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MASTER THESIS

Explaining Rural-Urban Differentials in Child Nutritional Outcome in Nepal: An Application of Quantile Regression – Counterfactual Decomposition

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GLODEP 2019

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Declaration

I, hereby, declare that the Thesis entitled 'Explaining Rural-Urban Differentials in Child Nutritional Outcome in Nepal: An Application of Quantile Regression – Counterfactual Decomposition', submitted to the GLODEP Consortium 2019, is my original work, and any theoretical and empirical literature and dataset used in the proceedings of this study have been duly cited and referenced.

Gopal Trital

Date: 24 May 2019

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Zásady pro vypracování

The objective of this study is to identify the rural-urban inequalities in the determinants of child malnutrition in Nepal. More specifically, the study aims to determine if the rural-urban differentials in under-five child stunting prevalence in Nepal are driven by disparities in household-level nutrition-related endowments (for example: mother's education, household wealth, access to health facilities, etc.) or by the differences in the magnitude of the relationship between endowments and height-for-age (HAZ). Under-five child stunting rates vary between 29% – 55% in seven provinces of Nepal and 42% – 32% between Rural and Urban areas, thus warranting a study representative of province specific sample on the variation of rural-urban malnutrition rates . Previous studies on child malnutrition in Nepal, largely conducted at the country-level, is not representative of province-level data on child nutrition. The first province-level Demographic Health Survey (DHS) Dataset Nepal 2016 was published only in 2017 that captures the most recent administrative division in the country. As a result, existing analysis conducted in average of the sample household at a national level does not reflect the updated rural-urban realities considering the socio-economic, demographic, and geographic heterogeneities across provinces. Furthermore, most of the previous studies in Nepal have only analysed mean effects of the determinants on the mean HAZ score. Consequently, existing policy recommendations are largely based on an average household at a national-level. This study is novel in the use of first province-level DHS Dataset 2016 and in its approach to identifying under-five stunting determinants at different points of unconditional distribution of HAZ score. The study expects to provide province-level federal government with recommendations on policy interventions appropriate for households at different quantiles along the unconditional distribution of HAZ score. This study will be based on the desk-based econometric analysis of DHS Nepal Dataset 2016 and theoretical and empirical review of existing literature. Determinants of child stunting will be ascertained through Quantile regression at different quantiles of HAZ score on household-level endowments, and existing rural-urban differentials will further be decomposed and explained through the use of Unconditional Quantile Regression based Counterfactual Decomposition methods developed by Firpo et. al. (2009).

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Seznam doporučené literatury:

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Abstract

Rural-urban difference in child nutritional outcome is evident in most of the low-income countries, including Nepal. Minimization of rural-urban gap in child nutrition is imperative to ensuring equitable investment in early childhood development, especially in a predominantly rural country like Nepal. This study explains differentials in child nutritional outcome as measured by under-five stunting, thus, capturing prolong differences in the population-level deprivation in rural and urban areas. The primary objective of this study is to explain whether existing rural-urban differences in under-five child stunting is best explained by differences in the level of nutrition-sensitive endowments (covariate effect) or their returns (coefficient effect).

This study utilizes recently developed Unconditional Quantile Regression (UQR) based methods to analyze the association between determinants of child stunting and child's height-for-age at rural, urban, and country levels. Subsequently, UQR based decomposition of rural-urban differences in under-five child stunting is conducted in the entire distribution of child's height-for-age with further comparative analysis in the sub-sample of children belonging to age groups 0-23 and 24-59 months.

Findings of this study indicate the dominance of covariate effects and minimal share of coefficient effects in explaining the rural-urban differences in under-five child stunting in Nepal. Household wealth, mother's education and health services environment comprising postnatal and antenatal care are found to explain most of the rural-urban nutritional gap in Nepal. Low levels of coefficient effects imply that interventions need not have fundamentally different approaches in rural and urban areas, and future policy efforts should instead prioritize equalization of nutrition-sensitive endowments.

Keywords: Stunting, Rural-Urban, Unconditional Quantile Regression, Decomposition

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LIST OF ABBREVIATIONS

ANC	Antenatal Care
ANOVA	Analysis of Variance
BMI	Body mass index
DHS	Demography Health Survey
EA	Enumeration Area
FANTA	Food and Nutrition Technical Assistance
HAZ	Height-for-age-z-score
HFIAS	Household Food Insecurity Access Scale
MDD	Minimum Dietary Diversity
MSNP	Multi-Sector Nutrition Plan
NDHS	Nepal Demographic Health Survey Dataset
OB	Oaxaca-Blinder
OLS	Ordinary Least Squares
PSU	Primary Sampling Unit
QRM	Quantile Regression Model
RIF	Recentered Influence Function
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
UNICEF	United Nations Children's Fund
UQR	Unconditional Quantile Regression
USAID	United States Agency for International Development
WAZ	Weight-for-age-z-score
WHA	World Health Assembly
WHO	World Health Organization
WHZ	Weight-for-height-z-score

CHAPTER I: INTRODUCTION

1. INTRODUCTION

This chapter explains the background (Section 1.1), policy context (Section 1.2), and the purpose (Section 1.3) of this study. Section 1.4 highlights existing literature gap and significance of the present study. Section 1.5 states scope, assumptions, and limitations, and Section 1.6 provides an overview of subsequent chapters.

1.1. BACKGROUND

An estimated 149 million under-five children were reported stunted in 2018 with the highest rates of prevalence in South Asia (35%) (WHO, 2018). Nepal's national stunting rate (35.8%) is higher than the South Asian average. Rural prevalence of stunting (40.2%) is even higher than the national average in Nepal, which is 8.2% more than that in urban areas (Ministry of Health, Nepal et al., 2017; UNICEF, 2018). Children struggling to achieve healthy growth status, more so in rural areas than in urban, is worrisome. It is even more alarming in a rapidly aging country like Nepal, where 80% of its population is rural. Nepal faces an urgent call to raise the productivity of future generation as its ratio of working-age population per old-age dependents is expected to fall sharply by two-thirds from 11.1 in 2015 to 3.8 in 2060 (Amin et al., 2017). This impending pressure to develop future human capital requires that the country maximizes its investment in early childhood development, which, at least, entails that children attain optimal physical growth irrespective of the region of residence. Failure to ensure equitable and optimum growing conditions for children is a setback for Nepal, a country that intends to graduate into a developing nation by 2022.

Child nutritional outcome is a consequence of the complex interplay of social, economic, and institutional characteristics that affect the household's ability to generate optimal living conditions for children (UNICEF, 1990). Usually, a similar set of factors affect child nutrition across rural and urban areas (Garrett and Ruel, 1999). Rural-urban gap in child nutritional outcome is, thus, largely a manifest of policy variables that render differing levels and effects of nutrition-sensitive endowments for households in rural and urban areas. It is thus fundamental to identify as to which specific set of policy variables most explains prevailing rural-urban differences in child growth and development.

Child nutritional outcome is widely assessed in terms of stunting (short stature for age), wasting (low weight for height) and underweight (low weight for age). Among these, stunting is an accumulated outcome of the prolonged nutritional deficit, and hence, best captures the long-term population-level deprivation as well as prevailing socioeconomic inequalities (Black et al., 2008; Onis et al., 1997). Stunting has long-term adverse consequences on child's cognitive and non-cognitive abilities, health, learning achievements and future economic productivity (Dewey and Begum, 2011; Grantham-McGregor et al., 2007; Hoddinott et al., 2013; Woldehanna et al., 2017). Furthermore, stunting is intergenerational. Children born to stunted mothers have a higher likelihood of being underweight and are more likely to suffer similar sets of socioeconomic deprivation as their parents (Ozaltin et al., 2010; Prendergast and Humphrey, 2014). Stunting is thus a serious impediment to human capital generation.

1.2. POLICY CONTEXT

Addressing child nutrition requires multidimensional and multisectoral policy initiatives at global, national, and local levels. Subsequently, over the years, several global and national commitments to reducing child stunting have been made. In 2012, the World Health Assembly (WHA) Resolution endorsed a global target of reducing 40% of the total number of stunted children by 2025 (WHO, 2014). In 2015, Goal 2 of Sustainable Development Goals (SDG) further aimed to end all forms of child malnutrition by 2030 along with achieving WHA target by 2025. As a signatory of WHA and SDG, Nepal is committed to reducing its current under-five stunting rates to 24% and 15% by the year 2025 and 2030, respectively (Joshi and Chitekwe, 2019).

However, despite continuous global and national commitments, regional disparities in child nutritional gap are persistent. Within-country differences are observed in most of the developing countries, including in South Asia where rural-urban differences in child nutritional outcome are highest (Smith et al., 2005). To accelerate the progress towards meeting WHA and SDG targets, Nepal implemented Multi-Sector Nutrition Plan (MSNP-I) for the period 2013-2017 in 2012. In 2017, Nepal endorsed an updated Multi-Sector Nutrition Plan-II (MSNP-II) to be implemented during the period 2018-2022. MSNP-II calls for multisectoral interventions in addressing under-five nutrition needs with specific attention on the initial 1000 days. More importantly, MSNP-II focuses on to ensure equitable nutritional outcome within the population by reducing regional imbalances, improving gender empowerment, and strengthening provincial-level governance structure for effective monitoring and accountability

(Joshi and Chitekwe, 2019; Ministry of Health, Nepal, 2017). In this context, MSNP-II can maximize the efficiency of nutrition-sensitive interventions by improving critical determinants that most explain the prevailing rural-urban child nutrition gap in Nepal.

1.3. PURPOSE OF THE STUDY

This study sets out to explain the existing rural-urban differences in child nutritional outcome in Nepal. Applying Unconditional Quantile Regression (UQR) based decomposition method, the study aims to quantify whether the rural-urban gap in under-five child stunting is explained by differences in the levels of nutrition-sensitive endowments or their returns. Moreover, the study intends to identify a specific set of determinants that are most associated with the rural-urban gap in child-stunting. The present study analyses and compares height-for-age for under-five children at national, rural, and urban levels. Additional analysis is also conducted to identify any differential association of endowments in the age groups 0-23 and 24-59 months.

More precisely, this study aims to answer the following research questions.

Main Research Question: What explains rural-urban differences in child stunting in Nepal?

Sub-research Questions:

i. What are the differences in the average *level* of child stunting determinants in rural and urban areas?
ii. What are the differences in the *association* of determinants and child stunting at rural, urban, and country levels?
iii. Which of the differences (in the level or association) most explains the rural-urban gap in child stunting at different points of height-for-age distribution across age groups?
iv. Which of the specific determinants are most associated with the rural-urban gap in child stunting at different points of height-for-age distribution?

1.4. SIGNIFICANCE OF THE STUDY

Previously, Srinivasan et al. (2013) conducted a similar study in Nepal using a dataset from the year 2006. However, the dataset thus analyzed does not represent the current provincial-level administrative structure in Nepal. Further, the study mostly centered on socioeconomic determinants with minimum consideration of healthcare, women empowerment, and household-level food security variables.

This study extends the previous study by adopting the latest dataset representative of newly restructured rural and urban areas in Nepal. Moreover, the present study incorporates an extensive set of determinants reflecting health service environment, women empowerment, household food security, and mother's nutrition. Findings of this study are expected to inform currently implemented national nutrition plan in Nepal (MSNP-II) with specific policy recommendations towards ensuring the equitable rural-urban nutritional outcome.

1.5. SCOPE, ASSUMPTIONS, AND LIMITATION OF THE STUDY

This study is a cross-sectional quantitative analysis of the most recent Demographic Health Survey Data collected during June 2016 – January 2017 in Nepal. The present study only analyses child stunting under five years of age. Further, this study assumes that comparable set of determinants are associated with child stunting in rural and urban areas and that any unobserved factors affecting child nutrition are not systematically different in rural and urban population.

The cross-sectional nature of this study limits causal inferences on the relationship between determinants and child nutritional outcome. Moreover, this study does not include all possible set of determinants due to unavailability and incompleteness of data, as detailed in Chapter III.

1.6. OUTLINE OF CHAPTERS

Succeeding chapters are outlined as follows. Chapter II reviews the existing literature and develops theoretical and methodological approaches for this study. Chapter III elaborates on the methodology thus adopted. Chapter IV presents and discusses the main findings of this study, and Chapter V concludes this paper with concluding remarks and recommendations.

CHAPTER II: LITERATURE REVIEW

2. LITERATURE REVIEW

This chapter presents theoretical (Section 2.1) and empirical (Section 2.2) reviews relevant to this study as outlined hereunder.

Section 2.1 offers a theoretical overview of meaning, causes, and indicators of child nutritional outcome. This section also highlights UNICEF Conceptual framework that guides the analytical proceeding of this study. Succeeding sub-sections present a theoretical account of rural-urban differences in areas of nutrition and health and approaches to studying them.

Section 2.2 presents a review of empirical studies explaining differences in child nutritional outcome and offers a comparative overview of methodologies adopted in the recent empirical literature. This section also establishes the rationale behind the choice of the methodology used in this study. This chapter concludes with a brief explanation of the existing literature gap.

2.1. REVIEW OF THEORETICAL LITERATURE

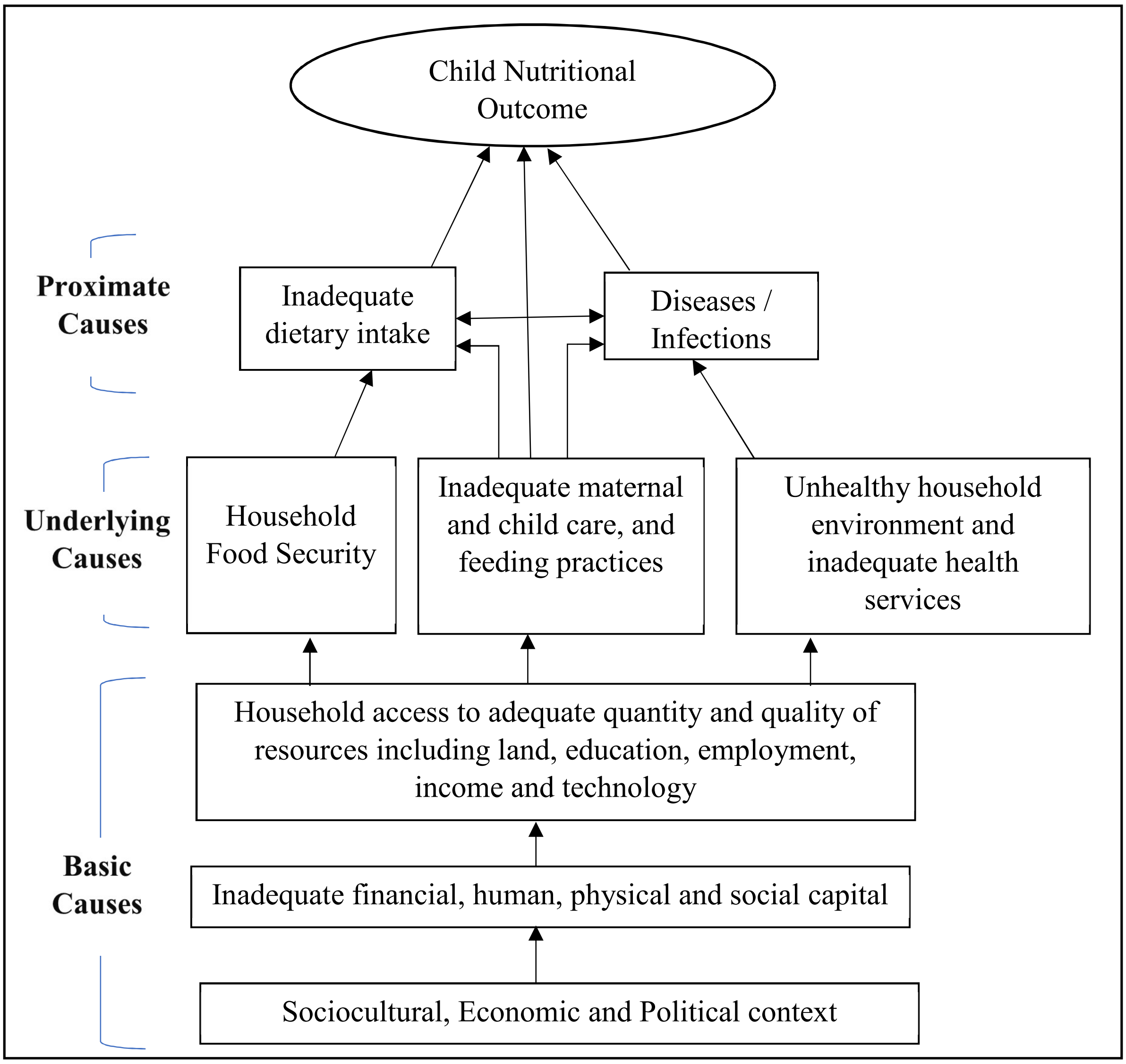
2.1.1. Meaning and Concept of Child Nutritional Outcome

'Child nutritional outcome' refers to physiological growth and development of the child, occurring as a consequence of dietary intake and/or presence of diseases or infections (WHO Working Group, 1986). Prolonged undernourishment of child due to poor nutrition or recurring infectious diseases results into 'undernutrition', a condition that indicates deficiencies in macronutrients (protein, carbohydrates, and fat) as well as micronutrients (electrolytes, vitamins, and minerals) (Müller and Krawinkel, 2005; Onis et al., 1997). On another extreme, surplus dietary intake over an extended period also results in another form of adverse nutritional outcome called 'overnutrition'. The term 'malnutrition' refers to both undernutrition and overnutrition and is indicative of long-term imbalances in nutrition and/or pathological condition (Ge and Chang, 2001; Sassi, 2018).

2.1.2. Causes of Child Malnutrition

UNICEF (1990) categorizes the causes of child malnutrition into three hierarchical levels, as illustrated in the following Conceptual framework (Figure 1).

Figure 1: UNICEF Conceptual Framework (1990)



Source: Adapted from UNICEF (1990) and Sassi (2018)

Figure 1 illustrates multisectoral and interrelated pathways leading to the production of child nutritional outcome (UNICEF, 1990). More precisely, the figure highlights three broad causes of child malnutrition, i. proximate ii. underlying, and iii. basic causes, hierarchically operating at different levels in a given population.

Inadequate dietary intake and/or presence of diseases or infections are proximate causes of child malnutrition. These individual-level proximate causes are interrelated and share a simultaneous relationship with child nutritional outcome as indicated by double-headed arrows in the above figure. Proximate determinants are manifestations of 'underlying causes' that include household-level factors comprising food security, maternal and child care practices, and a healthy living environment. Household-level factors are determined by an interplay of the social, economic, political, and environmental context within which the household exists.

This overarching context refers to basic causes that influence household-level availability and access to financial, human, physical and social capital, and subsequent production of optimal child nutritional outcome. Consequences of nutritional outcome further affect underlying and basic causes creating a multi-sectoral and intergenerational repetitive cycle of child malnutrition (Sassi, 2018; UNICEF, 1990, 2018). The causal factors of child malnutrition are, thus, produced through complex and multidimensional pathways as highlighted by UNICEF (1990) and as well-established by a considerable body of literature.

UNICEF Conceptual framework has been widely used in food security and child malnutrition studies as well as in the design and evaluation of nutrition-related programs. The present study also draws its analytical proceeding from this framework as detailed in Chapter III.

2.1.3. Indicators of Child nutritional outcome

Child nutritional outcome is most commonly assessed by anthropometric measures of child's height and weight, which in combination with age indicate observed deficit or surplus in child's physiological growth (WHO Working Group, 1986). The definition and interpretation of child nutritional outcome are, thus, based on the comparison of observed anthropometric values with the internationally accepted WHO child growth standard (Onis and Branca, 2016). Existing literature has established that under-five children of all ethnic backgrounds, on average, have similar growth potential irrespective of geographic regions (Onis and Branca, 2016). The recently updated 2006 WHO child growth standard represents the internationally comparable growth experience of well-fed under-five children based on the sample data from six countries: Brazil, Oman, Ghana, India, USA and Norway (Klasen, 2008).

Observed anthropometric measures on height and weight are compared with WHO child growth standard and expressed in terms of z-score. Z-score indicates the distance of observed anthropometric measure from the median value of the WHO reference population in terms of standard deviation. The computation of z-score for a child of specific age and sex group is shown hereunder.

$$z = \frac{x - M}{\sigma}$$

where x is the observed value of the anthropometric measure, M is the median value of that measure in the WHO reference population, and σ is the standard deviation of the measure in the reference population

This score is then interpreted based on the WHO recommended cut-off values. Children having height-for-age-z-score (HAZ) less than -2 are defined as 'stunted'. More precisely, children with HAZ less than -2 and -3 are termed as moderately and severely stunted, respectively. Similarly, children with weight-for-age-z-score (WAZ) and weight-for-height-z-score (WHZ) less than -2 are defined as 'underweight' and 'wasted' respectively (Mei and Grummer-Strawn, 2007; WHO Working Group, 1986). The terms 'stunting', 'underweight', and 'wasting' also indicate the relative severity of malnutrition. 'Stunting' is an indicator of chronic malnutrition that results due to prolonged imbalances in dietary intake, recurrent or chronic illness and/or underlying poor socioeconomic conditions (Sassi, 2018). 'Wasting', on the other hand, indicates an acute loss in child's weight resulting due to acute deficiencies in dietary intake and/or recent episodes of diseases. 'Underweight' is a composite indicator that combines the presence of both acute and chronic malnutrition (Klasen, 2008; Sassi, 2018; WHO Working Group, 1986).

2.1.4. Stunting as a measure of Child Nutritional Outcome

This study specifically focuses on the analysis of child stunting as a measure of child nutritional outcome. While 'wasting' and 'underweight' are important indicators, they are not reflective of long-term exposure to well-being conditions. On the other hand, 'stunting' captures the prolong nutritional outcome cumulative of socioeconomic, environmental and cultural factors existing before and after the birth of a child (Black et al., 2013; Onis et al., 1997; Sassi, 2018). In addition, the prevalence of child stunting is much alarming in developing countries in comparison to wasting, underweight, overweight, and obesity (UNICEF, 2018). Child stunting is widely used as an indicator for population-level deprivation and is also representative of prevailing inequalities within population subgroups (Black et al., 2008; Onis et al., 1997; WHO Working Group, 1986). An analysis of differences in the prevalence of child stunting, thus, provides substantial insights into the long-term rural-urban gap in social, economic, and environmental factors.

2.1.5. Rural-Urban Differences in Nutrition and Health

Average welfare provisions, including that of healthcare, education, and infrastructure, are better in urban areas in comparison to rural areas in most of the countries (Simler and Dudwick, 2010). World Bank (2009) postulates that rural-urban differences in living conditions are dynamic and initial rural-urban gap gradually narrows down with the increasing level of development in the country. However, the rural-urban convergence paradigm is not uniformly and naturally applicable in all economies (Simler and Dudwick, 2010). A considerable body of existing literature attests the presence of striking difference between rural and urban areas in education (Agrawal, 2014; Taji et al., 2019), socioeconomic conditions (Nguyen et al., 2007; Shedenova and Beimisheva, 2013; Zhang et al., 2016), and household food security and child dietary diversity (Hirvonen, 2016; Tibesigwa and Visser, 2016), among others. Further, previous studies have documented rural-urban health inequalities in both developing and developed countries in areas of differing mortality rates (Beatriz et al., 2018; Levin and Leyland, 2006), unequal maternal healthcare and unmet care needs (Pulok et al., 2018; Scheil-Adlung, 2015; Yaya et al., 2016; Zhu and Österle, 2017), and heterogeneous survival and life-expectancy rates (Levin and Leyland, 2006; Pampalon et al., 2010; Singh and Siahpush, 2014). As also described in detail by World Bank (2009), addressing rural-urban imbalances require relevant policy mechanisms based on the nature of the prevailing rural-urban gap. In this context, the decomposition of rural-urban differentials in child stunting, in terms of differences in the levels and returns of household-level endowments, provides key policy insights to addressing the rural-urban gap in child nutrition and health.

2.1.6. Theoretical Frameworks on Rural-Urban Differences in Health and Nutrition

Existing literature on rural-urban health and nutrition disparities are found to be either guided by theoretical frameworks related to compositional-contextual effects, urban bias, or subsequent theories related to a specific health outcome.

Studies delving into compositional-contextual effects framework define inter-group differential in health as an outcome of differences in the characteristics of individuals (composition effect) and differences in group-specific contextual factors (contextual effect) (Arcaya et al., 2015; Diez Roux, 2002). Most of the studies adopting compositional-contextual effect framework seek to test the hypothesis on the relative importance of contextual over compositional effect in the determination of health outcome. For example, Stafford et al. (2001) investigated whether area-specific contextual factors or individual-level characteristics better explained poor health outcomes in the UK. The authors found that contextual factors poorly explained the area-level differences in health outcomes.

Studies adopting the theoretical framework of urban bias investigate the existence of urban advantage in terms of health outcome. Theory of urban bias stresses the presence of deliberate and disproportionate allocation of well-being conditions in urban areas in comparison to rural areas (RAO and Lipton, 1980). A study by Akbar Zaidi (1985) is a prominent example of literature that sought to explain rural-urban health disparities in terms of urban bias. The author attributed rural-urban health inequalities in Pakistan to resource allocation bias driven by capitalistic urban class structure.

Meanwhile, most of the studies on differences in nutritional outcome hypothesize that a significant gap exists in the levels and effects of factors that produce observed differentials in child nutritional outcome. These studies are primarily descriptive and do not necessarily intend to test the relative importance of compositional over contextual effects. The primary objective of these studies remains the explanation of observed nutritional outcome differentials in terms of differences in the levels and effects of determinants. The conceptual framework outlined by UNICEF (1990) and/or household-based nutrition production function (Strauss and Thomas, 1995) provide theoretical guidance in the identification of underlying and basic determinants associated to child nutritional outcome. This study follows a similar line of analysis and gathers theoretical rationale from the UNICEF conceptual framework.

2.2. REVIEW OF EMPIRICAL LITERATURE

Empirical studies on the status and trends of prevailing rural-urban differences in child nutritional outcome can be grouped into the following two categories.

i. **Studies explaining differences over time**

These group of studies explain cross-country or country-specific differences in child nutritional outcome over a certain period, based on the analysis of pooled cross-sectional dataset.

ii. **Cross-sectional studies explaining differences at a point of time**

These studies explain the existing differentials in child nutritional outcome in terms of cross-country or rural-urban differences at a given point of time, based on the cross-sectional dataset.

The following section presents a brief review of empirical studies in the above two categories.

2.2.1. Review of Studies explaining differences in child nutritional outcome over time

Prevalence of stunting rates has declined in most of the countries over time. This has been substantiated by a considerable number of cross-country studies (Headey, 2013; Headey et al., 2017; Smith and Haddad, 2000) as well as country-specific empirical work conducted in Bangladesh (Headey et al., 2015), Ethiopia (Headey, 2015), Uganda (Yang et al., 2018) and Nepal (Cunningham et al., 2017; Headey and Hoddinott, 2015), among others. Studies cited above have primarily attributed the decline in stunting rates to improvements in socioeconomic and healthcare variables including mother's education, maternal and child care practices, women's relative status, and healthcare services. However, these studies have only analyzed country-level aggregate changes without considering the trend of rural-urban nutritional gap over time. Consequently, several cross-country and country-specific studies have investigated the trend of rural-urban differences in child nutritional outcome over time as reviewed hereunder.

Country-specific studies conducted in China (Liu et al., 2013), Cambodia (Srinivasan et al., 2016) and Paraguay (Ervin and Bubak, 2019) have pointed out that rural-urban gap in child nutritional outcome has declined over the years mainly as a result of improvements in socioeconomic characteristics and healthcare variables. Several cross-country studies have, however, pointed out that the decline in stunting rates have not been uniform across countries and in rural and urban areas. For example, Krishna et al. (2018) in their study of four South Asian countries (Nepal, India, Pakistan and Bangladesh) have shown that the reduction of stunting rates from 61% (in 1990) to 37% (in 2016) has not translated equally for all countries. The rates of decline are slow for India and Pakistan, especially for households belonging to poor wealth quintiles in all countries. Similarly, Fotso (2007) analyzed rural-urban differentials and inequities in 15 SSA countries between the late 1980s – early 2000s. His analysis revealed that nutritional gap has been declining in 6 SSA countries, however, due to increasing malnutrition rates in urban areas. Likewise, Paciorek et al. (2013) studied rural-urban differences in child nutritional outcome in 141 low and middle-income countries between 1985-2011. The authors found that the rural-urban gap in under-five HAZ and WAZ have reduced in most of the countries; however, at varying rates across countries and over time.

Overall, the review of studies explaining the trends of child nutritional outcome leads to three important conclusions: i. rural-urban nutritional gap persists even with the decline of aggregate stunting rates, ii. magnitude of the rural-urban gap varies across countries and over time, and iii. rural-urban gap might still widen despite the reduction of stunting at the national level. These conclusions establish the rationale for continuous monitoring of rural-urban disparities to devise timely and relevant policy solutions. To that, cross-sectional studies aimed at explaining prevailing rural-urban differences at a given point of time can provide meaningful policy conclusions. Some of these cross-sectional studies are briefly reviewed hereunder.

2.2.2. Review of Cross-sectional studies explaining rural-urban differences

A considerable body of cross-sectional studies has found significant rural-urban differences in most of the developing countries in South Asia, Sub-Saharan Africa, and Latin America. Smith et al. (2005), in their study of 36 developing countries, highlighted that the rural-urban gap in child stunting, as well as socioeconomic condition, is highest in South-Asia. Similarly, Van de Poel et al. (2007) have also shown that considerable rural-urban disparities exist in the likelihood of child stunting and mortality in most of the developing countries. Presence of substantial rural-urban nutritional gap has also been confirmed by country-specific studies conducted in Mozambique (Garrett and Ruel, 1999), Ethiopia (Hirvonen, 2016), India (Cavatorta et al., 2015), Bangladesh and Nepal (Srinivasan et al., 2013).

Van de Poel et al. (2007) remark that higher nutritional outcome in urban areas is most often the results of better urban conditions in maternal, preventive and curative health care services, sanitation, education, and timely initiation of complementary feeding practices. Similar conclusions have been made by country-specific studies cited above where most of the rural-urban gap is found to be explained by differences in the level of socioeconomic and healthcare variables like household wealth, parental education and antenatal care for mother. The analysis by Van de Poel et al. (2007) further reveals the following two conclusions. First, rural-urban disparities disappear in most of the countries once socioeconomic determinants are accounted for, as also shown by Smith et al. (2005), indicating a link between rural-urban socioeconomic inequalities and child nutritional outcome. Second, the rural-urban gap in child health outcome mainly persists among the wealthiest quintiles in rural and urban areas.

In the context of Nepal, previous research conducted by Srinivasan et al. (2013) pointed out that the rural-urban gap existed throughout the entire distribution of under-five HAZ. Rural-urban gap in child stunting was found to be explained mostly by differences in the level of household wealth, mother’s education and partner’s education, particularly among the most vulnerable households. These findings echo the conclusions made by Van de Poel et al. (2007) and Smith et al. (2005).

2.2.3. Review of Methodologies adopted in Literature

This section reviews methodologies adopted by recent empirical studies in child nutritional outcome. The methodologies are divided into two groups based on the objective of studies.

2.2.3.1. Studies Aimed at the Identification of Determinants

Table 1 presents a non-exhaustive list of a few recent studies that have identified the determinants of child stunting in several countries, including Nepal. Some observations concerning the literature thus presented are discussed hereunder.

First, most of the studies have used height-for-age-z-score (HAZ) as a dependent variable in their model for reasons previously highlighted in Section 2.1.4. Second, determinants and their association with child stunting are highly contextual across the population. Had that not been the case, all studies in Table 1 would have a similar set of significant determinants. Lastly, most studies in child nutrition have adopted either a linear or a logistic regression framework in their analysis. Almost all studies conducted in Nepal, as in Table 1, have used logistic regression in identifying the determinants of child undernutrition. Despite their extensive use, linear and logistic regression framework entail the following two methodological limitations.

First, the OLS based linear regression framework identify determinants at the conditional mean of child nutritional outcome. The effect of determinants, however, might not be uniform throughout the distribution of the outcome variable. A few of the recent studies (Aturupane et al., 2011; Borooah, 2005) have applied Quantile Regression model in the identification of determinants of child stunting. These studies have shown that mean-based linear regression models are misleading in explaining the differential effects of determinants at the lower tails of HAZ distribution. For example, Aturupane et al. (2011) found that usual OLS regression indicated no gender-disparity at the mean level of under-five child malnutrition in Sri Lanka. However, quantile regression revealed rampant gender-disparity at the lower end of HAZ distribution comprising the most vulnerable groups of the population.

Second, the application of logistic regression results in loss of statistical information by grouping the outcome variable into fewer categories. Categorization of the population as stunted or non-stunted assumes that there are no significant differences in risks in the nutritional outcome once the population crosses a specific cut-off score (Onis and Branca, 2016). However, the risk of under-five child malnutrition exists on both sides of the cut-off (Onis and Branca, 2016). Further, as Srinivasan et al. (2016) remark, the dichotomous outcome variable does not differentiate among mild, moderate and severe malnutrition, the analysis of which could be imperative to improve the allocative efficiency of targeted policies.

Inequality research most often requires an analysis of the whole distribution of outcome variable where observations at lower and upper tails do not face *(continued on page 15)*

Table 1: Existing Literature on Determinants of Child Stunting

Studies (Author, Year)	Country/Region	Outcome	Regression Method	Significant Determinants
(Smith and Haddad, 2000)	Cross-country	HAZ	Linear Regression	(6), (13), (15), (25), (35)
(Aturupane et al., 2011)	Sri Lanka	HAZ, WAZ	Quantile Regression	(6), (11), (14), (18), (21), (27), (28)
(Pramod Singh et al., 2009)	Nepal	HAZ, WAZ	Logistic Regression	(11), (19), (20), (22), (32)
(Mostafa, 2011)	Bangladesh	HAZ	Logistic Regression	(11), (14), (19), (22), (28), (32)
(Martorell and Young, 2012)	India, Guatemala	HAZ, WHZ	Logistic Regression	(1), (2), (11), (22), (23)
(Paudel et al., 2012)	Nepal	HAZ	Logistic Regression	(12), (15), (20), (24), (29), (34), (36), (38)
(Fenske et al., 2013)	India	HAZ	Quantile Regression	(1), (6), (19), (22), (26), (28), (32), (33)
(Tiwari et al., 2014)	Nepal	HAZ	Logistic Regression	(1), (6), (10), (19), (30), (37)
(Chirande et al., 2015)	Tanzania	HAZ	Logistic Regression	(6), (19), (21), (30), (32), (33)
(Aguayo et al., 2016)	India	HAZ	Logistic Regression	(4), (7), (11), (19), (24), (30), (33),
(Corsi et al., 2016)	India	HAZ	Logistic Regression	(4), (5), (6), (19), (22), (23)
(Kim et al., 2017)	South Asia	HAZ	Logistic Regression	(1), (3), (4), (5), (6), (19), (22), (23), (24), (31), (34)
(Dorsey et al., 2018)	Nepal	HAZ	Logistic Regression	(6), (19), (22), (37)

(1): Mother's age (2): Mother's Age at First Childbirth (3): Mother's Age at Marriage (4): Mother's Diet (5): Mother's Dietary Diversity (6): Mother's Education (7): Mother's height (8): Mother's Occupation (9): Participation in Growth Monitoring Program (10): Place of Delivery (11): Sanitation (12): Mother's Income (13): Women's Status (14): Father's Education (15): Food Security (16): Health-related infrastructure (17): Household Assets (18): Household Expenditure (19): Household Wealth (20): Housing condition (21): Improved source of water (22): Maternal BMI (23): Maternal Height (24): Minimum Dietary Frequency (25): Access to water (26): Antenatal Care (27): Availability of Electricity (28): Birth Order (29): Care practices (30): Chid Size at Birth (31): Child Vaccination (32): Child's age (33): Child's Gender (34): Complementary Feeding (35): Democratic governance (36): Diarrhea (37): Duration of Breastfeeding (38): Exposure to Pesticides

(continued from page 13) similar effects of covariates as that at the mean (Hao and Naiman, 2007). For example, explanatory variables like gender, education, income, healthcare services, etc. might affect households differently at different points of health outcome distribution (McGillivray et al., 2011, p. 64). Similarly, the analysis of policy variables at the average level of child stunting might not reflect relevant conclusions for population located at the lower extremes of HAZ distribution (Cavatorta et al., 2015). This heterogeneous effect of policy variables, thus, necessitates a methodological framework that extends beyond the mean to identify key policy insights targeted at the most vulnerable households at the bottom of HAZ distribution.

Quantile Regression Model (QRM) features a robust framework that goes beyond the conditional mean and captures the heterogeneous effect of determinants over the entire distribution of a response variable (Davino et al., 2014, p. 1). Koenker and Bassett (1978), introduced QRM in their seminal article entitled 'Regression Quantiles', as an extension of linear regression and least absolute deviation models to account for the presence of heteroskedastic errors in studies that featured skewed distribution of outcome variable. A few of the recent studies (Aturupane et al., 2011; Borooah, 2005) have applied Quantile Regression models in the analysis of nutritional outcome as already discussed. QRM, however, has some methodological limitations. QRM thus introduced by Koenker and Bassett (1978) is a 'Conditional Quantile Regression model' as it only accounts for the conditional partial effect (say, $\beta_{\tau 1}$) of a specific covariate $\mathcal{X} = x_1$ on the conditional quantile $Q_\tau(\mathcal{Y}|\mathcal{X} = x_1)$ of outcome variable $\mathcal{Y}$, ceteris paribus. The conditional quantile value of $\mathcal{Y}$ depends on the specific value of covariates in the model. Any change in the value of covariates or addition of a new set of covariates completely changes the conditional quantile value of $\mathcal{Y}$. One drawback of conditional QRM is that it cannot be extrapolated to describe the effect of covariates on the unconditional quantile $Q_\tau(\mathcal{Y})$ as the law of iterated expectations are inapplicable, i.e. $\mathbb{E}(Q_\tau(\mathcal{Y}|\mathcal{X})) \neq \mathbb{E}(Q_\tau(\mathcal{Y})$. In simple words, in conditional QRM , β_τ cannot be readily interpreted as the effect of mean-level changes ($\bar{x} + \delta x$) on unconditional quantile value $Q_\tau(\mathcal{Y})$ (Firpo et al., 2009). This drawback "limits the usefulness of conditional Quantile Regression in decomposition problems" (Fortin et al., 2010, p. 8) especially if policy implications are to be drawn from the detailed decomposition for each covariates as in this study. In contrast, 'Unconditional Quantile Regression (UQR)', as developed by Firpo et al. (2009), overcomes the above limitations and best suits the objective of this study. The implementation of UQR has been discussed in Chapter III.

2.2.3.2. Studies Aimed at the Decomposition of Differences in Child Stunting

Decomposition methods originated in labor economics. Development of advanced decomposition methods is still an emerging subject of research in Econometrics. Nevertheless, existing decomposition methods have been adopted in several empirical studies in various disciplines including health and nutrition. Most of the studies reviewed so far have used decomposition methods to explain differences in child nutritional outcome across or within countries over time or by region of residence (rural/urban). Table 2 presents a list of decomposition methods adopted by some of the leading studies in the field of child malnutrition research. Following observations are made concerning the methods thus presented in Table 2.

First, most of the studies have used decomposition methods based on linear probability models. Few studies have also used seminal Oaxaca-Blinder (OB) mean-decomposition as introduced by Oaxaca (1973) and Blinder (1973). OB decomposition breaks down the average difference of outcome into average differences in covariates (i.e., covariate effect) and coefficients (i.e., coefficient effects) using linear regression models. However, the above two methods decompose the differences in nutritional outcome only at the mean-level of HAZ distribution. The application of the mean-based decomposition method entails the same methodological limitation as previously highlighted in the discussion of linear regression framework in the preceding section.

Second, few studies (Van de Poel et al., 2007; Wagstaff et al., 2003) have applied Concentration-index based decomposition method. Concentration-index based analysis has also been used in other studies (Fotso, 2006; Huda et al., 2018; Restrepo-Méndez et al., 2015; Van de Poel et al., 2007). Concentration-index based method plots the cumulative proportion of the population facing socioeconomic inequalities against those suffering inequalities in child nutritional outcome (Fotso, 2006). In child malnutrition research, concentration-index based analysis mostly feature in studies where the bivariate relationship between socioeconomic inequalities and child nutritional outcome is of primary interest. However, most of the studies in child malnutrition are interested in comparing a range of other underlying and basic factors beyond socioeconomic variables like in this study.

Third, several recently developed methodological approaches allow OB-type decomposition of child nutritional gap over the entire distribution of outcome variable. These approaches, thus, extend the applicability of Quantile regression models in decomposition problems. However, Oaxaca-Blinder decomposition cannot be readily extended to *(continued on page 18)*

Table 2: Decomposition Methods Used in Literature

Studies (Author, year)	Type of Study	Study Period	Decomposed over	Decomposition method used
(Garrett and Ruel, 1999)	Country-specific	1996	Rural-Urban	OLS and Two-stage linear regression
(Smith and Haddad, 2000)	Cross-country	1970-90	Time	OLS country-fix effect model
(Wagstaff et al., 2003)	Country-specific	1993-98	Time	Concentration-Index Based Method
(Smith et al., 2005)	Cross-country	1990-98	Rural-Urban	OLS country-fix effect model
(Fotso, 2007)	Cross-country	1980-2000	Rural-Urban and Time	Multilevel logistic model
(Van de Poel et al., 2007)	Cross-country	1996-2004	Rural-Urban	Concentration-Index Based Method
(Headey, 2013)	Cross-country	1980s - 2000s	Time	OLS country-fix effect model
(Liu et al., 2013)	Country-specific	1989-2006	Rural-Urban and Time	Oaxaca-Blinder Mean Decomposition
(Paciorek et al., 2013)	Cross-country	1985-2011	Rural-Urban and Time	Bayesian hierarchical mixture model
(Srinivasan et al., 2013)	Country-specific	2006	Rural-Urban	Unconditional Quantile Regression
(Cavatorta et al., 2015)	Country-specific	2005	States	Machado and Mata Decomposition
(Headey and Hoddinott, 2015)	Country-specific	2001-11	Time	Linear Probability Model
(Headey et al., 2015)	Country-specific	1997-2011	Time	Linear Probability Model
(Headey, 2015)	Country-specific	2000-11	Time	Linear Probability Model
(Hirvonen, 2016)	Country-specific	2010	Rural-Urban	Oaxaca-Blinder Poisson Decomposition
(Srinivasan et al., 2016)	Country-specific	2000-14	Time	Unconditional Quantile Regression
(Cunningham et al., 2017)	Country-specific	1996–11	Time	Linear Probability Model
(Headey et al., 2017)	Country-specific	1992-14	Time	Linear Probability Model
(Ervin and Bubak, 2019)	Country-specific	1997-2012	Rural-Urban and Time	Linear Probability Model

(continued from page 16) conditional QRM due to its inherent methodological limitation, as discussed earlier. Nevertheless, literature offers several methodological approaches (Machado and Mata (2005), Chernozhukov et al. (2013), DiNardo et al. (1996)) to tackle such limitations pertaining to conditional QRM (Fortin et al., 2011). However, these approaches are either sensitive to the sequence of decomposition (i.e., they are path dependent), viz. , Chernozhukov et al. (2013) and DiNardo et al. (1996), or do not allow detailed decomposition of covariate and coefficient effects for individual covariates, viz. Machado and Mata (2005) and Chernozhukov et al. (2013). In fact, Cavatorta et al. (2015) used Machado and Mata (2005) method of decomposition in their study in explaining the cross-state disparities in under-five stunting in India. However, their study only captured the aggregate covariate and coefficient effects with no further decomposition for each of the individual determinants of child stunting.

In contrast, the Unconditional Quantile Regression (UQR), as developed by Firpo et al. (2009), best suits this study for the following reasons. First, UQR allows the analysis of the differential effect of determinants at different points of unconditional quantile distribution of the under-five HAZ. Second, since UQR are based on linear approximations and are estimated through linear regressions, UQR can be used to extend Oaxaca-Blinder type of decomposition for explaining differences in HAZ distribution across rural and urban areas (Firpo et al., 2018). Third, the method is useful in explaining rural-urban differentials in child stunting in terms of differences in the level of determinants (i.e., covariate effect) and differences in the strength of their association with child stunting (i.e., coefficient effect). Fourth, the model allows the decomposition of the rural-urban gap into covariate and coefficient effects at both aggregate-level (i.e., for the combined effect of all determinants) as well as for each of the individual determinants of child stunting. The detail decomposition, thus, facilitates the analysis of policy-specific determinants that could be targeted to narrow down the rural-urban gap in child stunting. Srinivasan et al. (2013) have also used this method in their study of rural-urban disparities in child stunting in Nepal and Bangladesh.

2.2.4. Existing Literature Gap

Most of the existing studies on child malnutrition in Nepal have only explained the conditional mean of the outcome variable, as previously highlighted. More recently, only Srinivasan et al. (2013) have conducted Unconditional Quantile Regression as well as decomposition of rural-urban differences in the entire distribution of HAZ in Nepal using the same methodology as in this study. In spite, the following gap persists in the literature in the context of Nepal.

First, most of the studies, including Srinivasan et al. (2013), have analyzed rural-urban differences in child stunting only in the age group of 0-59 months. However, the literature on child stunting provides ample evidence (Black et al., 2013; Garrett and Ruel, 1999; Leroy et al., 2014; Victora et al., 2010) that determinants might have differential effects in the child age groups 0-23 and 24-59 months. Stunting most prominently manifests during the first 1000 days of a child's life referring to the period from conception to 24 months of child's age (Onis and Branca, 2016). Consequently, a considerable number of nutrition interventions targeted at first 1000-days have been designed and implemented worldwide (Prendergast and Humphrey, 2014; Prentice et al., 2013). The analytical framework adopted in this study further extends the analysis made by Srinivasan et al. (2013) by comparing the findings obtained in the sample of children in the age group 0-59 months with those in sub-sample of 0-23 and 24-59 months. This study, thus, aims to provide relevant recommendations for programs and policies targeted at under-five children as well as for interventions designed to cater to specific age groups of children.

Second, the previous study by Srinivasan et al. (2013) in Nepal mostly considered socioeconomic variables in their model. This study further extends their study by incorporating an extensive set of determinants, including health service environment, women empowerment, household food security, and mother's nutrition.

Last and more importantly, conclusions made by Srinivasan et al. (2013) were based on 2006 DHS dataset, which is not representative of current sub-national provincial divisions in Nepal that were introduced only after the promulgation of the new constitution in 2015. Moreover, the present rural-urban structure is entirely different from the sampling frame earlier used by 2006 dataset. Over the years, Nepal has restructured its rural and urban areas as well as administrative structures. For example, the number of urban areas in Nepal has increased from 58 municipalities in 2006 to 263 municipalities in 2016. Any conclusions thus made by earlier studies based on the previous rural-urban classification are mostly irrelevant given the current political and administrative context in Nepal. This study uses Nepal Demographic Health Survey Dataset 2016 (NDHS), which is the first comprehensive survey to have incorporated the updated sampling frame representative of the most recent structural changes in the country.

CHAPTER III: METHODOLOGY

3. METHODOLOGY

This chapter discusses the analytical framework adopted in the present study in Section 3.1. Section 3.2 elaborates the description of data as well as the procedure involved in the selection of variables. Section 3.3 presents the econometric framework that operationalizes the analytical strategy applied in this study.

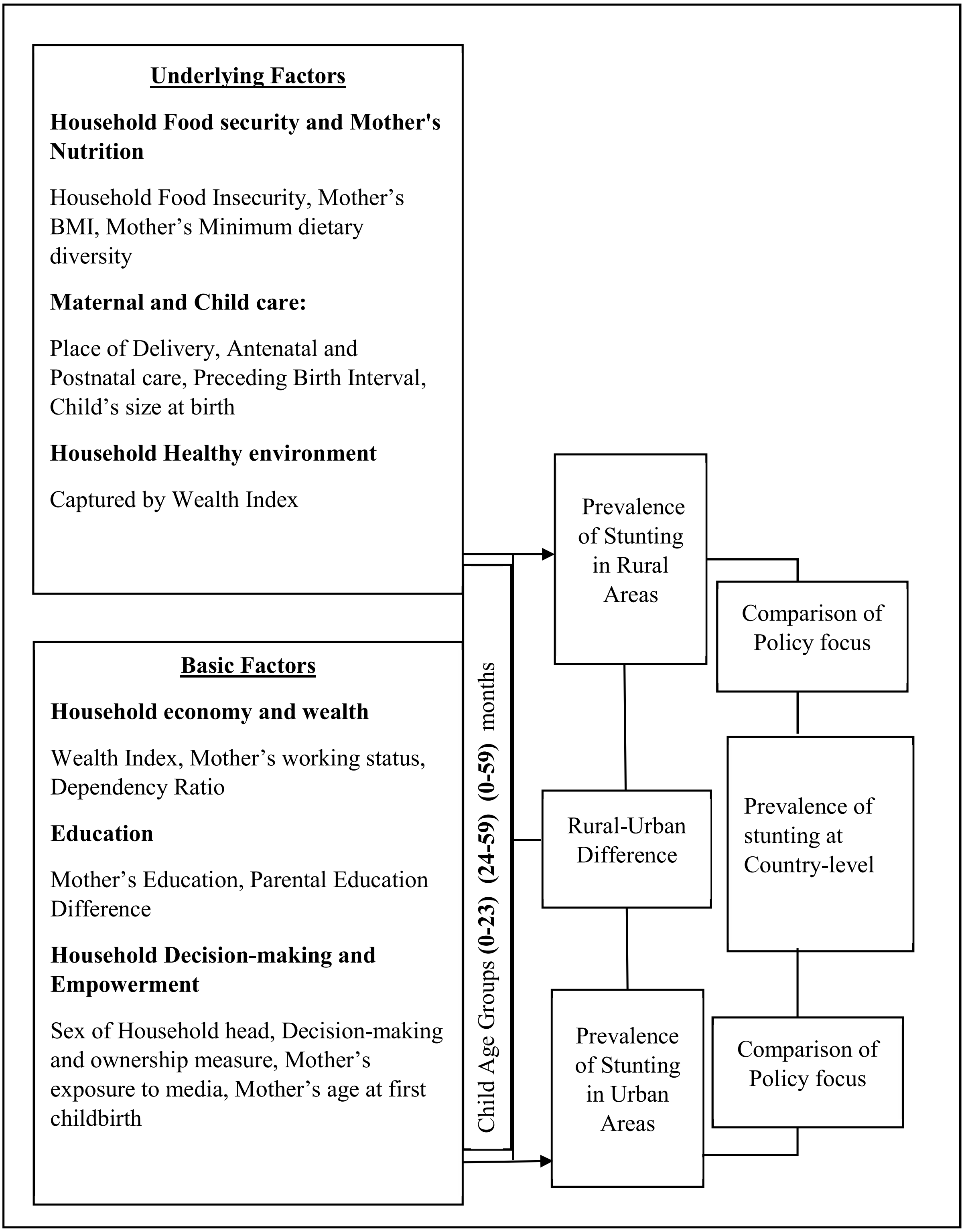
3.1. ANALYTICAL FRAMEWORK

Figure 2 illustrates the analytical framework implemented in this study, which is an adaptation of the UNICEF conceptual framework discussed in Chapter II Section 2.1.2. The analytical framework captures rural-urban differences in basic and underlying factors associated with the rural-urban gap in child nutritional outcome. Some of the key features of the analytical framework have been briefly stated hereunder.

First, the framework highlights stunting as the nutritional outcome variable of interest for this study. The choice of stunting against other indicators (wasting, underweight) was guided by the literature, as discussed in Chapter II Section 2.1.4. Second, the framework does not include proximate determinants of child stunting to avoid the risk of reverse causality. For example, existing literature has shown that children with suboptimal nutritional outcome are more susceptible to diseases or infections (Calder and Jackson, 2000; França et al., 2009). The dataset used in this study did not provide an alternative variable that could be used as an instrument for proximate factors. Third, the framework also highlights the analytical strategy employed in this study, which is briefly described as the following.

Firstly, the magnitude and significance of the association between determinants and child stunting were ascertained at rural, urban and country levels. Secondly, the policy focus indicated by the association of determinants and child stunting at the country level was compared with those from rural and urban areas to identify any area-specific policy needs. Thirdly, the rural-urban differentials in child stunting were decomposed into differences in the level and returns of determinants. In other words, the decomposition results helped in ascertaining whether the rural-urban gap in child stunting was driven by differentials in nutrition-sensitive endowments (covariate effect) or their returns (coefficient effect). Finally, the analysis was performed and compared for children of age groups 0-59, 0-23, and 24-59 months.

Figure 2: Analytical Framework of the Study



Source: Author's elaboration, as adapted from UNICEF Conceptual Framework (1990)

3.2. DESCRIPTION OF DATA

3.2.1. Source of Data and Sample Design

The dataset analyzed in this study came from Nepal Demographic and Health Survey 2016 (NDHS) conducted during the period June 2016 – January 2017. NDHS was selected as the source of data for the following novel features inherent in the dataset. First, NDHS was the first comprehensive survey that incorporated the updated sampling frame representative of province-level data as well as recently restructured rural and urban areas. Second, NDHS collected data on a range of household-level nutrition-sensitive endowments along with anthropometric measures of under-five children and, thus, best suited the purpose of this study.

NDHS employed a multi-stage cluster sampling design, stratified by rural and urban areas, in the selection of the study sample. In the initial stage, Primary Sampling Units (PSUs) and Enumeration areas (EA) were sampled with probability proportional to the population at the lowest administrative levels in rural and urban strata in each province, respectively. Subsequently, 30 households were randomly selected through systematic sampling methods within each of the PSUs and EAs (Ministry of Health, Nepal et al., 2017). A total weighted sample of 2362 (Urban: 1252, Rural: 1110) under-five children with valid HAZ was included in this study.

3.2.2. Selection of Dependent and Independent Variables

Child's height-for-age-z-score (HAZ) was selected as the dependent variable in this study. HAZ is a continuous variable with values ranging from -5 to +5. Independent variables constituted determinants of child stunting as well as controls for provinces, caste, ethnicity, and ecological regions. The selection of independent variables proceeded through the following stages:

In the first stage, a large set of explanatory variables were drawn from existing literature on child stunting based on the UNICEF Conceptual Framework (1990). Variables that were not applicable for all the observations in the dataset were discarded from the study. For example, 'cost of child delivery at health facility', 'cash incentive for delivery at a public health facility', etc. were only applicable for mothers who had their delivery at the hospital. Similarly, data on 'breastfeeding', 'child vaccination' and 'complementary feeding practices' were only available for children in a specific age group in the dataset.

In the second stage, each of the variables was then checked for the relevancy of their association with child stunting through ANOVA and chi-square tests. Any insignificant variable (at 10% significance level) were included in the final model only after a careful review of existing theoretical and empirical literature. However, all variables that were substantiated by the conceptual framework, theoretical literature, and further validated by existing empirical evidence were included in the final model irrespective of statistical significance to avoid omitted variable bias. Subsequently, the final model was checked for multicollinearity. Some variables that were found to be highly correlated were dropped after a review of existing literature. For example, variable 'father's education', was dropped due to the inclusion of a related variable 'parental education difference'.

Independent variables thus selected in the final model are presented in Table 3, along with the existing empirical evidence on their association with child nutrition and health. Table 3 presents variables in groups of individual and household level characteristics as tabulated hereunder.

Table 3: Evidence on Relationship between Independent variable and Child Nutrition/Health

Independent Variable	**Empirical Evidence**
Child-level Characteristics	
Child's Gender	(Chirande et al., 2015; Fenske et al., 2013; Pande, 2003; Raj et al., 2015)
Age-Squared	(Borooah, 2005; Ibrahim, 1999)
Child's age	(Fenske et al., 2013; Kim et al., 2017)
Birth Order	(Mostafa, 2011; Rana et al., 2019)
Child's Size at Birth	(Aguayo et al., 2016; Chirande et al., 2015)
Education	
Parental Education Difference	(Vollmer et al., 2017)
Mother's Education	(Chirande et al., 2015; Corsi et al., 2016; Cunningham et al., 2017)
Health Services Environment	
Child Born in Hospital	(Headey and Hoddinott, 2015)
Antenatal Care	(Headey and Hoddinott, 2015; MAL-ED Network Investigators, 2017)
Postnatal Care	(MAL-ED Network Investigators, 2017)
Preceding Birth Interval	(Headey and Hoddinott, 2015; Rana et al., 2019; Tiwari et al., 2014)

(Continued on next page)

Independent Variable	Empirical Evidence
Economic Attributes	
Wealth Index	(Corsi et al., 2016; Fenske et al., 2013; Headey et al., 2017; Pramod Singh et al., 2009)
Mother's Working Status	(Komatsu et al., 2018)
Dependency Ratio	(Srinivasan et al., 2013)
Household Food Security and Mother's Nutrition	
HH Food Security	(Sarma et al., 2017; Tiwari et al., 2014)
Mother's BMI	(Corsi et al., 2016; Fenske et al., 2013; Pramod Singh et al., 2009)
Mother's Minimum Dietary Diversity	(Hasan et al., 2019; Huang et al., 2018)
Decision-making and Empowerment Attributes	
Sex of Household Head	(Dorsey et al., 2018)
Decision-making and Ownership measure	(Na et al., 2015)
Mother's Exposure to Media	(Sarma et al., 2017)
Mother's Age at First Childbirth	(Fall et al., 2015; Finlay et al., 2011; Raj et al., 2010)

Some of the key considerations concerning the definition and/or inclusion of these variables are briefly explained hereunder.

i. Child-level Characteristics

Child's gender, age, birth order, and birth size were selected as child-level independent variables. 'Child's gender' serves to identify any gender disparity in nutritional outcome. Age-squared was included to account for the possible non-linear relationship between age and child stunting. The data on birth size was based on mother's perception of child's size at birth.

ii. Education

'Parental education difference' was calculated by subtracting mother's years of education from that of the father. The objective of including 'parental education difference' instead of 'father's education' (dropped due to multicollinearity) was to capture the possible gender disparity in parent's education.

iii. Health Services Environment

Place of delivery, and provision of antenatal and postnatal care were included to analyze the effects of community-level health services in relation to maternal and child care. Four or more antenatal care visits by mother during their pregnancies were categorized as ‘Antenatal care provided’ following the practice in existing studies (Headey and Hoddinott, 2015). ‘Postnatal care’ was categorized as ‘provided’ if the mother was checked up by any of the health providers within two days after the child delivery at home or two days before/after discharge in case of child delivery at the health facility. ‘Preceding birth interval’ was also included to account for inadequate health and nutritional care for mother and child due to short birth intervals (Boerma and Bicego, 1992).

iv. Economic Attributes

For this study, household economic attributes refer to household wealth, mother’s working status, and dependency ratio. Wealth Index was used as a proxy for household relative wealth and was readily available in the dataset. DHS calculated the wealth index using Principal Component Analysis of several indicator variables hypothesized to be correlated with household living standard (Rutstein, 2008). The index comprised of information on household ownership of assets including land, vehicles, type of floor and roof materials, etc. as well as household living environment in terms of availability of improved sanitation, drinking water and clean energy.

Mother’s working status comprised of two categories: ‘working’ and ‘not working’. 64.67% of total (1953) mothers in the sample were working. Out of the total working mothers, 76.81% were involved in agricultural work, and the remaining 23.19% were involved in manual (6.49%), sales (10.13%), clerical (1.42%) and managerial (5.15%) positions. The category ‘working’ thus entailed women working mostly in agriculture.

Dependency ratio was computed as the number of economically dependent household members (aged under 15 years and above 65 years) per those of working age (15-64 years). The inclusion of dependency ratio was intended to capture the overall household-level economic burden.

v. Household Food Security and Mother’s Nutrition

Household-level food security was assessed through the use of Household Food Insecurity Access Scale (HFIAS). The scale was developed by USAID’s Food and Nutrition Technical Assistance (FANTA) project, and was computed according to the methodology detailed by

Jennifer et al. (2007) based on the response to nine specific yes/no questions measuring the household-level perception of food insecurity. For this study, fully secure and mildly food insecure households were categorized as ‘food secure’ and those with moderate and severe levels of food insecurity were categorized as ‘food insecure’.

Mother’s nutrition was proxied through the inclusion of Mother’s Minimum Dietary Diversity (MDD) and mother’s Body mass index (BMI). MDD is a dichotomous indicator reflecting the dietary adequacy for women of reproductive age (15-49 years) and was computed following the methodology outlined by Women's Dietary Diversity Project (WDDP) Study Group (2017). Mother’s consumption of five or more food groups out of total ten food groups a day before the survey was defined as ‘Minimum Dietary Diversity achieved’ as per the methodology cited above. Data on Mother’s Minimum Dietary Diversity, however, was only available for mothers whose children were in the age group 0-23 months. Thus, Mother’s Minimum Dietary Diversity was only included in the analysis of age group 0-23 months.

Mother’s BMI, calculated as body weight in kilograms divided by the square of height in meters, is an indicator of chronic energy deficiency in adults (Shetty and James, 1994). WHO recommends classifying women with BMI less than 18.5, 18.5-24.9, 25-29.9 and above 29.9 as ‘underweight’, ‘healthy weight’, ‘overweight’ and ‘obese’, respectively (Dudenhausen et al., 2018; Sassi, 2018). However, for this study, categories ‘overweight’ and ‘obese’ were merged into one single group ‘overweight’ due to the low sample size for obese mothers.

vi. Decision-making and Empowerment Attributes

Following three variables pertaining to women’s status were included in this study, i. mother’s decision-making and ownership measure (created through factor analysis) ii. household bargaining power (proxied by household head sex), and iii. mother’s exposure to mass media.

Mother’s decision-making and ownership measure was constructed through factor analysis of a set of variables indicating women’s economic empowerment (decision-making on household purchase, control and perception of own and partner’s earnings), socio-familial empowerment (decision-making on health care and family visits) and legal empowerment (ownership of house and land), following the categorization scheme outlined by Jennings et al. (2014). This study, however, departed from the methodology adopted by Jennings et al. (2014) in two fronts. First, this study adopted a factor analysis method to produce a continuous measure instead of a mean-based dichotomous measure. The continuous measure allows greater flexibility in analyzing the differential levels and effects of decision-making and ownership throughout the distribution of HAZ. Second, the variable 'mother's attitude on domestic violence' was found to be poorly explained by the measure produced through factor analysis and was eventually dropped from the final model due to statistical insignificance in its association with child stunting.

'Sex of household head' was included to capture mother's bargaining power as widely used in previous literature (Smith et al., 2005). 'Mother's exposure to media' was also added to analyze mother's access to and utilization of mass media. Further, 'Maternal age at first childbirth', also widely used in the existing literature, was included as a proxy for sociodemographic factors contributing to early marriage and pregnancies, women's control over her reproductive health as well as changing fertility trends in rural and urban settings.

Independent variables are briefly summarized in Table 4.

Table 4: Description of Independent Variables

Variable	Type	Definition
Child-level characteristics		
Child's gender	Dummy	1=Female, 0=Male
Age-squared	Continuous	Child age squared
Age of the child	Continuous	Child's age in months
Birth Order	Dummy	1=First child, 0=otherwise
Child's size at birth	Dummy	1=Smaller than average, 0=otherwise
Education		
Parental Education Difference	Continuous	Father's minus Mother's years of education
Mother's Education	Continuous	Mother's years of education
Health Services Environment		
Child Born in Hospital	Dummy	1=Yes, 0=No
Antenatal Care for Mother	Dummy	1=Four or more ANC visits, 0=otherwise
Postnatal Care for Mother	Dummy	1=Provided 0=Not provided as recommended
Preceding Birth Interval	Dummy	1=More than 24 months, 0=otherwise
Economic Attributes		
Wealth Index	Continuous	DHS Wealth index factor score
Mother's Working Status	Dummy	1=Working, 0=Not working
Dependency Ratio	Continuous	Dependents per economically active members
Household Food Security and Mother's Nutrition		
HH Food security	Dummy	1=Househol d is food secure 0=Insecure

(Continued on next page)

Variable	Type	Definition
Mother's BMI	Categorical	0=Normal 1=Underweight 2=Overweight
Decision-making and Empowerment Attributes		
Sex of Household Head	Dummy	1=Female 0=Male
Decision-making and Ownership	Continuous	Index created through factor analysis
Mother's Exposure to media	Dummy	1=Yes 0=Not following media even once a week
Mother's Age at First Childbirth	Continuous	Maternal age of first childbirth

3.3. ECONOMETRIC FRAMEWORK

The following sections present the implementation of the econometric model adopted in this study.

3.3.1. Implementation of Unconditional Quantile Regression Model

This study implemented Unconditional Quantile Regression model according to the estimation procedure developed by Firpo et al. (2009;2018). The implementation proceeded through the following two stages:

Stage I: Decomposition of HAZ Differential into Aggregate Covariate and Coefficient Effects

Let N_R and N_U be the number of sampled under-five children in rural and urban areas respectively. Let i denote individual observation in each of these samples such that $i = 1,2, \dots, N$, and $N = N_R + N_U$.

Let's assume that for each group (rural and urban areas), child stunting, i.e., HAZ, and its determinants X follow a joint distribution function, which is different for rural and urban areas:

$$f(HAZ, x|A = T) = f(HAZ_i|X = x, A = T) * f(x|A = T) \qquad \text{(a)}$$

where, A: Area of residence, and T: Urban (U), Rural (R)

For simplicity, we can rewrite the joint distribution function in (a) in terms of the conditional distribution of HAZ as:

$$f_A(HAZ, x) = f_A(HAZ|X = x) * f_A(x) \qquad \text{(b)}$$

where $\mathrm{A} = \text{Urban (U), Rural (R)}$

The unconditional distribution function of HAZ, for both urban and rural areas, can then be found by integrating both sides over the conditional distribution of x in (b) as:

$$f_A(HAZ) = \int f_A(HAZ|X = x) * f_A(x)\, dx \qquad \text{(c)}$$

For each group (rural and urban), the unconditional quantile value of HAZ at τ^{th} quantile can then be estimated using the unconditional distribution of HAZ conditional only on the area of residence (rural or urban). Thus, the raw rural-urban HAZ difference at τ^{th} quantile in the respective HAZ distributions can be defined as:

$$\Delta q_\tau = q_\tau(HAZ, f_R(HAZ)) - q_\tau(HAZ, f_U(HAZ)) \qquad \text{(d)}$$

To explain the difference in HAZ between rural and urban areas at unconditional τ^{th} quantile, we then require a counterfactual distribution $q_\tau(HAZ, f_C(HAZ))$. The counterfactual represents the distribution of HAZ that would have been observed in rural area if rural area had same returns to its characteristics as in the urban area, at τ^{th}quantile. i.e.

$$q_\tau\big(HAZ, f_C(HAZ_i)\big) = q_\tau(HAZ, \int f_U(HAZ_i|X = x_i) * f_R(x_i)\, dx) \qquad \text{(e)}$$

where C represents counterfactual

In practice, the counterfactual distribution is never observed. However, under certain conditions as explained in Fortin et al. (2010) and Firpo et al. (2018), it can be identified using a reweighting procedure by using a logit estimation as indicated in Firpo et al. (2018). The distribution of determinants in the urban area was reweighted to form a counterfactual, which has a similar distribution as in the rural area. The reweighting procedure was carried out as follows:

First, logit regression was run on the pooled rural and urban dataset to predict the conditional probability that an observation i with characteristics $X = x$ belongs to the urban area. The conditional probability $P(T = R \mid X = x)$ thus obtained was then used to compute the reweighting factor $w(x)$ as:

$$w(x) = \frac{1-p}{p}\,\frac{P(T = R \mid X = x)}{1 - P(T = R \mid X = x)}$$

where p: proportion of observations in the urban area

Then, the distribution of HAZ in the urban area was multiplied by $w(x)$ to obtain the counterfactual distribution as:

$$q_\tau\big(HAZ, f_C(HAZ)\big) \cong q_\tau(HAZ, \int f_U(HAZ|x) * f_U(x) * w(x) * dx) \qquad \text{(f)}$$

Any difference in the distribution of observed covariates in the rural area and the counterfactual distribution is termed as 'reweighting error'. This step involved the appropriate model selection procedure to minimize reweighting error, which should ideally be statistically insignificant.

The rural-urban difference in HAZ at τ^{th} unconditional quantile was then decomposed into covariate and coefficient effects as hereunder.

$$q_\tau = q_\tau\big(HAZ, f_R(HAZ)\big) - q_\tau\big(HAZ, f_C(HAZ)\big) + q_\tau\big(HAZ, f_C(HAZ)\big) - q_\tau\big(HAZ, f_U(HAZ)\big) \qquad \text{(g)}$$

where,

$q_\tau\big(HAZ, f_R(HAZ)\big) - q_\tau\big(HAZ, f_C(HAZ)\big)$ **:** Represents Coefficient effect at quantile $\boldsymbol{\tau}$

$q_\tau\big(Haz, f_C(Haz)\big) - q_\tau\big(Haz, f_U(haz)\big)$ **:** Represents Covariate effect at quantile $\boldsymbol{\tau}$

Stage II: Decomposition of Covariate and Coefficient Effects for each covariate

Following Firpo et al. (2018, 14) and Srinivasan et al. (2013), this stage proceeded through the following steps:

***Step 1*:** First, Recentered Influence Function (RIF) was computed for each observation i in rural, urban and counterfactual groups by plugging in $\widehat{q_{T,\tau}}$ (i.e. estimated HAZ score at quantile $\boldsymbol{\tau}$; from Stage I) and $\hat{f}_T(\widehat{q_\tau})$ (i.e. estimated density function of HAZ at quantile $\boldsymbol{\tau}$) as:

$$\widehat{RIF}_T(HAZ_i; q_\tau, f_T(HAZ)) = \widehat{q_{T,\tau}} + \frac{(\tau - \mathbf{1}\{HAZ_i \leq \widehat{q_{T,\tau}}\})}{\widehat{f_T}(\widehat{q_{T,\tau}})} \qquad \text{(h)}$$

where, $T = \text{Urban, Rural, Counterfactual}$

$f_T(HAZ)$: Unconditional distribution function of HAZ at quantile τ for T

$\mathbf{1}\{HAZ_i \leq \widehat{q_{T,\tau}}\}$: A dummy expression whose value is either 0 or 1 depending on the value of the unconditional quantile for group T

$\hat{f}_T(\widehat{q_\tau})$: is the estimation of the density at the point $\widehat{q_{T,\tau}}$

RIF allows first-order approximation of the change in quantile function q_τ for any infinitesimal change in the distribution of HAZ by virtue of its mathematical property: $\mathbb{E}(\widehat{RIF}(HAZ_i; q_\tau, F_{HAZ}))=q_\tau$ (Firpo et al., 2018, 2).

Step 2: In this step, the RIF-regression was estimated for rural, urban and counterfactual groups at each quantile $\boldsymbol{\tau}$ with estimated RIF (i.e. $\widehat{RIF}(HAZ, \widehat{q_\tau})$) as a dependent variable. Firpo et al. (2009) elaborates three possible types of approaches in estimating the RIF-regression: RIF-OLS, RIF-Logit and RIF-Non-Parametric. Firpo et al. (2018, 11) have, however, suggested the use of linear specification, i.e., RIF-OLS, as it is more easily extended to decomposition analysis, as long as specification errors are minimized. Specification errors refer to functional misspecification of the model and/or incorporation of covariates that inadequately explains the dependent variable. Specification error in the model was kept at a minimum by choosing independent variables based on the UNICEF Conceptual Framework as well as by incorporating squared term for child's age (to account for any possible non-linearity) and relevant controls.

This study estimated linear RIF-regression by using simple OLS as following:

$$\widehat{RIF}(HAZ, \widehat{q_\tau})) = X_U \widehat{\beta_U} \text{ for urban area} \tag{i}$$

$$\widehat{RIF}(HAZ, \widehat{q_\tau})) = X_R \widehat{\beta_R} \text{ for rural area} \tag{j}$$

$$\widehat{RIF}(HAZ, \widehat{q_\tau})) = X_R^C, \hat{\beta}_U^C \text{ for counterfactual group} \tag{k}$$

where,

$\widehat{\beta_U}$ and $\widehat{\beta_R}$ represent unconditional quantile effects of covariate X_U and X_R on $\boldsymbol{\tau}^{\mathbf{th}}$ quantile HAZ score in urban and rural areas, respectively.

The results of models (i) and (j) are presented in Appendices 5-7 as detailed in Chapter IV.

Step 3: The estimated overall rural-urban HAZ differential ($\widehat{\Delta}_O$) at each quantile $\boldsymbol{\tau}$ was then decomposed by running two Oaxaca-Blinder (OB) decomposition using RIF-regressions, as demonstrated by Firpo et al. (2018, 29), i.e.

$$\widehat{\Delta}_O = \quad \left(\overline{X}_R^C - \overline{X}_U\right).\overline{\beta}_U^C + \overline{X}_U'.\left(\overline{\beta}_U^C - \widehat{\beta_U}\right) + \left(\overline{X}_R - \overline{X}_R^C\right)'.\widehat{\beta_R} + \overline{X}_R^{C\prime}.\left(\widehat{\beta_R} - \overline{\beta}_U^C\right) \tag{l}$$

The first OB decomposition refers to the first two terms, where:

$\left(\overline{\boldsymbol{X}}_{\boldsymbol{R}}^{\boldsymbol{C}} - \overline{\boldsymbol{X}}_{\boldsymbol{U}}\right).\overline{\boldsymbol{\beta}}_{\boldsymbol{U}}^{\boldsymbol{C}}$ **:** Represents the difference in covariate averages between the urban area and the counterfactual, i.e., covariate effect for X (also called endowment effect)

$\overline{\boldsymbol{X}}_{\boldsymbol{U}}'.\left(\overline{\boldsymbol{\beta}}_{\boldsymbol{U}}^{\boldsymbol{C}} - \widehat{\boldsymbol{\beta}_{\boldsymbol{U}}}\right)$**:** Represents specification error

The second OB decomposition refers to the second last terms where:

$\overline{\boldsymbol{X}}_{\boldsymbol{R}}^{\boldsymbol{C}\prime}.(\widehat{\boldsymbol{\beta}_{\boldsymbol{R}}} - \overline{\boldsymbol{\beta}}_{\boldsymbol{U}}^{\boldsymbol{C}})$**:** Represents coefficient effect for covariate X

$(\overline{\boldsymbol{X}}_{\boldsymbol{R}} - \overline{\boldsymbol{X}}_{\boldsymbol{R}}^{\boldsymbol{C}})'\,.\,\widehat{\boldsymbol{\beta}_{\boldsymbol{R}}}$**:** Represents the reweighting error.

Model selection procedure thus involved minimizing both specification and reweighting errors. The results of model (l) are presented in Appendices 9-11 as detailed in Chapter IV.

3.3.2. Key Assumptions

Firpo et al. (2018) highlight some fundamental assumptions that are inherent in the method adopted in this study.

i. Ignorability

The ignorability assumption holds that any unobserved factors affecting under-five HAZ were not systematically associated with the place of residence (rural/urban) once observed determinants were accounted for in the model (Firpo et al., 2018). For example, the way children are raised might be different in a rural joint family and an urban nuclear household. This study assumed that given the determinants included in this study, parent's attitude to raising children are, on average, not different in rural and urban areas. Ignorability is a strong assumption, which is, however, difficult to validate. Nonetheless, this study has incorporated a rich set of child stunting determinants informed by theoretical and empirical literature to improve the validity of this assumption.

ii. Common Support

This assumption holds that the factors explaining under-five HAZ are similar and comparable in rural and urban areas. This assumption would be violated if completely different factors determined child stunting in rural and urban areas. However, Garrett and Ruel (1999) provide evidence that determinants of child stunting are mostly similar across rural and urban areas. Nonetheless, the present study acknowledges the implication of this assumption.

3.3.3. Limitations

Following are the fundamental limitations of the methodological framework implemented in this study.

i. This study, based on a cross-sectional dataset, does not establish any causal relationship

ii. The coefficients of regression results are thus interpreted as *associations* rather than *causal effects*, consistent with previous studies (Cavatorta et al., 2015; O'Donnell et al., 2009; Srinivasan et al., 2013)
iii. Some of the variables included in this study (for example, mother's education) might be endogenous as they might be affected by the same set of unobserved factors that affect child stunting. However, this study does not intend to establish a causal mechanism between covariates and outcome variable. In this context, the decomposition methods are still valid, as also confirmed by O'Donnell et al. (2009) and Srinivasan et al. (2013).

3.3.4. STATA Implementation

STATA commands 'rifhdreg' and 'oaxaca_rif', developed by Rios-Avila (2018), implemented Unconditional Quantile Regressions and decompositions as detailed in the preceding section, and as described in Firpo et al. (2018). Further, the cluster survey design of DHS dataset was accounted for by using STATA command 'bsweights' as developed by Kolenikov (2010). Regressions were run with 'bs4rw' prefix to obtain bootstrapped standard errors based on rescaled sampling weights. $(n_h - 3)$ PSUs were resampled in each h^{th} stratum of size n_h with 450 repetitions to achieve first-order balance for most of the strata as suggested by Kolenikov (2010).

CHAPTER IV: RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

This chapter presents the results obtained in this study and discusses the interpretations and implications of the main findings (Section 4.1 - 4.3). The policy implication of the results thus presented is also discussed briefly in Section 4.4. Since this study utilizes recently developed Unconditional Quantile Regression (UQR) methods, an intuitive explanation of key terminologies and interpretations are also provided in Appendix 1.

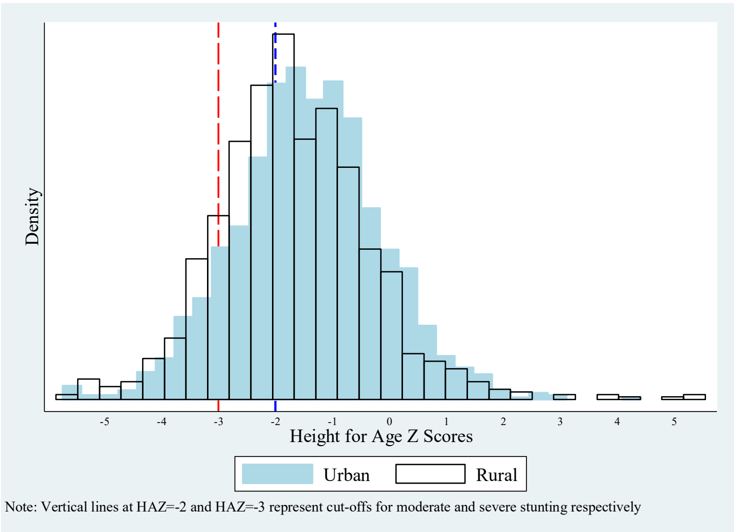
It is imperative to reiterate that the purpose of this study was not to establish causal inference. Careful interpretation of regression coefficients is, thus, advised. Regression coefficients should be interpreted as *associations* instead of *causal effects,* consistent with previous literature (Cavatorta et al., 2015; O'Donnell et al., 2009; Srinivasan et al., 2013).

Results obtained in this study are presented and discussed in the following sections.

4.1. DESCRIPTIVE STATISTICS

Figure 3 compares the distribution of HAZ in rural and urban areas in Nepal in the age group 0-59 months.

Figure 3: Differences in Rural-Urban HAZ Distribution (Age Group 0-59 months)



Comparison of HAZ at different quantiles at rural, urban, and country levels are also shown in Table 5.

Table 5: Summary Statistics of HAZ at Rural, Urban and Country levels

	Mean	SD	Q10	Q25	Q50	Q75	Q90
Country	-1.516	1.35	-3.150	-2.360	-1.580	-0.700	0.160
Rural	-1.638	1.31	-3.190	-2.530	-1.740	-0.850	-0.050
Urban	-1.408	1.37	-3.090	-2.190	-1.460	-0.600	0.270

Note: SD: Standard Deviation Q: Quantile

Figure 3 and Table 5 highlight that a large proportion of both rural and urban children were found to have negative HAZ, signifying that most under-five children in Nepal have a lower nutritional outcome as compared to the WHO reference population. Rural HAZ was even lower than the national or urban average. Rural children were found to have consistently higher deficits in HAZ at all quantiles and on both sides of the WHO cut-off score[1]. These deficits were also evident among children in age groups 0-23 and 24-59 months, as shown in Appendix 2. The presence of rural-urban nutritional gap in the entire distribution of HAZ was also highlighted by Srinivasan et al. (2013) in their studies. These results indicate that nutritional risks exist even among children who have a relatively better nutritional outcome in the population. Thus, any interventions designed to improve child nutrition or its relative rural-urban gap need to focus on the entire distribution of HAZ.

The rural deficit was also evident across most of the underlying and basic determinants (Appendices 3–4). On average, rural households were less wealthy, had a higher dependency ratio, were less food secure, and had a lesser proportion of mothers who were provided with postnatal and antenatal care services. Levels of determinants in rural areas were found to be lower than both national and urban averages across most of the variables included in this study. These findings are in line with the existing literature, which suggests that rural areas generally face a higher disadvantage in welfare provisions (Simler and Dudwick, 2010). Rural-urban difference in HAZ was also consistent across most of the categorical variables (Appendix 4).

Overall, rural areas were found to feature significantly higher disadvantage in terms of child stunting as well as underlying and basic determinants in comparison to urban areas.

4.2. UNCONDITIONAL QUANTILE REGRESSION RESULTS

Appendices 5-7 present the estimates of Unconditional Quantile Regression (UQR) for rural and urban areas along with country-level averages in the age group 0-59, 0-23 and 24-59

[1] HAZ values lower than the WHO cut off value at HAZ=-2 indicates that a child is stunted

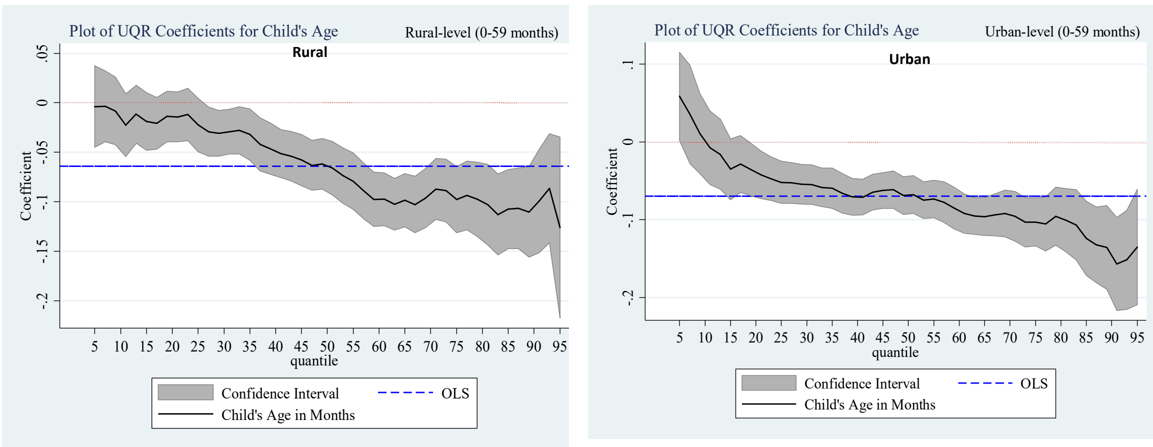
months, respectively. Additionally, plots of coefficients[2] for each of the determinants at country, rural and urban levels are also included in Appendix 8. The plot provides a graphical summary of UQR coefficients in the entire distribution of HAZ viz-a-viz OLS coefficient in the age group 0-59 months. UQR results are briefly summarized hereunder.

i. Similarities and Differences in OLS and UQR estimates

OLS and UQR estimates were mostly similar in terms of the direction of the association between determinants and HAZ. However, the strength and magnitude of OLS estimates were different from those of UQR, particularly towards the lower and upper extremes of HAZ distribution. For example, the coefficient of 'decision-making and ownership measure' at 90th quantile of HAZ distribution (0.64) was approximately twice the OLS estimate (0.33) in rural areas (Appendix 5). Further, some determinants found to be insignificant in OLS were found to be significant in UQR. For example, the insignificant association of 'Postnatal care' at the mean HAZ was found to be highly significant in the higher quantiles (in an urban area in the age group 0-59 months). Differences in OLS and UQR estimates can also be observed on the plots of coefficients in Appendix 8. For example: 'child's age' has downward sloping plots of UQR coefficients as opposed to a horizontal OLS line, as shown in the following figure reproduced from Appendix 8.

Figure 4: Comparison of OLS and UQR Coefficients (Reproduced from Appendix 8)

(a) (b)



Panels (a) and (b) in figure 4 indicate that HAZ and age share a negative relationship. However, significant age-squared variable in UQR results (Appendix 5) indicates that the relationship is

[2] Generated through self-written STATA Program. No STATA commands were available.

reversed at a certain age. The average age at which the reversal of such relationship occurs was found to be 41.12, 42.44, and 43.59 months at rural, urban, and country levels respectively[3].

These findings establish that OLS estimates from conditional linear regression are highly misleading in studies concerning child stunting, as also shown previously by Aturupane et al. (2011), Borooah (2005) and Srinivasan et al. (2013).

ii. Similarities and Differences in the Relationship of Determinants and HAZ

Strength and direction of the association between determinants and child stunting were found to vary across rural, urban, and country levels in all age groups. A summary of all statistically significant[4] determinants is provided in Table 6 for easy comparability of UQR coefficients across age groups and areas, based on the results tabulated in Appendices 5-7. Coefficients are presented in descending order of their magnitude and are expressed in terms of quantiles at which they are significant. Positively and negatively significant coefficients are indicated in blue and red colors, respectively. Table 6 reveals the following observations.

First, determinants were mostly similar across areas and age groups in terms of the *direction* of their association (positive or negative), except for some variables like 'child's age' and 'mother's age at first childbirth'. These similarities in direction can also be ascertained by observing the pattern of color (red or blue) across age groups, area, and HAZ quantiles in Table 6.

Second, the *magnitude* of association, however, was found to vary across all age groups, area, and HAZ quantiles (Appendices 5-7), as can also be observed in Table 6. None of the determinants was found to be consistently significant at all age groups and areas. Determinants significant at any quantile at the country-level were not necessarily significant at rural or urban levels, and vice-versa. This heterogeneity in the association of determinants at national, rural, and urban levels imply that policy interventions drawn at country-level might not necessarily address rural and urban realities effectively.

[3] Calculation of turning point for age and HAZ relationship: $\frac{\widehat{\beta_1}}{-2\,\widehat{\beta_2}}$ where $\widehat{\beta_1}$ and $\widehat{\beta_2}$ are estimated coefficients of Age and Age-squared respectively. Calculation based on Plassmann and Khanna (2007).

[4] Significance level ≤ 10%

Table 6: Significant Determinants at Rural, Urban and Country levels Across Age Groups and HAZ Quantiles

Determinants		Age Group (in months) 0-59	0-23	24-59
Child-level Characteristics				
Child's Gender (Female==1)	Country	ns	OLS	ns
	Rural	Q25	OLS	Q10
	Urban	ns	ns	ns
Child's Age (in months)	Country	Q90, Q75, Q50, OLS, Q25	Q75, Q10	Q90, Q25
	Rural	Q90, Q75, OLS, Q50	Q75	ns
	Urban	Q90, Q75, OLS, Q50, Q25	ns	Q90, Q50, Q25, OLS
Birth Order (First child==1)	Country	Q90, Q10	OLS	Q25
	Rural	Q25	Q10	Q25, Q50
	Urban	Q90	ns	ns
Child's size at birth (Smaller than average==1)	Country	Q50, Q75, OLS, Q25	Q50, Q25, Q75, OLS	Q50, Q25, OLS
	Rural	Q50	Q25	ns
	Urban	Q50, Q10, OLS, Q90, Q75, Q25	Q50, Q75, Q90, OLS, Q25	Q50, Q90, OLS
Education				
Parental Education Difference	Country	ns	ns	ns
	Rural	ns	Q50	ns
	Urban	ns	ns	ns
Mother's Education	Country	Q25, OLS	ns	Q10, Q25
	Rural	ns	Q50	ns
	Urban	Q25	ns	Q25
Health Services Environment				
Child born in Hospital (Yes==1)	Country	Q25	ns	Q90
	Rural	ns	ns	ns
	Urban	ns	ns	ns

(Continued on next page)

Table 6: Significant Determinants at Rural, Urban and Country levels Across Age Groups and HAZ Quantiles

Determinants		Age Group (in months) 0-59	0-23	24-59
Antenatal Care (At least 4 ANC Visits ==1)	Country	ns	Q50, Q75, OLS	ns
	Rural	ns	ns	ns
	Urban	Q75	Q50, Q75, Q90, OLS	ns
Postnatal Care (Provided==1)	Country	Q75, Q50	Q50	Q90, Q75
	Rural	ns	ns	ns
	Urban	Q90, Q75, Q50	Q10, Q25, Q50	Q75, Q90, Q50
Preceding Birth Interval (More than 24 months==1)	Country	ns	Q25	Q10
	Rural	Q50, Q25	Q25, Q50	ns
	Urban	Q50, OLS	Q90, Q75, OLS	Q50
Economic Attributes				
Wealth Index	Country	Q90, Q75, Q50, OLS	Q75, OLS, Q50	Q75, OLS
	Rural	Q90, OLS, Q50, Q75, Q25	OLS	Q50, OLS
	Urban	Q50, Q75, OLS	Q75, Q50, OLS	ns
Mother's Working Status (Working==1)	Country	Q10, Q25, Q50, OLS	Q10	Q10, Q25, Q50, OLS
	Rural	Q10	Q10	ns
	Urban	Q10, Q50, OLS	Q90	OLS
Dependency Ratio	Country	Q10, Q25, OLS	Q25	Q25
	Rural	Q10, Q50, Q25, OLS	OLS	ns
	Urban	ns	Q90	ns
Household Food Security and Mother's Nutrition				
Household Food Security (Secure==1)	Country	ns	ns	Q25
	Rural	ns	ns	Q90
	Urban	ns	ns	ns
Mother's Minimum Dietary Diversity (Achieved==1)	Country	na	ns	na
	Rural	na	ns	na
	Urban	na	ns	na

(Continued on next page)

Table 6: Significant Determinants at Rural, Urban and Country levels Across Age Groups and HAZ Quantiles

Determinants		Age Group (in months)		
		0-59	**0-23**	**24-59**
Mother's BMI (Underweight==1)	Country	ns	ns	ns
	Rural	Q75, OLS	Q50	ns
	Urban	Q75	ns	ns
Mother's BMI (Overweight==1)	Country	Q90, OLS, Q75, Q10, Q50, Q25	Q90, OLS	Q75, Q50, Q10, OLS, Q25
	Rural	Q90, Q75, OLS, Q50	OLS	Q90, Q75, OLS
	Urban	Q10, OLS, Q25, Q50	ns	Q25, Q50, OLS
Decision-making and Empowerment attributes				
Sex of Household head (Female==1)	Country	ns	Q75, OLS	Q90
	Rural	Q10	OLS	ns
	Urban	ns	ns	Q90
Decision-making and ownership measure	Country	Q90, Q75, OLS, Q50	ns	Q90, Q75, Q50, OLS, Q25
	Rural	Q90, Q50, OLS	OLS	ns
	Urban	Q75	ns	OLS, Q75, Q50
Mother's Exposure to media (Yes==1)	Country	ns	ns	OLS
	Rural	Q90, Q75, Q50	ns	Q90, Q75
	Urban	ns	ns	Q25
Mother's age at first childbirth	Country	ns	ns	Q90
	Rural	ns	Q90, OLS	ns
	Urban	Q90, Q75	ns	ns

Blue indicates positively significant coefficient; Red indicates negatively significant coefficient
OLS: Determinant is significant at conditional mean of HAZ; **Q10-Q90:** Respective Quantiles at which determinants are significant;
ns: Not significant in OLS and Q10-Q90, na: Not Applicable;
Statistical Significance level: ≤ 10%
Note: Coefficients are arranged in descending order (from higher to lower absolute value of coefficient) for each determinant in each age group

Third, most of the determinants were found to have a higher magnitude of association in the extreme quantiles of HAZ distribution (Table 6, Appendices 5-7). These determinants are outlined hereunder.

Table 7: Association of Determinants and HAZ at Extremes

Determinants that were found to have a stronger association in higher quantiles (across all age groups/areas)	*Mostly positive association:* wealth index, decision-making and ownership measure *Mostly negative association:* Child's age
Determinants that were found to have a stronger association in lower quantiles (across all age groups/areas)	*Mostly positive association:* Mother's education *Mostly negative association:* Mother's working status, dependency ratio

Strength of association in the extremes is crucial as, for example, determinants with a stronger positive association in higher quantiles provide relatively lower returns for vulnerable children at the bottom of HAZ distribution.

Lastly, Table 8 provides a summary of the observed association between the determinants and child stunting across area and age groups hereunder.

Table 8: Determinants and Nature of their Association with Child Stunting

Determinants that were found to have a generally **positive association** with HAZ	Mother's education, antenatal care, postnatal care, wealth index, mother's decision-making and ownership measure, and mother's exposure to media
Determinants that were found to have a generally **negative association** with HAZ	Child's size at birth, mother's working status
Determinants that were found to have generally **mixed association** depending on the age group or area	Child's gender, age of the child, birth order, place of delivery, preceding birth interval, sex of household head, mother's age at first birth
Determinants that were found to have a generally **minimal association** with HAZ	Parental education difference, household food security, mother's minimum dietary diversity

Some of the selected determinants thus presented are briefly discussed hereunder (on the following page).

Household wealth was found to have positive association with the improvement in HAZ at most of the quantiles across age groups and areas, as also evidenced in the literature (Corsi et al., 2016; Fenske et al., 2013; Headey et al., 2017). However, such improvement was more substantial for children with a relatively better nutritional outcome (as suggested by Table 7). The association of wealth index was also generally stronger in rural than in urban areas (Appendices 5-7). Further, **dependency ratio** featured negative association with child growth (Table 8), as also shown by Srinivasan et al. (2013). These findings imply that economic attributes, including wealth and lower dependency burden, are generally favorable to improving child nutritional outcome but mostly among relatively less vulnerable. This implication indicates that improving economic attributes alone would not resolve nutritional risk equally for all children in the population.

Mother's working status (in agriculture) was found to have a negative association with child growth, more strongly among the most vulnerable children at the bottom of HAZ distribution. This finding is in contrast to previous studies conducted in Mozambique (Komatsu et al., 2018) and Nepal (Moucheraud et al., 2019), where the association was found to be positive. However, these studies were based on logistic regression framework, and thus, might not have captured the disproportionate association at the lower quantiles of HAZ. Nevertheless, previous study based on UQR by Srinivasan et al. (2013) in Nepal, have found a similar result as in this study. The negative relationship between mother's work in agriculture and HAZ could be explained by the compromise in the time and attention for caring and feeding child, as also highlighted by Komatsu et al. (2018).

Overall, UQR has highlighted some of the key associations of determinants and child stunting. In most of the cases, the direction of association for a determinant was found to be consistent across areas/age groups/quantiles. However, the magnitude of their association widely varied.

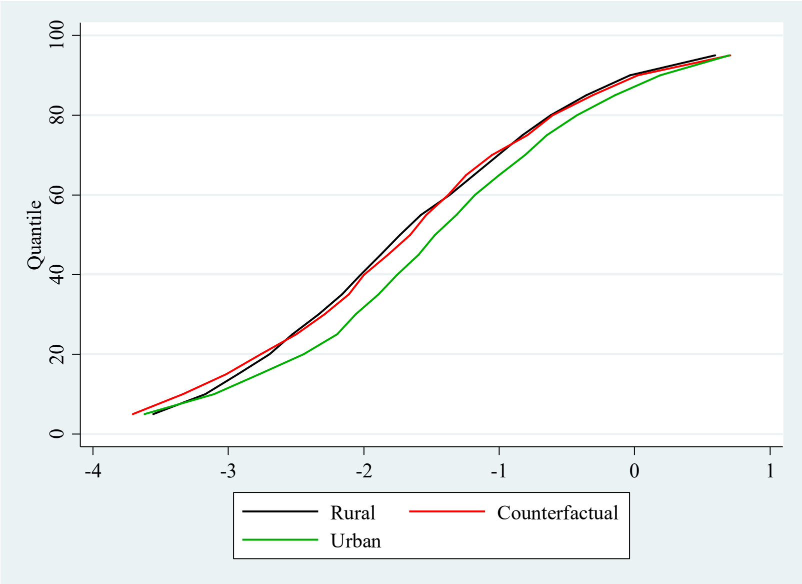
4.3. DECOMPOSITION RESULTS

Appendices 9-11 illustrate the decomposition of rural-urban differences in under-five child stunting into covariate and coefficient effects in the age groups 0-59, 0-23, and 24-59 months, respectively. The decomposition results are summarized hereunder.

4.3.1. Overall Decomposition Results

The overall decomposition of rural-urban difference in under-five HAZ was achieved by constructing a counterfactual distribution, as detailed in Chapter III Section 3.3. The counterfactual represents the distribution of HAZ that would have resulted in the rural area if rural determinants had similar returns as in the urban area. Figure 5 shows the cumulative distribution function (CDF) of HAZ in rural, urban, and counterfactual groups.

Figure 5: Cumulative Distribution Function in Rural, Urban and Counterfactual Groups



In Figure 5, the difference between the rural and the counterfactual distribution represents *coefficient effect*, which is part of the rural-urban difference explained by differences in returns to determinants. Subsequently, the difference between the counterfactual and the urban distribution indicates *covariate effect*, which is part of the rural-urban difference explained by the differences in levels of determinants. Following observations can be made from the above figure.

First, the plot of counterfactual distribution largely coincides with that of rural distribution. This observation indicates that the coefficient effect is minimal, and most of the rural-urban gap in child stunting is explained by the covariate effect. This finding is consistent with the previous study conducted by Srinivasan et al. (2013). The dominance of covariate effect was also found in a study conducted in China (Liu et al., 2013). Second, the rural-urban difference is minimal at lower quantiles of HAZ distribution. In fact, the rural-urban difference in HAZ was found to be statistically insignificant at 10^{th} quantile in all age groups (Appendices 9-11). This insignificance at the bottom of HAZ distribution suggests that the average HAZ is similar across rural and urban areas for highly vulnerable children.

Aggregate covariate and coefficient effects for age group 0-59 months (from Appendices 9-11) are also graphically plotted and compared in Figure 6. Similar graphs for age groups 0-23 and 24-59 months are included in Appendix 12.

Figure 6: Aggregate Covariate and Coefficient Effects (0-59 months)

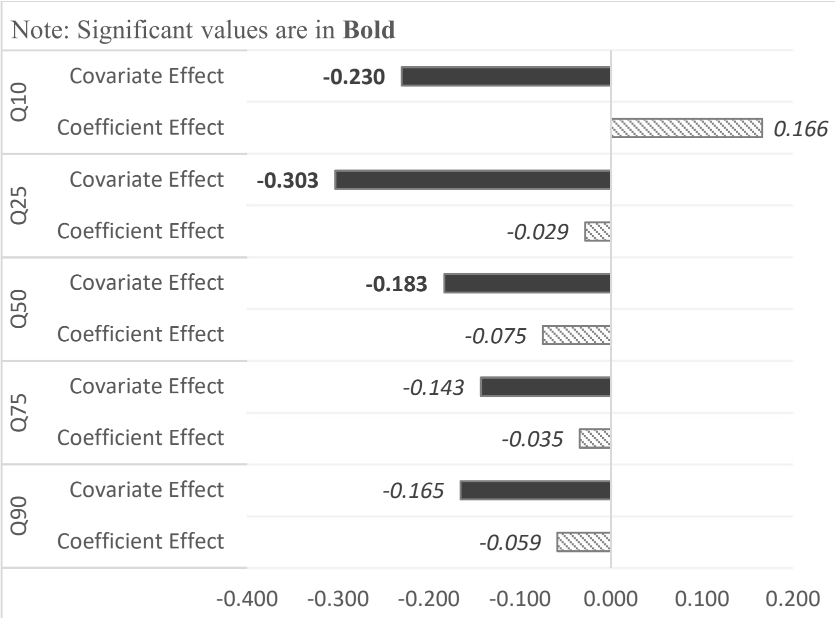


Figure 6 highlights the dominance of covariate over coefficient effect across all the quantiles. The dominance of covariate effect implies that the equalization of rural-urban child nutritional outcome would require an equivalent level of underlying and basic endowments in rural and urban areas. Moreover, the negative sign of covariate effect signifies that any decline in the levels of rural determinants relative to the urban area would further worsen the rural-urban nutritional gap. Such an effect would be witnessed more in the age group 24-59 months where covariate effects are relatively stronger than those in 0-23 months. In the age group 0-23 months, aggregate covariate effects are jointly insignificant, indicating that the combination of determinants is self-adjusting. Irrespective of the significance of the aggregate effect, individual determinants can still be significantly associated with rural-urban difference, as highlighted in the next section.

4.3.2. Detailed Decomposition Results

Decomposition method based on UQR enables further decomposition of aggregate effects into covariate and coefficient effects for each of the determinants in the model. Detailed decomposition results are presented in Appendices 9–11 for age groups 0-59, 0-23, and 24-59 months, respectively. These results are also summarized graphically in terms of the magnitude of significant individual covariate effects in Figure 7. As covariate effects are more dominant, only plots for individual covariate effects are presented here (in Figure 7)[5].

[5] Plots for significant individual coefficient effects are presented in Appendix 13

Figures are rounded to three decimal digits for better readability.

Figure 7: Significant Individual Covariate Effects in Age Groups 0-59, 0-23 and 24-59 months

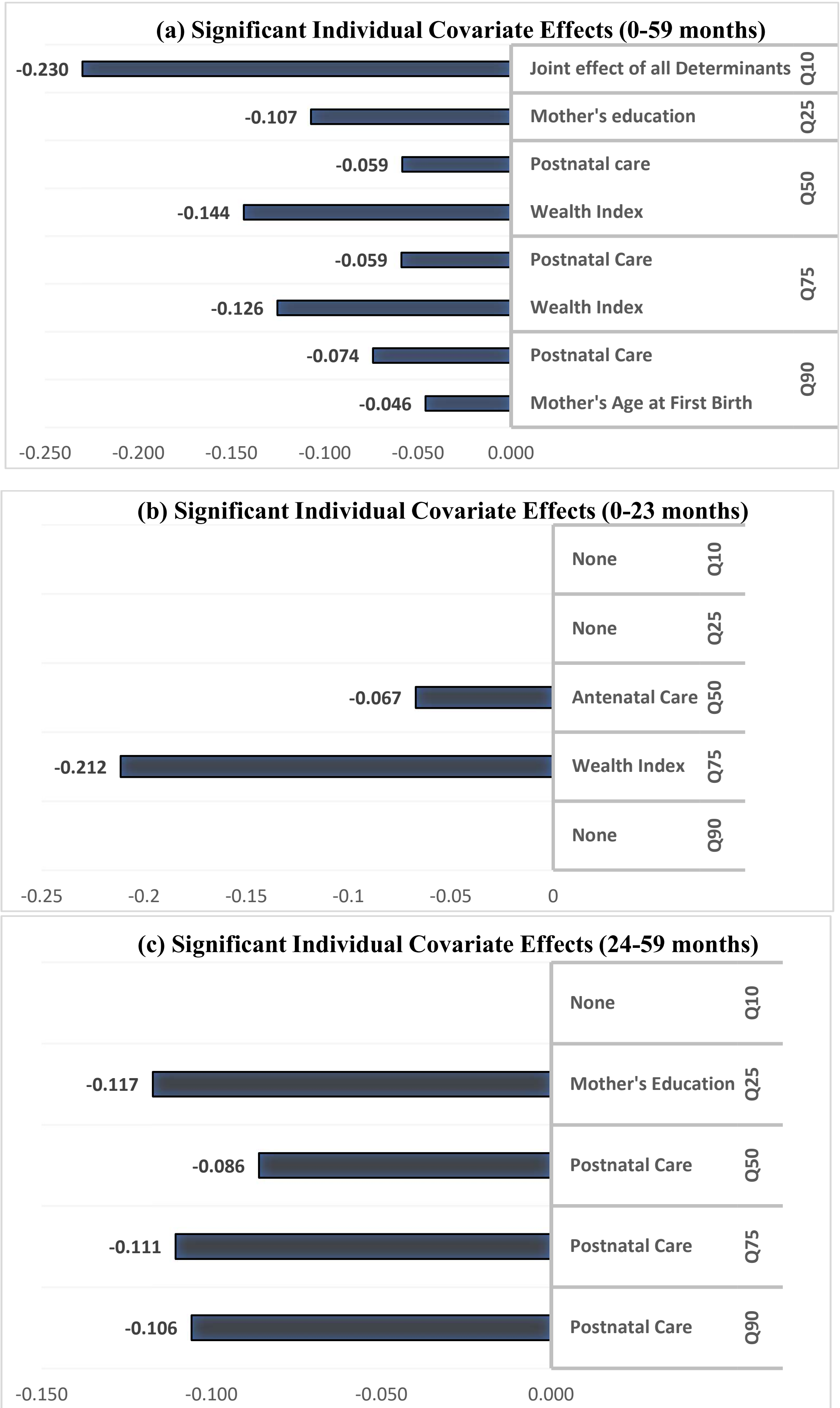


Figure 7 indicates that household wealth, mother's education, and health services environment comprising of postnatal and antenatal care explain most of the rural-urban gap in child stunting in Nepal. Srinivasan et al. (2013) had also concluded on the significant covariate effect of household wealth and parental education in their study. A similar set of determinants were found to explain the rural-urban nutritional gap in China (Liu et al., 2013). Findings from the present study also echo the conclusions made by Smith et al. (2005). Each of the determinants explaining the largest share of rural-urban nutritional gap in Nepal is individually discussed hereunder.

Household wealth was found to be the largest contributor to the covariate effect at higher quantiles in the age group 0-59 and 0-23 months. This finding is close to the results obtained by Hirvonen (2016). The maximum contribution of wealth index at higher quantile signifies that the equalization of rural-urban household wealth would most benefit rural children with a relatively better nutritional outcome. It is, however, imperative to note that wealth index as a proxy for the standard of living also captures household's access to sanitation and safe drinking water in addition to ownership of assets. At this juncture, it is difficult to pinpoint which of these specific correlates of wealth index best contributes to the covariate effect. Nonetheless, an improvement in the wealth index is expected to ensure healthy living conditions for optimal child growth.

Mother's education level was mostly insignificant in rural areas in UQR (Appendices 5-7). Decomposition results suggest that if years of education were to improve for all mothers in rural population at par the urban areas, the rural-urban nutritional gap would have significantly reduced in the lower quantiles of HAZ distribution. The positive association of mother's education on child nutrition has also been highlighted by several studies (Dorsey et al., 2018; Fenske et al., 2013; Smith and Haddad, 2000; Tiwari et al., 2014). The importance of mother's education in narrowing down the rural-urban nutritional gap was also witnessed in Cambodia (Srinivasan et al., 2016). However, mother's education level is significantly lower in rural areas in Nepal (Appendix 3), which could be explained by existing gender discrimination as most of the rural families hesitate to send their girl child to school (Panthhe and McCutcheon, 2015). Higher parental education difference in rural areas (Table 3) further corroborates the presence of gender discrimination in education. This implies that policy mechanisms should strongly prioritize investment in education and gender awareness in rural areas.

This study also highlighted the critical role of **maternal healthcare services** comprising postnatal and antenatal care in explaining the rural-urban nutritional gap, as also shown by earlier studies (Hirvonen, 2016; Paciorek et al., 2013; Srinivasan et al., 2016). Existing literature reveal that unavailability of quality health institutions, long distance to healthcare centres, lower levels of awareness, and rampant traditional practices are the primary reasons for low utilization of postnatal and antenatal care services in rural areas of Nepal (Chalise et al., 2019; Dhakal et al., 2007; Karkee et al., 2013; Målqvist et al., 2017). Improvement in child nutrition, thus, requires substantial proliferation of healthcare services and awareness programs among the rural population.

Contribution of **mother's age at first childbirth** was also high in explaining the rural-urban nutritional gap. The negative effect of early maternal age on child nutritional outcome has been established by previous studies (Fall et al., 2015; Finlay et al., 2011; Raj et al., 2010). In fact, Fall et al. (2015) assert that children born to young mothers aged less than 19 years have a 30-40% increased risk of stunting. This figure was close to mother's mean-age at first childbirth in the rural areas (19.78) in Nepal (Appendix 3). These observations point out that policy efforts in raising the provision and quality of unmet family care needs, women's awareness on reproductive rights as well as devising effective programs to combat early marriage practices should be the way forward to further reducing the rural-urban nutritional gap in Nepal.

Minimal contribution of coefficient effects

The contribution of aggregate coefficient effect was found to be minimal in explaining the existing rural-urban nutritional gap, as also concluded by Srinivasan et al. (2013) in their study. Coefficient effects can be interpreted in terms of differences in quality or structure of available rural-urban endowments. Gender discrimination, lower quality of mother's nutrition, higher structural differences in postnatal care services, and lower returns of household wealth, dependency ratio and mother's access to media were found to contribute most to the aggregate coefficient effect. The minimum contribution of coefficient effect implies that the nature and approach of nutrition intervention need not be fundamentally different in rural and urban areas and that interventions should instead prioritize the equalization of nutrition-sensitive endowments. Srinivasan et al. (2013) had also made a similar recommendation in their study.

To sum up, this study has identified that rural-urban difference in child stunting in Nepal is mostly explained by differences in the levels of household wealth, mother's education, and provision of postnatal and antenatal care across all age groups. Determinants contributing to the rural-urban differences in the age group 0-23 and 24-59 months were found to explain the gap in the overall age group 0-59 months as well. This finding suggests that any interventions made for the expansion of nutrition-sensitive endowments positively contribute to improving the rural-urban nutritional outcome for all children irrespective of their age group. A minimal share of rural-urban differences is also explained in terms of rural-urban differences in gender discrimination, quality of postnatal and antenatal care services as well as returns to household-level economic attributes in all age groups.

4.4. POLICY IMPLICATION

Results from this study should provide ample evidence for Nepal's Multi-Sector Nutrition Plan (MSNP-II) to prioritize interventions that would improve child nutritional outcome in the entire distribution of HAZ. Any interventions thus designed should not be limited only in certain age groups or only among those who are below the WHO cut-off score. Nevertheless, the strategic focus of MSNP-II to ascertain the equitable level of child nutritional outcome across regions, gender, and age groups is encouraging and is supported by the findings from this study.

The bottom-up approach of MSNP-II is well-supported by the findings of this study. MSNP-II is being implemented gradually across different provinces in Nepal. In that context, regional and local level coordination for further expansion and investments in education, gender awareness, and healthcare services should best maximize the improvement of the rural-urban nutritional gap. Decomposition results from this study provide a clear indication for MSNP-II that interventions need not be fundamentally different across rural and urban areas, and that priorities should be made to equalize rural-urban nutrition sensitive endowments.

Overall, the programmatic focus of MSNP-II in improving child nutrition, gender empowerment, bridging regional imbalances, and subsequent local integration and coordination at provincial-level is in line with the findings of this study.

4.5. STRENGTHS AND LIMITATION OF THE STUDY

This research work is the second study, after Srinivasan et al. (2013), that have utilized UQR based decomposition method in the analysis of child stunting in Nepal, and first of its kind to have comparatively analyzed child stunting in three age groups using the most recent province-representative dataset. The strength of this study lies in its use of nationally and sub-nationally representative high-quality dataset as well as in the use of a computationally intensive UQR based decomposition methods.

However, the cross-sectional nature of this study does not allow determining the causal pathways of association of determinants and child stunting or their differences. Nevertheless, this study has identified key policy variables that could best equalize prevailing rural-urban child nutritional gap in Nepal and has also set grounds for future research work.

4.6. ROBUSTNESS CHECKS

Specification and Reweighting errors indicate the robustness of linear approximation and reweighting procedures involved in the decomposition of rural-urban differences. These errors were statistically insignificant as detailed in the last section of decomposition results in Appendices 9–11. Additional robustness checks were also conducted by dropping province, caste and ethnicity, as well as ecological region dummy variables in the reweighting procedure as well as in the linear specification of the model. Resulting coefficients slightly differed in magnitude. However, the overall dominance of covariate effect at aggregate and individual levels remained intact.

CHAPTER V: CONCLUSION AND RECOMMENDATION

5. CONCLUSION AND RECOMMENDATION

The purpose of this study was to quantify whether rural-urban differences in under-five stunting were mostly explained by differences in the levels or returns of nutrition-sensitive endowments. Using recently developed Unconditional Quantile Regression (UQR) methods, the present study analyzed rural-urban differences at different points of child's height-for-age distribution with subsequent comparative analysis at rural, urban, and country levels. Further, UQR based decomposition of rural-urban differences in under-five child stunting was conducted in the entire distribution of child's height-for-age. This study has identified that differences in the levels of household wealth, mother's education and health services environment comprising of postnatal and antenatal care explain the largest share of rural-urban differences in child stunting in Nepal. A minimal share of the rural-urban gap was also explained by differences in prevailing gender discrimination, quality of healthcare services, and household-level economic attributes.

The conclusion made by this study has two crucial recommendations for the currently implemented Multi-sector Nutrition Plan (MSNP-II) in Nepal. First, the findings of this study recommend that nutrition-sensitive interventions need not have different approaches in rural and urban areas. However, the interventions should be coordinated along with national and province-level policy mechanisms to further invest in the expansion of improved sanitation, safe drinking water, mother's education, gender awareness, and healthcare services. Second, this study also recommends MSNP-II to prioritize interventions for all rural and urban under-five children and not only among those who are below the WHO cut-off score.

This study, however, has not been able to determine definitive causal pathways for the existing rural-urban differences and their association with child stunting determinants due to the cross-sectional nature of research. The limitation of this study thus calls for further research on establishing causal pathways of the associations discussed in this study. Moreover, future research work on analyzing the changes in levels and returns of determinants might further add dynamic policy perspective to the conclusions made in this study.

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Appendix 1: An Intuitive Guide to Understanding UQR Results

Results sub-section: Unconditional Quantile Regression Results

Meaning of Key Terminologies

Higher quantile: Unconditional HAZ quantile above 50^{th} quantile comprising of children with relatively better nutritional outcome in terms of height-for-age z-scores

Lower quantile: Unconditional HAZ quantile below 50^{th} quantile comprising of relatively vulnerable children with a deficit in nutritional outcome in terms of height-for-age z-scores

Interpretation of Significant UQR Coefficients/effects

If the Determinant is continuous: A continuous determinant x with a significant positive (or negative) UQR coefficient β at q^{th} quantile is interpreted as following:

> If the mean of x increases by 1 unit for all observations in the group (rural/urban/country), the value of HAZ at q^{th} quantile is expected to increase (or decrease) by β units, keeping all other factors constant.

If the Determinant is categorical: A categorical determinant ($x = 1$ *or* 0) with a significant positive (or negative) UQR coefficient β at q^{th} quantile is interpreted as following:

> If the proportion of observations with $x=1$ increases by 1 percentage point in the group (rural/urban/country), the value of HAZ at q^{th} quantile is expected to increase (or decrease) by $\beta/100$ units, keeping all other factors constant.

Results sub-section: Decomposition Results

Meaning of Key Terminologies

Covariate effect: Differences in the level of determinants. It is also referred to as 'endowment effect' indicating differences in the levels of endowments.

Coefficient effect: Differences in the coefficient of determinants. It is also referred to as 'structural effect' indicating differences in the returns to endowments.

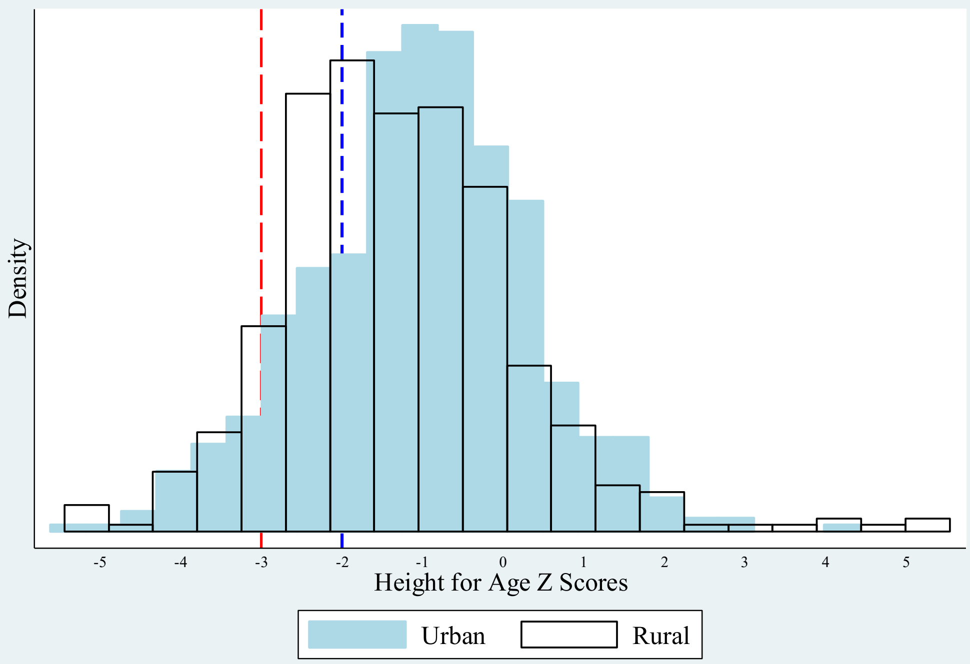
Interpretation of Significant Covariate/Coefficient effects

In overall decomposition: Significant covariate (or coefficient) effect indicates that the rural-urban differences in child stunting are explained by the aggregate rural-urban differences in the levels (or returns) of *all determinants*. Positive covariate (or coefficient) effect indicates a *decrease* in the rural-urban gap in child stunting. Alternately, negative covariate (or coefficient) effect indicates an *increase* in rural-urban gap in child stunting.

In detailed decomposition: Significant covariate (or coefficient) effect indicates that the rural-urban differences in child stunting are explained by the rural-urban differences in the level (or returns) of *specific determinant x* being considered. Interpretation of direction of covariate (or coefficient) effect is the same as stated for Overall decomposition.

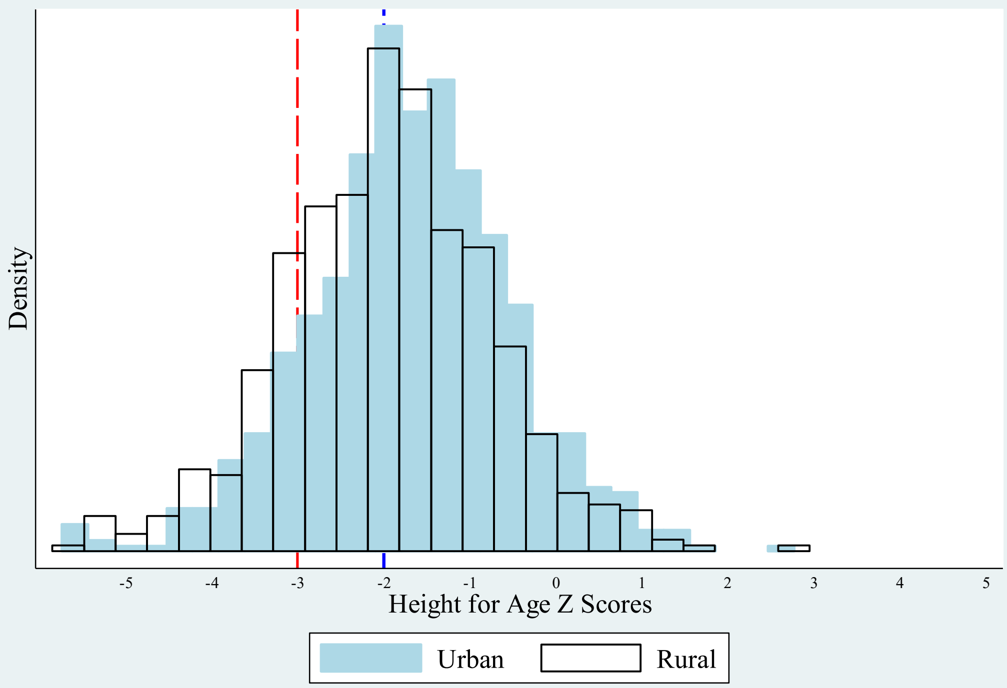
Appendix 2: Rural-Urban HAZ Comparison for Age Groups 0-23 and 24-59 months

Figure 2 (a): Rural-Urban HAZ Comparison for Age Group 0-23 months



Note: Vertical lines at HAZ=-2 and HAZ=-3 represent cut-offs for moderate and severe stunting respectively

Figure 2 (b): Rural-Urban HAZ Comparison for Age Group 24-59 months



Note: Vertical lines at HAZ=-2 and HAZ=-3 represent cut-offs for moderate and severe stunting respectively

Appendix 3: Descriptive Statistics: Continuous Variable

Variables	Weighted Mean of Variable in the Sample			
	Country-level	Rural	Urban	Difference[1]
Child-level Characteristics				
HAZ	-1.516 *(1.35)*	-1.638 *(1.31)*	-1.408 *(1.37)*	-0.230**
Child's age (in months)	29.448 *(17.2)*	29.103 *(16.51)*	29.755 *(17.8)*	-0.651
Education				
Parental Education Difference	1.777 *(5.01)*	2.301 *(4.85)*	1.311 *(5.09)*	0.990***
Mother's Education (in years)	4.873 *(4.33)*	3.809 *(3.9)*	5.818 *(4.49)*	-2.009***
Economic Attributes				
Wealth Index	-0.016 *(0.89)*	-0.302 *(0.68)*	0.239 *(0.99)*	-0.541***
Dependency Ratio	1.251 *(0.91)*	1.339 *(0.89)*	1.173 *(0.92)*	0.166**
Decision-making and Empowerment Attributes				
Decision-making and Ownership measure	0.422 *(0.37)*	0.364 *(0.35)*	0.473 *(0.38)*	-0.109***
Mother's Age at First Childbirth	19.786 *(0.26)*	19.344 *(3.12)*	20.179 *(3.63)*	-0.836***
Total Weighted Sample (N)	**2362**	**1110**	**1252**	

(1): Rural-Urban Difference (Adjusted Wald Test p-value reported as: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001) Standard Deviations are in Parenthesis.

Appendix 4: Descriptive Statistics: Categorical Variables

Variables	Weighted Proportion of Categories in Sample				Weighted Mean HAZ in Categories			
	Country	Rural	Urban	Difference[(1)]	Country	Rural	Urban	Difference[(1)]
Child-level Characteristics								
Child's Gender								
Male	52.24% *(0.50)*	51.51% *(0.48)*	52.88% *(0.51)*	-1.36 %	-1.53 *(1.37)*	-1.68 *(1.29)*	-1.40 *(1.42)*	-0.275**
Female	47.76% *(0.50)*	48.49% *(0.48)*	47.12% *(0.51)*	1.36 %	-1.50 *(1.33)*	-1.59 *(1.32)*	-1.41 *(1.32)*	-0.182+
Birth Order								
Second/Third Child	18.37% *(0.47)*	20.75% *(0.39)*	16.27% *(0.38)*	4.48 % *	-1.96 *(1.27)*	-2.07 *(1.13)*	-1.83 *(1.42)*	-0.239
First Child	81.63% *(0.39)*	79.25% *(0.39)*	83.73% *(0.38)*	-4.48 % *	-1.42 *(1.35)*	-1.52 *(1.33)*	-1.32 *(1.35)*	-0.199*
Child's Size at Birth								
>=Average	83.24% *(0.39)*	82.38% *(0.37)*	84.00% *(0.38)*	-1.62 %	-1.46 *(1.34)*	-1.60 *(1.28)*	-1.34 *(1.37)*	-0.267**
<Average	16.76% *(0.37)*	17.62% *(0.37)*	16.00% *(0.38)*	1.62 %	-1.79 *(1.38)*	-1.80 *(1.42)*	-1.78 *(1.33)*	-0.020
Health Services Environment								
Child born in Hospital								
Yes	54.35% *(0.5)*	41.21% *(0.48)*	66.01% *(0.49)*	-24.79 % ***	-1.31 *(1.31)*	-1.41 *(1.29)*	-1.25 *(1.30)*	-0.165
No	45.65% *(3.42)*	58.79% *(0.48)*	33.99% *(0.49)*	24.79 % ***	-1.76 *(1.36)*	-1.80 *(1.30)*	-1.71 *(1.45)*	-0.080
Antenatal Care								
>=4 ANC Visits	66.46% *(0.47)*	59.15% *(0.47)*	72.96% *(0.46)*	-13.81 % ***	-1.38 *(1.35)*	-1.51 *(1.31)*	-1.29 *(1.37)*	-0.223*
<4 ANC Visits	33.54% *(0.50)*	40.85% *(0.47)*	27.04% *(0.46)*	13.81 % ***	-1.76 *(1.31)*	-1.81 *(1.29)*	-1.69 *(1.31)*	-0.114
Postnatal Care								
Provided	44.48% *(0.50)*	34.68% *(0.46)*	53.18% *(0.51)*	-18.49 % ***	-1.32 *(1.31)*	-1.49 *(1.29)*	-1.23 *(1.31)*	-0.260*
Delayed/Not Provided	55.52% *(0.47)*	65.32% *(0.46)*	46.82% *(0.51)*	18.49 % ***	-1.67 *(1.36)*	-1.72 *(1.31)*	-1.61 *(1.42)*	-0.105
Preceding Birth Interval								
No or <24 months	52.85% *(0.37)*	52.76% *(0.48)*	52.93% *(0.51)*	-0.17 %	-1.46 *(1.34)*	-1.69 *(1.24)*	-1.25 *(1.38)*	-0.443***
>24 Months	47.15% *(0.50)*	47.24% *(0.48)*	47.07% *(0.51)*	0.17 %	-1.58 *(1.36)*	-1.58 *(1.38)*	-1.59 *(1.34)*	0.008

(Continued on next page)

Appendix 4: Descriptive Statistics: Categorical Variables

Variables	Weighted Proportion of Categories in Sample				Weighted Mean HAZ in Categories			
	Country	Rural	Urban	Difference(1)	Country	Rural	Urban	Difference(1)
Economic Attributes								
Mother's Working Status								
Working	60.30% *(0.49)*	62.26% *(0.47)*	58.57% *(0.51)*	3.69 %	-1.64 *(1.41)*	-1.70 *(1.43)*	-1.58 *(1.39)*	-0.119
Not Working	39.70% *(0.47)*	37.74% *(0.47)*	41.43% *(0.51)*	-3.69 %	-1.32 *(1.23)*	-1.53 *(1.11)*	-1.16 *(1.30)*	-0.373***
Household Food Security and Mother's nutrition								
Household Food Security								
Secure	63.67% *(0.48)*	60.56% *(0.47)*	66.43% *(0.49)*	-5.87 % +	-1.42 *(1.30)*	-1.52 *(1.24)*	-1.34 *(1.34)*	-0.182+
Insecure	36.33% *(0.49)*	39.44% *(0.47)*	33.57% *(0.49)*	5.87 % +	-1.68 *(1.42)*	-1.82 *(1.40)*	-1.54 *(1.43)*	-0.275*
Mother's BMI								
Healthy Weight	64.10% *(0.48)*	66.22% *(0.46)*	62.21% *(0.50)*	4.01 %	-1.57 *(1.35)*	-1.67 *(1.31)*	-1.48 *(1.38)*	-0.192*
Underweight	20.21% *(0.48)*	22.50% *(0.40)*	18.18% *(0.40)*	4.31 %	-1.80 *(1.28)*	-1.87 *(1.14)*	-1.72 *(1.43)*	-0.149
Overweight	15.69% *(0.4)*	11.28% *(0.31)*	19.60% *(0.41)*	-8.33 % ***	-1.10 *(1.29)*	-1.02 *(1.55)*	-1.14 *(1.13)*	0.114
Mother's Minimum Dietary Diversity								
Achieved	66.83% *(0.47)*	62.40% *(0.47)*	70.75% *(0.47)*	-8.35 % **	-1.49 *(1.34)*	-1.62 *(1.34)*	-1.38 *(1.32)*	-0.242**
Not Achieved	33.17% *(0.50)*	37.60% *(0.47)*	29.25% *(0.47)*	8.35 % **	-1.58 *(1.37)*	-1.67 *(1.25)*	-1.48 *(1.50)*	-0.190
Decision-making and Empowerment Attributes								
Sex of Household Head								
Male	68.11% *(0.36)*	72.71% *(0.43)*	64.03% *(0.49)*	8.68 % **	-1.50 *(1.38)*	-1.60 *(1.36)*	-1.39 *(1.39)*	-0.213*
Female	31.89% *(0.47)*	27.29% *(0.43)*	35.97% *(0.49)*	-8.68 % **	-1.56 *(1.28)*	-1.73 *(1.15)*	-1.44 *(1.35)*	-0.293*
Mother's Exposure to Media								
Yes	53.13% *(0.50)*	45.84% *(0.48)*	59.61% *(0.51)*	-13.77 % ***	-1.31 *(1.32)*	-1.40 *(1.37)*	-1.24 *(1.27)*	-0.161+
No	46.87% *(0.50)*	54.16% *(0.48)*	40.39% *(0.51)*	13.77 % ***	-1.75 *(1.34)*	-1.84 *(1.21)*	-1.65 *(1.49)*	-0.184+
Weighted Sample (N)					**Aggregated Weighted Mean**			
% of N	100%	47.01%	52.99%		**Country**	**Rural**	**Urban**	**Difference(1)**
Total N	**2362**	**1110**	**1252**		-1.52 *(1.35)*	-1.64 *(1.31)*	-1.41 *(1.37)*	-0.230**

(1): Rural-Urban Difference (Adjusted Wald Test p-value reported as: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001) Standard Deviations are in Parenthesis.

Appendix 5: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Child-level Characteristics													
Child's Gender (Female) [a]	Country	0.08978	*(0.06)*	0.01793	*(0.10)*	0.09267	*(0.07)*	0.03342	*(0.07)*	0.01535	*(0.08)*	0.07096	*(0.12)*
	Rural	0.11087	*(0.09)*	-0.06139	*(0.12)*	**0.22111***	*(0.11)*	0.12353	*(0.10)*	0.17185	*(0.14)*	0.17637	*(0.20)*
	Urban	0.06741	*(0.07)*	0.14717	*(0.17)*	0.12225	*(0.09)*	-0.02331	*(0.09)*	-0.03126	*(0.11)*	-0.07381	*(0.16)*
Age- Squared	Country	**0.00078*****	*(0.00)*	0.00003	*(0.00)*	**0.00045***	*(0.00)*	**0.00086*****	*(0.00)*	**0.00120*****	*(0.00)*	**0.00133*****	*(0.00)*
	Rural	**0.00078*****	*(0.00)*	0.00016	*(0.00)*	0.00029	*(0.00)*	**0.00084*****	*(0.00)*	**0.00128*****	*(0.00)*	**0.00116*****	*(0.00)*
	Urban	**0.00080*****	*(0.00)*	-0.00018	*(0.00)*	**0.00071****	*(0.00)*	**0.00078*****	*(0.00)*	**0.00125*****	*(0.00)*	**0.00164*****	*(0.00)*
Age of the Child (in months)	Country	**-0.06621*****	*(0.01)*	-0.00807	*(0.02)*	**-0.03532*****	*(0.01)*	**-0.06835*****	*(0.01)*	**-0.09715*****	*(0.01)*	**-0.11612*****	*(0.02)*
	Rural	**-0.06415*****	*(0.01)*	-0.01275	*(0.02)*	-0.02233	*(0.01)*	**-0.06227*****	*(0.01)*	**-0.09785*****	*(0.02)*	**-0.10382*****	*(0.02)*
	Urban	**-0.06975*****	*(0.01)*	0.00025	*(0.02)*	**-0.05205*****	*(0.01)*	**-0.06642*****	*(0.01)*	**-0.10293*****	*(0.02)*	**-0.13721*****	*(0.03)*
Birth Order (First Child) [b]	Country	0.03425	*(0.09)*	**0.36467***	*(0.19)*	0.22180	*(0.14)*	0.12019	*(0.11)*	-0.11433	*(0.11)*	**-0.37733***	*(0.18)*
	Rural	0.08035	*(0.12)*	0.27254	*(0.24)*	**0.38627+**	*(0.23)*	0.25355	*(0.16)*	-0.06084	*(0.15)*	-0.23896	*(0.18)*
	Urban	0.01007	*(0.12)*	0.31668	*(0.27)*	0.11452	*(0.19)*	-0.00923	*(0.14)*	-0.19651	*(0.15)*	**-0.45280+**	*(0.27)*
Child's Size at Birth (Smaller than Average) [c]	Country	**-0.23594****	*(0.08)*	-0.19302	*(0.15)*	**-0.22797+**	*(0.13)*	**-0.32225****	*(0.10)*	**-0.24329***	*(0.12)*	-0.19403	*(0.14)*
	Rural	-0.08530	*(0.12)*	-0.05182	*(0.16)*	-0.28391	*(0.17)*	**-0.23791+**	*(0.14)*	-0.17547	*(0.17)*	-0.03732	*(0.22)*
	Urban	**-0.38020*****	*(0.11)*	**-0.47429+**	*(0.28)*	**-0.30898***	*(0.15)*	**-0.50551*****	*(0.14)*	**-0.34659***	*(0.15)*	**-0.37663***	*(0.19)*
Education													
Parental Education Difference	Country	-0.00062	*(0.01)*	-0.00966	*(0.02)*	-0.01081	*(0.02)*	-0.00232	*(0.01)*	-0.00381	*(0.01)*	0.00274	*(0.01)*
	Rural	0.01030	*(0.02)*	0.01977	*(0.02)*	-0.00017	*(0.03)*	0.00434	*(0.02)*	0.00777	*(0.02)*	0.01152	*(0.02)*
	Urban	-0.01357	*(0.01)*	-0.05007	*(0.03)*	-0.02341	*(0.02)*	-0.01491	*(0.01)*	-0.01935	*(0.02)*	-0.01628	*(0.02)*
Mother's Education (in years)	Country	**0.01824+**	*(0.01)*	0.02417	*(0.02)*	**0.02673+**	*(0.02)*	0.01529	*(0.01)*	0.02345	*(0.01)*	0.01576	*(0.02)*
	Rural	0.00879	*(0.02)*	0.02777	*(0.02)*	0.00954	*(0.02)*	-0.00007	*(0.02)*	0.01833	*(0.02)*	-0.00181	*(0.03)*
	Urban	0.01869	*(0.01)*	0.02882	*(0.03)*	**0.04773***	*(0.02)*	-0.00366	*(0.02)*	-0.00182	*(0.02)*	0.00475	*(0.04)*
Health Services Environment													
Child Born in Hospital (Yes) [d]	Country	0.00982	*(0.08)*	0.22433	*(0.14)*	**0.18534+**	*(0.11)*	-0.06530	*(0.10)*	-0.09990	*(0.11)*	-0.16537	*(0.17)*
	Rural	0.03973	*(0.13)*	0.19650	*(0.15)*	0.09350	*(0.13)*	-0.00091	*(0.14)*	-0.04222	*(0.17)*	-0.05917	*(0.27)*
	Urban	-0.01434	*(0.11)*	0.12741	*(0.26)*	0.09160	*(0.16)*	-0.04545	*(0.13)*	-0.07007	*(0.16)*	-0.28623	*(0.20)*

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Appendix 5: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Antenatal Care (At least 4 ANC Visits) [e]	Country	0.06613	*(0.09)*	0.05244	*(0.15)*	0.03661	*(0.11)*	0.02816	*(0.10)*	0.08588	*(0.11)*	0.02241	*(0.15)*
	Rural	0.03765	*(0.12)*	0.11409	*(0.14)*	0.08739	*(0.15)*	0.02384	*(0.16)*	0.01509	*(0.16)*	-0.12017	*(0.22)*
	Urban	0.12961	*(0.12)*	0.11509	*(0.32)*	0.08606	*(0.17)*	0.04097	*(0.13)*	**0.22468+**	*(0.13)*	0.21449	*(0.19)*
Postnatal Care (Provided)[f]	Country	0.05148	*(0.08)*	-0.06964	*(0.13)*	-0.00029	*(0.11)*	**0.17351+**	*(0.10)*	**0.20708***	*(0.10)*	0.10956	*(0.14)*
	Rural	-0.06558	*(0.12)*	0.00746	*(0.15)*	-0.03390	*(0.18)*	0.03274	*(0.16)*	-0.03344	*(0.16)*	-0.31438	*(0.23)*
	Urban	0.15547	*(0.10)*	-0.13473	*(0.22)*	0.06354	*(0.15)*	**0.30424****	*(0.12)*	**0.30923***	*(0.14)*	**0.39589***	*(0.19)*
Preceding Birth Interval (>24 months)[g]	Country	-0.04718	*(0.07)*	-0.18276	*(0.11)*	0.09104	*(0.08)*	0.02494	*(0.07)*	0.00267	*(0.10)*	-0.03321	*(0.14)*
	Rural	0.08228	*(0.09)*	-0.12573	*(0.14)*	**0.21149+**	*(0.13)*	**0.30538***	*(0.13)*	0.12324	*(0.13)*	0.05454	*(0.18)*
	Urban	**-0.20510***	*(0.10)*	-0.26697	*(0.19)*	-0.10327	*(0.11)*	**-0.31840****	*(0.11)*	-0.09495	*(0.15)*	-0.12469	*(0.21)*
Economic Attributes													
Wealth Index	Country	**0.17213****	*(0.06)*	0.01206	*(0.09)*	0.11338	*(0.07)*	**0.17504****	*(0.07)*	**0.17887***	*(0.07)*	**0.35810*****	*(0.10)*
	Rural	**0.42479*****	*(0.12)*	0.14078	*(0.14)*	**0.32787***	*(0.13)*	**0.38209****	*(0.13)*	**0.35738***	*(0.16)*	**0.55264****	*(0.21)*
	Urban	**0.14538***	*(0.07)*	0.01649	*(0.13)*	0.05341	*(0.10)*	**0.24122****	*(0.08)*	**0.21308***	*(0.09)*	0.17177	*(0.14)*
Mother's Working Status (Working)[h]	Country	**-0.12684+**	*(0.07)*	**-0.31740****	*(0.12)*	**-0.19861***	*(0.09)*	**-0.17004***	*(0.08)*	-0.09864	*(0.10)*	0.07515	*(0.14)*
	Rural	-0.06071	*(0.12)*	**-0.31782***	*(0.16)*	-0.21710	*(0.14)*	-0.07549	*(0.15)*	0.06959	*(0.17)*	0.18434	*(0.24)*
	Urban	**-0.17580***	*(0.09)*	**-0.32369+**	*(0.17)*	-0.18780	*(0.12)*	**-0.18861+**	*(0.10)*	-0.09829	*(0.14)*	-0.09874	*(0.20)*
Dependency Ratio	Country	**-0.08835***	*(0.04)*	**-0.21061***	*(0.08)*	**-0.10187+**	*(0.06)*	-0.07389	*(0.05)*	-0.06894	*(0.05)*	-0.08018	*(0.08)*
	Rural	**-0.10586***	*(0.05)*	**-0.18234+**	*(0.09)*	**-0.12801+**	*(0.07)*	**-0.14325***	*(0.06)*	-0.05149	*(0.07)*	-0.05961	*(0.11)*
	Urban	-0.04008	*(0.07)*	-0.21081	*(0.15)*	-0.00567	*(0.09)*	-0.00941	*(0.07)*	-0.05920	*(0.07)*	-0.01347	*(0.11)*
Household Food Security and Mother's Nutrition													
HH Food Security (Secure) [i]	Country	0.01854	*(0.07)*	0.09544	*(0.13)*	0.16111	*(0.10)*	-0.00951	*(0.08)*	-0.09221	*(0.09)*	-0.23005	*(0.16)*
	Rural	-0.03326	*(0.11)*	0.21493	*(0.16)*	0.08711	*(0.15)*	0.04363	*(0.13)*	-0.10226	*(0.15)*	-0.28518	*(0.21)*
	Urban	-0.02346	*(0.11)*	-0.12505	*(0.23)*	0.14714	*(0.16)*	-0.02608	*(0.12)*	-0.07178	*(0.14)*	-0.18307	*(0.22)*

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Appendix 5: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Mother's BMI (Underweight) (j)	Country	-0.11366	*(0.09)*	-0.29297	*(0.18)*	-0.18515	*(0.12)*	-0.15132	*(0.10)*	0.04720	*(0.11)*	0.10036	*(0.15)*
	Rural	**-0.19554+**	*(0.12)*	-0.11607	*(0.19)*	-0.13662	*(0.15)*	-0.19181	*(0.14)*	**-0.32394***	*(0.15)*	-0.10643	*(0.22)*
	Urban	-0.02339	*(0.15)*	-0.56185	*(0.36)*	-0.12687	*(0.18)*	0.07188	*(0.15)*	0.33404*	*(0.16)*	0.07247	*(0.21)*
Mother's BMI (Overweight) (j)	Country	**0.33836****	*(0.11)*	**0.30014+**	*(0.17)*	**0.24936***	*(0.11)*	**0.25806+**	*(0.13)*	**0.32410***	*(0.14)*	**0.42219+**	*(0.24)*
	Rural	**0.42219***	*(0.17)*	0.10978	*(0.18)*	0.06336	*(0.18)*	**0.34382+**	*(0.20)*	**0.66698****	*(0.23)*	**0.76952+**	*(0.41)*
	Urban	**0.28593***	*(0.13)*	**0.46390+**	*(0.25)*	**0.26625+**	*(0.16)*	**0.26279+**	*(0.16)*	0.07428	*(0.18)*	0.27810	*(0.30)*
Decision making and Empowerment Attributes													
Sex of Household Head (Female) (k)	Country	-0.09585	*(0.08)*	0.09228	*(0.11)*	-0.04074	*(0.10)*	-0.04562	*(0.10)*	-0.14396	*(0.11)*	-0.21916	*(0.15)*
	Rural	-0.12500	*(0.12)*	**0.24634***	*(0.13)*	-0.03016	*(0.16)*	-0.01011	*(0.15)*	-0.11943	*(0.17)*	-0.29553	*(0.19)*
	Urban	-0.05848	*(0.12)*	0.02647	*(0.20)*	-0.03385	*(0.14)*	-0.00896	*(0.14)*	-0.19591	*(0.14)*	-0.05127	*(0.21)*
Decision making and Ownership measure	Country	**0.27725****	*(0.11)*	0.13729	*(0.17)*	0.10729	*(0.14)*	**0.26702***	*(0.12)*	**0.35292***	*(0.14)*	**0.72779*****	*(0.22)*
	Rural	**0.33594***	*(0.16)*	0.04366	*(0.21)*	-0.00928	*(0.20)*	**0.34794+**	*(0.19)*	0.17867	*(0.21)*	**0.64527***	*(0.29)*
	Urban	0.17898	*(0.14)*	0.27811	*(0.27)*	-0.00126	*(0.19)*	0.11237	*(0.15)*	**0.36483+**	*(0.19)*	0.36744	*(0.28)*
Mother's Exposure to Media (Yes) (l)	Country	0.10509	*(0.07)*	0.07924	*(0.13)*	0.14433	*(0.10)*	0.13125	*(0.08)*	0.05083	*(0.09)*	0.10439	*(0.15)*
	Rural	0.16483	*(0.11)*	-0.16451	*(0.15)*	0.15961	*(0.14)*	**0.23762+**	*(0.12)*	**0.30586***	*(0.15)*	**0.37090+**	*(0.22)*
	Urban	0.01994	*(0.09)*	0.33064	*(0.24)*	0.12162	*(0.13)*	-0.03815	*(0.12)*	-0.10686	*(0.11)*	-0.16194	*(0.19)*
Mother's Age at First Childbirth	Country	-0.00097	*(0.01)*	-0.02281	*(0.02)*	0.00703	*(0.01)*	0.00328	*(0.01)*	0.01944	*(0.01)*	0.01900	*(0.02)*
	Rural	-0.02118	*(0.02)*	-0.01941	*(0.02)*	-0.01368	*(0.02)*	-0.00611	*(0.02)*	0.01656	*(0.02)*	-0.04075	*(0.03)*
	Urban	0.01770	*(0.01)*	-0.00801	*(0.03)*	0.00918	*(0.02)*	0.00348	*(0.02)*	**0.03821***	*(0.02)*	**0.06252***	*(0.03)*
Constant	Country	-0.97449**	*(0.36)*	-3.13500***	*(0.62)*	-2.65775***	*(0.48)*	-1.13481**	*(0.38)*	-0.29259	*(0.42)*	1.37077*	*(0.56)*
	Rural	-0.43208	*(0.56)*	-2.84632***	*(0.69)*	-2.19150***	*(0.61)*	-1.17671*	*(0.58)*	-0.38250	*(0.65)*	2.33139**	*(0.88)*
	Urban	-1.18529*	*(0.47)*	-3.34525***	*(0.96)*	-2.58737***	*(0.62)*	-0.76535	*(0.48)*	-0.43932	*(0.63)*	1.20029	*(0.93)*
R-sqr	Country	0.197		0.091		0.114		0.142		0.142		0.109	
	Rural	0.198		0.101		0.124		0.141		0.149		0.133	
	Urban	0.231		0.139		0.134		0.170		0.169		0.133	

(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001) Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Reps.

Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Provinces ; (N=2372 (Country), N= 1039 (Rural), N= 1333 (Urban))

Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Healthy Weight (k) Male (l) Not following magazine/TV/Radio even once in a week

Appendix 6: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-23 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Child-level Characteristics													
Child's Gender (Female) [a]	Country	**0.19894***	*(0.09)*	0.21064	*(0.16)*	0.14552	*(0.13)*	0.15994	*(0.12)*	0.09125	*(0.13)*	0.10620	*(0.21)*
	Rural	**0.26207+**	*(0.15)*	0.27758	*(0.19)*	0.17259	*(0.18)*	0.25762	*(0.21)*	0.27938	*(0.19)*	0.40335	*(0.31)*
	Urban	0.10112	*(0.13)*	0.07783	*(0.27)*	0.14239	*(0.19)*	-0.10710	*(0.19)*	0.13781	*(0.21)*	-0.13783	*(0.30)*
Age- Squared	Country	-0.00157	*(0.00)*	**-0.00509***	*(0.00)*	-0.00068	*(0.00)*	-0.00100	*(0.00)*	0.00115	*(0.00)*	0.00054	*(0.00)*
	Rural	-0.00067	*(0.00)*	**-0.00460+**	*(0.00)*	0.00217	*(0.00)*	0.00160	*(0.00)*	0.00320	*(0.00)*	0.00240	*(0.00)*
	Urban	-0.00248	*(0.00)*	**-0.00791***	*(0.00)*	**-0.00447+**	*(0.00)*	-0.00100	*(0.00)*	0.00027	*(0.00)*	-0.00095	*(0.00)*
Age of the Child (in months)	Country	-0.02407	*(0.04)*	**0.10122+**	*(0.06)*	-0.03560	*(0.05)*	-0.06227	*(0.04)*	**-0.11069***	*(0.05)*	-0.10018	*(0.07)*
	Rural	-0.03952	*(0.05)*	0.10381	*(0.07)*	-0.08482	*(0.07)*	-0.11989	*(0.08)*	**-0.18458***	*(0.08)*	-0.13068	*(0.10)*
	Urban	-0.01404	*(0.05)*	0.14337	*(0.10)*	0.02663	*(0.07)*	-0.07718	*(0.06)*	-0.07859	*(0.08)*	-0.05097	*(0.10)*
Birth Order (First Child) [b]	Country	**-0.53561***	*(0.24)*	-0.51947	*(0.52)*	-0.46585	*(0.53)*	-0.43538	*(0.46)*	-0.02698	*(0.35)*	-0.47563	*(0.50)*
	Rural	-0.49000	*(0.35)*	**-0.85480***	*(0.38)*	-0.47647	*(0.62)*	-1.00671	*(0.78)*	0.30304	*(0.53)*	0.11342	*(0.56)*
	Urban	-0.46237	*(0.42)*	-0.12669	*(1.00)*	-0.45218	*(0.90)*	-0.00268	*(0.62)*	0.19437	*(0.47)*	-0.93252	*(0.60)*
Child's Size at Birth (Smaller than Average) [c]	Country	**-0.34330***	*(0.14)*	-0.31462	*(0.23)*	**-0.40405***	*(0.19)*	**-0.49547****	*(0.17)*	**-0.36569+**	*(0.19)*	-0.14071	*(0.28)*
	Rural	-0.20091	*(0.20)*	-0.28087	*(0.26)*	**-0.43665***	*(0.22)*	-0.37974	*(0.25)*	-0.16335	*(0.28)*	-0.06662	*(0.43)*
	Urban	**-0.65093*****	*(0.19)*	-0.24849	*(0.45)*	**-0.56944+**	*(0.32)*	**-0.73727****	*(0.25)*	**-0.73308****	*(0.25)*	**-0.69552+**	*(0.38)*
Education													
Parental Education Difference	Country	0.01603	*(0.02)*	0.00366	*(0.03)*	-0.00059	*(0.03)*	0.04004	*(0.02)*	0.00373	*(0.02)*	-0.01518	*(0.03)*
	Rural	0.03107	*(0.03)*	0.01622	*(0.04)*	0.05364	*(0.04)*	**0.06644***	*(0.03)*	0.02764	*(0.03)*	-0.01134	*(0.05)*
	Urban	0.00008	*(0.03)*	-0.00100	*(0.06)*	-0.05680	*(0.04)*	0.03614	*(0.03)*	-0.01967	*(0.04)*	-0.00601	*(0.04)*
Mother's Education (in years)	Country	0.02397	*(0.02)*	0.03169	*(0.03)*	0.01535	*(0.03)*	0.04058	*(0.03)*	0.02366	*(0.03)*	0.01428	*(0.04)*
	Rural	0.01479	*(0.03)*	0.03073	*(0.04)*	0.04748	*(0.04)*	**0.06858+**	*(0.04)*	0.03548	*(0.04)*	0.00736	*(0.06)*
	Urban	0.03329	*(0.03)*	0.03056	*(0.07)*	-0.01386	*(0.05)*	0.02696	*(0.04)*	0.01411	*(0.05)*	0.07743	*(0.06)*
Health Services Environment													
Child Born in Hospital (Yes) [d]	Country	0.04430	*(0.15)*	0.23076	*(0.25)*	-0.02274	*(0.19)*	-0.18203	*(0.17)*	0.14732	*(0.21)*	0.18767	*(0.29)*
	Rural	0.00900	*(0.24)*	0.17464	*(0.27)*	0.00746	*(0.22)*	-0.36523	*(0.28)*	-0.09386	*(0.29)*	0.47692	*(0.46)*
	Urban	0.11633	*(0.18)*	0.30843	*(0.53)*	-0.16168	*(0.30)*	-0.00586	*(0.25)*	0.25217	*(0.28)*	0.47035	*(0.39)*

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Appendix 6: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-23 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Antenatal Care (At least 4 ANC Visits) (e)	Country	**0.24031***	*(0.12)*	0.23560	*(0.19)*	0.10985	*(0.16)*	**0.38940***	*(0.16)*	**0.30629+**	*(0.16)*	0.41668	*(0.27)*
	Rural	0.22203	*(0.19)*	0.20187	*(0.20)*	0.04877	*(0.20)*	0.32947	*(0.24)*	0.23010	*(0.24)*	0.20454	*(0.39)*
	Urban	**0.27025+**	*(0.16)*	0.56315	*(0.44)*	0.23282	*(0.26)*	**0.48155***	*(0.20)*	**0.47010***	*(0.23)*	**0.46263+**	*(0.28)*
Postnatal Care (Provided)(f)	Country	0.08396	*(0.14)*	0.15262	*(0.21)*	0.30133	*(0.19)*	**0.40329***	*(0.17)*	-0.07809	*(0.18)*	-0.41989	*(0.28)*
	Rural	-0.07102	*(0.24)*	-0.10940	*(0.26)*	0.20471	*(0.28)*	0.39476	*(0.27)*	-0.05489	*(0.28)*	-0.61485	*(0.41)*
	Urban	0.22096	*(0.15)*	**0.51303+**	*(0.31)*	**0.45060+**	*(0.24)*	**0.42687***	*(0.21)*	0.08165	*(0.25)*	-0.29508	*(0.35)*
Preceding Birth Interval (>24 months)(g)	Country	-0.01399	*(0.13)*	0.06797	*(0.20)*	**0.32474+**	*(0.17)*	0.02122	*(0.15)*	-0.13583	*(0.18)*	-0.38966	*(0.26)*
	Rural	0.17702	*(0.18)*	0.08756	*(0.26)*	**0.58365****	*(0.21)*	**0.38980+**	*(0.20)*	0.04230	*(0.24)*	0.03061	*(0.38)*
	Urban	**-0.35369***	*(0.18)*	-0.04354	*(0.34)*	-0.09855	*(0.22)*	-0.27283	*(0.22)*	**-0.49039+**	*(0.27)*	**-0.66818+**	*(0.35)*
Economic Attributes													
Wealth Index	Country	**0.25135****	*(0.09)*	0.07711	*(0.13)*	0.09922	*(0.10)*	**0.20716***	*(0.10)*	**0.36858****	*(0.13)*	0.38217	*(0.24)*
	Rural	**0.40073***	*(0.17)*	0.29576	*(0.20)*	0.19790	*(0.17)*	0.12417	*(0.23)*	0.20768	*(0.21)*	0.24476	*(0.38)*
	Urban	**0.25579***	*(0.12)*	0.02510	*(0.24)*	0.30351+	*(0.16)*	**0.25654+**	*(0.15)*	**0.42447***	*(0.20)*	-0.06398	*(0.30)*
Mother's Working Status (Working)(h)	Country	-0.12526	*(0.12)*	**-0.35104***	*(0.18)*	-0.14305	*(0.16)*	-0.08510	*(0.15)*	-0.04045	*(0.16)*	-0.14247	*(0.28)*
	Rural	-0.14078	*(0.20)*	**-0.52056***	*(0.25)*	-0.27055	*(0.25)*	-0.15119	*(0.26)*	0.03691	*(0.28)*	0.14448	*(0.38)*
	Urban	-0.23489	*(0.15)*	-0.32940	*(0.29)*	-0.14024	*(0.22)*	-0.12124	*(0.19)*	-0.09762	*(0.23)*	**-0.69180+**	*(0.36)*
Dependency Ratio	Country	-0.07954	*(0.07)*	-0.21012	*(0.14)*	**-0.19109***	*(0.09)*	-0.07743	*(0.08)*	0.03821	*(0.09)*	0.17439	*(0.14)*
	Rural	**-0.14325+**	*(0.08)*	-0.18776	*(0.16)*	-0.17431	*(0.12)*	-0.11016	*(0.10)*	0.02278	*(0.10)*	-0.00118	*(0.15)*
	Urban	0.10238	*(0.11)*	-0.11573	*(0.23)*	-0.14796	*(0.14)*	0.00351	*(0.11)*	0.19638	*(0.15)*	**0.41905***	*(0.21)*
Household Food Security and Mother's Nutrition													
HH Food Security (Secure) (i)	Country	0.06932	*(0.11)*	0.04842	*(0.17)*	0.11481	*(0.16)*	0.07879	*(0.15)*	-0.03743	*(0.15)*	-0.12411	*(0.25)*
	Rural	0.07650	*(0.16)*	-0.11946	*(0.21)*	0.05714	*(0.22)*	0.16959	*(0.27)*	0.22709	*(0.22)*	0.04099	*(0.28)*
	Urban	-0.10157	*(0.16)*	-0.07797	*(0.31)*	-0.20671	*(0.26)*	-0.02651	*(0.21)*	-0.23835	*(0.24)*	-0.23028	*(0.34)*
Mother's Minimum Dietary Diversity (Achieved) (j)	Country	0.04524	*(0.12)*	-0.11579	*(0.20)*	0.04060	*(0.17)*	-0.06246	*(0.14)*	0.11705	*(0.15)*	0.35105	*(0.25)*
	Rural	0.08356	*(0.20)*	-0.29355	*(0.26)*	0.02213	*(0.24)*	0.21764	*(0.25)*	0.20522	*(0.21)*	0.12999	*(0.36)*
	Urban	-0.03788	*(0.13)*	0.31391	*(0.34)*	-0.09080	*(0.23)*	-0.20647	*(0.19)*	0.12277	*(0.23)*	0.34304	*(0.29)*

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Appendix 6: Unconditional Quantile Regression: Determinants of Child Stunting (Age 0-23 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Mother's BMI (Underweight) (k)	Country	-0.03525	*(0.14)*	-0.07286	*(0.29)*	-0.11483	*(0.20)*	-0.10148	*(0.17)*	-0.06797	*(0.17)*	0.15865	*(0.25)*
	Rural	-0.23841	*(0.20)*	-0.05544	*(0.32)*	-0.22541	*(0.28)*	**-0.47855***	*(0.22)*	-0.37224	*(0.24)*	-0.04213	*(0.34)*
	Urban	0.25959	*(0.19)*	-0.04384	*(0.50)*	0.18485	*(0.30)*	0.33825	*(0.26)*	0.14093	*(0.27)*	0.36404	*(0.33)*
Mother's BMI (Overweight) (k)	Country	**0.30378+**	*(0.18)*	0.32304	*(0.26)*	0.02800	*(0.21)*	0.13882	*(0.19)*	0.34322	*(0.26)*	**0.83501+**	*(0.48)*
	Rural	**0.49800+**	*(0.27)*	0.27793	*(0.27)*	-0.10711	*(0.28)*	0.25538	*(0.31)*	0.50882	*(0.41)*	1.18740	*(0.88)*
	Urban	0.10459	*(0.20)*	0.26312	*(0.45)*	0.09107	*(0.33)*	0.13768	*(0.26)*	0.31733	*(0.33)*	0.16367	*(0.47)*
Decision making and Empowerment Attributes													
Sex of Household Head (Female) (l)	Country	**-0.21294+**	*(0.11)*	0.01512	*(0.18)*	-0.16526	*(0.17)*	-0.12695	*(0.15)*	**-0.27492+**	*(0.16)*	-0.20603	*(0.27)*
	Rural	**-0.33610+**	*(0.17)*	0.17992	*(0.21)*	-0.22037	*(0.23)*	-0.13869	*(0.22)*	-0.38288	*(0.25)*	-0.54744	*(0.34)*
	Urban	-0.08974	*(0.15)*	-0.21206	*(0.32)*	0.02731	*(0.24)*	0.15803	*(0.21)*	-0.26479	*(0.23)*	-0.27504	*(0.34)*
Decision making and Ownership measure	Country	0.19470	*(0.17)*	-0.04816	*(0.28)*	-0.10981	*(0.22)*	0.30705	*(0.20)*	0.32943	*(0.22)*	0.57091	*(0.37)*
	Rural	**0.51643+**	*(0.29)*	0.00589	*(0.38)*	-0.14225	*(0.33)*	0.44546	*(0.33)*	0.49645	*(0.33)*	0.73121	*(0.56)*
	Urban	-0.13994	*(0.20)*	-0.27554	*(0.40)*	-0.30578	*(0.31)*	-0.38763	*(0.26)*	0.16043	*(0.32)*	0.38421	*(0.40)*
Mother's Exposure to Media (Yes) (m)	Country	0.00752	*(0.13)*	0.15952	*(0.19)*	0.12964	*(0.17)*	-0.11376	*(0.14)*	-0.09359	*(0.16)*	-0.17977	*(0.27)*
	Rural	0.08019	*(0.20)*	0.05148	*(0.24)*	0.20081	*(0.24)*	0.00309	*(0.22)*	0.07156	*(0.23)*	0.04410	*(0.32)*
	Urban	-0.09107	*(0.17)*	0.37999	*(0.34)*	-0.07739	*(0.23)*	-0.13017	*(0.20)*	-0.25125	*(0.22)*	-0.39205	*(0.38)*
Mother's Age at First Childbirth	Country	-0.01405	*(0.02)*	0.00396	*(0.03)*	-0.01304	*(0.02)*	-0.01386	*(0.02)*	-0.00025	*(0.02)*	0.00061	*(0.03)*
	Rural	**-0.04935+**	*(0.03)*	-0.03525	*(0.03)*	-0.03472	*(0.03)*	-0.03828	*(0.03)*	-0.02084	*(0.03)*	**-0.08565+**	*(0.04)*
	Urban	0.02909	*(0.02)*	0.06260	*(0.06)*	0.00675	*(0.04)*	0.01846	*(0.03)*	0.01106	*(0.03)*	0.03344	*(0.04)*
Constant	Country	-0.15225	*(0.60)*	-2.85901**	*(1.10)*	-1.00132	*(0.90)*	-0.32313	*(0.78)*	0.37391	*(0.83)*	1.74757	*(1.20)*
	Rural	0.56564	*(0.88)*	-0.95014	*(1.05)*	-0.17958	*(1.05)*	0.75966	*(1.19)*	0.21939	*(1.07)*	2.25078	*(1.71)*
	Urban	-0.54428	*(0.83)*	-4.96394*	*(1.99)*	-0.19742	*(1.61)*	-0.61297	*(1.08)*	-0.03537	*(1.21)*	1.76640	*(1.49)*
R-sqr	Country	0.244		0.122		0.141		0.216		0.182		0.133	
	Rural	0.245		0.181		0.161		0.217		0.222		0.153	
	Urban	0.330		0.173		0.202		0.289		0.232		0.187	

(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001) Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Reps.

Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Provinces ; (N=980 (Country), N=438 (Rural), N=542 (Urban))

Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Not Achieved (k) Healthy Weight (l) Male (m) Not following magazine/TV/Radio even once in a week

Appendix 7: Unconditional Quantile Regression: Determinants of Child Stunting (Age 24-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Child-level Characteristics													
Child's Gender (Female) [a]	Country	0.02723	*(0.07)*	-0.01508	*(0.12)*	0.07805	*(0.11)*	-0.01444	*(0.08)*	0.08852	*(0.10)*	0.02548	*(0.15)*
	Rural	0.05431	*(0.11)*	**-0.32113+**	*(0.17)*	0.06570	*(0.16)*	0.07675	*(0.14)*	0.07340	*(0.17)*	0.18931	*(0.26)*
	Urban	-0.00926	*(0.10)*	0.14856	*(0.20)*	0.12167	*(0.15)*	-0.12836	*(0.11)*	-0.04512	*(0.14)*	-0.11136	*(0.16)*
Age- Squared	Country	-0.00065	*(0.00)*	-0.00070	*(0.00)*	**-0.00105+**	*(0.00)*	-0.00069	*(0.00)*	-0.00067	*(0.00)*	**-0.00136***	*(0.00)*
	Rural	0.00023	*(0.00)*	0.00052	*(0.00)*	-0.00080	*(0.00)*	0.00103	*(0.00)*	0.00007	*(0.00)*	-0.00090	*(0.00)*
	Urban	**-0.00135***	*(0.00)*	-0.00204	*(0.00)*	**-0.00144+**	*(0.00)*	**-0.00153***	*(0.00)*	-0.00095	*(0.00)*	**-0.00173***	*(0.00)*
Age of the Child (in months)	Country	0.05474	*(0.03)*	0.04906	*(0.06)*	**0.09256+**	*(0.05)*	0.06262	*(0.04)*	0.05812	*(0.05)*	**0.11404***	*(0.06)*
	Rural	-0.01831	*(0.05)*	-0.04815	*(0.07)*	0.06890	*(0.07)*	-0.08376	*(0.06)*	0.00226	*(0.09)*	0.06318	*(0.11)*
	Urban	**0.11424***	*(0.05)*	0.15826	*(0.10)*	**0.12955***	*(0.06)*	**0.13138***	*(0.06)*	0.07630	*(0.05)*	**0.15296***	*(0.06)*
Birth Order (First Child) [b]	Country	0.13261	*(0.09)*	0.22151	*(0.15)*	**0.37370***	*(0.16)*	0.15863	*(0.11)*	0.03313	*(0.12)*	0.05816	*(0.16)*
	Rural	0.18158	*(0.14)*	0.16171	*(0.21)*	**0.45734***	*(0.23)*	**0.34420+**	*(0.18)*	0.04775	*(0.20)*	0.04444	*(0.22)*
	Urban	0.07970	*(0.12)*	0.34385	*(0.24)*	0.23014	*(0.18)*	0.02772	*(0.14)*	-0.12269	*(0.17)*	0.07032	*(0.25)*
Child's Size at Birth (Smaller than Average) [c]	Country	**-0.22768***	*(0.12)*	-0.15123	*(0.17)*	**-0.33676+**	*(0.18)*	**-0.33969****	*(0.12)*	-0.15991	*(0.17)*	-0.24370	*(0.18)*
	Rural	-0.07005	*(0.19)*	-0.15953	*(0.26)*	-0.03551	*(0.22)*	-0.27870	*(0.22)*	-0.08248	*(0.29)*	0.12637	*(0.37)*
	Urban	**-0.32561***	*(0.14)*	-0.35381	*(0.30)*	-0.35878	*(0.23)*	**-0.37939***	*(0.15)*	-0.17693	*(0.19)*	**-0.34899***	*(0.17)*
Education													
Parental Education Difference	Country	-0.00292	*(0.01)*	0.01549	*(0.02)*	-0.01401	*(0.02)*	-0.00668	*(0.01)*	-0.00619	*(0.01)*	-0.00365	*(0.01)*
	Rural	0.00685	*(0.02)*	0.02141	*(0.02)*	0.02084	*(0.02)*	-0.01197	*(0.02)*	0.00376	*(0.02)*	0.01672	*(0.03)*
	Urban	-0.01540	*(0.01)*	-0.05155	*(0.03)*	-0.01941	*(0.02)*	-0.01374	*(0.02)*	-0.01992	*(0.02)*	-0.02315	*(0.02)*
Mother's Education (in years)	Country	0.01957	*(0.01)*	**0.04512+**	*(0.02)*	**0.03820***	*(0.02)*	0.01683	*(0.02)*	0.00258	*(0.02)*	0.00435	*(0.03)*
	Rural	0.01239	*(0.02)*	0.03004	*(0.03)*	0.02923	*(0.02)*	-0.02064	*(0.02)*	0.01510	*(0.03)*	0.00466	*(0.03)*
	Urban	0.01992	*(0.02)*	0.03161	*(0.04)*	**0.05148***	*(0.03)*	0.00801	*(0.02)*	-0.02211	*(0.03)*	-0.01149	*(0.04)*
Health Services Environment													
Child Born in Hospital (Yes) [d]	Country	0.00565	*(0.09)*	0.13467	*(0.14)*	0.17957	*(0.13)*	0.05125	*(0.12)*	-0.13513	*(0.14)*	**-0.34393+**	*(0.19)*
	Rural	0.02989	*(0.13)*	0.19687	*(0.18)*	0.11991	*(0.18)*	0.12461	*(0.18)*	-0.02750	*(0.24)*	-0.24080	*(0.33)*
	Urban	-0.02423	*(0.14)*	0.19084	*(0.24)*	0.24388	*(0.16)*	0.10160	*(0.16)*	-0.23002	*(0.18)*	-0.39327	*(0.26)*

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Appendix 7: Unconditional Quantile Regression: Determinants of Child Stunting (Age 24-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Antenatal Care (At least 4 ANC Visits) (e)	Country	-0.01318	*(0.10)*	0.09679	*(0.18)*	0.08718	*(0.15)*	-0.10714	*(0.12)*	0.04264	*(0.11)*	-0.01562	*(0.16)*
	Rural	-0.02978	*(0.13)*	0.10660	*(0.19)*	0.13202	*(0.18)*	-0.07519	*(0.17)*	-0.02896	*(0.17)*	-0.28140	*(0.21)*
	Urban	0.03362	*(0.15)*	-0.02415	*(0.33)*	0.04757	*(0.19)*	0.00751	*(0.15)*	0.17970	*(0.15)*	0.27712	*(0.20)*
Postnatal Care (Provided)(f)	Country	0.04425	*(0.09)*	-0.23396	*(0.16)*	-0.23009	*(0.14)*	0.08802	*(0.12)*	**0.23920+**	*(0.13)*	**0.29531+**	*(0.17)*
	Rural	-0.03080	*(0.13)*	-0.00705	*(0.20)*	0.00053	*(0.20)*	-0.11365	*(0.20)*	-0.15391	*(0.22)*	0.02331	*(0.26)*
	Urban	0.13491	*(0.11)*	-0.36072	*(0.26)*	-0.24511	*(0.19)*	**0.34711***	*(0.14)*	**0.45589****	*(0.16)*	**0.44479+**	*(0.23)*
Preceding Birth Interval (>24 months)(g)	Country	-0.08204	*(0.07)*	**-0.24767+**	*(0.14)*	-0.08718	*(0.12)*	-0.08368	*(0.10)*	-0.07572	*(0.11)*	0.08456	*(0.14)*
	Rural	0.01673	*(0.11)*	-0.11604	*(0.18)*	0.01619	*(0.16)*	0.11753	*(0.16)*	-0.00058	*(0.17)*	-0.13795	*(0.22)*
	Urban	-0.15055	*(0.10)*	-0.30987	*(0.22)*	-0.21538	*(0.15)*	**-0.25545***	*(0.13)*	-0.13906	*(0.16)*	0.08991	*(0.19)*
Economic Attributes													
Wealth Index	Country	**0.10745+**	***(0.06)***	0.02905	***(0.10)***	0.05242	***(0.09)***	0.09423	***(0.08)***	**0.14864+**	***(0.08)***	0.14535	***(0.11)***
	Rural	**0.36413***	***(0.16)***	0.14750	***(0.18)***	0.17723	***(0.18)***	**0.50528***	***(0.20)***	0.37933	***(0.27)***	0.58790	***(0.38)***
	Urban	0.05744	*(0.08)*	0.04382	*(0.14)*	0.01896	*(0.11)*	0.06493	*(0.10)*	0.14588	*(0.10)*	0.05369	*(0.14)*
Mother's Working Status (Working)(h)	Country	**-0.15945+**	***(0.08)***	**-0.27254***	***(0.13)***	**-0.22722+**	***(0.13)***	**-0.19764***	***(0.10)***	-0.12110	***(0.12)***	-0.15613	***(0.18)***
	Rural	-0.08551	***(0.13)***	-0.23286	***(0.20)***	-0.22670	***(0.16)***	-0.02007	***(0.16)***	0.01270	***(0.22)***	0.19122	***(0.28)***
	Urban	**-0.19277+**	*(0.11)*	-0.30025	*(0.20)*	-0.20336	*(0.16)*	-0.14507	*(0.13)*	-0.20199	*(0.15)*	-0.33341	*(0.23)*
Dependency Ratio	Country	-0.07994	***(0.05)***	-0.13685	***(0.10)***	**-0.12216+**	***(0.07)***	-0.04085	***(0.05)***	-0.04916	***(0.06)***	-0.03182	***(0.09)***
	Rural	-0.08620	*(0.07)*	-0.15747	*(0.12)*	-0.08237	*(0.09)*	-0.08274	*(0.08)*	-0.06349	*(0.10)*	0.01377	*(0.16)*
	Urban	-0.07238	*(0.07)*	-0.12164	*(0.18)*	-0.01548	*(0.10)*	0.02595	*(0.07)*	-0.07868	*(0.08)*	-0.09634	*(0.09)*
Household Food Security and Mother's Nutrition													
HH Food Security (Secure) (i)	Country	-0.00103	*(0.10)*	0.01411	*(0.16)*	**0.25806+**	*(0.14)*	0.03340	*(0.11)*	-0.03203	*(0.12)*	-0.25703	*(0.17)*
	Rural	-0.12884	*(0.15)*	0.09915	*(0.20)*	0.08346	*(0.18)*	-0.07871	*(0.19)*	-0.11272	*(0.19)*	**-0.55119+**	*(0.31)*
	Urban	0.07287	*(0.12)*	-0.11390	*(0.25)*	0.28490	*(0.19)*	0.08820	*(0.14)*	-0.04910	*(0.15)*	-0.07330	*(0.19)*

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Appendix 7: Unconditional Quantile Regression: Determinants of Child Stunting (Age 24-59 months)

Dependent Variable: HAZ		OLS		Q10		Q25		Q50		Q75		Q90	
Mother's BMI (Underweight) [j]	Country	-0.13148	(0.10)	-0.21626	(0.20)	-0.13910	(0.16)	-0.10280	(0.13)	-0.04983	(0.14)	0.06837	(0.19)
	Rural	-0.10806	(0.16)	0.05282	(0.25)	-0.08600	(0.20)	-0.07197	(0.21)	-0.15971	(0.26)	-0.00614	(0.34)
	Urban	-0.20706	(0.16)	-0.48847	(0.36)	-0.22116	(0.22)	-0.08558	(0.16)	0.03353	(0.17)	-0.04076	(0.24)
Mother's BMI (Overweight) [j]	Country	0.32923**	(0.12)	0.36678*	(0.19)	0.25944+	(0.14)	0.37860**	(0.14)	0.40083*	(0.19)	0.32297	(0.24)
	Rural	0.37568+	(0.21)	-0.01453	(0.26)	0.18675	(0.21)	0.37804	(0.24)	0.70059*	(0.30)	0.90351*	(0.44)
	Urban	0.26563+	(0.14)	0.44506	(0.27)	0.31866+	(0.17)	0.31291+	(0.19)	0.25901	(0.22)	-0.03288	(0.27)
Decision making and Empowerment Attributes													
Sex of Household Head (Female) [k]	Country	-0.07382	(0.09)	0.01553	(0.15)	-0.07638	(0.13)	0.02873	(0.11)	-0.10078	(0.13)	-0.34851*	(0.16)
	Rural	-0.01244	(0.14)	0.06618	(0.19)	0.19411	(0.19)	-0.02755	(0.19)	-0.01157	(0.21)	-0.27410	(0.26)
	Urban	-0.11845	(0.14)	-0.21075	(0.25)	-0.02551	(0.17)	0.03203	(0.14)	-0.11210	(0.19)	-0.43875+	(0.23)
Decision making and Ownership measure	Country	0.29598*	(0.12)	0.19273	(0.20)	0.29260+	(0.17)	0.30002+	(0.17)	0.32781*	(0.17)	0.38026+	(0.22)
	Rural	0.20866	(0.19)	0.32591	(0.28)	0.05951	(0.23)	0.23770	(0.26)	0.08996	(0.27)	0.55568	(0.41)
	Urban	0.37893*	(0.17)	0.30251	(0.34)	0.20263	(0.24)	0.31876+	(0.19)	0.37503+	(0.22)	0.31878	(0.29)
Mother's Exposure to Media (Yes) [l]	Country	0.17833+	(0.10)	0.09561	(0.16)	0.20833	(0.13)	0.15463	(0.12)	0.18543	(0.14)	0.29457	(0.20)
	Rural	0.22533	(0.15)	-0.10060	(0.20)	0.06737	(0.20)	0.14711	(0.16)	0.45130*	(0.23)	0.63409+	(0.35)
	Urban	0.10993	(0.11)	0.25273	(0.24)	0.23980+	(0.14)	0.12339	(0.15)	-0.06579	(0.15)	-0.09736	(0.20)
Mother's Age at First Birth	Country	0.00667	(0.01)	-0.03004	(0.02)	0.00657	(0.02)	0.01425	(0.01)	0.02281	(0.02)	0.03952+	(0.02)
	Rural	0.00327	(0.02)	-0.02198	(0.03)	-0.00753	(0.02)	0.00961	(0.02)	0.03044	(0.03)	0.01205	(0.03)
	Urban	0.01062	(0.02)	-0.03199	(0.04)	0.00165	(0.03)	0.00101	(0.02)	0.02015	(0.02)	0.05070	(0.03)
Constant	Country	-3.68535***	(0.82)	-4.40046***	(1.34)	-5.57485***	(1.15)	-4.06463***	(1.00)	-3.25122**	(1.09)	-4.09854**	(1.42)
	Rural	-1.90479	(1.32)	-2.09942	(1.70)	-4.60074**	(1.68)	-0.61154	(1.66)	-2.58177	(1.98)	-2.12047	(2.48)
	Urban	-5.11830***	(1.07)	-6.19377**	(2.37)	-6.65376***	(1.50)	-5.29046***	(1.28)	-3.15907*	(1.34)	-4.98578**	(1.61)
R-sqr	Country	0.139		0.095		0.130		0.120		0.079		0.055	
	Rural	0.145		0.077		0.106		0.134		0.118		0.119	
	Urban	0.172		0.169		0.155		0.171		0.096		0.078	

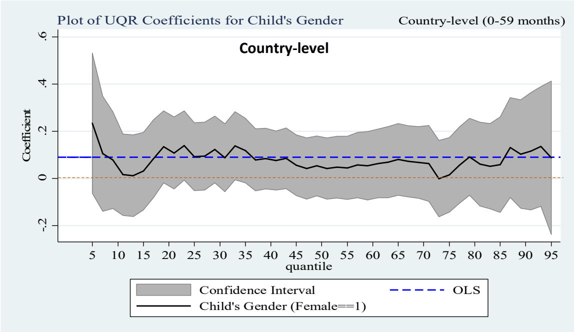
(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001) Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Reps.

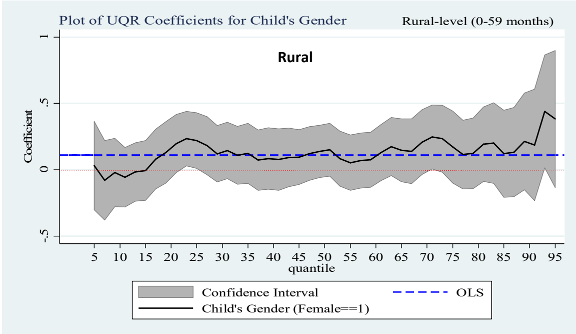
Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Provinces ; (N=1355 (Country), N=590 (Rural), N=765 (Urban))

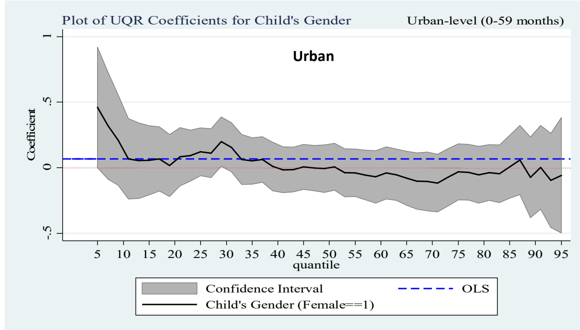
Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Healthy Weight (k) Male (l) Not following magazine/TV/Radio even once in a week

Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

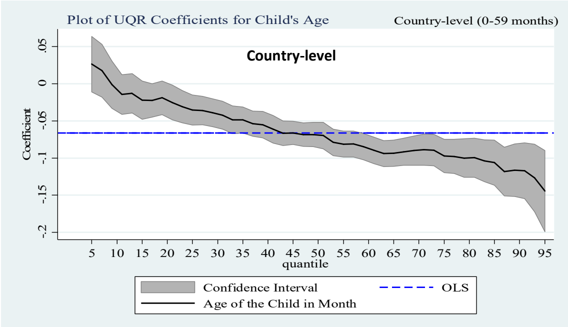
Child's Gender (Female == 1)

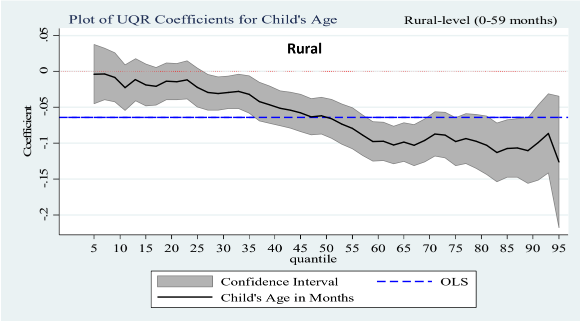


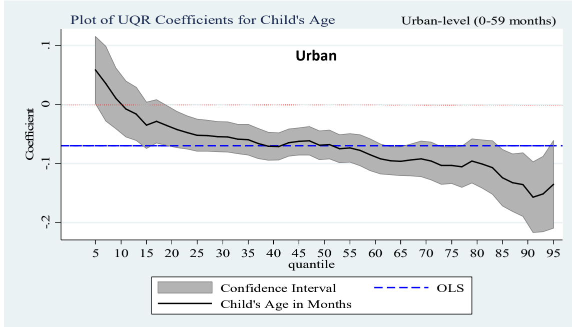




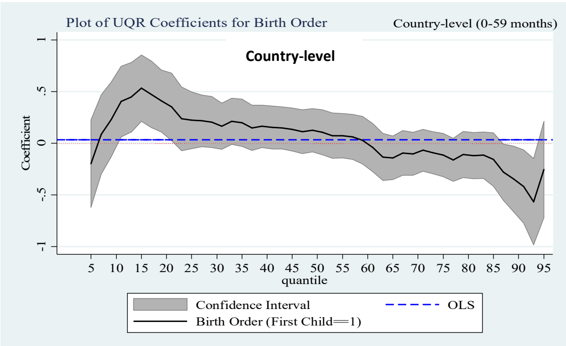
Child's Age (in months)

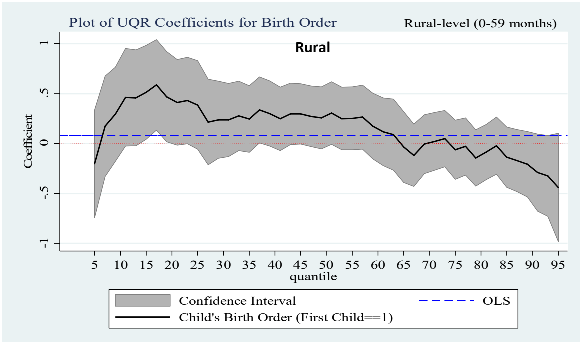


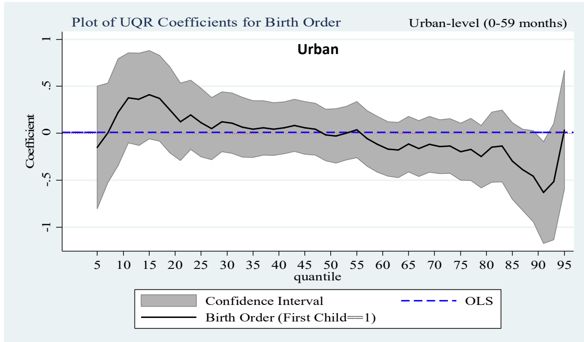




Birth Order (First Child ==1)

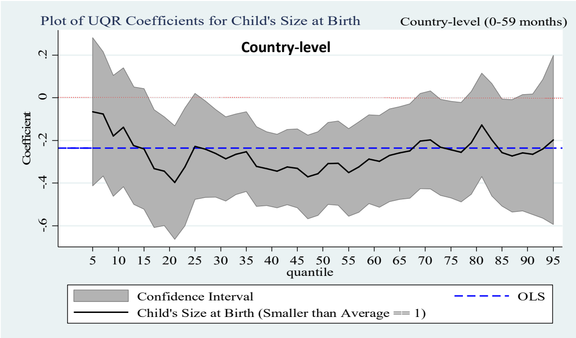


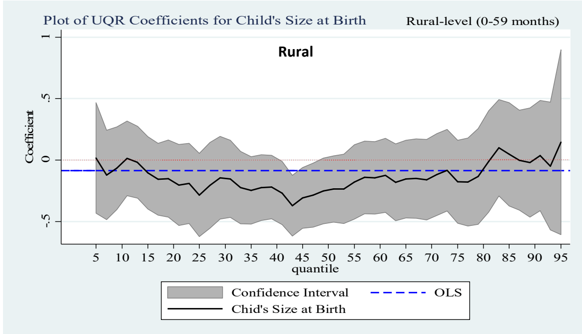


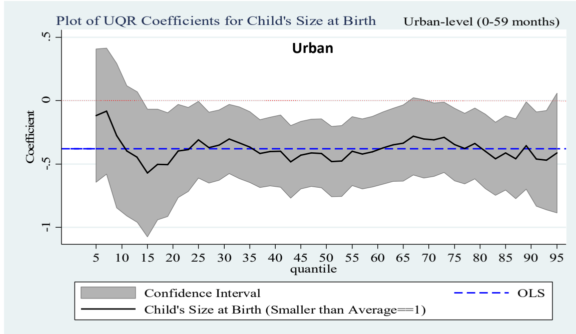


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

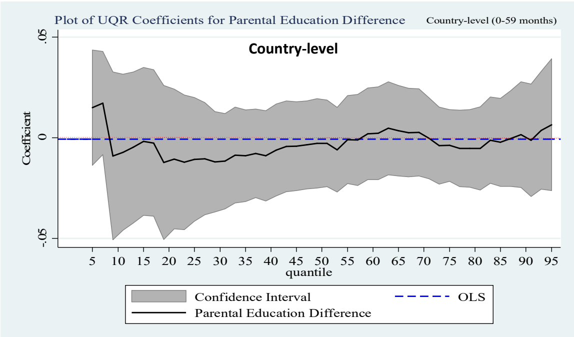
Child's Size at Birth (Smaller than Average ==1)

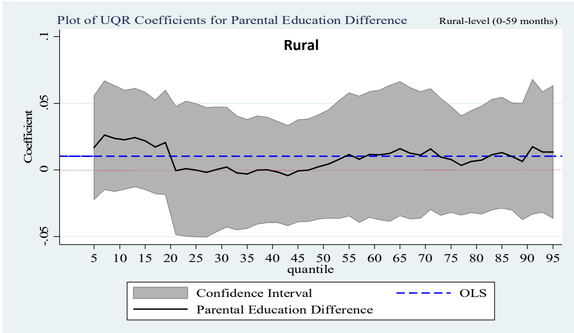


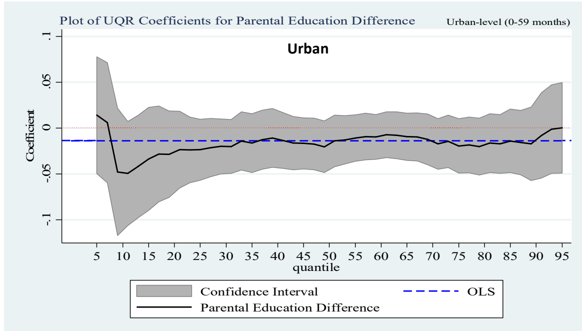




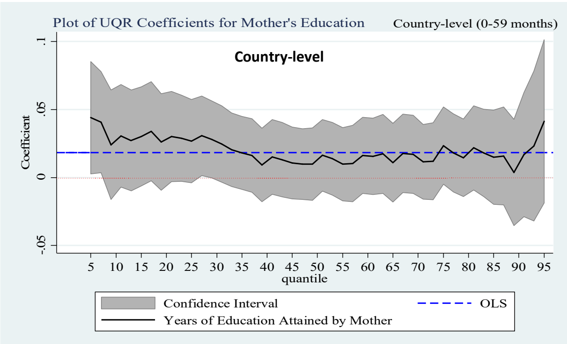
Parental Education Difference (in years)

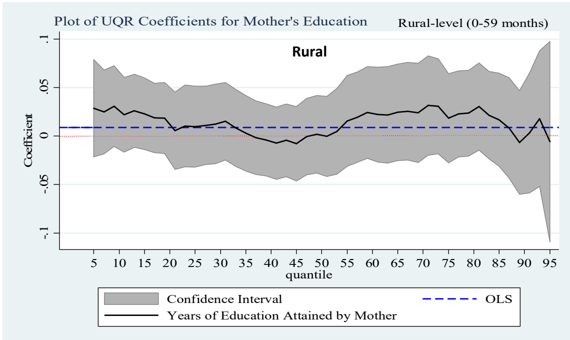


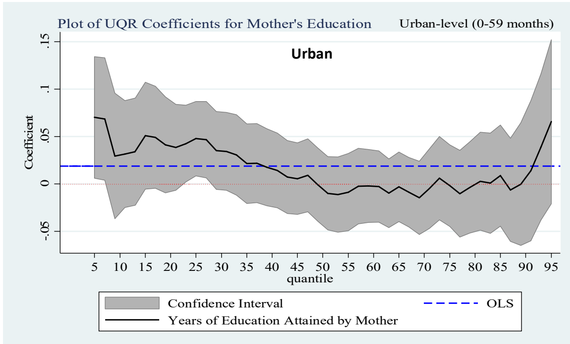




Mother's Education (in years)

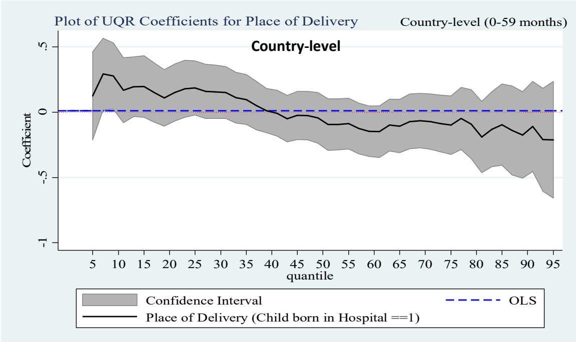


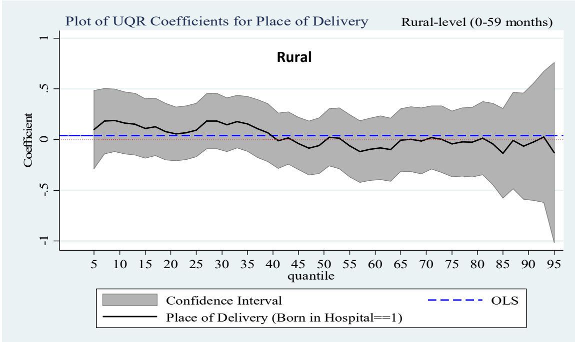


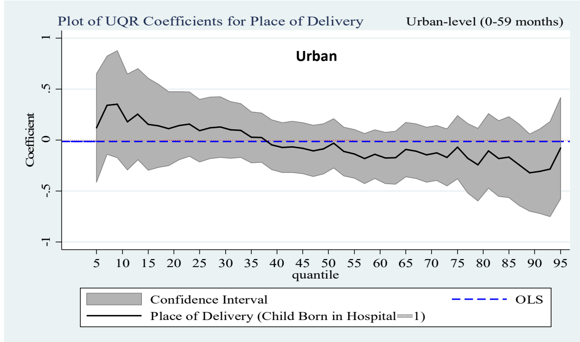


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

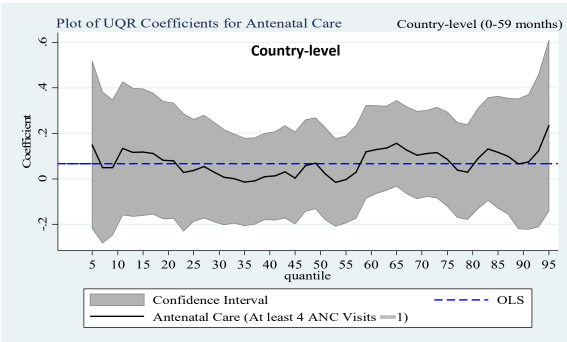
Place of Delivery (Born in Hospital == 1)

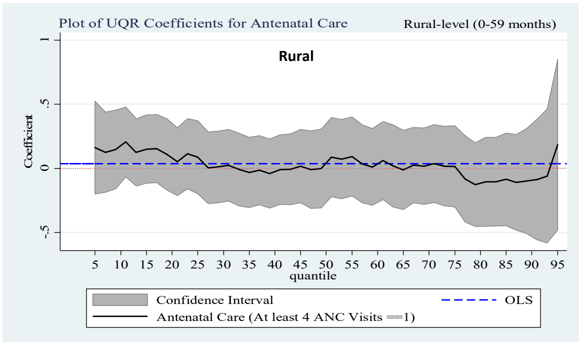


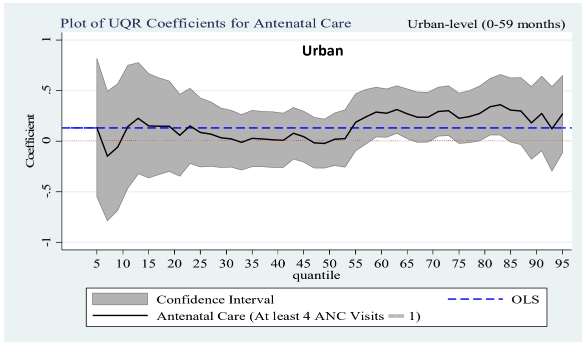




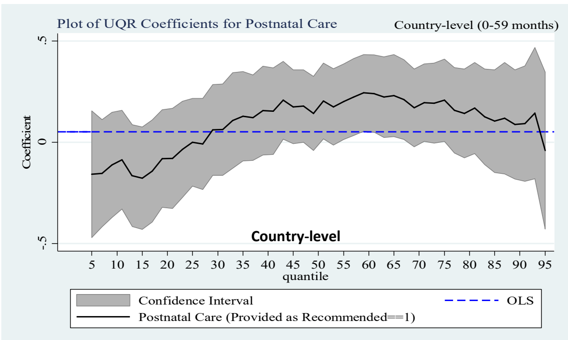
Antenatal Care (At least 4 ANC Visits==1)

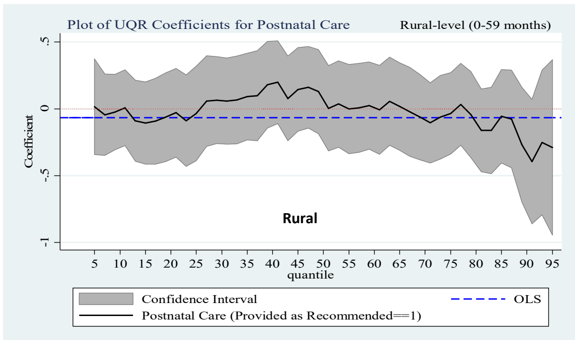


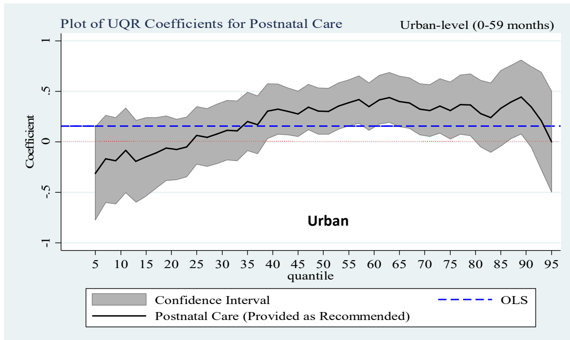




Postnatal Care (Provided as Recommended==1)

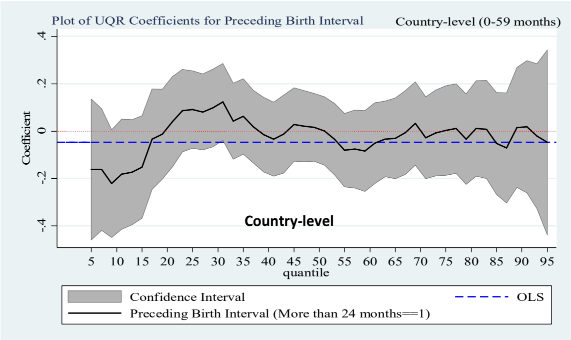


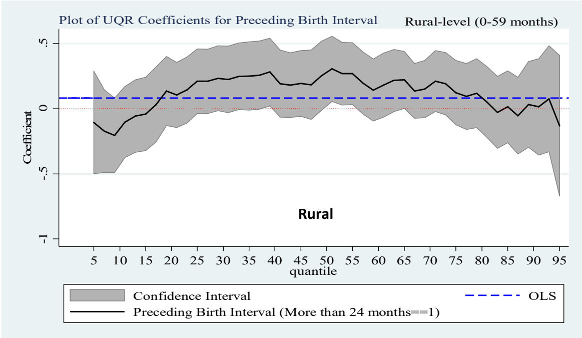


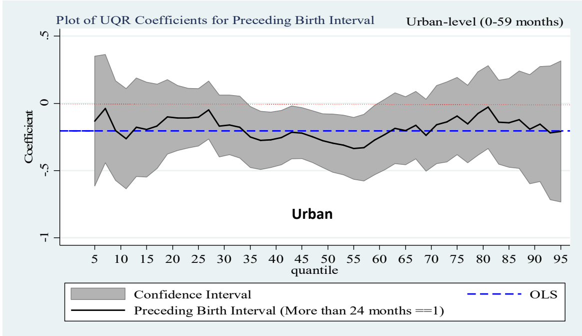


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

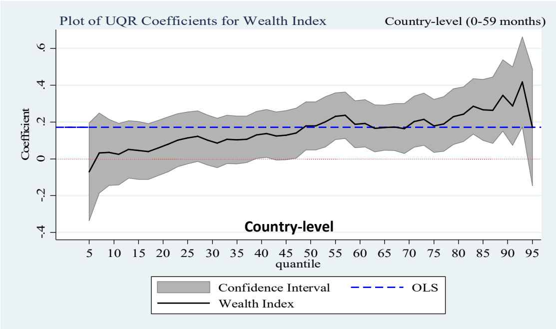
Preceding Birth Interval (More than 24 months==1)

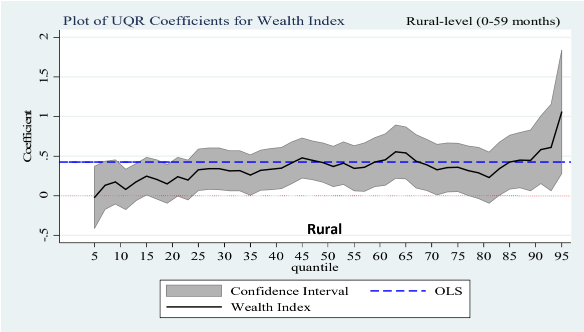


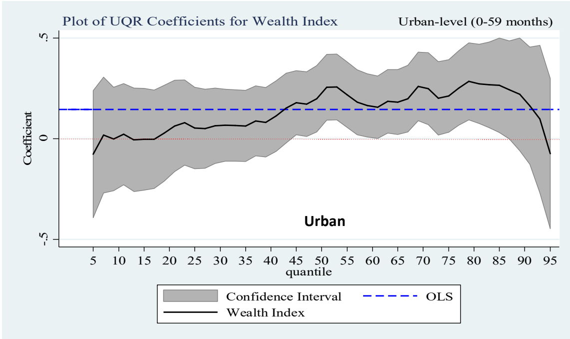




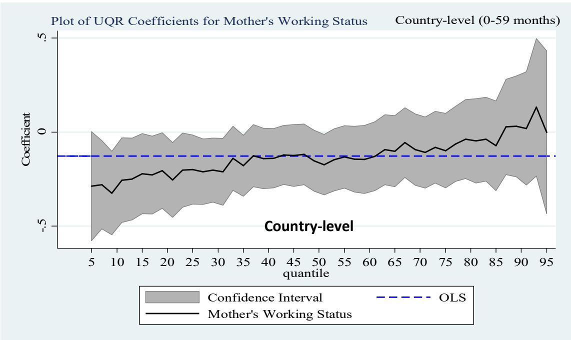
Wealth Index

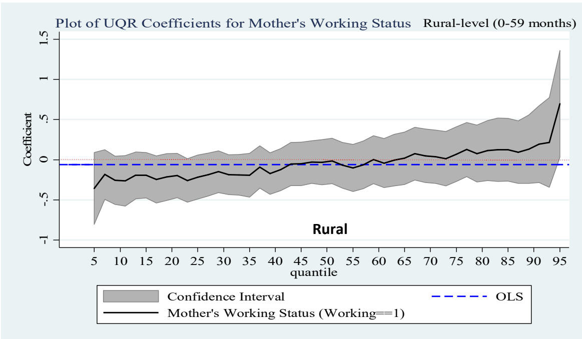


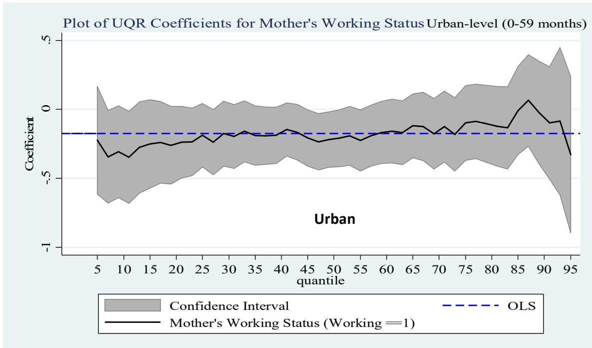




Mother's Working Status (Working == 1)

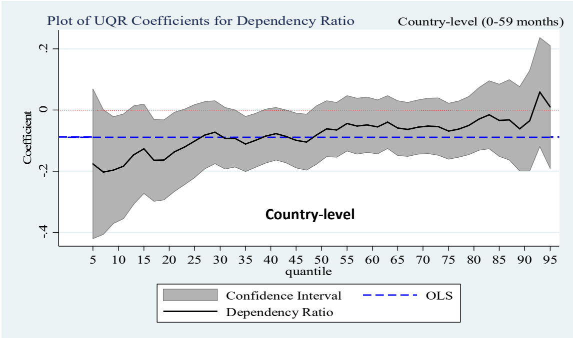


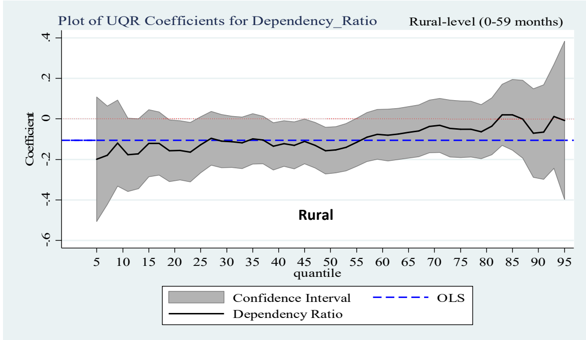


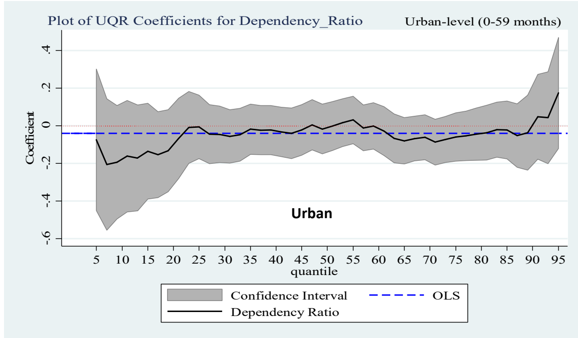


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

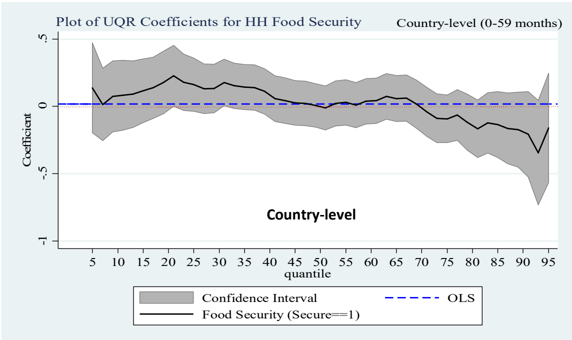
Dependency Ratio

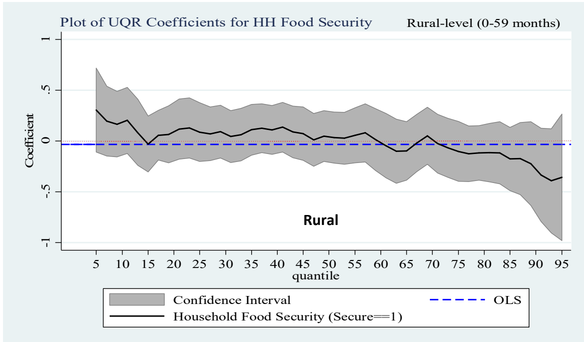


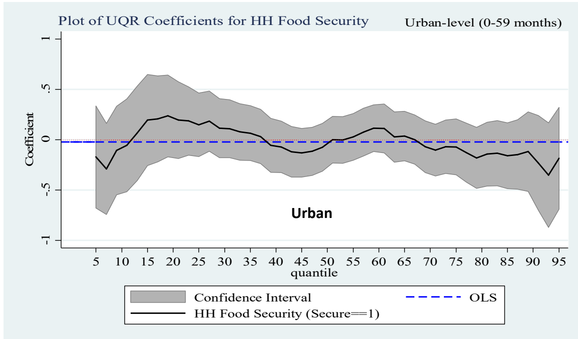




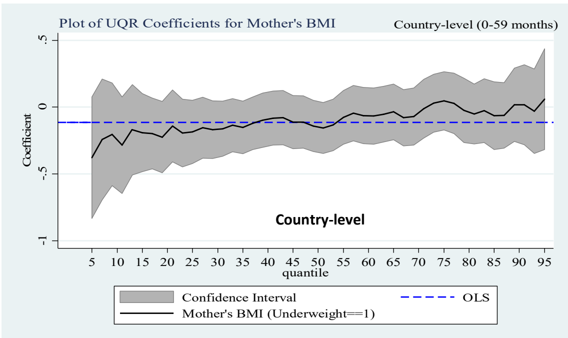
Household Food Security (Secure ==1)

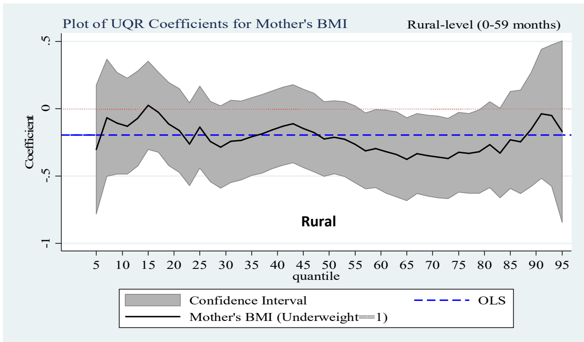


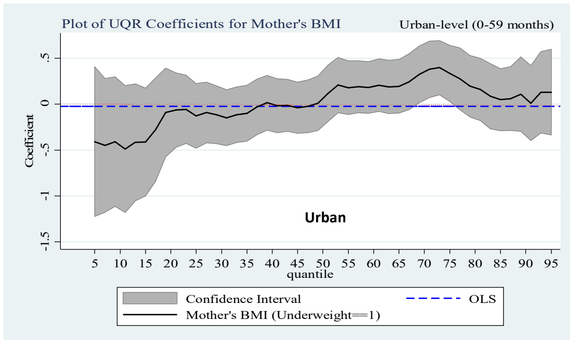




Mother's BMI (Underweight==1)

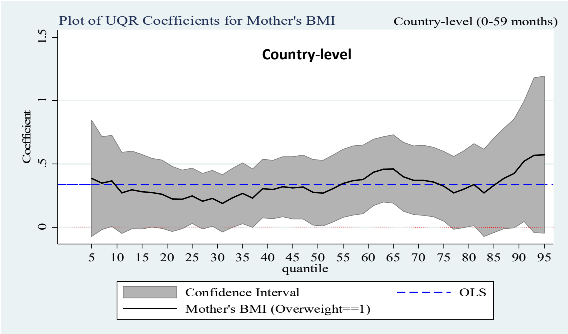


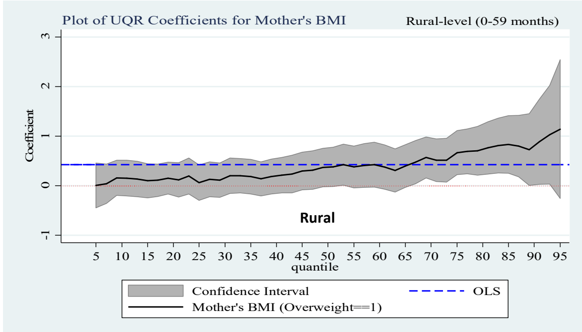


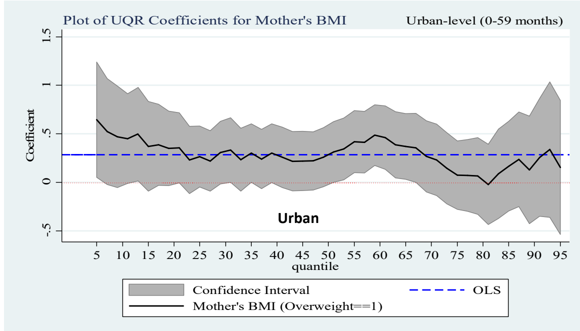


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

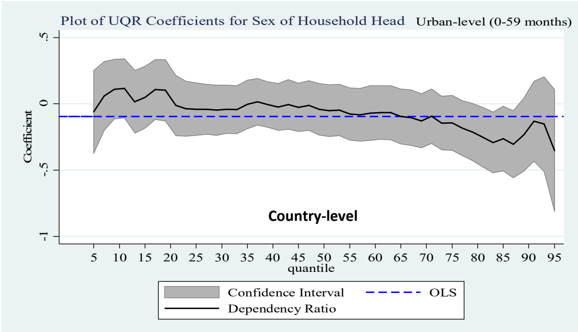
Mother's BMI (Overweight==1)

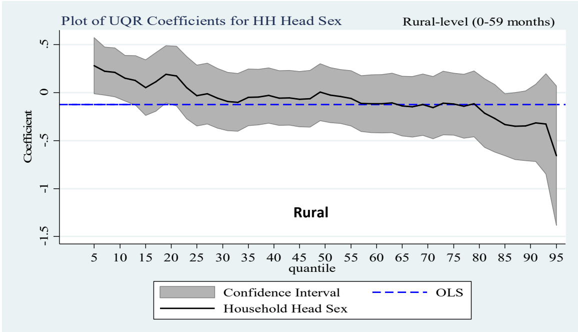


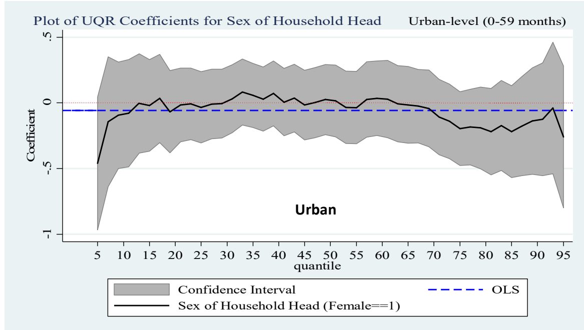




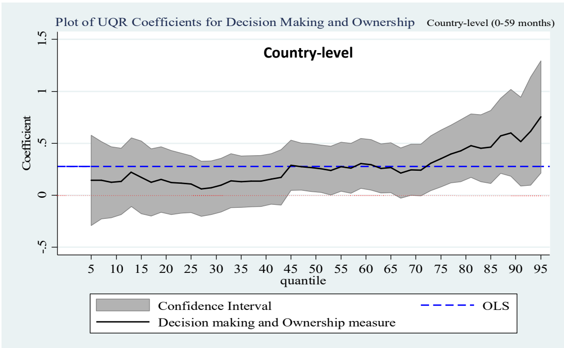
Sex of Household Head (Female==1)

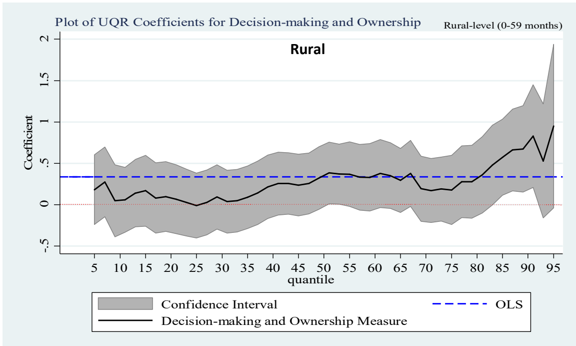


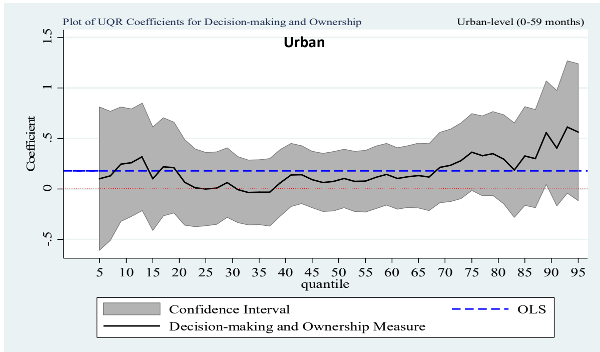




Decision-making and Ownership Measure

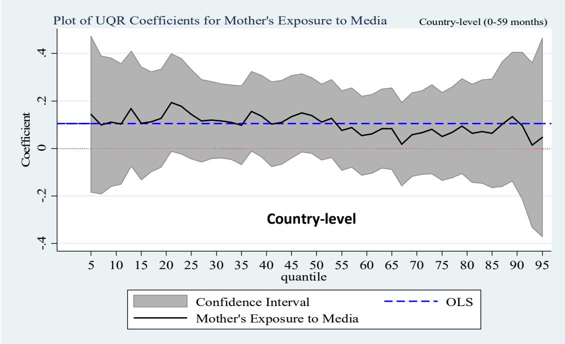


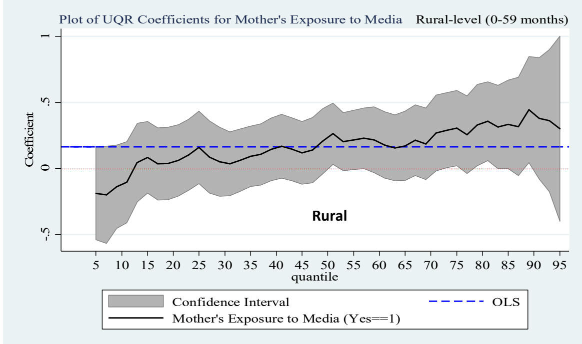


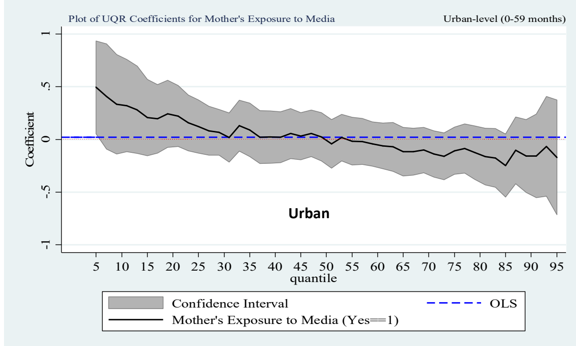


Appendix 8: Plot of UQR Coefficients compared to OLS at Country, Rural and Urban Levels (0-59 Months)

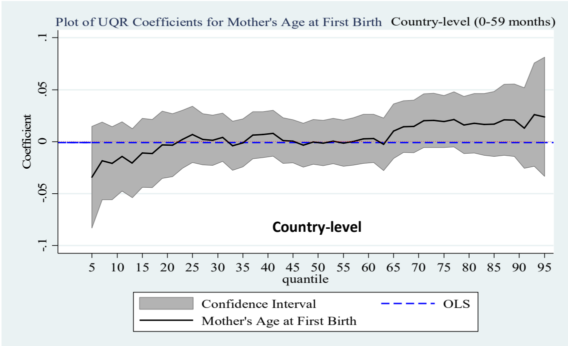
Mother's Exposure to Media (Yes==1)

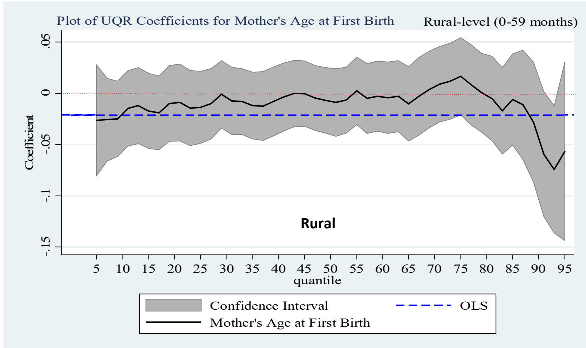


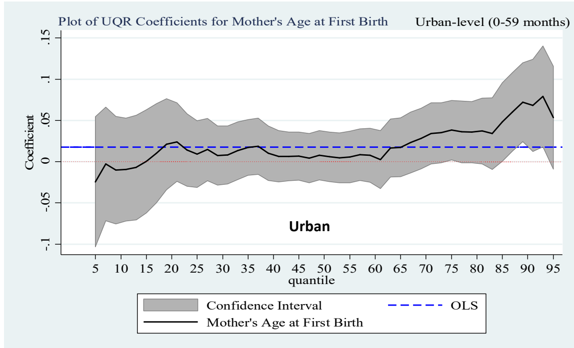




Mother's Age at First Childbirth







Appendix 9: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-59 Months)

Overall Decomposition

	Q10	Q25	Q50	Q75	Q90
Rural Area	-3.17059*** (0.07)	-2.52844*** (0.07)	-1.73156*** (0.05)	-0.82690*** (0.06)	-0.03326 (0.09)
Counterfactual	-3.33659*** (0.13)	-2.49974*** (0.12)	-1.65647*** (0.07)	-0.79234*** (0.11)	0.02588 (0.21)
Urban Area	-3.10647*** (0.08)	-2.19666*** (0.06)	-1.47312*** (0.06)	-0.64928*** (0.07)	0.19124* (0.09)
Rural-Urban Difference	-0.06412 (0.11)	**-0.33178***** (0.09)	**-0.25843***** (0.08)	**-0.17763+** (0.10)	**-0.22450+** (0.14)
Covariate Effect	**-0.23012+** (0.13)	**-0.30308*** (0.12)	**-0.18335**** (0.07)	-0.14307 (0.10)	-0.16536 (0.20)
Coefficient Effect	0.16600 (0.14)	-0.02871 (0.13)	-0.07509 (0.08)	-0.03456 (0.12)	-0.05915 (0.23)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Child-level Characteristics										
Child's Gender (Female) [(a)]	0.00189 (0.01)	0.00158 (0.00)	-0.00030 (0.00)	-0.00040 (0.00)	-0.00093 (0.01)	**-0.25258*** (0.13)	0.14685 (0.10)	0.09358 (0.07)	0.08974 (0.10)	0.03185 (0.15)
Age-squared	0.01662 (0.05)	-0.06715 (0.05)	-0.07445 (0.05)	-0.11768 (0.08)	-0.15243 (0.10)	0.56778 (0.64)	-0.52095 (0.45)	-0.28125 (0.41)	-0.20591 (0.53)	-0.98633 (0.78)
Age of the Child (in months)	-0.00039 (0.05)	0.07984 (0.05)	0.10232 (0.07)	0.15701 (0.10)	0.20591 (0.14)	-0.79191 (0.95)	0.91707 (0.74)	0.78471 (0.70)	0.39710 (0.95)	1.50857 (1.46)
Birth Order (First Child) [(b)]	-0.01171 (0.01)	-0.00425 (0.01)	0.00034 (0.01)	0.00726 (0.01)	0.01645 (0.01)	0.00355 (0.31)	-0.02971 (0.28)	0.16355 (0.19)	-0.24441 (0.19)	-0.06291 (0.31)
Child's Size at Birth (Smaller than Average) [(c)]	-0.00582 (0.01)	-0.00381 (0.01)	-0.00625 (0.01)	-0.00424 (0.01)	-0.00454 (0.01)	0.00668 (0.06)	0.02794 (0.06)	0.06459 (0.04)	0.03315 (0.05)	0.09997 (0.07)

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Appendix 9: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-59 Months)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Education										
Parental Education Difference (in years)	-0.04523 (0.04)	-0.02123 (0.02)	-0.01358 (0.02)	-0.01745 (0.02)	-0.01445 (0.02)	0.04414 (0.08)	0.04598 (0.07)	0.04462 (0.06)	0.02040 (0.08)	0.10465 (0.11)
Mother's Education (in years)	-0.06459 (0.07)	**-0.10741*** (0.05)	0.00827 (0.05)	0.00408 (0.05)	-0.01047 (0.08)	-0.07434 (0.15)	-0.09389 (0.14)	0.03219 (0.13)	0.07069 (0.17)	-0.08719 (0.26)
Health Services Environment										
Child Born in Hospital (Yes) [d]	-0.03228 (0.07)	-0.02330 (0.04)	0.01161 (0.03)	0.01773 (0.04)	0.07124 (0.05)	-0.10420 (0.12)	-0.05052 (0.12)	0.05845 (0.08)	0.02737 (0.10)	0.08364 (0.17)
Antenatal Care (At least 4 ANC Visits) [e]	-0.01780 (0.05)	-0.01337 (0.03)	-0.00639 (0.02)	-0.03471 (0.02)	-0.03260 (0.03)	0.11923 (0.19)	-0.00907 (0.17)	-0.06175 (0.14)	-0.11795 (0.15)	-0.18027 (0.22)
Postnatal Care (Provided)[f]	0.02570 (0.04)	-0.01217 (0.03)	**-0.05853*** (0.03)	**-0.05890+** (0.03)	**-0.07420+** (0.04)	0.05374 (0.11)	0.04380 (0.10)	-0.09761 (0.08)	-0.14136 (0.09)	**-0.26113+** (0.15)
Preceding Birth Interval (>24 months)[g]	-0.00753 (0.01)	-0.00293 (0.01)	-0.00906 (0.01)	-0.00268 (0.01)	-0.00346 (0.01)	-0.14991 (0.16)	0.13736 (0.12)	**0.19297+** (0.11)	0.14747 (0.12)	0.02796 (0.19)
Economic Attributes										
Wealth Index	-0.00973 (0.08)	-0.03164 (0.06)	**-0.14353*** (0.06)	**-0.12555*** (0.06)	-0.09958 (0.09)	0.01838 (0.07)	-0.08727 (0.06)	-0.06138 (0.05)	-0.05391 (0.07)	-0.08580 (0.10)
Mother's Working Status (Working)[h]	-0.02194 (0.02)	-0.01278 (0.01)	-0.01289 (0.01)	-0.00665 (0.01)	-0.00657 (0.02)	-0.04421 (0.19)	-0.03826 (0.15)	0.09982 (0.13)	0.21629 (0.16)	0.27183 (0.23)
Dependency Ratio	-0.05103 (0.04)	-0.00138 (0.02)	-0.00230 (0.02)	-0.01431 (0.02)	-0.00320 (0.03)	0.06361 (0.24)	-0.04248 (0.18)	**-0.22656+** (0.14)	-0.15511 (0.17)	-0.43564 (0.47)
Household Food Security and Mother's Nutrition										
HH Food Security (Secure) [i]	0.00425 (0.01)	-0.00503 (0.01)	0.00089 (0.01)	0.00244 (0.01)	0.00612 (0.01)	**0.40137*** (0.16)	0.01249 (0.16)	0.08038 (0.13)	-0.08339 (0.15)	-0.11724 (0.21)
Mother's BMI (Underweight) [j]	-0.02663 (0.02)	-0.00604 (0.01)	0.00344 (0.01)	0.01581 (0.01)	0.00337 (0.01)	-0.05236 (0.08)	-0.06870 (0.06)	-0.06458 (0.06)	**-0.17972**** (0.07)	-0.03221 (0.08)

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Appendix 9: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-59 Months)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Mother's BMI	-0.03165	-0.01824	-0.01808	-0.00506	-0.01864	-0.04832	**-0.06356+**	0.02047	0.01014	0.05070
(Overweight) (j)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)	(0.08)
Decision making and Empowerment Attributes										
Sex of Household Head	-0.00230	0.00295	0.00078	0.01699	0.00438	0.04381	0.01636	-0.03404	-0.04302	-0.01919
(Female) (k)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.07)	(0.07)	(0.06)	(0.07)	(0.09)
Decision making and	-0.03036	0.00014	-0.01237	-0.03977	-0.03941	-0.01377	-0.13009	0.12651	0.04329	0.30443
Ownership measure	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.14)	(0.14)	(0.12)	(0.14)	(0.23)
Mother's Exposure to	-0.04090	-0.01511	0.00476	0.01320	0.01968	-0.19191	-0.02559	0.04056	0.12949	0.22821
Media (Yes) (l)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.14)	(0.11)	(0.09)	(0.10)	(0.18)
Mother's Age at First	0.00601	-0.00692	-0.00263	-0.02863	**-0.04609+**	-0.09918	-0.71931	-0.14876	-0.02363	-1.51626
Childbirth	(0.03)	(0.02)	(0.01)	(0.02)	(0.03)	(1.06)	(0.76)	(0.62)	(0.78)	(0.99)
Constant	-	-	-	-	-	1.13078	1.09169	-1.28065	0.05625	0.54241
	-	-	-	-	-	(1.47)	(1.22)	(1.06)	(1.32)	(1.94)

Residuals

	Q10	**Q25**	**Q50**	**Q75**	**Q90**
Specification Error	-0.04123	-0.04391	0.07117	0.09060	0.01352
	(0.09)	(0.09)	(0.06)	(0.07)	(0.15)
Reweighting Error	0.01805	-0.00297	-0.00370	-0.00962	-0.01917
	(0.05)	(0.05)	(0.04)	(0.06)	(0.20)

(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001). Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Repetitions.

Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Provinces

Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Healthy Weight (k) Male (l) Not following magazine/TV/Radio even once in a week

Appendix 10: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-23 Months)

Overall Decomposition

	Q10	Q25	Q50	Q75	Q90
Rural Area	-2.85644*** (0.12)	-2.26751*** (0.11)	-1.38802*** (0.14)	-0.45814*** (0.11)	0.23305 (0.19)
Counterfactual	-3.10718*** (0.23)	-2.17614*** (0.24)	-1.27723*** (0.15)	-0.38617 (0.26)	0.62929 (0.55)
Urban Area	-2.89492*** (0.17)	-1.92748*** (0.13)	-1.04973*** (0.12)	-0.12189 (0.11)	0.69277*** (0.15)
Rural-Urban Difference	0.03847 (0.21)	**-0.34003*** (0.16)	**-0.33829+** (0.18)	**-0.33625*** (0.16)	**-0.45971+** (0.25)
Covariate Effect	-0.21226 (0.23)	-0.24866 (0.22)	-0.22750 (0.15)	-0.26428 (0.25)	-0.06348 (0.56)
Coefficient Effect	0.25073 (0.26)	-0.09138 (0.26)	-0.11079 (0.20)	-0.07197 (0.27)	-0.39624 (0.59)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Child-level Characteristics										
Child's Gender (Female) [a]	0.00319 (0.02)	0.00585 (0.01)	-0.00441 (0.01)	0.00566 (0.01)	-0.00564 (0.02)	-0.15177 (0.21)	-0.04598 (0.16)	0.10442 (0.14)	0.07039 (0.16)	0.22143 (0.23)
Age-squared	0.00589 (0.14)	0.00334 (0.09)	0.00075 (0.05)	-0.00020 (0.06)	0.00070 (0.08)	0.44347 (1.21)	1.75172+ (0.96)	-0.33904 (0.86)	0.02844 (0.94)	0.30639 (1.35)
Age of the Child (in months)	0.01026 (0.10)	0.00191 (0.05)	-0.00556 (0.06)	-0.00564 (0.09)	-0.00364 (0.09)	-0.04693 (1.89)	-1.56535 (1.51)	0.63651 (1.43)	-0.30012 (1.58)	0.25285 (2.19)
Birth Order (First Child) [b]	-0.00103 (0.01)	-0.00367 (0.01)	-0.00002 (0.01)	0.00158 (0.01)	-0.00754 (0.01)	0.06193 (0.81)	0.59425 (1.14)	0.22759 (1.14)	0.45371 (0.88)	1.19134 (1.01)
Child's Size at Birth (Smaller than Average) [c]	-0.00960 (0.03)	-0.02206 (0.03)	-0.02865 (0.03)	-0.02840 (0.03)	-0.02683 (0.03)	-0.00982 (0.11)	0.01574 (0.09)	**0.13510+** (0.08)	**0.15687+** (0.09)	**0.28021+** (0.14)

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Appendix 10: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-23 Months)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Education										
Parental Education Difference (in years)	-0.00117 (0.08)	-0.06629 (0.05)	0.04230 (0.05)	-0.02296 (0.05)	-0.00698 (0.06)	0.00779 (0.13)	**0.20444+** (0.11)	0.13939 (0.09)	0.02768 (0.10)	0.04298 (0.14)
Mother's Education (in years)	-0.06824 (0.17)	0.03103 (0.11)	-0.06057 (0.10)	-0.03160 (0.11)	-0.17267 (0.14)	0.00333 (0.36)	0.13496 (0.30)	0.19795 (0.27)	-0.14544 (0.31)	-0.65457 (0.57)
Health Services Environment										
Child Born in Hospital (Yes) [(d)]	-0.06397 (0.12)	0.03364 (0.07)	0.00122 (0.06)	-0.05246 (0.06)	-0.09743 (0.09)	-0.02591 (0.27)	-0.05640 (0.26)	-0.01134 (0.23)	-0.11097 (0.26)	0.12823 (0.39)
Antenatal Care (At least 4 ANC Visits) [(e)]	-0.07810 (0.07)	-0.03239 (0.04)	**-0.06719+** (0.04)	-0.06540 (0.04)	-0.06408 (0.04)	0.11869 (0.38)	-0.15029 (0.27)	0.11863 (0.21)	-0.08546 (0.24)	0.33618 (0.36)
Postnatal Care (Provided)[(f)]	-0.06086 (0.05)	-0.05362 (0.04)	-0.05095 (0.03)	-0.00972 (0.03)	0.03496 (0.05)	**-0.33027+** (0.19)	-0.15197 (0.18)	-0.11625 (0.16)	-0.20897 (0.20)	-0.28847 (0.32)
Preceding Birth Interval (>24 months)[(g)]	0.00236 (0.02)	0.00536 (0.02)	0.01487 (0.02)	0.02665 (0.03)	0.03615 (0.05)	-0.00210 (0.25)	0.13275 (0.19)	**0.28348+** (0.15)	0.18090 (0.19)	**0.51998+** (0.28)
Economic Attributes										
Wealth Index	-0.01247 (0.13)	-0.15123 (0.09)	-0.12821 (0.09)	**-0.21151+** (0.11)	0.03174 (0.15)	-0.07580 (0.09)	-0.02992 (0.08)	0.02190 (0.08)	0.04898 (0.08)	-0.04920 (0.14)
Mother's Working Status (Working)[(h)]	-0.03239 (0.04)	-0.01383 (0.03)	-0.01200 (0.02)	-0.00963 (0.03)	-0.06795 (0.06)	-0.10396 (0.29)	-0.15767 (0.24)	0.06618 (0.22)	0.22213 (0.26)	**0.95381*** (0.44)
Dependency Ratio	-0.02801 (0.08)	-0.03592 (0.05)	0.00085 (0.04)	0.04768 (0.05)	0.10130 (0.08)	0.12977 (0.37)	-0.28231 (0.26)	**-0.36175+** (0.22)	-0.43216 (0.28)	**-1.26217*** (0.63)
Household Food Security and Mother's Nutrition										
HH Food Security (Secure) [(i)]	-0.00116 (0.02)	-0.00309 (0.02)	-0.00040 (0.01)	-0.00357 (0.02)	-0.00343 (0.02)	0.12725 (0.23)	0.15100 (0.25)	0.13860 (0.25)	0.23408 (0.23)	-0.10594 (0.31)
Mother's Min Dietary Diversity (Achieved) [(j)]	-0.03453 (0.05)	0.01002 (0.03)	0.02285 (0.03)	-0.01355 (0.03)	-0.03769 (0.04)	**-0.40811+** (0.24)	0.01774 (0.21)	**0.30006+** (0.17)	0.14041 (0.18)	-0.17162 (0.25)

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Appendix 10: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 0-23 Months)

Detail Decomposition

Variables	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
	Q10	Q25	Q50	Q75	Q90	Q10	Q25	Q50	Q75	Q90
Mother's BMI	-0.00270	0.01141	0.02094	0.00870	0.02237	-0.20081	-0.19538	-0.27820**	-0.29312**	-0.22662
(Underweight) (k)	(0.04)	(0.03)	(0.03)	(0.02)	(0.03)	(0.15)	(0.14)	(0.10)	(0.10)	(0.16)
Mother's BMI	-0.00735	-0.00255	-0.00387	-0.00889	-0.00457	-0.05750	-0.04796	-0.02924	0.01220	0.04815
(Overweight) (k)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.05)	(0.05)	(0.04)	(0.06)	(0.14)
Decision making and Empowerment Attributes										
Sex of Household Head	0.02507	-0.00324	-0.01879	0.03140	0.03247	0.05529	-0.09662	-0.05370	-0.14232	-0.09764
(Female) (l)	(0.04)	(0.03)	(0.03)	(0.03)	(0.05)	(0.11)	(0.11)	(0.09)	(0.10)	(0.15)
Decision making and	0.03668	0.04083	0.05192	-0.02142	-0.05109	-0.12682	-0.09310	0.22995	0.13808	0.27807
Ownership measure	(0.06)	(0.04)	(0.04)	(0.05)	(0.06)	(0.24)	(0.23)	(0.17)	(0.18)	(0.34)
Mother's Exposure to	-0.05987	0.01223	0.02063	0.03971	0.06169	-0.03310	-0.03719	-0.05380	0.21119	0.44171+
Media (Yes) (m)	(0.06)	(0.04)	(0.03)	(0.04)	(0.06)	(0.30)	(0.23)	(0.17)	(0.18)	(0.27)
Mother's Age at First	-0.04122	-0.00446	-0.01223	-0.00730	-0.02199	0.08692	-0.31863	-0.90371	-0.64473	-3.64149*
Birth	(0.04)	(0.03)	(0.02)	(0.02)	(0.04)	(1.60)	(1.38)	(0.88)	(1.02)	(1.70)
Constant	-	-	-	-	-	0.67370	0.23298	-0.48903	-0.58395	-0.80171
	-	-	-	-	-	(2.45)	(2.27)	(1.75)	(2.07)	(2.95)

Residuals

	Q10	Q25	Q50	Q75	Q90
Specification Error	0.02690	-0.04868	0.02870	0.07461	0.17790
	(0.20)	(0.15)	(0.12)	(0.23)	(0.49)
Reweighting Error	0.04818	0.05325	0.04185	-0.02468	-0.12764
	(0.11)	(0.12)	(0.12)	(0.19)	(0.36)

(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001). Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Repetitions.

Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Provinces

Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Not Achieved (k) Healthy Weight (l) Male (m) Not following magazine/TV/Radio even once in a week

Appendix 11: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 24-59 Months)

Overall Decomposition

	Q10	Q25	Q50	Q75	Q90
Rural Area	-3.33643*** (0.07)	-2.67790*** (0.06)	-1.92456*** (0.07)	-1.04006*** (0.09)	-0.36516* (0.15)
Counterfactual	-3.37712*** (0.13)	-2.69705*** (0.16)	-1.96983*** (0.10)	-1.30770*** (0.11)	-0.45980* (0.20)
Urban Area	-3.20271*** (0.09)	-2.35918*** (0.09)	-1.67523*** (0.07)	-0.97265*** (0.08)	-0.27338** (0.10)
Rural-Urban Difference	-0.13372 (0.11)	**-0.31872**** (0.11)	**-0.24933**** (0.09)	-0.06742 (0.12)	-0.09178 (0.18)
Covariate Effect	-0.17441 (0.14)	**-0.33787*** (0.16)	**-0.29459**** (0.10)	**-0.33505**** (0.11)	-0.18642 (0.19)
Coefficient Effect	0.04069 (0.14)	0.01915 (0.16)	0.04526 (0.12)	**0.26764+** (0.14)	0.09464 (0.25)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Child Characteristics										
Child Gender (Female) [(a)]	-0.00081 (0.01)	-0.00065 (0.01)	0.00071 (0.01)	0.00024 (0.01)	0.00059 (0.01)	**-0.29971+** (0.16)	0.13044 (0.13)	0.06908 (0.10)	0.06575 (0.13)	0.15992 (0.20)
Age-squared	-0.00232 (0.16)	-0.00159 (0.12)	-0.00175 (0.12)	-0.00106 (0.09)	-0.00190 (0.13)	3.07287 (3.07)	-0.28394 (2.45)	2.88114 (2.34)	0.60143 (2.48)	1.76563 (3.37)
Age of the Child (in months)	0.01242 (0.14)	0.00994 (0.12)	0.01043 (0.12)	0.00593 (0.09)	0.01166 (0.13)	-5.25072 (5.65)	0.47370 (4.58)	-6.00282 (4.42)	-1.08549 (4.71)	-4.58284 (6.57)
Birth Order (First Child) [(b)]	-0.03579 (0.03)	-0.02342 (0.02)	-0.00292 (0.02)	0.01265 (0.02)	-0.00711 (0.03)	-0.21621 (0.24)	0.05218 (0.23)	0.10481 (0.20)	-0.14278 (0.21)	-0.24275 (0.25)
Child Size at Birth (Smaller than Average) [(c)]	0.00064 (0.01)	0.00064 (0.02)	0.00070 (0.01)	0.00032 (0.01)	0.00062 (0.01)	-0.02313 (0.07)	0.08182 (0.07)	-0.01498 (0.06)	0.00568 (0.06)	0.02978 (0.09)

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Appendix 11: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 24-59 Months)

Detail Decomposition

Variables	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
	Q10	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
<u>Education</u>										
Parental Education Difference (in years)	-0.03799 (0.05)	-0.01399 (0.05)	-0.01025 (0.03)	-0.01454 (0.08)	-0.01658 (0.14)	0.06407 (0.10)	0.12128 (0.08)	0.00267 (0.06)	0.05136 (0.09)	0.14148 (0.11)
Mother's Education (in years)	-0.07369 (0.10)	**-0.11736+** (0.06)	-0.01890 (0.05)	0.05106 (0.06)	0.02603 (0.09)	-0.06568 (0.16)	-0.04708 (0.13)	-0.11275 (0.14)	0.14870 (0.19)	0.18657 (0.26)
<u>Health Services Environment</u>										
Child Born in Hospital (Yes) [(d)]	-0.05739 (0.07)	-0.07171 (0.05)	-0.03091 (0.05)	0.06851 (0.06)	0.11494 (0.08)	-0.09850 (0.10)	-0.06446 (0.10)	-0.06687 (0.09)	0.04532 (0.11)	0.09276 (0.19)
Antenatal Care (At least 4 ANC Visits) [(e)]	0.00408 (0.06)	-0.00786 (0.03)	-0.00128 (0.03)	-0.03006 (0.03)	-0.04549 (0.04)	0.19716 (0.20)	0.06175 (0.16)	0.03200 (0.13)	-0.12307 (0.15)	-0.36208 (0.24)
Postnatal Care (Provided)[(f)]	0.08841 (0.06)	0.05874 (0.05)	**-0.08608*** (0.04)	**-0.11066*** (0.05)	**-0.10595+** (0.06)	0.08946 (0.10)	0.10871 (0.09)	-0.05045 (0.08)	**-0.23063*** (0.10)	-0.18190 (0.15)
Preceding Birth Interval (>24 months)[(g)]	-0.02521 (0.03)	-0.01713 (0.02)	-0.02103 (0.02)	-0.01121 (0.02)	0.00711 (0.02)	-0.06061 (0.19)	0.06456 (0.14)	0.10319 (0.14)	0.20809 (0.15)	-0.10703 (0.22)
Economic Attributes										
Wealth Index	-0.02945 (0.10)	-0.01246 (0.08)	-0.04415 (0.07)	-0.09710 (0.07)	-0.03507 (0.09)	0.01298 (0.09)	-0.03415 (0.09)	**-0.13894+** (0.08)	-0.07918 (0.11)	-0.16866 (0.14)
Mother's Working Status (Working)[(h)]	-0.01865 (0.02)	-0.01235 (0.02)	-0.00912 (0.01)	-0.01243 (0.02)	-0.02013 (0.02)	0.01330 (0.22)	-0.10785 (0.19)	0.07073 (0.18)	0.22987 (0.21)	0.40046 (0.29)
Dependency Ratio	-0.03228 (0.05)	-0.00402 (0.03)	0.00697 (0.02)	-0.02068 (0.02)	-0.02485 (0.03)	-0.04947 (0.27)	0.20196 (0.22)	-0.08565 (0.19)	-0.13914 (0.23)	0.27409 (0.34)
Household Food Security and Mother's Nutrition										
HH Food Security (Secure) [(i)]	0.00853 (0.02)	-0.02086 (0.02)	-0.00668 (0.01)	0.00364 (0.01)	0.00534 (0.02)	0.34101 (0.21)	0.04734 (0.19)	-0.19235 (0.16)	-0.06983 (0.17)	-0.23450 (0.28)
Mother's BMI (Underweight) [(j)]	-0.01705 (0.03)	-0.00755 (0.01)	-0.00302 (0.01)	0.00116 (0.01)	-0.00138 (0.01)	-0.01013 (0.10)	0.03584 (0.07)	0.02451 (0.06)	-0.07309 (0.08)	0.00905 (0.12)

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Appendix 11: Decomposition of Rural - Urban Child Stunting Differentials (Age Group 24-59 Months)

Detail Decomposition

	Differential in Determinants (Covariate Effect)					Differential in Returns (Coefficient Effect)				
Variables	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Mother's BMI	-0.04293	-0.03006	-0.03054	-0.02475	0.00308	-0.04117	-0.04777	0.04563	0.03317	**0.19001***
(Overweight) [(j)]	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.08)
Decision making and Empowerment Attributes										
Sex of Household Head	0.01400	0.00166	-0.00215	0.00737	0.02832	0.02474	0.08560	-0.03560	0.02696	0.11714
(Female) [(k)]	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.09)	(0.09)	(0.08)	(0.10)	(0.15)
Decision making and	-0.02817	-0.01845	-0.03004	-0.03459	-0.02885	0.06654	-0.19394	-0.04348	-0.12909	-0.02530
Ownership measure	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	(0.19)	(0.16)	(0.16)	(0.18)	(0.30)
Mother's Exposure to	-0.02861	-0.02654	-0.01413	0.00738	0.01071	**-0.28078***	0.00483	-0.06092	0.19226	0.26001
Media (Yes) [(l)]	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.14)	(0.13)	(0.12)	(0.15)	(0.23)
Mother's Age at First	0.03053	-0.00154	-0.00097	-0.01904	-0.04702	0.27246	0.08234	0.18493	0.57578	-0.53099
Birth	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(1.14)	(0.84)	(0.69)	(0.87)	(1.17)
Constant	-	-	-	-	-	2.68814	-0.18085	3.64089	0.48505	3.41567
	-	-	-	-	-	(3.19)	(2.53)	(2.41)	(2.77)	(4.00)

Residuals

	Q10	Q25	Q50	Q75	Q90
Specification Error	-0.03715	-0.05771	0.04550	-0.07343	-0.00869
	(0.14)	(0.12)	(0.09)	(0.11)	(0.17)
Reweighting Error	0.02338	-0.00342	-0.01041	0.00685	-0.00456
	(0.07)	(0.07)	(0.06)	(0.07)	(0.09)

(Statistical significance levels: + p<0.1 * p<0.05 ** p<0.01 *** p<0.001). Bootstrapped Standard Errors in Brackets. Bootstrapped (using `bsweights') at 450 Repetitions.
Note: All Regressions have been controlled for Caste and Ethnicity, Ecological regions and Province

Reference Categories: (a) Male (b) 2nd or 3rd Child (c) Average or larger than average (d) Home or elsewhere (e) Num of ANC visit <4 (f) Delayed or Not Provided (g) No or less than 24 Months (h) Not working (i) Severely or Moderately Insecure (j) Healthy Weight (k) Male (l) Not following magazine/TV/Radio even once in a week

Appendix 12: Aggregate Covariate and Coefficient Effects Age Groups 0-23 and 24-59 months

Figure 12a: Aggregate Covariate and Coefficient Effects (0-23 months)

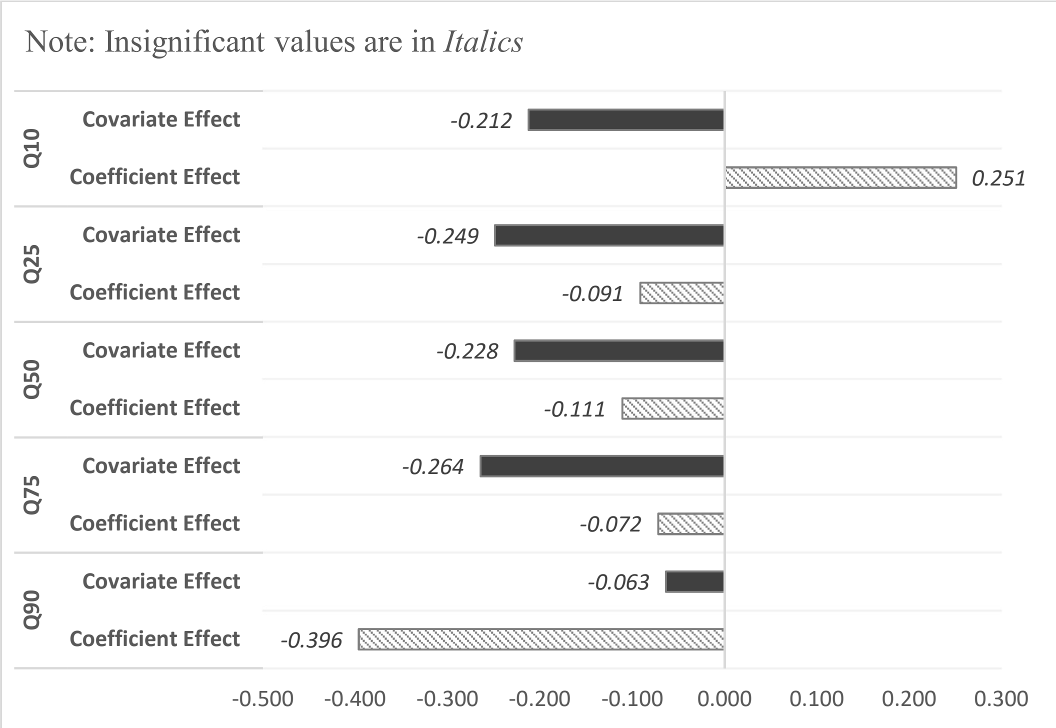
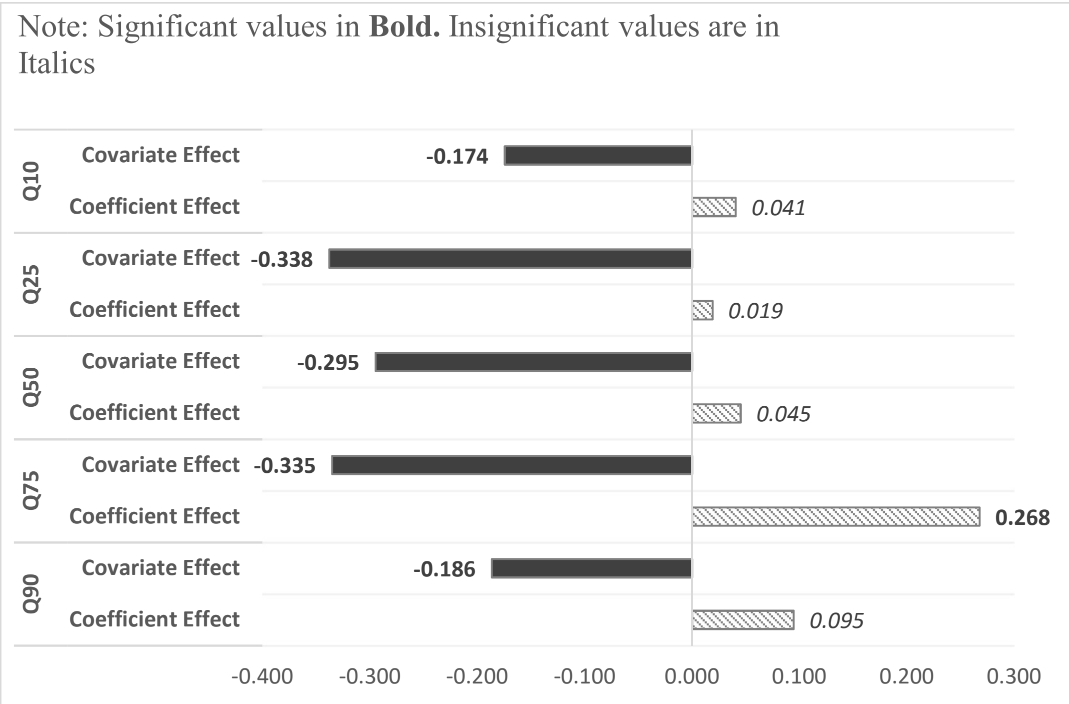


Figure 12b: Aggregate Covariate and Coefficient Effects (24-59 months)



Appendix 13: Significant Individual Coefficient Effects in All Age Groups

Figure 13(a): Significant Individual Coefficient Effects (0-59 months)

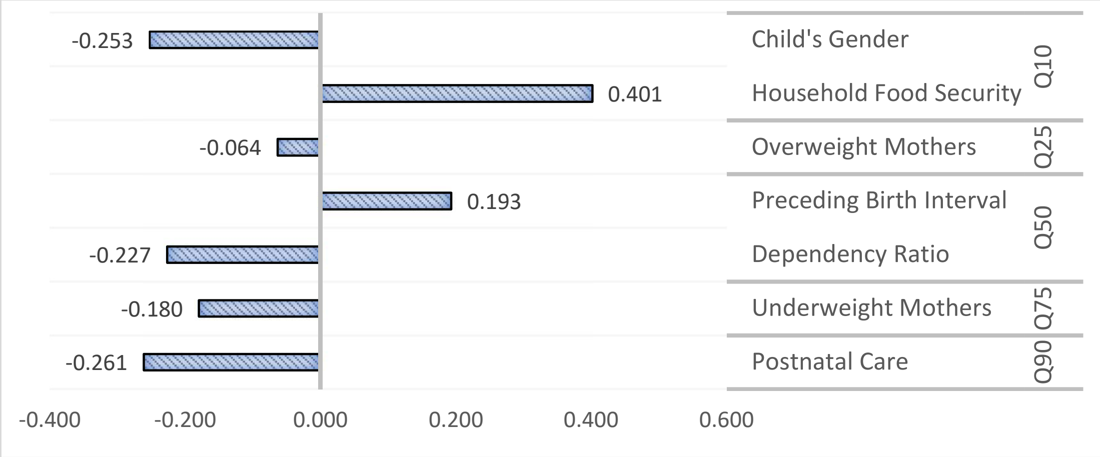


Figure 13(b): Significant Individual Coefficient Effects (0-23 months)

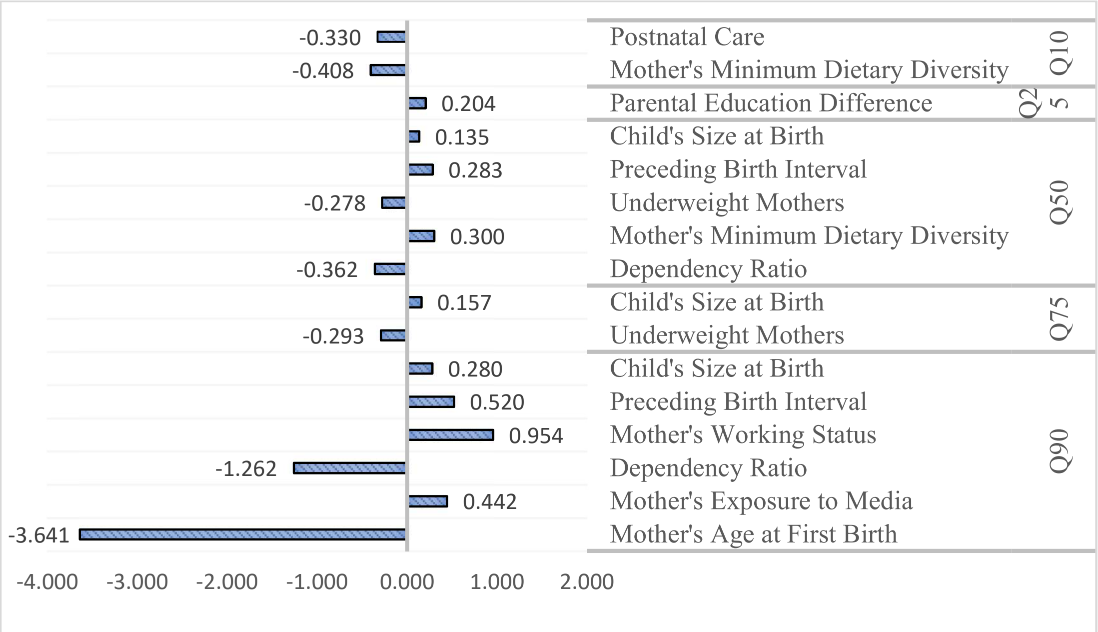


Figure 13(c): Significant Individual Coefficient Effects (24-59 months)