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**Article**

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James Ng\*

# Labor Migration in Indonesia and the Health of Children Left Behind

## Abstract

Economic research on labor migration in the developing world has traditionally focused on the role played by the remittances of overseas migrant labor in the sending country's economy. Recently, due in no small part to the availability of rich microdata, more attention has been paid to the effects of migration on the lives of family members left behind. This paper examines how the temporary migration of parents for work affects the health outcomes of children left behind using the longitudinal data obtained from the Indonesia Family Life Survey. The anthropometric measure of the child health used, height-for-age, serves as a proxy for stunting. The evidence suggests that whether parental migration is beneficial or deleterious to the child health depends on which parent moved. In particular, migration of the mother has an adverse effect on the child's height-for-age, reducing height-for-age Z-score by 0.5 standard deviations. This effect is not seen on the migration of the father.

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## 1 Introduction

Economic research on labor migration in the developing world has traditionally focused on the role played by the remittances of overseas migrant labor in the sending country's economy (for a survey of the empirical literature on remittances, see Adams (2011)). In the last decade, more attention has been paid to migration for work and its effects on the socioeconomic outcomes of sending households, thanks in large part to the increased availability of household survey data from developing countries. This study contributes to this particular strain of the migration literature by examining how the temporary migration of parents for work affects the health of children left behind, using the longitudinal data obtained from the Indonesia Family Life Survey (IFLS). Parental labor migration may be expected to improve children's nutrition and health care through expansion of the household budget constraint from remittances. However, deleterious effects of parental absence could offset these gains. The net effect of parental migration on the health of left-behind children is therefore an empirical question.

Surprisingly little attention has been paid to the relationship between migration and human capital accumulation in Indonesia, with three exceptions. Deb and Seck (2009) evaluated the effects of migration on an array of socioeconomic outcomes including the health of children in Indonesia. This In this study, we differ from theirs in that it focuses on children in households in which only the father or mother migrate—not the children—allowing for the isolation of the effects of parental migration without the confounding influence of child migration. Hasanah et al. (2017) investigated the impact of migration on food expenditure and food security of left-behind households in the eastern region of Indonesia. They found positive effects of migration on food expenditure and food security. Finally, Nguyen and Purnamasari (2011) find a reduction in child labor supply and an increase in children's idle time in sending households with female migrants. This study is therefore the earliest attempt at quantifying the effect of parental migration for work on the health of left-behind children in the Indonesian context.

In contrast to many other studies on the relationship between child health and socioeconomic outcomes, this study uses anthropometric measures of child health rather than subjective health status.<sup>1</sup> Also, the longitudinal design of the IFLS allows for the elimination of all unobserved child- and household-level time-invariant characteristics that are correlated with the explanatory variables, removing a major source of omitted variable bias in the estimated effects of parental migration.

The results suggest that whether parental migration is beneficial or deleterious to child health depends on which parent moved. Migration of the mother has an adverse effect on child height-for-age, whereas migration of the father has no effect. This finding is important because of the long temporal reach of health in childhood; a plethora of empirical evidence shows that poorer health in early life leads to lower educational attainment (Almond, 2006; Case et al., 2005), lower scores in high school standardized tests (Case and Paxson, 2008), and lower earnings (Black et al., 2007).

From an intrahousehold bargaining perspective, these findings suggest a rejection of the unitary model of the household, whereby a household is assumed to act as a single economic

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<sup>1</sup> Examples of papers in development studies that employ anthropometric measures of health are Domingues and Barre (2013) for Mozambique, and Brainerd (2010) for the Soviet Union.

unit, in favor of collective models of intrahousehold allocation (see Vermeulen [2002] for a survey of the collective approach and Vermeulen [2005] for a comparative analysis of the empirical validity of the two competing approaches). In households where mothers are absent due to labor migration, children may receive less care and as a consequence develop poorer health. While speculative, it is possible that the reason for a lack of an adverse effect from father's migration is that fathers tend to be less directly involved in child rearing.

## 2 Literature review

In recent years, with more availability of suitable microdata, the effects of migration on sending communities in the developing world have received increasing attention in the academic literature. Mexico in particular has been widely studied. For example, Hildebrandt and McKenzie (2005) examine the impact of migration in rural Mexico on various aspects of child health, finding that children in migrant households have lower infant mortality rates and higher birth weights, but receive less preventive health inputs such as breastfeeding and vaccinations. However, they are not able to examine what happens to children who were left behind by their migrant parents.

A series of papers by Francesca Antman does examine the impact of migration on left-behind family members, using data from the Mexican Migration Project. Two papers that are most closely related to the present study present evidence of the impact of father's migration on the education of left-behind children that appear to contradict each other. Antman (2011) finds that father's migration to the U.S. results in left-behind children reducing their study hours. In contrast, Antman (2012) finds that father's migration can lead to an increase in girls' education attainment of almost a full year, but find no such increase for boys. The contrasting results between the two studies is probably due to the inclusion of family fixed effects in the second study, which allows for the comparison of siblings within the same family to get around the endogeneity of father's migration. On balance, Antman's studies suggest a positive effect of father's migration on educational attainment for girls in Mexico. A major difference between the Mexican context and Indonesia's is migration away from the family in Mexico is undertaken predominantly by men, hence the focus solely on father's migration in Antman's papers.

Pörtner (2016) too finds a gender difference in the effect of parental *absence* on the time allocation of left-behind children in the Philippines. Interestingly, mother's absence is found to only significantly affect girls and father's absence to only significantly affect boys. In particular, girls spend significantly less time in school because of the absence of the mother and boys spend more time working when the father is absent. Unfortunately, a major weakness of this study is it has no way of knowing why a parent was absent, and parental migration is only one of any number of reasons a parent may be absent.

Roth and Tiberti (2017) use propensity score matching to provide evidence that in Cambodia, households with members who migrated for work have a lower poverty headcount, higher daily per capita consumption, and lower weekly per capita hours worked compared to households without any migrants. They attribute these effects to remittances. However, these effects vary significantly by household economic status, propensity to migrate, length of migration, and size of remittances. In some cases, they find migration to be deleterious; for example, for households below the poverty line, migration is associated with a decrease in consumption.

Zhang et al. (2014) find significant negative impacts of parental migration on the cognitive development of left-behind children in rural China. They find that being left-behind by *both* parents reduces children's math and Chinese language test scores. However, the effects shrink in magnitude and are insignificant when children are left behind by only one parent. A weakness of this study is it only covers households in a single county in Hunan Province, leaving unanswered questions about the validity of the findings at the national level.

Lei et al. (2018) examine the effect of parental internal migration in China on the health of left-behind children by comparing their health status to that of a control group consisting of children without migrant parents in rural areas and migrant children in urban areas. They were able to take this approach because they had access to data from a survey specifically designed to study the patterns and effects of internal migration in China. They find that migration of parents negatively affects the height-for-age and weight-for-age Z-scores of left-behind children, with the negative effects becoming more severe for younger children and for households where both parents migrate.

### 3 Data and descriptive statistics

#### 3.1 Data

The Indonesia Family Life Survey (IFLS) is an ongoing longitudinal household survey conducted by RAND, Universitas Gadjah Mada, and SurveyMETER. With an initial sample of 30,000 individuals in 1993 living in 13 of the 27 (at the time) Indonesian provinces, the IFLS is representative of over 80% of the Indonesian population. The IFLS collected information on children younger than 15. The mother, female guardian, or caretaker answered the questions on behalf of children aged younger than 11. A nurse took measures of physical health for each household member, including height and weight of children.

The study used data drawn from the 2000 and 2007 waves of the IFLS and identified children between the ages of 0–7 in 2000 who were re-interviewed in 2007, by which time they were aged 7–14. Children of this age had not reached physical maturity and were still dependent on their parents, for example, to make key health decisions for them, allowing for the isolation of parental migration effects on child health.

##### 3.1.1 Anthropometric indicators of health

The study uses two anthropometric indicators of the children health: height-for-age Z-scores (HAZ) and weight-for-age Z-scores (WAZ). In each wave of the IFLS, health workers collected anthropometric data of all household members, including height and weight of the children. HAZ are calculated by subtracting each child's height by the mean for a given age and sex of a reference population and dividing the result by the standard deviation of the reference distribution. WAZ are similarly computed. The reference population is an internationally accepted standard of well-nourished children—the 2000 United States Centers for Disease Control growth charts.<sup>2</sup> A HAZ of  $-1$  indicates that—given age and sex—the child's height is one standard deviation below the mean child in that age/sex group.

<sup>2</sup> The CDC growth charts can be accessed at [https://www.cdc.gov/growthcharts/cdc\\_charts.htm](https://www.cdc.gov/growthcharts/cdc_charts.htm).

Because height and weight represent unobserved nutrients and processes at the cellular level, they are appropriate proxies for child health status (Pelletier, 1994). Height-for-age is an adequate proxy of long-term nutritional status (Duggan et al., 2008). Weight-for-age can reflect both short- and long-term impediments to growth (de Onis, 2000). Following Alderman et al. (2006), children whose HAZ or WAZ were less than  $-6$  or greater than  $6$  were excluded because such extreme outliers were likely the result of errors in height, weight, or age data. Final dataset consisted of 2,841 children interviewed in 2000 and re-contacted in 2007.

### 3.1.2 Migration measure

The parental migration indicators are constructed based on responses from adult respondents to a series of questions in which they were first asked to recall the year of each migration event experienced since age 12, after which they were asked to provide the main purpose for each move based on a list of reasons. The adults who indicated that they moved for “work-related” reasons are flagged by the author. Respondents were also asked whether they moved with other household members, and if so, with whom, allowing the author to identify children whose parents moved without them for the sole purpose of work.

Migration is coded separately for fathers and mothers. In the interest of brevity, let us consider mother’s migration (father’s migration follows analogously). A child interviewed in 2000 is said to have experienced maternal migration if the mother had migrated for the sole purpose of work at least once after the child’s birth up until the time of the interview. The same child re-contacted in 2007 is said to have experienced maternal migration if the mother had migrated for work at least once since the 2000 interview. This yields four possible scenarios: (1) mother did not migrate in either period, (2) mother migrated in 2000 but did not in 2007, (3) mother did not migrate in 2000 but did in 2007, and 4) mother migrated in both periods.

Crucial to the analysis is whether there is enough variation in the migration indicator for a relationship between health and migration to be detected. Since variation in the incidence of parental migration comes from scenarios 2 and 3, it is crucial that most of the migration experiences fall under these two scenarios. This was indeed the case. Out of 80 (188) children whose mothers (fathers) migrated in 2000, 77 (181) did not experience maternal (paternal) migration in 2007. In contrast, of the 62 (117) children whose mothers (fathers) migrated in 2007, 59 (110) did not experience maternal (paternal) migration in 2000. No child in my sample had both parents simultaneously migrate for work.

## 3.2 Descriptive statistics

Tables 1a and 1b show the descriptive statistics for the 2,841 children included in the analysis in the year 2000 and 2007, respectively. On the whole, children were less healthy in 2007 than in 2000. To illustrate, average WAZ went from  $-1.05$  in 2000 to  $-1.11$  in 2007. This is consistent with findings from studies on Indonesia, for example, using nationally representative data from the National Socioeconomic Survey, Utomo et al. (2011) reported an increase in the percentage of children who were underweight between 2000 and 2005, a trend that held across all household expenditure quintiles.

**Table 1a** Characteristics of children by migration status of parents (year 2000)

	(1) Full sample	(2) Neither parent migrated	(3) One parent migrated
HAZ	-0.65 (1.65)	-0.67 (1.63)	-0.41 (1.81)
WAZ	-1.05 (1.63)	-1.07 (1.62)	-0.92 (1.69)
Male	0.52 (0.50)	0.53 (0.50)	0.48 (0.50)
Age (years)	3.90 (2.14)	3.98 (2.13)	3.21 (2.15)
Father's years of schooling	7.78 (3.81)	7.71 (3.81)	8.41 (3.75)
Mother's years of schooling	7.28 (3.57)	7.21 (3.53)	7.93 (3.86)
Monthly household expenditure per capita	15,5760.60 (198183.86)	15,4960.55 (202018.83)	16,3487.31 (156480.69)
Urban	0.42 (0.49)	0.42 (0.49)	0.39 (0.49)
Observations	2,841	2,573	268

*Notes:* Sample consists of children from the 2000 wave of the Indonesia Family Life Survey. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

*Source:* Author's calculation based on Indonesia Family Life Survey microdata.

**Table 1b** Characteristics of children by migration status of parents (year 2007)

	(1) Full sample	(2) Neither parent migrated	(3) One parent migrated
HAZ	-1.21 (1.18)	-1.20 (1.18)	-1.43 (1.17)
WAZ	-1.11 (1.36)	-1.09 (1.36)	-1.36 (1.28)
Male	0.52 (0.50)	0.52 (0.50)	0.53 (0.50)
Age (years)	11.27 (2.24)	11.25 (2.24)	11.56 (2.19)
Father's years of schooling	7.52 (3.86)	7.61 (3.86)	6.43 (3.66)
Mother's years of schooling	6.98 (3.66)	7.12 (3.67)	5.01 (2.98)
Per capita monthly household expenditure (rupiah)	3,52,422.43 (3,50,356.01)	3,58,573.25 (3,58,271.27)	2,61,259.84 (1,75,927.17)
Urban	0.45 (0.50)	0.46 (0.50)	0.36 (0.48)
Observations	2,841	2,662	179

*Notes:* Sample consists of children from the 2007 wave of the Indonesia Family Life Survey. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

*Source:* Author's calculation based on Indonesia Family Life Survey microdata.

Turning now to cross-sectional variation by migration incidence, in the 2000 survey, children with a migrant parent had better health metrics than children whose parents did not migrate. However, the pattern is reversed in 2007; children with a migrant parent had worse HAZ and WAZ than children whose parents stayed home.

In terms of per capita household expenditures,<sup>3</sup> children with migrant parents were richer in 2000 but poorer in 2007. In 2000, migrant parents were more educated than nonmigrant

<sup>3</sup> In the development economics literature, consumption is widely considered superior to income as a measure of individual wellbeing in developing countries. Deaton (1997) explains that consumption is a better measure of lifetime welfare than is current income on theoretical (i.e., the permanent income hypothesis) and practical grounds (it is more reliably measurable).



parents, but the opposite was true in 2007. Finally, in both years children with migrant parents were more likely to live in rural areas.

These descriptive statistics reveal significant cross-sectional differences between children based on the migrant status of their parents. How these differences would manifest themselves over time is a question that can be answered using panel data analysis. In Section 4, the author further discusses about controlling the observed characteristics to isolate the influence of parental migration in the determination of child health.

## 4 Empirical strategy

### 4.1 Theoretical motivation

The empirical strategy is grounded in the assumption of a static health production function for an individual:  $H = H(N; T(A, B_H, D), u)$ , where  $H$  represents a vector of measured health outcomes.<sup>4</sup> They depend on a vector of health inputs,  $N$ . Health inputs are under the control of the individual and include, for example, the use of health-care facilities, nutrient intake, and time used for the production of health. The technology,  $T$ , or shape of the underlying health production function varies over the life course. It is determined by demographic characteristics,  $A$ , such as age and sex; aspects of family background that affect health,  $B_H$ , such as parental health and genetic endowment; and environmental factors,  $D$ .

In the case of child health production, parents can be assumed to play a role in the determination of  $N$ . Parental migration can affect  $N$  in several ways. Migration necessarily involves a prolonged or temporary absence of the parent in a child's life, which could have deleterious consequences on the quality of  $N$ . On the other hand, if migration improves household income,  $N$  could be positively impacted. The net effect of parental migration has to be ascertained empirically.

### 4.2 Empirical specification

The author estimated the following regression equation for child  $i$  in household  $h$  at time  $t$ :

$$Health_{iht} = \alpha MigrantFather_{iht} + \beta MigrantMother_{iht} + X_{iht}\delta + \mu_i + \pi_h + error_{iht}$$

Two separate child-level regressions were run, one for HAZ as the dependent variable and another for WAZ. *MigrantFather* is a dummy variable indicating whether the father migrated for work up until time  $t$ . *MigrantMother* is analogous for mothers.  $X$  is a set of child observable characteristics that could also be correlated with child health status, namely age, parental education level, log monthly per capita household expenditures, and a dummy for whether the child resides in an urban area. A dummy for 2007 to control for unobserved secular time effects that are potentially correlated with the migration decision was also included.  $\mu_i$  and  $\pi_h$  are child and household fixed effects, respectively. Their inclusion removes any unobserved confounding characteristics of the child and household that do not change over time.

Although the estimates of the relationship between parental migration and child health are robust to time-invariant unobserved characteristics, the data do not allow to establish the

<sup>4</sup> See the Strauss and Thomas (2007) *Handbook of Development Economics* chapter for a treatment.



direction of causality in the relationship. For instance, it could be that a parent migrated for better economic opportunity in response to a child's poor health. Therefore, the estimates in this study should not be interpreted as causal. That said, a robustness check on coefficient stability following Oster (2016) was performed and the results suggested that the estimated coefficients on mother's migration are not driven by omitted variable bias.

## 5 Results

It is interesting to note that the data reveal no significant difference in the health indicators between girls and boys (Tables 2a and 2b). The one exception is WAZ in 2007, where a *t*-test suggests that girls were significantly *healthier* than boys in that year. These patterns are consistent with previous research showing no evidence of son preference in Indonesian societies (Kevane and Levine, 2003; Levine and Ames, 2003; Mani, 2007).

Estimates from the health regressions are presented in Table 3. As shown in column 1, having a mother who migrated for work is associated with a half standard deviation decrease in HAZ, statistically significant at 5%. However, migration of the father does not exhibit this negative correlation with child health; if anything, children with migrant fathers have better HAZ, although the relationship is statistically insignificant.

This paper's finding of a negative association between maternal labor migration and the health of left-behind children is potentially problematic in a country where a substantial number of women migrate for work with consequent long absences from the home, leaving caregiving responsibility to fathers. In a qualitative study, Lam and Yeoh (2016) considered the gendered nature of division of care in Indonesia vis-à-vis the migration of mothers away from

**Table 2a** Health of children by sex (year 2000)

	(1) Female		(2) Male		(3)	
	Mean	SD	Mean	SD	Difference	P-value
HAZ	-0.69	1.61	-0.62	1.68	-0.07	0.25
WAZ	-1.08	1.58	-1.02	1.67	-0.06	0.34
Observations	1,353		1,488		2,841	

Notes: Sample consists of children from the 2000 wave of the Indonesia Family Life Survey. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores; SD, standard deviation.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

**Table 2b** Health of children by sex (year 2007)

	(1) Female		(2) Male		(3)	
	Mean	SD	Mean	SD	Difference	P value
HAZ	-1.22	1.12	-1.20	1.24	-0.02	0.70
WAZ	-1.01	1.27	-1.20	1.42	0.19	0.00
Observations	1,353		1,488		2,841	

Notes: Sample consists of children from the 2007 wave of the Indonesia Family Life Survey. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores; SD, standard deviation.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

home for work. They found that left-behind fathers still preferred migration or work to taking over the mother's traditional role of caregiver. In extreme cases, as Lam and Yeoh (2016) reported, "some father-carers also confessed [...] to turning to aberrant activities such as gambling and drinking to ease their loneliness and stress."

This has policy implications for developing economies like Indonesia where women, many of whom are mothers, make up a substantial proportion of migrant workers (according to the World Bank, roughly 80% of all registered overseas Indonesian migrants are women). At the very least, economic returns should not be the only criterion by which the benefit of migration for work is measured, but attention should also be paid to the unintended consequences of migration, such as gendered effects on the well-being of left-behind family members, especially children.

Child WAZ is not statistically significantly correlated with either maternal or paternal migration. One possible explanation for the absence of a significant relationship between parents' migration and child weight is the composite nature of weight-for-age, which complicates interpretation; although weight-for-age is the most common anthropometric indicator used worldwide, it tends to conflate weight- and height-related growth deficits or excesses (Garza and de Onis, 2007). More specifically, low weight-for-age can reflect both wasting (low weight for height) and stunting (low height-for-age), rendering it ineffective in distinguishing between temporary and long-term nutritional deficits. Height-for-age is generally viewed as the most appropriate measure to use as a proxy for child nutritional status (Charmarbagwala et al., 2004) and reflects the cumulative effects of socioeconomic, health and nutrition problems (World Health Organization, 1995).

All estimates are robust to a logarithmic specification of age to account for potential non-linearities in the relationship between the health scores and age. In addition, the use of the cluster-robust estimator for standard errors makes the estimates robust to heteroskedasticity within households.

## 5.1 Omitted variable bias

Oster (2016) proposed a test for omitted variable bias that uses the information contained in the change in the coefficient of interest and the change in  $R$ -squared when moving from uncontrolled to controlled regression. If selection on the observed controls is proportional to the selection on the unobserved controls, then we can compute an identified set that bounds the coefficient of interest. An identified set that excludes zero suggests that the relationship between parental migration and child health is not driven by omitted variables.

Using information in Table 3 (columns 1 and 3) and Table 4, we computed Oster's recommended identified set of  $[\tilde{\beta}, \beta^*]$ , where  $\tilde{\beta}$  is the migration coefficient from Table 3, and  $\beta^* = \tilde{\beta} - \delta \frac{(\hat{\beta} - \tilde{\beta})(R_{max} - \tilde{R})}{(\tilde{R} - \hat{R})}$ .<sup>5</sup> The scalar  $\delta$  measures the relative degree of selection on observables and unobservables. A value of  $\delta=1$  suggests that the observables are at least as important as the unobservables.  $R_{max}$  is  $R$ -squared from a hypothetical regression of the health outcome on the migration variable and both observed and unobserved controls. If the outcome can be

<sup>5</sup>  $\hat{\beta}$  and  $\hat{R}$  are the migration coefficient and  $R$ -squared from an uncontrolled regression from Table 4.  $\tilde{R}$  is the  $R$ -squared from a main regression from Table 3.

**Table 3** Main regression results

	(1) HAZ	(2) HAZ	(3) WAZ	(4) WAZ
Mother migrated for work	-0.49** (0.20)	-0.37* (0.20)	-0.25 (0.24)	-0.03 (0.19)
Father migrated for work	0.04 (0.15)	0.19 (0.14)	-0.05 (0.16)	0.05 (0.12)
Age (years)	-1.01*** (0.06)		-0.69*** (0.07)	
Log age		-1.00*** (0.10)		-0.48*** (0.10)
Mother's years of schooling				
1-3	0.09 (0.15)	0.30** (0.14)	0.37* (0.22)	0.52** (0.23)
4-6	0.00 (0.18)	0.20 (0.18)	0.43 (0.27)	0.59** (0.27)
7-9	-0.00 (0.30)	0.32 (0.26)	0.35 (0.39)	0.58* (0.33)
10-12	0.44 (0.41)	0.30 (0.43)	0.54 (0.50)	0.32 (0.47)
>12	0.23 (0.48)	0.10 (0.47)	0.02 (0.56)	-0.18 (0.51)
Father's years of schooling				
1-3	0.07 (0.37)	0.29 (0.32)	-0.17 (0.37)	-0.03 (0.21)
4-6	0.09 (0.38)	0.35 (0.33)	-0.24 (0.39)	-0.13 (0.21)
7-9	0.34 (0.41)	0.56 (0.36)	-0.11 (0.44)	-0.17 (0.25)
10-12	0.09 (0.43)	0.20 (0.39)	-0.21 (0.46)	-0.30 (0.30)
>12	-0.31 (0.46)	-0.24 (0.43)	-0.23 (0.48)	-0.39 (0.33)
Log per capita monthly household expenditure	-0.04 (0.06)	-0.01 (0.05)	-0.03 (0.07)	0.02 (0.06)
Urban	0.15 (0.14)	-0.01 (0.14)	0.28 (0.20)	0.15 (0.19)
Year, 2007	7.04*** (0.45)	0.78*** (0.11)	5.15*** (0.50)	0.73*** (0.12)
Observations	3,140	3,064	3,140	3,064
R-squared	0.2625	0.2073	0.0730	0.0601

Notes: \*\*\* significant at 1%, \*\* significant at 5%, and \* significant at 10%. Standard errors are robust to clustering at the household level. Regressions include child and household fixed effects. The omitted category for years of schooling is 0 to 1 years. Household expenditure is the sum of expenses on food, nonfood items (durable and nondurable), and education, as reported by a female respondent, either the spouse of the household head or another person most knowledgeable about household affairs. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

**Table 4** Uncontrolled regression results

	(1) HAZ	(2) HAZ	(3) WAZ	(4) WAZ
Mother migrated for work	0.19 (0.17)		0.38** (0.16)	
Father migrated for work		0.36*** (0.11)		0.05 (0.11)
Observations	5,682	5,682	5,682	5,682
R-squared	0.0006	0.0049	0.0026	0.0001

Notes: \*\*\* significant at 1%, \*\* significant at 5%, and \* significant at 10%. Standard errors are robust to clustering at the household level. Regressions do not include any controls. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

fully explained by the migration variable, observed controls and unobserved controls, then  $R_{max} = 1$ . In the absence of external evidence,  $R_{max} = 1$ .

The identified sets are:  $[-2.41, -0.49]$  for the effect of mother's migration on HAZ,  $[-0.86, 0.04]$  for the effect of father's migration on HAZ,  $[-8.64, -0.25]$  for the effect of mother's migration on WAZ, and  $[-1.36, -0.05]$  for the effect of father's migration on WAZ. In both the HAZ and WAZ regressions, the interval for the coefficient on mother's migration safely excludes zero. This is evidence that omitted variable bias is probably not driving the coefficients on mother's migration seen in Table 3. In contrast, father's migration appears to be sensitive to omitted variable bias—why this is so is an interesting question for future research.

## 5.2 Selective attrition

Attrition bias is always a potential concern with panel data. If less healthy children were more likely to drop out of the IFLS, the estimated parental migration effects would be attenuated. Out of 2,924 children aged 0–7 from the 2000 survey, 83 dropped out in the 2007 wave. This high re-contact rate (97%) alleviates much of the concern about selective attrition. Nonetheless, the presence of selective attrition on observables following the methodology of Fitzgerald et al. (1998) was tested; the authors showed theoretically that a sufficient condition for the absence of attrition bias on observables is that the lagged dependent variable does not affect the probability of attrition.

The author estimated a linear probability model of 2007 attrition status on the child health indicators plus all other explanatory variables from 2000: if the lagged values of health do not significantly affect the probability of attrition, it would strengthen the case against attrition bias being a concern. As shown in Table 5, neither HAZ nor WAZ is a significant predictor of the likelihood of a child to attrite. Based on this test and the high re-contact rate, it is likely the case that attrition between the two waves of the IFLS did not bias the results of this paper.

## 5.3 Do parental migration coefficients differ by sex of child?

Of interest to researchers and policymakers is the question of whether statistical results differ by sex, especially in developing countries where parents may have strong gender preference. Table 6 shows the results from the child health regressions with the addition of an interaction term between each parental migration variable and sex of the child. In the HAZ regression (column 1), the “effect” of father's migration is positive for boys and negative for girls, with the difference being significant at 10%. However, the practical importance of this result is undermined by the nonsignificance of the slope coefficients on father's migration for boys ( $P = 0.156$ ) and for girls. On balance, the evidence shows that parental migration coefficients do not depend on the sex of the child. This is consistent with a long history of research showing no evidence of son preference in Indonesia, as was mentioned at the start of this section.

**Table 5** Selective attrition

	Attrited in 2007
HAZ	-0.002 (0.004)
WAZ	-0.002 (0.004)
Father migrated for work	0.014 (0.021)
Mother migrated for work	0.091* (0.048)
Age (years)	-0.007*** (0.002)
Mother's years of schooling	
1-3	0.004 (0.008)
4-6	0.025** (0.010)
7-9	0.024* (0.013)
10-12	0.051*** (0.017)
>12	0.026 (0.020)
Father's years of schooling	
1-3	0.022* (0.011)
4-6	0.035*** (0.012)
7-9	0.025* (0.014)
10-12	0.023 (0.015)
>12	-0.000 (0.016)
Log per capita monthly household expenditure	0.007 (0.005)
Urban	-0.000 (0.008)
Constant	-0.090 (0.062)
Observations	1804

Notes: \*\*\* significant at 1%, \*\* significant at 5%, and \* significant at 10%. Explanatory variables are from the 2000 wave of the Indonesia Family Life Survey. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

#### 5.4 Migration's impact on consumption as a possible mechanism

In Table 7, a possible mechanism through which parental migration relates to child health by regressing household consumption on the migration variables and other controls was explored. Father's migration is significantly positively correlated with household expenditure, whereas mother's migration is both practically and statistically insignificant. This suggests one possible pathway for the migration-child health relationship: mother's migration for work does not change a household's consumption pattern and hence child outcomes do not improve. In contrast, father's migration increases household consumption leading to improved child outcomes. Although imprecise, the results in Table 3 do agree broadly with this interpretation of events.

**Table 6** Do parental migration coefficients vary by sex of child?

	(1) HAZ	(2) WAZ
Mother migrated for work	-0.48* (0.26)	-0.26 (0.36)
Mother migrated for work × male	-0.06 (0.39)	-0.01 (0.44)
Father migrated for work	-0.23 (0.16)	-0.22 (0.18)
Father migrated for work × male	0.63* (0.34)	0.39 (0.33)
Age (years)	-1.01*** (0.06)	-0.69*** (0.07)
Mother's years of schooling:		
1-3	0.11 (0.16)	0.38* (0.22)
4-6	0.02 (0.18)	0.45* (0.27)
7-9	0.02 (0.31)	0.36 (0.39)
10-12	0.48 (0.41)	0.56 (0.50)
>12	0.26 (0.49)	0.05 (0.56)
Father's years of schooling:		
1-3	0.07 (0.36)	-0.17 (0.36)
4-6	0.08 (0.38)	-0.24 (0.39)
7-9	0.34 (0.40)	-0.11 (0.44)
10-12	0.11 (0.43)	-0.19 (0.45)
>12	-0.27 (0.46)	-0.21 (0.47)
Log per capita monthly household expenditure	-0.04 (0.06)	-0.02 (0.07)
Urban	0.14 (0.14)	0.28 (0.20)
Year = 2007	7.03*** (0.45)	5.15*** (0.51)
Observations	3,140	3,140
R-squared	0.2660	0.0743

Notes: \*\*\* significant at 1%, \*\* significant at 5%, and \* significant at 10%. Standard errors are robust to clustering at the household level. Regressions include child and household fixed effects. The omitted category for years of schooling is 0–1 years. Household expenditure is the sum of expenses on food, nonfood items (durable and nondurable), and education, as reported by a female respondent, either the spouse of the household head or another person most knowledgeable about household affairs. HAZ, height-for-age Z-scores; WAZ, weight-for-age Z-scores.

Source: Author's calculation based on Indonesia Family Life Survey microdata.

## 6 Conclusions

In this article, the author presented evidence that migration of the mother for work may have a net negative impact on height-for-age, a widely used anthropometric measure of the health for children. On average, having a mother who migrated for work at least once between 2000 and 2007 pushed children farther below the average height for their age and sex by half a standard deviation. Coupled with the fact that the average Indonesian child is underweight relative to the global mean, this is a cause for concern. No evidence of such an effect on height-for-age from migration of the father was found. In conclusion, this study reveals the possibility that leaving a child behind for economic opportunity can have a net negative effect on the child's health if it is the mother who makes the move.

**Table 7** Migration's impact on consumption as a possible mechanism

	(1)
	Log of per capita monthly household expenditure
Mother migrated for work	0.06 (0.09)
Father migrated for work	0.16** (0.07)
Age (years)	0.06* (0.03)
Mother's years of schooling	
1-3	0.13 (0.15)
4-6	0.19 (0.16)
7-9	0.27 (0.18)
10-12	0.17 (0.25)
>12	0.17 (0.29)
Father's years of schooling	
1-3	0.08 (0.14)
4-6	0.17 (0.15)
7-9	0.15 (0.16)
10-12	0.43** (0.18)
>12	0.51** (0.22)
Urban	0.14* (0.08)
Year=2007	0.43* (0.23)
Observations	3,140
R-squared	0.6860

This negative correlation between mother's migration and health of left-behind children broadly agrees with findings along other outcomes in other countries such as health and test scores in China (Zhang et al. 2014; Lei et al., 2018), and time spent in school in the Philippines (Pörtner, 2016). Interestingly, the lack of a negative correlation between father's migration and child health is not at odds with Antman (2012)'s finding of a beneficial impact from father's migration on the educational attainment of left-behind children in Mexico. This raises an interesting empirical question: Could it be the case that across different societies, mother's migration tends to be detrimental to child wellbeing whereas father's migration isn't?

In terms of relevance to policy, the finding suggests that, at least in Indonesia, mothers should be incentivized to not leave the household. This could be accomplished with forms of assistance, governmental or otherwise, that either substitutes away from the need for mothers to migrate for work or encourages husbands to migrate for work instead of their wives.

#### Declarations

#### Availability of data and material

All data used in the analyses in this paper are publicly available on the Indonesia Family Life Survey website: <https://www.rand.org/labor/FLS/IFLS.html>.

#### Competing interests

The author declares that he has no competing interests.



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### Authors' contributions

JN is the sole author of the paper.

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### References

- Adams, Richard H (2011): Evaluating the Economic Impact of International Remittances on Developing Countries Using Household Surveys: A Literature Review. *Journal of Development Studies* 47(6), 809–828.
- Alderman, Harold; John Hoddinott; Bill Kinsey (2006): Long Term Consequences of Early Childhood Malnutrition. *Oxford Economic Papers* 58(3), 450–474.
- Almond, Douglas (2006): Is the 1918 Influenza Pandemic Over? Long- Term Effects of In Utero Influenza Exposure in the Post–1940 U.S. Population. *Journal of Political Economy* 114(4), 672–712.
- Antman, Francisca M (2011): The Intergenerational Effects of Paternal Migration on Schooling and Work: What Can We Learn from Children's Time Allocations? *Journal of Development Economics* 96(2), 200–208.
- . (2012): Gender, Educational Attainment, and the Impact of Parental Migration on Children Left Behind. *Journal of Population Economics* 25(4), 1187–1214.
- Black, Sandra E; Paul J Devereux; Kjell G Salvanes (2007): From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes. *Quarterly Journal of Economics* 122(1), 409–439.
- Brainerd, Elizabeth (2010): Reassessing the Standard of Living in the Soviet Union: An Analysis Using Archival and Anthropometric Data. *Journal of Economic History* 70(1), 83–117.
- Case, Anne; Angela Fertig; Christina Paxson (2005): The Lasting Impact of Childhood Health and Circumstance. *Journal of Health Economics* 24, 365–389. doi:10.1016/j.jhealeco.2004.09.008.
- Case, Anne; Christina Paxson. (2008): Stature and Status: Height, Ability, and Labor Market Outcomes. *Journal of Political Economy* 116(3), 499–532.
- Charmarbagwala, Rubiana; Martin Ranger; Hugh Waddington; Howard White (2004): The Determinants of Child Health and Nutrition: A Meta-Analysis. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/505081468327413982/The-determinants-of-child-health-and-nutrition-a-meta-analysis>
- Deaton, Angus. (1997): The Analysis of Household Surveys: A Microeconomic Approach to Development Policy. Baltimore, MD: World Bank Publications, The Johns Hopkins University Press.
- Deb, Partha; Papa Seck (2009): Internal Migration, Selection Bias and Human Development: Evidence from Indonesia and Mexico. United Nations Development Programme Human Development Reports.
- Domingues, Patrick; Thomas Barre (2013): The Health Consequences of the Mozambican Civil War: An Anthropometric Approach. *Economic Development and Cultural Change* 61(4), 755–788.
- Duggan, Christopher; John B Watkins; W Allan Walker (2008): *Nutrition in Pediatrics: Basic Science, Clinical Applications*. Hamilton: BC Decker.
- Fitzgerald, J.; P. Gottschalk; R. Moffit (1998): An Analysis of Sample Attrition in Panel Data. *Journal of Human Resources* 33(2), 251–299.
- Garza, Cutberto; Mercedes de Onis (2007): An Overview of Growth Standards and Indicators and Their Interpretation, in: Susan S. Baker; Robert D. Baker; Anne M. Davis (eds.), *Pediatric Nutrition Support*. Sudbury, MA: Jones and Bartlett Publishers, 612.
- Hasanah, Alfiah; Silvia Mendolia; Oleg Yerokhin (2017): Labour Migration, Food Expenditure, and Household Food Security in Eastern Indonesia. *Economic Record* 93, 122–143.
- Hildebrandt, Nicole; David J. McKenzie (2005): The Effects of Migration on Child Health in Mexico. *Economía* 6(1), 257–289.
- Kevane, Michael; David Levine (2003). Changing Status of Daughters in Indonesia. C03-126. Center for International and Development Economics Research Working Paper.
- Lam, Theodora; Brenda S A Yeoh (2016): Migrant Mothers, Left-behind Fathers: The Negotiation of Gender Subjectivities in Indonesia and the Philippines. *Gender, Place & Culture* 0524(December 2017), Routledge: 1–14. doi:10.1080/0966369X.2016.1249349.
- Lei, Lianlian; Feng Liu; Elaine Hill (2018): Labour Migration and Health of Left-Behind Children in China. *The Journal of Development Studies* 54(1), 93–110.
- Levine, David I; Minnie Ames (2003): Gender Bias and the Indonesian Financial Crisis: Were Girls Hit Hardest? C03-130. Center For International and Development Economics Research Working Paper.

- Mani, Subha.** (2007): The Role of the Household and Community in Determining Child Health. 2007/78. UNU-WIDER Research Paper.
- Nguyen, Trang; Ririn Purnamasari** (2011): Impacts of International Migration and Remittances on Child Outcomes and Labor Supply in Indonesia How Does Gender Matter ? World Bank Policy Research Working Paper 5591.
- de Onis, Mercedes** (2000): Measuring Nutritional Status in Relation to Mortality. *Bulletin of the World Health Organization* 78(10), 1271-1274.
- Oster, Emily** (2016): Unobservable Selection and Coefficient Stability: Theory and Evidence. *Journal of Business and Economic Statistics*. doi:10.1080/07350015.2016.1227711.
- Pelletier, David L** (1994): The Relationship between Child Anthropometry and Mortality in Developing Countries: Implications for Policy, Programs and Future Research. *The Journal of Nutrition* 124(10 Suppl.), 2047S-2081S.
- Pörtner, Claus C** (2016): Effects of Parental Absence on Child Labor and School Attendance in the Philippines. *Review of Economics of the Household* 14(1), 103-130.
- Roth, Vathana; Luca Tiberti** (2017): Economic Effects of Migration on the Left-Behind in Cambodia. *Journal of Development Studies* 53(11), 1787-1805.
- Strauss, John; Duncan Thomas** (2007): Health over the Life Course, in: T. Paul Schultz; John A. Strauss (eds.) *Handbook of Development Economics*. Amsterdam: Elsevier Science. Vol. 4, 3375-3474.
- Utomo, Budi; Purwa K. Suahya; Fita R. Utami** (2011): Priorities and Realities: Addressing the Rich-Poor Gaps in Health Status and Service Access in Indonesia. *International Journal for Equity in Health* 10, 47.
- Vermeulen, Frederic** (2002): Collective Household Models: Principles and Main Results. *Journal of Economic Surveys* 16(4), 533-564.
- . (2005): And the Winner Is... An Empirical Evaluation of Unitary and Collective Labour Supply Models. *Empirical Economics* 30(3), 711-734.
- World Health Organization** (1995): *Physical Status: The Use and Interpretation of Anthropometry*. WHO Technical Report Series 854.
- Zhang, Hongliang; Jere R. Behrman; C. Simon Fan; Xiangdong Wei; Junsen Zhang** (2014): Does Parental Absence Reduce Cognitive Achievements? Evidence from Rural China. *Journal of Development Economics* 111, 181-195.