Mother's Empowerment and Child Malnutrition: Evidence from Pakistan

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Abstract

The objective of this paper is to explore the relationship between mothers' socioeconomic empowerment and malnutrition of children under age five in the context of Pakistan. At the first step, a composite empowerment index is developed by incorporating various characteristics of mothers; such as educational attainment, labor force participation, involvement in household decisions, asset ownership, freedom of movement and perceptions regarding domestic violence. Instead of using additive methods or assigning subjective weights to different aspects of mothers' empowerment, statistical weights, derived though Principal Component Analysis technique are applied. Nationally representative rich data of Pakistan Demographic and Health Survey 2012-13 is used to quantify the nature and direction of relationship between empowerment and child malnutrition in terms of stunting, wasting and underweights in a multivariate logistic regression framework. The estimated results indicate that empowerment is relatively more important than mothers' health and household poverty in determining nutritional status of children.

Keywords: Mothers' Empowerment Index, Principal Component Analysis, Child Malnutrition, Logistic Regression, Pakistan

JEL: I12, C25, J16

1. Preamble

According to Pakistan Demographic and Health Survey (PDHS) 2012-13, "45 percent of children under-five are stunted (too short for their age) indicating a chronic malnutrition. Stunting is most common among children of less educated mothers (55 percent) and those from the poorest households (62 percent). It was also observed that stunting is more common in rural areas (48 percent) than urban areas (37 percent). Wasting (too thin for height), which is a sign of acute malnutrition, is far less common (11 percent). In addition, 30 percent of Pakistani children are underweight (too thin for their age)".

In light of the alarming fact that one out of every three children in developing countries is malnourished, research on the causes of child malnutrition is continually expanding. A considerable portion of the empirical research is devoted for exploring the relationship between women's empowerment and nutrition, particularly child malnutrition. Moreover, as part of the quest to achieve gender equality, women's empowerment has increasingly been the focus of many development interventions by development partners and international agencies.

Empirical research confirm positive associations between increases in women's empowerment and improved nutrition outcomes and, conversely, that actions leading to women's disempowerment can result in adverse nutritional impacts for women themselves as well as for their children (Bhagowalia et al. 2012; Quisumbing 2003; Smith and Haddad 2000). Based on review of numerous empirical evidences from developing countries, Bold et al (2013) summarizes "studies have shown the important linkages between women's empowerment dimensions and nutritional outcomes". They further argue that in addition to being an end goal in itself, women's empowerment is also considered as a means by which to achieve other important development outcomes, such as poverty reduction and investment in human capital (nutrition, health and education). Smith et al (2003) observed that improvements in women's power relative to men's, both within the household and in the community, strongly influence children's nutritional status. In South Asia, where women's status is particularly low, they conclude "If women and men had equal status in South Asia, with all other factors held as is, the percentage of underweight children would decline from 46 to 33 percent—a reduction of 13.4 million malnourished children".

In the context of Pakistan, no evidence of any systematic effort to quantify the relationship between women's empowerment and child malnutrition is available[1]. Empowerment variables such as education and employment are used independently in the regression framework to explore the impact on child nutrition. However, these studies often infer conflicting results on the nature of relationship. For instance Arif et al (2012), while examining the determinants of child malnutrition in Pakistan, found that "surprisingly mothers' education did not turn out to be statistically significant" as a determining factor of child nutritional status in their estimated multivariate regression model. In contrast, other studies[2] using Pakistani data found a positive

[1] For an excellent and latest overview of empirical research on child malnutrition in Pakistan, see Raju and D'Souza (2017).

[2] See for instance, Headey, Hoddinott, and Park (2016); Di Cesare et al. (2015); Mahmood (2001); Fikree, Rahbar, and Berendes (2000); Alderman and Garcia (1994); Hazarika (2000)

and significant relationship between child nutrition and mothers' educational attainment. This leads to inconclusive discourse regarding the impact of women's empowerment on child nutritional status. Similarly, Fikree et al (2000) and Rahman et al. (2004) do not find mother's employment status and financial decision-making authority respectively to be associated with child nutritional status.

This study in this direction and provides the empirical evidence with reference to Pakistan on the relation between mothers' empowerment and child nutritional outcomes through a composite Empowerment Index (EI) by incorporating various aspects of women's empowerment including education, labor force participation, involvement in household decision, mobility, asset ownership and access to information. The analysis uses micro data of Pakistan Demographic and Health Survey 2012-13.

The paper proceeds as follows. Dimensions and methodology for measuring empowerment is presented in the next section. Data and specification of malnutrition model are described in Section 3, while discussions on empirical results are furnishes in Section 4. Last section is reserved for some concluding remarks.

2. Measuring Women's Empowerment

A number of studies[3] on conceptualizing empowerment have been produced for the purpose of getting a consensus on the definition of women's empowerment. Most often these studies refer to women's ability to make decisions and affect outcomes of importance to themselves and their families. Further, control over one's own life and over resources is often stressed in these studies. According to Malhotra et al (2002), the key underlying concepts that define women's empowerment relate to choices, control, and power. For instance, Eyben et al (2008) define empowerment as "Empowerment is a process which relates to the power of an individual to redefine her possibilities and options and to have the ability to act upon them, while Kabeer (2001) defines empowerment as "the expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them".

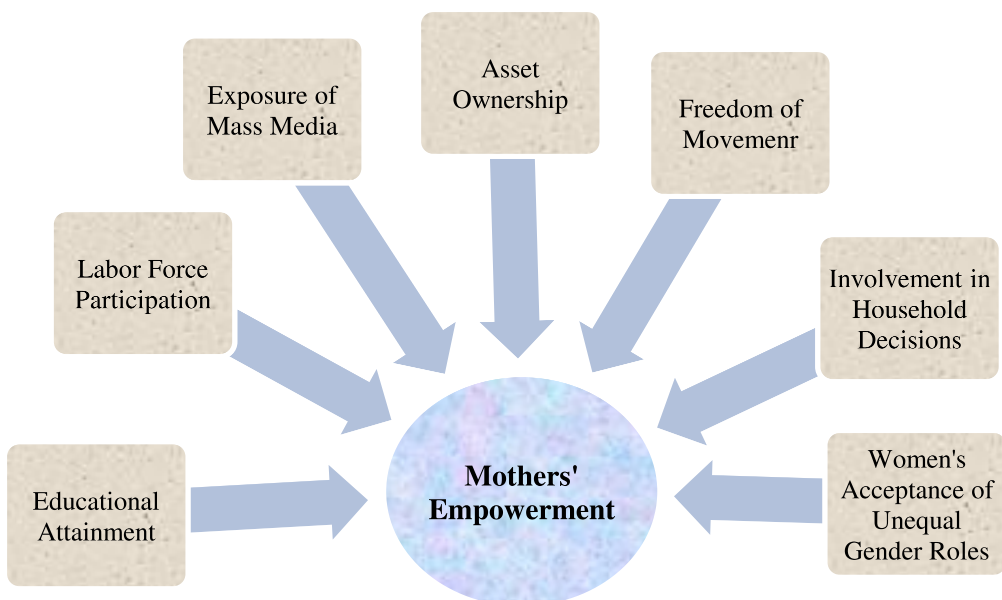
The nature of diversity and multiplicity in defining women's empowerment leads to the fact that it is characterized as a complex, multifaceted, context dependent notion and thus its measurement is challenging. Moreover, the empowerment process cannot be measured but can only be approximated because it is not directly observable. It is also highlighted in the relevant literature that women's empowerment cannot be quantified absolutely but only in relative terms and has to be assessed through proxies or indicators. The aspects of women empowerment which are considered in this study include; Women's Participation in Household Decisions, Women's Freedom of Movement, Women's Acceptance of Unequal Gender Roles and Women's Access to Sources of Empowerment (Education, Exposure of Mass Media, Employment and Property Rights).

[3] References of various studies are available in Malhotra et al (2002).

2.1 *Indicators of Women's Empowerment*

The composite Empowerment Index, developed for this study comprises of seven dimensions which are based upon the literature that indicated or confirmed their possible association with women's autonomy and empowerment[4]. A schematic view of the empowerment model for this study is furnished in the Exhibit 2.1, while the definitions of specific indicator for each empowerment aspect are tabulated in the Exhibit 2.2. Brief remarks on the selected indicators are in order.

Exhibit – 2.1
Dimensions of Empowerment Model



Educational Attainment: Education has the potential of empowering women in several different ways; it equips them with the awareness and knowledge required to make beneficial life choices, it increases their ability to access resources and services, and it enables them to become informed consumers and citizens (Kishor and Gupta, 2004). Education is also likely to enhance women's economic independence by equipping them with skills necessary to avail of paid employment opportunities, thereby also making their economic contributions more visible.

Women's educational attainment is represented in six categories; No education=0, Incomplete primary=1, Complete primary=2, Incomplete secondary=3, Complete secondary=4 and Higher=5. Besides women's own educational attainment, her level of education relative to those of husband is also included in the composite EI. If women has less education relative to husband, her score is 0 otherwise 1.

[4] Family Planning indicators are also used in studies of women's empowerment, however very little evidence was found to support family planning use as one of the components of women's empowerment (Phan, 2016).

Labor Force Participation: An important enabling factor for the economic and social empowerment of women is her participation in economic activities, particularly outside the home. It is argued that not only can employment be a source of economic independence, but it can help to give women a sense of self-worth.

The indicator which represents the nature of labor force participation in the EI is an ordinal variable. Scores are assigned as; 0 for not working women, 1 for women who reported occasional work outside home, 2 for seasonal working and 3 for women who reported working whole year.

Exposure to Mass Media: Due to higher level of illiteracy and low level of educational attainment of women, mass media is an important source for exposing women to the outside world and enhancing awareness. While mass media, especially TV is undoubtedly an important source of entertainment, it has tremendous educational value. Regular exposure to different mass media, particularly visual media, is likely to play a significant role in building women's information base and their exposure to alternative images that can help to reinforce the value of women.

Frequency of reading newspaper or magazines and watching television is included to assess the media exposure with the following categories; 0=not at all, 1=occasionally, 2=at least once a week and 3=daily.

Property Rights: Control over resources is an important aspect of women empowerment. For the EI, patterns of land and house ownership are included. Value 0 is assigned to the ordinal variables in case of no ownership, while values 1 and 2 are assigned for joint and alone ownership respectively.

Women's Freedom of Movement: In the PDHS, women's freedom of movement was not directly asked. Instead women were asked whether they need permission to go, face any problem in getting money needed and face any difficulty in going alone. These questions were asked with reference to get the medical help for self-care. Answers for these questions were recorded in two categories; ‘big problem’ and ‘not a big problem’. It can be safely argued that women, who reported problem in getting permission or face difficulty in going alone, are more limited in their freedom than women who answered ‘not a big problem’. For the EI, 0 is assigned to those women who responded ‘big problem’; otherwise 1 is assigned.

Woman’s involvement in household decision-making:
Women's extent of participation in various household and personal level decisions also reflects the extent of empowerment. PDHS asked each ever-married woman age 15-49, who in her household made the decisions regarding women’s health care, large household purchases, women’s visits to family or relatives and money husband earns[5]. Three choices were given to answer these questions; not involved (someone else decides), decide with husband and decide alone. Four ordinal variables are created for WEI by assigning values 0, 1 and 2 accordingly.

[5] Women who worked for cash were also asked “who mainly decides how the money they earned would be used”? However, this variable is dropped due to very low labor force participation rate and large refusal to answer.

Exhibit – 2.2
Components of Mothers' Empowerment Index

Dimensions – Variables	Definitions
Educational Attainment:	
Educational attainment of mothers	No education=0, Incomplete primary=1, Complete primary=2,Incomplete secondary=3, Complete secondary=4, Higher=5
Mother education compared with Father	Women less educated=0, More or Same Level of education=1
Labor Force Participation:	
Nature of Participation	Not Working=0, Occasional=1, Seasonal=2, All year=3
Exposure to Mass Media:	
Reading newspaper or magazine	Not at all =0, Occasionally=1, At least once a week=2, Daily=3
Watching television	Not at all =0, Occasionally=1, At least once a week=2, Daily=3
Asset Ownership:	
Owns a house alone or jointly	Does not own=0, Jointly own=1, Alone own=2
Owns land alone or jointly	Does not own=0, Jointly own=1, Alone own=2
Involvement in Household Decisions Regarding:	
Mothers health care	Not Involved=0, With Husband=1, Alone=2
Large household purchases	Not Involved=0, With Husband=1, Alone=2
Visits to family or relatives	Not Involved=0, With Husband=1, Alone=2
Money husband earns	Not Involved=0, With Husband=1, Alone=2
Women's Freedom of Movement – Getting Medical Help for self:	
Getting permission to go	Big problem=0, Not a big problem=1
Getting money needed for treatment	Big problem=0, Not a big problem=1
Not wanting to go alone	Big problem=0, Not a big problem=1
Women's Acceptance of Unequal Gender Roles – Beating of Wives by Husband Justified if:	
Wife goes out without telling husband	Justified=0, Not Justified=1
Wife neglects the children	Justified=0, Not Justified=1
Wife argues with husband	Justified=0, Not Justified=1
Wife refuses to have sex with husband	Justified=0, Not Justified=1
Wife burns the food	Justified=0, Not Justified=1

Women's Acceptance of Unequal Gender Roles: A fundamental element of empowerment is the rejection of the ascription of seemingly immutable and essentially unequal rights and privileges on the basis of the sex of an individual. One such 'right' often normatively ascribed to men is the right of husbands to regulate and control 'their' women's behavior (Kishor and Gupta, 2004). Acceptance of this normatively prescribed power of men over women reflects an acceptance of unequal gender roles. Women who see as justified the beating of wives by husbands are then less empowered than women who think otherwise (Sen and Batliwala 1997). According to (Kishor and Gupta, 2004), overall it can be safely said that in societies where the beating of wives by husbands is widely accepted is indicative of a lower status of women, both absolutely and relative to men.

To measure this aspect of women's empowerment, PDHS asked all respondents (ever married women aged 15-49) whether they thought that a husband is justified in beating his wife for each of the following reasons: wife goes out without telling husband, wife neglects the children, wife argues with husband, wife refuses to have sex with husband and wife burns the food. Five variables are developed for the composite EI with binary values; 0 if a women justifies beating and value 1 if she categorically argues 'Not Justified'.

2.2 Methodology for Combining Empowerment Indicators

A composite index is developed to establish the relationship between women's empowerment and child malnutrition. Composite indices represent aggregate measure of a combination of complex phenomena and summarize multi-dimensional issue to support policy decisions. Two issues however are encountered while developing composite indices; the substitutability among components and how to weight constituent variables.

Various efforts are made to represent women empowerment through composite indices. Women Empowerment in Agriculture Index (WEAI) WEAI is the first standard measure to directly capture women's empowerment in the agricultural sector. The WEAI was launched by International Food Policy Research Institute (IFPRI), Oxford Poverty and Human Development Initiative (OPHI), and USAID's "Feed the Future" program in 2012. The WEAI is comprised of two sub-indices: one measures the empowerment of women along five domains/dimensions and the second measures the gender parity of empowerment within the household (Alkire et al., 2013). Another notable composite index was developed by Tuladhar et al (2013) while assessing the relationship between women's empowerment and spousal violence for Nepal[6].

However, these studies either use additive methods assuming full substitutability among the components of the index which is not a desirable property – a deficit in one dimension can be compensated by a surplus in another – or apply subjective weights before aggregating the component indicators. Application of subjective cutoffs (thresholds) for categorizing the level of empowerment is also common in most of these studies.

The technique[7] of Principal Component Analysis (PCA) may be used to resolve issues of substitutability and assignment of weights to constituents of the composite indices. PCA provides weighing scheme derived from the given data instead of weighting recommended by experts, policy makers or through public opinion polls. Thus application of statistical weights for the construction of composite indices is a better option as these remove the subjectivity and personal biases. Smith et al. (2003) explored[8] the relationship between women's status and children's nutrition in various countries belongs to three developing regions: South Asia, Sub-Saharan Africa, and Latin America and the Caribbean with the help of a composite index. They

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[6] Mehwish et al. (2017) also developed an empowerment index for Pakistan using PDHS 2013 data. Their study follows the methodology of Tuladhar et al (2013) for combining empowerment indicators.

[7] Very brief description of Principal Components is provided in the Appendix–B. For conceptual clarity and computational details, see Adelman and Morris (1972).

[8] See also Phan (2016). Phan also developed composite index for women empowerment following the Principal Component Analysis technique for Southeast Asian countries including Cambodia, Indonesia, Philippines and Timor-Leste.

note that “Factor analysis was chosen after experimenting with three other methods. First is an index based on “absolute cutoffs” in which women are assigned points (either –1, 0, or +1) for achieving specified levels of each indicator and then summing the points to construct the index. This method has the advantage of being straightforward in the exact way it combines the indicators. Its disadvantages are that it assigns equal weight to each indicator, does not take into account their interrelations, and is based on cutoffs that may not be widely agreed upon as meaningful. Second is a method in which the women are divided into equal-sized groups along each indicator and then assigned points. Based on population proportions, this method relies on the variation in the sample, rather than cutoffs, to separate women into distinct groups. It has the same advantages and disadvantages as the cutoffs method. Third is principal components analysis, which yields an index. Note that index, based on principal component analysis performs far better than those based on the first two methods when subjected to validation analysis”.

This study therefore applies the PCA technique to the above-mentioned empowerment indicators for developing the composite EI. The index assigns empowerment score to each ever married woman aged 15-49 years in the dataset.

3 Data and Estimation Framework for Determinants of Child Malnutrition

This study uses Pakistan Demographic and Health Survey (PDHS) 2012-13 data, conducted under the aegis of the Ministry of National Health Services, Regulations and Coordination and implemented by the National Institute of Population Studies (NIPS). A nationally representative sample of 14,000 households from 500 primary sampling units (PSUs) was selected for 2012-13 PDHS. Details regarding sampling framework and sample allocation across various strata are furnished in the Appendix–A.

Household production framework suggested by Becker (1965) and Strauss and Thomas (1995) is referred in most studies that explore determinants of children’s nutritional status. This framework assumes that a household has preferences that can be characterized by the utility function U which depends on consumption of a vector of commodities (X), leisure (L), and the quality of children represented by their nutritional status (N).

$$U = u(X, L, N)$$

The assumption in such a model is that good nutrition, as estimated through standardized anthropometric measures is desirable in its own right, and it is likewise assumed that households make consumption decisions on the basis of reasons other than nutrition (Pitt and Rozenzweig, 1995). Household utility is maximized subject to several constraints, including a time specific nutrition production function and income constraints (Strauss and Thomas (1995). Guided by the underlying determinants, the reduced form of nutritional function for each child can be derived as:

$$N_i = f(C_i, M_i, F_i, H_i)$$

where N_i , C_i, M_i, F_i, and H_i denote child nutritional status, child characteristics, mother’s empowerment and health status, father characteristics and characteristics of household respectively. Brief definitions of dependent and explanatory variables are furnished below.

3.1 Defining Child Malnutrition

The 2012-13 PDHS collected data on the nutritional status of children by measuring the height and weight of all children under age 5 in selected households. These data allow the calculation of three indices: height-for-age, weight-for-height, and weight-for-age. According to PDHS report (NIPS, ICF 2013), indicators of the nutritional status of children were calculated using growth standards published by the World Health Organization (WHO) in 2006. The three nutritional status indices are expressed in standard deviation units (Z-Score) from the Multicenter Growth Reference Study median. The height-for-age index is an indicator of linear growth retardation and cumulative growth deficits in children. Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the WHO reference population are considered short for their age (stunted), or chronically malnourished. Children who are below minus three standard deviations (-3 SD) from the reference median are considered severely stunted. Stunting reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illness. Height-for-age, therefore, represents the long-term effects of malnutrition in a population and is not sensitive to recent, short-term changes in dietary intake. The weight-for-height index measures body mass in relation to height or length and describes current nutritional status. Children with Z-scores below minus two standard deviations (-2 SD) from the reference population median are considered thin (wasted) or acutely malnourished. Wasting represents the failure to receive adequate nutrition in the period immediately preceding the survey and may be the result of inadequate food intake or a recent episode of illness causing loss of weight and the onset of malnutrition. Children with a weight-for-height index below minus three standard deviations (-3 SD) from the reference median are considered severely wasted. The weight-for-height index also provides data on overweight and obesity. Children above two standard deviations (+2 SD) from the reference median are considered overweight or obese. Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute malnutrition (wasting) and chronic malnutrition (stunting), but it does not distinguish between the two. Children whose weight-for-age is below minus two standard deviations (-2 SD) from the reference population median are classified as underweight. Children whose weight-for-age is below minus three standard deviations (-3 SD) from the reference median are considered severely underweight.

For this analysis, children under age 5 whose Z-scores associated with height-for-age, weight-for-height, and weight-for-age are below minus two standard deviations (-2 SD) from the median of the WHO reference population are considered malnourished. Thus a value of 1 is assigned to the variable, N_i which covers children who are either stunted or wasted or underweight, while the value 0 is assigned to the well-nourished children.

Since the dependent variable N_i is dichotomous, a binary logistic regression model is fitted to ascertain the determinants of malnutrition among children under five years. The Logit model estimates the probability of falling into either of the dichotomous values of the dependent variables given the effect of the explanatory variables. Thus estimated parameters represent the probability that a child will be malnourished. A positive sign of the estimated coefficient implies that the variable will lead to increased malnutrition, while a negative sign indicate that the variable will reduce malnutrition.

3.2 Determinants Related to Child Characteristics

Child characteristics included in the final specification of multivariate analysis are age and sex of child and place of child delivery. Empirical literature[9] on determinants of child malnutrition suggests that aged children are more likely to suffer from malnutrition than younger children in developing countries. Thus a positive relationship between age and malnutrition is assumed.

An important aspect of child healthcare is empirically tested[10] by incorporating place of child delivery in the malnourishment model. The variable 'Child delivery at Home' is assigned value 1 for those children whose mother reported delivery at home, while delivery at public or private hospitals/nursing homes is assigned value zero. Thus the variable which reflects the absence of much health related facilities is assumed a positive relationship with malnourishment.

Child relative size and weight at birth are also important in determining the probability of malnourishment. Unfortunately majority of sampled women (80 percent) either didn't weight child at birth or didn't remember, while data on child's relative size at birth is available in categories (small, average and large) and not in kilograms/ponds. Nonetheless, these two variables were tried in preliminary specifications of malnutrition model but appeared statistically insignificant with wrong signs and thus dropped.

3.3 Mother's Empowerment and Nutritional Status

Two maternal characteristics, mother's empowerment and mother health status are included in the analysis. Mother's empowerment is represented through the empowerment score, described in the previous section. This score combines mother's characteristics related to education, labor force participation, access to information, property rights, involvement in household decisions and perception regarding domestic violence. Mother's nutritional status is considered through the Body Mass Index (BMI) which is a well-recognized indicator of energy reserves in adults. BMI is calculated as weight in kilograms divided by the square of height in meters. The estimated values of BMI for relevant sampled women are provided in the PDHS dataset. A category variable which assigns value 1 for those mothers whose BMI is in the range of 18.5 to 24.9 is used for this analysis. This BMI range reflects a healthy status (green) according to the WHO standard.

An inverse relationship between these two variables and malnourishment of children is assumed and thus negative signs of regression coefficients are expected.

3.4 Determinants Related to Characteristics of Father

Age and education of father are included in the malnourishment model to control for the variation in the characteristics of father. Based on earlier empirical research[11], inverse

[9] See for instance, Fazal et al. (2013)

[10] With respect to maternal and child health service use, studies find that formal antenatal care (Headey, Hoddinott, and Park 2016; Mahmood 2001) and delivery at a health facility (Headey, Hoddinott, and Park 2016; Alderman and Garcia 1994) are positively associated with nutrition status.

[11] Headey, Hoddinott, and Park (2016); and Mahmood (2001) find that father's education attainment is positively associated with child nutrition status, whereas Alderman and Garcia (1994) find the effect to be insignificant.

relationship between age and education of father and malnutrition is assumed. However, due to collinearity problem, instead of using level or years of education, a binary (1, 0) variable is created to reflect father with no education. Thus the positive sign of regression coefficient associated with illiterate father is expected.

3.5 Background Characteristics of Households

An important determinant of child malnutrition is household status in terms of income, consumption or poverty[12]. In almost all studies which are based on Demographic and Health Surveys (DHS), a wealth index is used to reflect the socioeconomic status of household. It is constructed as an indicator of the level of wealth that is consistent with expenditure and income measures and thus it is a proxy indicator for the long-term standard of living. In the DHS, the index is based on data from household ownership of assets and consumer goods such as source of drinking water, type of toilet facilities, type of fuel, ownership of various durable goods, and other characteristics relating to socioeconomic status of the household. According to PDHS report (NIPS, ICF International 2013), " …… the index is created in three steps. In the first step, a subset of indicators common to urban and rural areas is used to create wealth scores for households in both areas. Categorical variables are transformed into separate dichotomous (0-1) indicators. These indicators and those that are continuous are then examined using a principal components analysis to produce a common factor score for each household. In the second step, separate factor scores are produced for households in urban and rural areas using area-specific indicators. The third step combines the separate area-specific factor scores to produce a nationally applicable combined wealth index by adjusting area-specific scores through a regression on the common factor scores. This three-step procedure permits greater adaptability of the wealth index in both urban and rural areas. The resulting combined wealth index has a mean of zero and a standard deviation of one. Once the index is computed, national-level wealth quintiles (from lowest to highest) are obtained by assigning household scores to each de jure household member, ranking each person in the population by his or her score, and then dividing the ranking into five equal categories, each comprising 20 percent of the population".

Education level of family members also influences behavior of mothers with respect to health of children. Thus the highest level (years) of schooling completed by any household member, including household head is empirically tested through multivariate malnutrition model. An inverse relationship between the level of highest education in household and malnutrition is assumed on the basis of empirical literature.

Regional (urban/rural) and provincial binary variables are also incorporated in the logit models to control for spatial heterogeneity among households regarding the culture, social norms and the level of development. Six binary variables (Punjab urban, Punjab rural, Sindh Urban, Sindh rural, KPK urban and KPK rural) which represent sample strata are included, while Balochistan province is used as a reference category.

[12] See for instance, Headey, Hoddinott, and Park 2016; Di Cesare et al. 2015; Mahmood 2001; Hazarika 2000

4. Results and Discussions

Average values of empowerment score obtained by ever married women in the age cohort 15-49 in the PDHS 2013 data is furnished in the Exhibit 4.1. These scores are derived by combining various dimensions of women's empowerment considered in this analysis and by applying PCA technique for aggregating empowerment variables. The exhibit portrays this information across provinces, region and household poverty status.

Provincial ranking in terms of average women empowerment score is according to a priory expectation. Islamabad ranks the highest, while the lowest average value of empowerment score is appeared for Balochistan province. Again as expected, Gilgit/Baltistan is better off than Balochistan and KPK provinces mainly due to the relatively high female literacy and educational attainment.

Regional averages in terms of large cities, small cities (towns) and rural areas are also in accordance to the general perception regarding the women empowerment. The average score of rural women is 49, while in large cities women obtained an average 69.

The exhibit also confirms a strong positive relationship between women's empowerment and household poverty status, reflected through household wealth quintiles. Average empowerment score of women residing in poorest (lowest wealth quintile) households is almost half than women residing in richest (highest quintile) households.

Exhibit 4.2 reports the estimates of logistic regression function[13] for child malnourished model. The correlates or determinants of malnutrition, described above are included in the logistic function to assess the probability that a child will be malnourished. It is implied that a variable will lead to increased malnutrition if the estimated coefficient associated with the variable possess a positive sign, while a negative sign indicates that the variable will reduce malnutrition. The exhibit displays estimated coefficients, level of significance and marginal effects with respect to probability of malnourishment. Model summary statistics are also provided in the exhibit.

The summary statistics of the logistic regression indicate a good-fit of the model with 66 percent of correct predictions. Pseudo R-Squares[14] are low (13 and 17 percent), however it is common in studies based on cross-section data[15]. Sign of all estimated coefficients associated with variables are as hypothesized (in accordance to a priory expectation). Barring two coefficients associated with "Father with no Education" and "Sindh Rural", all estimated coefficients are statistically significant at least 5 percent level of significance.

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[13] Malnourishment model is also estimated though Probit regression specification. The results are provided in the Appendix–C. The summary statistics reveal that Pseudo R^2 is relatively low in the Probit regression.

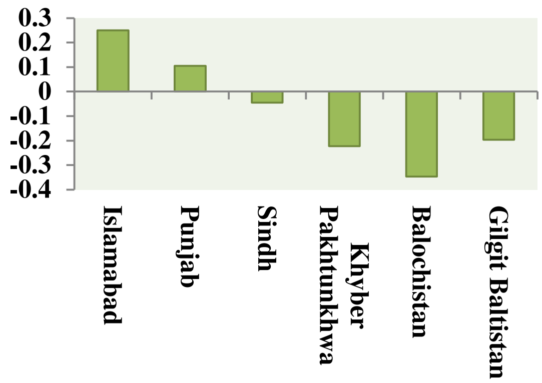
[14] As the binary dependent variable is used in the Logit regression function, traditional R-Square is not computed.

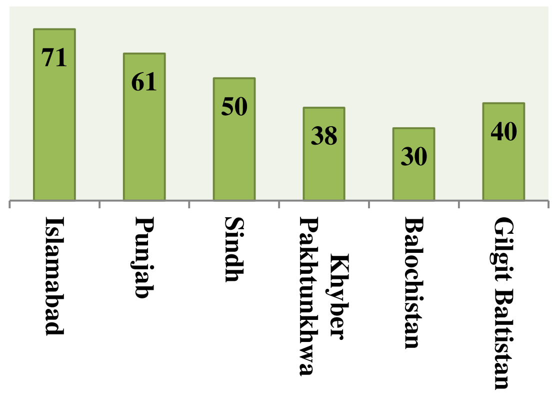
[15] See Smith et al. (2003). Their estimation results (Table 4.7) show the Pseudo R-Squares in the range of 6 to 15 percent in various specification and for various regions.

Exhibit – 4.1
Women Empowerment Score – Average Values

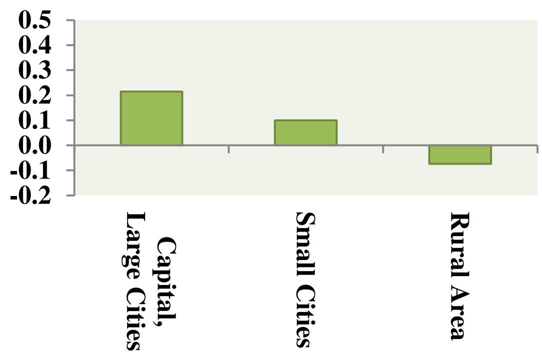
Empowerment Score [Z-Values]	Adjusted Score [0-100 Scale]

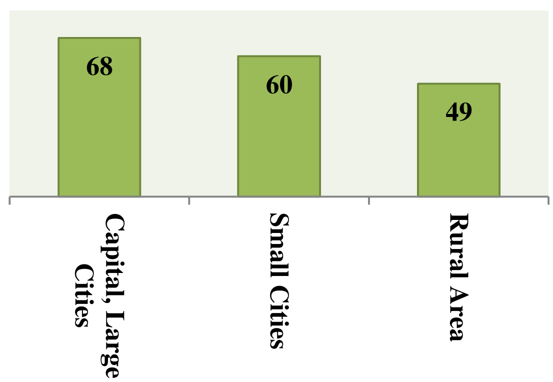
Provinces



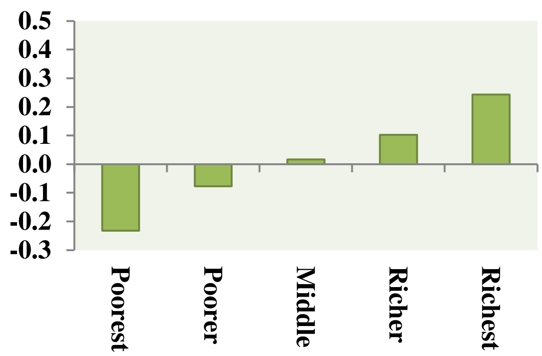


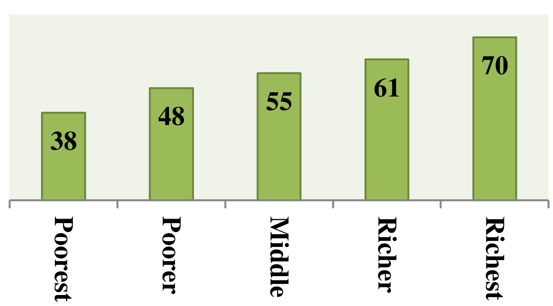
Region – Urban/Rural





Household Wealth Quintiles





Source: Estimated from DHS 2012-13 Pakistan data

Exhibit – 4.2
Determinants of Child Malnutrition – Age Group 0-59 Months
[Binomial Logit Model: Dependent Variable, Malnourished=1, Well-Nourished=0]

		Estimated Coefficients	*p*-Value	Marginal Effect (%)
Child Characteristics	Child Age	0.015	0.000	0.37
	Girl Child	-0.164	0.041	-4.07
	Child Delivery at Home	0.468	0.000	11.08
Characteristics of Mother	Mother's Empowerment Score	**-0.248**	**0.080**	**-6.11**
	Mother BMI - Green (18.5 to 24.9)	-0.161	0.052	-4.00
Characteristics of Father	Age of Father	-0.011	0.054	-0.27
	Father with no Education	0.158	0.109	3.93
Household Characteristics	Household Wealth Quintile	-0.172	0.000	-4.27
	Highest Education – Completed Years	-0.055	0.000	-1.37
Locations:	Punjab Urban	-0.371	0.014	-8.96
[Sample Strata]	Punjab Rural	-0.365	0.002	-8.83
	Sindh Urban	0.398	0.009	9.57
	Sindh Rural	0.154	0.305	3.83
	KPK Urban	-0.497	0.009	-11.69
	KPK Rural	-0.35	0.017	-8.49
	Intercept	0.643	0.015	--
Model Summary:				
	Chi-Square	379.45		
	Pseudo R-Squares:			
	Cox & Snell R-Square	0.125		
	Nagelkerke R-Square	0.167		

Notes: Marginal effects (%) are computed at mean value of variables.

Zero or less than 0.01 p-value indicates that the coefficient (β) is statistically significant at least at 90 percent confidence level and strongly rejects the null hypothesis that $\beta = 0$.

The chi-square statistic is the difference between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0. The value of Chi-Square strongly rejects the null hypothesis.

The results regarding child age indicates that aged children are more likely to suffer from malnutrition than younger children. According to Raju and D'Souza (2017), most studies in the context of Pakistan find that age is positively associated with child malnutrition. With respect to the effect of gender on nutrition, the negative sign associated with girls indicate that the likelihood of malnourishment is lower among girl child. The phenomenon is however consistent with general finding in other developing countries that boys naturally have poorer health than girls (IFPRI, 2016).

An important finding of this research in terms of policy is the positive and highly statistically significant coefficient associated with the variable 'Child Delivery at home'. High marginal effect of this variable on child malnutrition is also evident in the Exhibit. The findings support earlier studies that child delivery at a health facility has an impact on nutritional status (Headey et al. (2016) and Alderman and Garcia, 1994).

As expected, age of father which is also a proxy of experience is statistically significant with negative sign; indicating an inverse impact on child malnutrition. In contrast, education which is represented in the model as a binary variable for illiteracy is not statistically significant. Nonetheless, the positive sign indicates that likelihood of child malnutrition is higher in case of illiterate father.

Mother's status is represented through empowerment score and a variable reflecting mother's health status through green BMI. Empowerment score combines mother's characteristics related to education, labor force participation, access to information, property rights, involvement in household decisions and perception regarding domestic violence. Household poverty has also strong linkages with the food inadequacy and child malnutrition. For this research, household wealth quintiles are used to capture the household socioeconomic status. Wealth quintiles are developed with the data on ownership of assets and few characteristics relating to socioeconomic status of households.

All these three key variables are highly statistically significant and, as expected have an inverse relation with the likelihood of child malnutrition. However, the noteworthy finding of this research is that the marginal effect associated with the empowerment score is higher as compared with the mother's own nutritional status (BMI) and household poverty status. Estimated from the logit regression coefficient, marginal effect of women empowerment on the likelihood of malnutrition is estimated at -5.7 percent, while estimated marginal effects are -4.0 and -4.3 percent for mother's BMI and household poverty status respectively.

4. Concluding Remarks

This research investigates and quantifies the relationship between child malnutrition and mother's empowerment using data of Pakistan Demographic and Health Survey 2013. It is a first attempt in the context of Pakistan to model composite mother's empowerment score as one of the determinant of child malnutrition. The composite index is developed by combing maternal characteristics including education, labor force participation, access to information, property rights, involvement in household decisions and perception regarding domestic violence.

While the results based on the logistic regression analysis are broadly consistent with what has previously been reported in studies on malnutrition, they do yield one interesting findings that the mother's empowerment has an edge over their nutritional status and household poverty. Its marginal effect in reducing child malnutrition is larger than estimated for other two determinants.

This study thus shows that, in the interest of bringing about sustainable improvements in child nutritional status, women's status in terms of dimensions included in the composite empowerment model should be considered in all interventions by governments as well as by development partners and international agencies.

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Appendix – A

About the Sample

Pakistan Demographic and Health Survey (PDHS) was conducted under the aegis of the Ministry of National Health Services, Regulations and Coordination and implemented by the National Institute of Population Studies (NIPS). ICF International provided financial and technical assistance for the survey through USAID/Pakistan. The PDHS is part of the worldwide Demographic and Health Survey program.

The main objective of the 2012-13 PDHS was to provide reliable information on fertility and fertility preferences; awareness, approval, and use of family planning methods; maternal and child health; childhood mortality levels; knowledge and attitudes toward HIV/AIDS other sexually transmitted infections (STIs); and knowledge about other illnesses such as tuberculosis, hepatitis B, and hepatitis C.

A nationally representative sample of 14,000 households from 500 primary sampling units (PSUs) was selected for 2012-13 PDHS. All ever-married women age 15-49 in selected households were eligible for individual interviews. In the selected households, 14,569 eligible women were identified for individual interviews and 13,558 were successfully interviewed. The survey was designed to produce reliable estimates for key indicators at the national and provincial levels, including urban-rural breakdowns, as well as for Gilgit-Baltistan and Islamabad. The detail description of sample frame, design, weights, estimation of errors and data quality is provided in various appendices of 2012-13 PDHS report (NIPS, ICF 2013), while a schematic view of sample distributions across regions and provinces are reproduces below.

Sample Allocation of Clusters and Households by Regions and According to Residence Pakistan – 2012-13

	Allocation of Clusters			Allocation of Households		
	Urban	Rural	Total	Urban	Rural	Total
Punjab	58	85	143	1,624	2,380	4,004
Sindh	64	42	106	1,792	1,176	2,968
Khyber Pakhtunkhwa	35	56	91	980	1,568	2,548
Balochistan	33	34	67	924	952	1,876
Islamabad	35	13	48	980	364	1,344
Gilgit-Baltistan	23	22	45	644	616	1,260
Pakistan	248	252	500	6,944	7,056	14,000

Source: NIPS and ICF International (2013),
http://www.nips.org.pk/abstract_files/PDHS%20Final%20Report%20as%20of%20Jan%2022-2014.pdf
Accessed on July 22, 2017

<u>Appendix – B</u>

Brief Introduction of Principal Component Analysis:

Use of Factor Analysis (FA) technique[16] for indexing multidimensional phenomena has been well-established. FA essentially consists of consolidating the data so as to arrange it around the covariance structures of the variables. This technique reduces the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. The FA model can be described as follows:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + a_{i3}F_3 + \dots\dots a_{ij}F_j$$

where; X_i = Attribute or Dimension
a_{ij} = Proportion of the variation in X_i which is accounted for by the *jth* factor
F_j = *jth* factor or component

The Principal Component Analysis (PCA) procedure in the FA method produces components in descending order of importance, that is, the first component explains the maximum amount of variation in the data, and the last component the minimum. Thus, the first few components[17] (Principal Components) account for a sizeable part of the variation in the data and subsequent components contribute very little. This traditional PCA is best for continuous and normally distributed data as the technique assumes linear relationship between numeric variables.

For category indicator or variables, a team of Leiden University has developed Categorical Principal Components Analysis (CATPCA)[18]. The technique is now available in SPSS and may be applied for data reduction when variables are categorical (e.g. ordinal) and the researcher is concerned with identifying the underlying components of a set of variables (or items) while maximizing the amount of variance accounted by the principal components. The primary benefit of using CATPCA rather than traditional PCA is the lack of assumptions associated with CATPCA. CATPCA does not assume linear relationships among numeric data nor does it require assuming multivariate normal data. Furthermore, optimal scaling is used in SPSS during the CATPCA analysis and allows the researcher to specify which level of measurement (nominal, ordinal, interval/ratio, spline-nominal, & spline-ordinal etc.) in the optimally scaled variables is required.

Having a representation of the data in the component form, every household is ascribed a 'score' on each derived principal component using factor loading (variance in the individual attribute) as a weight and then multiplying this score with the standardized value of variables or dimensions. An overall score (OS) using scores of all principal components for an individual or household is obtained as follows:

$$(OS)_i = \sum_n \left[\sum (a_{ij} * Z_j)\right]$$

where; $\sum_n$ = Summation over *n* principal components
a_{ij} = Factor Loading of *ith* Factor and *jth* indicator (weights)
Z_j = Standardized value of *jth* variable or dimension

[16] For detailed discussion, see Adelman and Morris (1972).

[17] A threshold of Eigen-Value (greater than 1) is used to determine the number of Principal Components.

[18] Data Theory Scaling System Group (DTSS), Faculty of Social and Behavioral Sciences, Leiden University, The Netherlands.

Estimated Coefficients Derived from Probit Regression:

Determinants of Child Malnutrition – Age Group 0-59 Months
[Binomial Probit Model: Dependent Variable, Malnourished=1, Well-Nourished=0]

		Estimated Coefficients	***z*-Value**
Child Characteristics	Child Age	0.009	0.000
	Girl Child	-0.099	0.043
	Child Delivery at Home	0.287	0.000
Characteristics of Mother	Mother Empowerment Index	-0.140	0.099
	Mother BMI - Green (18.5 to 24.9)	-0.100	0.046
Characteristics of Father	Age of Father	-0.006	0.057
	Father with no Education	0.094	0.117
Household Characteristics	Wealth Quintile	-0.106	0.000
	Highest Education – Completed Years	-0.034	0.000
Locations:	Punjab Urban	-0.226	0.014
[Sample Strata]	Punjab Rural	-0.222	0.003
	Sindh Urban	0.246	0.008
	Sindh Rural	0.089	0.323
	KPK Urban	-0.301	0.009
	KPK Rural	-0.212	0.018
	Intercept	0.396	0.013
Model Summary:			
	Chi-Square	379.8	
	Log-Likelihood	-1779.83	
	Pseudo R-Square	0.096	

Notes: Zero or less than 0.01 z-value indicates that the coefficient (β) is statistically significant at least at 90 percent confidence level and strongly rejects the null hypothesis that $\beta = 0$.

The chi-square statistic is the difference between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0. The value of Chi-Square strongly rejects the null hypothesis.