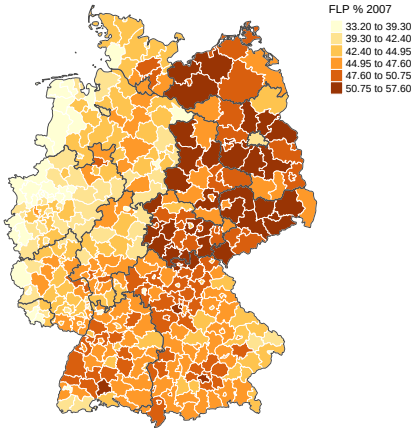
$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. Cluster robust standard errors. Slopes: year, year$^2$, recession, own calculations.

Figure A1: Area Types for Germany

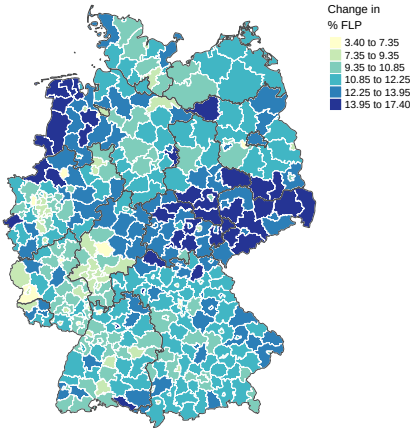



*Source: German Statistical Office: Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Sparsely populated rural county (Rural), Rural county with agglomeration approaches (Agglo), Urban District (Urban), Independent Metropolis (Metro).*

Figure A2: Female Labour Force Participation Rate and Change in Female Labour Force Participation Rate



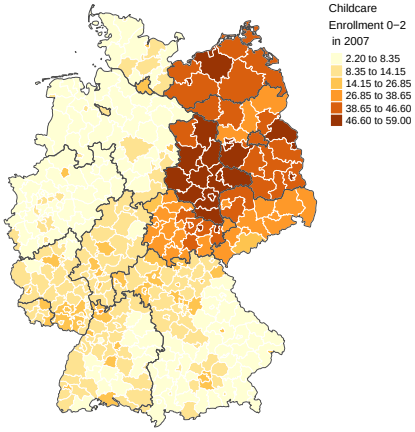

(a) Female Labour Force Participation Rate in 2007



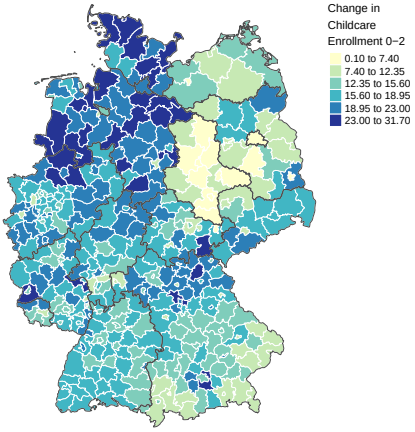

(b) Change in Female Labour Force Participation Rate from 2007 to 2017

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.*

Figure A3: Childcare Enrollment 0-2 and Change in Childcare Enrollment 0-2



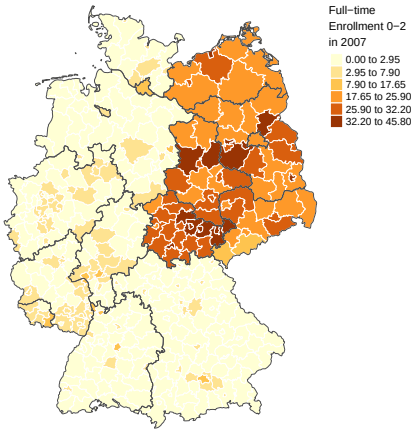

(a) Childcare Enrollment 0-2 in 2007



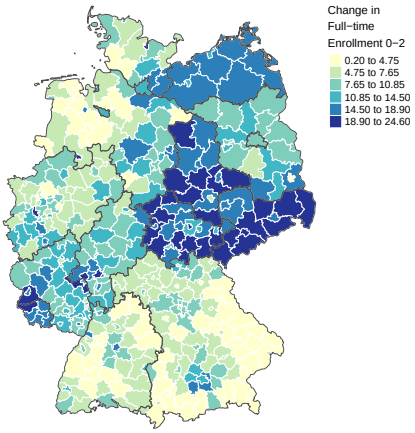

(b) Change in Childcare Enrollment 0-2 from 2007 to 2017

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.*

Figure A4: Full-time Enrollment 0-2 and Change in Full-time Enrollment 0-2



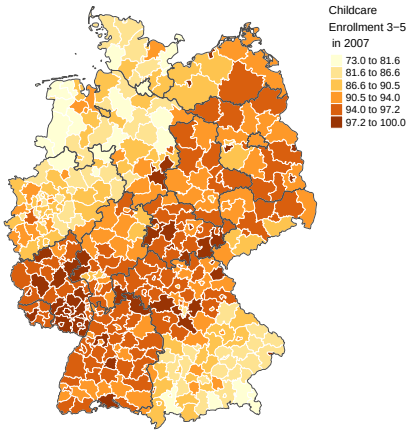

(a) Full-time Enrollment 0-2 in 2007



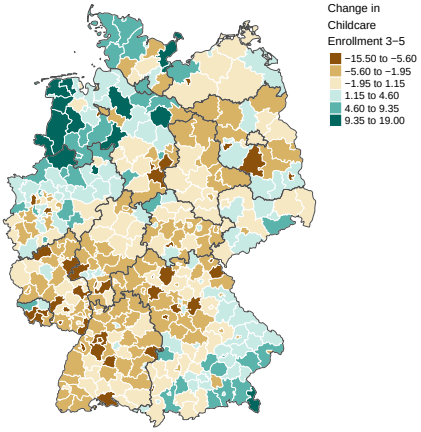

(b) Change in Full-time Enrollment 0-2 from 2007 to 2017

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.*

Figure A5: Childcare Enrollment 3-5 and Change in Childcare Enrollment 3-5



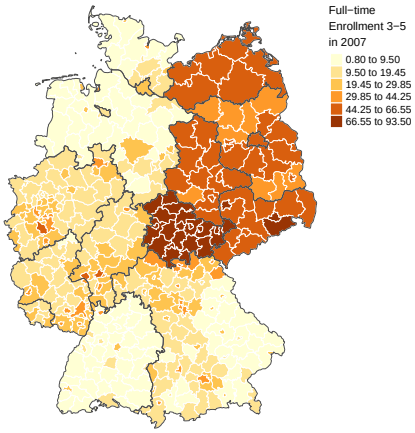

(a) Childcare Enrollment 3-5 in 2007



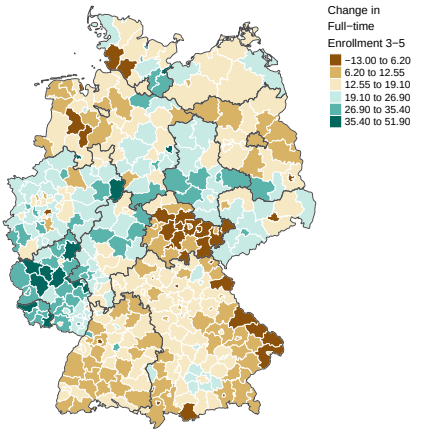

(b) Change in Childcare Enrollment 3-5 from 2007 to 2017

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.*

Figure A6: Full-time Enrollment 3-5 and Change in Full-time Enrollment 3-5




(a) Full-time Enrollment 3-5 in 2007




(b) Change in Full-time Enrollment 3-5 from 2007 to 2017

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; own calculations.*

Table A5: Variables per Year for Germany (N=4,407)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 45.25 | 46.67 | 47.45 | 48.20 | 49.85 | 50.79 | 52.05 | 53.10 | 54.18 | 55.34 | 56.62 | 50.86 |
| | (4.21) | (4.43) | (4.49) | (4.63) | (4.72) | (4.71) | (4.71) | (4.74) | (4.76) | (4.75) | (4.78) | (5.84) |
| Childcare enrollment 0-2 | 15.66 | 17.70 | 20.42 | 23.18 | 25.85 | 27.85 | 29.57 | 31.54 | 31.34 | 31.05 | 32.33 | 26.04 |
| | (13.75) | (13.22) | (13.73) | (13.56) | (13.49) | (13.19) | (12.94) | (12.32) | (11.94) | (12.06) | (12.10) | (14.13) |
| Full-time enrollment 0-2 | 7.31 | 8.00 | 9.46 | 11.01 | 12.46 | 13.85 | 14.99 | 16.21 | 16.50 | 16.76 | 17.43 | 13.09 |
| | (10.42) | (10.47) | (11.69) | (12.47) | (13.06) | (13.10) | (13.54) | (13.93) | (13.70) | (13.85) | (14.32) | (13.30) |
| Childcare enrollment 3-5 | 91.48 | 92.98 | 93.71 | 93.50 | 93.80 | 94.33 | 94.36 | 94.55 | 92.38 | 92.59 | 91.14 | 93.17 |
| | (5.56) | (4.67) | (4.43) | (4.08) | (3.61) | (3.33) | (3.33) | (3.37) | (3.41) | (3.42) | (3.65) | (4.10) |
| Full-time enrollment 3-5 | 25.09 | 27.21 | 29.57 | 31.46 | 33.65 | 35.76 | 37.71 | 40.47 | 41.02 | 42.38 | 42.54 | 35.16 |
| | (21.68) | (21.97) | (22.29) | (22.39) | (22.38) | (22.27) | (22.22) | (23.19) | (22.37) | (22.61) | (22.33) | (23.09) |
| Nr. of children 0-2 | 2.44 | 2.43 | 2.42 | 2.41 | 2.41 | 2.42 | 2.43 | 2.50 | 2.58 | 2.69 | 2.75 | 2.50 |
| | (0.25) | (0.25) | (0.25) | (0.24) | (0.25) | (0.25) | (0.25) | (0.25) | (0.26) | (0.26) | (0.27) | (0.28) |
| Nr. of children 3-6 | 2.59 | 2.54 | 2.50 | 2.48 | 2.50 | 2.50 | 2.50 | 2.48 | 2.53 | 2.56 | 2.62 | 2.53 |
| | (0.30) | (0.28) | (0.26) | (0.24) | (0.23) | (0.22) | (0.22) | (0.21) | (0.21) | (0.21) | (0.21) | (0.24) |
| Nr. of children 6-18 | 12.10 | 11.80 | 11.61 | 11.45 | 11.40 | 11.27 | 11.17 | 11.05 | 10.97 | 10.91 | 10.80 | 11.32 |
| | (2.13) | (2.16) | (2.05) | (1.91) | (1.74) | (1.58) | (1.43) | (1.28) | (1.13) | (1.03) | (0.93) | (1.68) |
| % of females 18+ | 48.54 | 48.44 | 48.36 | 48.30 | 48.24 | 48.19 | 48.09 | 47.87 | 46.96 | 46.90 | 46.83 | 47.89 |
| | (2.19) | (2.16) | (2.17) | (2.21) | (2.32) | (2.33) | (2.34) | (2.31) | (2.48) | (2.30) | (2.27) | (2.36) |
| % of females 25+ | 48.80 | 48.73 | 48.64 | 48.48 | 48.54 | 48.33 | 48.09 | 47.88 | 47.27 | 47.29 | 47.34 | 48.13 |
| | (2.16) | (2.09) | (2.04) | (1.98) | (1.94) | (1.85) | (1.79) | (1.74) | (1.74) | (1.67) | (1.66) | (1.97) |
| % of females 65+ | 57.92 | 57.62 | 57.37 | 57.22 | 57.38 | 57.16 | 56.94 | 56.73 | 56.53 | 56.39 | 56.24 | 57.05 |
| | (1.40) | (1.37) | (1.34) | (1.32) | (1.30) | (1.28) | (1.27) | (1.27) | (1.25) | (1.24) | (1.26) | (1.40) |
| Fertility rate | 1.40 | 1.41 | 1.38 | 1.42 | 1.41 | 1.44 | 1.45 | 1.51 | 1.54 | 1.65 | 0.80 | 1.40 |
| | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) | (0.11) | (0.11) | (0.12) | (0.12) | (0.14) | (0.09) | (0.23) |
| % university entrance qual. | 25.83 | 27.80 | 29.53 | 29.74 | 34.40 | 32.37 | 31.92 | 31.02 | 32.25 | 32.76 | 32.43 | 30.91 |
| | (8.98) | (10.29) | (10.33) | (9.17) | (9.35) | (9.76) | (10.24) | (9.00) | (8.95) | (9.47) | (8.88) | (9.79) |
| % school leaving without certificate | 7.33 | 7.07 | 6.65 | 6.44 | 6.01 | 5.80 | 5.60 | 5.63 | 5.76 | 5.97 | 6.56 | 6.26 |
| | (2.02) | (2.08) | (2.14) | (2.57) | (2.86) | (2.53) | (2.51) | (2.32) | (2.22) | (2.09) | (2.25) | (2.40) |
| %. students | 21.76 | 22.75 | 23.96 | 25.09 | 26.83 | 28.32 | 30.13 | 31.26 | 31.55 | 31.60 | 32.01 | 27.75 |
| | (40.98) | (42.65) | (45.13) | (47.38) | (49.59) | (51.39) | (54.39) | (54.47) | (54.37) | (53.79) | (53.87) | (50.13) |
| % female students | 23.25 | 23.73 | 23.83 | 24.92 | 24.89 | 25.33 | 25.20 | 25.94 | 26.02 | 26.11 | 26.76 | 25.09 |
| | (25.11) | (25.09) | (24.88) | (24.99) | (24.73) | (24.77) | (24.66) | (25.03) | (24.99) | (24.89) | (25.04) | (24.92) |
| Apprentice positions | 98.86 | 101.17 | 101.72 | 101.83 | 103.96 | 101.08 | 103.65 | 104.60 | 105.60 | 105.92 | 106.98 | 103.21 |
| | (3.89) | (2.97) | (2.71) | (3.13) | (3.95) | (18.39) | (5.56) | (5.51) | (5.66) | (5.91) | (6.97) | (7.58) |
| GDP | 28.35 | 28.98 | 27.94 | 29.50 | 31.49 | 32.09 | 32.77 | 33.93 | 34.66 | 35.90 | 37.12 | 32.06 |
| | (12.42) | (12.22) | (11.70) | (12.58) | (13.73) | (13.87) | (14.10) | (14.32) | (14.44) | (15.98) | (16.10) | (14.14) |
| Unemployment rate | 8.64 | 7.37 | 7.73 | 7.25 | 6.59 | 6.38 | 6.45 | 6.28 | 6.01 | 5.77 | 5.35 | 6.71 |
| | (4.16) | (3.78) | (3.44) | (3.19) | (3.23) | (3.13) | (3.00) | (2.89) | (2.77) | (2.60) | (2.42) | (3.31) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A6: Variables per Year for East Germany (N=847)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 49.93 | 51.94 | 53.21 | 54.26 | 56.12 | 56.87 | 58.20 | 59.22 | 60.24 | 61.38 | 62.70 | 56.73 |
| | (3.13) | (3.20) | (3.06) | (3.13) | (3.14) | (3.16) | (3.16) | (3.18) | (3.28) | (3.25) | (3.25) | (5.01) |
| Childcare enrollment 0-2 | 41.86 | 42.65 | 46.40 | 48.58 | 50.82 | 52.12 | 53.36 | 54.12 | 53.14 | 53.15 | 54.31 | 50.05 |
| | (7.36) | (6.75) | (6.49) | (6.17) | (6.01) | (5.21) | (4.72) | (4.60) | (4.21) | (3.89) | (4.23) | (7.01) |
| Full-time enrollment 0-2 | 27.67 | 28.36 | 32.26 | 35.22 | 37.57 | 38.87 | 40.71 | 42.34 | 41.92 | 42.45 | 43.83 | 37.38 |
| | (5.65) | (5.42) | (5.54) | (5.55) | (5.98) | (5.24) | (5.33) | (6.10) | (5.85) | (6.03) | (6.29) | (7.92) |
| Childcare enrollment 3-5 | 94.57 | 95.48 | 95.66 | 95.10 | 94.86 | 95.50 | 95.65 | 96.36 | 93.88 | 94.79 | 93.43 | 95.03 |
| | (2.90) | (2.43) | (2.38) | (2.51) | (2.53) | (2.38) | (2.44) | (2.54) | (3.23) | (2.54) | (2.80) | (2.73) |
| Full-time enrollment 3-5 | 61.98 | 64.26 | 66.61 | 68.05 | 69.56 | 70.53 | 72.04 | 77.03 | 75.71 | 77.10 | 76.37 | 70.84 |
| | (17.29) | (16.33) | (16.12) | (15.62) | (14.95) | (13.46) | (12.72) | (13.07) | (11.79) | (12.63) | (12.71) | (15.14) |
| Nr. of children 0-2 | 2.19 | 2.24 | 2.28 | 2.32 | 2.34 | 2.37 | 2.36 | 2.41 | 2.47 | 2.53 | 2.55 | 2.37 |
| | (0.24) | (0.26) | (0.27) | (0.28) | (0.29) | (0.29) | (0.29) | (0.29) | (0.29) | (0.29) | (0.29) | (0.30) |
| Nr. of children 3-6 | 2.21 | 2.22 | 2.23 | 2.25 | 2.34 | 2.39 | 2.42 | 2.44 | 2.50 | 2.51 | 2.56 | 2.37 |
| | (0.20) | (0.21) | (0.20) | (0.21) | (0.22) | (0.23) | (0.24) | (0.23) | (0.23) | (0.22) | (0.22) | (0.25) |
| Nr. of children 6-18 | 8.67 | 8.25 | 8.26 | 8.41 | 8.71 | 8.93 | 9.16 | 9.35 | 9.59 | 9.78 | 9.89 | 9.00 |
| | (0.78) | (0.76) | (0.76) | (0.77) | (0.77) | (0.77) | (0.77) | (0.75) | (0.71) | (0.71) | (0.70) | (0.94) |
| % of females 18+ | 46.80 | 46.86 | 46.92 | 47.07 | 47.10 | 47.24 | 47.27 | 47.09 | 45.71 | 45.96 | 45.85 | 46.72 |
| | (2.21) | (2.28) | (2.39) | (2.48) | (2.59) | (2.62) | (2.69) | (2.66) | (2.89) | (2.52) | (2.48) | (2.58) |
| % of females 25+ | 45.58 | 45.67 | 45.81 | 45.89 | 46.30 | 46.51 | 46.65 | 46.74 | 46.40 | 46.80 | 47.04 | 46.31 |
| | (1.67) | (1.67) | (1.73) | (1.77) | (1.78) | (1.74) | (1.70) | (1.69) | (1.64) | (1.67) | (1.66) | (1.76) |
| % of females 65+ | 59.13 | 58.79 | 58.52 | 58.38 | 58.37 | 58.19 | 58.00 | 57.80 | 57.56 | 57.34 | 57.14 | 58.11 |
| | (0.89) | (0.89) | (0.87) | (0.87) | (0.87) | (0.88) | (0.88) | (0.89) | (0.89) | (0.91) | (0.95) | (1.06) |
| Fertility rate | 1.37 | 1.42 | 1.41 | 1.47 | 1.48 | 1.52 | 1.53 | 1.59 | 1.61 | 1.72 | 0.84 | 1.45 |
| | (0.07) | (0.07) | (0.08) | (0.07) | (0.08) | (0.09) | (0.11) | (0.11) | (0.12) | (0.14) | (0.10) | (0.24) |
| % university entrance qual. | 35.76 | 40.98 | 41.89 | 35.82 | 32.72 | 34.55 | 31.03 | 31.44 | 33.24 | 33.81 | 34.48 | 35.06 |
| | (6.48) | (7.93) | (8.04) | (8.79) | (7.71) | (9.81) | (7.78) | (7.25) | (7.28) | (7.40) | (8.24) | (8.56) |
| % school leaving without certificate | 8.61 | 8.88 | 8.95 | 10.00 | 10.30 | 9.14 | 9.28 | 8.41 | 8.29 | 8.42 | 8.80 | 9.01 |
| | (2.09) | (2.23) | (2.51) | (2.91) | (3.04) | (2.88) | (2.38) | (2.26) | (2.22) | (2.05) | (2.25) | (2.52) |
| %. students | 19.50 | 20.26 | 22.13 | 23.95 | 25.88 | 28.29 | 30.47 | 32.33 | 33.26 | 33.07 | 32.38 | 27.41 |
| | (34.06) | (34.99) | (37.26) | (39.59) | (40.60) | (43.24) | (45.86) | (48.97) | (50.63) | (48.86) | (47.13) | (43.24) |
| % female students | 26.03 | 27.05 | 26.09 | 27.75 | 26.61 | 26.71 | 26.28 | 25.90 | 26.82 | 27.30 | 28.19 | 26.79 |
| | (26.07) | (26.23) | (25.72) | (26.13) | (25.86) | (25.87) | (25.21) | (25.40) | (25.61) | (25.38) | (25.09) | (25.55) |
| Apprentice positions | 97.05 | 100.40 | 101.43 | 101.37 | 104.29 | 104.75 | 105.01 | 106.59 | 107.39 | 107.35 | 107.25 | 103.90 |
| | (2.61) | (2.48) | (2.87) | (4.44) | (4.71) | (5.94) | (7.50) | (6.55) | (5.83) | (5.40) | (5.17) | (6.03) |
| GDP | 20.89 | 21.45 | 20.94 | 22.08 | 23.48 | 24.05 | 24.81 | 26.01 | 26.60 | 27.48 | 28.49 | 24.21 |
| | (4.70) | (4.60) | (4.71) | (4.85) | (4.96) | (4.72) | (4.76) | (5.04) | (5.18) | (5.18) | (5.23) | (5.52) |
| Unemployment rate | 14.88 | 12.88 | 12.66 | 11.45 | 10.69 | 10.22 | 9.92 | 9.39 | 8.82 | 8.13 | 7.22 | 10.57 |
| | (2.94) | (2.69) | (2.35) | (2.27) | (2.49) | (2.43) | (2.32) | (2.27) | (2.18) | (2.06) | (1.86) | (3.19) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A7: Variables per Year for West Germany (N=3,560)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 44.13 | 45.41 | 46.08 | 46.76 | 48.36 | 49.35 | 50.59 | 51.64 | 52.73 | 53.91 | 55.16 | 49.46 |
| | (3.63) | (3.70) | (3.61) | (3.66) | (3.69) | (3.77) | (3.74) | (3.79) | (3.82) | (3.84) | (3.84) | (5.11) |
| Childcare enrollment 0-2 | 9.44 | 11.76 | 14.24 | 17.14 | 19.91 | 22.08 | 23.91 | 26.18 | 26.14 | 25.80 | 27.06 | 20.33 |
| | (4.36) | (4.67) | (4.93) | (5.33) | (5.72) | (5.93) | (5.92) | (5.71) | (5.62) | (5.70) | (5.77) | (8.11) |
| Full-time enrollment 0-2 | 2.48 | 3.15 | 4.04 | 5.26 | 6.49 | 7.91 | 8.88 | 9.99 | 10.44 | 10.65 | 11.10 | 7.30 |
| | (2.17) | (2.51) | (2.95) | (3.52) | (4.12) | (4.62) | (5.00) | (5.47) | (5.75) | (5.85) | (6.09) | (5.48) |
| Childcare enrollment 3-5 | 90.75 | 92.38 | 93.24 | 93.13 | 93.54 | 94.06 | 94.06 | 94.12 | 92.03 | 92.07 | 90.59 | 92.73 |
| | (5.79) | (4.88) | (4.68) | (4.29) | (3.78) | (3.47) | (3.44) | (3.41) | (3.35) | (3.40) | (3.62) | (4.25) |
| Full-time enrollment 3-5 | 16.32 | 18.41 | 20.76 | 22.76 | 25.12 | 27.50 | 29.55 | 31.79 | 32.75 | 34.13 | 34.43 | 26.67 |
| | (10.48) | (11.41) | (12.21) | (12.98) | (13.68) | (14.65) | (15.03) | (15.22) | (15.19) | (15.49) | (15.46) | (15.18) |
| Nr. of children 0-2 | 2.50 | 2.48 | 2.46 | 2.44 | 2.43 | 2.43 | 2.45 | 2.52 | 2.60 | 2.73 | 2.79 | 2.53 |
| | (0.22) | (0.22) | (0.23) | (0.23) | (0.24) | (0.24) | (0.23) | (0.24) | (0.24) | (0.24) | (0.25) | (0.26) |
| Nr. of children 3-6 | 2.68 | 2.62 | 2.57 | 2.53 | 2.54 | 2.53 | 2.52 | 2.50 | 2.54 | 2.57 | 2.64 | 2.57 |
| | (0.24) | (0.23) | (0.22) | (0.21) | (0.21) | (0.21) | (0.21) | (0.21) | (0.20) | (0.21) | (0.21) | (0.22) |
| Nr. of children 6-18 | 12.91 | 12.65 | 12.40 | 12.17 | 12.05 | 11.83 | 11.64 | 11.45 | 11.30 | 11.18 | 11.02 | 11.87 |
| | (1.42) | (1.38) | (1.33) | (1.28) | (1.21) | (1.15) | (1.09) | (1.02) | (0.95) | (0.90) | (0.85) | (1.30) |
| % of females 18+ | 48.95 | 48.82 | 48.71 | 48.59 | 48.52 | 48.41 | 48.29 | 48.06 | 47.26 | 47.12 | 47.06 | 48.16 |
| | (1.98) | (1.95) | (1.97) | (2.04) | (2.17) | (2.20) | (2.21) | (2.18) | (2.28) | (2.19) | (2.15) | (2.22) |
| % of females 25+ | 49.57 | 49.46 | 49.32 | 49.10 | 49.07 | 48.76 | 48.43 | 48.15 | 47.48 | 47.41 | 47.41 | 48.56 |
| | (1.44) | (1.41) | (1.44) | (1.45) | (1.56) | (1.59) | (1.64) | (1.64) | (1.70) | (1.66) | (1.66) | (1.76) |
| % of females 65+ | 57.63 | 57.34 | 57.10 | 56.95 | 57.14 | 56.91 | 56.69 | 56.48 | 56.29 | 56.16 | 56.03 | 56.79 |
| | (1.34) | (1.32) | (1.29) | (1.26) | (1.27) | (1.24) | (1.22) | (1.21) | (1.20) | (1.21) | (1.23) | (1.34) |
| Fertility rate | 1.40 | 1.40 | 1.38 | 1.41 | 1.40 | 1.42 | 1.43 | 1.49 | 1.52 | 1.63 | 0.79 | 1.39 |
| | (0.11) | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) | (0.11) | (0.11) | (0.11) | (0.13) | (0.08) | (0.23) |
| % university entrance qual. | 23.47 | 24.67 | 26.59 | 28.30 | 34.80 | 31.85 | 32.13 | 30.92 | 32.01 | 32.51 | 31.94 | 29.92 |
| | (7.80) | (8.07) | (8.48) | (8.67) | (9.67) | (9.69) | (10.74) | (9.38) | (9.30) | (9.89) | (8.97) | (9.80) |
| % school leaving without certificate | 7.03 | 6.64 | 6.10 | 5.60 | 4.99 | 5.01 | 4.73 | 4.97 | 5.16 | 5.39 | 6.03 | 5.60 |
| | (1.88) | (1.79) | (1.63) | (1.58) | (1.58) | (1.63) | (1.57) | (1.79) | (1.75) | (1.63) | (1.89) | (1.85) |
| %. students | 22.30 | 23.34 | 24.40 | 25.36 | 27.06 | 28.32 | 30.05 | 31.01 | 31.15 | 31.26 | 31.92 | 27.83 |
| | (42.48) | (44.31) | (46.85) | (49.10) | (51.54) | (53.20) | (56.29) | (55.76) | (55.30) | (54.95) | (55.43) | (51.63) |
| % female students | 22.59 | 22.94 | 23.29 | 24.24 | 24.48 | 25.00 | 24.94 | 25.95 | 25.83 | 25.83 | 26.42 | 24.68 |
| | (24.87) | (24.78) | (24.68) | (24.71) | (24.47) | (24.53) | (24.56) | (24.98) | (24.88) | (24.80) | (25.05) | (24.75) |
| Apprentice positions | 99.30 | 101.35 | 101.79 | 101.94 | 103.88 | 100.21 | 103.33 | 104.13 | 105.17 | 105.58 | 106.91 | 103.05 |
| | (4.02) | (3.05) | (2.67) | (2.72) | (3.76) | (20.16) | (4.94) | (5.13) | (5.55) | (5.98) | (7.35) | (7.90) |
| GDP | 30.13 | 30.77 | 29.60 | 31.27 | 33.39 | 34.00 | 34.66 | 35.81 | 36.58 | 37.90 | 39.19 | 33.93 |
| | (13.01) | (12.78) | (12.24) | (13.19) | (14.45) | (14.63) | (14.90) | (15.15) | (15.26) | (16.99) | (17.12) | (14.90) |
| Unemployment rate | 7.16 | 6.06 | 6.56 | 6.25 | 5.61 | 5.47 | 5.63 | 5.54 | 5.34 | 5.21 | 4.90 | 5.79 |
| | (2.82) | (2.65) | (2.49) | (2.48) | (2.55) | (2.52) | (2.52) | (2.50) | (2.46) | (2.39) | (2.32) | (2.59) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A8: Variables per Year for Metropolitan Areas only (N=737)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 43.00 | 44.30 | 45.02 | 45.43 | 47.14 | 47.93 | 48.82 | 49.66 | 50.45 | 51.65 | 52.80 | 47.84 |
| | (4.23) | (4.39) | (4.47) | (4.51) | (4.56) | (4.63) | (4.62) | (4.68) | (4.70) | (4.77) | (4.70) | (5.45) |
| Childcare enrollment 0-2 | 16.03 | 17.57 | 19.62 | 21.87 | 24.34 | 26.29 | 27.90 | 30.26 | 31.17 | 31.03 | 31.99 | 25.28 |
| | (12.53) | (12.01) | (11.82) | (11.41) | (11.76) | (11.78) | (11.62) | (10.93) | (10.28) | (10.49) | (10.59) | (12.60) |
| Full-time enrollment 0-2 | 8.75 | 9.63 | 11.09 | 12.79 | 14.57 | 16.20 | 17.36 | 19.08 | 19.73 | 20.06 | 20.69 | 15.45 |
| | (9.81) | (9.43) | (9.93) | (10.48) | (11.26) | (11.32) | (11.48) | (11.77) | (11.47) | (11.68) | (11.94) | (11.68) |
| Childcare enrollment 3-5 | 89.57 | 91.14 | 91.77 | 91.51 | 91.95 | 92.97 | 92.81 | 93.20 | 91.44 | 91.49 | 89.68 | 91.60 |
| | (4.60) | (4.23) | (4.31) | (4.11) | (3.28) | (3.25) | (3.26) | (3.67) | (4.03) | (4.10) | (4.46) | (4.10) |
| Full-time enrollment 3-5 | 33.21 | 36.16 | 39.05 | 41.33 | 43.56 | 45.74 | 47.48 | 50.50 | 51.32 | 53.13 | 52.97 | 44.95 |
| | (17.65) | (17.72) | (17.85) | (18.47) | (17.90) | (17.63) | (17.18) | (18.51) | (17.75) | (18.24) | (17.62) | (18.92) |
| Nr. of children 0-2 | 2.58 | 2.60 | 2.63 | 2.63 | 2.65 | 2.66 | 2.68 | 2.76 | 2.84 | 2.96 | 3.01 | 2.73 |
| | (0.23) | (0.23) | (0.24) | (0.25) | (0.27) | (0.28) | (0.27) | (0.25) | (0.24) | (0.23) | (0.23) | (0.28) |
| Nr. of children 3-6 | 2.51 | 2.50 | 2.50 | 2.51 | 2.58 | 2.58 | 2.59 | 2.57 | 2.62 | 2.65 | 2.72 | 2.57 |
| | (0.21) | (0.20) | (0.19) | (0.20) | (0.20) | (0.20) | (0.21) | (0.21) | (0.21) | (0.21) | (0.21) | (0.21) |
| Nr. of children 6-18 | 10.59 | 10.38 | 10.26 | 10.17 | 10.22 | 10.18 | 10.17 | 10.17 | 10.22 | 10.27 | 10.26 | 10.26 |
| | (1.58) | (1.59) | (1.50) | (1.40) | (1.26) | (1.16) | (1.09) | (1.00) | (0.93) | (0.91) | (0.88) | (1.23) |
| % of females 18+ | 51.30 | 51.16 | 51.11 | 51.10 | 51.09 | 51.02 | 50.89 | 50.68 | 49.84 | 49.53 | 49.42 | 50.65 |
| | (2.34) | (2.41) | (2.46) | (2.44) | (2.68) | (2.74) | (2.76) | (2.69) | (2.93) | (2.84) | (2.86) | (2.72) |
| % of females 25+ | 50.01 | 50.01 | 50.05 | 49.93 | 49.92 | 49.72 | 49.53 | 49.28 | 48.74 | 48.69 | 48.65 | 49.50 |
| | (1.80) | (1.74) | (1.71) | (1.79) | (2.17) | (2.14) | (2.15) | (2.23) | (2.27) | (2.19) | (2.19) | (2.10) |
| % of females 65+ | 59.04 | 58.71 | 58.44 | 58.25 | 58.51 | 58.29 | 58.10 | 57.93 | 57.80 | 57.71 | 57.63 | 58.22 |
| | (1.10) | (1.08) | (1.03) | (1.04) | (0.90) | (0.86) | (0.84) | (0.81) | (0.77) | (0.75) | (0.72) | (1.00) |
| Fertility rate | 1.33 | 1.34 | 1.33 | 1.36 | 1.34 | 1.35 | 1.36 | 1.42 | 1.44 | 1.54 | 0.76 | 1.33 |
| | (0.12) | (0.11) | (0.11) | (0.11) | (0.12) | (0.12) | (0.11) | (0.12) | (0.13) | (0.16) | (0.15) | (0.23) |
| % university entrance qual. | 33.16 | 35.06 | 36.45 | 37.57 | 40.63 | 40.90 | 42.32 | 40.10 | 41.05 | 41.64 | 40.41 | 39.03 |
| | (7.61) | (8.71) | (8.46) | (7.85) | (8.23) | (8.84) | (8.12) | (7.54) | (7.04) | (7.74) | (6.96) | (8.39) |
| % school leaving without certificate | 7.96 | 7.41 | 7.06 | 6.81 | 6.29 | 6.11 | 5.81 | 6.27 | 6.22 | 6.07 | 7.07 | 6.64 |
| | (2.38) | (2.08) | (1.98) | (2.30) | (2.62) | (2.34) | (2.48) | (2.26) | (2.17) | (2.15) | (2.44) | (2.37) |
| %. students | 73.28 | 75.96 | 79.66 | 82.88 | 86.48 | 89.62 | 94.66 | 97.58 | 97.87 | 98.08 | 97.71 | 88.53 |
| | (62.89) | (66.28) | (71.29) | (76.32) | (79.40) | (81.08) | (85.66) | (82.26) | (80.87) | (79.13) | (79.22) | (77.06) |
| % female students | 41.32 | 41.34 | 42.09 | 42.63 | 42.35 | 43.95 | 44.11 | 44.53 | 44.71 | 44.87 | 45.21 | 43.37 |
| | (17.60) | (17.68) | (16.54) | (16.11) | (15.84) | (14.83) | (14.72) | (14.84) | (14.42) | (14.26) | (14.24) | (15.56) |
| Apprentice positions | 97.72 | 100.14 | 100.77 | 100.95 | 102.29 | 102.38 | 101.37 | 101.94 | 102.72 | 102.83 | 103.27 | 101.49 |
| | (3.98) | (3.17) | (2.72) | (2.36) | (3.33) | (4.42) | (4.59) | (5.23) | (5.11) | (5.49) | (7.13) | (4.74) |
| GDP | 42.10 | 42.54 | 41.11 | 43.14 | 45.84 | 46.50 | 47.37 | 48.59 | 49.21 | 51.14 | 52.51 | 46.37 |
| | (16.79) | (16.50) | (15.71) | (17.65) | (19.53) | (20.23) | (21.26) | (21.61) | (21.43) | (25.50) | (25.01) | (20.54) |
| Unemployment rate | 10.80 | 9.47 | 9.78 | 9.39 | 8.82 | 8.62 | 8.68 | 8.56 | 8.32 | 8.05 | 7.55 | 8.91 |
| | (3.17) | (2.98) | (2.72) | (2.72) | (2.81) | (2.73) | (2.70) | (2.64) | (2.62) | (2.60) | (2.49) | (2.86) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A9: Variables per Year for Urban Areas only (N=1,438)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 44.80 | 46.09 | 46.76 | 47.43 | 49.13 | 50.07 | 51.34 | 52.40 | 53.45 | 54.59 | 55.88 | 50.17 |
| | (3.54) | (3.64) | (3.61) | (3.61) | (3.69) | (3.72) | (3.64) | (3.66) | (3.65) | (3.65) | (3.68) | (5.04) |
| Childcare enrollment 0-2 | 11.24 | 13.69 | 16.15 | 19.01 | 21.79 | 23.87 | 25.50 | 27.86 | 27.72 | 27.57 | 28.86 | 22.10 |
| | (7.54) | (7.47) | (7.85) | (7.74) | (8.11) | (8.15) | (8.15) | (7.35) | (6.89) | (7.15) | (7.24) | (9.64) |
| Full-time enrollment 0-2 | 3.86 | 4.63 | 5.75 | 7.29 | 8.71 | 10.11 | 11.17 | 12.36 | 12.79 | 13.06 | 13.59 | 9.38 |
| | (6.26) | (6.26) | (7.11) | (7.70) | (8.12) | (8.13) | (8.67) | (8.75) | (8.65) | (8.83) | (9.25) | (8.69) |
| Childcare enrollment 3-5 | 92.87 | 94.28 | 95.08 | 94.61 | 94.91 | 95.15 | 95.08 | 95.02 | 92.67 | 92.88 | 91.66 | 94.03 |
| | (4.65) | (3.55) | (3.28) | (3.06) | (2.76) | (2.73) | (2.80) | (2.77) | (2.73) | (2.80) | (2.96) | (3.36) |
| Full-time enrollment 3-5 | 18.40 | 20.90 | 23.80 | 26.08 | 28.76 | 31.12 | 33.21 | 35.38 | 36.16 | 37.83 | 38.10 | 29.96 |
| | (14.99) | (15.20) | (15.63) | (15.91) | (16.61) | (16.92) | (16.90) | (17.14) | (16.75) | (17.01) | (16.90) | (17.60) |
| Nr. of children 0-2 | 2.49 | 2.47 | 2.45 | 2.43 | 2.43 | 2.44 | 2.45 | 2.51 | 2.60 | 2.73 | 2.79 | 2.53 |
| | (0.22) | (0.21) | (0.21) | (0.20) | (0.21) | (0.21) | (0.20) | (0.20) | (0.20) | (0.19) | (0.20) | (0.23) |
| Nr. of children 3-6 | 2.70 | 2.64 | 2.58 | 2.55 | 2.57 | 2.56 | 2.55 | 2.53 | 2.57 | 2.60 | 2.67 | 2.59 |
| | (0.24) | (0.23) | (0.22) | (0.22) | (0.21) | (0.20) | (0.20) | (0.20) | (0.19) | (0.19) | (0.19) | (0.21) |
| Nr. of children 6-18 | 12.96 | 12.69 | 12.46 | 12.24 | 12.17 | 11.96 | 11.79 | 11.61 | 11.45 | 11.35 | 11.20 | 11.99 |
| | (1.39) | (1.40) | (1.33) | (1.26) | (1.16) | (1.07) | (0.99) | (0.93) | (0.84) | (0.78) | (0.73) | (1.23) |
| % of females 18+ | 48.61 | 48.50 | 48.39 | 48.31 | 48.26 | 48.13 | 47.98 | 47.74 | 46.84 | 46.81 | 46.74 | 47.85 |
| | (1.33) | (1.26) | (1.29) | (1.45) | (1.58) | (1.63) | (1.70) | (1.75) | (1.82) | (1.84) | (1.83) | (1.74) |
| % of females 25+ | 49.55 | 49.46 | 49.31 | 49.13 | 49.14 | 48.87 | 48.53 | 48.24 | 47.50 | 47.56 | 47.54 | 48.62 |
| | (1.58) | (1.51) | (1.50) | (1.43) | (1.31) | (1.30) | (1.26) | (1.28) | (1.30) | (1.30) | (1.35) | (1.57) |
| % of females 65+ | 57.23 | 56.97 | 56.75 | 56.60 | 56.84 | 56.66 | 56.47 | 56.29 | 56.11 | 56.02 | 55.91 | 56.53 |
| | (1.21) | (1.19) | (1.17) | (1.15) | (1.12) | (1.10) | (1.09) | (1.06) | (1.00) | (0.97) | (0.95) | (1.16) |
| Fertility rate | 1.41 | 1.42 | 1.39 | 1.42 | 1.43 | 1.44 | 1.45 | 1.51 | 1.55 | 1.66 | 0.80 | 1.41 |
| | (0.08) | (0.08) | (0.08) | (0.09) | (0.08) | (0.09) | (0.10) | (0.10) | (0.09) | (0.10) | (0.05) | (0.22) |
| % university entrance qual. | 24.88 | 26.56 | 28.81 | 29.68 | 33.57 | 34.51 | 34.30 | 32.46 | 33.66 | 33.69 | 33.51 | 31.42 |
| | (6.95) | (7.41) | (8.15) | (7.62) | (8.79) | (8.04) | (9.75) | (8.20) | (8.11) | (8.61) | (7.92) | (8.76) |
| % school leaving without certificate | 6.48 | 6.17 | 5.79 | 5.33 | 4.95 | 4.73 | 4.61 | 4.76 | 4.87 | 5.35 | 5.76 | 5.34 |
| | (1.45) | (1.45) | (1.46) | (1.43) | (1.64) | (1.30) | (1.44) | (1.36) | (1.45) | (1.58) | (1.65) | (1.59) |
| %. students | 12.68 | 13.41 | 13.93 | 14.26 | 15.55 | 16.63 | 17.68 | 18.25 | 18.45 | 18.77 | 19.92 | 16.31 |
| | (26.06) | (26.93) | (27.42) | (27.26) | (28.78) | (30.26) | (31.81) | (32.26) | (32.62) | (32.65) | (33.69) | (30.07) |
| % female students | 23.28 | 23.88 | 24.62 | 25.84 | 26.57 | 26.96 | 26.97 | 28.59 | 27.68 | 27.45 | 27.20 | 26.27 |
| | (25.11) | (25.21) | (25.32) | (25.34) | (25.35) | (25.21) | (25.11) | (25.85) | (25.60) | (25.11) | (25.10) | (25.26) |
| Apprentice positions | 99.15 | 101.40 | 101.77 | 101.82 | 103.76 | 100.70 | 103.06 | 103.77 | 104.66 | 104.87 | 105.80 | 102.79 |
| | (3.53) | (3.53) | (2.81) | (2.48) | (3.33) | (18.37) | (4.05) | (4.49) | (4.78) | (4.93) | (5.65) | (7.01) |
| GDP | 27.62 | 28.19 | 26.77 | 28.19 | 30.29 | 30.81 | 31.25 | 32.42 | 33.22 | 34.31 | 35.41 | 30.76 |
| | (9.39) | (9.14) | (8.77) | (8.98) | (10.02) | (9.90) | (9.65) | (9.70) | (10.21) | (10.81) | (10.91) | (10.13) |
| Unemployment rate | 6.72 | 5.69 | 6.26 | 6.01 | 5.32 | 5.19 | 5.36 | 5.26 | 5.03 | 4.90 | 4.58 | 5.49 |
| | (2.71) | (2.48) | (2.29) | (2.17) | (2.13) | (2.07) | (2.05) | (2.02) | (1.96) | (1.87) | (1.79) | (2.23) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A10: Variables per Year for Agglomerations only (N=1,111)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 46.17 | 47.68 | 48.58 | 49.43 | 50.98 | 52.00 | 53.35 | 54.44 | 55.61 | 56.74 | 58.02 | 52.09 |
| | (4.22) | (4.51) | (4.61) | (4.77) | (4.87) | (4.78) | (4.73) | (4.75) | (4.65) | (4.70) | (4.74) | (5.95) |
| Childcare enrollment 0-2 | 17.04 | 18.93 | 21.96 | 24.88 | 27.37 | 29.30 | 31.05 | 32.78 | 32.08 | 31.68 | 33.07 | 27.28 |
| | (15.53) | (14.80) | (15.42) | (15.40) | (14.96) | (14.52) | (14.32) | (13.68) | (13.32) | (13.47) | (13.40) | (15.41) |
| Full-time enrollment 0-2 | 7.76 | 8.40 | 9.89 | 11.40 | 12.68 | 14.17 | 15.31 | 16.56 | 16.41 | 16.77 | 17.46 | 13.35 |
| | (11.46) | (11.61) | (12.91) | (13.92) | (14.28) | (14.43) | (14.96) | (15.75) | (15.28) | (15.48) | (15.92) | (14.59) |
| Childcare enrollment 3-5 | 91.21 | 92.71 | 93.38 | 93.29 | 93.31 | 93.87 | 94.22 | 94.36 | 92.12 | 92.36 | 90.89 | 92.88 |
| | (6.45) | (5.32) | (5.08) | (4.85) | (4.14) | (3.66) | (3.56) | (3.73) | (3.44) | (3.58) | (3.87) | (4.55) |
| Full-time enrollment 3-5 | 24.34 | 26.13 | 27.94 | 29.57 | 31.41 | 33.43 | 35.46 | 38.45 | 38.88 | 40.06 | 40.29 | 33.27 |
| | (22.87) | (23.49) | (23.94) | (24.26) | (23.87) | (23.84) | (24.10) | (25.51) | (24.54) | (24.75) | (24.43) | (24.67) |
| Nr. of children 0-2 | 2.41 | 2.41 | 2.40 | 2.38 | 2.36 | 2.38 | 2.40 | 2.45 | 2.53 | 2.64 | 2.70 | 2.46 |
| | (0.28) | (0.26) | (0.25) | (0.24) | (0.23) | (0.23) | (0.23) | (0.24) | (0.24) | (0.26) | (0.27) | (0.27) |
| Nr. of children 3-6 | 2.61 | 2.55 | 2.51 | 2.47 | 2.49 | 2.49 | 2.49 | 2.47 | 2.52 | 2.54 | 2.62 | 2.52 |
| | (0.36) | (0.34) | (0.31) | (0.27) | (0.25) | (0.24) | (0.23) | (0.23) | (0.22) | (0.22) | (0.23) | (0.27) |
| Nr. of children 6-18 | 12.34 | 12.02 | 11.81 | 11.65 | 11.58 | 11.45 | 11.33 | 11.20 | 11.11 | 11.02 | 10.90 | 11.49 |
| | (2.37) | (2.41) | (2.30) | (2.13) | (1.95) | (1.77) | (1.60) | (1.43) | (1.26) | (1.14) | (1.03) | (1.87) |
| % of females 18+ | 47.88 | 47.81 | 47.74 | 47.63 | 47.62 | 47.58 | 47.44 | 47.23 | 46.24 | 46.14 | 46.10 | 47.22 |
| | (1.81) | (1.79) | (1.80) | (1.80) | (1.88) | (1.88) | (1.89) | (1.84) | (1.95) | (1.69) | (1.55) | (1.92) |
| % of females 25+ | 48.35 | 48.28 | 48.12 | 47.92 | 48.04 | 47.85 | 47.66 | 47.43 | 46.92 | 46.92 | 47.00 | 47.68 |
| | (2.14) | (2.05) | (1.97) | (1.80) | (1.68) | (1.61) | (1.47) | (1.42) | (1.43) | (1.32) | (1.30) | (1.75) |
| % of females 65+ | 57.87 | 57.54 | 57.29 | 57.14 | 57.24 | 57.01 | 56.79 | 56.56 | 56.32 | 56.14 | 55.98 | 56.90 |
| | (1.41) | (1.39) | (1.36) | (1.33) | (1.35) | (1.35) | (1.33) | (1.34) | (1.32) | (1.32) | (1.33) | (1.46) |
| Fertility rate | 1.42 | 1.43 | 1.40 | 1.44 | 1.43 | 1.46 | 1.47 | 1.53 | 1.56 | 1.67 | 0.81 | 1.42 |
| | (0.10) | (0.10) | (0.10) | (0.10) | (0.10) | (0.11) | (0.11) | (0.12) | (0.12) | (0.13) | (0.07) | (0.23) |
| % university entrance qual. | 23.53 | 25.22 | 26.62 | 26.51 | 32.65 | 28.37 | 27.46 | 27.37 | 28.53 | 29.36 | 29.07 | 27.70 |
| | (9.88) | (11.03) | (11.21) | (9.35) | (10.21) | (9.27) | (8.83) | (8.28) | (8.70) | (9.47) | (9.15) | (9.84) |
| % school leaving without certificate | 7.52 | 7.31 | 6.79 | 6.76 | 6.30 | 6.19 | 5.93 | 5.74 | 6.09 | 6.19 | 6.85 | 6.51 |
| | (1.85) | (2.18) | (2.21) | (2.90) | (3.04) | (2.75) | (2.52) | (2.27) | (2.32) | (2.13) | (2.23) | (2.48) |
| %. students | 12.68 | 13.50 | 14.43 | 15.69 | 17.17 | 18.68 | 20.13 | 21.09 | 21.43 | 21.28 | 21.21 | 17.94 |
| | (26.71) | (27.57) | (29.21) | (30.85) | (32.76) | (35.22) | (37.83) | (38.97) | (39.55) | (39.08) | (39.19) | (34.59) |
| % female students | 19.06 | 20.92 | 19.60 | 21.63 | 20.85 | 20.92 | 20.31 | 20.06 | 20.31 | 20.52 | 21.65 | 20.53 |
| | (25.01) | (25.49) | (24.78) | (25.59) | (24.62) | (24.63) | (24.18) | (24.32) | (24.57) | (24.72) | (25.25) | (24.74) |
| Apprentice positions | 98.80 | 101.29 | 102.00 | 101.70 | 104.26 | 102.06 | 104.39 | 105.72 | 106.71 | 107.37 | 108.88 | 103.92 |
| | (3.67) | (2.41) | (2.65) | (3.39) | (4.00) | (18.57) | (5.28) | (5.11) | (5.13) | (5.67) | (6.78) | (7.66) |
| GDP | 25.50 | 26.12 | 25.28 | 26.96 | 28.76 | 29.27 | 30.00 | 31.10 | 31.75 | 33.01 | 34.28 | 29.27 |
| | (10.45) | (10.28) | (9.69) | (10.74) | (11.91) | (11.89) | (11.84) | (12.33) | (12.43) | (13.38) | (13.99) | (12.10) |
| Unemployment rate | 8.41 | 7.12 | 7.42 | 6.86 | 6.20 | 5.96 | 5.97 | 5.78 | 5.48 | 5.24 | 4.86 | 6.30 |
| | (4.41) | (3.99) | (3.62) | (3.29) | (3.33) | (3.20) | (3.00) | (2.86) | (2.66) | (2.46) | (2.28) | (3.39) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*

Table A11: Variables per Year for Rural Areas only (N=1,121)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Female Laborforce Participation | 46.37 | 47.95 | 48.82 | 49.79 | 51.43 | 52.39 | 53.80 | 54.93 | 56.17 | 57.35 | 58.68 | 52.51 |
| | (4.36) | (4.60) | (4.63) | (4.72) | (4.92) | (4.82) | (4.74) | (4.63) | (4.55) | (4.43) | (4.40) | (6.00) |
| Childcare enrollment 0-2 | 19.75 | 21.70 | 24.91 | 27.71 | 30.55 | 32.55 | 34.41 | 35.89 | 35.40 | 34.92 | 36.17 | 30.35 |
| | (17.04) | (16.44) | (17.13) | (16.85) | (16.63) | (16.04) | (15.40) | (15.12) | (15.02) | (15.08) | (15.09) | (16.92) |
| Full-time enrollment 0-2 | 10.37 | 10.85 | 12.74 | 14.24 | 15.68 | 16.80 | 18.02 | 18.91 | 19.28 | 19.32 | 20.08 | 16.02 |
| | (12.66) | (12.92) | (14.71) | (15.65) | (16.57) | (16.55) | (17.01) | (17.36) | (17.27) | (17.36) | (17.94) | (16.37) |
| Childcare enrollment 3-5 | 91.23 | 92.77 | 93.53 | 93.61 | 94.06 | 94.64 | 94.60 | 95.00 | 92.89 | 93.16 | 91.71 | 93.38 |
| | (5.88) | (5.10) | (4.61) | (3.91) | (3.68) | (3.43) | (3.46) | (3.29) | (3.61) | (3.36) | (3.38) | (4.20) |
| Full-time enrollment 3-5 | 29.08 | 30.52 | 32.36 | 33.74 | 35.64 | 37.47 | 39.30 | 42.45 | 42.65 | 43.47 | 43.49 | 37.28 |
| | (27.05) | (27.31) | (27.64) | (27.27) | (27.38) | (26.96) | (26.89) | (27.85) | (26.69) | (26.81) | (26.53) | (27.49) |
| Nr. of children 0-2 | 2.31 | 2.29 | 2.29 | 2.28 | 2.27 | 2.28 | 2.28 | 2.34 | 2.41 | 2.52 | 2.56 | 2.35 |
| | (0.23) | (0.20) | (0.20) | (0.18) | (0.17) | (0.17) | (0.17) | (0.18) | (0.19) | (0.20) | (0.22) | (0.21) |
| Nr. of children 3-6 | 2.48 | 2.44 | 2.40 | 2.37 | 2.38 | 2.38 | 2.39 | 2.37 | 2.42 | 2.44 | 2.51 | 2.42 |
| | (0.31) | (0.27) | (0.24) | (0.22) | (0.19) | (0.19) | (0.18) | (0.17) | (0.17) | (0.17) | (0.17) | (0.22) |
| Nr. of children 6-18 | 11.75 | 11.38 | 11.19 | 11.07 | 11.02 | 10.94 | 10.86 | 10.77 | 10.71 | 10.67 | 10.56 | 10.99 |
| | (2.37) | (2.44) | (2.31) | (2.12) | (1.90) | (1.69) | (1.48) | (1.30) | (1.11) | (0.98) | (0.86) | (1.80) |
| % of females 18+ | 47.30 | 47.20 | 47.13 | 47.11 | 46.97 | 47.00 | 47.04 | 46.85 | 45.91 | 46.05 | 45.96 | 46.77 |
| | (1.70) | (1.60) | (1.58) | (1.56) | (1.59) | (1.62) | (1.64) | (1.55) | (1.90) | (1.58) | (1.59) | (1.70) |
| % of females 25+ | 47.50 | 47.41 | 47.38 | 47.26 | 47.36 | 47.17 | 47.00 | 46.94 | 46.35 | 46.39 | 46.55 | 47.03 |
| | (2.24) | (2.12) | (2.04) | (1.93) | (1.85) | (1.58) | (1.57) | (1.44) | (1.39) | (1.31) | (1.35) | (1.78) |
| % of females 65+ | 58.11 | 57.82 | 57.56 | 57.42 | 57.45 | 57.20 | 56.95 | 56.69 | 56.45 | 56.23 | 56.02 | 57.08 |
| | (1.24) | (1.25) | (1.23) | (1.24) | (1.22) | (1.22) | (1.22) | (1.23) | (1.22) | (1.19) | (1.21) | (1.38) |
| Fertility rate | 1.40 | 1.41 | 1.39 | 1.43 | 1.42 | 1.46 | 1.48 | 1.53 | 1.56 | 1.68 | 0.81 | 1.42 |
| | (0.09) | (0.09) | (0.10) | (0.08) | (0.09) | (0.09) | (0.11) | (0.12) | (0.11) | (0.13) | (0.06) | (0.23) |
| % university entrance qual. | 24.52 | 27.18 | 28.79 | 27.88 | 33.09 | 27.97 | 26.46 | 26.81 | 28.31 | 29.09 | 29.16 | 28.11 |
| | (8.87) | (11.60) | (11.17) | (8.78) | (8.23) | (8.25) | (6.57) | (6.39) | (6.46) | (7.31) | (7.11) | (8.63) |
| % school leaving without certificate | 7.82 | 7.76 | 7.33 | 7.33 | 6.90 | 6.59 | 6.42 | 6.23 | 6.30 | 6.50 | 6.96 | 6.92 |
| | (2.20) | (2.27) | (2.56) | (3.04) | (3.58) | (3.12) | (3.13) | (2.99) | (2.62) | (2.40) | (2.53) | (2.84) |
| %. students | 8.58 | 8.94 | 9.68 | 10.34 | 11.70 | 12.61 | 13.66 | 14.47 | 14.68 | 14.64 | 14.72 | 12.18 |
| | (18.97) | (19.48) | (21.15) | (22.59) | (25.28) | (27.26) | (29.42) | (30.99) | (31.14) | (30.64) | (29.84) | (26.44) |
| % female students | 15.50 | 14.75 | 15.01 | 15.35 | 15.25 | 15.36 | 15.32 | 16.16 | 17.19 | 17.61 | 19.15 | 16.06 |
| | (23.85) | (23.06) | (22.81) | (22.72) | (22.69) | (22.67) | (22.65) | (22.85) | (23.46) | (23.75) | (24.44) | (23.12) |
| Apprentice positions | 99.31 | 101.43 | 102.00 | 102.54 | 105.02 | 99.74 | 105.17 | 106.31 | 107.60 | 107.88 | 109.01 | 104.18 |
| | (4.36) | (2.38) | (2.52) | (3.84) | (4.63) | (23.39) | (7.28) | (6.38) | (6.54) | (6.47) | (7.32) | (9.31) |
| GDP | 23.10 | 23.91 | 23.42 | 24.74 | 26.29 | 27.05 | 27.87 | 29.04 | 29.78 | 30.77 | 31.99 | 27.08 |
| | (6.54) | (6.68) | (6.64) | (7.06) | (7.35) | (7.44) | (7.50) | (7.60) | (7.85) | (8.13) | (8.45) | (7.94) |
| Unemployment rate | 9.92 | 8.38 | 8.58 | 7.83 | 7.14 | 6.86 | 6.87 | 6.58 | 6.27 | 5.92 | 5.35 | 7.25 |
| | (4.88) | (4.41) | (3.99) | (3.62) | (3.69) | (3.54) | (3.37) | (3.15) | (2.97) | (2.66) | (2.36) | (3.78) |

*Source: German Statistical Office: Data on subsidized childcare; Federal Office for Building and Regional Planning ("Indikatoren und Karten zur Raumentwicklung", INKAR): Indicators and Maps on the Spatial Development; Mean values and standard deviations (in parentheses), own calculations.*