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Understanding Day Care Enrolment Gaps*

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Abstract

We document gaps in day care enrolment by family background in a country with a universal day care system (Germany). Research demonstrates that children of parents with lower educational attainment and children of migrant parents may benefit the most from day care, making it important to understand why such enrolment gaps exist. We carry out complementary decomposition and quasi-experimental analyses making use of a unique data set that records both parental wishes for day care and actual usage. Our decomposition shows that (a) provision-related factors (local shortages and the level of parental fees) explain at least as much of the gaps as differences in parental wishes for day care, and that (b) far more of the gap by parental education is explained (79%) than of the gap by parental migrant status (22%). Our quasi-experimental designs confirm that reducing both parental fees and shortages significantly decreases the enrolment gap by parental education but not by parental migrant status. We discuss implications for policy.

Keywords Child care · Early education · Family background · Decomposition · Discrimination · Synthetic control

JEL Classification I24 · J13

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1 Introduction

By school starting age, children of less-educated or migrant parents are often behind their peers in measures of child development (e.g. Bradbury et al., 2015; Carneiro and Heckman, 2003). In many cases, these inequalities are already so deeply ingrained that they are difficult to address through the school system. Day care is considered an effective means of influencing child development in pre-school years, especially for children of less-educated or migrant parents. As a result, universal day care is increasingly seen as an opportunity to “level the playing field” for children of different family backgrounds (e.g. Cornelissen et al., 2018; Felfe and Lalive, 2018; Havnes and Mogstad, 2011, 2015). If enrolments gaps in day care exist, children from disadvantaged backgrounds may be less likely to reap these benefits.

As a political concept, universal day care aims to ensure that all households, regardless of their income or employment, have access to appropriate day care options. The role of parental fees, if at all in place, is to capture some of the consumer surplus to help fund the programme, but not to regulate supply and demand. As such, setting the right level of fees and meeting resultant demand for day care slots is largely the responsibility of the public sector. However, even where universal day care systems are in place, there remain enrolment gaps across many OECD countries (e.g. OECD, 2018). This paper aims to contribute to our understanding of why this is the case.

One reason that enrolment gaps may exist is if less-educated or migrant parents somehow face greater barriers to access, despite the intended universality of the system. For example, the system may be characterised by shortages of day care slots or parental contributions to day care costs, that are inhibiting for low-income families. Less-educated or migrant parents may be more affected by shortages if having fewer resources (e.g. in terms of time, money, or networks) makes it more difficult to secure a slot when these are scarce, or if discrimination is exacerbated under shortages.¹ Less-educated or migrant parents may also be less able

¹In a randomised controlled trial, Andersen and Guul (2019) show that discrimination by public school teachers is most acute when workloads are high.

to afford day care fees, even where parental contributions are income-adjusted. Finally, in the absence of any such barriers to access, enrolment gaps might exist if less-educated or migrant parents have a lower ‘wish’ for day care. In the spirit of universal day care, we define parental ‘wishes’ in this paper as a simple yes/no dichotomous measure to describe whether or not parents would want to use existing day care options if the costs of usage (in terms of parental fees and search costs) were effectively zero.² Less-educated and migrant parents may have lower wishes, as defined, if they tend to prefer informal care arrangements over day care or expect lower economic returns to educational investments in their children or to parental employment (Boneva and Rauh, 2018; Cunha et al., 2013; Elango et al., 2015).

In order to investigate the causes of day care enrolment gaps, we use a large representative survey data set of more than 62,000 children under the age of three in Germany. A unique feature of this data is that it reports parental wishes for day care irrespective of actual usage. Using this data, we document gaps in day care enrolment by parental education and parental migrant status. We carry out a decomposition analysis to explore the relative importance of differences in parental wishes and provision-related explanations for the gaps, such as local shortages—unfulfilled wishes at the county-level—and the level of fees. The decomposition is useful to highlight the key determinants of the gap, but offers only cross-sectional estimates. We therefore propose separate empirical strategies for each access barrier (shortages and fees) to provide more causal estimates of their impact. For shortages we make use of within-county changes in shortages over time that largely reflect differences in the timing of the roll-out of day care slots across Germany, using a panel fixed effects model. For parental fees, we use the synthetic control method to estimate the impact of a substantial reduction of fees due to a policy change in one German federal state.

We find enrolment gaps of 14 percentage points by parental education and 12 percentage points by parental migrant status, corresponding to gaps of around 37 percent in each case.³

²As such, we think of enrolment gaps that arise from parental fees and shortages (referred to as ‘access barriers’) as being a provision-related issue rather than one related to differences in willingness-to-pay (since this may reflect household resources). We discuss these issues in detail in the conceptual framework.

³Both family backgrounds are coded as binary indicators. We define parents as being less-educated if the

We show that the gaps in parental wishes for these family backgrounds are much smaller than the enrolment gaps. In fact, for children with a migrant family background there is hardly any gap in parental wishes at all. The decomposition reveals that access barriers (shortages and fees) explain at least as much of the enrolment gaps as differences in wishes. It also shows that the total explained share is much higher for the gap by parental education than for the gap by parental migrant status. Our quasi-experimental analysis finds that reducing day care shortages significantly decreases the enrolment gap by parental education but has no effect on the migrant-native gap. Similarly for parental fees, a large reduction in one state significantly reduced the enrolment gap by parental education but had no impact on the gap by parental migrant status.

In terms of policy implications, the results suggest that the enrolment gap by parental education may be lessened by reducing fees, through increasing availability and/or by boosting demand, e.g. through informational campaigns taking heterogeneous family backgrounds into account (see discussion in Cornelissen et al., 2018). However, the enrolment gap by parental migrant status does not seem to be affected by changes to these supply constraints. Our results imply that the gap for migrant parents reflects barriers to access that remain even when day care is available and affordable. We suggest two possibilities: (i) that migrant parents face discrimination even where the shortage of places is less acute, or (ii) that migrant parents do not find the quality of care to be adequate. The former possibility is consistent with existing evidence of stronger discrimination against migrants than against those with lower socioeconomic statuses in Germany.⁴ The latter possibility could be the case if the quality of care is lower in the areas where migrant parents typically live, if migrant parents are more greatly affected by quality issues that affect everyone, such as group size, or if migrant parents are affected by specific quality concerns, such as a lack of multilingual teachers or a consideration of different cultures. The generalisability of our findings to other

respondent has no university entry qualification and a migrant background if both parents were born abroad (see Section 3 for more details and alternative definitions).

⁴We discuss this evidence in the interpretations sections.

contexts should take into account differences in the institutional context (i.e. market vs. non-market provision) as well as the nature and extent of discrimination in that country.

This paper is closely related to the literature on the evolution and causes of educational inequalities and intergenerational educational mobility (see e.g. Björklund and Salvanes, 2011, for an overview). The existing economic literature mainly focuses on exploring socio-economic status gradients in educational attainment or achievement, with a particular focus on higher education (e.g. Boneva and Rauh, 2017; Machin and Vignoles, 2004; Hanushek et al., 2019). Such gaps are both well documented and understood in terms of their major determining factors. Conversely, while gaps in early educational settings are widely documented (e.g. Greenberg, 2011; Magnuson and Waldfogel, 2016; Stahl and Schober, 2018; Zachrisson et al., 2013), their drivers are not well understood. Most previous research on the determinants of enrolment gaps is based on either cross-country variation or time variation within a single country or region (e.g. Abrassart and Bonoli, 2015; Bainbridge et al., 2005; Van Lancker and Ghysels, 2012; Pavolini and Van Lancker, 2018; Sibley et al., 2015; Van Lancker, 2018). The results of these studies are mixed overall, but suggestive of the fact that enrolment gaps are related to the availability and affordability of day care.

Another strand of literature the paper is related to is the one on the child development effects of day care, which also serves as a motivation for this paper. A number of studies have looked at the heterogeneous child development impacts of day care attendance in Germany. Felfe and Lalive (2018), looking at a similar age group to our paper (children under three), find that children from migrant parents benefit in terms of language skills and their socio-emotional development. Children of lower educated parents also benefit in their socio-emotional development. Cornelissen et al. (2018) point out that children from disadvantaged backgrounds are less likely to attend day care and are disadvantaged in terms of school readiness, but that this disadvantage practically disappears when they attend day care for more than two years. Finally, Kuehnle and Oberfichtner (2020) look at the impact of earlier attendance and find suggestive evidence of positive effects of high-quality care for

the children of non-native or lower educated mothers (note that the two latter studies look at older age groups than our study).⁵

The paper proceeds as follows: Section 2 outlines the institutional background and introduces the conceptual model guiding our analysis. Section 3 describes the data used. Section 4 documents enrolment gaps by family background and examines the relative importance of wish-related and provision-related explanations in a decomposition analysis. Section 5 presents the impact on enrolment gaps for the provision-related factors (i) local day care shortages and (ii) day care fees using quasi-experimental designs. Section 6 interprets the results and provides policy implications. Section 7 concludes.

2 The universal day care system in Germany

2.1 Institutional background

In recent years, there has been a strong political effort to increase the provision of universal and publicly subsidised day care in Germany. Thanks in part to a legal claim for children older than three, in place since 1996, enrolment rates were consistently above 90 percent in the 2010s for this age group. For the under threes, enrolment rates were persistently low until the mid-2000s. In 2005 (*TAG*) and in 2008 (*KiföG*), two laws came into effect at the federal level, committing local governments to gradually expand day care places for children under the age of three. From August 2013 onward, every child above the age of one has a legal claim to a place in day care. The reforms led to a large increase in the enrolment rates of children aged under three. Whereas in 2006 the fraction of children under the age of three enrolled in day care was about 12 percent, the enrolment rates in 2019 were just above 34 percent. Despite this increase, there are large and persistent day care shortages; i.e. demand

⁵The link between school readiness and later achievement is well established (Duncan et al., 2007) and goes beyond the scope of this paper. See e.g Drange and Havnes (2019); Felfe et al. (2015); Gupta and Simonsen (2010); Havnes and Mogstad (2011, 2015) for international evidence on the child development effects of day care.

for day care far exceeds the number of places (Alt et al., 2019). In addition, the expansion has happened heterogeneously across states, counties and municipalities, resulting in large variation in day care shortages across regions.

The German day care system is highly decentralised with three levels of government (federal, state and municipality), youth welfare offices (which mostly cover areas identical to counties) as well as providers sharing responsibilities (Spieß, 2008). While the federal government sets out the broad framework, the responsibility for funding lies with the states and municipalities. Municipalities must also decide through forecasts how many slots need to be provided, but the provision itself is often done by non-profit providers. Non-profit providers must be licensed by the youth welfare offices as part of the local provision plan and ensure that the states' required standards for services are being met. Almost all day care places are publicly subsidised and provided by the municipalities themselves or by non-profit organisations, including churches and welfare associations. For example, in 2017 33% of day care institutions were public providers, 59.2% other non-profit organisations, and only 2.6% of institutions were private and non-charitable (Statistisches Bundesamt, 2017). On average, public subsidies cover about 70% of day care costs (Spieß, 2013), with some states covering 100% for certain age groups and households.

The remaining proportion of day care costs is partly covered by parental fees.⁶ The fees parents pay are usually income-dependent with a progressive fee structure. In some states and municipalities, it also depends on other factors, such as the number of siblings, hours of day care, and type of provision. There is no uniform rule under which the regional administrative unit determines the level of fees and/or the exemption of fees; as of 2018, only in one out of the 16 federal states (the city-state Hamburg) is this determined centrally at the state level. In four states it is decided at the level of youth offices, in three at the municipality level, in five states at the carrier level, and in three states at the municipality and carrier

⁶Parental fees are not paid to the individual day care institution. Thus, day care centres usually have no financial incentive to take in children from families with higher income. However, they get larger subsidies when they take in children with special needs who need additional support.

level (Autorengruppe Bildungsberichterstattung, 2018). Some low-income parents, welfare recipient families in particular, are exempted from paying fees. Overall, parental fees amount to about 5 to 10% of average earnings. Thus, they are lower than the OECD average and much lower than in countries with low public subsidies like the US (OECD, 2016, 2019). Importantly, fees are fixed for certain periods of time and are not determined by changes in demand or supply. However, fees vary widely across regions, income, and family structure (Schmitz et al., 2017).

Before the introduction of the legal claim to day care for all children above the age of one in August 2013, the federal law (*KiföG*) stipulated that children whose parents (or the single parent) were employed, in education, or in receipt of unemployment benefits (*Leistungen zu Eingliederung in Arbeit im Sinne des Zweiten Buches*) must be granted access to day care.⁷ Ultimately, these regulations provided preferential access to households without a stay-at-home parent. Since the prevalence of stay-at-home parents may vary by parental background, this change in law could potentially have impacted on enrolment gaps. However, we do not believe this to be a confounding relationship for our analysis.⁸ Indeed our causal estimates are robust to using just the periods before the change or just the periods after the change.⁹

Generally, families are free to decide which day care institution to choose. However, due to severe shortages, the number of applications is typically much larger than the number of available spots.¹⁰ The allocation of scarce slots is largely uncoordinated (e.g. Fugger et al., 2017) and varies by the region and type of provider. Some providers and counties have transparent selection criteria and a centralised application system, many others do not. For example, public providers sometimes prioritise children who already have or had a sibling

⁷Some states and municipalities had additional regulations. For example, they gave priority in access to single parent families or families who did not speak German at home (e.g. Spieß, 2008).

⁸Our analysis is conducted at the local level, whereas the change in law was a national policy shift. We have no reason to believe that the effects on the enrolment gaps were differential at the local level nor correlated with change in shortages.

⁹Available on request.

¹⁰Despite the legal entitlement for all children above the age of one, there are few cases of legal action. According to KiBS data, less than 1% of parents who state having demanded a slot but not receiving one, report having undertaken legal action already.

in the same facility or live close by. Day care provided by churches might in addition select families based on their religious affiliation (e.g. Herzog and Klein, 2018).

2.2 Conceptual framework

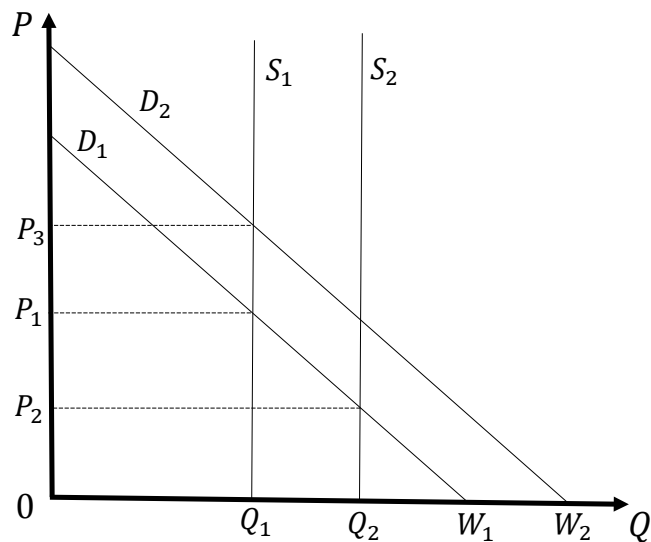
We outline a brief model to conceptualise day care take-up and provision in our institutional context. Figure 1 plots illustrative demand and supply curves for day care. The demand curve D plots the number of parents that use day care (Q) against the cost of day care (P). In line with our context, we define the cost of day care as parental fees (set by the state) plus search costs. Due to the pervasive shortages of places in our context, the cost of the search can be significant in terms of time, money and even a mental cost.¹¹ If certain types of parents are more sensitive to these costs (fees and search costs) then those parents would be concentrated closer to the bottom end of the demand curve. The existence of discrimination would enter as higher search costs for discriminated groups. The supply curve S is inelastic (a vertical line), indicating the number of slots provided by the state.

We define a concept of parental ‘wishes’ W as whether or not parents would use day care if costs were effectively zero, i.e. zero fees and just a small reasonable search cost (such as making one application). Thus, the sum of parental wishes corresponds to the x-intercept on the demand curve.¹² The concept of parental wishes is a policy-relevant measure of hypothetical demand in a truly universal system with zero parental contributions. The difference between the sum of parental ‘wishes’ and the number of available slots S gives a measure of the shortfall of places. It is this shortage that contributes to excessive search

¹¹Some parents spend months or even years searching, often unsuccessfully, for a day care spot for their child. The search often begins shortly after childbirth since centres are sometimes booked out years in advance, though they do not take applications for unborn children. Parents can also spend significant financial resources on the search. Desperate parents have been known to offer large cash rewards for a day care spot, and there is a proliferation of private organisations that offer day care search services at a cost of hundreds, or thousands of Euros. Finally, there is a mental strain of attempting what seems to some as an impossible task, while facing the real possibility of an extended and unpaid career gap after the paid leave period expires.

¹²To take into account the small reasonable search cost the y-axis can be normalised such that zero equals the cost of, say, one application. Regardless, in stylised demand models negligible search costs are commonly omitted.

Figure 1: Illustrative model of day care supply and demand in a universal day care system



Note: Figure depicts demand and supply curves for day care in a non-market system. The demand curve plots the take-up Q of day care against day care costs P which are made up of search costs (driven by availability) and parental fees (set by the state). Parental ‘wishes’ W reflect one point on the demand curve, i.e. where the price is effectively zero (a small reasonable search cost notwithstanding).

costs that comprise P .

We envisage that search costs act as the equilibrating mechanism in our non-market system. For example, if the state expands slots (S_1 to S_2) then shortages decrease, making it easier to find a slot. The result is that the search costs component of day care costs will decrease until the total cost equals P_2 and usage equals the new supply at Q_2 .¹³ This might result in a lowering of the enrolment gap if certain types of parents are distributed at the bottom of the demand curve.

In our model, shifts in fees would initially lower the cost of day care (to say P_2). But without an increase in spaces, usage cannot increase to Q_2 . Instead, parents between Q_1 and Q_2 may temporarily join the search, intensifying the competition for limited spots, which will push up search costs until point P_1 is reached again, returning to the original equilibrium.

¹³Note though, that if the fees alone are higher than P_2 then the cost will not fall below that level. The new equilibrium would then be characterised by effectively zero search costs and excess supply.

The difference from the previous equilibrium is that the overall cost of day care now has a smaller fees component and a larger search costs component. While beyond the scope of our simple model, such a change could result in a change to the enrolment gap if, for example, parents with fewer resources are comparatively more sensitive to fees than to search costs. An increase in parental preferences for day care would shift the demand curve to the right from D_1 to D_2 . This would shift parental wishes from W_1 to W_2 . Without an increase in the supply of spaces there would be an increase in shortages and search costs would become higher until the cost of day care equals P_3 . Again this could potentially impact on enrolment gaps.

In our paper, we refer to factors that impact on the costs of day care as ‘access barriers’. The implication is that enrolment gaps arising from these factors are a provision-related issue, rather than one related to parental demand, e.g. willingness-to-pay. We frame shortages and fees this way in line with the goal of universal day care, i.e. a lack of resources should not prevent any parents from having access to day care. Day care quality is also arguably an access barrier. However, it is a little less clear-cut compared with fees and shortages, since the quality level is multidimensional and potentially uncapped. Thus, we take no particular stance theoretically, assuming that quality might sometimes occur as a shift to the demand curve or sometimes as a potential cost (i.e. a lack of quality) of using day care.

3 Data

In our empirical analysis, we use a unique representative data set, the German Child Care Study (*KiBS*) of the German Youth Institute (DJI). The KiBS is an annual survey of households with children under the age of three with a specific focus on children’s care arrangements (Alt et al., 2018). The survey was first conducted in 2012 and we use information from all available waves, covering 2012 through 2016. In each wave, the KiBS surveys approximately 800 children in each of the 16 federal states in Germany. The data also include

appropriate weights for conducting national-level analyses.¹⁴ We focus on children in the under-three age group, where there is still considerable variation in day care enrolment. In total, we observe 62,437 children under the age of three, making the data set the largest available to analyse day care enrolment in Germany.

3.1 Day care wishes

A unique feature of the data is that parents report wishes for day care irrespective of actual enrolment. We assume that parents understand their reported wishes as being an indicator of whether or not they would use day care in the absence of access barriers such as fees and shortages (i.e. true universal day care). We base this assumption on the wording/structure of the survey as well as supporting empirical analysis discussed in Section A.1 of the appendix. While we assume that parents imagine an ideal situation in terms of fees and shortages when answering the wishes question, we do not assume that their wishes necessarily reflect ideal quality levels. Instead, our understanding is that some parents may consider quality issues as an access barrier (and report a wish) whereas others may consider them more of an issue of preferences (and not indicate a wish). The implication is that quality issues may be partly captured by differences in demand but may also appear in the unexplained part of the enrolment gaps.

The sum of reported parental wishes thus provides us with one point on the demand curve—the x-intercept—and is the empirical counterpart to W from our conceptual framework.¹⁵ In principle, the full schedule might be possible to trace out using methods of contingent valuation, as is typical in the environmental literature (Alberini and Kahn, 2006). In fact, the survey does report a willingness-to-pay measure, but it does so only in one wave

¹⁴The sampling design leads to smaller states being oversampled. Survey weights, calculated on the state level, account for this. A comparison of the weighted share of children under the age of three in day care with administrative statistics in Appendix Table A2 shows that they closely resemble each other. All figures and tables in this paper are based on weighted calculations using the KiBS data unless indicated otherwise.

¹⁵To account for the small reasonable search cost empirically, we create a stricter alternative measure of wishes that is equal to one only if the parent additionally reports having applied at least once for a day care slot. However, only around one in five parents that report a wish for day care have never submitted an application, indicating that the measure already captures a real wish for day care.

and only for a sample of non-users, making it unusable for analysis. Ultimately, though, we argue that the x-intercept of the demand curve as captured by parental wishes is an appropriate and policy-relevant measure in the context of universal day care.

3.2 Available slots

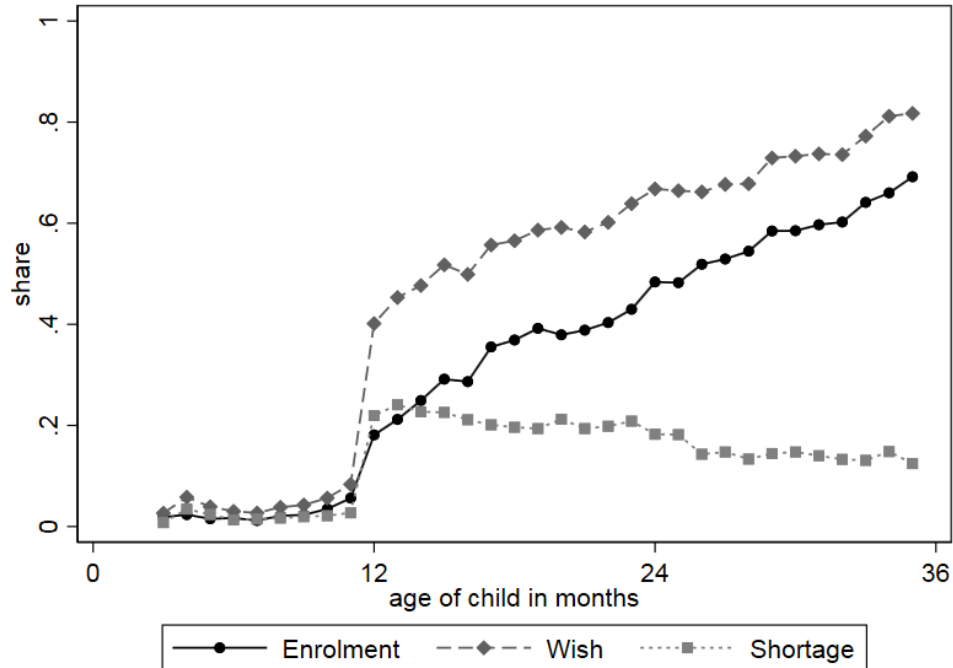
Given pervasive shortages in the German context, we use actual enrolment as a measure of available day care slots. The Federal Statistical Office takes the same approach, based on the (reasonable) assumption that the number of untaken slots is negligible. In any county, or for any child age group, we subtract the share of parents who have a slot from the share of parents who record a wish to create a measure of shortages. Figure 2 plots day care enrolment, wishes, and shortages (the difference) aggregated by the child’s age *in months*. Below the age of one, both wishes and slots are very low, but wishes jump when the child turns one.¹⁶ The number of slots exhibits a much smaller jump, which results in a substantial increase in shortages at this age. Afterwards, both the wishes and the number of slots increase continuously with a slightly steeper slope in availability. Overall, in our sample, 31% of children below three years are in day care. The fraction of parents stating a wish for day care amounts to about 44%. This implies that, on average, only 71% of wishes are fulfilled, thus describing a situation of severe day care shortages.

In our analysis, we consider county-level shortages as one main explanatory variable for the existence of enrolment gaps.¹⁷ County-specific day care shortages are defined as the fraction of parents who state that they wish for a slot in day care but whose children are

¹⁶The sudden jump in wishes between the 11th and 12th months is likely due to the end of paid parental leave (e.g. Kluge and Schmitz, 2018) and the start of the legal claim to day care (introduced in 2013).

¹⁷The publicly available data set only contains identifiers for the federal states. Through confidential on-site access we were granted access to *anonymised* county identifiers, i.e. we can distinguish between counties but not identify them unambiguously. We were also able to add some specific county-level controls in the analysis: an indicator of urban counties and indicators of the GDP tercile of counties within the federal state. As described in Section 2, many decisions regarding the provision of day care are enacted at the municipality-level, one level smaller than counties, so an analysis at that level would in principle be appealing. However, municipality identifiers are not available and due to the granularity (10,848 municipalities exist in Germany) we would also be unable to create measures of local shortages. An analysis at the relatively fine county-level is still an advancement on previous studies and, as can be seen in Figure A3, sufficient variation exists at that level.

Figure 2: Day care enrolment, wishes and shortage by age



Notes: Figure shows enrolment in day care, wishes and shortages by age of child pooled for the years 2012-2016. Enrolment means that the child is enrolled in day care, wishes indicates that the parents state that they wish for their child to be in enrolled in day care. Shortage is the difference of these measures, i.e. it denotes the share where a wish was indicated but they are not enrolled in day care. The first three months with low observations numbers are omitted. Weighted averages, source: KiBS Panel 2012-2016.

not enrolled. County shortages range from 0 to 39.2%. See Figure A3 for the distribution of county-level shortages and the deviations from state averages – the effective variation used in one of our specifications.

The data also contains information on day care fees, as reported by the parents in one of the study years (2015). As described in the institutional context, fees vary by household income and other characteristics. For those enrolled in day care, average fees are just below 240 Euros a month. Note that this number is larger than hypothetical average monthly fees if *all* children were enrolled in day care, as fees are progressive and children from lower-income households are underrepresented in day care.

We also have information on a number of other wish-related factors, including the number of applications submitted to day care institutions and hours of day care desired. Furthermore,

the respondents are asked about reasons for not enrolling in day care. They are discussed in more detail in sections 4 and 6.

3.3 Family background

The data set contains various socio-economic characteristics of the main respondent and the household. We focus on two main indicators to measure family background, which are both coded as binary variables: parental education and parental migrant status.¹⁸ The less-educated parents indicator is equal to one for children where the respondent parent has no university entrance qualification (Abitur) and zero otherwise.¹⁹ The migrant parents indicator is defined as being equal to one if both the parents (or the single parent) are born in a non-Western European and non-North American country. We make this distinction since Western European and North American countries are in many ways similar to Germany. As a result immigrants from these countries should be affected by shortages and fees similarly to Germans. Overall, 48% of children are defined as being from a less-educated household and 15% are defined as having two migrant parents.

Our selection of these indicators is based on several factors. Firstly, these are the subgroups for which enrolment gaps are often documented in research and in the public debate. Secondly, these are the subgroups most commonly found in the literature to have greater child development benefits from day care enrolment. Thirdly, these indicators are thought to be more fixed (exogenous) with respect to day care enrolment compared with alternatives such as household income or labour force participation. Fourthly, it is plausible that both of these groups face barriers to accessing public services, with each exploring a slightly different dimension. For example, the migrant group may be more exposed to discrimination, have a

¹⁸Children from migrant parents have the same right to day care as children from native parents. Different rules apply for refugee children, but very few would be in the data in the sample period.

¹⁹Educational differences by Abitur vs. no-Abitur are reflected in the financial resources of the household and tertiary education obtained, making it a variable that captures socio-economic status. Another common distinction made in the literature is whether parents have obtained tertiary education. As this information is not available in all waves, we do not use this measure in our main specification, but report results in the appendix.

smaller network of German acquaintances, be less knowledgeable of the (application) system and have lower levels of German-language skills; things that may give an edge in securing a spot in a competitive environment. In the appendix, we investigate enrolment gaps by alternative indicators: no university degree (57% of our sample), main language at home not German (16%),²⁰ welfare recipients (19%) and below-median pre-birth income (the last two measures are only available in wave 4, and waves 4 and 5, respectively).

Table 1: Summary statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|-------|----------|-----------|-----|------|
| <i>Day care enrolment, wishes and preferences</i> | | | | | |
| Day care enrolment | 62473 | .31 | .463 | 0 | 1 |
| Day care wish | 62435 | .436 | .496 | 0 | 1 |
| Day care shortage | 62435 | .125 | .331 | 0 | 1 |
| Total monthly fees (in Euros) | 6149 | 238.363 | 137.622 | 0 | 730 |
| Hours of day care wished for | 57970 | 13.499 | 18.002 | 0 | 60 |
| Number of applications | 35710 | 2.417 | 3.718 | 0 | 25 |
| Day care wish - strict measure | 35994 | .413 | .492 | 0 | 1 |
| <i>Family background</i> | | | | | |
| Less-educated (no Abitur) | 62473 | .48 | .5 | 0 | 1 |
| No university degree | 49664 | .571 | .495 | 0 | 1 |
| German not main language at home | 62287 | .162 | .369 | 0 | 1 |
| One foreign-born parent | 62473 | .028 | .164 | 0 | 1 |
| Two foreign-born parents (& non-Western) | 61338 | .151 | .358 | 0 | 1 |
| Welfare recipient | 23758 | .185 | .388 | 0 | 1 |
| Pre-birth monthly net income | 11457 | 1579.352 | 951.809 | 0 | 5000 |
| <i>Other household and child characteristics</i> | | | | | |
| Age of child (months) | 62473 | 18.294 | 9.326 | 0 | 35 |
| Female child | 62473 | .483 | .5 | 0 | 1 |
| Number of children in household | 61993 | 1.812 | .859 | 1 | 5 |
| Respondent has a partner | 62271 | .969 | .173 | 0 | 1 |
| Married | 62473 | .789 | .408 | 0 | 1 |

Notes: Summary statistics pooled over all waves. Observations are individual survey responses. The strict wish measure denotes an indicated wish for day care and further requires at least one application to have been submitted. Questions on general preferences for day care (not wish) asked in waves 1 to 4. Questions on fees are only asked in wave 4 for those enrolled. Questions on pre-birth income only in wave 4, on number of applications in waves 3 to 5, on welfare payments in wave 4 and 5. Monthly fees, number of applications, pre-birth income and number of children in household are winsorised at the 99th percentile. Weighted averages, source: KiBS Panel 2012-2016.

²⁰10% of families speak German and another language to the same degree at home, meaning that only 6% predominantly speak another language.

Table 1 presents summary statistics of our sample. Observation numbers differ between the variables, as not all questions are asked in each wave and some are conditional on day care enrolment.

4 Day care enrolment gaps and their determinants

4.1 Enrolment gaps and reasons for non-enrolment

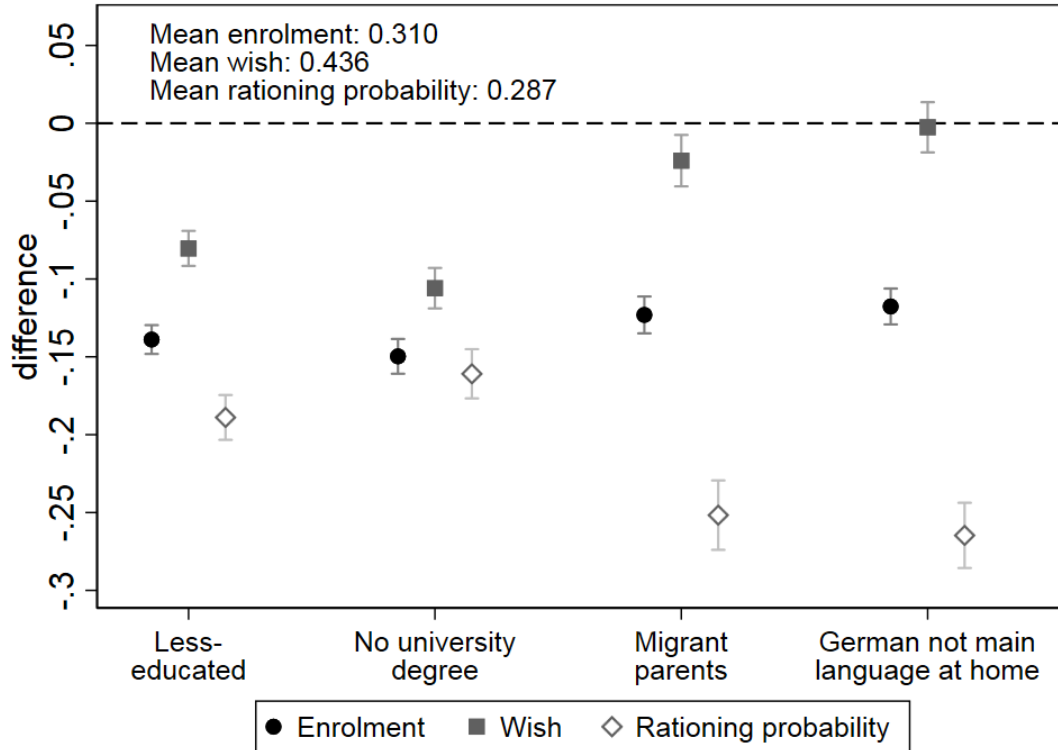
In Figure 3 we show gaps in enrolment and wishes for our two main measures of family background (less-educated and migrant parents) plus two alternative definitions (no university degree and German not main language at home). The coefficients are obtained from regressing enrolment and wishes on the binary categories of family background.²¹ We also add a measure of rationing probability, i.e. the share of day care wishes that go unfulfilled.

Children from less-educated parents have, on average, about a 14 percentage point (ppt) lower enrolment rate than children from more-educated parents (about 37% lower) but only about 8 ppt lower wishes (17% lower). Comparing the gaps in relative terms, parental wishes would not seem to be able to explain much more than one half of the gap. Children with migrant parents also have a significant enrolment gap of about 12 ppt (37% lower) but have almost no gap in wishes (2 ppt, or 5% lower). Thus, parental wishes, as defined, do not seem to be a main explanation for the migrant-native gap. Accordingly, the difference in the share of day care wishes not fulfilled (rationing probability) is large with 25% (18% by education). The gaps for our two alternative categories are quite consistent with our main categories.

To show that differences are not just driven by overlapping categories, we also produce the gaps by parental education and by parental migrant status when conditioning on (not) having a migrant background and having high-(or less-) educated parents, respectively. Results are shown in Appendix Figure A5. The overall patterns remain, especially that wishes do not

²¹Appendix Figure A4 shows these gaps specifically by parents' country of origin, Appendix Table A3 compares the distribution of birth countries in our data with official statistics and characterises the sample by country of origin.

Figure 3: Gaps in day care enrolment, wishes and rationing probability



Notes: Figure shows differences in day care enrolment and wishes by four measures of family background. Rationing probability is the the share not enrolled conditional on having a wish. For illustrative purposes we display the negative value of this in the figure. Coefficients stem from regressing the dependent variable on the indicator for family background in separate weighted regressions. Reading example; enrolment is 13.9 percentage points lower for children from less-educated parents (compared to those from high-educated parents). The mean value among all respondents is indicated in the figure. Whiskers indicate 95% confidence intervals. Source: KiBS Panel 2012-2016.

seem to be a main explanation for enrolment gaps by parental migrant status.

Table 2 provides an initial insight into potential drivers of the enrolment gaps by family background. The table gives an overview of the reasons that parents provide for not having enrolled in day care, which we categorise as being related to availability (A), fees (F), quality (Q), or parental wishes (W). The wish-related factors demonstrate the particular reasons behind differences in wish by family background, which we have shown can partly explain the enrolment gap. The relatively larger differences by education are consistent with our finding that wishes explain a larger part of that particular enrolment gap. Less-educated and migrant parents are more likely to report provision-related factors (A, F or Q) than more-educated

and native-born parents, respectively.²² On the whole, availability and quality factors appear to be important for both groups, although perhaps comparatively more important for migrant parents over less-educated parents. Fees are also important for both, although the difference in willingness-to-pay is greater by parental education than migrant status. To gain a better understanding of the underlying determinants for the enrolment gap, we next turn to an accounting exercise where we investigate to what degree differences in enrolment can be explained by a set of explanatory variables.

4.2 Decomposition analysis

As Fortin et al. (2011) point out, while decomposition exercises are helpful in identifying factors contributing to differences, the goal is mostly not to understand mechanisms or to identify causal parameters. We focus on variables thought to potentially explain day care enrolment gaps: parental wishes for day care, the local level of local shortages, the imputed level of individual fees, and a set of pre-determined household characteristics (number of children, partner, pre-birth income).²³ We are unable to include measures of day care quality due to a lack of available data at the county-level.²⁴ To avoid the complication of sequence sensitivity when covariates are subsequently added, we turn to Gelbach's (2016) conditional composition which is based on the omitted variables formula. In a first step, the base model is estimated where the dependent variable (enrolment) is regressed on a dummy and the group indicator (family background in our case). In a second step, the full model using all covariates is estimated. Taking into account both the correlation between the dependent

²²As explained in the introduction, we categorise willingness-to-pay and parental fees as provision-related factors in line with the institutional context.

²³Because fees are only available for those in day care, we use our data set to impute hypothetical fees for all children. For this, we regress observed day care fees on a number of variables that commonly determine day care fees (number of children in household, 15 household net income bins, age dummies for the children, desired hours corrected by the median gap between desired and actually used hours for those enrolled in day care, and a binary indicator for welfare recipients). Regressions are run by state and include county fixed effects to allow for regional variation in fee structure. In a second step, we predict hypothetical fees for each child based on the coefficients obtained above

²⁴We are also unable to include any of the reasons for not using day care from Table 2 since these questions are only asked conditional on not using day care.

Table 2: Reasons for not using day care

| | Observations (1) | All | Parental education | | | Both parents born abroad | | |
|---|---------------------|--------|--------------------|-------------|----------------|--------------------------|------------|----------------|
| | | (2) | High (3) | Less (4) | (4)–(3) (5) | No (6) | Yes (7) | (7)–(6) (8) |
| <i>Would use day care if ...</i> | | | | | | | | |
| if day care was for free (F) | 17496 | 0.15 | 0.12 | 0.18 | 0.05*** | 0.14 | 0.22 | 0.08*** |
| if the child had a full-day slot (A) | 17310 | 0.09 | 0.08 | 0.10 | 0.03*** | 0.08 | 0.14 | 0.06*** |
| if the child had a half-day slot (A) | 17281 | 0.15 | 0.13 | 0.17 | 0.05*** | 0.13 | 0.23 | 0.09*** |
| if opening hours were more suitable (A) | 17240 | 0.17 | 0.14 | 0.19 | 0.06*** | 0.15 | 0.25 | 0.10*** |
| if day care institution was nearby (A) | 17111 | 0.14 | 0.10 | 0.17 | 0.06*** | 0.11 | 0.26 | 0.15*** |
| if registration / application was easier (A) | 4527 | 0.18 | 0.14 | 0.22 | 0.08*** | 0.15 | 0.34 | 0.19*** |
| if staff was multilingual (Q) | 17078 | 0.07 | 0.05 | 0.09 | 0.03*** | 0.05 | 0.18 | 0.13*** |
| if groups were smaller (Q) | 17180 | 0.18 | 0.16 | 0.20 | 0.04*** | 0.17 | 0.27 | 0.10*** |
| if culture / religion was considered more (Q) | 17066 | 0.05 | 0.03 | 0.07 | 0.04*** | 0.03 | 0.13 | 0.10*** |
| <i>Reasons for not using day care</i> | | | | | | | | |
| Did not get a spot (A) | 26389 | 0.11 | 0.10 | 0.12 | 0.01** | 0.10 | 0.15 | 0.05*** |
| Insufficient opening hours (A) | 31056 | 0.07 | 0.06 | 0.08 | 0.02*** | 0.07 | 0.07 | 0.00 |
| I'm home myself (W) | 26454 | 0.61 | 0.53 | 0.68 | 0.15*** | 0.60 | 0.65 | 0.05*** |
| Want to raise child myself (W) | 31125 | 0.75 | 0.72 | 0.78 | 0.07*** | 0.75 | 0.78 | 0.03** |
| Child is too young (W) | 31375 | 0.85 | 0.86 | 0.84 | -0.02*** | 0.85 | 0.84 | -0.01 |
| Child should spent time with siblings (W) | 22242 | 0.36 | 0.31 | 0.40 | 0.10*** | 0.35 | 0.45 | 0.10*** |
| Grandparents can take care of child (W) | 23833 | 0.32 | 0.26 | 0.37 | 0.11*** | 0.33 | 0.28 | -0.04*** |
| Fear of negative influences (W) | 4614 | 0.07 | 0.05 | 0.09 | 0.04*** | 0.06 | 0.12 | 0.05** |
| Insufficient support at institution (Q) | 4606 | 0.11 | 0.11 | 0.11 | -0.00 | 0.10 | 0.13 | 0.03 |
| Insufficient consideration of culture (Q) | 4613 | 0.02 | 0.01 | 0.03 | 0.02*** | 0.01 | 0.08 | 0.07*** |
| <i>Willingness to pay</i> | | | | | | | | |
| Maximum fee for a day care spot (F) | 1479 | 172.63 | 224.01 | 141.95 | -82.06*** | 184.31 | 145.28 | -39.02*** |

Notes: *W* indicates factors related to day care wishes. We regard *Q* (quality), *F* (fees) and *A* (availability) as access barriers. Columns (2)-(4) and (6)-(7) show the share of affirmative responses for the corresponding questions. Multiple affirmative responses are possible. Columns (5) and (8) show the difference between the groups (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). All questions are only asked conditional on the child not being enrolled in day care. Weighted averages, source: KiBS Panel 2012-2016.

variable and the outcome variable as well as the correlation between the group indicator and the dependent variable, the conditional decomposition from Gelbach provides consistent estimates on the role of each covariate in moving the group indicator from the baseline to the full model.

We present the decomposition in Table 3. Column (1) shows the decomposition of the gap by education using household characteristics, wish for day care and shortages as explanatory variables for all waves. We interact local shortages with family background to allow for differential effects of shortages. Of the raw gap of 13.3 ppt, 10.1 ppt can be explained by the set of covariates. Wish for day care and shortages together account for roughly half the explained gap. Comparing shortages and its interaction shows that the enrolment gap is explained mostly by heterogeneous impacts of the access barrier rather than its distribution by family background. In column (3) we add fees and its interaction with family background as well as the pre-birth net income to proxy pre-birth labour market attachment. As fees are only available in wave 4 we show the model of column (1) restricted to the same sample in column (2) for a comparison. Fees explain about the same as shortages in the restricted model in column (3) and compared with column (2) the introduction of fees does not reduce coefficients on shortages or wishes by much but instead reduces the unexplained share. For fees, too, heterogeneous effects appear important. Differentiated by parental migrant status (columns 4-6), the covariates can overall explain a smaller share of the enrolment gap. The wish for day care, shortages, and fees all seem to be of lesser importance and the share of the gap that remains unexplained is three to four times as large as for the gap by education.

In Appendix Table A4 we show an Oaxaca-Blinder (OB) decomposition (Oaxaca, 1973; Blinder, 1973) of the enrolment gap with qualitatively similar results, specifically that the unexplained share is much larger for children with migrant parents and that shortages and fees drive the gap through heterogeneous effects.²⁵ A useful interpretation of Table A4 is

²⁵Gelbach (2016) points out that his decomposition approach nests the Oaxaca-Blinder decomposition. In fact, we get a slightly larger explained share since we add interactions of shortages and fees with family background, which capture heterogeneous effects that are part of the unexplained share in the equivalent OB decomposition. Without the interaction terms the explained shares are identical.

Table 3: Decomposition of the enrolment gap

| | by parental education | | | by parental migrant status | | |
|------------------------------------|-----------------------|----------------------|----------------------|----------------------------|---------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\hat{\delta}_{household}$ | -0.002*** (0.000) | -0.003*** (0.001) | -0.002* (0.001) | -0.002*** (0.001) | -0.002** (0.001) | -0.001 (0.001) |
| $\hat{\delta}_{wish}$ | -0.049*** (0.006) | -0.060*** (0.013) | -0.059*** (0.013) | -0.038*** (0.008) | -0.031* (0.018) | -0.030* (0.018) |
| $\hat{\delta}_{shortages}$ | -0.003*** (0.001) | -0.002** (0.001) | -0.002** (0.001) | -0.011*** (0.001) | -0.003** (0.001) | -0.004** (0.001) |
| $\hat{\delta}_{shortagesInteract}$ | -0.047*** (0.012) | -0.032 (0.025) | -0.025 (0.025) | -0.008 (0.020) | 0.027 (0.043) | 0.042 (0.043) |
| $\hat{\delta}_{fees}$ | | | -0.012*** (0.002) | | | -0.007*** (0.002) |
| $\hat{\delta}_{feesInteract}$ | | | -0.012 (0.012) | | | -0.029 (0.018) |
| Raw gap | -.133 | -.143 | -.143 | -.141 | -.131 | -.131 |
| Gap due to covariates | -.101 | -.096 | -.112 | -.059 | -.009 | -.029 |
| Share unexplained | .241 | .328 | .214 | .58 | .929 | .78 |
| Waves in sample | 1-5 | 4 | 4 | 1-5 | 4 | 4 |
| N | 43,464 | 8,399 | 8,399 | 42,678 | 8,368 | 8,368 |

Note: Table shows a conditional decomposition of the enrolment gap following Gelbach (2016). Household characteristics are number of children and a dummy for whether the respondent has a partner. In columns (3) and (6) pre-birth household net income, which is only available in wave 4 is added to household characteristics. Shortages are local shortages at the county-level. The sample is restricted to a minimum of 50 observations per county-year. Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016.

also that the *explained* part is due to differences in the distribution of variables and the *unexplained* part denotes effect heterogeneity between the groups.

The decomposition analysis shows that the heterogeneous impacts of the access barriers, shortages and fees, can explain significant proportions of the enrolment gaps (especially by parental education) beyond that which is explained by differences in parental wishes. While the decomposition is useful in identifying key drivers of the enrolment gap, the analysis is entirely cross-sectional and could be biased by the omission of unobservables. On the provision side, these could be things such as opening hours, proximity to centres, and day care quality. On the usage side, the enrolment gaps may also depend on unobserved family

characteristics such as norms towards maternal labour market attachment. Most of these provision and demand-related factors will vary at the county level as a result of institutional, cultural, and economic differences. In the next section, we address issues of identification more carefully and outline individual approaches to estimate heterogeneous effects of each access barrier, availability and fees, on enrolment.

5 The impacts of access barriers on enrolment gaps

5.1 Local day care shortages

To estimate the impact of local shortages on the enrolment gap we estimate the following empirical model:

$$Y_{icst} = \beta_0 + \beta_1 L_i + \beta_2 S_{ct} + \beta_3 (L_i * S_{ct}) + X'_{ict} \beta_4 + \mu_c + \lambda_{st} + \varepsilon_{icst} \quad (1)$$

where Y_{icst} is day care enrolment of child i from county c in state s in year t , L_i is an indicator of either less-educated or migrant parents, S_{ct} are county-level shortages, X'_{ict} is a vector of exogenous household controls (the age of the child in three categories and its gender as well as the marital status of the respondent) and county-level controls (explained below), λ_{st} are state-year effects, and μ_c are county fixed effects. The coefficient of interest, β_3 , indicates whether the enrolment gap depends on the county-level shortages.

The state-year effects will account for several sources of unobservable differences, such as institutional changes, which occur almost entirely at the state level, and longstanding cultural differences such as those between East and West Germany. To account for some remaining potentially confounding relationships we additionally include county-level controls in X_{ict} : an urban-rural indicator, and indicators of the GDP tercile of counties within the state, plus interactions between the two county controls with the family background to account for differential effects. To deal with unobservable covariates that could vary within state-year

cells, such as local norms or day care quality, we additionally include county fixed-effects.

The identifying assumption is that time-variation in shortages within a county is uncorrelated with unobservables that impact day care enrolment differently by family background. We argue that this is plausible since time-variation in shortages within counties should largely reflect differences in the timing of the roll-out of day care spots in response to the federal level introduction of a legal entitlement to day care. Unobserved wish-related and provision-related factors that affect the enrolment gaps, such as local norms and day care quality are likely to be relatively fixed over a short period. Differences in speed or the timing of the roll-out are used in several previous studies as a source of variation in day care slots that is exogenous to day care quality or other factors that impact on child development (e.g. Cornelissen et al., 2018; Felfe and Lalive, 2018).

Table 4 presents results from the estimation of equation (1) with and without the county fixed effects. Column (2) reports a negative and highly significant relationship between regional day care shortages and the enrolment gap for children from less-educated parents using the pooled OLS model. Specifically, an increase in shortages by 10 ppt is associated with an increase in the day care enrolment gap by parental education of about 5 ppt (in all tables we multiply the shortage measure by 100).²⁶ Column (4) reports the results with county fixed effects where the identifying variation comes from changes in shortages within counties over time. The results are very similar to the pooled OLS estimates and indicate that regional day care shortages have a significant impact on the enrolment gap by parental education. As shown in the appendix Table A5, very similar patterns emerge when differentiating by whether the respondent parent has a university degree.²⁷ Further,

²⁶The relationship between shortages and enrolment is not one-for-one as we do not condition the sample on individuals who have stated a wish for day care. The reason is that this already differs by family background and would thus change the composition of our sample. We also believe that without conditioning we identify more policy-relevant parameters. However, results when this condition is imposed (available on request) are qualitatively similar.

²⁷As a robustness check, appendix Table A6 also shows coefficients when shortages are calculated leaving individual i out of the calculation, i.e. $S_{-ict} = \frac{1}{N-1} \sum_{n \neq i}^N Shortage_{nct}$. We prefer to use unadjusted shortages as the main specification since the leave-one-out version introduces an unintended source of variation in our fixed-effects estimation. Specifically, individuals that are enrolled will mechanically have a higher shortage

results are also robust to using the stricter wish measure, see Section 3, to calculate shortages despite much lower observation numbers (results are available upon request).

Table 4: Day care enrolment, family background and regional shortages

| | Day care enrolment | | | | | | | |
|---------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Mean of dep. var | 0.375 | 0.375 | 0.375 | 0.375 | 0.376 | 0.376 | 0.376 | 0.376 |
| Less educated | -0.105*** (0.021) | -0.035 (0.025) | -0.097*** (0.021) | -0.038 (0.025) | | | | |
| Less educated \times shortage | | -0.005*** (0.001) | | -0.004*** (0.001) | | | | |
| Migrant parents | | | | | -0.093** (0.043) | -0.090* (0.049) | -0.086* (0.045) | -0.086* (0.052) |
| Migrant \times shortage | | | | | | -0.000 (0.001) | | 0.000 (0.001) |
| Shortage | -0.005*** (0.001) | -0.002*** (0.001) | -0.005*** (0.001) | -0.003*** (0.001) | -0.005*** (0.001) | -0.005*** (0.001) | -0.004*** (0.001) | -0.004*** (0.001) |
| State \times wave FEs | Y | Y | Y | Y | Y | Y | Y | Y |
| County FEs | | | Y | Y | | | Y | Y |
| Observations | 43,668 | 43,668 | 43,668 | 43,668 | 42,845 | 42,845 | 42,845 | 42,845 |

Note: Weighted regressions of equation (1) with and without county fixed effects. Migrant parents indicates that both parents are born abroad in a non-Western country. Shortages are local shortages at the county level. The sample is restricted to a minimum of 50 observations per county (Appendix Figure A6 shows robustness to different cut-offs). All estimates control for the sex and age of the child, marital status of the respondent and county-level controls (urban indicator and GDP tercile within the state) interacted with the family background. Standard errors, clustered at the individual-level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: KiBS Panel 2012-2016.

Columns (5)-(8) of Table 4 examine the role of regional shortages for enrolment gaps by parental migrant status. In contrast to the estimates by educational background, the results suggest that regional shortages play a minor role in explaining the migrant parents enrolment gap. The migrant interaction with regional shortages is not significant and is very close to zero in both empirical specifications (using state by wave or county and wave fixed effects). Table A5 in the appendix shows estimates based on the indicator “German not main language at home.” Again, results are robust to using this alternative measure of migrant family background.²⁸

than individuals who are not enrolled in the same county. Nevertheless, the coefficients of interest (interaction of the family background with shortages) remain virtually unchanged.

²⁸Additionally, results are also robust to imposing the restriction that both parents have to be non-European (in contrast to the current definition of parents being non-Western European and non-North American). These results are available upon request.

In Section A.3 in the appendix we estimate alternative specifications to investigate potential non-linear effects. The results are broadly consistent with those reported in Table 4 although there is a sharper marginal increase in the enrolment gap at lower levels of shortages compared with at higher levels of shortages.

Overall, the findings suggest that reducing regional day care shortages substantially lowers the enrolment gap for children of less-educated parents, but it does not help to reduce the migrant-native enrolment gap. We discuss interpretations of these results in Section 6.

5.2 Day care fees

Next, we focus on the role of day care fees as a determinant of the enrolment gap. Due to the lack of time variation in the fee data, and because hypothetical fees for those not enrolled are unavailable, we analyse the effect of a substantial reduction in fees using the synthetic control method. Specifically, we examine the case of the federal state of Hamburg, where in August 2014 fees were abolished for the first five hours of care per day.²⁹ Hamburg was the only state to change its fees regulation during our sample window of 2012–2016.³⁰ For those enrolled in half-day care, fees were eliminated completely, and for those enrolled in more than half-day care, fees were reduced by an amount equal to the half-day fee they would have previously paid (depending on the household income and number of persons in the household). Thus, all parents of children aged 0–2 had a significant fee reduction.

Since Hamburg has a fixed fee regulation, only dependent on net household income and household size (which we have in our data), we are able to compute the theoretical reduction in fees for all Hamburg children in our sample (including those not in day care). Monthly

²⁹Each German federal state independently sets broad regulations for day care fees, e.g. which types of households are exempted from fees. The detailed fee structure itself is set at a more regional level. Typically, fees vary by hours of day care enrolment, household income and other household characteristics (see Section 2 for more details). Beginning in 2005, some states started abolishing day care fees, initially for older children, subsequently for younger children.

³⁰Before 2012, three states had abolished fees for the last day care year (6 years old), two states (Berlin and Hamburg) had abolished fees for the last three years (3–6 years old), and Rhineland-Palatinate had abolished fees for the last five years (1–6 years old). For Hamburg, fees were abolished for the first five hours of daily care only, while the other states abolished fees for all-day care.

fees for the average household were reduced by a total of 178 Euros (63% of the pre-reform fees). For the children of less-educated parents in our sample, fees were reduced by 162 Euros and for the children of better-educated parents, the reduction amounts to 184 Euros. When expressed as a percentage of net income, fees were reduced by 4.4% overall, 4.3% for children of less-educated parents and 4.7% for children of better-educated parents. Thus, the relative magnitude of the reduction was roughly comparable for both groups.

The large reduction of fees in Hamburg provides a quasi-random treatment that we use to estimate the impact of fees on the enrolment gap using the synthetic control method of Abadie et al. (2010). Specifically, we examine the evolution of the enrolment gap for Hamburg ($N = 3,724$ for Hamburg) before and after the reduction of fees, comparing it to the evolution for a *synthetic Hamburg* constructed as a weighted average of the remaining federal states, none of which changed their fundamental fee structure in the sample window. The weights for creating synthetic Hamburg are chosen so as to best approximate the real Hamburg based on pre-treatment values of the outcome variable and covariates.³¹ Following Kaul et al. (2015), we choose two of the three available pre-treatment outcomes (2012 and 2014) and four covariates (unemployment, population density, GDP per capita, and migration share) to be used in selecting the weights matrix. The resultant weights are reported in Table 5.

Figure 4 shows the results by parental education. Panels (a), (b) and (c) plot the evolution of enrolment from less-educated parents, enrolment from better-educated parents, and the enrolment gap, respectively, over time for Hamburg and synthetic Hamburg. Each light grey line plots the estimated effect when carrying out the synthetic control method using one of the 15 non-treated control federal states as a placebo treatment, following Abadie et al. (2010).³² These placebo treatment effects are used for statistical inference (also as Abadie et al., 2010), and the significance of post-intervention outcomes is marked on the plots.

³¹Weights are chosen to minimise the mean squared prediction error (MSPE) for the outcomes variable over the pre-treatment period. For more detail on the process, see Abadie et al. (2010).

³²Rather than plotting the placebo treatment effects on a separate chart with a baseline of zero, we plot them on the same chart using synthetic Hamburg as the baseline. Effectively, we normalise the placebo controls to synthetic Hamburg to visualise statistical inference on the same chart as the pre-trends.

The figures show that the enrolment of children from less-educated parents increases, while it holds constant for those from more-educated parents, and the enrolment gap decreases relative to the synthetic control. These differences emerge in the first post-intervention period and become statistically significant by the second post-intervention period.³³ Overall, the average of both post-intervention periods suggests a decrease in the enrolment gap by 7.3 ppt. This is an economically significant effect size since it approximately halves the enrolment gap.

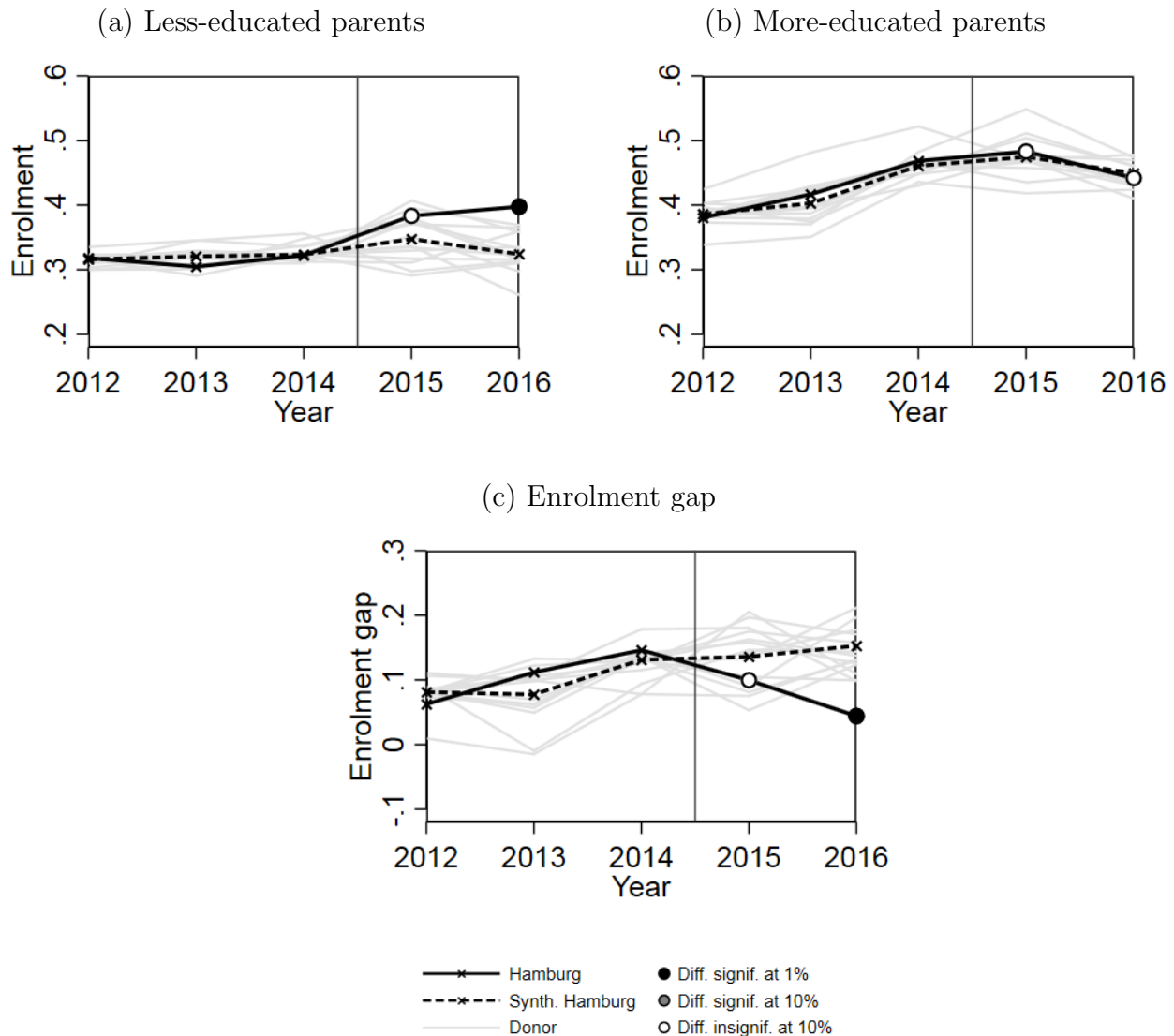
Between 2014 and 2016 the total number of slots held roughly steady in both Hamburg and the synthetic control states as shown by the enrolment figures in Table A2. Thus, the reduction of fees did not appear to coincide with an increase in slots. This fact may seem inconsistent with the increase in enrolment by less-educated parents in Hamburg relative to the control seen in Figure 4. However, this apparent difference is explained by the fact that there is also a slight decrease in enrolment by children from more-educated parents in Hamburg compared to the control group over the period (of around 1.5 ppt). Since the more-educated group represents the majority in Hamburg (a share of 0.72 compared with around 0.55 in the control states), the small decrease in attendance offsets the larger increase by the less-educated group. Thus, we can be fairly sure that the drop in the enrolment gap is a fees effect since there are no correlated changes in supply.

To help provide a sense-check for the size of the estimate, we also carry out a regression of equation (1) without county fixed effects using the information on fees reported for one wave in place of the shortages variable. We report the results in Table A8 in the appendix. Taking the estimate on the interaction between fees and less-educated parents from column (2) and multiplying it with the average fee reduction in Hamburg provides an expected reduction in the enrolment gap of $0.057 \times 1.78 = 10.1$, which is comparable to our synthetic control estimate.

We also carry out the synthetic control analysis for the enrolment gap by parental mi-

³³In the synthetic control method, significance levels are based on comparing the deviation between the treated unit and the synthetic control to the typical deviation between the donors and the synthetic control.

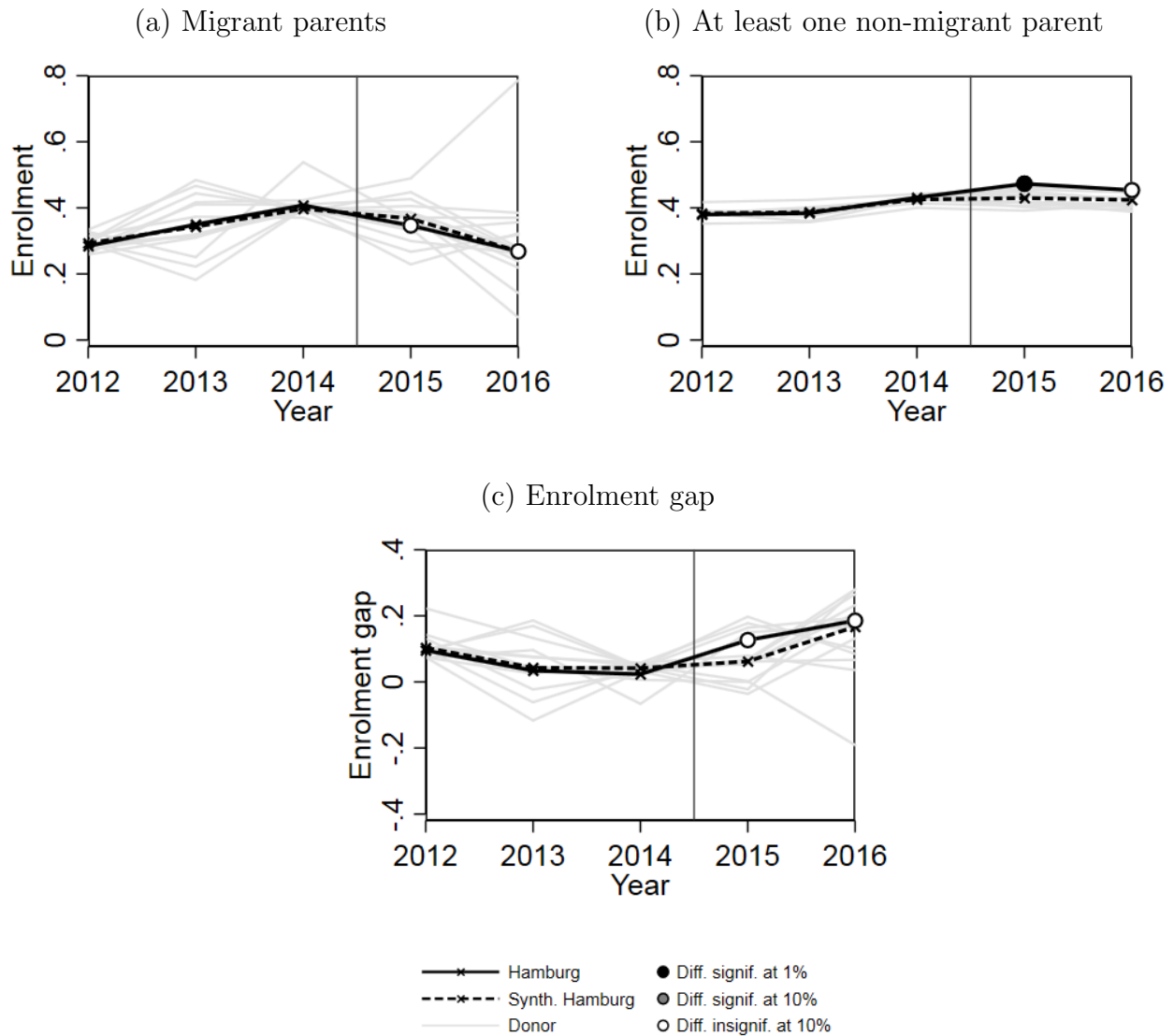
Figure 4: The effect of fee elimination in Hamburg on the enrolment gap (by parental education)



Notes: Figures show the evolution in Hamburg vs. synthetic Hamburg of (panel a) the enrolment rate of children from less-educated parents; (panel b) the enrolment rate of children from better-educated parents; and (panel c) the enrolment gap. All interviews for the 2014 wave occurred before fees were eliminated, making this the last wave with fees—as indicated by the vertical line. Weights for the synthetic Hamburg are reported in Table 5. Each light grey line plots the estimated effect (relative to synthetic Hamburg) when carrying out the synthetic control method using one of the 15 non-treated control federal states as a placebo treatment, following Abadie et al. (2010). Values by state based on weighted averages. Source: KiBS Panel 2012-2016.

grant status and present the results in Figure 5. The enrolment of children with a migrant family background is unaffected by the change in fees. The native group sees an increase in enrolment; however, the effect is small and does not seem to persist, nor is there a significant

Figure 5: The effect of fee elimination in Hamburg on the enrolment gap (by parental migrant status)



Notes: Figures show the evolution in Hamburg vs. synthetic Hamburg of (panel a) the enrolment rate of children with migrant parents; (panel b) the enrolment rate of children with at least one non-migrant parent; and (panel c) the enrolment gap. All interviews for the 2014 wave occurred before fees were eliminated, making it the last wave with fees—as indicated by the vertical line. Weights for the synthetic Hamburg are reported in Table 5. Each light grey line plots the estimated effect (relative to synthetic Hamburg) when carrying out the synthetic control method using one of the 15 non-treated control federal states as a placebo treatment, following Abadie et al. (2010). Values by state based on weighted averages. Source: KiBS Panel 2012-2016.

increase in the enrolment gap in any post-intervention period.

Overall, we conclude that reducing fees appears to have large effects on the enrolment gap by parental education, even when fees are income-dependent, but does not impact the

Table 5: Synthetic Hamburg weights

| State | by parental education | | | by parental migrant status | | |
|------------------------|-----------------------|-------|-------|----------------------------|--------|-------|
| | Low | High | Gap | Foreign | Native | Gap |
| Schleswig-Holstein | 0 | 0 | 0 | 0 | 0 | 0 |
| Lower Saxony | 0 | 0 | 0 | 0 | 0.389 | 0 |
| Bremen | 0.239 | 0 | 0.393 | 0 | 0 | 0 |
| North Rhine-Westphalia | 0 | 0 | 0 | 0 | 0 | 0 |
| Hesse | 0 | 0 | 0 | 0 | 0 | 0 |
| Rhineland-Palatinate | 0 | 0 | 0 | 0 | 0 | 0 |
| Baden-Württemberg | 0 | 0 | 0.334 | 0.288 | 0 | 0.313 |
| Bavaria | 0.363 | 0 | 0 | 0 | 0 | 0.142 |
| Saarland | 0 | 0.636 | 0 | 0 | 0 | 0 |
| Berlin | 0 | 0 | 0 | 0.510 | 0.439 | 0.392 |
| Brandenburg | 0.0580 | 0.364 | 0.273 | 0.202 | 0.171 | 0.153 |
| Mecklenburg-Vorpommern | 0 | 0 | 0 | 0 | 0 | 0 |
| Saxony | 0 | 0 | 0 | 0 | 0 | 0 |
| Saxony-Anhalt | 0.340 | 0 | 0 | 0 | 0 | 0 |
| Thuringia | 0 | 0 | 0 | 0 | 0 | 0 |

Notes: Table shows the weight that each federal state received in figure 4 and 5. The states with positive weights create a “synthetic Hamburg”. See text for how weights were determined.

enrolment gap by parental migrant status. Thus, these results mirror those for the impacts of day care shortages in the previous section.

6 Interpretation of the results and policy suggestions

The results for the enrolment gap by parental education are fairly straightforward to interpret. Part of the gap is explained by preferences, as reflected in the wish gap for this type of family background. Some of the gap seems to be explained by financial resources since the gap responds to fees. Finally, the gap gets smaller when places are scarce which is consistent with discrimination and/or differences in search effectiveness/intensity (although it is not possible to distinguish between these).

The results from the enrolment gap by parental migrant status are somewhat less straightforward to interpret. The enrolment gap by migrant status is (a) not reflected in a significant gap in wishes, (b) still there at low levels of shortages, (c) not bigger or smaller at higher lev-

els of shortages, and (d) not bigger or smaller after a big reduction in fees. Any explanation for the enrolment gap for migrant parents needs to be able to fit these four facts.

Firstly, the lack of a significant gap in wishes allows us to rule out that the enrolment gap is because migrant parents do not want a place due to different preferences. There may be concern that stated preferences reflect parental aspirations and not actual willingness to enrol. However, this does not seem consistent with the fact that 81% of rationed parents also report having made applications to day care centres.³⁴

Secondly, enrolment is not well explained by differences in search effectiveness, since the enrolment gap is unaffected by the level of shortages. Factors such as being well-networked and knowing to apply extremely early are likely to give applications from native-born parents an ‘edge’ when shortages are high. Thus, if the enrolment gap was due to these factors one would expect it to decrease as shortages lessen—but it does not. Other possible factors, such as a complete lack of understanding of the application process or a complete lack of German language, may continue to be important even with low shortages if they prevent foreign parents from applying at all. However, this is not consistent with the fact that most parents that wish for a spot have also managed to submit at least one application.

Thirdly, we cannot rule out discrimination as an explanation for the enrolment gap. If discrimination against migrant parents is strong enough then it would result in an enrolment gap that does not necessarily get smaller with marginal increases in the availability of places. Migrant parents will struggle to find a place even at relatively low level of shortages if they are at the ‘back of the queue’ for any spot as a result of discrimination.³⁵ To explore the plausibility of this explanation we looked to the literature on discrimination in Germany. We found the evidence to be highly supportive of discrimination against migrants as a potential explanation for the day care enrolment gap. While we did not find any German evidence from

³⁴This figure is actually a little lower for migrant parents (76%), but still reflects the vast majority. The difference could already reflect a hesitancy to apply due to a lower success rate.

³⁵We are not able to distinguish between different reasons for discrimination e.g. if centres make assumptions about workload based on parent characteristics (statistical discrimination), or if they hold implicit or explicit racial bias (taste-based discrimination).

the day care context, specifically, we found many studies showing discrimination in other market and non-market areas such as schooling (Lüdemann and Schwerdt, 2013; Bonefeld and Dickhäuser, 2018), employment (Kaas and Manger, 2012; Weichselbaumer, 2019; Koopmans et al., 2019) and housing (Auspurg et al., 2017).³⁶ We discuss these studies in detail in the appendix section A.4. In short, empirical analyses of data on real individuals as well as several audit studies find discrimination against people perceived to be migrants, in particular when there is a perceived difference in cultural values (e.g. women wearing headscarves) in Germany. Studies that examine discrimination against both migrants and people from lower socioeconomic backgrounds found discrimination targeted the former exclusively, which is consistent with our pattern of results.

Fourthly, it appears that financial concerns are no more or less important for foreign parents than for other parents, based on the result that eliminating fees does not lower the gap in enrolment. This is somewhat consistent with the fact that the difference in the maximum willingness-to-pay for a day care spot between migrant parents and other parents is smaller than the same difference by education (Table 2).

Fifthly, there may be further barriers to access that exist even in areas of low shortages. One possibility is day care quality. Even if parents report wanting a day care spot, and spots are available and affordable, they will not enrol their children if they find the quality to be too low. In fact, Table 2 shows that migrant parents are more likely than other parents to report any of the quality indicators (Q) such as group size, opening hours, and proximity of care, as reasons for not enrolling their children in day care. Gaps by parental education also exist, but they are always smaller. One potential explanation for these differences is that migrant parents place a greater emphasis on quality compared with other parents. However, it could also be that migrant parents live in areas with lower day care quality, making these concerns more prevalent. Migrant parents may also have specific quality concerns. Indeed, foreign parents are three to four times more likely than other parents to cite “if staff were

³⁶We looked at one Danish study of the day care context that found parents are less likely to want to apply to a day care centre if there is a high share of migrant children there (Batsaikhan et al., 2019).

multilingual” and “if culture/religion were considered more” as factors that would lead them to enrol. Notably, citing these quality factors does not seem to be related to lower parental wishes for day care, suggesting parents see these as provision-related issues.

Policy recommendations. In the context of child development effects found in the literature, closing enrolment gaps could have both efficiency and equality improvement at the societal level. If policymakers wish to close the gap by parental education, our results indicate that expanding availability and reducing shortages may be effective measures to achieve this. In the appendix, Section A.5, we carry out a brief cost-effectiveness calculation making use of our effect sizes and external cost estimates. Our estimates indicate that closing the gap by 1 ppt would cost 200m Euros when addressed through shortages but only 5m Euros when addressed through fee reductions. Nevertheless, this narrow cost effectiveness measure ignores the wider benefits of adding extra day care spots. (A full cost-benefit analysis is beyond the scope of this study.) In addition to improving provision factors, carefully-designed informational campaigns considering different family backgrounds and their specific reservations about day care could also be effective in increasing the parental day care wishes (Cornelissen et al., 2018). A caveat is that increasing demand without increasing slots may intensify competition, resulting in higher search costs for all parents.

The policy recommendations for the enrolment gap by parental migrant status, however, are a little more tentative. Our results imply that ensuring adequate availability and affordability of care is unlikely to be enough to close this gap. As suggested, quality concerns as well as the existence of discrimination are potential explanations for our findings.³⁷ Policymakers wanting to close this gap may therefore find it effective to ensure that day care centres deliver adequate high-quality care for all children respective of diverse cultures. Furthermore, certain measure to tackle discrimination may also be helpful. One could envisage training staff in issues related to diversity, as well as implementing an impartial application

³⁷We also raised the issue of language difficulties, although for reasons given we do not expect this to be a major explanation for our results. Nevertheless, in some cases it might be effective to provide assistance with the application process, available in multiple languages.

and decision system with transparent selection criteria. Such measures could result in a composition of children that are more representative of the applications received or indeed of the local population composition.

7 Conclusion

Despite expansions in day care provision for the under-three age group in Germany, there are substantial gaps in day care enrolment by family background. We show that wishes for day care cannot fully account for enrolment gaps. Our results suggest that day care fees and local day care shortages play a significant role in explaining gaps by parental education. Reducing day care fees (or a more progressive fee structure) and reducing regional day care shortages can lower enrolment gaps by parental education substantially. However, enrolment gaps by parental migrant status are less affected by changes in local barriers to access. We interpret our results and discuss policy measures for addressing enrolment gaps in each case.

While our results are specific to the German context, there may be some generalisability to the findings. When considering our findings one should take into account differences in the societal and institutional context. Our findings on shortages are likely to generalise only to other non-market contexts, since market delivery of day care is unlikely to be characterised by high search costs characterised by an undersupply of slots. Our findings on fees, on the other hand may be relevant to market contexts where fees make up an even larger part of the costs of day care. Finally, it is worth considering the extent of discrimination in different countries and the extent to which discrimination might differ between market and non-market systems.³⁸

Given the great potential of high-quality day care to reduce inequalities in later life outcomes by family background, it is important to have a thorough understanding of why enrolment gaps in day care exist and how to reduce them. Our study provides a first

³⁸While economic theory suggests discrimination may be driven out by competition there is plenty of evidence across international contexts that discrimination continues in market systems. Thus, it is important to consider the role of discrimination on a case-by-case basis.

comprehensive analysis based on large sample data. We capture important provision-related factors: the availability of day care slots and parental fees. One factor that we do not observe is the quality of the day care centres. Furthermore, we know little about the magnitude and type of discrimination facing less-educated or migrant parents. Our results suggest that these factors may be important, particularly for the enrolment of children of migrant parents. Field experiments could contribute to filling this gap and help to better understand the nature of enrolment gaps in day care, while also proposing solutions to reduce them. We leave this for future research.

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Appendix (for online publication)

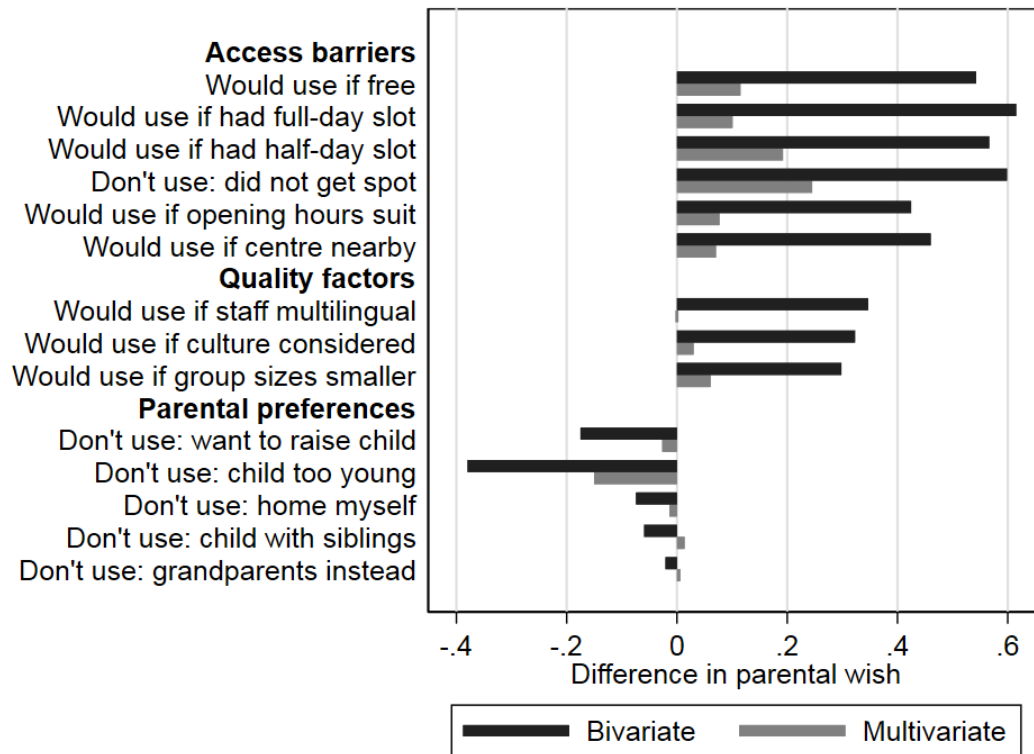
A.1 Interpretation of the parental wishes variable

Based on the wording/structure of the survey, we assume that parental wishes reflect whether or not they would use day care if fees (set by the state) and search costs (due to shortages) were zero. Specifically, the survey is structured such that parents are first asked for their reasons for not using day care (or factors that would lead them to use day care) from lists of options that include access barriers (e.g. “did not get a slot”), quality factors (e.g. “would use if group sizes were smaller”) and parental preferences (“child too young”) before they are asked whether they have a ‘wish’ for day care. Essentially, parents are conditioned beforehand to think of access barriers as a wedge between their ideal wishes and their actual usage. Due to this wording/structure we think that parents who do not use day care due to an access barrier, e.g. because they could not get a slot, would not go on to indicate having no wish for day care.

We investigate this interpretation using regressions of parental wishes on their reported factors/reasons for non-usage. We present the estimated coefficients in Figure A1. The bivariate coefficients suggest—as expected—that parents indicating access barriers (fees or shortages) as reasons for non-usage are highly likely to also report having a wish for day care. Further, if they report a preferences reason then they are less likely to have a wish for day care. Since parents are allowed to report multiple reasons, we also present multivariate coefficients that take into account correlations between the reasons. The differences mostly remain, confirming the idea that reported parental wishes reflect their preferences for day care ignoring existing access barriers. Quality factors on the other hand appear to have a weaker positive relationship with reporting a wish for day care in the multivariate analysis. The implication is probably that quality concerns are considered an access-barrier by some parents but not by others.³⁹

³⁹There are some slight deviations from this categorisation. For example, group size is a quality factor that has a small but positive coefficient, indicating that parents consider large group sizes to be perhaps

Figure A1: Parental wishes regressed on factors/reasons for not using day care



Note: Figure depicts coefficients of factors/reasons in weighted regression with parental wishes as the outcome variable. The multivariate regression includes all 14 factors/reasons that appear in at least three survey waves and has a sample size of 10,309 observations. For consistency the bivariate regressions make use of the sample, despite some of them appearing in further waves. Source: KiBS Panel 2012-2016.

something of an access barrier. Furthermore, some of the preferences factors have zero or even slightly positive coefficients in the multivariate analysis that suggest they are similar to quality factors.

A.2 Comparison of analysis sample with dropped observations

Appendix Table A1 compares the analysis sample with the dropped observations. The sampling design favours observations coming from counties with a *larger* population (especially urban counties) and those from federal states with a *smaller* population as these have fewer counties and every state has roughly the same number of unweighted observations per year. The analysis sample is positively selected; day care enrolment, income, and employment rates are higher, the share with migrant parents and less-educated parents levels is smaller (all differences are significant at the 1% level). Although the sample restriction means that our sample is not fully representative of Germany, the data used still covers a large fraction of the German population and advances on previous studies looking at specific groups or smaller regions.

Table A1: Comparison of analysis sample with dropped observations

| | Analysis sample (1) | Dropped observations (2) | Difference (3) |
|--|------------------------|-----------------------------|----------------------|
| <i>Panel A: individual characteristics</i> | | | |
| Day care enrolment | 0.374 (0.003) | 0.243 (0.003) | 0.131*** (0.005) |
| Day care wish | 0.490 (0.004) | 0.380 (0.004) | 0.110*** (0.006) |
| Day care shortage | 0.115 (0.002) | 0.136 (0.003) | -0.021*** (0.004) |
| Lower education (no Abitur) | 0.403 (0.004) | 0.560 (0.005) | -0.157*** (0.006) |
| No university degree | 0.493 (0.004) | 0.660 (0.006) | -0.167*** (0.007) |
| German not main language at home | 0.169 (0.003) | 0.155 (0.004) | 0.014*** (0.005) |
| Both parents born abroad (& non-Western) | 0.144 (0.003) | 0.158 (0.004) | -0.014*** (0.005) |
| Employed | 0.451 (0.004) | 0.415 (0.006) | 0.036*** (0.007) |
| Necessity weighted net equivalent income | 1984.15 (38.715) | 1729.88 (26.626) | 254.28* (46.987) |
| <i>Panel B: county characteristics</i> | | | |
| Urban county | 0.671 (0.003) | 0.216 (0.004) | 0.455*** (0.006) |
| 1st GDP tercile | 0.042 (0.001) | 0.276 (0.004) | -0.234*** (0.004) |
| 2nd GDP tercile | 0.273 (0.003) | 0.374 (0.005) | -0.101*** (0.006) |
| 3rd GDP tercile | 0.685 (0.003) | 0.350 (0.005) | 0.335*** (0.006) |
| <i>Panel C: share of federal states</i> | | | |
| Schleswig-Holstein | 0.046 (0.001) | 0.019 (0.001) | 0.027*** (0.001) |
| Hamburg | 0.049 (0.001) | - | - |
| Lower Saxony | 0.083 (0.002) | 0.103 (0.002) | -0.019*** (0.003) |
| Bremen | 0.016 (0.000) | - | - |
| North Rhein-Westphalia | 0.051 (0.003) | 0.389 (0.005) | -0.338*** (0.006) |
| Hesse | 0.078 (0.002) | 0.076 (0.002) | 0.002 (0.003) |
| Rhineland-Palatinate | 0.063 (0.001) | 0.031 (0.001) | 0.033*** (0.002) |
| Baden-Württemberg | 0.104 (0.003) | 0.166 (0.004) | -0.062*** (0.004) |
| Bavaria | 0.177 (0.003) | 0.140 (0.003) | 0.037*** (0.005) |
| Saarland | 0.020 (0.000) | 0.001 (0.000) | 0.019*** (0.000) |
| Berlin | 0.097 (0.002) | - | - |
| Brandenburg | 0.037 (0.001) | 0.019 (0.001) | 0.019*** (0.001) |
| Mecklenburg-Vorpommern | 0.033 (0.001) | 0.004 (0.000) | 0.029*** (0.001) |
| Saxony | 0.077 (0.001) | 0.024 (0.001) | 0.053*** (0.002) |
| Saxony-Anhalt | 0.033 (0.001) | 0.017 (0.001) | 0.016*** (0.001) |
| Thuringia | 0.036 (0.001) | 0.014 (0.000) | 0.022*** (0.001) |
| Observations | 43,691 | 18,782 | 62,473 |

Notes: Comparing characteristics of observations used in the analysis sample and observations dropped due to the sample restriction of having at least 50 observations per county and year. Panel A shows individual characteristics, Panel B displays the share of observations coming from each federal state. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted averages, source: KiBS panel 2012-2016.

A.3 Non-linear estimation

We further examine alternative specifications to investigate the potential non-linear effects of shortages and fees estimating a model with shortages as a binomial:

$$Y_{icst} = \gamma_0 + \gamma_1 L_i + \gamma_2 S_{ct} + \gamma_3 S_{ct}^2 + \gamma_4 (L_i * S_{ct}) + \gamma_5 (L_i * S_{ct}^2) + X'_{ict} \gamma_6 + \mu_c + \lambda_{st} + u_{icst} \quad (2)$$

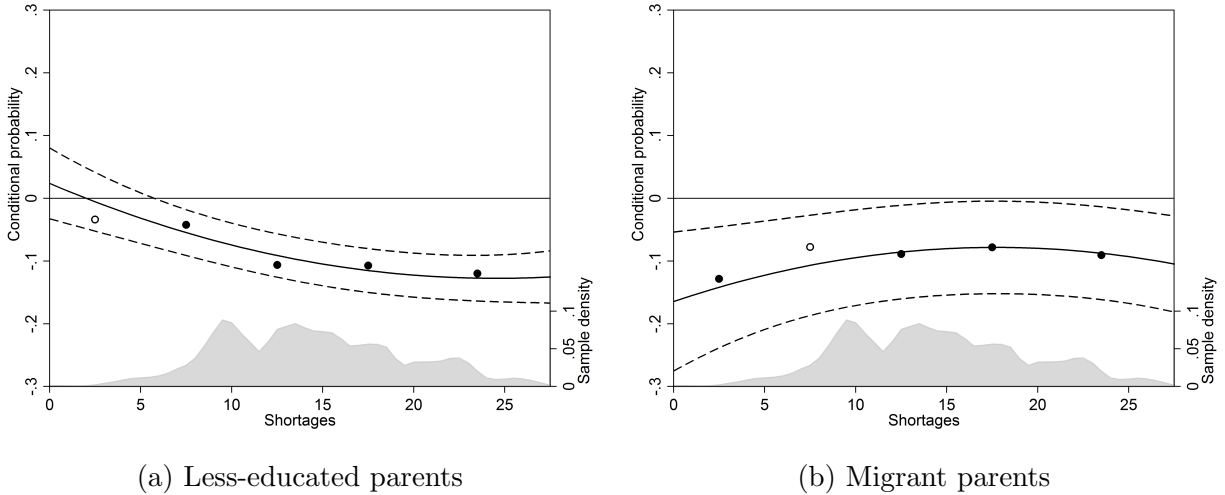
We also estimate a semi-parametric model:

$$Y_{icst} = \sum_b \delta_b S_{b,ct} + \sum_b \pi_b (L_i * S_{b,ct}) + X'_{ict} \sigma + \mu_c + \lambda_{st} + e_{icst} \quad (3)$$

where S_b are bins for shortages 5 percentage points in width. The advantage of the non-linear specifications is to gain insight into the effect size at different initial levels of shortages. For example, the non-linear specification might reveal that marginal changes have little effect on the enrolment gap at high levels of shortages, suggesting that only a large change would be effective.

Figure A2 presents the results of the estimation of equation (2) and equation (3). For the less-educated parents group, there appears to be a clear non-linear relationship between the day care enrolment gap and local shortages. Specifically, the enrolment gap is close to zero and not statistically significant when shortages are very low and then quickly increases to around 10 ppt before effectively flattening out at higher levels of shortages (above about 20 ppt). The binomial specification finds a zero intercept (in contrast to the less flexible linear specification) and the enrolment gap in the first shortages bin (0 ppt–5 ppt) is insignificant. This implies that the enrolment gap may be substantially reduced when shortages are zero. For the migrant parents category, a very different picture emerges: the enrolment gap is fairly flat at about 10 ppt at all levels of shortages. This is consistent with findings from the linear model in Table 4.

Figure A2: The enrolment gap by parental background at different levels of shortages



Notes: Graphical illustrations of the results of the estimation equation (2) and equation (3). The solid line plots the enrolment gap by (a) parental education and (b) parental migrant status against shortages and is equal to $E[Y_{icst}|L_{it} = 1] - E[Y_{icst}|L_{it} = 0] = \gamma_1 + \gamma_4 \times S_{ct} + \gamma_5 \times S_{ct}^2$. The dashed lines represent the 10% confidence intervals reflecting meaningful standard errors computed for marginal effects following Aiken and West (1991). The markers plot the enrolment gap in each shortages bin b , i.e. the parameters δ_{1b} . The filled markers are significant at the 10% level whereas the empty markers are insignificant. The grey area represents a kernel density plot of the sample distribution. Source: KiBS Panel 2012-2016.

A.4 Evidence on discrimination in Germany

An analysis of data on real students finds teachers are less likely to recommend the higher secondary school track to second-generation immigrants compared with native Germans conditional on school achievement tests and measure of general ability (Lüdemann and Schwerdt, 2013). Furthermore, an audit study finds that teachers gave lower grades for identical written pieces to students with typically Turkish-sounding names rather than typically German-sounding names (Bonefeld and Dickhäuser, 2018). Kaas and Manger (2012) carry out an audit study for student internships and find having a German-sounding rather than Turkish-sounding name on otherwise similar applications increases the likelihood of a callback by 14%. Weichselbaumer (2019) carries out an audit study making use of the fact that photos of applicants are typically included on job applications in Germany. The study finds discrimination against applications with a Turkish name, but the largest discrimination was against women wearing headscarves.

In an audit study in the rental market in Germany, Auspurg et al. (2017) find discrimination by landlords against applicants with Turkish-sounding names rather than German-sounding names. The study finds that landlords tend to discriminate against migrants but not against lower occupational status. Finally, Koopmans et al. (2019) test the relative importance of taste discrimination based on cultural value distance against statistical discrimination based on education levels in an audit study and find discrimination against ethnic groups is mostly based on the former. Overall, the evidence suggests that the strongest levels of discrimination in Germany are faced by immigrants, rather than those with low-status occupations or lesser educational attainment. There appears to be a particular intolerance towards cultural differences, which if true would often put migrant parents at a particular disadvantage. In conclusion, the existing evidence seems consistent with the possibility that families with a migrant background could face discrimination in the context of day care.

A.5 Cost effectiveness calculations

We combine our baseline estimates with estimates of policy cost to reach back-of-the-envelope estimates of cost effectiveness for each approach in terms of closing the enrolment gap by parental education.

The marginal effect for shortages is a 5 ppt reduction in the gap per 10 ppt reduction in shortages. Thus, assuming a linear effect, to close the gap by 1 ppt would require a 2 ppt reduction in shortages. Given there are about 2.3m children aged under three in Germany, this amounts to delivering $2.3\text{m} \times 0.02 = 46,000$ spots. We found estimates of the cost of a full-day spot for the under-three age group across three different federal states (Berlin, Baden-Württemberg, and North Rhine-Westphalia). Under threes require a smaller child-teacher ratio so they are more costly to provide for than the over-threes. The typical estimate suggests a cost of around 15,000 Euros. Thus, the total cost of reducing the enrolment gap by parental education would be $46,000 \text{ slots} \times 15,000 \text{ Euros} = 690\text{m Euros}$.

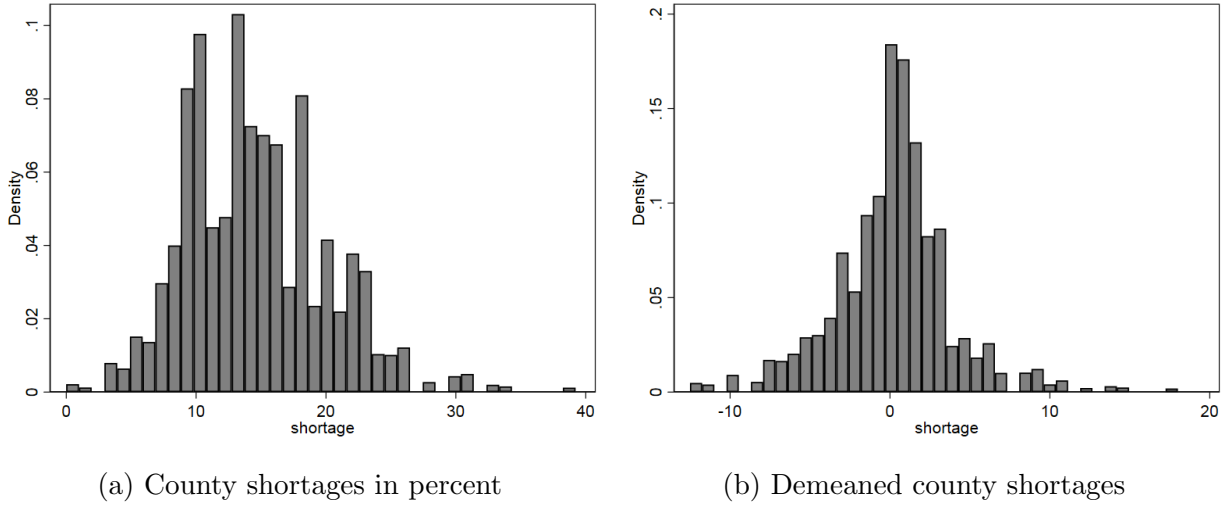
The effect for fees (using the case of Hamburg) is a 7.3 ppt reduction in the gap for a

178 Euro reduction in fees for everyone. Thus, assuming a linear effect again, closing the gap by 1 ppt would require a $178 \text{ Euros} \div 7.3 \text{ ppt} =$ a 24.4 Euro reduction in fees. Holding the number of places constant, this reduction would apply only to the 31% of children under three in day care. Thus, the total cost to reduce the enrolment gap by parental education by 1pp would be $713,900 \text{ slots} \times 24.4 \text{ Euros} = 17.4\text{m Euros}$.

Clearly, if policymakers are concerned solely with closing the enrolment gap by parental education then reducing fees is the cheaper option by far. As argued in our motivation, closing the gap may have societal benefits in terms of equality (since narrowing development gaps may narrow future earnings gaps) but also in terms of efficiency (since the child development effects are larger for children of parents with lower educational attainment). However, while providing more spaces is much more expensive, it has the additional benefit of increasing the number of children attending day care. A full cost-benefit analysis is beyond the scope of this study but would have to take the extra child development effects, plus the potential impacts on parental earnings of each approach.

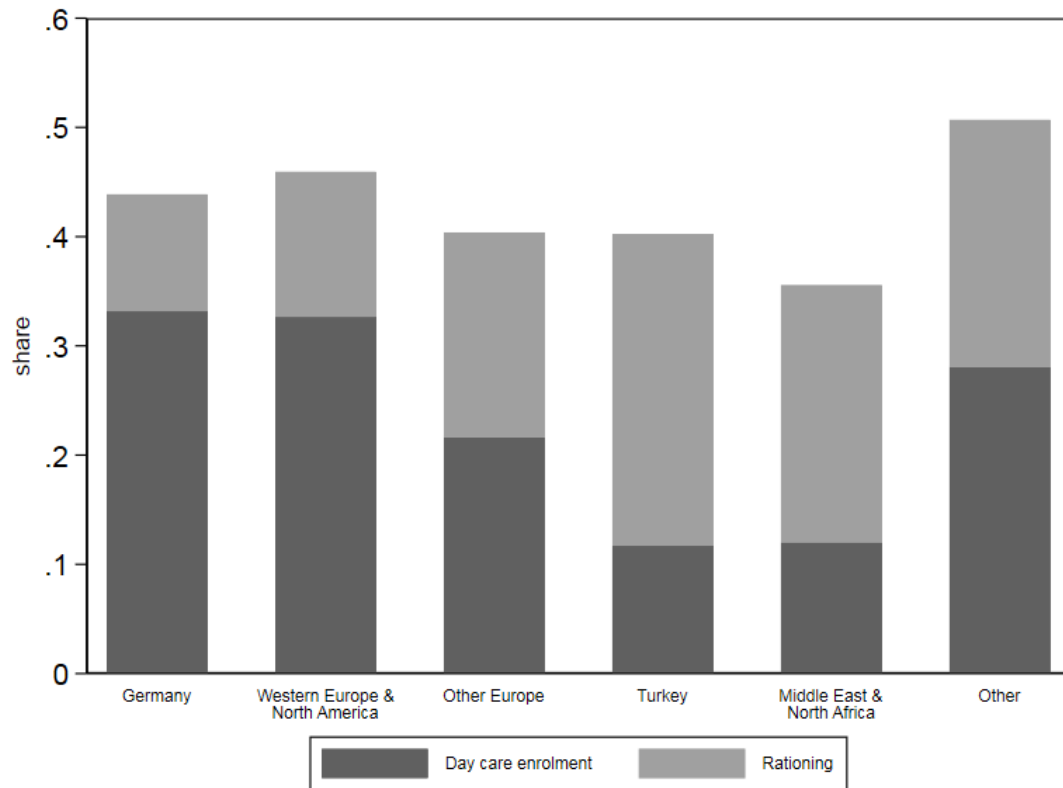
A.6 Figures

Figure A3: Shortages in day care



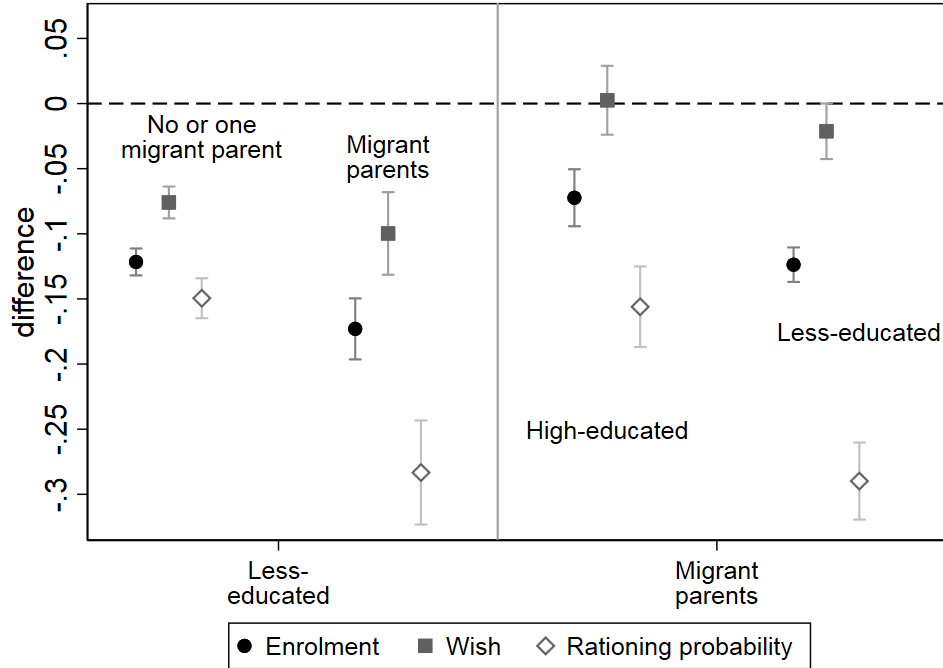
Notes: Figure shows (a) raw shortages in day care at the county level; and (b) demeaned county shortages subtracting the state-level average. An individual shortage denotes that a day care spot is desired for the child, but the child is not enrolled. Shortages are calculated at the county-by-year level. The sample is restricted to those with at least 50 county-by-year observations. Panel (b) omits the city-states of Berlin and Hamburg as these are absorbed in our analysis by state and wave fixed effects. Source: KiBS Panel 2012-2016.

Figure A4: Day care enrolment and rationing by birth country of the parents



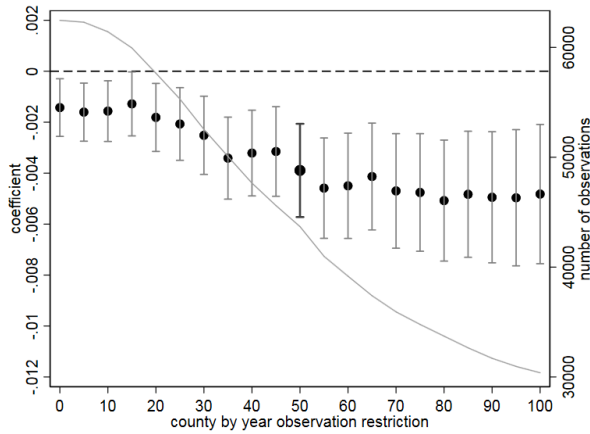
Note: Figure shows day care enrolment and the rationing probability (wish for day care but not enrolled) by birth country of the responding parent. Weighted averages, source: KiBS Panel 2012-2016.

Figure A5: Conditional gaps in day care enrolment, wish and rationing probability

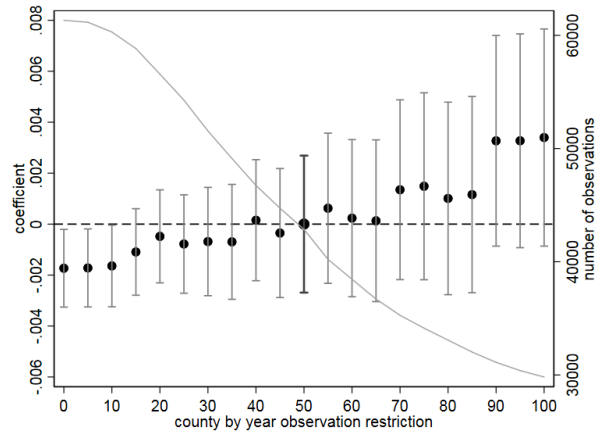


Notes: Figure shows differences in day care enrolment and wish by two measures of family background (parental education and parental migrant status — defined as having two migrant parents), conditional on (not) having migrant parents and having high-(or less-) educated parents, respectively. Rationing probability is enrolment conditional indicating a wish. Coefficients stem from regressing the dependent variable on the indicator for family background conditional on the factors indicated in separate weighted regressions. Reading example; the day care enrolment gap for children from less-educated parents is 12.2 ppt when at least one parent is a non-migrant 17.3 ppt when both parents are migrants (solid black circles on the left side of the figure). Mean enrolment is 0.31, mean wish 0.436 and mean rationing probability 0.287. Whiskers indicate 95% confidence intervals. Source: KiBS Panel 2012-2016.

Figure A6: Interaction term of Table 4 by sample restriction



(a) Less-educated parents, col (4)



(b) Migrant parents, col (8)

Notes: Figures show the coefficient of the interaction term of the county fixed effect model in Table 4 for different county-by-year number of observation restrictions (in intervals of five). The coefficients are obtained from the specification shown in columns (4) and (8) for less-educated parents and migrant parents, respectively. The bold markers indicate the coefficients shown in the table. Whiskers present 95 percent confidence intervals. The grey line and the y-axis on the right show the number of observations used in each estimation. Weighted regressions, source: KiBS Panel 2012-2016.

A.7 Tables

Table A2: Share of children below 3 years in child care – comparison of KiBS and official statistics

| Federal state | 2012 | | 2013 | | 2014 | | 2015 | | 2016 | |
|------------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|--------------------|
| | KiBS (1) | Difference (2) | KiBS (3) | Difference (4) | KiBS (5) | Difference (6) | KiBS (7) | Difference (8) | KiBS (9) | Difference (10) |
| Schleswig-Holstein | 0.241 | -0.001 | 0.262 | -0.001 | 0.295 | -0.008 | 0.320 | 0.006 | 0.311 | 0.002 |
| Hamburg | 0.358 | 0.000 | 0.384 | 0.000 | 0.427 | -0.003 | 0.453 | 0.020 | 0.429 | 0.000 |
| Lower Saxony | 0.220 | -0.001 | 0.244 | 0.000 | 0.275 | -0.004 | 0.283 | 0.000 | 0.285 | 0.001 |
| Bremen | 0.212 | 0.000 | 0.232 | 0.000 | 0.264 | -0.005 | 0.281 | 0.010 | 0.271 | 0.001 |
| North Rhein-Westphalia | 0.181 | 0.000 | 0.198 | -0.001 | 0.233 | -0.005 | 0.266 | 0.007 | 0.257 | 0.000 |
| Hesse | 0.236 | -0.001 | 0.256 | -0.001 | 0.283 | -0.005 | 0.306 | 0.009 | 0.297 | 0.000 |
| Rhineland-Palatinate | 0.269 | -0.001 | 0.282 | 0.000 | 0.304 | -0.002 | 0.312 | 0.006 | 0.301 | 0.002 |
| Baden-Württemberg | 0.231 | 0.000 | 0.248 | -0.001 | 0.274 | -0.004 | 0.285 | 0.007 | 0.279 | 0.002 |
| Bavaria | 0.230 | 0.000 | 0.247 | -0.001 | 0.269 | -0.002 | 0.281 | 0.006 | 0.272 | 0.000 |
| Saarland | 0.220 | -0.001 | 0.245 | -0.001 | 0.263 | -0.007 | 0.286 | 0.003 | 0.287 | 0.004 |
| Berlin | 0.425 | -0.001 | 0.436 | -0.001 | 0.459 | -0.001 | 0.475 | 0.016 | 0.459 | 0.000 |
| Brandenburg | 0.534 | 0.000 | 0.536 | 0.000 | 0.572 | -0.006 | 0.579 | 0.011 | 0.572 | 0.000 |
| Mecklenburg-Vorpommern | 0.536 | 0.000 | 0.544 | -0.001 | 0.556 | -0.005 | 0.562 | 0.002 | 0.560 | 0.000 |
| Saxony | 0.464 | 0.000 | 0.472 | 0.000 | 0.494 | -0.005 | 0.511 | 0.005 | 0.507 | 0.001 |
| Saxony-Anhalt | 0.575 | 0.000 | 0.577 | 0.000 | 0.577 | -0.006 | 0.583 | 0.004 | 0.572 | 0.002 |
| Thuringia | 0.497 | -0.001 | 0.513 | -0.001 | 0.519 | -0.005 | 0.527 | 0.003 | 0.524 | 0.002 |

Notes: Comparison of the share of children under three years old in day care as calculated with the KiBS panel 2012-2016 data using sample weights with official statistics provided by the Federal Statistical Office of Germany.

Table A3: Characteristics by country of origin

| | Share of migration population | | Day care | | | Number of applications (6) | Less-educated (7) | Household net income (8) |
|----------------------------------|-------------------------------|-------------|------------------|-------------|-----------------|-------------------------------|----------------------|-----------------------------|
| | Microcensus 2017 (1) | KiBS (2) | Enrolment (3) | Wish (4) | Shortage (5) | | | |
| Germany | - | - | 0.332 | 0.439 | 0.107 | 2.789 | 0.457 | 4084.169 |
| Western Europe and North America | 0.091 | 0.177 | 0.327 | 0.461 | 0.133 | 2.954 | 0.393 | 4063.182 |
| Other Europe | 0.360 | 0.519 | 0.216 | 0.404 | 0.188 | 2.137 | 0.589 | 3122.679 |
| Turkey | 0.136 | 0.090 | 0.117 | 0.402 | 0.285 | 1.56 | 0.801 | 2906.720 |
| Asia | 0.221 | 0.105 | 0.18 | 0.438 | 0.257 | 2.081 | 0.64 | 2985.501 |
| Africa | 0.062 | 0.060 | 0.257 | 0.479 | 0.220 | 1.957 | 0.534 | 2826.919 |
| Others | 0.127 | 0.049 | 0.321 | 0.502 | 0.180 | 3.159 | 0.368 | 3554.822 |

Notes: Table shows characteristics of children with different migration backgrounds. Shares of the Microcensus data refer to children aged 0-5, KiBS data 0-3. For *Western Europe and North America*, and *Other Europe* the composition between Microcensus and KiBS data differs slightly as the Microcensus data only contains the number of children from EU28 and the 12 countries with the largest migrant population share of those. Western European countries not listed are thus assigned to *Other Europe*, leading to an underestimation of the *Western Europe* share in the Microcensus. When countries are assigned to EU28 and residual European countries the share in the Microcensus are 0.291 and 0.286, and 0.344 and 0.386 in the KiBS respectively. In the KiBS data, the country refers to birth country of the responding parent. Microcensus data obtained from the Federal Statistical Office. Weighted averages, source: KiBS panel 2012-2016.

Table A4: Oaxaca-Blinder decomposition of the enrolment gap

| | by parental education | | | by parental migrant status | | |
|-------------------|------------------------|------------------------|------------------------|----------------------------|------------------------|------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Explained | -0.0551*** (0.0058) | -0.0646*** (0.0129) | -0.0735*** (0.0129) | -0.0511*** (0.0086) | -0.0360* (0.0183) | -0.0411** (0.0184) |
| Unexplained | -0.0781*** (0.0041) | -0.0783*** (0.0085) | -0.0694*** (0.0086) | -0.0895*** (0.0077) | -0.0952*** (0.0158) | -0.0901*** (0.0159) |
| Raw gap | -.133 | -.143 | -.143 | -.141 | -.131 | -.131 |
| Share unexplained | .587 | .548 | .486 | .636 | .726 | .687 |
| Waves in sample | 1-5 | 4 | 4 | 1-5 | 4 | 4 |
| N | 43,464 | 8,399 | 8,399 | 42,678 | 8,368 | 8,368 |

Note: Table shows the Oaxaca-Blinder decomposition of the enrolment gap as pioneered by Oaxaca (1973) and Blinder (1973). Explanatory variables per column as in Table 3; columns (1), (2), (4), (5) contain number of children in household, partner, wish for day care and local shortages. Columns (3) and (6) add local fees and pre-birth income. Shortages are local shortages at the county level. The sample is restricted to a minimum of 50 observations per county-year. Estimated using the Stata package provided by and documented in Jann (2008). Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016

Table A5: Day care enrolment, family background and regional shortages – alternative family background definition

| | Day care enrolment | | | | | | | |
|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Mean of dep. var | 0.379 | 0.379 | 0.379 | 0.379 | 0.375 | 0.375 | 0.375 | 0.375 |
| No university | -0.095*** (0.028) | -0.031 (0.032) | -0.086*** (0.028) | -0.031 (0.032) | | | | |
| No university × shortage | | -0.004*** (0.001) | | -0.004*** (0.001) | | | | |
| Other language at home | | | | | -0.139*** (0.042) | -0.136*** (0.049) | -0.127*** (0.043) | -0.126** (0.050) |
| Other language × shortage | | | | | | -0.000 (0.001) | | -0.000 (0.001) |
| Shortage | -0.004*** (0.001) | -0.002 (0.001) | -0.004*** (0.001) | -0.002 (0.001) | -0.005*** (0.001) | -0.005*** (0.001) | -0.004*** (0.001) | -0.004*** (0.001) |
| State × wave FEs | Y | Y | | | Y | Y | | |
| County FEs | | | Y | Y | | | Y | Y |
| Wave FEs | | | Y | Y | | | Y | Y |
| Observations | 35,603 | 35,603 | 35,603 | 35,603 | 43,536 | 43,536 | 43,536 | 43,536 |

Notes: Weighted regressions of equation (1) with and without county fixed effects. The sample is restricted to a minimum of 50 observations per county. Shortages are local shortages at the county level. All estimates control for the sex and age of the child, marital status of the respondent and an indicator of urban counties, the county fixed effects estimates include regional controls at the state-by-year level (unemployment, population density, GDP per capita and migration share). Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016.

Table A6: Day care enrolment, family background and regional shortages – leave-one-out shortage

| | Day care enrolment | | | | | | | |
|---|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Mean of dep. var | 0.375 | 0.375 | 0.375 | 0.375 | 0.376 | 0.376 | 0.376 | 0.376 |
| Less educated | -0.105*** (0.021) | -0.035 (0.025) | -0.097*** (0.021) | -0.041 (0.025) | | | | |
| Less educated \times shortage $_{-i}$ | | -0.005*** (0.001) | | -0.004*** (0.001) | | | | |
| Migrant parents | | | | | -0.097** (0.043) | -0.099** (0.050) | -0.090** (0.045) | -0.099* (0.051) |
| Migrant \times shortage $_{-i}$ | | | | | | 0.000 (0.001) | | 0.001 (0.001) |
| Shortage $_{-i}$ | -0.001* (0.001) | 0.001 (0.001) | 0.003*** (0.001) | 0.005*** (0.001) | -0.001* (0.001) | -0.001* (0.001) | 0.003*** (0.001) | 0.003*** (0.001) |
| State \times wave FEs | Y | Y | | | Y | Y | | |
| County FEs | | | Y | Y | | | Y | Y |
| Wave FEs | | | Y | Y | | | Y | Y |
| Observations | 43,668 | 43,668 | 43,668 | 43,668 | 42,845 | 42,845 | 42,845 | 42,845 |

Notes: In contrast to Table 4, this table uses leave-one-out county shortages, i.e. excluding the individual contribution. Weighted regressions of equation (1) with and without county fixed effects. Migration background indicates that both parents are born abroad in a non-Western country. The sample is restricted to a minimum of 50 observations per county. Shortages are local shortages at the county level. All estimates control for the sex and age of the child, marital status of the respondent and an indicator for urban counties. The county fixed effects estimates include regional controls at the state-by-year level (unemployment, population density, GDP per capita and migration share). Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016.

Table A7: Day care enrolment, family background and regional shortages

| | Day care enrolment | | | |
|-------------------------------|----------------------|-------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| Mean of dep. var | 0.378 | 0.378 | 0.391 | 0.391 |
| Below median pre-birth income | -0.149*** (0.057) | -0.096 (0.070) | | |
| Low income \times shortage | | -0.003 (0.002) | | |
| Welfare recipient | | | -0.190*** (0.065) | -0.227*** (0.075) |
| Welfare \times shortage | | | | 0.002 (0.002) |
| Shortage | -0.004** (0.002) | -0.002 (0.002) | -0.006*** (0.001) | -0.006*** (0.001) |
| State \times wave FEs | Y | Y | Y | Y |
| Observations | 8,422 | 8,422 | 17,090 | 17,090 |

Notes: Weighted regressions of equation (1) with and without county fixed effects. The sample is restricted to a minimum of 50 observations per county. Shortages are local shortages at the county level. All estimates control for the sex and age of the child, marital status of the respondent. Information on pre-birth income and welfare recipient status available in wave 4, and wave 4 and 5 respectively. Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016.

Table A8: Day care enrolment, family background and fees

| | Day care enrolment | | | |
|-----------------------------|----------------------|----------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| Mean of dep. var | 0.378 | 0.378 | 0.377 | 0.377 |
| Less-educated | -0.182*** (0.053) | -0.050 (0.072) | | |
| Less-educated \times fees | | -0.057*** (0.021) | | |
| Migrant parents | | | 0.022 (0.076) | 0.043 (0.101) |
| Migrant \times fees | | | | -0.009 (0.028) |
| Day care fees | 0.036*** (0.013) | 0.058*** (0.015) | 0.052*** (0.012) | 0.053*** (0.014) |
| State FEs | Y | Y | Y | Y |
| Observations | 8,987 | 8,987 | 8,941 | 8,941 |

Notes: Weighted regressions of equation (1) without the county fixed-effects. The sample is restricted to a minimum of 50 observations per county. All estimates control for the sex and age of the child, marital status of the respondent and indicators for urban counties and terciles for the GDP per capita of the counties. As fees are only available for those in day care, we use our data set to impute hypothetical fees for all children. For this we regress observed day care fees on a number of variables that commonly determine day care fees (number of children in household, 15 household net income bins, age dummies for the children, desired hours corrected by the median gap between desired and actually used hours for those enrolled in day care, and a binary indicator of welfare receipt). Regressions are run by state and include county fixed effects to allow for regional variation in the fee structure. In a second step, we predict hypothetical fees for each child based on the coefficients obtained above and then compute the county average. Standard errors, clustered at the individual level, in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Weighted regressions, source: KiBS Panel 2012-2016.



