Minimum Wage, Worker Quality, and Consumer Well-Being: Evidence from the Child Care Market

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Abstract

We study the impact of the minimum wage on service quality and consumer well-being within the child care market. Although child care firms increase teacher pay in response to minimum wage reforms, we find no impact on employment. Instead, providers respond by implementing other revenue-enhancing and cost-saving practices, such as raising prices, increasing child-to-staff ratios, and serving fewer publicly-subsidized children. We also show that service quality improves: staff turnover declines, teachers are more likely to have taken early childhood education courses, and teacher-child interactions improve. Nevertheless, parents report that they are less satisfied with their child care provider.

Keywords: Child care, child care quality, minimum wage

JEL Codes: J13, J15, J21, K39

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1 Introduction

While a substantial literature examines the effects of minimum wage reforms, much of it focuses on the labor market outcomes of potentially exposed workers, primarily within the restaurant and retail sectors (e.g., Belman and Wolfson, 2014; Congressional Budget Office, 2019; Neumark et al., 2014). Minimum wage reforms can also affect consumers, including through changes in price (e.g., Ashenfelter and Jurajda, 2022; Link, 2024) and product quality (Ruffini, 2022; Clemens, 2021). Understanding the full impact of minimum wage changes therefore requires examining firms' adjustments across multiple margins simultaneously. Such analyses remain rare, however, reflecting the limited availability of data on non-labor market outcomes.

In this paper, we holistically study the impact of the minimum wage on the child care services sector. Child care is a large and differentiated market where quality can have important consequences for individuals' short- and long-run well-being (NICHD ECCRN, 2000).[1] Within this context, our paper examines not just the employment effects of minimum wage reforms; it is one of the first to assess direct measures of worker quality and job performance as well as consumer well-being. As with other service sector firms, child care contains a large number of low-wage employees, worker productivity is difficult to quantify, and managers cannot easily substitute away from labor inputs in the production process. Therefore, results from this study are likely to be broadly applicable.

We first combine state and federal minimum wage changes between 2001 and 2019 with data from the Quarterly Workforce Indicators (QWI) to examine child care workers' earnings, employment, and turnover. This period witnessed over 250 changes to effective state minimum wages. We use two identification strategies: the first is a two-way fixed effects design using state-by-quarter variation in minimum wage reforms, and the second is a border county discontinuity design that aggregates hundreds of minimum wage "experiments" that occur when adjacent counties lie in different states, leading one county to experience a minimum wage increase while a bordering county in another state does not (Dube et al., 2010). The two designs have different advantages: state-level two-way fixed effects use all available data, while the border-county discontinuity design necessarily restricts the sample to counties on state borders but has the advantage of a potentially improved counterfactual due to the comparison county's geographic proximity.

[1] Indeed, the child care services industry provides care for 13 million preschool-age children and employs 4.7 million workers across multiple sectors with heterogeneous quality (Bassok et al., 2016; Brown and Herbst, 2022). In addition, recent estimates suggest that 2% of working-age women are employed in the child care industry, compared to 0.9% in retail clothing stores and 5% in restaurants (Brown and Herbst, 2022).

We check that the minimum wage binds in the child care market, as is likely given that over 30% of workers' wages are within 10% of the minimum wage.[2] While child care directors may have limited ability to adjust employment levels (due to states' child-to-staff ratio requirements), facility closures may nevertheless decrease aggregate employment in child care, reducing parents' access to such services. Furthermore, documenting any changes to turnover is particularly important in light of recent work linking higher teacher turnover to worse child outcomes (Markowitz, 2019). Staff turnover rates in the industry are comparatively high, with one recent study estimating that 46% of child care teachers leave their program from one year to the next (Bassok et al., 2021b). Nevertheless, there is emerging evidence that even temporary increases in compensation can substantially reduce turnover (Bassok et al., 2021a). Thus there are reasons to suspect that raising the minimum wage will bind in the child care industry, increasing employee earnings and potentially reducing turnover as a result.

We then provide evidence on the price pass-through of minimum wage increases. Previous work finds that price pass-through tends to be stronger among firms producing locally provided goods and services than among those producing tradable goods, consistent with smaller demand elasticities due to limited substitution options (Link, 2024). Thus, price pass-through may be particularly important in this market, where the product is inherently local. In addition, price increases may be particularly salient in child care as labor shares are high, with labor costs estimated to account for 70% of child care business expenses (Helburn and Howes, 1996). Although price may be a particularly important margin to study in this context, data on prices in the U.S. child care market is extremely limited. Our analysis therefore relies on newly available county-level price data from market rate surveys of child care providers accessed via the National Database of Childcare Prices.[3] Because data collection methodologies and data quality vary substantially across states, to avoid making cross-state comparisons, our main analysis identifies price responses from variation in local minimum wages over time within one state, California, which has reliable data over the period 2008 to 2018 (Rodgers, 2023). Given that most child care providers are severely liquidity constrained, reporting profit margins of less than one percent (U.S. Department of the Treasury, 2021), they may respond to an increase in labor costs by initiating a full price pass-through. However, parents with young children are also liquidity constrained, and child care expenses consume a large share of family income (Herbst, 2023). Thus

[2]This figure is based on the authors' analysis of the Current Population Survey for the years 2015 to 2019. By comparison, Dube et al. (2010) estimate that 33% of restaurant workers are within 10% of the minimum wage.

[3]Market rate surveys are administered periodically by states to establish subsidy payment amounts under the Child Care and Development Fund (CCDF), the nation's largest means-tested child care subsidy program.

it is unclear a priori whether providers will pass-through labor cost increases or seek adjustments on other margins.

For example, providers might offset increased labor costs by serving fewer children receiving subsidies through the Child Care and Development Fund (CCDF). It is widely acknowledged that CCDF reimbursements are too low to cover the full cost of producing high-quality services (Workman, 2018), and the program imposes an array of quality and documentation requirements that may be burdensome for providers (Slicker and Hustedt, 2022). Therefore, in an attempt to raise revenue and reduce costs, providers might respond to minimum wage increases by replacing subsidized children with families who pay the full cost of care out-of-pocket.[4] To test this, we construct a state-by-year panel of the number and share of child care providers that served subsidy-receiving families from 2000 to 2019.

In the final set of analyses, we study two issues that have received considerably less attention in the minimum wage literature: service quality and consumer satisfaction. Service quality might improve if more productive workers are attracted to child care employment, worker effort increases, or worker stress decreases. However, quality could also decline if high-skilled workers are laid off to reduce costs, providers substitute toward less productive non-labor inputs, or child-to-staff ratios increase. Indeed, two recent studies of the nursing care sector highlight these conflicting possibilities. Ruffini (2022) shows that U.S. minimum wage increases reduced inspection violations, adverse resident health conditions, and resident mortality, while Giupponi and Machin (2018) find that a wage increase in the UK lowered ratings of care quality.[5] Such an analysis within child care is important because a significant share of children attend low- to mediocre-quality providers, a problem often attributed to the market's informational frictions (NICHD ECCRN, 2000).[6] Because it is costly for parents to monitor child care providers, it is not clear whether an increase in the minimum wage would improve quality, nor is it clear whether consumers would recognize or value an increase in quality if it occurred. We first provide evidence on the quality of care, proxied by improvements in teacher credentials, the quality of teacher-child interactions, and the number of providers accredited by the National Association for the Education of Young Children (NAEYC). Data on teachers come

[4] A recent survey finds that 73% of center-based providers had in the past year turned families away or used a waitlist due to a lack of space, indicating that providers may be able to fill spots used by CCDF families with those who pay full tuition (Council of Economic Advisers, 2022). Such changes would be consistent with how nursing homes selectively admit non-Medicaid patients instead of Medicaid patients when they are near capacity (Gandhi, 2020).

[5] Evidence from other low-wage sectors shows workforce improvements, both because existing workers become more productive and through labor-labor substitution, with firms more likely to hire better-credentialed workers (Fairris and Bujanda, 2008; Horton, 2017; Clemens et al., 2021; Coviello et al., 2022; Ku, 2022).

[6] The evidence suggests that parents are not able to accurately assess the quality of their child's program, and their level of satisfaction is uncorrelated with many dimensions of quality (Bassok et al., 2018; Herbst et al., 2020; Mocan, 2007).

from the Birth cohort of the Early Childhood Longitudinal Survey (ECLS-B), while the data on accreditations are drawn from the market research firm AggData. Second, we study the impact of minimum wage increases on consumer well-being, using data from Yelp to measure parents' satisfaction with their child care provider.

Our main results can be summarized as follows. First, we find that minimum wage increases bind in the child care industry, raising monthly earnings for new hires between 1.0% and 1.3% for a 10% increase in the minimum wage. These magnitudes are consistent with Ruffini (2022)'s analysis of nursing home assistants, Dube et al. (2010)'s analysis of restaurant workers, and Dube et al. (2016)'s analysis of teenagers. In addition, we find no impact on employment levels. While this contrasts with the findings in some recent studies (Clemens and Wither, 2019; Clemens and Strain, 2021; Gopalan et al., 2021; Harasztosi and Lindner, 2019; Jardim et al., 2022), it is consistent with others that find null effects in certain contexts (Cengiz et al., 2019; Dube et al., 2016; Ruffini, 2022). Our results also show that minimum wage increases improve the stability of the child care workforce by reducing staff turnover. The estimates imply that a 10% increase in the minimum wage reduces the turnover rate by 1.1% overall using the county border specification. The reduction in turnover is larger among young workers (1.8%)—a result that has also been documented in other industries (Brochu and Green, 2013).

Our results also suggest that child care providers pass-through the increase in labor costs to consumers. Relying on a two-way fixed effects model and local minimum wage reforms in California, we find that a 10% increase in the minimum wage raises center-based market prices between 4.2% and 8.1%, depending on the age group served, which is consistent with a 100% pass-through. Our estimates are larger than recent studies of McDonald's restaurants (1.2% to 1.4%) (Ashenfelter and Jurajda, 2022), San Jose's restaurants (0.58%) (Allegretto and Reich, 2018), and grocery stores (0.4% to 0.8%) (Leung, 2021; Renkin et al., 2022), which we hypothesize is due to child care's comparatively high labor share.

In addition, we uncover at least two other margins along which child care providers adjust to the increase in labor costs. First, center-based program enrollments and child-to-staff ratios increase significantly, by 5.6% and 4.7%, respectively, for a 10% increase in the minimum wage. Second, minimum wage reforms induce providers to alter their participation in the CCDF, with fewer center-based providers serving subsidized children (-12.2%). Given that center-based workers are more exposed to minimum wage reforms than home-based providers, we interpret these findings as tentative evidence that such providers are in need of alternative revenue sources.

The evidence also suggests that increases in the minimum wage are associated with improvements in teacher quality. Teachers are more likely to have made a variety of human capital investments, including taking courses or completing certifications in early childhood education (ECE). Teachers also participate more intensively in several education-related activities with children (e.g., reading), and they engage in higher-quality interactions with children. Specifically, our estimates imply that a 10% increase in the minimum wage raises teachers' overall score on the Arnett Caregiver Interaction Scale (CIS) by 2.4%, or 0.1 standard deviations. These improvements occur despite the previously-mentioned increase in child-to-staff ratios. Although we are not able to definitively test whether these quality improvements derive from higher wages attracting more productive workers or from higher wages leading to better job performance among existing workers, our results—showing reductions in turnover—imply the latter could be a key driver. The improvement in teacher qualifications and teacher-child interactions is important in light of the evidence that such inputs are strongly correlated with child care quality (Blau, 2001; Pianta et al., 2009).

Despite the increase in individual worker productivity, we find that consumers are less satisfied with their child care provider. Our analysis of business reviews on Yelp finds that a 10% increase in the minimum wage is associated with a reduction in consumers' star ratings by 0.03 points (on a scale of one to five). Reductions occur in both low- and high-income markets. To probe whether the increase in market prices might explain consumers' growing dissatisfaction with their child care provider, we analyze the extent to which consumers discuss issues related to the cost of care in the open-ended (textual) reviews. The evidence indicates that comments and complaints about pricing are more common following a minimum wage increase. In contrast, there is no evidence that consumers are more likely to discuss issues related to children's interactions with their teachers, providers' learning and academic environment, or other proxies for quality like classroom group sizes or child-to-staff ratios.

In summary, our results paint a complicated picture about the impact of the minimum wage on the child care market. On the one hand, we show that workers' earnings and job performance increase, and that turnover decreases. The increased stability in the workforce may be beneficial to children if it reinforces the warm and stimulating teacher-child relationships that are shown to be important for child development (Hamre, 2014; NICHD ECCRN, 2002). Our results also suggest, however, that providers may respond by increasing prices, serving fewer low-income children receiving subsidies, and increasing child-to-staff ratios. Furthermore, consumers are less

satisfied with their provider, which may be explained by the increase in prices or ratios. This tension in our results is consequential because it has implications for the question of whether minimum wage reforms can improve child care quality and, ultimately, child well-being. Evidence from both the child care market (Blau, 2001) and K-12 system (Britton and Propper, 2016; Hendricks, 2014; Loeb and Page, 2000) shows that teacher compensation is related to child outcomes. Thus our finding of wage-driven improvements in teacher job performance tentatively bodes well for these outcomes. However, if providers substitute toward less productive inputs—by increasing child-to-staff ratios—the net increase in service quality may be lessened.

The remainder of the paper proceeds as follows. Section 2 provides a brief overview of how the child care market is organized. Section 3 introduces the key data sources and discusses the empirical models. Results are presented in Section 4, and we provide a discussion of the results in Section 5. Section 6 concludes the paper.

2 Overview of the Child Care Market

Children ages 0 to 4 in the U.S. generally participate in private-sector child care services that take place in center- or home-based environments. Center-based programs—which are generally for-profit and nonprofit institutions, places of worship, and community-based organizations—are licensed and regulated, and they operate out of either stand-alone buildings or are co-located with other entities. Most center-based programs are organized into classrooms that serve children of different ages (i.e., infants, toddlers, older preschoolers, and school-age children), and classrooms typically include a lead or head teacher as well as an assistant teacher. The best available evidence suggests that the center-based sector contains 129,000 programs employing approximately 1 million teachers and serving nearly 7 million preschool-age children (National Survey of Early Care and Education Project Team, 2013).

Home-based child care takes place in the home of the provider or in the child's home. Throughout the paper, we refer to the former as "home-based" care and the latter as "private household" care. Home-based providers are also licensed and regulated, and they function as small, independent businesses that operate out of the caregiver's home. Private household providers are typically relatives, friends, or neighbors of the child, as well as nannies, au pairs, or babysitters who are hired through word-of-mouth networks or child care job websites (e.g., Care.com). It is important to note that family, friend, and neighbor (FFN) care can also take place in the caregiver's home, but for the purposes of this paper we refer to these arrangements as private household care. Those in the private household

sector are referred to as either "informal" or "unlisted" caregivers because they are unlicensed and unregulated and cannot be found on state-maintained lists of providers. In addition, such caregivers are either unpaid or paid directly by parents at a negotiated rate. Altogether the home-based sector includes 3.8 million workers who care for over 7 million children (National Survey of Early Care and Education Project Team, 2016).

Relative to all other workers, those employed as child care workers are younger, more likely to be black and Hispanic, and more likely to have preschool-age children (Brown and Herbst, 2022). Child care workers also have fewer years of education, with 23% having a four-year college degree compared to 33% among non-child care workers. Nevertheless, there is important heterogeneity across the care sectors in worker skill: fully 23% of center-based employees have a college degree, followed by 17% among private household workers, and 13% among home-based workers. Among center-based teachers with a college degree, over half (55%) majored in early childhood education (ECE) and another 20% majored in an education-related field (Herbst, 2023). Finally, in-field professional qualifications are common among center-based teachers, with 27% having a Child Development Associate (CDA) credential and 43% having a state teaching certificate.

As discussed in Section 1, the child care industry is characterized by high staff turnover and low wages. Recent national estimates suggest that the center-based departure rate, or the share of workers who left a given program in the last year, is 17%. However, some state-specific studies find substantially higher turnover rates. For example, a study of Louisiana's programs estimates a turnover rate of 37%, and that most turnover is a departure from the ECE profession entirely (Bassok et al., 2021b). As for home-based providers, longevity is fairly short, with approximately 46% of businesses in operation for no more than five years. The evidence also suggests that turnover is countercyclical, rising during times of economic expansion and falling when the economy is in recession (Brown and Herbst, 2022). These workforce challenges stem mainly from the low pay received by child care workers. The median hourly wage of child care employees is $10.80, compared to $17.97 for all other female workers (Herbst, 2023). Another analysis finds that child care workers earn 23% less than those in other occupations after controlling for age, education, and other demographic characteristics (Gould, 2015). Nearly 15% of caregivers reside in families with an income below the poverty line, compared to 7% of those in other occupations (Gould, 2015).

3 Data Sources and Identification Strategy

3.1 Data Sources

Our empirical work relies on multiple data sources. First, to study the impact of the minimum wage on earnings, employment, and turnover, we use information from the Quarterly Workforce Indicators (QWI) database between 2001 and 2019 (Abowd, 2011).[7] The QWI is the product of a partnership between the U.S. Census Bureau and the state Labor Market Information entities, connecting individual-level earnings data from Unemployment Insurance records, firm-level characteristics from the Quarterly Census of Employment and Wages (QCEW), and demographic information from the Decennial Census, Social Security Administration records, and individual tax returns.[8] Such linkages allow for county-level analyses disaggregated by industry, employees' educational attainment, and other characteristics. Our analysis focuses on five key outcomes in the Child Day Care Services industry (NAICS code: 624410): monthly earnings, total (beginning-of-quarter) employment, turnover, new hires, and separations.[9] Each outcome is measured separately for the child care industry overall as well as for workers in five education categories (less than high school, high school/GED, some college, college or more, and those under age 25).

For the county border specification, the unit of analysis is the county-quarter combination, and for the two-way fixed effects analysis, it is the state-quarter combination.[10] In the county border specification, we limit the sample to all contiguous counties in the continental U.S. that are on opposite sides of a state border. Of the 3,108 eligible counties, 1,184 are located along a border with another state, providing 1,308 county-pairs.[11] Because the QWI suppresses data when cell size is too small, we may be concerned that missing data could be endogenous to minimum wage changes if minimum wage changes decrease employment, hires, and/or separations. Therefore, we only include counties where neither county in the border pair has any missing observations for that variable.[12] There are 1,308 candidate cross-border county pairs. Due to the restriction that each county must have a full time series in the outcome of interest, the number of county border pairs in a given regression ranges from 829 to 180

[7] We conduct additional analyses on earnings and supply using the American Community Survey (ACS) and the Quarterly Census of Employment and Wages (QCEW). Refer to Appendix A for a description of the data sources and results.

[8] Sometimes demographic information is not available for a particular worker, in which case it is imputed.

[9] Employment is defined as the number of jobs that are held on the first day of the quarter. The turnover rate is calculated as one-half of the sum of the number of new hires and separations in a given quarter divided by the total employment in that quarter. New hires is defined as the number of workers employed at a given firm in the reference quarter who were not employed there in any of the previous four quarters. Separations is defined as the total number of workers whose job with a given firm ended in the specified reference quarter.

[10] Although all states and the District of Columbia participate in the QWI, they entered the data-sharing agreement in different years, with most states participating as of the early-2000s.

[11] The number of county pairs is larger than the number of border counties because each county can be part of more than one pair.

[12] A county has zero missing observations if there are observations for that variable for all quarters from the first quarter the county is in the data until the last. This may be less than the full time series due to changes in county organization.

depending on the outcome, with subgroup analyses having fewer pairs due to data suppression from smaller cell sizes.[13]

To assess providers' responses to minimum wage reforms, we first examine the question of price pass-through, drawing on data from state-administered child care market rate surveys. To receive CCDF funding from the federal government, states are required to conduct a child care market rate survey at least every two years. These price data are then used by states to evaluate and set reimbursement amounts for providers serving low-income families in the subsidy system. The National Database of Childcare Prices (NDCP) compiles all of the state-specific market rate data into a county-by-year-level dataset of median (full-time) prices per week by provider-type (i.e., center- and home-based) and child-age in each year from 2008 to 2018 (Brown et al., 2022).[14] Our main analysis is conducted using the market rate surveys from California for two reasons. First, states employ a variety of methodologies to conduct their market rate surveys, with varying response rates and reliability that make cross-state comparisons difficult to interpret. Thus it is preferable to perform the analysis using one state to avoid these cross-state comparisons. California provides an ideal setting given its numerous local minimum wage changes and the reliability of its market rate surveys (Rodgers, 2023). Second, in order to provide consistent and complete data across counties, a non-trivial share of the NDCP data were imputed for a variety of reasons.[15] For example, for the variable representing center-based prices for children ages birth to five months, 18% of county-year cells required zero imputations, 40% required one imputation, and the remaining required two or more imputations. California's data, in contrast, includes minimal imputations between 2008 and 2018 for the two age groups for which the state collects data: 0 to 23 months and 24 to 47 months.[16]

We then examine whether child care providers respond to minimum wage increases by serving fewer low-income children receiving subsidies through the CCDF. The federal Office of Child Care maintains state-by-year lists of the average monthly number of children and families receiving a subsidy over the course of each calendar year,

[13]Specifically, for our main outcomes: there are 431 pairs for new hire earnings, 692 for employment, 407 for turnover, and 829 for average monthly earnings. There are fewer pairs with full time series when restricting to subgroups. In order, the number of available pairs for each outcome for individuals less than age 25 and for education levels less than high school, exactly high school, some college, and college degree are as follows: new hire earnings 300, 180, 249, 263, 207; employment 611, 508, 669, 678, 593; turnover 291, 163, 231, 246, 184; and average monthly earnings 675, 697, 784, 800, 750.

[14]Prices are reported for the following age groups: birth to five months, six to 11 months, 12 to 17 months, 18 to 23 months, 24 to 29 months, 30 to 35 months, 36 to 41 months, 42 to 47 months, 48 to 53 months, 54 months to school Age, and school age.

[15]According to Brown et al. (2022), imputations were required for five key reasons: one or more of the child age groups were missing, the state did not report prices in weekly units, the state did not report prices in the median, state- rather than county-level prices were reported, and the state did not conduct a market rate survey in a given year.

[16]Note that when we perform robustness analyses using the full NDCP database of child care prices along with state-level minimum wage changes, we include only observations with no price imputations or only one imputation to maintain a higher level of data quality.

as well as the number of providers that received CCDF funds to offer subsidized slots.[17] The provider data are reported for regulated and unregulated providers (for select years) and across multiple sectors (e.g., center- and home-based services and family, friend, and neighbor (FFN) care). These data are organized into state-year cells for the years 2000 to 2019, and we construct two sets of outcome variables. First, we examine the log number of children receiving CCDF subsidies and the log number of providers serving subsidized children, overall and disaggregated by sector. We then examine whether the composition of providers changed, calculating the share of subsidy-accepting providers that are centers, homes, and FFNs.

The next of set of empirical analyses examine various measures of service quality. We first study the density of providers that are accredited by the National Association for the Education of Young Children (NAEYC). To do so, we obtained a list of all such center-based providers over the period 2011 to 2020 from the market research company AggData. The provider list includes the name and physical address of each business along with its county and state of operation, and we use this information to assign to each one the relevant state and county FIPS identifier. Two versions of the data are prepared: a county-by-year dataset to implement the contiguous county border design and a state-by-year dataset to estimate the standard TWFE model. For both datasets, the outcomes of interest are the log number of NAEYC-accreditated providers and the share of NAEYC-accreditated providers.[18] As noted previously, obtaining the NAEYC's Early Learning Program (ELP) accreditation is very difficult, and our data suggest that at most 12.8% of center-based providers were accredited during the study period.

We also examine a number of teacher-level measures of skill investment and job performance. These analyses rely on the ECLS-B, a nationally-representative sample of approximately 11,000 children born in 2001. Our sample pools observations from the 24-month and preschool-age waves of data collection, which span the years 2003 to 2006.[19] During these waves, interviews were conducted with the focal child's primary non-parental caregiver, and a subset of providers were observed by trained evaluators to produce ratings of the quality of caregiver interactions with children.[20]. Thus we are able to measure a large number of quality-related attributes, including caregivers'

[17]The data can be accessed here: https://www.acf.hhs.gov/occ/data/fy-2019-ccdf-data-tables-final. Thank you to our research assistant Kaleigh Strohl for assistance in collecting this data.

[18]Note that the numerator for the second outcome comes from the AggData listing of NAEYC-accredited providers, while the denominator comes from the QCEW's data on the number of child care industry establishments.

[19]Although the observation period is relatively brief, the ECLS-B provides the most comprehensive information on child care program quality that we are aware of. Given the long-lasting effects of quality in early education settings, we believe it is critically important to assess such outcomes in the most credible way possible. Assessing quality over a longer time horizon is an important area for future research.

[20]Information about the child's provider was obtained via a 40-minute telephone interview. All provider-types (no matter how formal or informal) were eligible for the interview. Only children currently using non-parental care were eligible to have their provider

education and skill investments, the kinds of activities they engage in with children, and the nature of their interactions with children.

Specifically, the outcomes related to skill investments focus on whether caregivers have a degree in early childhood education (ECE), take courses in ECE or child development, have an ECE-related certification, and completed recent training in ECE. All of these outcomes are measured through binary indicators. We then study whether and how frequently caregivers engage in a range of educational activities with children, including reading, singing, playing games, and building items, all of which are measured by the log number of times per week the activity is performed. We also measure the frequency of caregivers' engagement in ten activities to teach math and other conceptual skills (e.g., telling time, working with shapes and patterns).[21] Finally, we assess the quality of child-caregiver interactions as measured by the Arnett Caregiver Interaction Scale (CIS). A widely used measure of caregivers' interactions with groups of children, the Arnett CIS includes 26 item-statements that explore four dimensions of interaction quality: detachment, punitiveness, permissiveness, and sensitivity. Each item is rated on a four-point scale ranging from "not at all" to "very much" depending on how much a given statement characterizes the nature of caregivers' interaction.[22] The CIS is an example of *process quality*, which refers to the way in which children experience and connect with the child care environment, including the quantity and quality of activities and interactions with caregivers. Such measures are important because process quality is shown to be a stronger predictor of child development than the regulatable inputs to quality like child-to-staff ratios and staff qualifications (NICHD ECCRN, 2002; Pianta et al., 2009; Sabol et al., 2013). Our analysis examines the log of each domain-specific score as well as the log overall CIS score.

Our final analysis examines the impact of the minimum wage on a measure of consumer well-being (or satisfaction) using a unique dataset of consumer reviews of child care providers from the website Yelp (Herbst et al., 2020). Business and reviewer information in the 40 largest U.S. cities was scraped from pages listing "child care and day

interviewed, and the provider must have been interviewed first before the observational component could occur. If the focal child was no longer at a given arrangement, a provider was still eligible for the interview as long as it could be conducted within four weeks of the child's departure.

[21] These activities are: count out loud, use geometric manipulatives, use counting manipulatives, play math-related games, use/play music to teach concepts, use movement/creative drama to teach concepts, use measurement instruments, use calendar-related activities, use games and activities to tell time, and work with shapes and patterns

[22] An example of an item-statement in each domain is the following: "fails to supervise the children very closely" (detachment); "threatens children in trying to control them" (punitiveness), "exercises firmness when necessary" (permissiveness); and "speaks warmly to the children" (sensitivity). The CIS was completed by trained observers who spent at least two hours in the child care setting assessing quality. Data were collected on the same individual who completed the provider survey and who was identified by the parents as the child's primary non-parental caregiver. Thus, Arnett scores are available for both formal (center-based) and informal (home-based or family, friends, and neighbor) child care arrangements.

care" providers over the years 2005 to 2017. Each firm's physical address was used to geocode the location of all providers so that state minimum wage data could be attached. The dataset includes information on 52,638 unique Yelp reviews of 10,270 child care providers located in 31 states. Yelp provides two opportunities for consumers evaluate businesses: a star rating system, in which consumers rate businesses on a scale of one to five stars, and an open-ended, text-based assessment. The star rating system is our primary measure of consumer well-being. The average Yelp rating in the dataset is 4.3 stars, with about 76% of reviews containing a five-star rating. In a supplementary analysis, we exploit Yelp's text-based narrative reviews to examine the salience of child care costs to consumers' evaluation of the provider. This is operationalized by assessing whether such costs are discussed by consumers in the text reviews. A bank of relevant words and phrases was created (e.g., "price," "cost," "fees," "affordable," and "expensive") searched in the reviews, such that a given review r_i is coded as having discussed a given topical dimension d_j if the intersection of the vectors r_i and d_j is empty. A binary indicator is created equal to one if a given review discusses the topic of child care costs. Over 12% of Yelp reviews contain such a discussion.[23]

Finally, we rely on state-level minimum wage data from Vaghul and Zipperer (2021). To move from monthly minimum wage data to quarterly, we take the maximum recorded minimum wage in that quarter, and for analysis relying on an annual minimum wage, we use the maximum recorded minimum wage in that year. For the within-California minimum wage analysis, we rely on data on local minimum wages from the U.C. Berkeley Labor Center (UC Berkeley Labor Center, 2023). Because our analysis is at the county level due to the nature of the pricing data, we aggregate the local minimum wage data to the county level using the maximum minimum wage in effect for non-profit small businesses in that county in a given year.

3.2 Empirical Strategy

We utilize several modeling strategies to estimate the impact of minimum wage policy. In particular, when the data allow, we use a contiguous border county-pair design, which compares outcomes for neighboring counties across state borders when one state changes their minimum wage Dube et al. (2010). Second, for all analyses, we use a standard two-way fixed effects (TWFE) design. Using both strategies allows us to test the robustness of our results to different samples and sources of policy variation. Finally, when the data allow, we use an event study

[23] An additional search of consumers' discussion of the learning and academic environment was also conducted. Here words such as "curriculum," "learn," "teach," "skills," and "development" were searched. Such topics were discussed in about 74% of the reviews, and a binary indicator for these reviews was similarly constructed.

design to confirm that our results are not driven by differential pre-trends.

The TWFE and county-border designs have different underlying assumptions, with different advantages and disadvantages. The TWFE approach is appealing because it uses all available data, potentially increasing the representativeness of the results and reducing variance due to the relatively high number of observations. It relies on the assumption that areas with constant minimum wages in a given period provide a good counterfactual for the changes in market outcomes that would have occurred in states with minimum wage increases had those increases not occurred. This assumption requires only that the trends in outcomes are similar, though Allegretto et al. (2013) raise concerns that states with higher minimum wages experience more severe recessions and have more polarized labor markets and thus may not provide a good counterfactual.[24] We provide event study figures to provide reassuring evidence that results are not driven by pre-existing differences in outcome trajectories across states.

We also rely on county-border discontinuity design when the data provide sufficiently fine geography. This methodology identifies the impact of minimimum wage reforms by using variation in states' minimum wage laws across all contiguous county-pairs that straddle opposite sides of a state border. The validity of this strategy rests on the ability of neighboring counties to provide a good counterfactual for the changes in market outcomes that would have occurred in the absence of minimum wage increases. One advantage of the contiguous county border approach is that these adjacent counties are more demographically and economically similar than (interior) counties located far away from one another (Allegretto et al., 2013; Dube et al., 2016; Ruffini, 2022) and are better balanced on a range of demographic, labor market, and firm characteristics (Ruffini, 2022). This similarity suggests that including only neighboring counties may provide a better counterfactual than including all counties, with the downside being that restricting the analysis to border counties reduces the sample size and potentially generalizability. This strategy also requires minimal spatial spillovers of minimum wage changes into neighboring counties in other states, as spillovers would lead to contamination of the comparison group. McKinnish (2017) raises some concerns with this spatial spillover assumption by showing that minimum wage changes affect cross-state commuting behavior, though effects are small. Jardim et al. (2023) find spillovers in wages and employment when minimum wage changes are particularly large, but there are no spillovers for the modest changes that are

[24] In addition, Dube et al. (2010) raises concerns about this assumption, showing that states with higher minimum wages experience lower employment growth rates, though these concerns relate primarily to a time period before our sample period.

most representative of changes during our sample period.[25] Overall, given the different assumptions, advantages, and disadvantages of these two approaches, we believe that the credibility of our results increases if they are robust to multiple empirical strategies.

We utilize the county-border discontinuity approach outlined in Dube et al. (2010) to examine earnings, employment, and turnover (QWI); prices (National Database of Childcare Prices); and NAEYC accreditation (AggData). In the contiguous county border approach, the analysis is restricted to a comparison of child care business and worker outcomes across two adjacent counties located in different states. Empirically, we estimate the impact on these outcomes for those in counties that experienced an increase in the minimum wage relative to those in an adjoining county that did not experience a minimum wage increase. Although this approach was first used in a limited way over two decades ago by Card and Krueger (1994) and then later expanded by Dube et al. (2010), it remains an important methodological tool in the minimum wage literature.

Limiting the samples to county-pairs that are separated by a common state border, the model is specified as follows:

$$Y_{cspt} = \alpha + \beta_1 Log(MinWage)_{st} + \theta X'_{cst} + \xi_c + \eta_p \times \zeta_t + \varepsilon_{cspt}, \quad (1)$$

where Y_{cst} denotes some outcome for county c located in state s and part of county pair p in quarter t. The variable $Log(MinWage)_{st}$ is the log state-level minimum wage, and the coefficient of interest is β_1, which we interpret as the change in a given outcome for a 10% increase in the minimum wage. The vector X'_{st} represents controls for the log county population and total employment. The model includes a set of county fixed effects, ξ_c, which accounts for all time-invariant characteristics across counties that are correlated with differences in the minimum wage. Importantly, the model also includes a set of county-pair fixed effects interacted with time fixed effects, $\eta_p \times \zeta_t$. The interaction absorbs all unobserved time-varying shocks that are specific to a given county-pair, and its inclusion in the model ensures that the coefficient β_1 is identified only by contiguous-county comparisons of cross-state minimum wage differences.[26] The standard errors in this model are two-way clustered at the state and border segment levels.

[25] To further test for cross-border spillovers, we use the QWI data to estimate models that include only interior counties.

[26] Implicit in this statement is that only the contiguous county-pairs with exposure to different minimum wage amounts are used to generate the estimates.

We supplement the county border analysis with a standard TWFE design that takes advantage of minimum wage changes in all geographic units. We do so for both practical and theoretical reasons. First, practically,some of our datasets do not include information on county identifiers, precluding us from implementing the contiguous county border methodology. For example, the CCDF administrative data on subsidy participants are reported at the state-level, and the ECLS-B data on teacher quality contain only state identifiers. Second, because the standard TWFE design relies on a different set of counties and identifying assumptions (relative to the county border methodology), the credibility of our results increases if they are robust to multiple empirical strategies. Our TWFE model takes the general form:

$$Y_{ist} = \alpha + \beta_1 Log(MinWage)_{st} + \theta X_{st}^{'} + \xi_s + \zeta_t + \varepsilon_{ist}, \tag{2}$$

where Y_{ist}, $Log(MinWage)_{st}$, and $X_{st}^{'}$ are defined in the same manner as above with time t now defined at the annual level. The subscript i on the outcome applies only to the datasets that are organized at the individual level (e.g., CPS, ACS, and the ECLS-B); all other data sets are aggregated to the state- or county-level. For the aggregated data, the subscript s on the outcome refers to the state or county. All analyses using the ECLS-B control for caregivers' gender, age, race/ethnicity, education level, self-reported health status, self-reported smoker status, number of years of child care work experience, whether the spoken language is non-English (when caring for children), and provider-type fixed effects. The ξ_s and ζ_t denote a set of geographic (state or county) and time fixed effects, respectively. As an additional robustness check, in some analyses, following Allegretto et al. (2011), we replace the time fixed effects with Census division by time fixed effects, which account for any region-specific time-varying unobservables that are correlated with the outcomes. Conceptually, these fixed effects are equivalent to the border-pair interactions included in the previous model and are intended to restrict comparisons to (potentially) more similar geographic areas. The standard errors are clustered at the state level.

For the analysis of Yelp's consumer reviews, we are able to exploit the fact that child care businesses received multiple reviews during the study period. Therefore, we relate state-level changes in minimum wage laws to within-firm changes in Yelp reviews. Conceptually, we compare a firm's average rating when the state's minimum wage is relatively low to the same firm's average rating when the minimum wage is higher. The estimated model takes the following form:

$$Y_{ist} = \alpha + \beta_1 Log(MinWage)_{st} + \theta X_{ist}^{'} + \xi_i + \eta_m + \zeta_y + \varepsilon_{ist}, \quad (3)$$

where Y_{ist} and $Log(MinWage)_{st}$ are defined in the same manner as above. Here the subscript i denotes a given Yelp review. The $X_{ist}^{'}$ is a set of controls for reviewer characteristics, including a quadratic in friend count, quadratic in review count, whether the reviewer has a profile picture, whether the reviewer attached any photos to the review, whether any individual rated the review as "useful," whether the review contains formal language or slang words, and whether the review contains swear words. The ξ_i denotes a set of firm fixed effects, while the η_m and ζ_y denote calendar month and year fixed effects, respectively. Standard errors are clustered at the firm level.

Given that we rely on several data sources, each one covering a different time period, it is important to describe the nature of the minimum wage variation in each. The QWI spans from 2001 to 2019, a period in which there were 257 minimum wage changes of at least twenty-five cents across all 51 states.[27] Of these, 191 were state-level changes in 36 states.[28] The Yelp data cover the years 2005 to 2017 for the 40 largest U.S. cities in 31 states. In these states and years, there are 118 minimum wage changes, including changes in all 31 states, as well as 83 state-only changes in 22 states. The NAEYC data span years 2011 to 2020 and include 91 minimum wage changes across 25 states, none of which are federal changes. The ECLS-B surveys span the shortest time period, 2003 to 2006, but still include numerous minimum wage changes: 118 changes across 31 states, including 83 state-level changes across 22 states. Figure C2 provides information on the years and sizes of minimum wage changes by state, and Figure C3 summarizes the states contributing variation across each dataset. To estimate changes in prices, we rely on within-state variation in minimum wages in California from 2008 to 2018, a period over which there were 22 minimum wage changes across seven counties. Figure C4 provides the time series of these changes.

To provide reassurance that our results are driven by changes to the minimum wage rather than pre-existing trends, we perform an event study analysis whenever the data permit it. Due to the staggered treatment timing, we also test robustness to using methods that provide unbiased estimates in that context. We provide a high-level description of our approach here. A detailed description of the event study design can be found in Appendix B. First, the event study design is complicated by the fact that most states experience more than one minimum wage

[27] For the purposes of counting the number of minimum wage changes, we consider multi-year phase-ins as one event.

[28] The CCDF data begins one year earlier and spans 261 changes in 51 states, including 195 state-level changes in 36 states. The QCEW, which spans from 1990 to 2019, has 422 minimum wage changes in 51 states, of which 236 are state-level changes in 36 states.

event over the course of our sample, while an event study requires at most one focal event per entity. We therefore follow Lafortune et al. (2018) and duplicate the time series for a given state so that there is one copy of that state's data for each minimum wage event. Each copy is then assigned a different event as the one focal event. We use this same data for both the standard estimates and the alternative estimates. Second, an emerging literature indicates that TWFE estimates may be biased in staggered policy roll-out settings, as is the case with the minimum wage. Wrong-signed estimates can emerge when earlier-treated units have larger treatment effects than later-treated units or the effect of treatment grows over time (Baker et al., 2022).[29] These biased results emerge because standard difference-in-differences implicitly uses earlier-treated units as a control group for later-treated units. Therefore, whenever possible, in addition to the TWFE estimates, we present results from estimators designed to compare treated units only to units that are never treated or not-yet-treated. We primarily rely on the Callaway and Sant'Anna (2021) (CSA) estimator because it can use not-yet-treated units as a comparison. Most other methods require a sufficiently large never treated group for comparison, but all units are eventually treated in most of our data sets.[30]

4 Results

The discussion of our results proceeds in four steps. We first present estimates for the impact of the minimum wage on child care workers' earnings, employment, and turnover. We then examine several ways in which providers might respond to minimum wage increases, focusing on the price pass-through to consumers, changes in child enrollments and ratios, and providers' willingness to serve low-income children receiving a subsidy. Third, we examine various measures of child care service quality, teachers' skill investments, and teachers' job performance. In the final set of analyses, we provide evidence on consumers' satisfaction with their child care provider, as measured by their Yelp reviews.

4.1 Earnings and Employment

The results presented in Table 1 confirm that minimum wage increases are binding in the child care sector. Panel A presents results on the effect of the minimum wage on the monthly earnings of new hires overall and by

[29] Under the assumption that states that increase their minimum wages earlier are likely to see smaller effects than those that increase the minimum wage later, estimates may be too small in absolute value but not wrong-signed.

[30] These alternative difference-in-differences estimators, including CSA, are much more computationally expensive than standard TWFE estimators and are often underpowered for difference-in-differences with state panel data (Weiss, 2024). For the CCDF outcomes, CSA produces confidence intervals too wide to be informative, so we omit those results from the figure (results available upon request). All other event study figures include an alternative estimator.

education level estimated using a state-level two-way fixed effects design, Panel B adds Census Division-by-year fixed effects, and Panel C estimates the model using the border county discontinuity strategy. Education level is only available for workers age 25 and older, so there is an additional category for workers who are younger than 25 years old. A 10% increase in the minimum wage is associated with a statistically-significant 0.7% to 1.3% increase in monthly earnings for center-based workers depending on the specification [column (1)]. The increase in earnings is largest for the groups for whom the minimum wage is likely most binding: young employees, who have the least experience, and employees with less formal education. New hire child care employees under the age of 25 experience a 1.5% to 2.5% increase in earnings [column (2)], and those without a high school diploma experience a 0.9% to 1.7% increase in earnings for a 10% increase in the minimum wage [column (3)], with all six estimates statistically significant at the 1% level. However, child care workers throughout the education and experience distribution see an increase in earnings, including those with some college education [column (5)] in two of the three specifications. The point estimates for new employees with a college degree are much smaller and not statistically significant. Event study estimates in Figure C6 show that these wage increases are not driven by differential pre-trends.

In Appendix Table C1, we test whether there is an effect on overall monthly earnings, as opposed to new hires' earnings. Across all three specifications, the minimum wage is associated with increased earnings for child care workers under the age of 25. In the county border specification, the minimum wage increases are binding across employees of all education levels, whereas the two-way fixed effects specifications generate smaller point estimates. Average monthly earnings are lower in the county border sample, suggesting that more workers in those counties may have wages at or near the minimum wage, potentially explaining why the minimum wage is more binding in this specification.

The results for monthly earnings can be explained by an increase in wages and/or hours of work. In Appendix Table C2, we use the ACS to confirm that the hourly wages of center-based workers increase as a result of minimum wage increases. We find that hourly wages for center-based teachers increase by about 1% for a 10% increase in the minimum wage. There is no detectable change in the usual number of hours worked per week, but the point estimate is positive and increases in annual earnings exceed increases in hourly wages, suggesting a small increase in hours.[31] These surveys also allow us to look at other child care sectors. Estimated changes in hourly wages

[31]The increase in hours is consistent with later results indicating an increase in enrollment. Centers typically send teachers home as the number of children dwindles at the end of the day. If enrollment is higher, then the average number of children still in care at the end of the day increases, requiring staff to stay longer on average.

and annual earnings are negative but mostly not statistically significant for the home-based and private household sectors. The exception is a marginally significant 1.9% decline in hourly wages for private household workers, which may indicate a change in composition as the most qualified workers may switch sectors as wages increase in the center-based sector. Regressions indicate no change in usual hours of work per week for home-based workers but an increase for private household workers. This increase would be consistent with families relying more on informal care, possibly in response to price increases in the formal sector.

Table 2 estimates the effect of the minimum wage on employment in the center-based sector. Most of the point estimates are positive and not statistically significant throughout the education distribution, despite the bindingness of the minimum wage. In the two-way fixed effect specification (Panel A), we estimate that a 10% increase in the minimum wage is associated with a 1% increase in beginning-of-quarter employment, which is statistically significant at the 10% level. Estimates in the other two specifications are not statistically significant. Event study estimates in Figure C7 show that the (mostly) null effects on employment are not driven by differential pre-trends.

The positive point estimates on employment for center-based workers are confirmed in the CPS and ACS, as shown in Appendix Table C3, where the outcome variable is a binary indicator for employment in the center-based sector. The estimates are similar to the ACS, with a 10% increase in the minimum wage associated with a 1.6% increase in center-based employment.[32] Point estimates for the CPS are of a similar magnitude but are not statistically significant given the larger standard errors due to the smaller sample. These surveys allow us to estimate the effect on employment in the home-based and private household sectors as well, and we see no detectable effects on employment in those sectors. Finally, using the Quarterly Census of Employment and Wages (QCEW), we also see no detectable effects of the minimum wage on the number of center-based establishments, as shown in Appendix Table C4. These null effects are found in models using the standard TWFE design [column (1)], TWFE with division-by-year effects [column (2)], and the contiguous county border design [column (3)].

Table 3 estimates the effect of the minimum wage on turnover within the child care industry. Turnover is defined as one-half new hires plus separations divided by total employment.[33] Our results suggest that minimum

[32]The ACS point estimates give a change in the probability that a woman is employed in the sector. We find that a 10% increase in the minimum wage is associated with a 0.02 percentage point increase in the probability of working in the center-based sector, from a base of 1.3%, or a 1.6% increase in the probability of employment in the center-based sector.

[33]We created this turnover rate variable because we want to estimate the effect of the minimum wage in this quarter on employee churn in this quarter. The QWI-provided turnover rate is calculated as one-half new hires from *last quarter* plus separations from *next*

wage reforms generally have a stabilizing effect on the child care workforce. In the county border specification (Panel C), we find that minimum wage increases are associated with reductions in staff turnover throughout the experience and education distribution. Overall, we estimate a 1.1% reduction in turnover for a 10% increase in the minimum wage on a base quarterly turnover rate of 15% [column (1)]. The reduction in turnover is larger for workers under the age of 25, who were previously shown to be most bound by the minimum wage. For these workers, a 10% increase in the minimum wage is associated with a 1.8% decrease in turnover on a base quarterly turnover rate of 23% [column (2)]. In the two-way fixed effects specification (Panel A), we estimate that a 10% increase in the minimum wage is associated with a 1.3% decline in turnover for child care workers under the age of 25. Estimates for other workers are smaller and not statistically significant, and estimates become more attenuated with the addition of Census division-by-year fixed effects (Panel B). Event study estimates in Figure C8 show that the estimated changes are not driven by differential pre-trends.

Finally, for all three outcomes (new hire earnings, beginning-of-quarter employment, and turnover), we estimate county-level TWFE models that include only interior counties to test whether the results are driven by cross-border spillovers. The results, which can be found in Table C5, are qualitatively similar to the statewide TWFE estimates, although the estimated increases in employment are now statistically significant for most groups.

4.2 Firm-Level Adjustments

The results presented above suggest that workers employed in center-based child care settings experience an increase in earnings following an increase in the minimum wage. It is therefore important to examine the ways in which providers respond to the increased labor costs. The results presented in Tables 4 and 5 examine two key revenue sources: market prices charged to families and whether providers accept children using CCDF vouchers. The decision to accept subsidized children is an important margin to study because low-income families rely on these subsidies to defray the cost of child care. Such expenses are an important obstacle to low-income families' employment (e.g., Tekin, 2007), while the receipt of a CCDF subsidy is shown to increase the likelihood of employment and human capital investments (e.g., Herbst and Tekin, 2011, 2016). Despite the CCDF's importance, the reimbursements paid to providers for serving subsidized children are typically far less than the market price and do not cover the cost of providing high-quality services (Workman, 2018). Thus, there are reasons to believe that

quarter divided by employment.

some providers may opt out of the CCDF if their operating costs increase.

Table 4 estimates the price pass-through of the minimum wage to consumers using California's market rate surveys along with a county-level two-way fixed effects design. We find that for children under age two, a 10% increase in the minimum wage is associated with a 4.2% increase in median center-based market prices. For children ages 24 to 47 months, a 10% increase in the minimum wage is associated with an 8.0% increase in prices. We uncover similar evidence of price pass-through in the home-based sector in California: for home-based providers, a 10% increase in the minimum wage is associated with a 4.7% increase in the market price for children under age two and a 5.0% increase for two- to four-year-olds. As noted earlier, given the dramatically different methodologies for collecting market rate data and data quality across the states, our main analyses rely on local minimum wage changes and price data from one state. For estimates using market rate surveys from all states, see Appendix Table C6. For center-based care, the results are quantitatively similar at younger ages but smaller and no longer statistically significant at older ages. For home-based care, the point estimates are smaller and not statistically significant.

Because the first minimum wage changes in California occurred in 2015, there are several years where market rate survey data are available before any local minimum wage increases. There are also a number of counties that never have local minimum wages during our sample period. Thus, it is possible to conduct a clean event-study analysis of child care prices using the California data. This analysis confirms that pre-period coefficients are not statistically different from zero, and the price increases occur only after the minimum wage increases, as shown in Figure C5. Such results support the appropriateness of our identification strategy.

Table 5 presents estimates of the effect of minimum wage changes on child and provider participation in the CCDF using a state-level two-way fixed effects design. There is no detectable effect on the number of children or providers within the CCDF system. However, we find evidence of a shift in the provider-types participating in the program. Specifically, a 10% increase in the minimum wage is associated with a 12% reduction in the number of unique center-based provider-recipients, along with a 28% increase in the number of home-based provider-recipients of CCDF funds. The remaining rows in Table 5 show how the composition of provider-recipients changes by calculating the share of CCDF recipients that are of a particular provider-type. Similar results emerge. For example, we find that a 10% increase in the minimum wage is associated with a 2.2 percentage point decrease in

the share of CCDF providers that are center-based facilities. Together, these patterns suggest that higher labor costs lead some center-based providers to stop accepting children using CCDF vouchers, which typically pay less than what providers would receive for a private-pay family. Families then shift to using their CCDF vouchers for home-based providers, which are less exposed to minimum wage changes.

Event study estimates in Figure C9 confirm that the reduction in the number of center-based providers is not driven by differential pre-trends. However, the event study figures suggest null or negative effects on the number of home-based providers, in contrast to the increases seen in the main specification. Additional analysis reveals that the change is due to replacing the continuous treatment with the dichotomous treatment necessary for the event study (results available upon request). Given the sensitivity of the home-based provider estimates to the choice of specification, they should be interpreted more cautiously.

4.3 Service Quality and Teacher Productivity

The next set of results examines changes in quality at the facility and teacher levels. We begin with the results presented in Table 6, which estimates the impact of minimum wage reforms on NAEYC accreditation rates. Irrespective of the methodological approach (i.e., county border or state two-fixed effects) or the way local NAEYC density is measured, we find no detectable effects on the number of center-based child care providers that are accredited. As an additional check on these results, Table 7 uses the ECLS-B's provider survey to examine the likelihood of obtaining *any* quality accreditation. Again, we find little change in the share of accredited providers. However, we uncover evidence that child care services—in addition to raising prices and serving fewer subsidized children—make some cost-saving adjustments that may have implications for quality. As shown in Table 7, we find that total enrollments increase by 5.6% and child-to-teacher ratios increase by 4.7% for a 10% increase in the minimum wage. These results, together with those presented in Table 2, suggest that the increase in ratios is driven entirely by the decision of child care providers to increase child enrollments, rather than by reducing the number of teachers, although this is speculative.[34]

In Table 8, we examine the effect of the minimum wage on teacher-level proxies of quality and productivity,

[34] Although child-to-teacher ratios are regulated by state licensing laws, in practice providers may operate below the required ratios either voluntarily or involuntarily. Providers who chose to have fewer children per teacher prior to a minimum wage increase may decide to increase enrollment, reducing product quality for parents and job quality for teachers. The increase in teacher earnings from a minimum wage increase may compensate teachers for this decrease in job quality. Providers may involuntarily operate below required ratios due to vacancies. Minimum wage increases and higher provider prices increase the opportunity cost of a vacancy, so providers may become more aggressive about filling vacancies, such as via increased advertising.

controlling for state and time fixed effects. We begin in Panel A, which shows various measures of teacher skill investments. Generally speaking, our results suggest that minimum wage reforms are associated with improved teacher training on average, either through up-skilling or a change in the composition of the workforce. A 10% increase in the minimum wage is associated with an increase in the probability that a teacher completed an early childhood education (ECE) certification by 2 percentage points [column (2)], any ECE college coursework by 4 percentage points [column (3)], and any child care-related coursework by 2 percentage points [column (4)]. Panel B explores the frequency with which teachers engage in a variety of education-related activities with children. Again, we find that higher minimum wages increase teachers' engagement with these activities. A 10% increase in the minimum wage is associated with a 2.5% increase in the number of times teachers read with children [column (1)], a 2.9% increase in the number of times teachers build things with children [column (4)], and a 1.3% increase in the number of activities teaching math and other conceptual skills [column (5)]. There are no detectable effects on singing or playing games, although the point estimates are positive.

In the final set of results, shown in Panel C, we study domain-specific Arnett CIS scores [columns (1) through (4)] as well as the total Arnett score [column (5)] measuring the nature of teacher-child interactions. Looking at the total score, we find that minimum wage increases improve teachers' interaction with children. The point estimate implies that raising the minimum wage by 10% increases teachers' total Arnett score by 2.4%, or about 0.1 standard deviations. A back-of-the-envelope calculation implies that the change in real minimum wages from 2005 to 2019 could increase Arnett scores by one-fifth of a standard deviation. This effect is approximately equivalent to the estimated increase in scores from moving from a typical child care teacher with at most a high school degree to one with at least some college education. Although most of the individual components for the score are not statistically significant, the coefficients imply improvements of 1.5% to 3.1%.[35]

4.4 Consumer Satisfaction

The results discussed above suggest that increases in the minimum wage induce child care providers to increase market prices and ratios while also improving teachers' job performance and human capital. These changes may have implications for consumer satisfaction (albeit in different ways) depending on parents' perceptions of care quality and their relative preferences for lower-cost versus lower-quality services. On the one hand, the increase in

[35] Event study analyses are not possible when using the ECLS-B data because the limited timeframe of the data (2003-2006) does not provide adequate pre- and post-reform periods.

teacher quality could generate an improvement in consumer satisfaction. However, if consumers care more about the cost of child care or observed ratios, the increase in prices and ratios might reduce satisfaction. Combining data on Yelp consumer reviews with a model controlling for firm and time fixed effects, we show in Table 9 that an increase in the minimum wage reduces consumers' satisfaction with their child care provider. Indeed, the estimates imply that raising the minimum wage by 10% is associated with a *within-center* 0.031-point decrease in the average Yelp rating on a five-point scale [Panel A, column (1)], and a 1.4 percentage point decrease in the probability of giving the highest possible rating [Panel B, column (1)]. As shown in columns (2) and (3), such declines persist across providers located in lower- and higher-income communities.

To shed light on whether the increase in market prices may be responsible for the reduction in consumer satisfaction, we examine whether parents are more likely to discuss cost-related topics in the open-ended Yelp reviews. We find that such comments are more common following a change to minimum wage law. As shown in Panel C, column (1), a 10% increase in the minimum wage is associated with a within-center 1.5 percentage point increase in the probability that consumers discuss prices in the review. Columns (2) and (3) again reveal the symmetry across those in lower- and higher-income communities: the salience of cost-related topics increases for both groups following an increase in the minimum wage. Panel D examines whether there is a change in the probability that a review discusses the provider's learning environment. We find no change in the probability a review discusses the learning environment, suggesting that the decline in consumer satisfaction is not driven by perceived changes in quality but rather by an increase in prices.[36]

5 Discussion and Interpretation

Our analysis has uncovered four main findings. First, although the minimum wage is binding in the child care sector, there is no discernible effect on employment. Second, child care providers instead respond to the minimum wage by making changes to increase revenue: increasing prices, enrollment, and child-to-teacher ratios and sometimes no longer accepting child care vouchers. Third, higher minimum wages may be associated with higher-quality care due to lower staff turnover, an increase in the likelihood that teachers have taken ECE coursework, and improved teacher-child interactions. Finally, although most measures point to increases in quality, parents'

[36] Given that previous analyses showed that minimum wage increases lead to increases in child-staff ratios—which might also reduce consumer satisfaction—we examine whether parents are more likely to discuss topics related to classroom group sizes or ratios. Again, we find no such evidence, suggesting that the increase in prices is the most likely candidate for the reduction in satisfaction.

satisfaction with their provider is lower, likely driven by increased prices. In this section, we briefly contextualize the results and discuss potential mechanisms for our findings and implications for policy.

5.1 Contextualizing the Magnitude of the Price Elasticities

Using child care price data from California, we find a price elasticity of 0.42 with respect to the minimum wage for center-based providers serving children under 24 months of age (Table 4, Column (1)). The estimated elasticity for those ages 24 to 47 months is larger at 0.81 (Column (2)). Estimates using national data from the NDCP range from 0.16 to 0.57 depending on the age of child served (Table C6). A strong price response may be expected given that child care is a locally provided service with limited substitution options (Link, 2024), and previous research finds that child care tax credits are largely absorbed by providers, suggesting a low price elasticity of demand (Rodgers, 2018). To put our estimates in context, Ashenfelter and Jurajda (2022) estimate a price elasticity of McDonald's Big Macs with respect to the minimum wage of 0.14. While the fast food and child care industries have large shares of workers bound by the minimum wage, one important difference is the substantially higher labor share within child care, at 70% compared to 30% in fast food restaurants (Ashenfelter and Jurajda, 2022; Helburn and Howes, 1996).[37] Accounting for the difference in labor shares implies a child care price elasticity of 0.33, which is within the range of our estimates. The high labor share can lead to a higher price elasticity with respect to the minimum wage.[38]

Another way to contextualize the magnitude of our price estimates is to calculate the fraction of the rise in families' child care expenses over the past decade that is explained by increases in the minimum wage. Herbst (2023) estimates that in 2019 dollars, median hourly child care expenses rose from $4.18 per hour in 2005 to $5.96 in 2019, a real increase of 43%. The population-weighted minimum wage increased by 20% in real dollars during that time. Applying the price elasticity of 0.42, we estimate that 20% of the increase in families' child care expenses over the past decade is due to increases in the minimum wage.

[37] Although the restaurant and child care industries overall have similar fractions of workers bound by the minimum wage, the fast food industry may be lower-paying than the restaurant industry as a whole. Ashenfelter and Jurajda (2022) find a wage elasticity with respect to the minimum wage of 0.70 for McDonald's workers, compared to the 0.13 that we estimate for child care workers.

[38] There is also evidence that labor shares are higher for lower-priced centers as compared to higher-priced centers (Borowsky et al., 2022), so another explanation for the high elasticities may be that the median price elasticity is higher than the mean price elasticity. In addition, as noted above, the minimum wage can increase the demand for child care if more parents enter the labor force (Godøy et al., 2021), thus providing another explanation for an increase in prices.

5.2 Interpretation and Reconciliation of Results

We have presented a number of results from different data sets to comprehensively examine how providers respond to changes in the minimum wage. Here we discuss how some of these findings relate to each other and attempt to reconcile some seemingly incongruous results. Specifically, we discuss the finding that both child care prices and enrollments increase as well as what the wage and price elasticities indicate about the magnitude of the minimum wage's pass-through to consumers.

Given that median prices increase, with downward-sloping demand, we might have expected enrollment to decrease, but we find suggestive evidence that provider-level enrollments and child-to-staff ratios increase. Although speculative, we offer a few explanations for why prices and enrollments might increase. First, an increase in the minimum wage may shift the demand curve for care, leading to increases in both prices and quantity. One in ten mothers of young children (and 16% of those who are employed) earn wages low enough to be directly affected by an increase in the minimum wage.[39] In addition, a shift in the demand curve would be consistent with Godøy et al. (2021), who find that minimum wage increases lead to increases in employment and the use of formal child care among low income single mothers. The authors find that a 10% increase in the minimum wage associated with a 20% increase in the probability of using formal child care, with no detectable effects on formal care use for children of married parents, suggesting an overall increase in the demand for formal care. Second, many providers operate waitlists. Non-profit providers in particular may not charge profit-maximizing prices and therefore may have the ability to increase both enrollments and prices due to excess demand at previous prices. This explanation is consistent with other literature observing firms responding to increases in costs or decreases in revenue in non-canonical ways when they have other goals in their objective function beyond profit maximization (He and Mellor 2012; White and Wu 2014; Kim et al. 2025). Third, the reduction in teacher turnover (along with other improvements in quality) may have led to reductions in child turnover, reducing vacancies and increasing average enrollment. This is analogous to the idea that, due to search frictions, reductions in employee turnover due to the minimum wage can increase employment (Gittings and Schmutte, 2016). Fourth, providers may have chosen to increase advertising in order to increase enrollment and revenue in light of the cost increases. Finally, it is

[39] Statistic is based on authors' calculations of the fraction of mothers of children under the age of 5 who earn within 10% of the state minimum wage in the CPS pooled across years 2015-2019.

important to keep in mind that price and enrollment increases may be distinct different levers for responding to cost increases, and individual child care providers may be doing one or the other.

Also of interest is the degree of pass-through from the minimum wage. Calculating the pass-through requires price and payroll elasticities with respect to the minimum wage along with the labor share. We estimate both elasticities in the paper, although note that they are not fully comparable because the price elasticity is at the median, while the payroll elasticity is at the mean. The 95% confidence intervals suggest price elasticities of 0.30 to 0.53 for children younger than 24 months and of 0.39 to 0.99 for children between 24 and 48 months (Table 4). Estimates of the payroll elasticity suggest an upper bound of 0.43 at the 95% level (Table C7).[40] The labor share in child care is about 70% (Helburn and Howes, 1996), suggesting a total cost elasticity with respect to the minimum wage of up to 0.30 for the mean provider.[41] Given the lower bound estimate of the price elasticity of 0.30, our results are consistent with at least a full pass-through of labor costs. The low profit margins for many child care businesses means that they may be required to pass along the full increase in labor costs in order to remain viable (U.S. Department of the Treasury, 2021). In addition, child care centers do have some local market power, both because of parents' preferences for proximity (Brown 2018; Bodéré 2023) and the well-known barriers to entry (e.g., space requirements, licensing, and regulations). Given the potential increased demand from a minimum wage-induced rise in parental labor force participation (Godøy et al., 2021), it is also possible that the high estimated pass-through is partially due to centers increasing their profit margins.

5.3 Mechanisms for Effects on Employment and Quality

We find that, as expected, the minimum wage binds in the child care market: a 10% increase in the minimum wage is associated with a 0.7% to 1.3% increase in monthly earnings for new employees. Given downward-sloping labor demand curves, we might expect to see declines in employment. However, if anything, there is an increase in employment in the child care sector as the minimum wage increases. This is consistent with previous research that has found little to no employment responses to the minimum wage even in industries where the minimum wage binds (Card and Krueger 1994; Dube et al. 2010; Cengiz et al. 2019; Ruffini 2022).

[40] Estimates of the payroll elasticity are somewhat higher than the wage elasticity (Tables 1, C1, and C2) given the positive point estimates on the employment elasticity, likely driven by a reduction in vacancies due to the reduction in turnover.

[41] The cost elasticity at the mean provider is likely an underestimate for the elasticity at the median provider for two reasons. First, the labor share is likely to be higher at providers charging the median price given evidence that the labor share is higher among lower-priced providers as compared to higher-priced providers (Borowsky et al., 2022). Second, given the skewness in the wage distribution, the median provider likely has an above-mean fraction payroll attributable to low-wage workers and therefore a higher payroll elasticity.

There are likely several forces at work. First, turnover is high in the child care sector, with estimates of one in eight teachers leaving in a given quarter and one in three leaving in a given year, and we find that minimum wage increases significantly reduce turnover rates (Brown and Herbst, 2022; Bassok et al., 2021b). Reductions in turnover may result in fewer open positions, thereby increasing point-in-time employment. This is consistent with models that allow for search frictions in the labor market, which find that higher minimum wages can improve recruitment and retention, reduce vacancy rates, and lower turnover-related costs (Schmitt 2013; Dube et al. 2016). Second, single mothers increase their labor force participation when the minimum wage is raised, which may increase the demand for child care, leading to an increase in employment in the sector (Godøy et al., 2021). Third, the child care industry is heavily regulated and must comply with child-to-staff ratio requirements. Nearly all states verify compliance with child care regulations, including ratios, through unannounced annual inspections, with some states publicly posting violations (Office of Child Care, 2014). For providers that remain open, this may leave little room to adjust employment in response to minimum wage changes and remain in compliance with state regulations. Given these constraints, it is perhaps not surprising that providers adjust by increasing revenue through higher prices, accepting fewer child care vouchers, and increasing enrollments.

We also find that higher minimum wages are associated with improvements in teachers' formal ECE training, in the number of learning-related activities they perform with children, and in their Arnett scores, a scale measuring teacher-child interactions. There are two possible mechanisms: a change in the composition of child care teachers or the upskilling of existing teachers (or a combination). Although we are not able to distinguish between these two mechanisms, given the reduction in turnover, it seems possible that higher wages allow individuals to remain in child care positions when they otherwise may have left for higher-paying positions in other sectors. Another piece of evidence in favor of this explanation is our finding that higher minimum wages are associated with an increased probability that teachers enroll in ECE courses: a 10% increase in the minimum wage is associated with a 0.4 percentage point (or 8%) increase in the probability of having taken any ECE college coursework. Higher wages may allow individuals who are better matched to and more interested in caregiver roles to remain in the child care sector. Because they are better matched, their productivity is higher, as shown by spending more time in educational activities and having better interactions with children. In addition, low wages can cause financial stress, which may affect job performance and teachers' interactions with children (Meuris and Leana, 2015). Indeed, one

recent study finds that increased compensation reduces child care teachers' stress (Bassok et al., 2021a), and this stress reduction may have positive spillovers for the children in their care. It is interesting that these improvements in teacher-child interactions occur *despite* increases in the average number of children per teacher. That interaction quality increased, not decreased, suggests that the positive effects of higher wages on teacher composition and/or disposition outweigh any negative effects from higher ratios, although this is speculative.

5.4 Mechanisms for Changes in Child Care Subsidy Receipt

We find that a 10% increase in the minimum wage is associated with a 12% decrease in the number of center-based providers and a suggestive 28% increase in the number of home-based providers receiving CCDF-funded child care subsidies. These changes could be due to centers' unwillingness to accept vouchers or to parents shifting from center- to home-based care. Providers have both revenue-enhancing and cost-saving motives for not accepting vouchers. On the revenue side, the CCDF offers reimbursements to providers capped at the lesser of the private-pay tuition and the maximum reimbursement amount. The maximum reimbursement amount is typically less than what they would have received from a private-pay family (Slicker and Hustedt, 2022). In addition, unlike private-pay families, the CCDF pays based on attendance—not enrollment—so, for example, providers are not paid for days when subsidized children are out sick. Thirty-seven states allow providers to charge parents the difference between the voucher and the private-pay rate (Schulman, 2019), although it is unclear how common it is for centers to do so given that providers in those states still cite the lower reimbursement rates as a reason for not accepting subsidized children (Rohacek and Adams, 2017). But if increased labor costs from the minimum wage lead providers to charge subsidized families the tuition balance or increase market prices, it could induce families to shift away from center-based care.[42] Furthermore, many families using a subsidy are required to contribute a co-payment, and some providers report challenges with collecting those payments. Such challenges reduce revenue if the family does not pay and may lead to substantial administrative and time costs from attempting to collect the money (Rohacek and Adams, 2017). Finally, providers report that navigating the subsidy system is administratively burdensome, so no longer accepting vouchers may be one way to reduce costs elsewhere when faced with rising labor costs (Slicker and Hustedt, 2022).

A reduction in the availability or accessibility of center-based providers (who become less likely to accept

[42]Note that our data includes the number of centers serving at least one child using vouchers, so all children using vouchers would need to leave a center in order for it to no longer be included in the count.

vouchers) presents several challenges for low-income families. First, such families may have to choose a less-preferred child care arrangement if their preferred option is no longer available because it does not accept vouchers. In addition, center-based care is rated to be of higher quality than home-based care, on average (Bassok et al., 2016). Therefore, a shift from center- to home-based settings likely means that disadvantaged children receive less exposure to high-quality care environments. High-quality care is important for child development (Barr and Gibbs, 2022), and lower-quality care can have negative effects that reach into adulthood (Baker et al., 2019). The reduction in the number of center-based providers receiving CCDF-funded subsidies is particularly concerning in light of the decline in the number of providers participating in the subsidy system in recent years. From 2010 to 2019, the number of participating center-based providers declined by over 20%, from 92,980 to 71,490. Our estimates imply that minimum wage increases over this period account for 27% of this decline.

5.5 Implications for Policy

Our findings are relevant for a number of recently proposed or implemented policies affecting the wages of child care workers. Most directly, they speak to the potential implications of the "Fight for $15" movement, which advocates for raising the minimum wage to $15 per hour for all workers. Our paper is highly relevant to such a policy, and we expect that many of our key findings would materialize—including the increase in teacher wages and market prices, the reduction in turnover, and the improvement in service quality—if it were to be implemented. However, there are other policies, such as those stemming from states' experimentation in the child care sector using funds from the American Rescue Plan Act of 2021 (ARPA), that might cause only a subset of these effects to occur.

One program within ARPA is the Child Care Stabilization Program, which aims to provide financial assistance and support to the child care sector in the wake of the Covid-19 pandemic. By providing much-needed financial stability, the Child Care Stabilization Program seeks to increase the resilience of the child care industry while facilitating greater access to affordable, high-quality child care. The program offers grants to child care providers to help maintain their operations, and the funds can be used for a variety of purposes, including personnel wages or bonuses, rent or mortgage payments, utilities, and cleaning and sanitation supplies. Several states are using these funds to provide stipends or bonuses to child care providers. Our paper can speak to some possible effects of raising teacher compensation, although we would not expect the effects to be identical because the money for the

additional compensation is coming from the government instead of child care providers.

Our results suggest that there are two main effects of the minimum wage on the child care market: higher wages may affect the composition and productivity of employees, and higher labor costs may lead centers to find ways to increase revenue or decrease costs in other areas. Policies like the ARPA Stabilization grants that increase compensation for child care workers with government funds would only affect the composition and productivity of employees without putting cost pressure on firms. Separating the effects into those due to employees' (or potential employees') responses to the minimum wage and into firms' responses is speculative as we do not have direct evidence on the drivers behind each result, but many results can logically be attributed to one or the other. Higher wages may allow teachers to stay in child care if they desire, reducing turnover and improving the match between the employee and the firm. Given that minimum wage reforms may increase wages at teachers' potential outside employment options, our estimates on the reduction in turnover and the increase in child care quality should be interpreted as a lower bound for what might be expected if wages increased only in the child care sector. As long as wage enhancements or bonuses are fully funded, as is the case with ARPA, we would not expect centers to experience increased cost pressure. Given that such pressure is the likely driver behind the increase in market prices, enrollment, and ratios and the decrease in subsidy participation, we would not expect these outcomes to be affected. In addition, since higher market prices are likely responsible for the decline in consumer satisfaction, we would also not expect to see a reduction in Yelp ratings as long as teacher compensation programs are fully funded.

6 Conclusion

In this paper, we find that increases in the minimum wage have important implications for service quality within the child care market. These findings underline the usefulness of investigating effects of the minimum wage that go beyond the employment margin. The implications of our findings for child care quality are complex: while lower turnover, increased teacher credentials, and improved teacher-child interactions might improve quality, increases in the number of children per teacher may have the opposite effect. Furthermore, parental satisfaction with care depends not only on its quality but also its perceived value, and we find that satisfaction declines, likely driven by the increase in prices.

Our paper contributes to a small but growing minimum wage literature that examines firms outside the fast food and restaurant industries and that assesses outcomes related to service quality and consumer well-being. In

particular, our paper complements recent work by Giupponi and Machin (2018) and Ruffini (2022), who study these outcomes in the nursing care sector. Although some previous papers examine the price pass-through of minimum wage increases (e.g., Aaronson et al., 2008; Allegretto and Reich, 2018; Ashenfelter and Jurajda, 2022; Renkin et al., 2022), we extend this literature by studying a variety of other strategies firms use to adjust to the increase in labor costs. Finally, our work is relevant to a set of papers studying the impact of minimum wage reforms on parental labor supply (Godøy et al., 2021) and time investments in children (Gearhart et al., 2022). This work finds that raising the minimum wage increases the employment of parents with children ages 0 to 5, while also increasing the amount of time parents spend in enriching activities with children. However, other work shows that increases in the minimum wage reduce children's test scores (Regmi, 2020). Our paper, which shows potentially conflicting effects on non-parental care quality as well as a possible shift among subsidized families away from the center-based sector, may shed light on these test score results.

Based on the discussion above, there are multiple avenues for future work to explore. First, it seems important to study the impact of minimum wage reforms on the demand for child care, the time spent in care, and families' care expenses. Assuming that a more generous minimum wage represents a positive income shock and that child care is a normal good, one might expect the demand for non-parental care services to increase, and that those already consuming such services to purchase more or to consume different service-types. Along these lines, a second avenue for future work is to understand how minimum wage increases affect the demand for child care quality. If quality is a normal good, the demand for higher-quality services is expected to increase. However, our results—which show a reduction in consumer satisfaction—indicate that any price increases that accompany a minimum wage expansion might instead induce families to shift into lower-quality care.

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Table 1: Effect of Minimum Wage on Log of Monthly Earnings of New Hires

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Two-Way Fixed Effects						
Log(Min. Wage)	0.104***	0.195***	0.117***	0.088***	0.076***	0.022
	(0.018)	(0.036)	(0.016)	(0.023)	(0.020)	(0.031)
Dep. Var. Mean	7.11	6.89	7.14	7.17	7.22	7.35
Mean Level	1,161	945	1,217	1,246	1,314	1,474
Level of Data	State	State	State	State	State	State
N	3,661	3,661	3,661	3,661	3,661	3,661
Panel B: Add Census Division-by-Year Fixed Effects						
Log(Min. Wage)	0.073**	0.150***	0.091***	0.058	0.030	-0.006
	(0.034)	(0.041)	(0.033)	(0.035)	(0.031)	(0.045)
Dep. Var. Mean	7.11	6.89	7.14	7.17	7.22	7.35
Mean Level	1,161	945	1,217	1,246	1,314	1,474
Level of Data	State	State	State	State	State	State
N	3,654	3,654	3,654	3,654	3,654	3,654
Panel C: County Border Design						
Log(Min. Wage)	0.126**	0.253***	0.165***	0.124**	0.106*	0.013
	(0.055)	(0.059)	(0.053)	(0.053)	(0.053)	(0.083)
Dep. Var. Mean	7.11	6.92	7.19	7.18	7.23	7.36
Mean Level	1,286	1,049	1,387	1,409	1,488	1,701
Level of Data	County	County	County	County	County	County
N	70,797	47,271	29,922	52,818	54,353	38,342

Notes: Table provides estimates from an OLS regression of the log of monthly earnings for new hires in the child care industry (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019 using three different specifications. The outcome of interest for all regressions in the log of monthly earnings for stable new hires. Panel A presents estimates using state-level data and a two-way fixed effects design, Panel B adds Census division-by-year fixed effects, and Panel C uses county-level data with a county border design, as in equation 1. All regressions include geography fixed effects (state in Panels A and B and county in Panel C), log of population, and log of employment. Panel B adds Census division-by-year fixed effects. Panel C includes county border pair by year-quarter fixed effects. Observations in Panel C are only included in the regression if there is full data availability on employment for both counties in the border pair. Full data availability is defined as no missing observations in the county from the first quarter the county is in the data set through the last quarter the county is in the data set. Note that due to data availability, we restricted to full data availability of stable employment rather than of new hire monthly earnings. Regressions are weighted by population. Standard errors in Panels A and B are clustered at the state level, and in Panel C, standard errors calculated using two-way clustering at the state and border segment levels are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Effect of Minimum Wage on Log of Beginning-of-Quarter Employment

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Two-Way Fixed Effects						
Log(Min. Wage)	0.100*	0.097	0.173	0.181***	0.093	0.032
	(0.060)	(0.068)	(0.105)	(0.062)	(0.059)	(0.055)
Dep. Var. Mean	10.09	8.574	7.820	8.537	8.797	8.306
Mean Level	15,676	3,609	1,687	3,372	4,291	2,716
N	3,752	3,752	3,752	3,752	3,752	3,752
Panel B: Add Census Division-by-Year Fixed Effects						
Log(Min. Wage)	0.008	0.015	0.031	0.051	-0.030	-0.013
	(0.073)	(0.081)	(0.138)	(0.081)	(0.077)	(0.067)
Dep. Var. Mean	10.09	8.574	7.821	8.537	8.797	8.307
Mean Level	15,676	3,609	1,687	3,372	4,291	2,716
N	3,751	3,751	3,751	3,751	3,751	3,751
Panel C: County Border Design						
Log(Min. Wage)	0.111	0.196	0.064	0.081	0.075	0.063
	(0.105)	(0.119)	(0.110)	(0.096)	(0.102)	(0.118)
Dep. Var. Mean	7.228	5.847	5.163	5.700	5.941	5.684
Mean Level	578	145	79	124	156	130
N	72,286	55,158	42,046	68,574	69,052	53,098

Notes: Table provides estimates from an OLS regression of the log of beginning-of-quarter employment for child care workers (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019 using three different specifications. The outcome of interest for all regressions in the log of beginning-of-quarter employment. Panel A presents estimates using state-level data and a two-way fixed effects design, Panel B adds Census division-by-year fixed effects, and Panel C uses county-level data with a county border design, as in equation 1. All regressions include geography fixed effects (state in Panels A and B and county in Panel C), log of population, and log of employment. Panel B adds Census division-by-year fixed effects. Panel C includes county border pair by year-quarter fixed effects. Observations in Panel C are only included in the regression if there is full data availability for both counties in the border pair. Full data availability is defined as no missing observations for that outcome in the county from the first quarter the county is in the data set through the last quarter the county is in the data set. Regressions are weighted by population. Standard errors in Panels A and B are clustered at the state level, and in Panel C, they calculated using two-way clustering at the state and border segment levels are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effect of Minimum Wage on Log of Turnover

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Two-Way Fixed Effects						
Log(Min. Wage)	-0.059	-0.127***	-0.031	-0.019	0.009	-0.007
	(0.056)	(0.046)	(0.067)	(0.056)	(0.059)	(0.059)
Dep. Var. Mean	-1.867	-1.437	-1.944	-2.063	-2.123	-2.090
Mean Level	0.17	0.25	0.16	0.13	0.13	0.13
Level of Data	State	State	State	State	State	State
N	3,676	3,676	3,676	3,676	3,676	3,676
Panel B: Add Census Division-by-Year Fixed Effects						
Log(Min. Wage)	-0.035	-0.050	-0.049	-0.037	-0.009	0.001
	(0.046)	(0.039)	(0.049)	(0.050)	(0.054)	(0.060)
Dep. Var. Mean	-1.868	-1.438	-1.944	-2.063	-2.124	-2.091
Mean Level	0.17	0.25	0.16	0.13	0.13	0.13
Level of Data	State	State	State	State	State	State
N	3,670	3,670	3,670	3,670	3,670	3,670
Panel C: County Border Design						
Log(Min. Wage)	-0.108**	-0.181***	-0.145	-0.176**	-0.154*	-0.109
	(0.051)	(0.047)	(0.088)	(0.065)	(0.082)	(0.133)
Dep. Var. Mean	-1.953	-1.515	-2.075	-2.192	-2.234	-2.226
Mean Level	0.15	0.23	0.13	0.12	0.11	0.11
Level of Data	County	County	County	County	County	County
N	32,857	18,721	8,484	13,512	14,417	11,747

Notes: Table provides estimates from an OLS regression of the log of indicated measures for child care workers (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019. The outcome of interest for all regressions in the log of monthly earnings for stable employees. Panel A presents estimates using state-level data and a two-way fixed effects design, Panel B adds Census division-by-year fixed effects, and Panel C uses county-level data with a county border design, as in equation 1. All regressions include geography fixed effects (state in Panels A and B and county in Panel C), log of population, and log of employment. Panel B adds Census division-by-year fixed effects. Panel C includes county border pair by year-quarter fixed effects. Observations in Panel C are only included in the regression if there is full data availability for both counties in the border pair. Full data availability is defined as no missing observations for that outcome in the county from the first quarter the county is in the data set through the last quarter the county is in the data set. Regressions are weighted by county population. Standard errors in Panels A and B are clustered at the state level, and in Panel C, they calculated using two-way clustering at the state and border segment levels are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effect of Minimum Wage on Prices

	Center-based Care		Home-based Care	
	(1)	(2)	(3)	(4)
	0 to 23 months	24 to 47 months	0 to 23 months	24 to 47 months
Log(Min. Wage)	0.415***	0.804***	0.470***	0.496***
	(0.0575)	(0.0843)	(0.0466)	(0.0615)
Dep. Var. Mean	5.702	5.372	5.257	5.173
Mean Level	302	218	194	178
N	522	522	522	522

Notes: This table reports OLS estimates of the relationship between the log of the county-level minimum wage and the log of median weekly child care prices from California Market Rate Surveys from 2010 to 2018. County-level minimum wages are defined as the highest statutory minimum wage of any municipality in that county in the given year. All regressions include controls for the log of county population, county fixed effects, and year fixed effects. Regressions are weighted by county population. The standard errors are clustered at the county level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effect of Minimum Wage on Child Care and Development Fund Participants

Outcome	(1) Coeff. (SE)	(2) N	(3) Dep. Var Mean
Log(Child Subsidy Recipients)	-0.285	1,020	31,052
	(0.244)		
Log(Total Provider Recipients)	-0.498	1,010	10,758
	(0.899)		
Log(Center Provider Recipients)	-1.223*	1,006	1,792
	(0.697)		
Log(Home Provider Recipients)	2.789**	1,004	540
	(1.188)		
Log(FFN Provider Recipients)	-0.247	1,006	6,230
	(0.652)		
Share of CCDF Providers: Centers	-0.220**	1,001	0.287
	(0.106)		
Share of CCDF Providers: Homes	0.153**	999	0.059
	(0.059)		
Share of CCDF Providers: FFN	0.075	1,001	0.538
	(0.083)		

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and the log number of children receiving CCDF child care subsidies, log number of child care providers receiving CCDF funds, log number of center-based providers receiving CCDF funds, log number of home-based providers receiving CCDF funds, log number of friend, family, neighbor (FFN) providers receiving CCDF funds, the center-baed share of all CCDF providers, the home-based share of all CCDF providers, and the FFN share of all CCDF providers, respectively. The data are from the Office of Child Care's CCDF Statistics (available here: https://www.acf.hhs.gov/occ/data/child-care-and-development-fund-statistics), and span the years 2000 to 2019. All models include the log population, log total employment, state fixed effects, and region-by-year fixed effects. Regressions are weighted by the state population, and the standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Effect of Minimum Wage on Programs' NAEYC Accreditation

	(1) Num. NAEYC	(2) Frac. NAEYC	(3) Log(NAEYC)	(4) Frac. NAEYC
Log(Min. Wage)	-12.66	-0.090	-0.232	-0.005
	(10.97)	(0.070)	(0.267)	(0.065)
County Level: Border Design	Yes	Yes	No	No
State Level: Division-by-Year FE	No	No	Yes	Yes
Dep. Var. Mean	29.63	0.128	5.12	0.098
N	20,896	15,796	408	357

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and the number or fraction of NAEYC establishments. Standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Effect of Minimum Wage on Program-Level Adjustments

	(1) Enrollment	(2) Child-Staff Ratio	(3) Accred.
Log(Min. Wage)	0.561**	0.465***	-0.299
	(0.274)	(0.151)	(0.181)
Dep. Var. Mean	120.80	6.41	0.453
N	1,718	1,704	1,706

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and the log number of children attending the sampled center-based program (column (1)), the log child-to-staff ratio in the sampled teacher's classroom (column (2)), and a binary indicators for whether the sampled center-based program has any accreditation. Data come from the 24-month and preschool-age waves of the ECLS-B. All regressions include controls for the total number of teachers in the program, percent of white teachers, percent of white children, percent of children who speak a non-English language, log of annual state total employment, state fixed effects and wave fixed effects. The standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effect of Minimum Wage on Teacher Skill Investments and Job Productivity

Panel A: Teacher Skill Investments					
	(1)	(2)	(3)	(4)	(5)
	ECE Deg.	ECE Cert.	ECE Course	Oth. Course	ECE Train
Log(Min. Wage)	0.043	0.207*	0.391***	0.230***	0.031
	(0.164)	(0.119)	(0.098)	(0.072)	(0.104)
N	6,753	7,761	3,703	5,472	7,381
Dep. Var. Mean	0.441	0.241	0.474	0.845	0.701
Panel B: Quality of Teacher Activities					
	(1)	(2)	(3)	(4)	(5)
	Reads	Sings	Games	Builds	Edu. Act.
Log(Min. Wage)	0.250*	0.098	0.181	0.291***	0.130*
	(0.135)	(0.296)	(0.130)	(0.098)	(0.066)
N	5,465	5,462	5,457	5,454	5,412
Dep. Var. Mean	6.48	7.37	4.37	3.64	42.55
Panel C: Arnett Scores of Teacher-Child Interactions					
	(1)	(2)	(3)	(4)	(5)
	Detach.	Harsh	Perm.	Sens.	Total
Log(Min. Wage)	0.176	0.150	0.181	0.311*	0.239**
	(0.108)	(0.106)	(0.130)	(0.176)	(0.109)
N	2,902	2,913	5,457	2,910	2,914
Dep. Var. Mean	10.74	24.26	6.90	20.61	62.49

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and measures of teacher skill investments, teacher activities with children, and Arnett scores of child-teacher interactions. Data come from the 24-month and preschool-age waves of the ECLS-B. In Panel A, the outcomes are binary indicators for whether the sampled teacher has an ECE (college) degree, an ECE certification/credential, done any ECE college coursework, done any child care-related coursework, and done any ECE training in the past year, respectively. In Panel B, the outcomes are the log number of times per week the teacher reads books to, sings songs with, plays games with, and builds something with children as well as the log frequency of math/conceptual activities with children, respectively. In Panel C, the outcomes are the log of teacher's Arnett detachment, harshness, permissiveness, sensitivity, and total score, respectively. All regressions include controls for the teacher's gender, age, race/ethnicity, education level, self-reported health status, self-reported smoker status, number of years of child care work experience, and spoken language is non-English (when caring for child(ren). The models also include log of annual state total employment, provider-type fixed effects, state fixed effects, and wave fixed effects. The standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Effect of Minimum Wage on Yelp Consumer Reviews of Child Care Providers

	(1) Full	(2) Low-Inc	(3) High-Inc
Panel A: Average Rating			
Log(Min. Wage)	-0.309*	-0.407*	-0.237
	(0.177)	(0.247)	(0.259)
Dep. Var. Mean	4.29	4.22	4.35
N	49,430	23,505	26,481
Panel B: Highest Rating			
Log(Min. Wage)	-0.142***	-0.123	-0.188**
	(0.054)	(0.077)	(0.078)
Dep. Var. Mean	0.761	0.741	0.779
N	49,430	23,505	26,481
Panel C: Review Discusses Price			
Log(Min. Wage)	0.151***	0.136**	0.177***
	(0.046)	(0.064)	(0.066)
Dep. Var. Mean	0.124	0.135	0.115
N	49,430	23,505	26,481
Panel D: Review Discusses Learning Envir.			
Log(Min. Wage)	-0.030	0.027	-0.083
	(0.053)	(0.075)	(0.075)
Dep. Var. Mean	0.738	0.727	0.740
N	49,430	23,505	26,481

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and consumer ratings of child care providers on Yelp between 2005 and 2017. In Panel A the outcome of interest is the reviewerâs rating of the provider on a scale from one to five, where five is the best possible rating. In Panel B, the outcome of interest is an indicator that equals one if the reviewer gave the provider a rating of five (the highest rating) and equals zero otherwise. In Panel C, the outcome is an indicator that equal one if the reviewer discussed the price or affordability of the provider and zero otherwise. Column (1) includes the full sample of Yelp reviews; columns (2) is limited to reviews of providers located in low-income counties (below the median of household income); and column (3) is limited to reviews of providers located in high-income counties (at or above the median of household income). All regressions include controls for available reviewer characteristics (quadratic in friend count, quadratic in review count, an indicator for whether they have a profile picture, an indicator for whether they attached any photos to their review, an indicator for whether any individual rated the review as "useful," indicators for whether the review contains formal language or slang words, and an indicator for whether the review contains swear words), year fixed effects, calendar month fixed effects, and firm fixed effects. The standard errors are clustered at the firm level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A Data Appendix

This section provides information on the data sources used for our supplementary analyses: the Quarterly Census of Employment and Wages (QCEW), the Current Population Survey (CPS), the American Community Survey (ACS), and data on NAEYC providers from AggData.

We use the Quarterly Census of Employment and Wages (QCEW) between 1990 and 2019 to examine the stock of child care workers and establishments. The QCEW is an establishment-level database of employment and wage information for individuals covered by state unemployment insurance laws, organized by six-digit NAICS industry code at the national-, state-, and county-levels. The main outcomes include the (log) number of employees and establishments in the Child Day Care Services industry (NAICS code: 624410). The unit of analysis is either the state- or county-quarter combination, depending on the empirical strategy.

To study employment and wages in various child care sectors, we use individual-level data over the years 2001 to 2019 from the American Community Survey (Ruggles et al., 2022). Our analytic sample includes civilian women ages 18 to 64. Men are excluded because they comprise less than 5% of child care workers. Aside from its large samples, a key advantage of the ACS is it allows us to identify workers in three child care sectors: center- and home-based programs as well as private household settings. To classify workers, we rely on the industry and occupation codes attached to the most recently held primary job (Brown and Herbst, 2022). Center-based workers include non-self-employed individuals who work in the Child Day Care Services industry and whose occupation is a child care worker, preschool (or kindergarten) teacher or assistant teacher, education administrator, or special education teacher. Home-based workers are defined as self-employed individuals working in the Child Day Care Services industry whose occupation is a child care worker or education administrator. Finally, private household child care workers are defined as individuals employed in the Private Household Services industry and whose primary occupation is a child care worker. Our outcome variable is (log) hourly wages, defined as annual earnings in the previous year divided by (typical) hours worked each week multiplied by the (binned) number of weeks of work. To deal with the binned measurement of weeks, we restrict the analysis to those employed 50-52 weeks in the previous year.[43]

To supplement the ACS analysis of wages, we also rely on the March Demographic Supplement to the Current Population Survey (CPS) between 1992 and 2019. We define the sample in the same manner, and we are able to observe workers in the three child care sectors defined above. Although the CPS contains smaller samples, one advantage is that it includes a continuous measure of weeks of employment, thereby allowing us to measure hourly wages more precisely.

To examine the density of center-based providers that are NAEYC-accredited, we rely on lists of such providers obtained from the market research company AggData for the years 2011 to 2020. The listings include the name and physical address of each provider along with its state and county of operation. We collapsed the data into state- and county-year cells, calculating the log number of accredited providers and the share of accredited providers within the state or county.[44] The NAEYC's accreditation, the Early Learning Program (ELP), is considered one of the most rigorous quality accreditations available in the child care market. Providers must meet a variety of standards to obtain and retain their accreditation, including the use of an approved education curriculum, meeting requirements for staff training and education, and conducting child development assessments. To show evidence of meeting the standards, providers undergo an initial four-step evaluation—which includes a site visit—as well as annual follow-up evaluations that require considerable effort and resources (Xiao, 2010).

[43]The ACS interviews individuals throughout the calendar year. The questions on earnings pertain to the 12 months preceding the time of interview. Unfortunately we cannot ascertain when a given individual was interviewed, which means that the 12-month window differs dramatically across individuals.

[44]The numerator for the latter outcome comes from the AggData listing of NAEYC-accredited providers, while the denominator comes from the QCEW's data on the number of child care industry establishments.

B Methods Appendix

To provide support for the identifying assumption that absent changes in the minimum wage, outcomes across different states would have trended in parallel, we perform an event study analysis when possible. Because the event study approach requires treatment to be dichotomous and occur only once per observation, the data set up and treatment definition are different from the continuous difference-in-differences models in the main paper. This distinction is important to keep in mind when interpreting results. This section outlines the methods and data changes made for the event studies.

Treatment is defined as a minimum wage change of at least twenty-five cents. Multi-year phase-ins are treated as one event, and the total amount of the minimum wage increase over the length of the phase-in is included for checking whether the minimum wage increase is greater than twenty-five cents. A state can have more than one event if it experiences more than one increase of at least twenty-five cents (separated by at least one year with no increase). In this case, the full time series for that state is copied for each minimum wage increase in that state, with one time series associated with each minimum wage event m. This approach to handling more than one treatment event within the same entity was introduced by Lafortune et al. (2018), who show in Monte Carlo simulations that it performs well for identifying the average treatment effect of events, and a similar approach is adopted by Godøy et al. (2021) in their paper studying the impact of minimum wage increases on parental labor supply. From 2000 to 2019, all states have at least one event, the median state has two events, and six states have four events. Over this time period, the mean and median number of phase-in years is three years.

We then run the following event-study regression:

$$Y_{mst} = \alpha + \sum_{\tau=-\infty, \tau \neq -1, -3}^{\infty} \beta_\tau \mathbb{1}_{mt} + \theta X_{st}^{'} + \xi_m + \zeta_t + \varepsilon_{mst},$$

where Y_{mst} is the value of the outcome Y for observations associated with minimum wage event m in state s at time t. $\mathbb{1}_{mt}$ is an indicator function that equals one if at time t it has been τ years since minimum wage event m. $X_{st}^{'}$ is a vector of control variables for state s at time t (the same control variables included in the TWFE specification). ξ_m are minimum wage event fixed effects, and ζ_t are time fixed effects. Since all units are eventually treated, to avoid multicollinearity, we omit from the model the variables denoting the year prior and three years prior to the first year of the minimum wage reform (Schmidheiny and Siegloch, 2023). Standard errors are clustered at the state level.

Since the minimum wage changes represent a staggered difference-in-differences design, TWFE estimates are potentially biased. TWFE implicitly makes comparisons between later-treated units and earlier-treated units, and if, at the time of the comparison, treatment effects differ across these types of units, TWFE estimates can be biased. For example, if treatment effects grow over time, then including these comparisons can cause the estimated treatment effects to be biased down or wrong signed. Therefore, in addition to estimating the standard two-way fixed effects event study, we also estimate models that are robust to the staggered implementation, primarily Callaway and Sant'Anna (2021) (CSA). CSA essentially creates a series of 2x2 difference-in-differences comparisons between treated units and a group of never treated and not-yet-treated units, eliminating comparisons to already-treated groups. Our context requires an estimator that can use not-yet-treated groups in estimation (instead of only never treated) because all or most states are eventually treated with a minimum wage change (depending on the data set). The imputation estimator in Borusyak et al. (2024) (BJS) can also use never-treated states in estimation; however, it is less preferable in our context because of the often-short untreated pre-periods available. BJS uses pre-period patterns to impute a counterfactual in the post-period and thus works best when there is a longer untreated pre-period to use estimate the counterfactual. However, our context includes frequent events across states, limiting the number of available comparison states and the length of the available pre-period for the

treated state.

These event studies differ from the difference-in-differences specifications in several important ways. First, the event studies do not account for treatment intensity. They treat all minimum increases over the twenty-five cent threshold the same, not adjusting for the size of the increase. Second, all increases in a multi-year phase-in are grouped into one event. In the difference-in-differences specification, each increase has a separate effect. In the event study, we might see an increase in the size of the effect in future years as the minimum wage continues to increase. Third, the event studies ignore any minimum wage changes below the twenty-five cent threshold. Given these caveats, the results from the event study specifications should primarily be used to test that there were not pre-existing differential trends in the outcome variables between states that raised minimum wages at a particular time compared to others that did not. Ensuring that the pre-period coefficients are not different from zero provides some reassurance that results are driven by changes in the minimum wage and not by other differences between states with different minimum wages.

C Appendix Figures and Tables

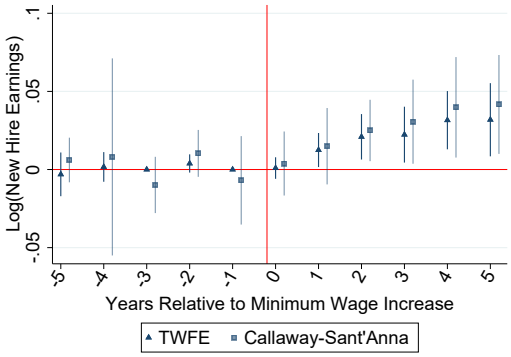
Figure C1: Median Hourly Wages of Child Care Workers, by Sector, 2005-2019



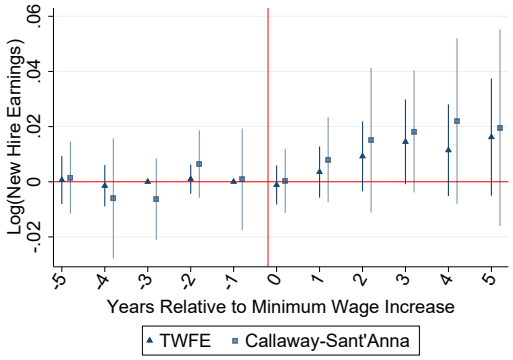
Source: American Community Survey from 2005 to 2019.
Notes: The term "Private Household" refers to private household child care providers, defined as those employed in the private household services industry and whose primary occupation is a child care worker. The term "Home-Based" refers to workers who are self-employed in the child day care services industry and whose occupation is a child care worker or education administrator. The term "Other Female Workers" refers to women employed in all other (non-child care) industries. All figures are adjusted for inflation to reflect 2019 dollars.

Figure C6: Event Study Estimates of the Impact of Minimum Wage Reforms on New Hire Earnings in Child Care Sector

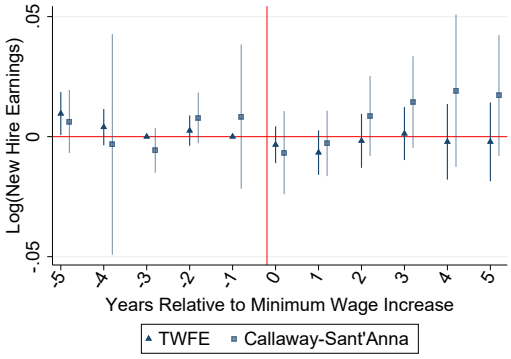
(a) Younger than Age 25



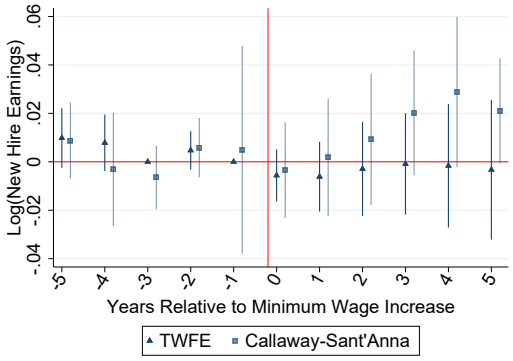
(b) Highest Education Level: Less than High School



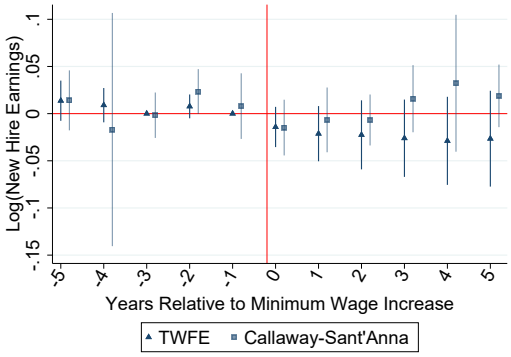
(c) Highest Education Level: High School Degree



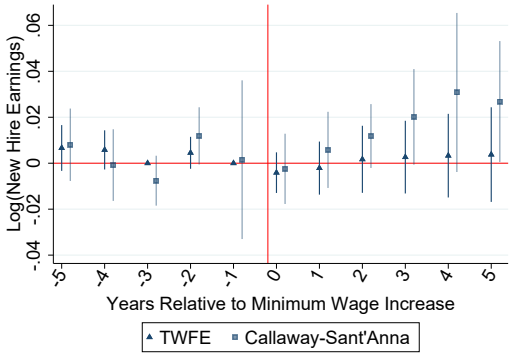
(d) Highest Education Level: Some College



(e) Highest Education Level: At least a Bachelor's Degree

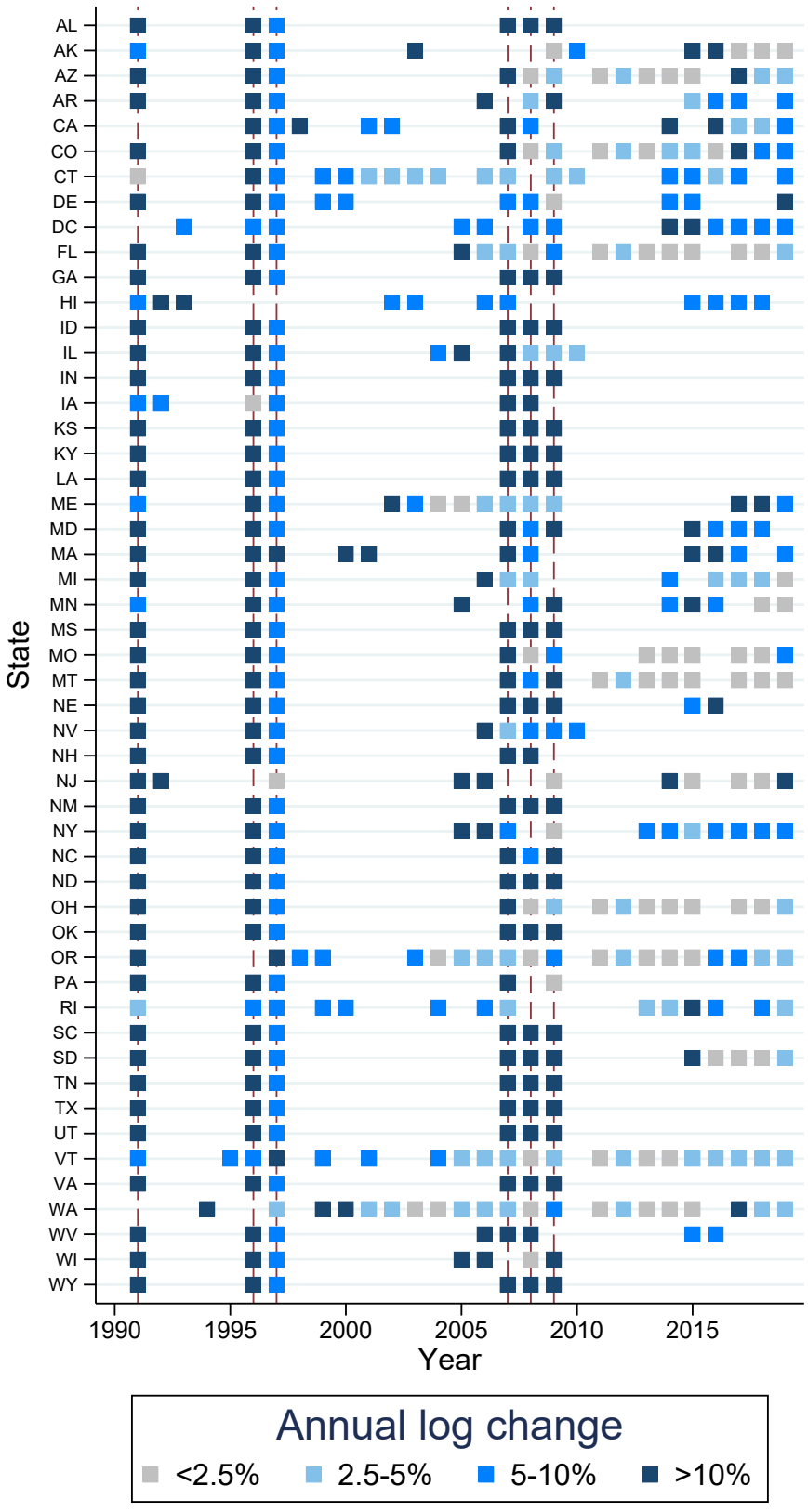


(f) Overall



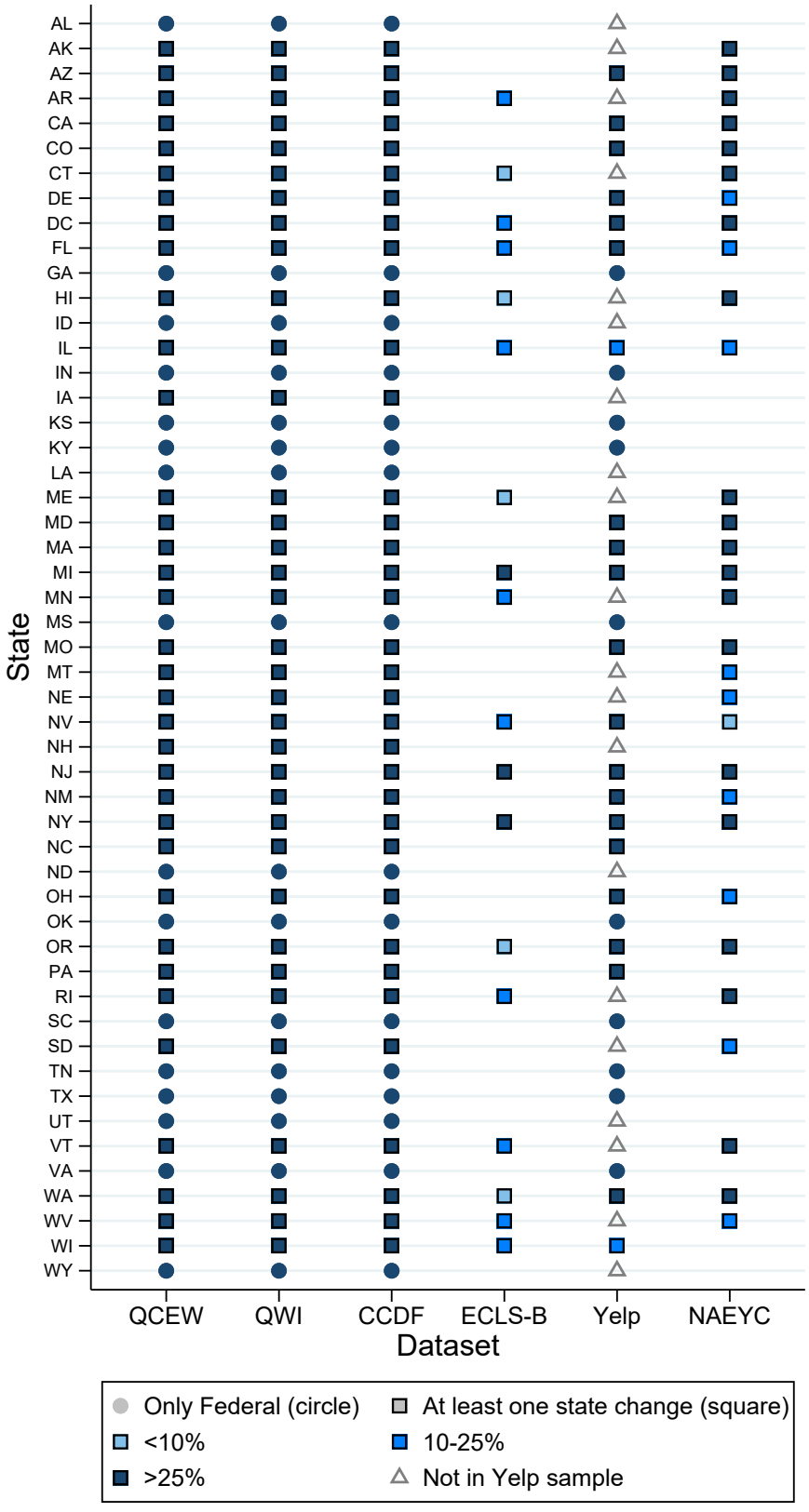
Notes: Figures report event study coefficients from estimates of the relationship between minimum wage reforms and the log of monthly earnings of new hires in the child care sector from 2001 to 2019. Data is annualized from the Quarterly Workforce Indicators and is at the county level. State and federal minimum wage changes of at least 25 cents are included. The data is stacked so that observations are repeated for each minimum wage change (see Appendix A for more detail). Event time zero is the first year of the minimum wage increase. In cases where a minimum wage increase was phased in over the course of two or more years, the observation is included only once, and time zero is the first year of the phase in. All regressions include minimum wage event and year fixed effects. Regressions are weighted by county population. The standard errors are clustered at the state level, and error bars represent 95% confidence intervals.

Figure C2: Minimum Wage Changes by Year, 1990-2019



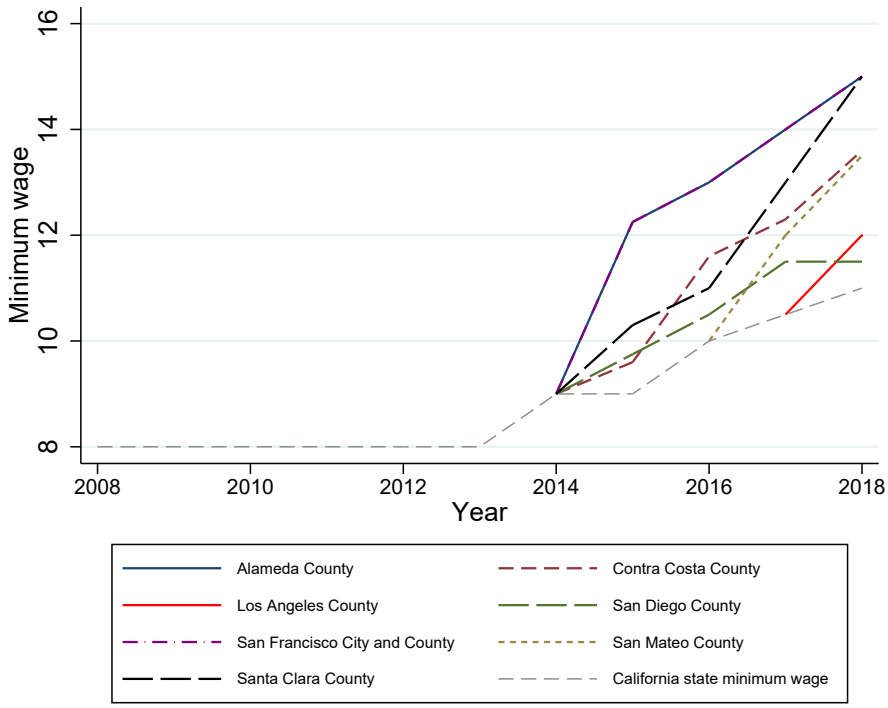
Notes: Figure indicates which states experience minimum wage changes in each year of our data. Vertical lines indicate years in which the federal minimum wage changed.

Figure C3: Minimum Wage Changes in Each Sample



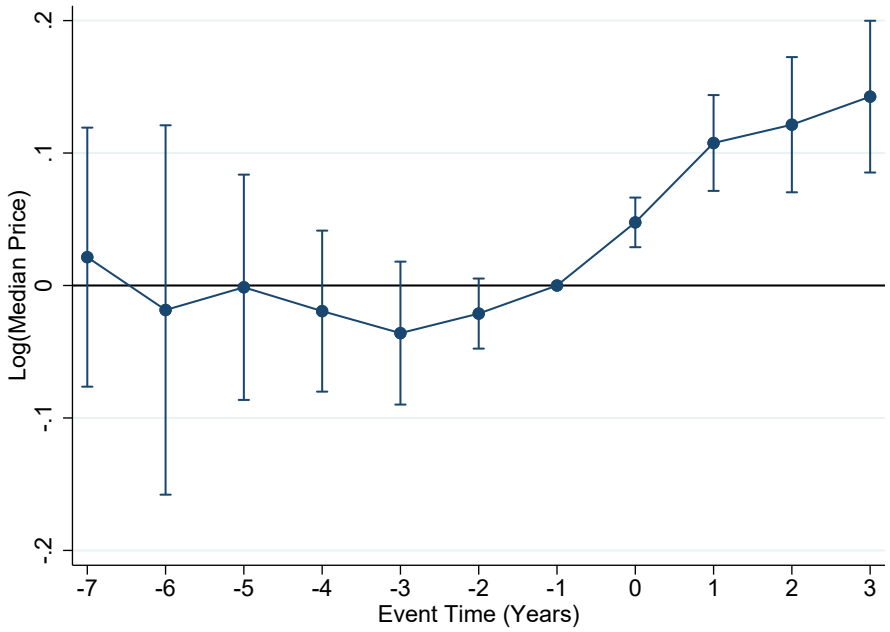
Notes: Figure indicates which states experienced changes in the minimum wage during the sample periods for each data set, with color indicating the cumulative size of those changes from the beginning of the sample period through the end of the sample period.

Figure C4: Minimum Wage Changes in California



Notes: Figure shows minimum wages in California during our sample period. County-level minimum wages are defined as the highest minimum wage observed in any municipality in that county in a given year.

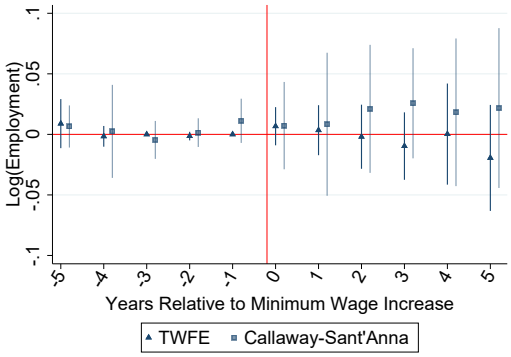
Figure C5: Event-Study Estimates of the Impact of Minimum Wage Reforms on Child Care Prices



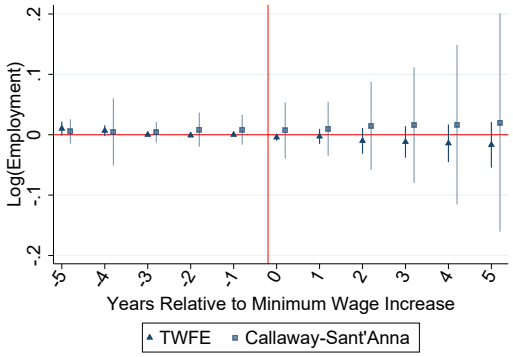
Notes: This figure reports stacked event study coefficients (Cengiz et al., 2019) from estimates of the relationship between the log of the county-level minimum wage and the log of median weekly child care prices from California Market Rate Surveys from 2010 to 2018. County-level minimum wages are defined as the highest statutory minimum wage of any municipality in that county in the given year. Event time zero is the first year that the county had a higher minimum wage than the state minimum wage. Each county-year has four price observations included: infant center-based, preschool center-based, infant home-based, and preschool home-based. All regressions include price type fixed effects as well as controls for the log of county population, county fixed effects, and year fixed effects. Regressions are weighted by county population. The standard errors are clustered at the county level, and error bars represent 95% confidence intervals.

Figure C7: Event Study Estimates of the Impact of Minimum Wage Reforms on Employment in Child Care Sector

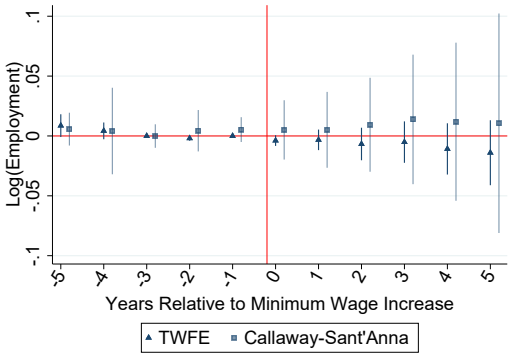
(a) Younger than Age 25



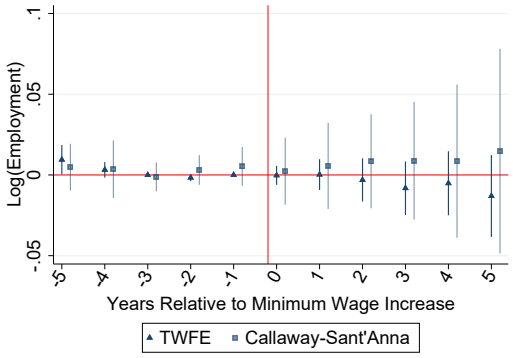
(b) Highest Education Level: Less than High School



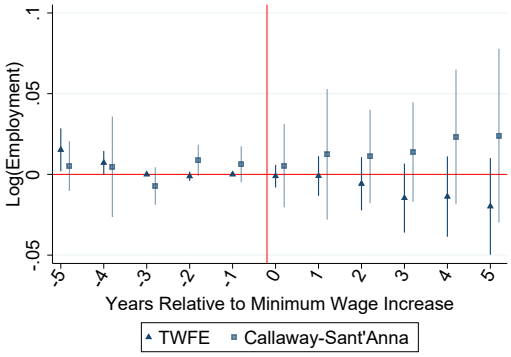
(c) Highest Education Level: High School Degree



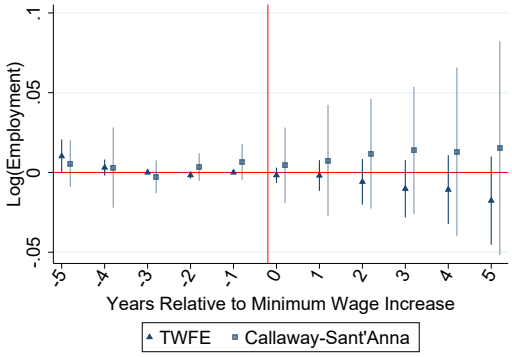
(d) Highest Education Level: Some College



(e) Highest Education Level: At least a Bachelor's Degree



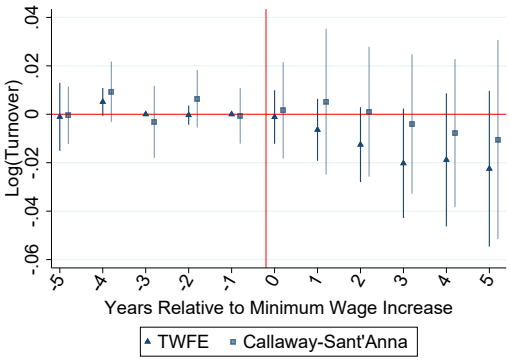
(f) Overall



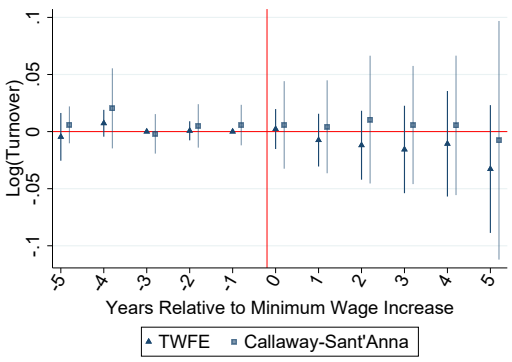
Notes: Figures report event study coefficients from estimates of the relationship between minimum wage reforms and the log of employment in the child care sector from 2001 to 2019. Data is annualized by taking the average of beginning-of-quarter employment within each year from the Quarterly Workforce Indicators and is at the county level. State and federal minimum wage changes of at least 25 cents are included. The data is stacked so that observations are repeated for each minimum wage change (see Appendix A for more detail). Event time zero is the first year of the minimum wage increase. In cases where a minimum wage increase was phased in over the course of two or more years, the observation is included only once, and time zero is the first year of the phase in. All regressions include minimum wage event and year fixed effects. Regressions are weighted by county population. The standard errors are clustered at the state level, and error bars represent 95% confidence intervals.

Figure C8: Event Study Estimates of the Impact of Minimum Wage Reforms on Turnover in Child Care Sector

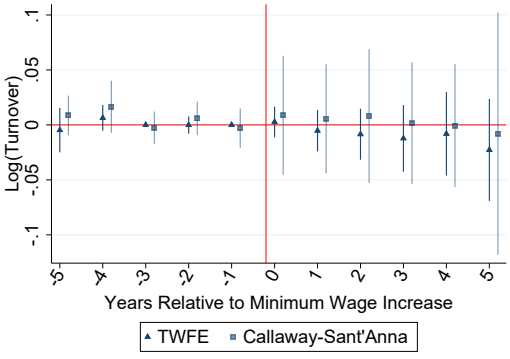
(a) Younger than Age 25



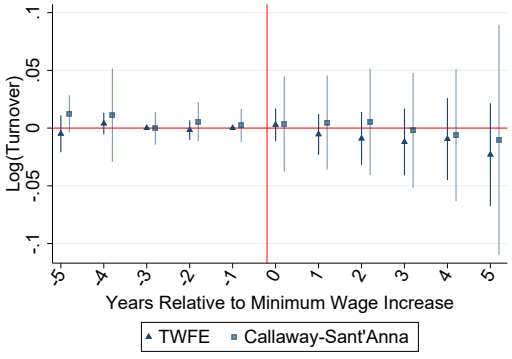
(b) Highest Education Level: Less than High School



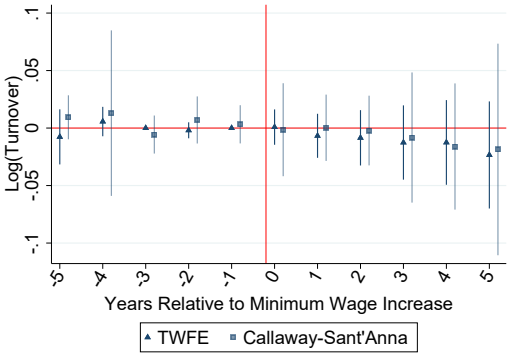
(c) Highest Education Level: High School Degree



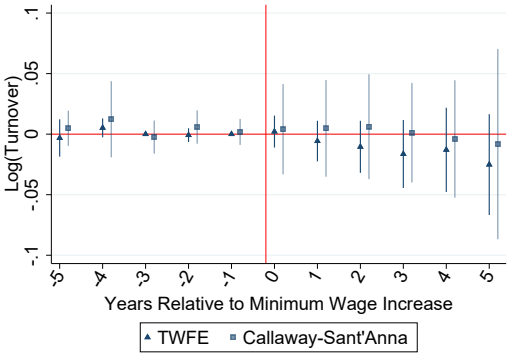
(d) Highest Education Level: Some College



(e) Highest Education Level: At least a Bachelor's Degree



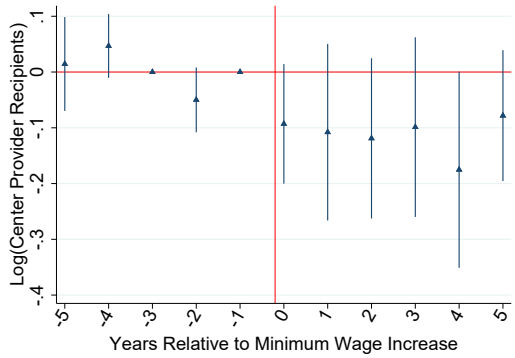
(f) Overall



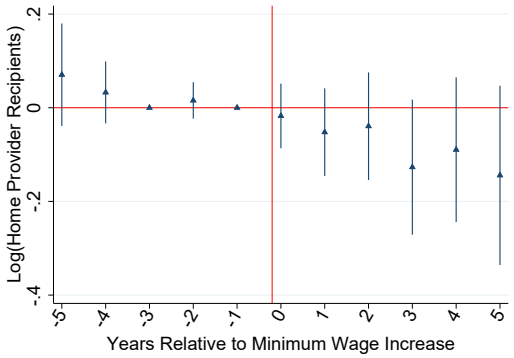
Notes: Figures report event study coefficients from estimates of the relationship between minimum wage reforms and the log of turnover in the child care sector from 2001 to 2019. Data is annualized by taking the average quarterly turnover within each year from the Quarterly Workforce Indicators and is at the county level. State and federal minimum wage changes of at least 25 cents are included. The data is stacked so that observations are repeated for each minimum wage change (see Appendix A for more detail). Event time zero is the first year of the minimum wage increase. In cases where a minimum wage increase was phased in over the course of two or more years, the observation is included only once, and time zero is the first year of the phase in. All regressions include minimum wage event and year fixed effects. Regressions are weighted by county population. The standard errors are clustered at the state level, and error bars represent 95% confidence intervals.

Figure C9: Event Study Estimates of the Impact of Minimum Wage Reforms on Number of Children and Providers Using CCDF-Funded Child Care Subsidies

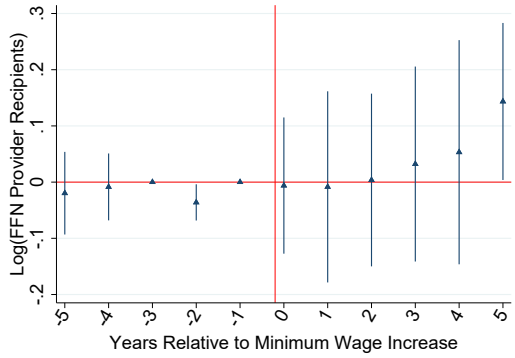
(a) Log(Number of Center-based Providers)



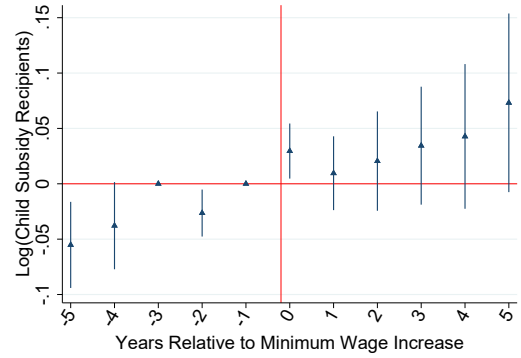
(b) Log(Number of Home-based Providers)



(c) Log(Number of Family, Friends, and Neighbors Providers)



(d) Log(Number of Children Using CCDF)



Notes: Figures report event study coefficients from estimates of the relationship between minimum wage reforms and outcomes from CCDF. State and federal minimum wage changes of at least 25 cents are included. The data is stacked so that observations are repeated for each minimum wage change (see Appendix A for more detail). Event time zero is the first year of the minimum wage increase. In cases where a minimum wage increase was phased in over the course of two or more years, the observation is included only once, and time zero is the first year of the phase in. All regressions include Census Division-by-year fixed effects, minimum wage event and year fixed effects. Error bars represent 95% confidence intervals.

Table C1: Effect of Minimum Wage on Log of Monthly Earnings

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Two-Way Fixed Effects						
Log(Min. Wage)	0.022	0.140***	0.029	0.020	0.010	0.014
	(0.026)	(0.027)	(0.020)	(0.026)	(0.026)	(0.045)
Dep. Var. Mean	7.422	6.976	7.334	7.400	7.507	7.716
Mean Level	1,599	1,028	1,486	1,585	1,757	2,148
Level of Data	State	State	State	State	State	State
N	3,705	3,705	3,705	3,705	3,705	3,705
Panel B: Add Census Division-by-Year Fixed Effects						
Log(Min. Wage)	0.011	0.109***	0.011	0.004	-0.009	0.001
	(0.040)	(0.040)	(0.037)	(0.033)	(0.034)	(0.052)
Dep. Var. Mean	7.422	6.976	7.334	7.400	7.507	7.716
Mean Level	1,599	1,028	1,486	1,585	1,757	2,148
Level of Data	State	State	State	State	State	State
N	3,702	3,702	3,702	3,702	3,702	3,702
Panel C: County Border Design						
Log(Min. Wage)	0.132***	0.230***	0.145***	0.127***	0.123***	0.130*
	(0.049)	(0.049)	(0.051)	(0.037)	(0.044)	(0.076)
Dep. Var. Mean	7.398	6.986	7.330	7.384	7.485	7.687
Mean Level	1,382	970	1,341	1,386	1,521	1,843
Level of Data	County	County	County	County	County	County
N	129,065	76,166	81,396	111,409	115,819	93,705

Notes: Table provides estimates from an OLS regression of the log of indicated measures for child care workers (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019 using three different specifications. The outcome of interest for all regressions in the log of monthly earnings for stable employees. Panel A presents estimates using state-level data and a two-way fixed effects design, Panel B adds Census division-by-year fixed effects, and Panel C uses county-level data with a county border design, as in equation 1. All regressions include geography fixed effects (state in Panels A and B and county in Panel C), log of population, and log of employment. Panel B adds Census division-by-year fixed effects. Panel C includes county border pair by year-quarter fixed effects. Observations in Panel C are only included in the regression if there is full data availability for both counties in the border pair. Full data availability is defined as no missing observations for that outcome in the county from the first quarter the county is in the data set through the last quarter the county is in the data set. Regressions are weighted by population. Standard errors are in parentheses, and in Panels A and B are clustered at the state level, and in Panel C, they are calculated using two-way clustering at the state and border segment levels.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C2: Effect of Minimum Wage on Child Care Teacher Wages and Hours, by Sector

	Center-based		Home-based		Private Household	
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Low Ed.	All	Low Ed.	All	Low Ed.
Panel A: Log(Hourly Wages)						
Log(Min. Wage)	0.084**	0.109**	-0.241	-0.120	-0.190*	-0.131
	(0.0357)	(0.0469)	(0.306)	(0.383)	(0.114)	(0.137)
Mean Hourly Wage	12.05	10.64	12.50	11.05	11.72	11.30
N	166,422	102,233	10,427	7,113	18,942	13,784
Panel B: Log(Usual Weekly Hours)						
Log(Min. Wage)	0.0267	0.0358	-0.0003	0.0554	0.1652*	0.2715**
	(0.0261)	(0.0344)	(0.1378)	(0.1752)	(0.0878)	(0.1081)
Mean Hours	33.03	32.83	42.47	42.03	32.16	31.55
N	166,422	102,233	10,427	7,113	18,942	13,784
Panel C: Log(Annual Earnings)						
Log(Minimum Wage)	0.134**	0.184**	-0.121	0.278	-0.095	0.104
	(0.059)	(0.078)	(0.360)	(0.453)	(0.189)	(0.229)
Mean Annual Earnings	15,743	13,449	19,666	16,830	13,272	12,119
N	166,422	102,233	10,427	7,113	18,942	13,784

Notes: This table reports OLS two-way fixed effect estimates of the relationship between the log of the minimum wage and each outcome using data from the American Community Survey from years 2000 to 2019. The first two columns include child care teachers in the center-based sector, the next two columns include child care teachers in the home-based sector, and the last two columns include child care workers in the private household sector. “Low education" workers are defined as workers who do not have at least an Associate’s degree. Regressions include state and year fixed effects and use provided person weights. Standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C3: Effect of Minimum Wage on Probability of Employment in Child Care, by Sector

	Center-based		Home-based		Private Household	
	All	Low Ed.	All	Low Ed.	All	Low Ed.
Panel A: Current Population Survey						
Log(Min. Wage)	0.00342	0.00392	0.00102	0.00144	-0.00038	-0.00072
	(0.00261)	(0.00292)	(0.00139)	(0.00217)	(0.00107)	(0.00216)
Mean Employment Rate	0.0130	0.0117	0.0050	0.0059	0.0030	0.0032
N	1,589,628	664,798	1,589,628	664,798	1,589,628	664,798
Panel B: American Community Survey						
Log(Min. Wage)	0.00215**	0.00374**	-0.00044	-0.00037	0.00037	0.000395
	(0.00099)	(0.00157)	(0.00090)	(0.00107)	(0.00039)	(0.00050)
Mean Employment Rate	0.0130	0.0137	0.0050	0.0060	0.0020	0.0030
N	15,466,008	9,170,561	15,466,008	9,170,561	15,466,008	9,170,561

Notes: This table reports OLS two-way fixed effect estimates of the relationship between the log of the minimum wage and the probability that a woman is working in one of the listed child care sectors. Data is from women interviewed for the Current Population Survey from years 1992 to 2019 and the American Community Survey from years 2000 to 2019. “Low education" workers are defined as workers who do not have at least an Associate’s degree. Regressions include state and year fixed effects and use provided person weights. Standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C4: Effect of Minimum Wage on the Number of Child Care Industry Establishments

	(1) State-level TWFE	(2) Division-by-Year FE	(3) Border County Design
Log(Min. Wage)	0.114	0.107	-0.056
	(0.116)	(0.132)	(0.119)
Mean Num. Establishments	2,671	2,671	205
Geography	State	State	County
Frequency	Annual	Annual	Quarterly
N	1,428	1,428	85,776

Notes: This table reports OLS estimates of the relationship between the log of the minimum wage and the log number or child care establishments reported in the Quarterly Census of Employment and Wages (QCEW) from 1992 to 2019. All regressions include controls for log of employment and log of annual population at the appropriate geography and are weighted by population. Column (1) includes state and year fixed effects. Column (2) includes state and Census division by year fixed effects. Standard errors in these two columns are clustered at the state level. Column (3) uses the county-pair border identification strategy and includes only counties where both counties in the pair have zero missing observations. The regression includes county fixed effects and county pair-year-quarter fixed effects. Standard errors are clustered two ways by state and border segment.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C5: Effect of Minimum Wage on Child Care Wages and Employment, Interior Counties Only

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Log(New Hire Earnings)						
Log(Min. Wage)	0.149***	0.280***	0.138***	0.104***	0.104***	0.0666
	(0.0260)	(0.0371)	(0.0257)	(0.0236)	(0.0277)	(0.0397)
Dep. Var. Mean	7.11	6.92	7.17	7.19	7.24	7.35
Mean Level	1,096	934	1,247	1,247	1,305	1,483
N	46,832	29,548	17,141	24,627	26,294	19,847
Panel B: Log(Beginning-of-Quarter Employment)						
Log(Min. Wage)	0.151**	0.199*	0.237**	0.247***	0.144**	0.0499
	(0.0697)	(0.102)	(0.111)	(0.0743)	(0.0678)	(0.0772)
Dep. Var. Mean	7.047	5.599	5.018	5.523	5.786	5.346
Mean Level	452	126	72	102	129	95
N	76,449	62,066	52,203	72,815	73,804	60,690
Panel C: Log(Turnover)						
Log(Min. Wage)	0.0301	-0.0825*	0.0897	0.0813	0.101	0.0831
	(0.0550)	(0.0467)	(0.0765)	(0.0645)	(0.0654)	(0.0652)
Dep. Var. Mean	-1.873	-1.440	-1.945	-2.051	-2.116	-2.085
Mean Level	0.17	0.25	0.17	0.14	0.13	0.14
N	44,152	28,661	14,729	21,871	23,887	17,232

Table provides estimates from an OLS regression of the log of indicated measures for child care workers (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019. Only observations for counties that do not border another state were included. The QWI suppresses small cells, so counties were also only included if they had observations in every year of data in order to mitigate issues with endogenous missing data. In Panel A, the outcome variable is the log of monthly new hire earnings, in Panel B it is log of beginning-of-quarter employment, and in Panel C, it is log of turnover within the child care sector. All regressions use a standard OLS two-way fixed effects design and include county fixed effects, log of population, and log of employment. Regressions are weighted by county population. Standard errors are clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C6: Effect of Minimum Wage on Prices

	(1) 0 to 5	(2) 6 to 11	(3) 12 to 17	(4) 18 to 23	(5) 24 to 29	(6) 30 to 35	(7) 36 to 41	(8) 42 to 47	(9) 48 to 53
Panel A: Center-Based Care									
Log(Minimum Wage)	0.519*	0.519*	0.573*	0.444*	0.389	0.164	0.190	0.190	0.285**
	(0.274)	(0.274)	(0.298)	(0.252)	(0.232)	(0.224)	(0.227)	(0.227)	(0.136)
Mean Weekly Price	215	215	210	205	187	185	172	172	170
N	5,339	5,339	5,343	5,343	5,353	5,353	5,357	5,357	5,357
Panel B: Home-Based Care									
Log(Minimum Wage)	-0.064	-0.064	-0.040	0.081	0.126	0.155	0.189	0.189	0.249
	(0.089)	(0.089)	(0.094)	(0.124)	(0.158)	(0.198)	(0.263)	(0.263)	(0.258)
Mean Weekly Price	155	155	152	151	145	144	140	140	140
N	5,246	5,246	5,254	5,254	5,258	5,258	5,262	5,262	5,264

Notes: This table reports estimates of the relationship between the log of the minimum wage and the log of weekly price charged for child care using the county-border discontinuity design. Data are from the National Database of Childcare Prices (NDCP), which includes county-level information on median weekly prices compiled from state Market Rate Surveys for the years 2008 to 2018. In order to provide consistent and complete data across counties, sometimes data in the NDCP is imputed for certain age groups, years, counties, and/or to convert prices to a weekly measure or to estimate the median based on other information about the distribution of prices. In order to maintain a higher level of data quality, regressions only include observations with imputations done on at most one of these margins. All regressions control for county-level log employment and log population as well as county fixed effects and county pair-year-quarter fixed effects. Standard errors are clustered two ways by state and border segment.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C7: Effect of Minimum Wage on Log of Payroll

	(1) All	(2) Age < 25	(3) LTHS	(4) High School	(5) Some College	(6) College
Panel A: Two-Way Fixed Effects						
Log(Min. Wage)	0.126*	0.228***	0.210*	0.202***	0.0994	0.0428
	(0.0635)	(0.0790)	(0.111)	(0.0688)	(0.0647)	(0.0646)
Dep. Var. Mean	18.60	16.68	16.26	17.04	17.40	17.11
Level of Data	State	State	State	State	State	State
Mean Level	79,796,288	11,838,771	8,219,221	16,816,322	23,847,930	19,074,044
N	3,761	3,761	3,761	3,761	3,761	3,761
Panel B: Add Census Division-by-Year Fixed Effects						
Log(Min. Wage)	0.0242	0.127	0.0464	0.0581	-0.0373	-0.0103
	(0.0809)	(0.0835)	(0.144)	(0.0873)	(0.0872)	(0.0860)
Dep. Var. Mean	18.60	16.68	16.26	17.04	17.40	17.11
Level of Data	State	State	State	State	State	State
Mean Level	79,796,288	11,838,771	8,219,221	16,816,322	23,847,930	19,074,044
N	3,761	3,761	3,761	3,761	3,761	3,761
Panel C: County Border Design						
Log(Min. Wage)	0.197	0.419***	0.152	0.181*	0.162	0.167
	(0.119)	(0.129)	(0.122)	(0.103)	(0.125)	(0.151)
Dep. Var. Mean	15.38	13.64	13.00	13.84	14.18	13.94
Mean Level	15,195,375	2,043,672	1,619,999	2,976,353	4,423,381	4,378,249
Level of Data	County	County	County	County	County	County
N	140,551	102,908	123,287	135,602	134,306	125,808

Notes: Table provides estimates from an OLS regression of the log of quarterly payroll for the child care industry (NAICS code 6244) on minimum wage using data from the Quarterly Workforce Indicators (QWI) at the quarterly level for years 2001 to 2019 using three different specifications. The outcome of interest for all regressions in the log of total payroll for the industry in the given geography in that quarter. Panel A presents estimates using state-level data and a two-way fixed effects design, Panel B adds Census division-by-year fixed effects, and Panel C uses county-level data with a county border design, as in equation 1. All regressions include geography fixed effects (state in Panels A and B and county in Panel C), log of population, and log of employment. Panel B adds Census division-by-year fixed effects. Panel C includes county border pair by year-quarter fixed effects. Observations in Panel C are only included in the regression if there is full data availability on employment for both counties in the border pair. Full data availability is defined as no missing observations in the county from the first quarter the county is in the data set through the last quarter the county is in the data set. Note that due to data availability, we restricted to full data availability of stable employment for consistency with the new hire earnings regressions. Regressions are weighted by population. Standard errors in Panels A and B are clustered at the state level, and in Panel C, standard errors calculated using two-way clustering at the state and border segment levels are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.