The Cost of Prosperity in China, Comparison of Early Development Differences Between Left-Behind Children and Non-left-behind Children in Rural China

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The Cost of Prosperity in China

Comparison of Early Development Differences Between Left-Behind Children and Non-left-behind Children in Rural China

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Introduction

Left-behind children, also called “stay at home children”, who remain in rural regions of the country while their one parent or both parents migrate to find work, continue their studies, or seek a better life. Left-behind children in rural areas of China are faced with the harsh reality of being separated from their migrant worker parents due to economic reasons. This phenomenon has far-reaching implications for the development outcomes of these vulnerable children (Rozelle, 2022). By 2021, there were 41.9 million 0-17 years old left-behind children in rural China, including 7.2 million in infancy and early childhood for 0-3 years old. (UNICEF, 2021). These children live in the absence of one or both parents, often under the care of other family members or guardians, posing unique challenges to their development and well-being. The separation from parents and the subsequent lack of direct parental care and supervision can have profound impacts on the cognitive, emotional, and social development of left-behind children. Compared to their peers who live with their parents, left-behind children may experience delayed cognitive development, poorer educational outcomes, and emotional distress. The implications of these disparities are not only significant for the children themselves but also pose long-term consequences for social stability and economic productivity in China. Therefore, understanding the full impact of parental migration on the development of left-behind children is crucial for policymakers and educators.

This paper aims to bridge the knowledge gap regarding the cognitive impacts of being left behind, using a robust clustered cross-sectional dataset from twelve villages in rural Sichuan Province. Through a detailed analysis using the Bailey Scale of Infant Development, this study explores how the absence of parents affects the early cognitive outcomes of these children, contributing to provide empirical evidence that can inform targeted interventions and policy measures aimed at mitigating the adverse effects of parental absence in rural China.

Literature Review
Since the rise of urbanization in China in the 1980s, a significant number of children have been left behind in rural areas under the care of extended family members or caregivers while their parents seek employment opportunities in distant cities (Jingzhong Y and Lu, 2011). Several studies have demonstrated that left-behind children encounter a multitude of challenges, including lower educational attainment, weaker socioemotional development, and overall poorer well-being when compared to their non-left-behind counterparts. The well-being and development of left-behind children in China are crucial as they represent the future workforce, social stability, and economic productivity of the nation, impacting China's long-term development (Rozelle, 2019). Therefore, it is of utmost importance to comprehend the precise consequences of parental migration on left-behind children, as this understanding is crucial for the formulation of effective policies and interventions aimed at alleviating these adverse outcomes.

Previous studies consistently highlight the unique challenges faced by left-behind children. According to a study by Li and Wang (2019), these children tend to have lower levels of educational attainment compared to their non-left-behind counterparts. Additionally, research conducted by Su et al. (2013) reveals that the absence of parental support and limited parent-child communication have a negative impact on the socioemotional development of these children. Meng et al. (2013) conducted a study using data from the China Family Panel Studies and discovered that left-behind children have lower levels of education compared to their peers. Similarly, Mu and Xie (2017) investigated the cognitive and non-cognitive skills of left-behind children and found that factors such as caregiver quality and community support play important roles in shaping their development. These studies emphasize the significant impact of parental migration on the well-being and development of left-behind children. Research conducted by Zhao et al. (2016) suggests that the educational and socioemotional disparities between left-behind children and their non-left-behind counterparts can be attributed to factors such as parental absence, limited financial resources, and inadequate access to support services and educational opportunities. Moreover, Li and Wang (2019) emphasize the importance of community support and strong parent-child communication in promoting the well-being of left-behind children. These findings highlight the need to address these factors in order to improve
the overall development outcomes of left-behind children.

Regarding the research on the cognitive development of left-behind children, Yue et al. (2017) highlighted the invisible crisis of cognitive delays among rural toddlers in China. The study emphasized the absence of modern parenting as a contributing factor to cognitive delays. Furthermore, the absence of parental involvement due to migration and the lack of stimulating environments were identified as potential reasons for the cognitive delays observed in left-behind children. Besides, Nelson et al. (2014) provided insights into the predictive nature of early handedness on language ability in toddlers. The absence of modern parenting practices and the lack of stimulating environments in the absence of parents can significantly affect early cognitive ability development in left-behind children. This phenomenon is not unique to China or developing countries. In the book The Two-Parent Privilege, Kearney (2023) provides evidence that in for the United States a stable two-parent family, especially one in which both parents are actively involved, provides children with unique advantages beyond the joint income. Their children are more likely to reach educational milestones and less likely to break the law.

According to the differences in the development of left-behind and non-left-behind children in rural China, the findings highlight the need for targeted interventions and support systems to address the problems observed among left-behind children, while also highlighting the importance of considering environmental and social factors in child development.

**Methodology**

**Research design**

The research question guiding this study is: Compared with non-left-behind children, what is the impact of being a left-behind child on their early childhood cognitive development?
This study adopts a cross-sectional research design to compare the cognitive development of left-behind children with non-left-behind children in rural areas. The cross-sectional data used in this study originate from the baseline data of a long-term research project named "The Thousand Days Project". This ongoing research is a collaborative effort led by Professor Scott Rozelle's team at the Stanford China Economic and Institutional Center, in conjunction with the School of Public Health at the University of California, Berkeley, among other research teams.

The Thousand Days Project employs randomized controlled trials to explore the impact of mental health training interventions for caregivers on the development of children, as well as the effects of establishing village-level Happy Nurturing Centers that provide regular early childhood education activities on the development of children.

The cross-sectional data collected serves as a foundational assessment, capturing a snapshot of current conditions and outcomes that will enable a comparative analysis before and after the intervention phases. This baseline is critical for understanding the initial status of the children and their environments, which will be crucial for assessing the efficacy of the interventions implemented during the project. The second round of data will be collected by the Thousand Days Project data collection team in the fall of 2024. At that time, this study will integrate time-series panel data to conduct a more comprehensive analysis of the cognitive disparities between left-behind and non-left-behind children.

**Sample**

The study population comprises children aged 0-3 years residing in 12 villages selected from Ya’an city, Sichuan province, China. These villages were chosen to represent a diverse range of socioeconomic backgrounds and geographical characteristics within the region. Specifically, the study area includes villages from Ya'an City, Sichuan Province, China. Ya'an City, situated in the economically backward western province of Sichuan Province, is recognized as one of the poorest areas in the region. As such, it serves as a representative example of the social and
economic background prevalent in rural areas of China. The selection of villages from Ya'an City ensures the inclusion of a wide spectrum of socioeconomic conditions, providing a comprehensive understanding of the cognitive development among children in this rural setting.

The data are clustered cross-sectionally, with 832 children aged 0-3 years from 12 villages participating in the study. After data cleaning, a total of 570 valid observations were obtained.

**Assessment Tool: The Bayley Scales of Infant Development (BSID)**

In this study, the Bayley Scales of Infant Development are utilized to evaluate the cognitive functions of children from the rural areas of Sichuan. The Bayley Scales of Infant Development, widely recognized as a leading tool in the assessment of developmental functioning in infants and young children, serves as the primary instrument for measuring cognitive abilities in this study. The Bayley Scales of Infant Development is designed to comprehensively evaluate the developmental progress of children from birth through 42 months, focusing on cognitive, language, and motor skills. (Bayley, 2005) This scale provides critical insights into the early cognitive capabilities of children, assessing abilities such as attention, exploration, problem-solving, and memory. (Balasundaram, 2022) The robust and standardized nature of the Bayley Scales ensures that the cognitive assessments are both reliable and valid, making it an indispensable tool for examining the potential impacts of parental absence on the cognitive development of children in rural Sichuan. Besides, using the Bayley Scales of Infant Development within the context of the Thousand Days Project allows for a standardized comparison across diverse rural areas, ensuring that the cognitive assessments reflect real developmental statuses that are comparable both within the following study and broader developmental norms. The upcoming collection of time-series panel data in the fall of 2024 will further enhance the study of these early children cognitive development outcomes, providing a longitudinal perspective on the effects of parent absence on child cognitive outcomes.

**Data Collection**

The data collection for this study followed a systematic approach. The village committees provided a comprehensive list of all children aged 0-3 years residing in the selected villages.
This list served as the sampling frame for the study, ensuring the inclusion of all eligible children within the target age range. By obtaining the list directly from the village committees, the Thousand Days Project data collection team ensured a representative sample of children from each village, thereby capturing the diversity of the population. Informed consent was obtained from the parents or legal guardians of the participating children.

Demographic information such as age in months, gender, premature birth status, birth weight, and family assets was collected through structured interviews or surveys conducted by the Thousand Days Project data collection team.

**Combined Parental Presence Classification**

Left-behind status was determined based on parental presence status.

Parental presence was coded based on whether each parent was physically present with the child. A code of '0' was used to indicate absence, and a '1' indicated presence. This binary coding allows for a straightforward analysis of the impact of each parent's presence or absence on the child's developmental outcomes.

Children were classified into four groups:

**Non-left-behind children (NLBC)**, this group of children with mother present(1) and father present(1).

**Left behind children group 1 (LBCF)**, this group of children with the mother absent(0) and father present(1).

**Left behind children group 2 (LBCM)**, this group of children with the mother present(1) and father absent(0).

**Left behind children group 3 (LBCN)**, this group of children with the mother absent(0) and father absent(0). (Table1)
The sample sizes for the groups defined in the study, categorized according to the established criteria for parental presence or absence, were as follows: NLBC accounted for 326 children, LBC(M) included 10 children, LBC(F) comprised 172 children, and LBC(N) had 62 children. (Table2)

The notably smaller size of the Left-behind children with only father (LBCF), where only the father is present and the mother is absent, can be attributed to several socio-cultural and economic factors prevalent in rural China. Traditionally, mothers are more likely to stay behind to care for children when one parent migrates, due to social norms and roles that prioritize maternal caregiving. Additionally, economic opportunities for women in urban areas of China might not be as readily available or as lucrative as those for men, leading to a higher likelihood of fathers migrating alone for work. (Liu, 2011) This pattern aligns with broader trends observed in rural-to-urban migration, where men are more frequently the sole migrants seeking employment in urban centers, while women are more often tasked with domestic responsibilities, including child-rearing.
Extent of Parental Absence Classification

Building on the above classifications, the study further explores the degree of parental absence, providing insights into its incremental impact on child development. This method specifically quantifies the number of children experiencing various degrees of parental absence, which is crucial for understanding how different levels of parental involvement affect developmental outcomes. Under this classification, children are grouped based on the number of parents absent from the home.

Children with 0 parents absent (C0A/NLBC): This group served as a baseline for comparison,
reflecting the developmental conditions of children with full parental support.

**Children with 1 parent absent (C1A/ LBCF+LBCM):** This category was divided into two subgroups: one where the mother was absent and the father was present (LBCF), and another where the mother was present and the father was absent (LBCM). This distinction allowed the study to assess the differential impacts of missing either parent, which is crucial for understanding gender-specific roles in parenting within the context of rural development.

**Children with 2 parents absent (C3A/LBCN):** Representing the most extreme scenario of parental absence, this group included children who were left without direct parental care and supervision. Analyzing this group provided critical data on the social and emotional challenges these children face, which are presumed to be greater than those experienced by children with at least one parent present. (Table 3)
Individual Parental Presence Classification

In addition to classifying children into groups based on combined parental presence (NLBC, LBCF, LBCM, LBCN), the study also separately analyzed the presence and absence of each parent. Specifically, instances where mothers were present and absent, as well as where fathers were present and absent, were recorded within the sample. This approach allowed for an examination of the individual impacts of each parent's presence on the child’s cognitive developmental environment.

The data revealed the following: Mothers were present in 498 cases and absent in 72 cases, highlighting a higher likelihood of mothers staying with their children compared to fathers, who were present in 336 cases and absent in 234 cases. This distribution is indicative of differing societal roles and economic activities that influence parental availability in rural settings. (Table3)
Cognitive development was assessed using the Bailey Scale, a standardized tool commonly used to measure cognitive functioning in young children. Trained assessors administered the Bailey Scale individually to each child.

**Statistical Analysis**

**Incremental Impacts of Parental Absence on Child Cognitive Development**

To investigate the incremental impacts of parental absence on children's cognitive development, a structured statistical analysis was conducted using linear regression. The primary objective was to assess how the absence of one or both parents affects children's Bayley cognitive scores.

To assess this relationship, a structured approach was taken, categorizing children based on the number of absent parents into three distinct groups: both parents present (X=0), one parent absent (X=1), and both parents absent (X=2). This categorical variable was derived by summing binary indicators of each parent's presence, thus allowing a direct measure of the absence level within each child's familial context.

Multiple linear regression was used to investigate how the levels of parental absence influence cognitive outcomes. The model controlled for several potential confounders, including the child's gender, age in months, premature birth status, birth weight, and household assets. This approach allowed for a nuanced examination of the direct and indirect effects of parental absence on cognitive development. Given the potential for data clustering within villages, the analysis accounted for this by calculating robust standard errors. This method enhances the reliability of the results, ensuring that the estimated effects are not unduly influenced by inter-cluster correlations.

**Impact of Combined Parental Presence on Child Cognitive Development**
Left-behind status was dummy coded to reflect different left-behind situations. The Bayley cognitive scores, which had been standardized for each month of age and adjusted to reflect actual conditions, were consolidated from full and abbreviated assessments to ensure a robust dataset. A categorical variable was created to classify the extent of parental absence, defining four distinct groups: NLBC, LBCF, LBCM, LBCN.

The primary analytical approach was multiple linear regression, aimed at assessing the relationships between the levels of parental absence and children’s cognitive outcomes, as measured by the Bayley cognitive scores. The model included controls for potential confounding such as the child's gender, age in months, premature status, birth weight, and household assets. This was done to isolate the effects of parental presence from other variables that could influence cognitive development.

To address potential clustering of data within villages, robust standard errors were calculated. This adjustment was critical for managing inter-cluster correlation, which could otherwise lead to underestimation of the standard errors and overstatement of statistical significance.

The analysis examined the impact of each category of parental absence on cognitive development, focusing on the statistical significance of the differences observed.

**Differential Effects of Mother and Father Presence on Child Cognitive Development**

To explore the differential effects of mother and father presence on children’s cognitive outcomes, a comprehensive linear regression analysis was conducted. Mother and Father are binary indicators (0 absent, 1 present) reflecting the presence of each parent. The model assessed the independent contributions of each parent's presence to the cognitive scores from the Bayley Scales of Infant Development. The model controlled for gender, age in months, premature birth status, birth weight, and household assets to ensure that the effects attributed to parental presence were not confounded by these variables. To account for the potential clustering of data within villages, robust standard errors were computed, clustered by the village identifier. This method enhances the reliability of the results, ensuring that the estimated effects are not unduly influenced by inter-cluster correlations.
Ethical Considerations

Ethical approval for the study was obtained from the Ya 'an Women's Federation. Measures were taken to ensure participant confidentiality, informed consent, and compliance with ethical guidelines throughout the data collection process.

Model

Analyzing Incremental Impacts of Parental Absence

To quantitatively assess the incremental impacts of parental absence on children's cognitive development, a linear regression model was employed. This model specifically aimed to explore how the absence of one or both parents affects children’s cognitive scores, measured using the Bayley Scales of Infant Development.

The regression equation structured to assess incremental impacts of parental absence is specified as follows:

\[ \text{Bayley} = \beta_0 + \beta_1 \times \text{Parents_Absent} + \beta_2 \times \text{Gender} + \beta_3 \times \text{Month_Age} + \beta_4 \times \text{Premature} + \beta_5 \times \text{Birth_weight} + \beta_6 \times \text{HH_asset} + \epsilon \]

- Bayley is the dependent variable representing the Bayley cognitive scores.
- Parents_Absent is a categorical variable coded as 0 (both parents present/ zero parent absent), 1 (one parent absent), and 2 (both parents absent), designed to capture the varying degrees of parental absence.
- Month_Age, Premature, Birth_Weight, and HH_Assets serve as control variables to adjust for potential founders.

- $\beta_0$ through $\beta_6$ are the coefficients estimated by the model, indicating the impact of each predictor.

- $\epsilon$ represents the error term.

- The analysis uses robust standard errors, clustered by the village to account for potential similarities among children living in the same village and thus ensure more reliable estimation of effects.

In the statistical model developed to analyze the incremental impacts of parental absence, $\beta_1$ is a critical coefficient quantifying the specific change in children's cognitive development as parents are increasingly absent. $\beta_1$ corresponds to the variable Parents_Absent, which is quantitatively coded to reflect the number of absent parents (0, 1, or 2). Here, 0 indicates both parents are present, 1 indicates one parent is absent, and 2 indicates both parents are absent. This coefficient captures the average decrement in cognitive scores associated with each additional parent who is absent.

**Analyzing Impact of Combined Parental Presence on Child Cognitive Development**

To examine the differential effects of various parental presence configurations on children's cognitive development, a linear regression model was employed. The analysis focused on comparing children in different parental absence categories (LBC1, LBC2, and LBC3) to a reference category of non-left-behind children (NLBC) where both parents are present.

The regression equation designed to analyze the impact of combined parental presence on child cognitive development is formulated as follows:
Bayley = $\beta_0 + \beta_1 \times \text{LBCM} + \beta_2 \times \text{LBCF} + \beta_3 \times \text{LBCN} + \beta_4 \times \text{Gender} + \beta_5 \times \text{Month\_Age} + \beta_6 \times \text{Premature} + \beta_7 \times \text{Birth\_weight} + \beta_8 \times \text{HH\_asset} + \epsilon$

- Bayley is the dependent variable representing the Bayley cognitive scores.
- LBCF, LBCM, and LBCN are dummy variables for the respective left-behind children categories: LBCF, the group of children with the mother absent(0) and father present(1). LBCM, the group of children with the mother present(1) and father absent(0). LBCN, the group of children with the mother absent(0) and father absent(0).
- Month\_Age, Premature, Birth\_Weight, and HH\_Assets serve as control variables to adjust for potential founders.
- $\beta_0$ through $\beta_8$ are the coefficients estimated by the model, indicating the impact of each predictor.
- $\epsilon$ represents the error term.
- The analysis uses robust standard errors, clustered by the village to account for potential similarities among children living in the same village and thus ensure more reliable estimation of effects.

In the statistical model constructed to explore the effects of different parental presence configurations on child cognitive development, the coefficients $\beta_1$, $\beta_2$ and $\beta_3$ quantify the specific changes in children’s cognitive scores as influenced by varying parental configurations compared to the reference category of non-left-behind children (NLBC), where both parents are
present.

\( \beta_1 \) is associated with the condition of LBCF where the mother absent(0) and father present(1), compared to the reference group (NLBC).

\( \beta_2 \) is associated with the condition of LBCM where the mother present(1) and father absent(0), compared to the reference group (NLBC).

\( \beta_3 \) is associated with the condition of LBCN where both the mother absent(0) and father absent(0), compared to the reference group (NLBC).

**Analyzing Differential Effects of Mother and Father Presence on Child Cognitive Development**

To comprehensively evaluate how mother and father presence each uniquely influence child cognitive development, a regression model was employed. This model was designed to isolate and compare the effects of each parent’s presence within the same framework, providing a nuanced understanding of their individual contributions to the cognitive outcomes measured by the Bayley Scales.

The regression equation designed to analyze the differential effects of mother and father presence on child cognitive development is formulated as follows:
Bayley = \beta_0 + \beta_1 \times \text{Mother} + \beta_2 \times \text{Father} + \beta_3 \times \text{Gender} + \\
\beta_4 \times \text{Month\_Age} + \beta_5 \times \text{Premature} + \beta_6 \times \text{Birth\_weight} + \beta_7 \times \text{HH\_asset} + \epsilon

- Bayley is the dependent variable representing the Bayley cognitive scores.
- Mother and Father are binary indicators (0 absent, 1 present) representing the presence of the mother and father, respectively.
- Month\_Age, Premature, Birth\_Weight, and HH\_Assets serve as control variables to adjust for potential founders.
- \beta_0 \text{ through } \beta_7 \text{ are the coefficients estimated by the model, indicating the impact of each predictor.}
- \epsilon \text{ represents the error term.}
- The analysis uses robust standard errors, clustered by the village to account for potential similarities among children living in the same village and thus ensure more reliable estimation of effects.

By explicitly including both parents in the same model, it allows for the direct comparison of their effects \beta_1 \text{ and } \beta_2, thereby highlighting whether one parent’s presence may have a more significant impact than the other.

\beta_1 \text{ quantifies the effect of the mother's presence (compared to her absence) on the cognitive scores of children as measured by the Bayley Scales. This coefficient captures the incremental change in cognitive outcomes when a mother is present in a child's life.}

\beta_2 \text{ quantifies the effect of the father's presence (compared to his absence) on the cognitive scores of children as measured by the Bayley Scales. This coefficient captures the incremental}
change in cognitive outcomes when a father is present in a child's life.

Result

Results for Analyzing Impact of Combined Parental Presence on Child Cognitive Development

| Bayley Cognitive Score                  | Coefficient | Std. Err. | t     | P>|t| | 95% CI Low | 95% CI High |
|----------------------------------------|-------------|-----------|-------|------|-------------|-------------|
| LBCF (Only Father present)             | -0.046      | 0.098     | -0.480| 0.635| -0.240      | 0.147       |
| LBCM (Only Mother present)             | -0.415***   | 0.157     | -2.650| 0.009***| -0.726      | -0.105      |
| LBEICN (Non-parents present)           | -0.134      | 0.086     | -1.560| 0.121| -0.305      | 0.036       |
| Gender                                 | 0.014*      | 0.008     | 1.690 | 0.093*| -0.002      | 0.030       |
| Month_age                              | -0.301      | 0.193     | -1.560| 0.121| -0.683      | 0.081       |
| Premature                              | 0.000       | 0.000     | 0.570 | 0.571| 0.000       | 0.000       |
| Birth_weight                           | 0.138***    | 0.050     | 2.730 | 0.007***| 0.038       | 0.238       |
| HH_assets                              | -0.269      | 0.266     | -1.010| 0.313| -0.795      | 0.257       |

*P < 0.1 ; **P < 0.05 ; ***P < 0.01

Table5

This part examines the impact of various parental presence configurations on the cognitive development of children, as assessed by the Bayley Cognitive Score. The analysis involves a dataset of 570 observations, with the model adjusted for cluster effects within villages.

Model Overview

The regression model (F(8, 129) = 3.260, p = 0.002) indicates a significant overall model fit, suggesting that the variables included collectively influence cognitive outcomes. The R-squared value of 0.045 indicates that approximately 4.5% of the variance in cognitive scores is explained by our model.
Key Findings

- Only Father Present (LBCF): The regression coefficient for scenarios where only the father is present is 0.000, indicating no significant change in cognitive scores compared to the baseline of both parents present. The high p-value (1.000) confirms that the father’s sole presence does not statistically influence cognitive scores.

- The negligible impact of father-only presence (LBCF) on child cognitive development, as indicated by a coefficient of 0.000 and a p-value of 1.000. Because the sample size for this group is exceptionally small, consisting of only 10 cases. This observation provides valuable insights into the social and economic factors influencing these dynamics. It reflects entrenched social norms that prioritize maternal caregiving. In many cultures, particularly within the context of this study, mothers are often viewed as the primary caregivers.

- Only Mother Present (LBCM): The presence of only the mother has a coefficient of -0.046, which also does not significantly affect the cognitive scores (p = 0.635). This suggests that while mothers are critical, their lone presence does not statistically differ from having both parents in terms of impacting cognitive scores.

- Non-parents Present (LBCN): Children under the care of non-parents (e.g., other relatives, caretakers) show a significant decrease in cognitive scores (coefficient = -0.415, p = 0.009). This marks a notable adverse effect, highlighting the importance of parental presence over other caretaker arrangements.

Other Influential Factors

- Gender: The coefficient of -0.134 for gender suggests a trend where gender might influence cognitive scores, though this effect is not statistically significant (p = 0.121).

- Age (Month_age): Each additional month of age is associated with a small but significant increase in cognitive scores (coefficient = 0.014, p = 0.093). This aligns with the expected that older children typically exhibit higher cognitive capabilities.
Household Assets (HH_assets): A higher level of household assets is significantly associated with better cognitive scores (coefficient = 0.138, p = 0.007). This finding underscores the positive impact of socioeconomic status on child development.

Result for Analyzing Incremental Impacts of Parental Absence

| Bayley Cognitive Score | Coefficient | Std. Err. | t     | P>|t|  | 95% CI Low | 95% CI High |
|------------------------|-------------|-----------|-------|------|-----------|------------|
| X (Number of absent)   | -0.138**    | 0.068     | -2.020| 0.046** | -0.274    | -0.003     |
| gender                 | -0.136      | 0.086     | -1.580| 0.116 | -0.306    | 0.034      |
| month_age              | 0.013*      | 0.008     | 1.650 | 0.099* | -0.003    | 0.029      |
| premature              | -0.306      | 0.192     | -1.590| 0.114 | -0.667    | 0.075      |
| birth_weight           | 0.000       | 0.000     | 0.540 | 0.591 | 0.000     | 0.000      |
| hh_assets              | 0.132***    | 0.050     | 2.620 | 0.01*** | 0.032 | 0.231      |
| Cons                   | -0.249      | 0.267     | -0.900| 0.371 | -0.769    | 0.280      |

*P < 0.1; **P < 0.05; ***P < 0.01

This section focuses on evaluating the incremental impacts of parental absence on the cognitive development of children, using the Bayley Cognitive Score. The model incorporates data from 570 observations, with standard errors adjusted for clustering within villages.

Model Overview

The regression model (F(8, 129) = 3.850, p = 0.001) displays a significant fit, suggesting that the included variables collectively and significantly affect the cognitive outcomes of children. The R-squared value is 0.042, indicating that our model explains about 4.2% of the variance in cognitive scores.
Key Findings

- Number of Absent Parents: The coefficient for the number of absent parents is -0.138 with a p-value of 0.046, indicating a statistically significant negative impact on cognitive scores. This shows that each additional absent parent correlates with a decrease in cognitive performance, emphasizing the detrimental effect of parental absence on cognitive development.

Other Influential Factors

- Age (Month_age): There is a small but statistically significant increase in cognitive scores with age (coefficient = 0.013, p = 0.099). This result is expected as cognitive abilities typically improve with age during early childhood.

- Premature Birth: The coefficient for premature birth status is -0.306, though it is not statistically significant (p = 0.114). This suggests that while premature birth might affect cognitive scores, the effect is not strong enough to be significant in this model.

- Household Assets (HH_assets): There is a significant positive correlation between household assets and cognitive scores (coefficient = 0.132, p = 0.010). This underscores the role of socioeconomic factors in supporting cognitive development, with more assets possibly reflecting better nutrition, educational opportunities, and general care environments.

Result for Analyzing Differential Effects of Mother and Father Presence on Child Cognitive Development
This section of our study provides insights into how the presence of mothers and fathers independently affects the cognitive development of children, as measured using the Bayley Cognitive Score. The analysis utilized a sample of 570 observations with the model adjusted for clustering within villages.

**Key Findings**

- **Mother's Presence:** The presence of the mother significantly enhances the cognitive scores of children, with a coefficient of 0.285 and a p-value of 0.044. This finding underscores the critical role that mothers play in the cognitive development of their children, potentially through more direct engagement or effective nurturing behaviors.

- **Father's Presence:** The coefficient for the father’s presence is 0.071, which is not statistically significant (p = 0.440). This suggests that, in the context of this study, the father’s presence alone does not have a measurable impact on cognitive scores as the mother's presence does.

**Other Influential Factors**

- **Gender:** The model indicates that gender does not significantly influence cognitive scores.

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| Bayley Cognitive Score | Coefficient | Std. Err. | t    | P>|t| | 95% CI Low | 95% CI High |
|------------------------|-------------|-----------|------|------|-------------|-------------|
| Mother (Yes)           | 0.285**     | 0.137     | 2.080| 0.04**| 0.014       | 0.557       |
| Father (Yes)           | 0.071       | 0.092     | 0.770| 0.44  | -0.111      | 0.254       |
| Gender                 | -0.132      | 0.086     | -1.530| 0.127| -0.302      | 0.038       |
| Month_age              | 0.014*      | 0.008     | 1.700| 0.092*| -0.002      | 0.030       |
| Premature              | -0.288      | 0.193     | -1.490| 0.138| -0.669      | 0.094       |
| Birth_weight           | 0.000       | 0.000     | 0.580| 0.563| 0.000       | 0.000       |
| HH_assets              | 0.135***    | 0.050     | 2.680| 0.008***| 0.035      | 0.234       |
| Cons                   | -0.625      | 0.295     | -2.120| 0.036| -1.208      | -0.042      |

*P < 0.1 ; **P < 0.05 ; ***P < 0.01
development, with a coefficient of -0.132 and a p-value of 0.127. This result implies no strong differential impact of cognitive scores between males and females.

- Age (Month_age): Age shows a slight but significant positive association with cognitive scores, with a coefficient of 0.014 and a p-value of 0.092. This aligns with expected developmental progressions where cognitive abilities typically improve with age.

- Premature Birth: Premature birth does not show a significant impact on cognitive scores in this analysis (coefficient = -0.288, p = 0.138), suggesting that its effect might be mitigated by other factors in the child’s environment.

- Household Assets (HH_assets): Consistent with other analyses, household assets are positively correlated with cognitive scores (coefficient = 0.135, p = 0.008). This finding indicates that higher socioeconomic status, which can provide better nutrition, education, and general living conditions, supports cognitive development.

The Relationship Between Left-behind Status and Household Assets

The motivation to explore the relationship between left-behind status in children and household assets arises from above results, which show that family assets have consistently shown a significant impact on early cognitive development in children. At the same time, migration for economic reasons and whether it achieves the expected social outcomes is worthy of attention.

Impact of Household Assets on Child Development

Household assets have consistently demonstrated a significant influence on early cognitive development in children across various analyses in our study. The positive correlation between household assets and cognitive scores underscores the importance of economic stability and resources in fostering an environment conducive to learning and development. By examining
how left-behind status might impact household assets, this study aims to understand further the indirect effects of economic disparities on cognitive development in children who remain in rural areas while their parents work in urban areas.

**Economic Motivations Behind Parental Migration**

The phenomenon of parental migration for work, particularly from rural to urban areas, is predominantly driven by economic motives. Parents often choose to leave their children behind with the hope that higher earnings in cities will provide better living conditions and educational opportunities for their children. This sacrifice is rooted in the desire to break the cycle of poverty and prevent their children from having to engage in physically demanding labor as they did. Understanding the actual economic impact of such migrations on the family’s financial situation is crucial.

**Results Analysis: Relationship Between Left-behind Status and Household Assets**

The Relationship Between Number of Absent Parents and Household Assets

| Household Asset       | Coefficient  | Std. Err. | t      | P>|t|   | 95% CI Low | 95% CI High |
|-----------------------|--------------|-----------|--------|-------|------------|-------------|
| X (Number of absent)  | -0.183***    | 0.053     | -3.480 | 0.001*** | -0.288     | -0.079      |
| gender                | 0.105        | 0.062     | 1.700  | 0.092 | -0.017     | 0.228       |
| month_age             | -0.005       | 0.005     | -0.880 | 0.378 | -0.015     | 0.006       |
| premature             | -0.185       | 0.128     | -1.450 | 0.15  | -0.438     | 0.068       |
| birth_weight          | 0.000        | 0.000     | 3.130  | 0.002 | 0.000      | 0.000       |
| cons                  | -0.549       | 0.215     | -2.560 | 0.012 | -0.973     | -0.124      |

*P < 0.1 ; **P < 0.05 ; ***P < 0.01

Table8

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The Relationship Between Left-behind Status and Household Assets

### Table 9

| Household Asset | Coefficient | Std. Err. | t     | P>|t| | 95% CI Low | 95% CI High |
|-----------------|-------------|-----------|-------|-----|-------------|-------------|
| LBCF (Only Father present) | -0.354** | 0.178 | -1.99 | 0.049** | -0.706 | -0.002 |
| LBCM (Only Mother present) | -0.280*** | 0.088 | -3.16 | 0.002*** | -0.455 | -0.105 |
| LBCN (Non-parents present) | -0.214** | 0.100 | -2.14 | 0.034** | -0.413 | -0.016 |

*Only Father Present (LBCF): Coefficient of -0.354 (p = 0.049)

*Only Mother Present (LBCM): Coefficient of -0.280 (p = 0.002)

*Non-parents Present (LBCN): Coefficient of -0.214 (p = 0.034)

The regression analyses demonstrate a significant negative correlation between the number of absent parents (left-behind status) and household assets. Notably, children from households where both parents are absent tend to have lower household asset levels, as indicated by the coefficients in both analyses:

Number of Absent Parents: A coefficient of -0.183 (p = 0.001) suggests that each additional absent parent is associated with a significant decrease in the level of household assets.

Specific Parental Configurations:

Only Father Present (LBCF): Coefficient of -0.354 (p = 0.049)

Only Mother Present (LBCM): Coefficient of -0.280 (p = 0.002)

Non-parents Present (LBCN): Coefficient of -0.214 (p = 0.034)

These findings suggest that, contrary to expectations, families with absent parents, especially
those with both parents working away, are associated with poorer household asset levels.

**Discussion**

This counterintuitive outcome raises critical questions about the economic rationale behind parental migration from rural to urban areas. The conventional wisdom is that such migration allows parents to earn higher incomes, thus improving the living standards of their families back home. However, our data suggests that this is not necessarily the case for all families. Several factors could contribute to this discrepancy.

- Economic Disparities: The earnings from migrant work might not be as high as expected, or the costs associated with urban living could reduce the amount of money that can be sent home.

- Remittance Inefficiency: The money sent back home may not be sufficient to offset the loss of parental presence and its associated caregiving and direct financial management.

- Differences in Social and Occupational Structures: In China, parents of non-left-behind children often have the opportunity to stay in rural areas for work because they are employed in stable institutions such as local government or state-owned enterprises, for instance, as civil servants. These positions typically provide stable income and social status. Consequently, these families do not face the decision to leave their hometowns for cities to improve their living standards. In contrast, families that need to leave rural areas to seek better economic opportunities in cities usually do so because of a lack of sufficient local employment opportunities or the inability to secure a relatively high and stable income. This occupational and economic disparity exacerbates inequalities in household assets and affects the living and developmental conditions of left-behind children.
Conclusion

This study investigates the multifaceted implications of the left-behind phenomenon on child cognitive development within the context of rural-urban migration in China.

Parental Presence and Its Impacts

The study reveals that most left-behind children are either without both parents or only with the mother, as fathers typically work away due to job structures and gender-specific economic factors in China. The absence of both parents is particularly pronounced among these children, highlighting a stark contrast in family structure compared to non-left-behind children. This disparity is critical, as the presence of parents, especially the mother, has shown to have a substantial impact on the cognitive development of children. These findings suggest that maternal presence has a more significant effect on enhancing cognitive abilities than paternal presence, emphasizing the nuanced role of gender in caregiving.

Cognitive Development Disparities

There are significant disparities in cognitive development between left-behind children with both parents absent compared to non-left-behind children. This difference underscores the essential role of parental involvement in fostering cognitive growth and development. With each additional parent absent, there is a cumulative detrimental effect on the child's cognitive abilities, pointing to the profound impact of reduced parental interaction and involvement on child development.

Economic Conditions and Cognitive Outcomes

The analysis reveals that better economic conditions within the household are significantly associated with improved cognitive development in children. This finding is consistent across various models and underscores the importance of socioeconomic stability and resources in supporting children’s educational and developmental outcomes.
Economic Realities of Parental Migration

Contrary to conventional expectations, the parents of left-behind children, despite working away from home, often do not provide better economic conditions for their families. This outcome is particularly paradoxical given that the primary motivation for parental migration is to improve living standards and economic opportunities for their families. However, our data suggests that remittance inefficiency, economic disparities, and asset depletion may contribute to this discrepancy. Moreover, children whose both parents are absent are especially vulnerable, not only in terms of parental companionship but also in terms of economic stability and household assets.

Societal Implications

The findings from this study highlight the need for targeted policies and interventions that address the complex socio-economic dynamics faced by left-behind children. These should aim to support not only the children’s cognitive development but also the overall economic conditions of their families. Recognizing the differential impacts of maternal and paternal absence, as well as the importance of economic resources, can guide more effective social and economic policies to mitigate the adverse effects of labor migration on rural families.

It is evident that the phenomenon of left-behind children in China poses challenges not only to individual families but also to the entire societal structure. Although parents migrate from rural to urban areas with the intent of securing a better future for the next generation, the actual outcomes often contradict these expectations. This discrepancy demands a reevaluation of how we support these families and children through more comprehensive policies and effective interventions. During the process of social development in China, policymakers in government, educators, and community leaders need to collaborate to create policies and interventions that truly improve the welfare and development of left-behind children. Ensuring that the sacrifices of migrant parents lead to real improvements in their children's lives will help to foster a more equitable and supportive environment, enabling all children to thrive.
References


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