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Long-term benefits of early childhood education on off-farm employment: evidence from rural China

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Abstract

This paper examines the long-term benefits of early childhood education (ECE) on off-farm employment of rural labors in China. Using panel data from the China Rural Development Survey, a nationally representative survey of 2000 rural households at 100 villages in 5 provinces, we employed two identification strategies (i.e., the FFE model and IV model) to overcome the endogeneity of ECE experience. Results show that individuals with any ECE (preschool) experience is 6–7 (7–8) percentage points more likely to engage in off-farm work at the first job than those without, while the impacts of kindergarten are insignificant. Conditional on being employed off-farm at the first jobs, ECE (including any ECE and preschool) has positive impacts on the probabilities of both being full-time off-farm employed and being employed outside of their home cities, but not on the probability of being self-employed. One possible mechanism underlying these research findings is that ECE significantly improves one's educational attainment. We also find that most of these effects are more prominent for disadvantaged groups (females or individuals with less-educated parents).

Keywords Early childhood education · Long-term benefits · Off-farm employment · Rural labors · China

JEL Classification J24 · E24 · I28

Introduction

Early childhood represents a particularly sensitive period for the development of children's potential skills and fundamental abilities (Almond & Currie, 2010; Knudsen et al., 2006). Early childhood education (ECE) has been widely documented to enhance children's human capital in multiple aspects, including academic performance (Barnett & Jung, 2021; Weiland & Yoshikawa, 2013), cognitive skills (Burger, 2010; Campbell & Ramey, 1994), non-cognitive skills (Camilli et al., 2010), educational attainment (Gray-Lobe et al., 2023; Reynolds et al., 2001), and physical health (Cohen & Syme, 2013).

Theoretically, the human capital benefits brought by ECE can carry over to labor markets in the forms of broader participation, higher earnings, or stabler employment (Almlund et al., 2011; Duncan & Dunifon, 2012; Levin, 2013; Mincer, 1985; Oreopoulos, 2006; Wolbers, 2000). However, empirical evidence about the potential impacts of ECE on labor market outcomes remains mixed. Most relevant studies demonstrate significant positive impacts of ECE on labor market participation (Dumas & Lefranc, 2012; Havnes & Mogstad,

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2011). Meanwhile, some researchers find only moderate or even no significant impacts (Bingley et al., 2018; Shafiq et al., 2018). The discrepancy in these findings renders it difficult to inform policies.

A precise estimate of the impacts of ECE on labor market outcomes is empirically challenging for at least three reasons, which may also help explain why previous studies yielded mixed evidence. One is data constraint. High-quality long-term datasets lie at the core in precisely estimating the benefits of ECE on labor market outcomes. However, it has been quite difficult, if not impossible, to acquire such long-term datasets, especially in developing countries. Constrained by data availability, earlier studies mostly used ordinary least squares (OLS) regressions and thus were unable to address the potential endogeneity associated with non-random self-selection into (or out of) ECE (e.g., Goodman & Sianesi, 2005). In this case, OLS estimates would be systematically biased as unobserved factors, such as family risk preference, simultaneously affect one's long-term outcomes and ECE experience. Some more recent studies provided more rigorous evidence by employing differences-in-differences or instrumental variable approaches to address the endogeneity of ECE experience (e.g., Dumas & Lefranc, 2012; Havnes & Mogstad, 2011). However, most of them come from developed countries (e.g., Norway, France) and their findings may not be well generalized to the contexts of developing countries. In short, constrained by data availability, rigorous empirical evidence is especially scarce in developing countries.

The second reason lies in the different practices of ECE in different contexts, such as targeted *vs* universal, preschool *vs* kindergarten. Taking the Abecedarian and Perry Preschool projects, for example, targeted ECE programs usually target at certain groups of children and families, and tend to be resource-intensive and high-quality. In contrast, universal ECE programs, taking the Head Start program for example, have broader coverage of beneficiaries (Barnett, 2010). In the context of China, preschool ("*You er yuan*" in Mandarin) provides no more than 3 years of ECE services for 3- to 6-year-old children before they enter primary schools, while kindergarten ("*Xue qian ban*" in Mandarin) is more close to be the preparation grade of primary school education (as grade 0), which offers 5- to 6-year-old children 1-year subject-based education to prepare them for primary school (Tian et al., 2020). Considering these differences in different types of ECE, the long-term impacts of ECE experience are likely to be context-dependent.

Finally, the mixed findings may reflect heterogeneous effects of ECE across different study populations-different genders, different races, different parental educational backgrounds, different household income levels may all influence the effectiveness of ECE. Specifically, it has been generally shown that the long-term benefits of ECE experience are more prominent among children with disadvantaged backgrounds such as girls (Havnes & Mogstad, 2011), blacks (Thompson, 2018), children with less-educated parents (Dietrichson et al., 2020), children from lower-income households (Bartik et al., 2012; Havnes & Mogstad, 2015), while it is insignificant or may even exert negative impacts among their advantaged counterparts (Dietrichson et al., 2020; Havnes & Mogstad, 2015). Thus, research focused on the disadvantaged groups may identify significant benefits of ECE experience on one's labor market outcomes (Bailey et al., 2021; García et al., 2020; Heckman et al., 2013; Thompson, 2018), whereas study samples with a higher proportion of advantaged children may lead observers to conclude that ECE is ineffective (Fort & Zanella, 2019).

Off-farm employment is of particular importance for rural labors' long-term outcomes in developing countries. Due to the seasonality in agricultural production, off-farm employment usually serves as a risk adaption strategy for rural labors, especially in developing areas with abundant rural labor force and limited arable land (Chen et al., 2019). There has been compelling evidence that off-farm employment contributes greatly to poverty alleviation, as well as income and welfare growth for rural labors in most settings, especially during the COVID-19 pandemic (Li et al., 2021; Luo et al., 2020). Hence, understanding the possible long-term benefits of ECE on rural labors' off-farm employment has far-reaching policy implications for not only ECE arrangements but also off-farm employment.

China provides an interesting case to study this topic. With the labor market development, human capital has been playing an increasingly important role in off-farm employment outcomes (Li et al., 2005; Maurer-Fazio, 1999; Zhang et al., 2002), making the human capital accumulation during early childhood even more salient (Reynolds et al., 2001; Thompson, 2018). Moreover, in rural China, there have long existed two types of ECE with different training goals and curriculum arrangements, namely preschool and kindergarten as mentioned above. Taken together, it provides a unique opportunity to explore the potential long-term benefits of ECE (including preschool and kindergarten) on off-farm employment in the context of rural China.

To obtain causal estimates of the long-term benefits of ECE on rural labors' off-farm employment in China, the present study addresses the endogeneity problem by applying the family fixed effects (FFE) model and the instrumental variables (IV) method. We draw on data from the China Rural Development Survey (CRDS), a nationally representative longitudinal survey of rural households in China. The CRDS collected two modules of unique information that facilitate our identification strategy. First, detailed information on ECE experience (including preschool and kindergarten) and off-farm employment from multiple members of the same families was collected. Such rich information

can help eliminate the unobservable confounding factors shared within a family (say, village socio-economics characteristics, family culture and risk preference, etc.) by taking advantage of the within-household across-individuals variation in ECE experience (the FFE model). Second, we also collected information on the earliest ECE facilities (again including preschool and kindergarten) in all the sampled villages. This piece of information allows us to construct the IVs to further eliminate the endogeneity problem (the IV model). Besides, the rich information in the CRDS dataset also enables us to address contextual confounding by controlling for a set of covariates at the individual, parent, and village levels, as well as a full set of birth cohort fixed effects in the estimations.

Our empirical analyses verify the long-term benefits of ECE on off-farm employment among rural labors. By employing the FFE model and IV model, we identified significant positive impacts of ECE on rural labors' extensive and intensive margins of off-farm employment outcomes at the first job. Moreover, the long-term benefits of ECE are mainly driven by attending preschools rather than kindergartens. One possible mechanism underlying these observed relationships is that ECE significantly improves one's educational attainment. Results from heterogeneity analyses show that most of these effects are more pronounced among those disadvantaged groups (females or individuals with less-educated parents).

This study contributes to the literature in two ways. First, given what previous studies have documented about the short- or medium-term benefits of ECE, this study extends the literature not only by providing the long-term benefits of ECE on labor market outcomes, but also by comparing the long-term benefits of two different types of ECE (preschool and kindergarten). Second, we explore the potential working channels of ECE, which helps improve our understanding of why ECE matters for labor market outcomes.

The rest of this paper is structured as follows. Sect. "Literature review" reviews the literature. Sect. "Data" introduces the data, followed by an empirical framework in Sect. "Empirical methods". Sect. "Results" presents our empirical findings. The final section concludes.

Literature review

Why and how ECE experience affect labor market outcomes?

We would expect ECE experience to affect labor market outcomes for two reasons. First, the benefits of ECE on children's human capital development can be theoretically supported by the natural science and economic theories. Specifically, a lot of literature from brain sciences, genetics, and neurosciences has consistently shown that early childhood is a crucial period to lay a solid foundation not only for physical health, but also for the development of language, motor, cognitive, and socio-emotional skills for the entire life cycle (e.g., Dahl, 2004). Further from the perspective of economics, Cunha and Heckman (2008) formalize a model of life-cycle skill formation. A key idea from the model is "self-productivity," which is captured by the memorable phrase "skills beget skills." That said, early investments matter more than late investments as the plasticity during this window renders children more susceptible to relevant interventions and earlier investment means that there is more time to reap its benefits. More importantly, it is not always possible to remediate early skill deficits completely with later investment (Cunha et al., 2008; Heckman et al., 2001; Heckman et al., 2006). Such being the case, early childhood investments can raise the level of human capital in a way that increases the productivity of later childhood.

Corresponding to the above theories, a plenty of empirical evidence worldwide has shown that ECE experience exerts positive effects on children's human capital accumulation such as academic performance (Barnett & Jung, 2021; Weiland & Yoshikawa, 2013), cognitive skill (Burger, 2010; Campbell & Ramey, 1994), social–emotional ability (Camilli et al., 2010), and physical and mental health (Carneiro & Ginja, 2014; Thompson, 2018) in short or medium term.

Second, the classic theory of human capital proposed by Schultz (1961) shows that, considering the important role of human capital in modern economic production, human capital accumulation is conducive to help labors achieve higher labor market returns. Lower human capital can reduce the capacity to work and exert substantive negative impacts on labor force participation, job choice, and earnings (Almlund et al., 2011; Duncan & Dunifon, 2012; Levin, 2013; Wolbers, 2000). Additionally, with the increased efficiency of labor resource allocation all over the world, individuals with more human capital are more likely to earn more in both developed (e.g., Oreopoulos, 2006) and developing countries (e.g., Jones, 2001).

In empirical, human capital is widely believed to promote individuals' labor market outcomes such as participation and earnings (e.g., Heckman et al., 2006). In general, educational attainment, often measured by years of schooling, is often used as the indicator of human capital. According to the estimation of Duflo (2001) and Psacharopoulos and Patrinos (2004), the economic return to education ranges from 6.8 to 10.6 percent on average around the world. In China, Liu et al. (2020) have drawn on the same dataset as our study, i.e., the China Rural Development Survey (CRDS) and found that, among rural labors engaged in off-farm work, the average return to education is 2.4–3.9 percent in terms of their hourly wage rate.

Taken together, ECE experience may affect labor market outcomes given its significant benefits on human capital accumulation along with the substantial economic returns to human capital in labor markets.[1] Then a natural question arises that, whether the ECE experience can yield different impacts on children from different socioeconomic backgrounds? Overall, the long-term effects of ECE depend not only on the quality of the ECE services that children get, but also on the quality of the counterfactual care, i.e., the quality of the care the children would be exposed to in the absence of ECE services.[2] For those disadvantaged children, the better-quality day care and nursery center services may offer them a unique opportunity for a head start to overcome challenges associated with their disadvantaged backgrounds (Barnett, 2011). In contrast, for those advantaged children, the quality of the ECE services they get is comparatively lower than that of their counterfactual care, which may exert negative effects on their labor market outcomes (Dietrichson et al., 2020). Therefore, the disparity in the quality of their alternative care implies the heterogeneity in the long-term impacts of ECE on children from different socioeconomic backgrounds.[3]

Empirical evidence on the impacts of ECE on labor market outcomes

Plenty of empirical studies have examined the long-term impacts of ECE on labor market outcomes across different contexts. Many scholars have found significant positive impacts (Bailey et al., 2021; Chetty et al., 2011; García et al., 2020; Heckman et al., 2013; Thompson, 2018). For example, Goodman and Sianesi (2005) find that ECE experience is associated with an increase of 3 percent in wages for women up to 33 years old in British. Fessler and Schneebaum (2019) demonstrate that ECE experience significantly increases one's likelihood of working full time by 5.8 percentage points and hourly wages by 7.1 percent in Austria. Using data from the Head Start in the USA, Thompson (2018) finds that individuals exposed to this program experience a $2,199 (in 2012 dollars) increase in annual adult earnings than their counterparts who did not. Moreover, Bailey et al. (2021) provide additional evidence that attending Head Start is associated with a significant increase in the extensive margin (a 4 percentage points increase in the probability of being employed) and intensive margin (a 2-week increase per year and a 3-h increase per week in the job duration as adults) of employment. More recently, a systematic review of 26 studies on the long-term impacts of typical universal ECE programs by Dietrichson et al. (2020) also conclude beneficial effects of ECE on earnings, employment, and welfare in adults.

Despite these extensive empirical evidence, some studies find only moderate or even no significant impacts of ECE experience on labor market outcomes. For example, drawing on data from urban adults in 12 low- and middle-income countries, Shafiq et al. (2018) demonstrate that the association of ECE experience with earnings in labor markets is relatively weak. Meanwhile, Bingley et al. (2018) show that living in a neighborhood with ECE at the age of 4 does not affect the probability of having no earnings at age 35.

What does the empirical studies say about the heterogeneous impact of ECE experience on labor market outcomes? Earlier studies on the long-term impacts of ECE experience have revealed substantial pro-disadvantaged bias. Specifically, girls (Havnes & Mogstad, 2011), blacks (Thompson, 2018), children with less-educated parents (Dietrichson et al., 2020), children from lower-income households (Bartik et al., 2012; Havnes & Mogstad, 2015) are found to be the primary beneficiaries of the long-term benefits of ECE experience. In contrast, children from relatively advantaged backgrounds are found to even experience a loss in labor market from ECE experience (Dietrichson et al., 2020; Havnes & Mogstad, 2015).

Despite the potentially strong relationship between ECE experience and labor market outcomes, however, rigorous evidence on the long-term benefits of ECE experience on rural labors' off-farm employment outcomes in China remains scarce. Moreover, the few existing estimates focusing on the short- or medium-run benefits of two major types of ECE programs in rural China (including preschool and kindergarten) tend to vary significantly in terms of the persistence and magnitudes (Rao et al., 2012; Zhang, 2013).[4]

[1] In fact, an insightful work by Bartik et al. (2012) obtained earnings effects of an ECE program (i.e., Tulsa pre-K program) by combining their results about its treatment effects on average test-score percentiles with Chetty et al. (2011)'s findings on the earnings returns to early test scores in adult, which partly echoes the above-mentioned theoretical backgrounds regarding why ECE experience can exert long-term impacts on one's employment status in labor market. Moreover, Berlinski et al. (2008) also find positive long-term impacts of ECE on labor market outcomes by estimating the benefits of ECE on educational achievement and the obtained returns to education in the literature in Uruguay.

[2] There mainly exists two distinct counterfactual modes of care with different quality including parental care and informal care (including relatives, unlicensed care givers, and other irregular care givers such as friends and neighbors).

[3] For example, focusing on the disadvantaged groups, Thompson (2018), Heckman et al., (2013), García et al., (2020), and Bailey et al., (2021) both find that the ECE program is highly effective, whereas Fort and Zanella (2019) conclude that the ECE program is ineffective with a higher proportion of advantaged samples.

[4] For example, Rao et al. (2012) drew on a small sample of 205 pupils in a southwestern county in China and found that children who attended developmentally appropriate programs showed higher cognitive performance at the end of first grade than those who attended

Hence, to the best of our knowledge, this study is the first to draw on the nationally representative data to explore the long-term benefits of ECE experience (including preschool and kindergarten) on individual's off-farm employment outcomes in rural China.

Based on the theoretical reasoning and literature review, we propose three hypotheses for this study:

1. ECE experience will benefit rural labors' off-farm employment outcomes at the first job in China. Moreover, we expect the two types of ECE (including preschool and kindergarten) will have different impact on the off-farm employment outcomes of rural labors.
2. The benefits of ECE experience on rural labors' off-farm employment outcomes in China work through its contribution to human capital accumulation, such as educational attainment.
3. The benefits of ECE experience on rural labors' off-farm employment outcomes are heterogeneous by children's socioeconomic status, such as gender and parental education.

Data

Survey

This study draws on panel data from the China Rural Development Survey (CRDS), a nationally representative longitudinal survey of rural households in China, designed and conducted by the authors themselves over the past two decades or so. In the first survey wave in 2005, the CRDS adopted a multi-stage stratified cluster sampling strategy and obtained a sample of 2000 households at 100 villages in 25 counties from 5 provinces. The sampling process was conducted as follows. First, within each of the five major agro-ecological zones in China (i.e., eastern coastal, southwestern, Loess Plateau, north and central, northeastern), one province was randomly selected to obtain five sample provinces (i.e., Jiangsu, Sichuan, Shaanxi, Hebei, and Jilin). Second, within each sample province, five counties were selected from a list of counties arranged in descending order of gross value of industrial output (GVIO) per capita using an equal distance random sampling method. Third, within each sampled county, two townships were randomly selected following the same procedure as the county selection. Fourth, within each township, two villages were also randomly selected following the same procedure as the county selection. Finally, within each village, 20 households were randomly selected to conduct the survey. To date, four follow-up surveys for all sample households have been conducted in 2008, 2012, 2016, and 2019, respectively. In this paper, we draw on the dataset from the 2016 survey wave as this wave collected detailed information on the ECE experience of all household members as well as their extended family members (namely, those who have separated from the original households). More importantly, the 2016 survey wave tracked at least three generations for each sample household, including the parents, their children, and grandchildren, which offers a unique opportunity to employ the household fixed effects model.

Sample

In order to estimate the long-term impacts of ECE on one's off-farm employment, we take a two-step procedure to construct our study sample from the 2016 survey wave. In the first step, we restrict our sample to those individuals who have entered the labor market during 1998–2015. Thus, individuals under 16 years old,[5] those enrolled full-time in school, retirees, and household members who did not work for health-related reasons during this time were excluded. In the second step, to ensure the validity of the household fixed effects and the instrumental variable identification strategies, we further excluded those individuals who are inlaws as the family-invariant unobservable confounding factors (say, genes) are only shared within the immediate family members.[6] As we will discuss later, we use whether there existed any preschool or kindergarten in this village before the individual under discussion was at ECE age as our instrumental variable. We also excluded those individuals who were not born in local villages as the village-level instrumental variable for individuals' ECE experience will fail to satisfy the asymptotic relevance condition in their cases. After this process, we are left with a study sample of 2049 individuals from 560 families who had the required information to implement our identification strategy. Moreover, when examining the impact of ECE experience on certain performance in the labor market (e.g., job types and locations), we further restricted our sample to those 1726 individuals engaged in off-farm employment.[7]

Footnote 4 (continued)

preprimary classes, sat in grade one classes, or had no ECE experience.

[5] There is no clear retirement line for rural residents. Statistics show that most individuals over 60 years are still working in on- or off-farm sectors in China. Therefore, we did not excluded the samples who are 60+ years old in our sample group.

[6] By "inlaws" we mean mother-in-law, father-in-law, daughter-in-law, and son-in-law.

[7] To understand the representative of our study sample, we further compared the 11 observable characteristics at the individual, parent, and village levels between our study sample and the entire original sample in CRDS. Results show that 6 of the 11 coefficients come out

Variables

Off-farm employment outcomes at the first job

Based on the employment history of each sampled individual, we constructed four dummy variables to measure her/his off-farm employment outcomes at the first job. The first one, *off-farm employment*, takes the value of one if an individual was engaged in off-farm employment at her/his first job and zero otherwise. Conditional on being engaged in off-farm employment at her/his first job, we further describe the characteristics of their off-farm employment at the first job with three extra dummy variables. *Full-time off-farm job* takes the value of one if full-time employed in off-farm and zero otherwise. *Self-employed off-farm job* indicates whether one was self-employed (i.e., self-employed = 1, otherwise = 0). *Migrant worker*, measures the location of their off-farm job at the first job (i.e., outside of the city = 1, otherwise = 0).

ECE experience

We measure one's ECE experience by three dummy variables. The first one, *any ECE*, takes the value of one if an individual had ever participated in any ECE (preschool or kindergarten) and zero otherwise. The second, *preschool*, measures whether an individual had ever participated in preschool (1 = yes, 0 = no). The third, *kindergarten*, measures whether an individual had ever participated in kindergarten (1 = yes, 0 = no).

Covariates

Following the literature, we control for characteristics at the individual, parent, and village levels that may affect one's off-farm employment outcomes (Wang et al., 2017; Ji et al., 2012). Specifically, we control for four covariates at the individual level (including gender, ethnicity, number of siblings, and age at the first job), five covariates at the parent level (including education years of both parents, both parents' age when the child entered in labor market, whether any parent is a Communist Party of China (CPC) member), and two covariates at the village level (including per capita income and distance to the township seat). We also include birth cohort (both the FFE model and IV model) and province fixed effects (only the IV model) to control for temporal and cross-sectional trends that might affect one's off-farm employment outcomes.

Descriptive statistics

Table 1 reports summary statistics of the key variables. Our data show that among the 2049 sampled individuals, 45% had any ECE experience. Specifically, 26% of them had participated in preschool, whereas 31% in kindergarten and 11% in both types of ECE. In the sample, slightly more than half (55%) are males, and 3% are ethnic minorities, with an average of 10 years of schooling. When sample individuals entered labor market, they were about 18 years old while their parents were slightly more than 50 years old. Their parents barely finished 9 years of education, almost 17% of their parents are CPC members. On average sample villages are 5 km away from their township seats.

Our data also demonstrate individuals with any ECE experience are more likely to engage in off-farm employment than their counterparts without any ECE experience at the first job (90% vs 81%). Moreover, conditional on being employed off-farm at the first job, individuals with any ECE experience are more likely to have full-time off-farm jobs and be employed outside of the city than their counterparts without ECE experience. However, there seems to be little difference in the probability of being self-employed between individuals with and without any ECE experience. Results from these descriptive analyses are only suggestive, multivariate analyses are needed to get a rigorous estimate of the benefits of ECE on rural labors' off-farm employment.

Empirical methods

Identification strategy

This paper seeks to examine the causal effects of ECE on rural labors' off-farm employment in China. We start with a statistical model that links one's ECE experience and off-farm employment outcomes:

$$Y_{icp} = \alpha + \beta ECE_{icp} + \boldsymbol{Z}'_{icp}\boldsymbol{\gamma} + \varepsilon_{icp}, \quad (1)$$

where Y_{icp} denotes the off-farm employment outcomes of individual i in province p of birth cohort c. ECE_{icp} is the indicator of ECE experience, including any ECE, preschool, and kindergarten. $\boldsymbol{Z}$ is a set of covariates at the individual, parent, and village levels which we introduced above. If Eq. (1) is correctly specified, the estimated coefficient on ECE experience, β, can capture its long-term causal effect on one's off-farm employment outcomes.

However, a simple OLS estimate of β in Eq. (1) may be biased due to endogeneity. To address this problem, we find

Footnote 7 (continued)

statistically indifferent from zero (Table 7), and the remaining 5 significant coefficients are mostly related to age. These age-related differences are understandable considering the way our study sample was constructed.

Table 1 Summary statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All sample			Without ECE experience			With ECE experience			Diff
	Mean	SD	N	Mean	SD	N	Mean	SD	N	(4–7)
Panel A: Outcome variables										
Off-farm employment at the first job (1 = yes)	0.854	[0.353]	2049	0.812	[0.391]	1117	0.904	[0.295]	932	0.092***
Full-time off-farm job at the first job (1 = yes)	0.927	[0.260]	1726	0.91	[0.286]	891	0.945	[0.227]	835	0.035***
Self-employed off-farm job at the first job (1 = yes)	0.029	[0.168]	1726	0.026	[0.160]	891	0.032	[0.176]	835	0.006
Migrant workers (1 = yes)	0.639	[0.480]	1726	0.594	[0.491]	891	0.688	[0.464]	835	0.093***
Panel B: Individual characteristics										
Male (1 = yes)	0.553	[0.497]	2049	0.565	[0.496]	1117	0.539	[0.499]	932	− 0.026
Ethnic minority (1 = yes)	0.029	[0.167]	2049	0.022	[0.148]	1117	0.037	[0.188]	932	0.014*
Number of siblings	1.263	[0.957]	2049	1.461	[0.981]	1117	1.026	[0.871]	932	− 0.434***
Age at the first job	18.375	[2.830]	2049	18.007	[2.601]	1117	18.817	[3.023]	932	0.810***
Panel C: Parent characteristics										
Father's age	52.340	[6.821]	2049	53.359	[7.184]	1117	51.118	[6.149]	932	− 2.241***
Mother's age	50.947	[6.510]	2049	51.967	[6.733]	1117	49.724	[6.015]	932	− 2.242***
Father's education (years)	8.476	[2.549]	2049	8.179	[2.499]	1117	8.833	[2.564]	932	0.654***
Mother's education (years)	8.098	[2.436]	2049	7.85	[2.317]	1117	8.396	[2.540]	932	0.546***
Father or Mother is a CPC member (1 = yes)	0.166	[0.371]	2049	0.183	[0.385]	1117	0.145	[0.352]	932	− 0.038**
Panel D: Village characteristics										
Per capita income (log)	7.091	[0.656]	2049	6.971	[0.635]	1117	7.234	[0.653]	932	0.262***
Distance to township site (km)	5.069	[3.983]	2049	5.372	[4.159]	1117	4.705	[3.734]	932	− 0.667***

Standard deviations in brackets. ***$p<0.01$, **$p<0.05$, *$p<0.1$

it necessary to discuss about the potential sources of endogeneity by separating the demand and supply sides.

On the demand side, there might be the individual-level self-selection of attending ECE, for instance, children who appear to be more socially competent and well-adjusted are more likely to be sent to attend ECE, and they are also more likely to have better employment outcomes later. To alleviate the demand-side endogeneity, we took an instrument variable (IV) approach. Specifically, referring to some previous studies (Chen et al., 2023; Duflo, 2001), we exploited the exogenous variations in the village ECE services supply condition at the sample individuals' ECE age. The IV is defined as a dummy variable taking the value of one if ECE services were available in her/his village before an individual reached 6 years old and zero otherwise.

We conduct the IV estimations as follows:

Stage 1

$$P_{icp} = \alpha + \beta \boldsymbol{I}(pyear_v \le byear_i + 6) + \boldsymbol{Z}'_{icp}\boldsymbol{\gamma} + \alpha_c + \delta_p + \varepsilon_{icp} \quad (2)$$

Stage 2

$$Y_{icp} = \alpha + \beta \widehat{P}_{icp} + \boldsymbol{Z}'_{icp}\boldsymbol{\gamma} + \alpha_c + \delta_p + \varepsilon_{icp}, \quad (3)$$

where $pyear_v$ denotes the earliest year when ECE service (including preschool and kindergarten) was available in village v. $byear_i$ is the birth year of individual i. δ_p denotes the province fixed effects. The IV is defined by the indicator faction, I(·), which takes the value of one if ECE services were available in her/his village before an individual reached 6 years old and zero otherwise.

On the supply side, the village-level selection issue might also drive individuals' ECE attendance and their labor market outcomes simultaneously, such as the availability of village social infrastructure and public services. To alleviate this kind of endogeneity, referring to Demming (2009) and Bietenbeck et al. (2019), we take advantage of the variations of ECE attendance across family members within a household, who are born in the same village and share the same village characteristics. To be specific, we employ a family fixed effect (FFE) model as follows.

$$Y_{icp} = \alpha + \beta P_{icp} + \boldsymbol{Z}'_{icp}\boldsymbol{\gamma} + \eta_h + \alpha_c + \varepsilon_{icp}, \quad (4)$$

where η_h denotes the household and α_c denotes the birth cohort fixed effects. The rest are the same as in Eq. (1).[8]

[8] It should be noted that we are unable to control for the family fixed effects in IV estimations.

Since both the dependent variable and the key explanatory variable are binary in this study, we follow Newey (1987), Silva (2016), and use the aextlogit and ivprobit commands in Stata to conduct our FFE and IV estimations, respectively. With aextlogit, we are able to compute the marginal impacts of the estimates for fixed effects logit (Kitazawa, 2012), whereas Ivprobit allows us to conduct the instrumental variable estimation with the probit model.

Instrument validity

Relevance

The relevance criterion requires that the IV must be correlated with the ECE experience significantly. We test and confirm this correlation in the first-stage regressions of 2SLS (reported in Table 2). Our data show that compared to their peers from villages without any ECE services at their ECE age, individuals from villages with ECE services at their ECE age are 11.8 to 17.4 percentage points more likely to have any ECE experience (significant at 0.01 level), confirming a strong relationship between the ECE service availability at one's ECE age and her/his ECE experience.

Exclusion

The exclusion criterion requires that the IV of ECE experience has no direct effect on individuals' off-farm employment outcomes in rural China. In this study, if the availability of ECE service at one's ECE age is associated with certain unobservable village characteristics (such as the availability of infrastructure and public services within a village) that also determines one's labor market outcomes, in other words, the IV is correlated with the error term, the exclusion condition of the IV would be violated. Due to data constraints, we are not able to test whether the IV is correlated with the error term or not in 2SLS regressions by using a single instrumental variable. So, we follow Di Falco et al. (2011) and Chen et al. (2023) and perform a series of tests to assess the validity of the exclusion restriction as follows.

First, is it possible that the IV at the village level reflects the accessibility of infrastructure and public services within a village that also affects one's labor market outcomes? More specifically, the provision of ECE service relies on both the well-constructed service facilities and adequate caregivers or teachers, which may associate with other channels that determine one's off-farm employment outcomes. To deal with this concern, we focus on individuals from villages that have ever provided ECE services and reran the IV regressions. Results in Table 8 show that in these villages with better accessibility of infrastructure and public services, IV remains to be a significant predictor of individual's ECE experience and the estimated long-term benefits of ECE are quite robust. Therefore, we rule out the possibility that the IV at the village level may reflect the accessibility of infrastructure and public services within a village that also affect one's labor market outcomes.

Second, is it possible that the IV reflects other unobservable village characteristics that also affect one's labor market outcomes? For example, children from more developed villages might be more likely to have access to ECE service and have better labor market outcomes than their peers from less-developed villages. To address this concern, we conduct two tests. Specifically, following Di Falco et al. (2011), we firstly focus on the subsample of individuals without any ECE experience to perform a falsification test to explore whether our IV can predict their off-farm employment outcomes. The logic behind this test is that if the IV is directly correlated with individuals' off-farm employment outcomes, one would find significant impacts of the IV on off-farm employment outcomes in any restricted subsample. As it turned, our results in Table 9 show that the IV estimates are insignificant in 11 out of 12 tests.[9] We then follow Chen et al. (2023) and test the association between 13 observable village characteristics[10] and the availability of ECE services at village level, where village characteristics are measured in 2000, 2004, 2007, 2011, 2015, 2019, respectively. As shown in Table 10, most of the coefficients turn to be insignificant. Thus, it is reasonable to rule out the possibility that the IV reflects certain village social economic characteristics that affect rural labors' off-farm employment outcomes.

By extensively testing the relevance and exclusion restrictions of the instrument of ECE experience, we have demonstrated that to the extent that the availability of ECE services at one's ECE age strongly predicts her/his ECE experience but do not directly affect the labor market outcomes through the accessibility of infrastructure and public services or certain village social economic characteristics. In other words, whether the IV provides a source of exogenous variations in ECE experience is needed for identification. Results about the instrument validity not only strengthen our own research findings, but also lends support to previous findings based on such an IV.[11]

[9] The only exception is the probability of being self-employed at the first job with a small estimated coefficient of 0.03.

[10] Specifically, the village characteristics used in this test include number of households, population, per capita income, land size, crop size, number of labors, whether the road is paved, distance to township site, number of villagers working in the township government, number of villagers working in the county government, number of firms, average daily wage for male labors, average daily wage for female labors.

[11] It is worth noting that both the Duflo (2001) and Chen et al. (2023) point out that the use of the supply shocks can significantly reduce the estimation bias associated with the endogeneity on the demand side.

Table 2 Effects of ECE on being employed in off-farm sector at the first job

Models	(1) FFE	(2) IV	(3) FFE	(4) IV	(5) FFE	(6) IV
Preschool or kindergarten	0.070***	0.063***				
	(0.015)	(0.014)				
Preschool			0.083***	0.068***		
			(0.021)	(0.017)		
Kindergarten					0.015	0.015
					(0.014)	(0.014)
Male	0.039**	0.037**	0.037***	0.037***	0.034**	0.035**
	(0.017)	(0.015)	(0.014)	(0.014)	(0.014)	(0.016)
Ethnic minority	− 0.082*	− 0.116**	− 0.075*	− 0.076*	− 0.078*	− 0.112**
	(0.045)	(0.047)	(0.045)	(0.043)	(0.046)	(0.048)
Age at the first job	0.033***	0.033***	0.033***	0.034***	0.033***	0.033***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)
Number of siblings	− 0.046***	− 0.043	− 0.045***	− 0.041***	− 0.050***	− 0.048***
	(0.009)	(0.009)	(0.010)	(0.012)	(0.009)	(0.009)
Father's age	0.004	0.010	0.004	0.015	0.005	0.015
	(0.003)	(0.012)	(0.003)	(0.013)	(0.003)	(0.012)
Mother's age	− 0.006**	− 0.005	− 0.007**	− 0.020	− 0.007**	− 0.013
	(0.003)	(0.014)	(0.003)	(0.014)	(0.003)	(0.016)
Father's education (years)	0.006*	0.001	0.005	0.004	0.007*	0.026*
	(0.004)	(0.017)	(0.004)	(0.019)	(0.004)	(0.015)
Mother's education (years)	0.009**	0.009***	0.009**	0.025	0.010***	0.026
	(0.004)	(0.004)	(0.004)	(0.018)	(0.004)	(0.018)
Father or Mother is a CPC party member	0.028	0.031	0.024	0.115	0.025	0.155
	(0.026)	(0.025)	(0.026)	(0.107)	(0.026)	(0.100)
Per capita income in local village		0.006		0.001		0.012
		(0.012)		(0.012)		(0.012)
Distance to township site		− 0.003		− 0.003		− 0.003
		(0.002)		(0.002)		(0.002)
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	2049	2049	2049	2049	2049	2049
First-stage estimation (outcome: ECE participation)						
Whether there existed ECE in this village before the sampled individual was at ECE age (6 years old)		0.125***		0.174***		0.118***
		(0.025)		(0.021)		(0.030)
F		31.18		57.63		23.44

(1) The odd columns report estimations from the FFE model, the even columns report estimations from the IV model. All estimations control for the full set of birth cohort fixed effects. Estimations from the FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects. (2) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Results

Main results

Tables 2 and 3 report our main results. In these tables, the odd columns present estimations from the family fixed effects (FFE) model, whereas the even columns report estimations from the IV model. Moreover, the first two columns report the impacts of any ECE experience, the second and third two columns report the impacts of preschool and kindergarten, respectively. All estimations reported here control for the full set of birth cohort, while estimations from the

Table 3 Effects of ECE on off-farm employment outcomes at the first job

Models	(1) FFE	(2) IV	(3) FFE	(4) IV	(5) FFE	(6) IV
Panel A: Full-time off-farm job at the first job (1=yes)						
Preschool or kindergarten	0.021*	0.016*				
	(0.011)	(0.010)				
Preschool			0.025*	0.019*		
			(0.015)	(0.011)		
Kindergarten					0.006	0.017
					(0.013)	(0.111)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel B: Self-employed off-farm job at the first job (1=yes)						
Preschool or kindergarten	0.005	0.004				
	(0.008)	(0.005)				
Preschool			0.004	0.003		
			(0.008)	(0.006)	− 0.000	− 0.000
Kindergarten					(0.009)	(0.007)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel C: Migrant workers at the first job (1=yes)						
Preschool or kindergarten	0.075***	0.085***				
	(0.022)	(0.024)				
Preschool			0.154***	0.156***		
			(0.026)	(0.026)		
Kindergarten					0.058***	0.055**
					(0.022)	(0.023)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726

(1) Control variables include all explanatory variables reported in Table 2. The odd columns report estimations from the FFE model, the even columns report estimations from the IV model. All estimations control for the full set of birth cohort fixed effects. Estimations from the FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects. (2) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects.

When we examine the effects of any ECE experience on one's off-farm employment at the first job, two notable findings emerge. First, regression results from both FFE and IV models consistently show that ECE experience has a statistically significant and positive effect on one's probability of engaging in off-farm employment at the first job.

Specifically, individuals with any ECE (preschool) experience is 6–7 (7–8) percentage points more likely to engage in off-farm work at the first job than those without.[12] Second, unlike ECE experience in general or preschool in specific, regression results from both FFE and IV models also suggest that the impacts of kindergarten on rural labor's off-farm employment are insignificant. This finding is in line with the expectations that different types of ECE exert various impacts in the context of China.

The estimated coefficients of the control variables are also informative and consistent with the previous findings. For example, males and non-ethnic minorities are more likely to engage in off-farm work at the first job, which is commonly observed in China (e.g., Wang et al., 2016).

Conditional on being employed off-farm at the first job, regression results further demonstrate statistically significant and positive effect of any ECE (preschool) experience on one's degree of engagement in off-farm employment at the first job. Specifically, compared with their peers without any ECE experience, those with any ECE (preschool) experience are 2 (2–3) percentage points more likely to be full-time off-farm workers at their first job (Panel A), and 8–9 (15–16) percentage points more likely to be employed outside of the city at their first job (Panel C). However, our data do not provide any evidence that any ECE/preschool/kindergarten affects one's probability of being self-employed worker at the first job (Panel B). Nor do we find any evidence that kindergarten affects their degrees of engagement in off-farm (Columns 5–6, Panel A).

So far, our results have shown that ECE experience affects both the extensive margin (higher probability of engaging in off-farm employment) and the intensive margin (higher probability of being full-time employed or being migrant workers) of rural labors' off-farm employment at the first job in China. How do these findings compare to previous studies? As far as we know, there has been little research that explores the long-term benefits of ECE on off-farm employment in the same context. The most comparable existing studies we could find are focused on other outcome measures or from different contexts. For example, Bailey et al. (2021) studied the long-term impacts of Head Start in America and found that attending ECE is associated with a significant increase in the extensive margin (a 4 percentage points increase in one's probability of being employed) and intensive margin (a 2-week increase per year and a 3-h increase per week in one's job duration as adults) of employment. Fessler and Schneebaum (2019) demonstrate that ECE experience significantly increases one's chances of working full time by 5.8 percentage points on average in Austria. Comparatively speaking, our findings are consistent with these studies, although with slightly larger magnitude.[13]

Potential mechanisms

The results reported so far have shown that rural labors benefit from ECE on their long-term outcomes in the labor market. Why is it like this? One important channel that has been proposed in several studies is the improved educational attainment brought by ECE (Goodman & Sianesi, 2005; Havnes & Mogstad, 2011). To test this hypothesis in our study, we investigate the impacts of ECE on one's years of schooling which has long been used to represent educational attainment in previous studies (Filmer & Pritchett, 1999).

Results from regressions show that ECE experience significantly improves rural labors' educational attainment. Specifically, individuals with any ECE (preschool) experience had completed 0.5–1.4 (0.5–1.5) more years of schooling than their counterparts without the corresponding experience (Table 4). However, compared to the effect of any ECE or preschool, the effect of kindergarten on educational attainment is not only smaller but also less precise, which partly echoes its insignificant effects on rural labors' off-farm employment outcomes (as shown in Tables 2 and 3). Taken together, these findings lend further evidence in support of the hypothesis that rural labors benefit from ECE on their off-farm employment outcomes by improving their educational attainment.[14]

Heterogeneity in long-term impacts of ECE

The long-term impacts of ECE experience may differ by subgroups of individuals, such as gender and household socioeconomic status (Dietrichson et al., 2020). Hence, in this sub-section, we further investigate the potential heterogeneous effects of ECE on rural labors' off-farm employment. Tables 5, 6 repeat the analyses reported in Tables 2, 3, but this time adding the interaction term of any ECE experience with gender and parental education years,[15] respectively.

[12] The estimates obtained from the FFE model are quite similar to those obtained from the IV model, which lend further support to the robustness of our findings.

[13] Our findings regarding slightly larger coefficient estimates might be resulted from the relatively low quality of counterfactual cares in rural China. Such being the case, ECE experience can give children a head start to overcome challenges associated with their disadvantaged backgrounds.

[14] It should be noted that we could only examine the mediating role of educational attainment due to the data limitations. Future studies with more detailed data can shed more light on this issue.

[15] According to the father's and mother's education years reported in Table 1, in this subsection, we calculate the highest education years among parents to represent household SES.

Table 4 Potential mechanisms

Outcome: years of schooling	(1) FFE	(2) IV	(3) FFE	(4) IV	(5) FFE	(6) IV
Preschool or kindergarten	0.489***	1.409*				
	(0.075)	(0.776)				
Preschool			0.480***	1.519**		
			(0.092)	(0.650)		
Kindergarten					0.473***	1.572
					(0.078)	(0.984)
Female	− 0.047	− 0.015	− 0.044	− 0.057	− 0.053	− 0.041
	(0.073)	(0.094)	(0.073)	(0.091)	(0.073)	(0.091)
Ethnic minority	− 0.359*	− 0.325	− 0.318	− 0.139	− 0.389*	− 0.501
	(0.216)	(0.285)	(0.217)	(0.256)	(0.217)	(0.359)
Age at the first job	0.695***	0.652***	0.691***	0.648***	0.697***	0.663***
	(0.027)	(0.031)	(0.027)	(0.031)	(0.027)	(0.032)
Number of siblings	− 0.337***	− 0.295***	− 0.329***	− 0.322***	− 0.359***	− 0.348***
	(0.049)	(0.061)	(0.050)	(0.061)	(0.049)	(0.054)
Father's age	0.000	− 0.009	0.001	− 0.007	0.002	− 0.005
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)
Mother's age	− 0.005	0.009	− 0.007	− 0.005	− 0.007	0.006
	(0.016)	(0.020)	(0.016)	(0.018)	(0.016)	(0.020)
Father's education (years)	0.065***	0.060***	0.065***	0.072***	0.072***	0.076***
	(0.018)	(0.022)	(0.018)	(0.021)	(0.018)	(0.019)
Mother's education (years)	0.058***	0.047**	0.056***	0.053***	0.060***	0.052***
	(0.018)	(0.020)	(0.018)	(0.020)	(0.018)	(0.019)
Father or Mother is a CPC party member	0.342***	0.416***	0.315***	0.361***	0.335***	0.402***
	(0.120)	(0.128)	(0.120)	(0.122)	(0.120)	(0.128)
Per capita income in local village		0.151		0.182		0.315***
		(0.101)		(0.139)		(0.079)
Distance to township site		0.004		− 0.005		0.003
		(0.013)		(0.011)		(0.013)
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
Constant	− 4.487***		− 3.949***		− 4.855***	
	(0.684)		(0.690)		(0.689)	
N	2049	2049	2049	2049	2049	2049
R^2	0.585	0.127	0.584	0.236	0.585	0.039

(1) The odd columns report estimations from the FFE model, the even columns report estimations from the IV model. All estimations control for the full set of birth cohort fixed effects. Estimations from the FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects. (2) Standard errors in parentheses

***$p<0.01$, **$p<0.05$, *$p<0.1$

A number of informative patterns emerge from heterogeneity analyses. First, there appear to be certain gender differences in the effect of ECE on off-farm employment at the first job, while relatively insignificant gender differences in the three other off-farm employment indicators (namely, full-time, self-employed, and migrant). More specifically, compared with males, females tend to benefit more from ECE on their off-farm employment outcomes (Panel A, Table 5). However, this gender heterogeneity shows no clear patterns among different estimation models or different types of ECE. For example, estimates from the FFE model (Columns 1 and 5, Panel A) show that females with any ECE

Table 5 Heterogeneous analyses by gender

ECE Models	(1)	(2)	(3)	(4)	(5)	(6)
	Preschool or kindergarten		Preschool		Kindergarten	
	FFE	IV	FFE	IV	FFE	IV
Panel A: Off-farm employment at the first job (1 = yes)						
ECE	0.089***	0.082***	0.100***	0.080***	0.063***	0.058***
	(0.022)	(0.022)	(0.029)	(0.023)	(0.024)	(0.021)
ECE*male	− 0.039***	− 0.021	− 0.037	− 0.031	− 0.034*	− 0.027
	(0.014)	(0.013)	(0.041)	(0.045)	(0.018)	(0.017)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	2049	2049	2049	2049	2049	2049
Panel B: Full-time off-farm job at the first job (1 = yes)						
ECE	0.005	0.007	0.010	0.010	0.013	0.010
	(0.019)	(0.016)	(0.022)	(0.017)	(0.020)	(0.018)
ECE*male	0.016	0.054***	0.021	0.009	0.025	0.016
	(0.023)	(0.014)	(0.027)	(0.021)	(0.026)	(0.018)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel C: Self-employed off-farm job at the first job (1 = yes)						
ECE	− 0.008	0.006	− 0.024*	0.004	− 0.007	0.006
	(0.012)	(0.010)	(0.014)	(0.010)	(0.012)	(0.011)
ECE*male	0.005	0.003	0.013**	0.007	0.005	0.004
	(0.015)	(0.011)	(0.007)	(0.017)	(0.016)	(0.011)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel D: Migrant workers at the first job (1 = yes)						
ECE	0.045	0.049*	0.149***	0.149***	0.106***	0.121***
	(0.031)	(0.028)	(0.035)	(0.035)	(0.032)	(0.035)
ECE*male	0.024	0.029	0.010	0.016	0.059	0.066
	(0.041)	(0.043)	(0.049)	(0.052)	(0.044)	(0.046)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726

(1) Control variables include all explanatory variables reported in Table 2. The odd columns report estimations from the FFE model, the even columns report estimations from the IV model. All estimations control for the full set of birth cohort fixed effects. Estimations from the FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects. (2) The first two columns report the impacts of preschool or kindergarten. The second two columns report the impacts of preschool. The third two columns report the impacts of kindergarten. (3) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 6 Heterogeneous analyses by parental education

ECE Models	(1)	(2)	(3)	(4)	(5)	(6)
	Preschool or kindergarten		Preschool		Kindergarten	
	FFE	IV	FFE	IV	FFE	IV
Panel A: Off-farm employment at the first job (1 = yes)						
ECE	0.043*	0.036*	0.028*	0.025*	0.093*	0.105**
	(0.025)	(0.019)	(0.016)	(0.014)	(0.048)	(0.046)
ECE* **I**(Parental educ. > Median)	− 0.095**	− 0.110**	− 0.044	− 0.032	− 0.033**	− 0.029***
	(0.048)	(0.045)	(0.038)	(0.030)	(0.014)	(0.009)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	2049	2049	2049	2049	2049	2049
Panel B: Full-time off-farm job at the first job (1 = yes)						
ECE	0.017	0.013	0.066*	0.039*	0.003	0.003
	(0.022)	(0.017)	(0.038)	(0.023)	(0.024)	(0.019)
ECE* **I**(Parental educ. > Median)	− 0.001	0.001	− 0.051	0.040	− 0.006	− 0.005
	(0.026)	(0.021)	(0.041)	(0.045)	(0.029)	(0.025)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel C: Self-employed off-farm job at the first job (1 = yes)						
ECE	0.001	0.001	0.032	0.024*	0.019**	0.017**
	(0.014)	(0.010)	(0.026)	(0.013)	(0.008)	(0.008)
ECE* **I**(Parental educ. > Median)	− 0.005	− 0.004	− 0.036	− 0.056	− 0.021	− 0.019
	(0.016)	(0.013)	(0.028)	(0.050)	(0.018)	(0.021)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726
Panel D: Migrant workers at the first job (1 = yes)						
ECE	0.106*	0.092**	0.129**	0.148***	− 0.110**	0.119**
	(0.056)	(0.045)	(0.056)	(0.055)	(0.051)	(0.057)
ECE* **I**(Parental educ. > Median)	− 0.071***	− 0.078***	− 0.057	− 0.050	− 0.063***	− 0.065**
	(0.025)	(0.026)	(0.036)	(0.036)	(0.025)	(0.026)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Family FEs	Yes	No	Yes	No	Yes	No
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	N.A	Yes	N.A	Yes	N.A	Yes
N	1726	1726	1726	1726	1726	1726

(1) Control variables include all explanatory variables reported in Table 2. The odd columns report estimations from the FFE model, the even columns report estimations from the IV model. All estimations control for the full set of birth cohort fixed effects. Estimations from the FFE model additionally control for the full set of family fixed effects and estimations from the IV model additionally control for the full set of province fixed effects. (2) The first two columns report the impacts of preschool or kindergarten. The second two columns report the impacts of preschool. The third two columns report the impacts of kindergarten. (3) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

(kindergarten) experience are 4 (3) percentage points higher than males in their probabilities to engage in off-farm job at the first job, while it is insignificant in IV estimates (Columns 2 and 6, Panel A). Meanwhile, regression results show insignificant gender differences in the effect of preschool on one's off-farm employment at the first job across all models (Columns 3–4, Panel A). Moreover, nearly all estimates of gender heterogeneity in ECE on the three other off-farm employment indicators are insignificant, with the only two exceptions showing that males tend to benefit more from ECE on their probabilities of being full-time employed in off-farm (Column 2, Panel B) or self-employed (Column 3, Panel C) at the first job.

Second, results from Table 6 further suggest significant heterogeneity in the long-term benefits of ECE experiences on off-farm employment by parental education. More specifically, compared with individuals with better-educated parents, those with less-educated parents benefit more from any ECE or kindergarten experiences, while this heterogeneity was not observed when we focus on the preschool experience or certain off-farm employment indicators. For example, when it comes to one's probability of engaging in off-farm job at the first job, individuals who had attended any ECE (kindergarten) and with less-educated parents are 10–11 (3) percentage points higher than those with better-educated parents (Columns 1–2 and 5–6, Panel A). Similar patterns also appear when it comes to one's probabilities of being migrant workers (Panel D). However, this household SES heterogeneity mainly occurred in any ECE or kindergarten experience on the above two off-farm employment outcomes, but not in preschool experience (Columns 3–4) or the two other off-farm employment indicators (namely, full-time and self-employed, Panels B and C).

Generally speaking, these findings of heterogeneity are consistent with the previous studies (Havnes & Mogstad, 2011, 2015), which also shows that children from relatively disadvantaged backgrounds tend to benefit more from ECE.

Taken together, the above results provide suggestive evidence on the gender and household SES heterogeneity in the long-term benefits of ECE. In general, females or individuals with less-educated parents seem to be the primary beneficiaries of ECE. This finding highlights the inclusiveness of the long-term benefits of ECE in rural China.

Conclusions and discussions

This paper provides empirical evidence in support of the long-term benefits of ECE on off-farm employment outcomes in rural China. By employing two identification strategies (i.e., the FFE model and IV model), we found significant positive impacts of ECE on rural labors' off-farm employment outcomes. One possible mechanism underlying these relationships is that ECE significantly improves one's educational attainment. Results from heterogeneity analyses show that this effect is more pronounced in terms of some off-farm employment outcomes among females or individuals from relatively lower SES households.

Why do the long-term benefits on rural labors differ by ECE types in China?

Our results show that the long-term benefits of ECE on rural labors' extensive and intensive margins of off-farm employment at the first job are mainly driven by preschool experience rather than by kindergarten experience. The finding of different benefits by ECE types is consistent with several previous studies (Rao et al., 2012; Zhang, 2013). Nonetheless, a natural question arises: why preschool experience has long-term benefits on off-farm employment outcomes while kindergarten experience does not in the context of rural China? Here, we try to provide two possible explanations.

On the one hand, the different impacts of preschools and kindergartens may be driven by their different training goals and curriculum arrangements in rural China. According to Rao et al. (2012), the overall goal of preschool is to promote child development in behavior habits, movement ability, physical and mental health, intelligence, morality and art areas, etc. In comparison, kindergarten education emphasizes more on promoting children's academic readiness for primary schools. Such being the case, curriculums in rural preschools are often play-based, with open and constantly changing play environment, adequate play time, multiple teachers' roles, and child-centered play activities. In contrast, curriculums in kindergartens are relatively more academic, emphasizing the learning of basic numeracy and literacy skills via memorization and recitation. Thus, following the skill formation theory (Cunha & Heckman, 2008), attending preschool may achieve substantial human capital promotion compared to kindergarten, which is increasingly valuable in labor markets (Burger, 2010).

On the other hand, we found that individuals with preschool experience tend to come from relatively more disadvantaged backgrounds than those with kindergarten experience. Specifically, as shown in Table 11, compared to individuals with kindergarten experience, those with preschool experience are more likely to be ethnic minorities (4.1% vs 1.9%) and have 0.6 more siblings, have less-educated fathers (1.053 less years of schooling) and mothers (0.859 less years of schooling), come from villages with lower per capita income and longer distance to township site. Considering the significant pro-disadvantaged bias of the impacts of ECE, the more prominent long-term benefits found for preschool on off-farm employment outcomes may have something to do with the relatively more disadvantaged backgrounds of its participants.

Limitations

We acknowledge at least three limitations of our study. First, due to data constraints, we were only able to detect the impacts of different types of ECE, but unable to explore the potential reasons. Although we have proposed certain suggestive explanations, more rigorous explorations are needed to improve our understanding of the research findings. Future studies with more detailed data can shed more light on these issues.

Second, the ECE nowadays in China is different from what our sampled individuals have attended (mostly during the 2000's), which has improved significantly in terms of both access and quality. Thus, the magnitude of the effects of the current ECE may be bigger than our estimates. Despite that, our estimates indeed provide evidence in support of the long-term benefits of ECE, which can be interpreted as a lower bound of estimates.

Third, although we have employed the FFE and IV models to address the endogeneity in the supply and demand sides of ECE, respectively, still, we are unable to purge out all the potential unobserved confounders. The relationships of ECE experience and one's off-farm employment outcomes are still worth further explorations with a more robust identification strategy.

Policy implications

Despite these limitations, we can draw at least three policy implications from our research findings. First, our findings about the overall benefits of ECE experience suggest that improving access to ECE might serve as an effective instrument to improve rural labors' off-farm employment outcomes in China. Given the limited access to ECE for ECE-aged children in rural areas (Gong et al., 2016), more efforts should be made to facilitate ECE attendance among children from rural households.

Second, we find that most of the long-term benefits of ECE on off-farm employment outcomes are driven by the disadvantaged groups (females or individuals with less-educated parents). Thus, more support are needed to ease the financial burden on disadvantaged households and ensure their children's access to affordable ECE in rural China. This can not only serve as an effective way to maximize the aggregate gains of ECE experience for rural labors, but also help narrow the child development gap and thus reduce the inequality in the labor market outcomes between individuals from disadvantaged and advantaged backgrounds.

Third, the finding that it is preschool rather than kindergarten which benefits rural labors more in their off-farm employment outcomes that the types of ECE services should be considered when designing or improving ECE policies or programs. Meanwhile, this also demonstrates the importance of distinguishing ECE types when evaluating the benefits of ECE programs in developing countries in future research.

Appendix

See Tables 7, 8, 9, 10, 11.

Table 7 Representativeness of our study sample

	(1)	(2)	(3)	(4)	(5)
	Our study sample		Original sample in CRDS		Diff
	Mean	SD	Mean	SD	(3–1)
Panel A: Individual level					
Male (1 = yes)	0.553	0.497	0.496	0.500	0.057
Ethnic minority (1 = yes)	0.029	0.167	0.039	0.193	− 0.010
Number of siblings	1.263	0.957	1.937	1.131	− 0.674
Age at the first job	18.375	2.830	17.732	1.307	0.643***
Panel B: Parent level					
Father's age	52.340	6.821	65.095	8.139	− 12.755***
Mother's age	50.947	6.510	62.933	7.661	− 11.986***
Father's education (years)	8.476	2.549	7.651	1.318	0.825***
Mother's education (years)	8.098	2.436	6.469	1.294	1.629***
Father or Mother is a CPC member (1 = yes)	0.166	0.371	0.176	0.251	− 0.010
Panel C: Village level					
Per capita income (log)	7.091	0.656	7.190	0.614	− 0.099
Distance to township site (km)	5.069	3.983	5.044	3.903	0.025
Number of individuals	2049		9770		

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table 8 Effects of ECE on off-farm employment outcomes using subsample individuals from villages that ever have provided ECE services

ECE	(1) Preschool or kindergarten	(2) Preschool	(3) Kindergarten
Panel A: Off-farm employment at the first job (1 = yes)			
ECE	0.238**	0.060*	0.264
	(0.102)	(0.032)	(0.207)
Covariates	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
N	1103	1015	895
Panel B: Full-time off-farm job at the first job (1 = yes)			
ECE	0.211**	0.246**	0.282
	(0.092)	(0.107)	(0.179)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	926	863	736
Panel C: Self-employed off-farm job at the first job (1 = yes)			
ECE	-0.003	0.047	-0.047
	(0.060)	(0.069)	(0.112)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	925	862	736
Panel D: Migrant workers at the first job (1 = yes)			
ECE	0.530***	0.603***	0.341**
	(0.192)	(0.190)	(0.146)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	922	860	734
First-stage estimation (outcome: ECE participation)			
Whether there existed ECE in this village before the sampled individual was at ECE age (6 years old)	0.212***	0.189***	0.156***
	(0.027)	(0.027)	(0.032)
F	19.430	22.426	11.945

(1) Control variables include all explanatory variables reported in Table 2. All estimations control for the full set of birth cohort and province fixed effects. (2) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 9 Effects of IV on off-farm employment outcomes using subsample individuals without ECE experience

	(1)	(2)	(3)
ECE	Preschool or kindergarten	Preschool	Kindergarten
Panel A: Off-farm employment at the first job (1 = yes)			
IV	0.057	0.016	0.060
	(0.113)	(0.107)	(0.124)
Covariates	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
N	780	1093	964
Panel B: Full-time off-farm job at the first job (1 = yes)			
IV	0.047	0.079	0.006
	(0.086)	(0.074)	(0.087)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	549	792	714
Panel C: Self-employed off-farm job at the first job (1 = yes)			
IV	0.018	0.034*	0.060
	(0.016)	(0.019)	(0.067)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	547	790	712
Panel D: Migrant workers at the first job (1 = yes)			
IV	0.005	0.010	0.025
	(0.155)	(0.137)	(0.159)
Covariates	Yes	Yes	Yes
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
N	543	784	708

(1) Control variables include all explanatory variables reported in Table 2. All estimations control for the full set of birth cohort and province fixed effects. (2) Marginal effects evaluated at sample means are reported. Standard errors in parentheses

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 10 Association between village characteristics and the availability of ECE services at village level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IV	Any ECE	Preschool	Kindergarten	Any ECE	Preschool	Kindergarten	Any ECE	Preschool	Kindergarten
Time	2000			2004			2007		
Number of households	− 0.000	− 0.000	0.000	− 0.000	− 0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population	0.000	0.000	0.000	0.000	0.000	0.000	0.000	− 0.000	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income (log)	0.001	0.012	− 0.000	0.040	0.042	0.023	− 0.010	0.015	0.011
	(0.042)	(0.042)	(0.031)	(0.045)	(0.045)	(0.033)	(0.040)	(0.040)	(0.030)
Land size	− 0.000	− 0.000	− 0.000	− 0.000	− 0.000	0.000	− 0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Crop size	− 0.000	− 0.000	− 0.000	0.000	0.000	− 0.000	− 0.000	− 0.000	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of labors	0.000	0.000	0.000	− 0.000	− 0.000	− 0.000	− 0.000	0.000	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Whether the road is paved	− 0.060	− 0.046	− 0.069*	0.003	0.015	− 0.012	− 0.055	− 0.036	− 0.006
	(0.052)	(0.051)	(0.038)	(0.052)	(0.052)	(0.038)	(0.061)	(0.061)	(0.045)
Distance to township site (km)	− 0.008	− 0.006	− 0.002	− 0.008	− 0.007	− 0.003	0.004	0.005	0.004
	(0.006)	(0.006)	(0.004)	(0.006)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)
Number of villagers working in the township government	− 0.002	− 0.001	− 0.003	− 0.004	− 0.005	− 0.004	− 0.001	0.001	− 0.006
	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)	(0.003)	(0.006)	(0.006)	(0.004)
Number of villagers working in the county government	− 0.009	− 0.011	− 0.003	− 0.007	− 0.006	− 0.002	− 0.002	− 0.002	0.000
	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)
Number of firms	0.006	0.007	0.001	− 0.002	− 0.001	− 0.001	− 0.003	− 0.003	− 0.002
	(0.008)	(0.008)	(0.006)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Average daily wage for male labors	− 0.001	− 0.001	0.001	0.000	− 0.001	0.004	0.000	0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Average daily wage for female labors	0.001	0.001	− 0.001	− 0.007	− 0.006	− 0.011***	0.002	0.001	− 0.001
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.002)
Constant	0.163	0.077	0.067	− 0.008	− 0.038	− 0.034	0.113	− 0.104	− 0.055
	(0.299)	(0.297)	(0.221)	(0.312)	(0.312)	(0.228)	(0.322)	(0.322)	(0.238)
Number of villages	99	99	99	100	100	100	99	99	99
R^2	0.075	0.072	0.081	0.112	0.097	0.138	0.077	0.065	0.084
F	0.531	0.506	0.577	0.837	0.709	1.057	0.549	0.452	0.598
Prob > F	0.8990	0.9152	0.8663	0.6205	0.7496	0.4071	0.8868	0.9446	0.8494
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
IV	Any ECE	Preschool	Kindergarten	Any ECE	Preschool	Kindergarten	Any ECE	Preschool	Kindergarten
Time	2011			2015			2019		
Number of households	− 0.000	0.000	− 0.000	− 0.000	− 0.000	− 0.000	− 0.000	− 0.000	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population	− 0.000	− 0.000	− 0.000	− 0.000	− 0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per capita income (log)	− 0.081*	− 0.066	− 0.051	0.042	0.045	0.012	0.077**	0.081**	0.028
	(0.047)	(0.047)	(0.036)	(0.032)	(0.032)	(0.024)	(0.037)	(0.036)	(0.028)
Land size	− 0.000	− 0.000	− 0.000	0.000	0.000	0.000	− 0.000	− 0.000	0.000

Table 10 (continued)

IV	(10) Any ECE	(11) Preschool	(12) Kindergarten	(13) Any ECE	(14) Preschool	(15) Kindergarten	(16) Any ECE	(17) Preschool	(18) Kindergarten
Time	2011			2015			2019		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Crop size	0.000	0.000	0.000	− 0.000	− 0.000	− 0.000	0.000	0.000	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of labors	0.000	0.000	0.000	0.000	0.000	0.000	− 0.000*	− 0.000*	− 0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Whether the road is paved	0.121	0.112	0.055	0.015	0.007	0.051	0.166	0.137	0.089
	(0.077)	(0.077)	(0.059)	(0.112)	(0.111)	(0.082)	(0.203)	(0.203)	(0.154)
Distance to township site (km)	0.004	0.004	0.004	0.000	0.000	0.002	− 0.001	− 0.001	0.001
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Number of villagers working in the township government	− 0.006*	− 0.006*	− 0.003	− 0.001	− 0.001	− 0.001	− 0.001	− 0.000	− 0.001
	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Number of villagers working in the county government	0.006	0.006*	0.003	− 0.000	0.000	− 0.001	− 0.001	− 0.001	− 0.003
	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
Number of firms	− 0.001	− 0.001	− 0.001	− 0.003	− 0.003	− 0.003	0.000	− 0.000	0.000
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Average daily wage for male labors	− 0.001	− 0.001	0.001	0.001	0.001	0.001	− 0.001	− 0.002	− 0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average daily wage for female labors	0.003*	0.003*	0.000	− 0.001	− 0.001	0.001	0.002	0.002	0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.530	0.420	0.307	− 0.311	− 0.338	− 0.213	− 0.655*	− 0.624	− 0.261
	(0.359)	(0.360)	(0.275)	(0.290)	(0.289)	(0.214)	(0.391)	(0.390)	(0.296)
Number of villages	99	99	99	99	99	99	95	95	95
R^2	0.152	0.137	0.105	0.073	0.066	0.085	0.133	0.123	0.104
F	1.168	1.041	0.765	0.514	0.465	0.605	0.953	0.877	0.721
Prob > F	0.3168	0.4211	0.6940	0.9099	0.9381	0.8441	0.5041	0.5793	0.7371

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 11 Difference between individuals with preschool experience and those with kindergarten experience

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	With preschool experience			With kindergarten experience			Diff
	Mean	SD	N	Mean	SD	N	(4–1)
Panel A: Outcome variables							
Off-farm employment at the first job (1 = yes)	0.841	0.366	533	0.941	0.236	635	0.100***
Full-time off-farm job at the first job (1 = yes)	0.927	0.260	512	0.955	0.207	634	0.028
Self-employed off-farm job at the first job (1 = yes)	0.034	0.181	512	0.033	0.179	634	− 0.001
Migrant workers (1 = yes)	0.539	0.499	510	0.852	0.355	632	0.313***
Panel B: Individual characteristics							
Male (1 = yes)	0.551	0.498	533	0.510	0.501	635	− 0.041
Ethnic minority (1 = yes)	0.041	0.198	533	0.019	0.133	635	− 0.022*
Number of siblings	1.607	0.910	533	0.963	0.774	635	− 0.644***
Age at the first job	18.047	2.737	533	19.051	3.002	635	1.004***
Panel C: Parent characteristics							
Father's age	54.809	7.185	533	54.275	7.568	635	− 0.533
Mother's age	53.121	6.889	533	52.782	7.200	635	− 0.339
Father's education (years)	7.792	2.249	533	8.845	2.100	635	1.053***
Mother's education (years)	6.624	2.274	533	7.483	2.075	635	0.859***
Father or Mother is a CPC member (1 = yes)	0.148	0.303	533	0.152	0.301	635	0.004
Panel D: Village characteristics							
Per capita income (log)	6.903	0.650	533	7.586	0.480	635	0.683***
Distance to township site (km)	5.072	4.204	533	4.134	3.375	635	− 0.938***

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

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