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Does Maternal Employment Affect Child Nutrition Status? New Evidence from Egypt

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Abstract

Despite that maternal employment can increase family income; several studies suggest that it has adverse health consequences for children. The literature on the effects of maternal employment on children in the Middle East and North Africa (MENA) is sparse. In this study, we assess the impact of maternal employment on children's health in Egypt, the most populous country in the MENA region. We use a nationally representative sample of 12,888 children under the age of five from 2014 Demographic and Health Survey for Egypt, to estimate the causal impact of mothers' employment on their children's nutritional status, as measured by the Height-for-Age Score (HAZ). We adopt various estimation methods and control for observed and unobserved household characteristics to identify the causal effect of maternal employment. These different techniques include Propensity Score Matching (PSM), and an Instrumental Variable Two Stage Least Squares approach. We find that maternal employment has a robust negative impact on child nutritional status in Egypt. However, the effect of maternal employment is understated when the Ordinary Least Squares and PSM are applied. More family-friendly policies for working moms are strongly needed in Egypt.

Keywords: Maternal Employment, Child Under-nutrition, Instrumental Variable, Egypt.

JEL Classification: I15; J13

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1. Introduction

Nutritional status in childhood is a key predictor of an individual's well-being and health. Inadequate nutrition in childhood has irreversible consequences on human body growth such as low height for age (Dewey & Begum, 2011). Malnourished children experience a sluggish recovery from illnesses, and a higher vulnerability to infections and disease (Pelletier et al., 1995; UNICEF, 2013). High rates of malnutrition can also affect the national development and economic prosperity since it impairs the life-long productivity of the population.

The recent surveys on children nutritional status suggest that the proportion of malnourished children in the Middle East is one of the highest. Egypt has the largest number of children stunted in the Middle East and North Africa (MENA). About 2.5 million children are considered too short for their age or so-called stunted. The stunting problem arises from the failure to receive adequate nutrition for an extended period. The 2014 Egypt Demographic and Health Survey (EDHS) suggested that one in every five children in Egypt are considered short for their age while 10% of the sampled children are found to be severely stunted (Ministry of Health and Population [Egypt] et al., 2015).

As female participation in the labor market has been rising globally, a growing literature has emerged to explore whether maternal employment is a determinant of child health. There are two potential mechanisms through which maternal employment can affect child health and growth. Firstly, maternal employment can increase household's income and improve household's welfare. It allows escaping poverty and reduces the threat of food insecurity. A Middle Eastern worker whose wife has a small business once said: "I am happy that my wife works and contributes to the family with her income, as I cannot earn a decent living with my income" (Majbouri, 2016). In addition to the income effect, if unemployed mothers are more likely to be depressed from staying home, which might drive them to withdraw from their children, then engaging in economic activity may be a protective factor against depression and improve the quality of maternal time spent with the kids (Parcel & Menaghan, 1990). Maternal employment can also decrease fertility, which benefits children by freeing up family financial resources and maternal time which would have been shared across children otherwise (Stafford, 1987).

On the other hand, maternal employment shrinks maternal time to care for children (Cawley & Liu, 2012; Sivakami, 1997). Working women might have less time to breastfeed their children, preparing rich-nutrition food and take them regularly to health care providers. Maternal employment does not only influence the quantity of maternal time but also the quality of it. Because if mothers are engaged in stressful work with long working hours, they are subject to exhaustion and stress, which in turn affect the quality of maternal time. Furthermore, returning to work shortly after child delivery can also influence children cognitive abilities. The existing literature suggested that fathers do not increase the time they spend with children to compensate for the reduction in the mothers' time (Cawley & Liu, 2012).

Therefore, there is a tradeoff between the additional income and maternal time. Consequently, predicting the direction of the relationship between maternal employment and child nutritional status is not obvious, as the net effect of maternal employment will depend on which effect suppresses the other.

The existing evidence on this subject remains limited with mixed findings. Furthermore, little attention has been given to children' height for age compared to children's weight and development. For example, Ulijaszek and Leighton (1998) suggested that women's work has a positive impact on child nutritional status. Similarly, Leslie (1988) found no significant evidence of an adverse effect of maternal employment on children health. In Nigeria, Ukwuani and Suchindran (2003) control for whether women can carry their children to work and found that malnutrition increase when mothers did not take children to work. Others have suggested children of working mothers are at much greater risk of morbidity after controlling for a broad range of socioeconomic factors (Blau & Grossberg, 1992; Datar et al., 2014; Morrill, 2011; Rastogi & Dwivedi, 2014; Sivakami, 1997). Baker et al. (2008) studied the impact of subsidizing child care in Quebec on maternal labor supply, and child health. They found the subsidy has increased maternal labor supply significantly. However, the subsidy program has exacerbated child health substantially and led to a poor quality parental relationship. Meyer (2016) has looked at the impact of maternal employment on childhood overweight in Germany. She showed that children of full-time employment mothers are at a higher risk of overweight. In the U.S., Anderson et al. (2003) have reached the same conclusion on the effect of maternal employment on children overweight. In another study, Mocan et al. (2015) explored the impact of mothers' earning on health care utilization and infants health. They revealed that mother' earning has a modest to no impact on babies' health measured by birth weight.

As the participation of women in the labor force has increased in MENA countries (Gardner, 2003), studying the consequences of maternal employment has gained added importance. In the present study, we attempt to investigate the relationship between maternal employment and children's height-for-age (stunting) in Egypt, where evidence is scared. We exclusively focus on children height-for-age because of the vast number of stunted children in Egypt compared to other measures of malnutrition. Additionally, this study will improve the literature by using various econometrics methods to overcome the endogeneity problem. To the best of our knowledge, this paper is the first attempt to draw causal evidence on the consequences of maternal employment on children' height in Egypt. Thus, the paper has a twofold contribution, it is one of the few to explore the impact of maternal employment on height-for-age, and it will add a new evidence from Egypt to the current body of literature. Secondly, it attempts to provide casual evidence by instrumenting maternal employment with a variable representing local labor market conditions that might influence maternal employment but not child nutrition (Baum II, 2003).

The study answers an important question from the policy point of view, and the findings of the study will support decision makers in Egypt in curbing child malnutrition. The next section presents the study's methodology followed by a presentation of the results, and Section 4 concludes.

2. Methodology

2.1. Data and Variables

In this paper, we use data from the Demographic and Health Survey (DHS). The DHS is an international survey conducted in 85 countries. The survey contains data for a comprehensive set of indicators in the areas of population, health, and nutrition. For a detailed description of the DHS see Ministry of Health and Population [Egypt] et al. (2015). The paper uses data from the most recent rounds of the Demographic and Health Survey (DHS) for Egypt (2014). The EDHS is the only survey that collects data on child nutritional status in Egypt. It collects a nationally representative sample of 12,888 children, aged 0-5 years, for which we observe their characteristics and nutritional status as well as their parents' characteristics and employment status.

Our outcome variable is the height-for-age Z-score (HAZ), which equals $\frac{A-M}{\sigma}$ where A is the individual value of child height, M is the median of the reference population for the same sex and age, and σ is the standard deviation (SD) in the reference population. It is a continuous variable that measures linear growth and, it is normally distributed. It ranges between -6 SD and 6 SD. If the average mean of HAZ has a negative value across a given population, it would suggest that the nutritional status of the entire population is poorer on average than that of the World Health Organization (WHO) Growth Standard Population.

Our core explanatory variable is a binary variable indicating whether the mother is currently employed. Currently employed includes women who have done work in the past seven days aside from housework, in addition to persons who did not work in the past seven days but who are regularly employed and were absent from work for leave, illness, vacation, or any other such reason.

The analysis controls for a large number of child-level characteristics, parental and household-level factors along with other socioeconomic determinants related to the affordability of purchasing rich nutrition food and living in a healthy environment. In particular, the analyses include child sex dummy to control for the difference between boys and girls in addition to child's age in months to account for age differentials. We also control for child's birth weight, a dummy variable with multiple categories. We control whether the child is twin or single birth. Mother's age controlled for by a dummy variable with multiple categories. Also, maternal level of education (no education, primary, secondary and higher) is included in the model, as maternal educational attainment is an important determinant of child health. We additionally control for partner's level of education (no education, primary, secondary and higher), number of children under five in the household. Current marital status (married, widowed, and divorced), a categorical variable with the mother's marital status is included in our model, as the presence of partner can raise parental time with child. We include region dummy to control for regional differences.

Regarding economic status, the EDHS collected information on households' assets that were used to develop a wealth index. The wealth index is constructed by the EDHS team, and it is based on assets ownership including ownership of consumer items such as TV, bicycle, and vechiles in addition to housing characteristics such as the source of drinking water, sanitation facilities, and type of building materials. The EDHS used principal components analysis to construct the index, and it is a continuous variable with a zero mean and standard deviation of one. However, maternal employment can increase household wealth. Therefore, the wealth index might absorb the income effect of maternal employment and the models that include maternal employment along with wealth index will capture the partial effect of maternal employment.

All descriptive and multivariate analyses are population weighted using the sampling weights provided in the EDHS survey as well as the cluster effect, and the survey design is considered in the regression analyses as well.

2.2 . Estimation Strategy

Evaluating the causal effect of maternal employment on child health is challenging and requires an adequate estimation methodology. Maternal employment is certainly an endogenous covariate. Reverse causality is a key concern here if mothers of undernourished children are more likely to be unemployed. Additionally, omitted bias is another concern as unobserved factors can influence women employment status as well as child health at the same time. For example, if the husband is unemployed and provides little contribution to the household budget, it will influence both child health as well as women employment status. In all cases, the standard regression methods, OLS or logistic, will yield biased estimators and only capture the mere correlation between child health and women's work.

2.2.1. Propensity Score Matching

To address the selection bias problem, we implement a propensity score matching (PSM) analysis to reduce the potential bias resulting from the self-selection into employment. The PSM analysis limits the selection bias due to confounding variables when estimating the treatment effect by constructing an artificial comparison control group, where individuals are matched based on their propensity to become employed. After matching, the PSM compares the outcome between the treatment and control groups. Formally, the propensity score (PS) could be defined as in Equation (1).

$$PS_i = Prob\ (E = 1|Z_i) \qquad (1)$$

Where PS_i is the probability that a mother i is employed $(E = 1)$, conditional on all the observed characteristics (Z) that can be utilized to balance potential confounders across the control group and consequently lowers any estimation bias. Logit regression model is utilized to estimate the PSs for each individual based on a number of fundamental characteristics.

2.2.2. Instrumental Variable Estimation

Despite that PSM is found to be an effective method for dealing with selection bias. However it is based on a strong assumption that all selection bias is on observable characteristics (Becker & Ichino, 2002; Rosenbaum & Rubin, 1983). We performed another identification strategy based on an instrumental variable (IV). The IV estimation can tackle the reverse causality and omitted bias problem and estimate the causal impact of maternal employment. We instrument maternal employment by local labor market conditions, more specifically by the cluster average of women's working status. The EDHS divided its sample into clusters, which corresponds to the district in urban areas and villages in rural areas. Local labor market conditions have been used in various studies to instrument maternal employment. (Anderson et al., 2003; Bishop, 2011; Datar et al., 2014; Greve, 2011)

For comparison, we begin by showing the results from the standard OLS that does not account for reverse causality as a first step as in Equation (2):

$$HAZ_{ji} = \beta_0 + \beta_1 WP_j + \beta_2 X_{ji} + \varepsilon_{ji} \quad (2)$$

Where, HAZ is the Height for age index for child j born to mother i, WP is a binary indicator related to whether the married women employed and X is a vector of a child, mother and father characteristics, which contains child sex and year of birth, parents' education, number of children in the house, mother's marital status, economic status, husband's employment situation and the sector of employment.

However, in the presence of omitted variables and reverse causality, the OLS model would yield bias estimators since $Cov\ (WP, \varepsilon) \neq 0$. Therefore, we employ the IV technique to tackle the problem of endogeneity of maternal employment. As previously mentioned, we use the cluster average of women's working status as an IV.

The following two stage least squares (2SLS) model, presented in Equations (3) and (4), is estimated:

$$HAZ = \beta_0 + \beta_1 WP + \beta_2 X + \varepsilon \quad (3)$$

$$WP = \Pi_0 + \Pi_1 z_1 + \Pi_2 z_2 + \upsilon \quad (4)$$

Where z_1 is the exogenous instrumental variable (IV), and z_2 is a vector of control variables, and υ and ε are the error terms which accounts for the remaining unexplained variation. A valid IV must be strongly associated $(\Pi_1 \neq 0)$ with the maternal employment (e.g. the endogenous variable) and exogenous in the basic model. The intuition behind choosing the cluster average of women's working status as an IV is that it reflects employment opportunities at the area of living and more importantly it shows the effectiveness of the social networks (Lenze & Klasen, 2017). Previous research has suggested that social networks and employment probability are strongly correlated (Montgomery, 1991). Therefore, one can argue that living in a district where a significant proportion of women are employed can provide women job seekers with information about job opportunities or with employee referrals. Furthermore, the cluster average of women's working status is likely to influence child nutritional status exclusively through mother's employment status, $Cov(z_1, \varepsilon)$ = 0 (instrument exogeneity), and has no independent effect on child nutritional status, as local employment rate is based on the economic conditions.

To avoid bias in coefficients from the over-sampled population and adjust the standard errors for the survey clustering effect (Deaton, 1997), the regression analysis has taken the survey design, i.e. the sampling weight, the cluster and the strata, into account. We also account for the clustering at the family level, as some mothers have multiple births and children would have the same background characteristics; therefore, our standard errors are adjusted for that level of clustering too.

To ensure that our conclusions do not change with the model specification, we explore the impact of maternal employment on the probability of being stunted. We replace the continuous HAZ variable with a binary variable indicating whether the child is stunted or not to check that our most important conclusion does not change when we dichotomize the dependent variable. The binary dependent variable is now equal to one when the value of HAZ is below -2 SD from the median of the reference population and zero otherwise. We use the linear probability model (LPM) via two-stage least squares. Besides the simplicity of interpretation, previous studies have suggested that LPM via-two-stage least squares offers a good estimate of the average effect (Angrist & Pischke, 2008; Chassang & Padro-i-Miquel, 2009; Wooldridge, 2010).

3. Results

3.1. Descriptive Statistics

Table 1 presents the HAZ data from the 2014 EDHS by background characteristics. In our sample, the HAZ average mean is equal to -0.6. A negative mean would suggest that the nutritional status of the entire population is poorer on average than the WHO growth reference population. 21% of children were stunted and it mountains among children ages 18-23, and it is also ostensibly among children below six months. The nutritional status of children in Upper Egypt is far worse compared to other regions. Children whose mothers had received secondary education or higher have better nutritional status than children of less educated mothers. Considering the economic situation, children from the lowest and second wealth quintile have poorer nutritional status than the better-off households. Children whose mothers are employed have poorer nutritional status than other women. Nevertheless, this association does not necessarily indicate a causal relation, as mothers who are engaged in economic activity might systematically differ from other women.

Insert Table 1 here

Table 2 shows the differences in women employment status by selected background characteristics. The participation of ever-married women in economic activity in Egypt is limited. Overall, 16% of women are employed. The percentage of employed women increases with age. Additionally, the table reveals that women living in urban regions, who completed secondary school or higher and women in the richest wealth quintile were much more likely to be currently employed than other women. Married women are less likely to be used compared to the rest. It seems that working mothers have different characteristics compared to the rest; therefore, controlling for these observed characteristics will reduce the possible bias problem.

Insert Table 2 here

The 2014 EDHS asked women who indicated that they were working or had worked within the year before survey about the kind of work that they did. Table 3 illustrates the differences in the occupational profile among female workers. It shows most of the women are working in non-agriculture occupations. The majority of the employed women work in professional, technical, and managerial or clerical jobs. Women in the lowest wealth quintile or did not receive education are employed in agricultural occupations.

Insert Table 3 here

3.2. Causal Inference

We adopted several estimation methods to identify the effect of maternal employment. As a first step, we apply the PSM technique. Table 4 compares the average HAZ score for children whose mothers are employed and their matched comparison in the control group. The results yield that the maternal employment has a negative impact on child nutritional status. Children whose mothers are employed have -0.26 SD less HAZ score compared to the rest. The PSM is not free from limitations. One limitation is that the matching is based on observed characteristics. Therefore, we have to assume that there are no systematic differences in the unobserved characteristics between the children whose mothers are employed and the others, which might be considered a strong assumption.

Table 5 describes the results from the OLS. To show the weight of each group of independent variables, we estimate several models with several specifications. Firstly, we begin with child characteristics alone then we control for parents' characteristics to the model in addition to the region fixed effect. In the complete specification, we only add the household's wealth index to the model. This applies to all tables. Models that include the wealth index will only capture the partial effect of maternal employment, as the adverse health consequences of maternal employment on child health might be attenuated by increased household financial resources since maternal employment can improve household economic status.

Insert Table 4 here

In Table 5, the coefficient of maternal employment always has a negative sign implying that other things being fixed (women education, region, and other factors), children whose mothers are employed, on average, had a lower HAZ score. The maternal employment coefficient increases as the predictive power of the model pick. Looking at the third column with the complete specification, children whose mothers are employed have HAZ score lower by -0.26 SD. The t statistic on maternal employment is 3.59 that corresponds to a p-value that is zero in the first three decimals. The estimate of OLS is almost as large as the PSM average treatment effect. The two coefficients are highly significant at 5% level. Therefore, controlling for a wide variety of individual characteristics in the OLS has been an effective technique in limiting the bias.

The OLS suggests that male children have poorer HAZ than female. We find a negative association between child's age and HAZ score. Twins children have poorer nutritional status compared to the rest. Birth weight has no impact on the current nutritional status. In contrast to the literature, parental education and household wealth do not have a significant impact on child nutritional status (Apouey & Geoffard, 2016). Compared to other regions, children living in Upper Egypt are worse off.

The IV estimates are given in Table 6. In the same way, as in Table 5, we run several specifications in Table 6. The IV 2SLS model confirms the harmful impact of maternal employment on child nutritional status. This means when we estimate maternal employment impact by 2SLS; the maternal employment estimates retain their negative sign. In the core specification where only child characteristics are employed, maternal employment exacerbates the HAZ score by -0.44. However, because of its relatively large standard errors, it is only significant at the 10% level. Adding more control variable increase the explanatory power of the model. As the explained variation picks in the third column, the maternal employment's coefficient picks as well. The IV estimate of maternal employment is three times larger than the OLS one. However, the standard error is greater too. Therefore, the OLS estimation, as well as the PSM, understate the impact of maternal employment to a large extent. Other factors being fixed, the IV 2SLS model suggests that children whose mother are employed have HAZ score -0.9 SD less than the others. The 2SLS estimate is highly significant at the 1% level.

Moreover, controlling for the household's wealth index has a negligible impact on the maternal employed coefficient. The coefficient slightly declines from -0.908 to -0.907. This minor decline in the value coefficient can be interpreted as the positive side impact of maternal employment via increasing household wealth. Similar to the OLS results, boys, twins', and children from Upper Egypt have poorer nutritional status. Children whose mothers completed secondary or higher have 0.3 SD higher HAZ compared to others. Wealth index has no significant effect on HAZ.

Insert Table 6 here

Lastly, we examine the impact of maternal employment when our outcome variable is a binary variable. Our dependent variable can be defined to indicate whether a child is stunted (HAZ below -2 SD), which is an interesting outcome. Our results confirm the negative relationship between women's work and child nutritional status in Egypt. Everything else in the model held fixed; maternal employment increases the probability of being stunted by 0.15, which is a sharp increase in probability. Children of working mothers are at much greater risk of experiencing stunted growth. Children of Upper Egypt have 10% higher probability of being stunted. Girls have a lower probability of being stunted by 3%. Twins have a higher probability of being stunted by 7%. Children whose mothers have received secondary or superior education reduces the likelihood of stunting by 5%. Household wealth status does not affect the probability of stunting, and the maternal employment coefficient does not change after the inclusion of wealth index.

Insert Table 7 here

4. Conclusion

In the present paper, we study the causal relationship between women's work in Egypt and their children nutritional status. Evaluation of children nutritional status is based on height adjusted for age measurements compared to growth standards generated by the WHO. It captures chronic malnutrition and not sensitive to short-term changes (Larrea & Kawachi, 2005). The direction of women's work impact on child nutritional status is theoretically ambiguous. On the one hand, women's work increase household's financial resources and the positive association between income and health in childhood is well-established in the literature (Case et al., 2002). However, on the other hand, women's work adds constraints on women time for child rearing activities such as breastfeeding, cooking healthy food and other activities. Therefore, the net effect of women's work on child health is not visible.

An IV method is employed to address the endogeneity problem that exists between women's work and child nutritional status. The cluster average of women's working status is utilized as an IV. We also perform a robustness check to verify the significance of the relationship. We benefit from the availability of the 2014 EDHS, and the analysis is conducted on 12,888 children in Egypt. We find a strong negative robust association between maternal employment and child nutritional status. Our results indicate that maternal employment deteriorates children HAZ by about one unit of SD. Our results are robust to different specifications and different econometric methods, i.e., OLS, 2SLS, and IV probit.

It is an open question why the maternal employment impact on children's health is conflicting in literature. One possibility is that the final impact of maternal employment on child health is likely to be country specific based on some factors such as the generosity of parental leave at the national level. For example, despite that the period from birth to age two is critical for optimal child growth; the Egyptian law provides working women with only three months paid leave. Also, the Egyptian Government does not offer any form of parental allowance to support families raising their children. Therefore, women engaged in the formal sector must return shortly to their work and would have less time to take care of their children and even breastfed them. The Egyptian society, as well as work environment, is characterized by traditionalism that hinders mothers from breastfeeding at work. Additionally, mothers would have to send their young children to caretakers, which might not be a perfect substitute at least in emotional basis.

Additionally, an important assumption for a child to benefit from mother's employment is that the additional income gained must be spent on food and health care that would improve child nutritional status. If extra income devoted to assets which are not related to child nutritional status then we have no reason to expect that maternal employment would lead to a better child health.

Despite that, a detail policy proposal is outside the scope of the study. However, the policy implication of this study is evident. More family friendly policies for working moms are strongly needed in Egypt. The three months' maternal leave seems to have long-lasting harmful consequences on children health. Friendly environment that allows moms to carry their infants to the workplace might improve children health if it supports natural breastfeeding. Children allowance to families with infants can play a major role in reducing stunting prevalence.

References

Anderson, P. M., Butcher, K. F., & Levine, P. B. (2003). Maternal employment and overweight children. *Journal of Health Economics, 22*(3), 477-504.

Angrist, J. D., & Pischke, J.-S. (2008). *Mostly harmless econometrics: An empiricist's companion*: Princeton university press.

Apouey, B. H., & Geoffard, P.-Y. (2016). Parents’ education and child body weight in France: The trajectory of the gradient in the early years. *Economics & Human Biology, 20,* 70-89.

Baker, M., Gruber, J., & Milligan, K. (2008). Universal child care, maternal labor supply, and family well-being. *Journal of Political Economy, 116*(4), 709-745.

Baum II, C. L. (2003). Does early maternal employment harm child development? An analysis of the potential benefits of leave taking. *Journal of Labor Economics, 21*(2), 409-448.

Becker, S. O., & Ichino, A. (2002). Estimation of average treatment effects based on propensity scores. *The Stata Journal, 2*(4), 358-377.

Bishop, J. (2011). The effect of maternal employment on youth overweight in Australia. *Economic Record, 87*(s1), 92-104.

Blau, F. D., & Grossberg, A. J. (1992). Maternal Labor Supply and Children's Cognitive Development. *The Review of Economics and Statistics, 74*(3), 474-481.

Case, A., Lubotsky, D., & Paxson, C. (2002). Economic status and health in childhood: The origins of the gradient. *The American Economic Review, 92*(5), 1308-1334.

Cawley, J., & Liu, F. (2012). Maternal employment and childhood obesity: A search for mechanisms in time use data. *Economics & Human Biology, 10*(4), 352-364.

Chassang, S., & Padro-i-Miquel, G. (2009). Economic shocks and civil war. *Quarterly Journal of Political Science, 4*(3), 211-228.

Datar, A., Nicosia, N., & Shier, V. (2014). Maternal work and children's diet, activity, and obesity. *Social Science & Medicine, 107,* 196-204.

Deaton, A. (1997). *The analysis of household surveys: a microeconometric approach to development policy*: World Bank Publications.

Dewey, K. G., & Begum, K. (2011). Long-term consequences of stunting in early life. *Maternal & Child Nutrition, 7*(s3), 5-18.

Gardner, E. H. (2003). *Creating Employment in the Middle East and North Africa*: International Monetary Fund.

Greve, J. (2011). New results on the effect of maternal work hours on children's overweight status: Does the quality of child care matter? *Labour Economics, 18*(5), 579-590.

Larrea, C., & Kawachi, I. (2005). Does economic inequality affect child malnutrition? The case of Ecuador. *Social Science & Medicine, 60*(1), 165-178.

Lenze, J., & Klasen, S. (2017). Does Women's Labor Force Participation Reduce Domestic Violence? Evidence from Jordan. *Feminist Economics, 23*(1), 1-29.

Leslie, J. (1988). Women's work and child nutrition in the Third World. *World Development, 16*(11), 1341-1362.

Majbouri, M. (2016). Against the wind: labor force participation of women and economic instability in Iran. *Feminist Economics, 22*(4), 31-53.

Meyer, S.-C. (2016). Maternal employment and childhood overweight in Germany. *Economics & Human Biology, 23*, 84-102.

Ministry of Health and Population [Egypt], El Zanaty and Associates [Egypt], & ICF International. (2015). *Egypt Demographic and Health Survey 2014*. Retrieved from Cairo, Egypt and Rockville, Maryland, USA:

Mocan, N., Raschke, C., & Unel, B. (2015). The impact of mothers' earnings on health inputs and infant health. *Economics & Human Biology, 19*, 204-223.

Montgomery, J. D. (1991). Social networks and labor-market outcomes: Toward an economic analysis. *The American Economic Review, 81*(5), 1408-1418.

Morrill, M. S. (2011). The effects of maternal employment on the health of school-age children. *Journal of Health Economics, 30*(2), 240-257.

Parcel, T. L., & Menaghan, E. G. (1990). Maternal working conditions and children's verbal facility: Studying the intergenerational transmission of inequality from mothers to young children. *Social Psychology Quarterly*, 132-147.

Pelletier, D. L., Frongillo Jr, E. A., Schroeder, D. G., & Habicht, J.-P. (1995). The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization, 73*(4), 443.

Rastogi, S., & Dwivedi, L. K. (2014). Child Nutritional Status in Metropolitan Cities of India: Does Maternal Employment Matter? *Social Change, 44*(3), 355-370.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41-55.

Sivakami, M. (1997). Female work participation and child health: An investigation in rural Tamil Nadu, India. *Health Transition Review,* 21-32.

Stafford, F. P. (1987). Women's work, sibling competition, and children's school performance. *The American Economic Review, 77*(5), 972-980.

Ukwuani, F. A., & Suchindran, C. M. (2003). Implications of women's work for child nutritional status in sub-Saharan Africa: a case study of Nigeria. *Social Science & Medicine, 56*(10), 2109-2121.

Ulijaszek, S. J., & Leighton, D. (1998). Maternal employment and child nutritional status in a very poor population of residents and migrants from Bangladesh in Calcutta, India. *Anthropological Science, 106*(3), 253-263.

UNICEF. (2013). Improving child nutrition: the achievable imperative for global progress. *New York: UNICEF*.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*: MIT press.

Table 1: HAZ by background characteristics

Background characteristics	% below -SD	Mean height for age children
Total	21.4	-0.6
Sex : Male	22.8	-0.6
Sex : Female	19.9	-0.5
Residence : Urban	23	-0.6
Residence : Rural	20.7	-0.6
Education : No education	24.5	-0.7
Education : Primary	26.8	-0.8
Education : Secondary	20	-0.5
Education : Higher	20.3	-0.4
Age in months : <6	19.6	-0.4
Age in months : 6-8	16.4	0
Age in months : 9-11	18.9	-0.2
Age in months : 12-17	21.3	-0.4
Age in months : 18-23	24.6	-0.7
Age in months : 24-35	21.6	-0.6
Age in months : 36-47	22.5	-0.7
Age in months : 48-59	21.5	-0.8
Region : Urban Governorates	19	-0.3
Region : Lower Egypt	17.9	-10
Region : Lower Egypt - urban	19.3	-0.4
Region : Lower Egypt - rural	17.6	-0.3
Region : Upper Egypt	26.2	-10
Region : Upper Egypt - urban	29.8	-1
Region : Upper Egypt - rural	24.8	-1
Region : Frontier governorates excluding North and South Sinai	15.1	0.1
Wealth quintile : Lowest	24.1	-0.8
Wealth quintile : Second	23.1	-0.7
Wealth quintile : Middle	18.1	-0.4
Wealth quintile : Fourth	20	-0.5
Wealth quintile : Highest	23.4	-0.6
Currently employed: Yes	23	-0.54
Currently employed: No	20	-0.68
Total	21.4	-0.6

Table 2: working women by socioeconomic characteristics

Characteristic	**% of working women**
Total 15-49	15,5
Age (grouped) : 15-24	4,7
Age (grouped) : 25-34	14,7
Age (grouped) : 35-49	20,9
Residence : Urban	18,4
Residence : Rural	14
Education (2 groups): No education or primary	11,5
Education (2 groups) : Secondary or higher	17,6
Wealth quintile : Lowest	13,2
Wealth quintile : Second	11,8
Wealth quintile : Middle	14
Wealth quintile : Fourth	16,4
Wealth quintile : Highest	22,2
Marital status : Married or living together	14,9
Marital status : Widowed, divorced, separated	25,8

Table 3: Occupation type by socioeconomic background

Characteristic	Professional, managerial	Clerical	Sales, services	Skilled manual	Unskilled manual	Agriculture
Residence: Urban	54.6	13	21.9	7.9	1.7	0.8
Residence: Rural	38.8	6.6	21	6.1	0.8	26.7
Education						
No education or primary	6	0.2	33	11.5	4.1	44.9
Secondary or higher	59.1	12.4	17.3	5.2	0.1	5.9
Wealth quintile						
Lowest	13.6	3.9	13	4.7	0.9	63.9
Second	26.6	5.9	28.6	8.3	2.4	28.1
Middle	47.4	8.5	26.6	7.4	1	9
Fourth	54.9	10.8	24.3	7.4	1.8	0.7
Highest	64.1	13.3	15.8	6.3	0.2	0.2

Table 4: Propensity Score Matching

	height/age standard deviation (new who)
Average Treatment Effect	
respondent currently working (yes vs no)	-0.263**
	(0.0812)
Observations	12888

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: OLS regression models

	height/age standard deviation (new who)	height/age standard deviation (new who)	height/age standard deviation (new who)
respondent currently working- yes	-0.125	-0.269***	-0.269***
	(0.0738)	(0.0748)	(0.0748)
Sex of child- female	0.167***	0.164***	0.164***
	(0.0436)	(0.0433)	(0.0433)
child's age in months	-0.0228***	-0.0253***	-0.0253***
	(0.00556)	(0.00554)	(0.00554)
Age squared	0.000195*	0.000215*	0.000215*
	(0.0000870)	(0.0000865)	(0.0000864)
Child has a twin	-0.221	-0.273*	-0.273*
	(0.140)	(0.133)	(0.133)
size of child at birth: larger than average	0.663	0.525	0.525
	(0.501)	(0.500)	(0.500)
size of child at birth: average	0.546	0.449	0.450
	(0.492)	(0.487)	(0.487)
size of child at birth: smaller than average	0.343	0.260	0.260
	(0.505)	(0.503)	(0.503)
size of child at birth: very small	0.0775	0.0183	0.0174
	(0.478)	(0.472)	(0.472)
size of child at birth: don't know	-0.743	-0.775	-0.775
	(0.668)	(0.642)	(0.642)
Maternal age: 20-24		0.134	0.135
		(0.144)	(0.144)
Maternal age: 25-29		0.229	0.229
		(0.146)	(0.147)
Maternal age: 30-34		0.332*	0.332*
		(0.149)	(0.149)
Maternal age: 35-39		0.266	0.266
		(0.155)	(0.155)
Maternal age: 40-44		0.490**	0.489**
		(0.182)	(0.182)
Maternal age: 45-49		0.524	0.523
		(0.306)	(0.305)
Maternal education: primary		-0.217*	-0.216*
		(0.0977)	(0.0976)
Maternal education: secondary		0.00747	0.00992
		(0.0738)	(0.0751)
Maternal education: higher		0.165	0.170
		(0.108)	(0.111)
husband education level: primary		-0.0990	-0.0984
		(0.0922)	(0.0919)
husband education level: secondary		0.0500	0.0511
		(0.0791)	(0.0788)
husband education level: higher		0.0731	0.0755

		(0.103)	(0.103)
current marital status: widowed		0.535	0.535
		(0.291)	(0.291)
current marital status: divorced		-0.291	-0.293
		(0.291)	(0.291)
current marital status: separated		-0.548	-0.548
		(0.420)	(0.420)
number of children 5 and under in household (de jure): 1		0.0715	0.0738
		(0.116)	(0.117)
number of children 5 and under in household (de jure): 2		0.0744	0.0761
		(0.117)	(0.118)
number of children 5 and under in household (de jure): 3		0.0628	0.0639
		(0.131)	(0.131)
number of children 5 and under in household (de jure): 4		0.270	0.268
		(0.239)	(0.238)
number of children 5 and under in household (de jure): 5		0.512	0.505
		(0.593)	(0.591)
number of children 5 and under in household (de jure): 6		0.544	0.532
		(0.350)	(0.359)
number of children 5 and under in household (de jure): 7		-0.629^{***}	-0.647^{***}
		(0.152)	(0.172)
number of children 5 and under in household (de jure): 9		0.230	0.227
		(0.133)	(0.133)
Lower Egypt- urban		-0.102	-0.104
		(0.209)	(0.209)
Lower Egypt- rural		-0.0480	-0.0592
		(0.191)	(0.200)
Upper Egypt- urban		-0.746^{***}	-0.749^{***}
		(0.216)	(0.217)
Upper Egypt- rural		-0.720^{***}	-0.733^{***}
		(0.192)	(0.209)
Frontier governorates		0.415	0.409
		(0.262)	(0.267)
wealth index factor score (5 decimals)			-0.0105
			(0.0584)
Constant	-0.678	-0.531	-0.530
	(0.497)	(0.551)	(0.551)
Observations	12885	12875	12875

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: IV estimation

	height/age standard deviation (new who)	height/age standard deviation (new who)	height/age standard deviation (new who)
respondent currently working- yes	-0.435	-0.908***	-0.907***
	(0.251)	(0.273)	(0.272)
Sex of child- female	0.167***	0.161***	0.161***
	(0.0437)	(0.0434)	(0.0434)
child's age in months	-0.0224***	-0.0247***	-0.0247***
	(0.00558)	(0.00555)	(0.00555)
Age squared	0.000191*	0.000210*	0.000210*
	(0.0000871)	(0.0000866)	(0.0000865)
Child has a twin	-0.221	-0.291*	-0.291*
	(0.141)	(0.135)	(0.135)
size of child at birth: larger than average	0.655	0.506	0.506
	(0.484)	(0.466)	(0.466)
size of child at birth: average	0.546	0.446	0.446
	(0.476)	(0.453)	(0.453)
size of child at birth: smaller than average	0.345	0.267	0.267
	(0.489)	(0.469)	(0.469)
size of child at birth: very small	0.0691	0.00981	0.00903
	(0.462)	(0.441)	(0.442)
size of child at birth: don’t know	-0.745	-0.779	-0.779
	(0.653)	(0.609)	(0.609)
Maternal age: 20-24		0.124	0.124
		(0.143)	(0.144)
Maternal age: 25-29		0.248	0.248
		(0.147)	(0.147)
Maternal age: 30-34		0.385*	0.385*
		(0.152)	(0.152)
Maternal age: 35-39		0.337*	0.337*
		(0.159)	(0.159)
Maternal age: 40-44		0.558**	0.558**
		(0.187)	(0.187)
Maternal age: 45-49		0.571	0.570
		(0.312)	(0.310)
Maternal education: primary		-0.216*	-0.215*
		(0.0986)	(0.0986)
Maternal education: secondary		0.0166	0.0190
		(0.0739)	(0.0754)
Maternal education: higher		0.306**	0.310**
		(0.117)	(0.120)
husband education level: primary		-0.0980	-0.0974
		(0.0923)	(0.0920)
husband education level: secondary		0.0488	0.0499
		(0.0795)	(0.0792)
husband education level: higher		0.129	0.131

		(0.102)	(0.101)
current marital status: widowed		0.646*	0.646*
		(0.298)	(0.298)
current marital status: divorced		-0.206	-0.209
		(0.281)	(0.280)
current marital status: separated		-0.517	-0.518
		(0.425)	(0.425)
number of children 5 and under in household (de jure): 1		0.114	0.116
		(0.118)	(0.119)
number of children 5 and under in household (de jure): 2		0.113	0.115
		(0.118)	(0.118)
number of children 5 and under in household (de jure): 3		0.104	0.105
		(0.131)	(0.131)
number of children 5 and under in household (de jure): 4		0.346	0.344
		(0.240)	(0.240)
number of children 5 and under in household (de jure): 5		0.597	0.590
		(0.604)	(0.602)
number of children 5 and under in household (de jure): 6		0.748	0.736
		(0.462)	(0.468)
number of children 5 and under in household (de jure): 7		-0.0649	-0.0834
		(0.268)	(0.277)
number of children 5 and under in household (de jure): 9		0.226	0.224
		(0.134)	(0.134)
Lower Egypt- Urban		-0.0683	-0.0699
		(0.207)	(0.207)
Lower Egypt- Rural		-0.0136	-0.0247
		(0.189)	(0.198)
Upper Egypt- Urban		-0.727***	-0.730***
		(0.215)	(0.216)
Upper Egypt- Rural		-0.695***	-0.708***
		(0.191)	(0.206)
Frontier governorates		0.431	0.425
		(0.262)	(0.266)
wealth index factor score (5 decimals)			-0.0103
			(0.0576)
Constant	-0.648	-0.587	-0.586
	(0.480)	(0.519)	(0.519)
Observations	12885	12875	12875

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: IV with binary outcome (stunted)

	Model 1	Model 2	Model 3
respondent currently working-yes	0.0916	0.150**	0.150**
	(0.0486)	(0.0547)	(0.0546)
Sex of child- female	-0.0339***	-0.0330***	-0.0330***
	(0.00899)	(0.00901)	(0.00902)
child's age in months	0.00200	0.00243*	0.00243*
	(0.00102)	(0.00103)	(0.00103)
Age squared	-0.0000235	-0.0000280	-0.0000280
	(0.0000173)	(0.0000174)	(0.0000174)
Child has a twin	0.0573	0.0679*	0.0679*
	(0.0311)	(0.0308)	(0.0308)
size of child at birth: larger than average	-0.153	-0.121	-0.120
	(0.105)	(0.100)	(0.100)
size of child at birth: average	-0.137	-0.113	-0.113
	(0.102)	(0.0975)	(0.0975)
size of child at birth: smaller than average	-0.0750	-0.0542	-0.0541
	(0.102)	(0.0981)	(0.0980)
size of child at birth: very small	-0.0392	-0.0215	-0.0217
	(0.0985)	(0.0943)	(0.0943)
size of child at birth: don’t know	0.155	0.168	0.168
	(0.158)	(0.151)	(0.151)
Maternal age: 20-24		-0.0600	-0.0599
		(0.0367)	(0.0366)
Maternal age: 25-29		-0.0721*	-0.0720*
		(0.0367)	(0.0366)
Maternal age: 30-34		-0.0977**	-0.0977**
		(0.0373)	(0.0373)
Maternal age: 35-39		-0.0930*	-0.0931*
		(0.0399)	(0.0398)
Maternal age: 40-44		-0.123**	-0.123**
		(0.0433)	(0.0433)
Maternal age: 45-49		-0.0916	-0.0919
		(0.0570)	(0.0568)
Maternal education: primary		0.0290	0.0292
		(0.0223)	(0.0223)
Maternal education: secondary		-0.0312*	-0.0307*
		(0.0153)	(0.0155)
Maternal education: higher		-0.0515*	-0.0506*
		(0.0237)	(0.0240)
husband education level: primary		0.00812	0.00824
		(0.0198)	(0.0197)
husband education level: secondary		-0.0214	-0.0212
		(0.0165)	(0.0165)
husband education level: higher		-0.0306	-0.0301
		(0.0211)	(0.0209)
current marital status: widowed		-0.101	-0.101

		(0.0525)	(0.0525)
current marital status: divorced		0.0389	0.0384
		(0.0570)	(0.0570)
current marital status: separated		0.0551	0.0550
		(0.0876)	(0.0875)
number of children 5 and under in household (de jure): 1		-0.00256	-0.00209
		(0.0241)	(0.0244)
number of children 5 and under in household (de jure): 2		-0.00305	-0.00269
		(0.0242)	(0.0244)
number of children 5 and under in household (de jure): 3		-0.00156	-0.00134
		(0.0279)	(0.0280)
number of children 5 and under in household (de jure): 4		-0.0272	-0.0277
		(0.0504)	(0.0498)
number of children 5 and under in household (de jure): 5		0.0900	0.0884
		(0.118)	(0.118)
number of children 5 and under in household (de jure): 6		-0.110	-0.113
		(0.112)	(0.114)
number of children 5 and under in household (de jure): 7		-0.101	-0.105
		(0.0544)	(0.0552)
number of children 5 and under in household (de jure): 9		0.0415	0.0409
		(0.0291)	(0.0286)
Lower Egypt- Urban		-0.00101	-0.00137
		(0.0294)	(0.0293)
Lower Egypt- Rural		-0.0147	-0.0171
		(0.0272)	(0.0285)
Upper Egypt- Urban		0.0985^{*}	0.0978^{*}
		(0.0385)	(0.0389)
Upper Egypt- Rural		0.0528	0.0501
		(0.0287)	(0.0320)
Frontier governorates		-0.0440	-0.0454
		(0.0290)	(0.0295)
wealth index factor score (5 decimals)			-0.00228
			(0.0106)
Constant	0.308^{**}	0.368^{***}	0.368^{***}
	(0.102)	(0.108)	(0.108)
Observations	12885	12875	12875

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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