Foreign Direct Investment and Child Mortality;
An Empirical Investigation in the case of Tanzania.

A Research Paper presented by:

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in partial fulfilment of the requirements for obtaining the degree of
MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Economics of Development
(ECD)

Specialization: **Econometric Analysis of Development Policies**

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November 2018

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List of Acronyms

UNDP	United Nations Development Programme
FDI	Foreign Direct Invest
U5MR	Under-five Mortality Rate
IMR	Infant Mortality Rate
NMR	Neonatal Mortality Rate
PNNR	Post Neonatal Mortality Rate
MITI	Ministry of Industry and Trade
NBS	National Bureau of Statistics
MoHCDGED	Ministry of Health, Community Development, Gender, Elderly and Children
MoH	Ministry of Health
OCGS	Office of Chief Government Statistician
TIC	Tanzania Investment Centre
TRA	Tanzania Revenue Authority
EPZA	Export Processing Zones Authority
SEZ	Special Economic Zones
BRELA	Business Licensing and Registration Agency
POPC	President's Office Planning Commission
FYDP	Five Year Development Plan
NSGRP	National Strategy for Growth and Reduction of Poverty
PRS	Poverty Reduction Strategy
PRSP	Poverty Reduction Strategy Paper
MDGs	Millennium Development Goals
SDGs	Sustainable Development Goals
TFP	Total Factor Productivity
GDP	Gross Domestic Product
BoT	Bank of Tanzania
TDV2025	Tanzania Development Vision 2025
HIPC	Highly Indebted Poor Countries
SSA	Sub-Saharan Africa
HIV	Human Immune Virus
AIDS	Acquired Immune Deficiency Syndrome
UN	United Nations
IMF	International Monetary Fund

WB	World Bank
ILO	International Labour Organization
UNICEF	United Nations Children Emergency Fund
WHO	World Health Organization
UNIDO	United Nation Industrial Development Organization
OECD	Organization for Economic Co-operation and Development
UNCTAD	United nations Conference on Trade and Development
SAPs	Structural Adjustment Programs
LTTP	Long Term Perspective Plan
WDI	World Development Indicators
LIC	Low Income Countries
LNG	Liquefied Natural Gas
UTCOP	Uganda–Tanzania Crude Oil Pipeline
HDI	Human Development Index
PHC	Primary Health Care
LiST	Lives Saved Tools
GNP	Gross National Product
WTO	World Tarde Organization
VAT	Value Added Tax
PSA	Production Sharing Agreement
MDA	Mining Development Agreement
DHS	Demographic Health Survey
TFR	Total Fertility Rate
TPDC	Tanzania Petroleum Development Corporation

Acknowledgements

This paper is dedicated to the memory of my late father Amon Mwabeza, an ISS Alumni who was an extraordinary being to a great inspiration for my academic and professional endeavors.

I would like to take this Opportunity to thank who in one way or another provided their contribution which facilitated successful accomplishment of Research Paper. I would like to extend my sincere gratitude to my supervisors Prof Mathias Rieger and Prof. Arjun Bedi for their advice and guidance. I am indebted to my first supervisor Mr. Mathias Rieger for his regular advice and encouragement throughout this research process. Similarly, I am grateful to the Institute of Social Studies (ISS) for granting me an opportunity to pursue my postgraduate study and as a result I have been able to undertake this research.

Finally, great thanks are extended to my family especially my wife Christina for taking care of beloved son Joachim during my absence for studies as well as for her advice, encouragement and support during and before commencement of my studies.

Abstract

This paper examines the impact of Foreign Direct Investment (FDI) on child mortality in Tanzania mainland during 1999-2012 period. FDI impact on child mortality is hypothesized to be mediated through incomes, the paper thus first examines FDI effect on income and then consequent income impact on child mortality. Focusing on 17 Tanzania mainland regions, the paper uses panel data gathered from multiple sources such as Population and Hosing Census, National Accounts and Foreign Private Investment Reports. Fixed-Effect regressions technique is employed for main analysis.

Study finds FDI to exert positive effect on income however income is found to have no consequent impact on child mortality, thus concluding FDI to have no significant effect on child mortality in Tanzania. Absence of effect is thought to be due to weak direct association between income and child mortality that was also observed in previous case study. Study was limited by absence of well-established analytical frameworks for FDI and child mortality relationship, it therefore argues for more studies to be conducted on the subject as globalization accelerates at unprecedented pace.

Relevance to Development Studies

Globalization and its fast pace observed in recent decade has made development process of a country to be dependent on its ability to benefit trade, investment and other globalization aspects. With discussion on globalization dwelling much on its economic impact, its crucial to also shed some light on its social welfare implication like impact on population health outcomes. Since development entails more than just economic growth, it is relevant to investigate the effect of globalization phenomenon like FDI on population health outcome like child mortality in order to understand policy and other interventions necessary for country to maximize its benefit as well as mitigate its negative consequences if any.

Keywords

Foreign Direct Investment, Child mortality, Income, Tanzania

Chapter 1 Introduction

During his inaugural speech to the newly formed Cabinet of independent Tanganyika (now Tanzania) on 10th December 1961, Julius K. Nyerere (country's first President) branded "poverty, ignorance and diseases" as nation's main vices and argued that eliminating them should be country's central development agenda. In what one would term walking the talk his government in 1967 adopted socialism and self-reliance policies under the banner of "Ujamaa". In addition to embracing planned economy, as part of Ujamaa policy free education and health services[1] were provided to all citizens (Abel-Smith and Rawal 1992).

From mid-1990's to mid-2000's Tanzania embarked on a significant reorientation of its development agenda and approach (Nord et al, 2009). This was a measured response to bleak economic performance peppered with worsening poverty and socio-economic conditions that occurred (between late 1970's to early 1990's. A situation which was in part blamed on the failure of "Ujamaa" policies as well as negative consequences of Structural Adjustments Programs (SAPs). SAPs prioritization of macroeconomic stabilization and growth at expense[2] of social services delivery and human capital development (Lugalla 1995) was alleged to have contributed to the deteriorating socio-economic situation.

The efforts to reorient Tanzania's development agenda and approach among other things entailed two major aspects. First, embracing broad-based development approach and pro-poor policies in which both economic growth and human social welfare are integral part of development strategy. Second, increased focus on attracting Foreign Direct Investment (FDI) to stimulate economic development, with FDI becoming an important element of Tanzania's development strategy (Ministry of Industry and Trade 2004[3], Ayanwale 2007). These efforts culminated into the adoption of Tanzania Development Vision 2025 (TDV 2025) in 2000.

Vision 2025 overarching objective is to transform Tanzania into semi-industrialized middle-income country (with nominal per capita GDP of $3,000) by the year 2025. In addition to having a strong and competitive economy, good governance and rule of law, Vision 2025 goals also include attaining high-quality livelihood for all Tanzanians. Each goal has corresponding targets, for example Vision 2025 goal of attaining high-quality livelihood has; absence of abject poverty, attaining life expectancy comparable to levels found in typical middle-income countries, reduction of child and maternal mortality rates by three-quarters

[1] this continued until 1993 when the government introduced cost-sharing in health and education on a user charges basis as part of cutting back state role to contain fiscal deficits under SAPs (Lugalla 1995:44, Muela et al. 2000:298).
[2] Philip Mpango (current Minister for Finance and Planning) lecture series on Economic Planning in Tanzania (23 November 2013).
[3] Tanzania Mini-Tiger Plan 2020.

of 2000 levels, and access to primary health care for all among its targets (Planning Commission, 2000).

Adoption of Vision 2025 was taking place in the same year the world was embracing Millennium Development Goals (MDGs). Tanzania being the signatory to the United Nations Millennium Declaration (Resolution 55/2) it had to mainstream MDGs goals into its development Vision and corresponding national plans. The goals which included; eradication of extreme poverty and hunger, achieve universal primary education, reduce child mortality, improve maternal health, and combat HIV/AIDS, malaria and other diseases among others (Sachs and McArthur 2005, Travis et al. 2016).

Implementation of Vision 2025 was earmarked to be through medium-term development strategies/plans, since during the same time Tanzania was developing Poverty Reduction Strategy Paper (PRSP) under World Bank support (part of Highly Indebted Poor Countries-HIPC Initiative), Tanzania's first Poverty Reduction Strategy Paper-PSRP (2000-2003) became the implementing instrument for the Vision. The first Poverty Reduction Strategy was followed by National Strategy for Growth and Reduction of Poverty (NSGRP) or MKUKUTA in its Swahili acronym, and it has been implemented in two phases MKUKUTA 1 and II in 2005-2010 2011-2015 respectively. MKUKUTA had three main clusters namely; growth and reduction of income poverty (Cluster 1), improved quality of life and social well-being (Cluster 2) and governance and accountability (Cluster 3). Each cluster had several goals and each goal had corresponding targets. Cluster 2 had five goals and one of them was, 'improving survival, health, nutrition and well-being, especially for children, women and vulnerable groups' which set 2015 targets for infant and under-five mortality rates at 38 and 54 per 1,000 live birth respectively (Ministry of Finance 2011b:71).

Implementation of Poverty Reduction Strategies presided over the period of unprecedented growth and economic transformation, growth in aggregate and real GDP per capita averaged 6.7 and 3.6 percent respectively, with per capita GDP increasing from $497.2 in 2000 to $836 in 2015. It was also the period characterized by increased FDI activities, as Tanzania became more successful in attracting FDI than most Sub-Saharan Africa (SSA) and other low-income countries.

FDI has been credited as one of the factors behind accelerated economic growth and consequent increase in per capita income (WB 2007, Nord et al. 2009, and IMF 2016), FDI role can be evidenced through Tanzania economic growth accounting as well as the examination of sectoral growth. Growth accounting indicates capital accumulation[4] and total factor productivity (TFP) to have been the main contributors to real GDP growth from late 1990's to mid-2010's (WB 2007:14-16, Nord et al. 2009: 56-59, and IMF 2016: 7-8). FDI has

[4] it is expected to continue being a significant economic growth driver because recent data (2008-2014) indicates growth is becoming more capital intensive (IMF 2016:7)

thus played a role in observed growth by contributing to significant increase in capital accumulation (Nord et al. 2009: 59) through helping to crowd in private investment[5] (IMF 2016: 11); also, FDI coupled with macroeconomic stability and implementation of structural reforms have played a crucial role in acceleration of TFP (2009;59). Cross-examination of sectoral FDI and growth during the 2000-2006 period indicates, most sectors which were larger FDI recipients were also the ones that registered highest growth rates (WB 2007: 15).

In 2011 MKUKUTA seized to be country's principal medium-term development strategy and implementing instrument of Vision 2025; it was replaced by Five Year Development Plans (FYDPs) which were adopted in the wake of nation reverting to long-term planning[6]. The first FYDP (2011-2015) was implemented along with MKUKUTA II but unlike MKUKUTA it put more emphasis on growth accelerating interventions like infrastructure investment among others (Planning Commission 2011). After 2015, Poverty Reduction Strategies effectively seized to exist, and its social initiatives were incorporated into the second five-year development plan (2016-2020), whose main priority is industrialization through promoting manufacturing and development of resource-based industries such as mining (precious germs, coal, iron and steel, and industrial minerals like soda ash) and natural gas (Ministry of Finance and Planning 2016b).

Poverty reduction strategies saw more emphasis being put on 'pro-poor' interventions with increasing public expenditure on social sectors (Williamson and Canagarajah 2003). Between early and late 2000's public health expenditure increased tremendously; its share of total government expenditure increased from 9.2 percent in 1999 to reach an all-time high of 28.2 percent[7] in 2006, public health spending per capita increased almost threefold between 2005 and 2009 (IMF 2016:37). This helped to support interventions such as 'National Strategic Plan to Accelerate Reduction of Maternal, Newborn and Child Deaths in Tanzania'. Interventions which are lauded to have contributed in improving health outcomes; for example, under-five mortality rate (U5MR) declined considerably from 147 deaths in 1999 to 81 deaths per 1,000 births in 2010 despite marginally missing the MKUKUTA target of 79 and life expectancy which has increased from 51 years in 2002 to 58 years in 2010 (Ministry of Finance 2012: 55-58).

However, from late 2000's to mid-2010's public health expenditure has exhibited a change in pattern compared to an earlier period. Public health expenditure share of budget started to decrease (from 18.2 percent in 2007 to 12.3 percent in 2014, and public health spending per capita also stalled (IMF 2016: 38-

[5] Increase in private investment from an annual average of 16.7 percent of GDP during 1996-2007 period to 25.5 percent of GDP in 2008-14 period is in part credited to FDI (IMF 2016: 7)

[6] Through adoption of Long-Term Perspective Plan (LTPP) 2011-2025 which is earmarked to be implemented through three successive Five-Year Development Plans

[7] World Development Indicators database

39). The reasons attributed this observed change in pattern are; decrease in donor financing (both General Budget Support-GBS and Health Basket Fund) and shift in government's prioritization towards economic sectors (e.g. infrastructure and manufacturing) and away from social sectors in the wake of adoption of Five-Year Development Plans as a medium-term development framework (Ministry of Finance and Planning, 2016a[8]: 125-126). This change has prompted worries that registered momentum in health outcomes improvement might be adversely impacted therefore putting country's chances of attaining national and international (Sustainable Development Goals[9]-SDGs) health targets in jeopardy.

Declining share of public spending in social sectors general and health in particular highlights the need for effectively employing multifaceted and alternative strategies for improving not only health but also other non-income welfare aspects. Strategies that will help to supplement health interventions in post poverty reduction strategy era and help the country attain national and international goals.

Literature suggests that in developing countries income (along with factors education and income distribution among other factors) plays a more significant role in improving health outcomes (especially child mortality) than public health spending (Pritchett and Summers 1996, Filmer and Pritchett 1997, Mogford 2004, and O'Hare et al. 2011). This assertion can be supported by data in Tanzania case; IMF (2016) analytical report show Tanzania in 2010-2014 period performed better on health outcomes than other low-income countries (LIC) with same level of public health spending per capita and health spending efficiency score[10]. Tanzania's infant mortality and incidence of tuberculosis was lower than comparator countries while its health-adjusted life expectancy (HALE) was similar to low-income countries average (IMF 2016: 38-40), implying income and other determinants of health outcomes played a role in noticed improvements.

Considering that income provides an alternative way for improving health outcomes, it is crucial that income's underlying determinants (of which FDI is one) and the relationship of those determinants with population health outcome(s)of interest (child mortality in our case) is clearly understood. However, there is very limited theoretical and empirical literature on the matter, and to matter worse empirical results on FDI and child mortality relationship have been ambiguous (Alsan et al. 2006, Burns et al. 2017).

[8] MKUKUTA II Assessment Report

[9] IMR and U5MR of 40 per 1,000 live births and 25 deaths per 1,000 live births respectively.

[10] Using Data Envelopment Analysis (DEA) approach, Tanzania's 2010-2014 health spending efficiency score was estimated to be 0.86 in line with sample average of comparator countries (IMF 2016:39)

This paper therefore examines the impact of Foreign Direct Investment (FDI) on child mortality in Tanzania mainland during the period 1999 to 2012. The paper begins by examining the impact of FDI on income (measured by per capita GDP) and subsequently the impact of income on under-five mortality. In so doing the paper attempt to answer the following research question; Does FDI exert an impact on per capita income? and Does income exert an impact on child mortality?

Understanding FDI and child mortality relationship in Tanzania context helps policymakers to design more effective FDI policies, ones that maximize country's welfare by having the impact that transcends typical economic benefits of FDI (i.e. economic growth, increase government revenue and employment generation). This might in-turn provide an additional policy option (using FDI as a policy instrument for attaining health and other social welfare goals) which will not only help country efforts of improving health outcomes but also improve policy coherence i.e. synergies between economic policies and social/health policies and interventions. This is even more important at this juncture as the country is poised to receive significant FDI inflows in the near future; approximately $34 billion (equivalent to 65 percent of Tanzania's 2017 nominal GDP i.e. $52.09 billion) from a $30 billion Liquefied Natural Gas (LNG) Project and $4 billion Uganda–Tanzania Crude Oil Pipeline (UTCOP).

The study contributes to the literature in a number of ways. First, by focusing on a single country (Tanzania), it addresses country's specific dimension to the FDI and child mortality debate. Second, by covering the recent period (unlike the majority of previous studies which covered period prior to 2000's with just a handful of them covering up to mid-2000's) it captures potential consequences of recent dynamics such as global financial crisis and increased prominence of Chinese investment to Africa in the FDI and child mortality relationship. Lastly, this paper will add insights to the existing body of literature, especially considering limited literature on FDI and child mortality relationship and ambiguity surrounding their empirical findings.

Fixed-effect regression technique is employed for analysis and used panel data of 17 Tanzania mainland regions for FDI flows, per capita GDP, child mortality and other socio-economic and demographic indicators (education, fertility, population etc.) from Bank of Tanzania's (BoT) Foreign Private Investment report and national accounts and Population and Housing Census publications by National Bureau of Statistics (NBS) and other sources.

Study findings show FDI to exert a positive impact on income, but income has no subsequent impact on under-five mortality implying FDI has no significant effect on under-five mortality in Tanzania; the results are robust for the inclusion of other determinants of child mortality namely total fertility rate, female education, and proportion of rural population. Findings echoes Burns et al (2017) results but differ from those which found either positive (Shandra et al. 2005, Jorgenson 2009) or negative effect (Dawson 2010, Chuang et al. 2015). The technical explanation for the observed absence of FDI effect might be the

inability to account for all crucial child mortality determinants due to data limitations and absence of well-established analytical framework(s) for FDI and child mortality relationship. More practical explanation is the observed weak income and child mortality relationship in low-income countries in general (O'Hare et al. 2011) and Tanzania in particular (Afnan-Holmes et al. 2015) either due to inequality of income or income effect on child mortality being mediated through health-related interventions (e.g. coverage) or other factors.

Findings have two policy implications; first, health interventions remain a relevant and effective way of improving health outcomes in the country; second, economic policies (FDI attractions) that are purely fixated on income and growth without an appropriate regard of social welfare might undermine their potential benefit or even worse deteriorate welfare. Therefore, economic growth focused interventions shouldn't be at the expense of social welfare ones, and to maximizes benefits from both categories of interventions, strong synergies between them is indispensable.

The rest of the paper is organized as follows: Section 2 presents the theoretical framework and literature review for the study. Section 3 provides some context on Tanzania with regard to FDI, income, and under-five mortality. Section 4 narrates methodological issues including model identification, data and variables used and estimation techniques; Section 5 presents and discusses paper's findings; and finally, Section 6 presents concluding remarks.

Chapter 2 Literature Review

Although income (as measured by GDP per capita) has long served as the hegemonic yardstick through which country's level of development can be measured. Amartya Sen's "Capabilities Approach" and other related efforts saw the World (from late 1980's) under championship of United Nations Development Program (UNDP) adopting a broader measure of development and welfare which includes health and education alongside income. Child mortality though not directly part of the three indicators that compose Human Development Index (HDI), it has been among health indicators that are closely associated with development and welfare of nations.

Child mortality refers to deaths of children under the age of five years (Hill 1991, UNICEF 2018), it encompasses four different measures namely; Neonatal mortality rate (NNR), Postneonatal mortality (PNNR), Infant Mortality Rate (IMR) and Under-Five Mortality Rate(U5MR). All these mortality rates measures probability of dying per thousands of live births at different children's age: - neonatal mortality captures death occurrence in the first month of life; postneonatal, deaths occurrence between first month and one year of child life, infant mortality captures probability of dying between birth and the first birthday and under-five mortality looks at deaths occurrence for children aged between zero and five years (Sullivan and Tureeva 2004:77).

Out of the four aforementioned measures, infant mortality and under-five mortality rates have been the most prominent ones. Infant mortality tends to be sensitive to availability, utilization and effectiveness of health care, hence often used for inter-country or intra-country comparison of health care systems and for designing and monitoring population and health programs (Anyanwu and Erhijakpor 2009:401). Under-five mortality on the other hand captures health as well as demographic and socio-economic dynamics of a country, therefore in addition to being a preeminent measure of the health status of a country (O'Hare et al 2011:408) it serves as a rudimentary measure of country's development and social welfare (Masuy-Stroobant and Gourbin 1995).

Globalization drive witnessed in the past 30 years saw a surge in interest among social scientists and researchers in other fields to examine the socio-economic and political consequences of globalization on countries especially developing ones. Foreign Direct Investment (FDI) along with international trade are among globalization aspects whose welfare impacts on developing countries has been the subject of much inquiry. Regrettably, a majority of such inquiries have been economics oriented focusing much on economic impact of FDI (impact on variables such as income, investment, productivity etc.) with little theoretical and empirical literature on FDI linkage with social measures of welfare such as under-five mortality. Even recent FDI literature that have attempted to investigate FDI impact on poverty largely focuses on income poverty measures (example poverty incidence or headcount, poverty gap, GINI Index and income of lowest quintiles or deciles of income distribution; Magombeyi and Odhiambo

2012:79-86) with just a handful of them (Reiter and Steensma 2010, Gohou and Soumaré 2012, Israel 2014, and Fauzel et al. 2017) using more multi-dimensional measures of poverty and development such as HDI.

Limited theoretical and empirical literature on FDI and child mortality linkage has multiple implications for this study. At theoretical level, it implies theoretical (and consequently conceptual) formulation of their relationship would have to rely on combining theoretical explanations provided by different strands of literature (in our case combining income and child mortality and FDI and income theoretical relationships). The implication at empirical level is that there would be limited empirical lessons (estimation techniques and results) which the study can draw from and make comparisons.

2.1. Frameworks for Analysis of Child Mortality Determinants

Child mortality in essence measure child survival, both theory and empirical studies on the matter has evolved over the past four decades. In the wake the Alma-Ata Declaration[11] of 1978, there was increased research interest on primary health care and health outcomes especially child mortality. Research efforts were however hampered by two intertwined factors; first, the differences and disconnect between approaches used by social scientists and medical scientists on determinants of child survival especially in developing countries (Mosley and Chen, 1984). Second, the absence of a thorough and clear conceptual models for studying determinants of child health and survival in developing countries, one that integrates research techniques used in both social sciences and medical sciences research (Hill 2003:138).

Mosley and Chen (1984) noted the disparity between social science and medical research. They pointed out that social science research focused on association of socio-economic and cultural factors (e.g. income and maternal education) and child mortality; they use correlation between them to draw causal inference on determinants of child mortality, and; they often don't address the medical causes of death. Medical research, on the other hand, focused on the biological processes of diseases as related to death and morbidity (state of being sick) rather than mortality; they associate mortality to specific diseases processes (e.g. infections or malnutrition) and often tend to ignore the consequences of diseases to mortality as well as socio-economic determinants of diseases in the first place.

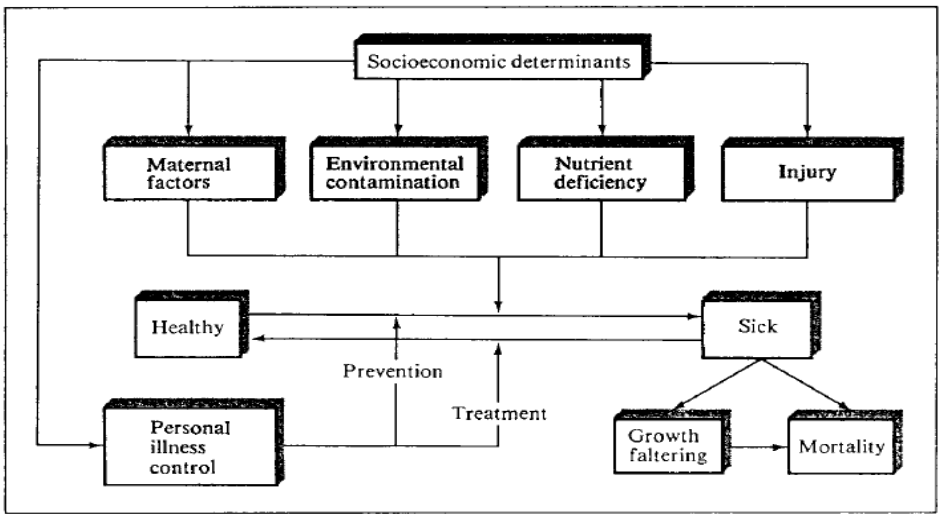
Mosley and Chen (1984) argued that while both approaches provide a valuable contribution in understanding child mortality their principal methodological differences compartmentalize knowledge and hence handicaps development of more lucid approaches for explaining and understanding child mortality, particularly in developing nations. To address the aforementioned challenges, they de-

[11] adopted at the International Conference on Primary Health Care (PHC) held on September, 1978 in Kazakhstan

veloped an analytical framework that integrates both approaches. Their framework builds on earlier work by Davis and Blake (1956) who separated and proximate and intermediate variables of child mortality.

The central premise of Mosley and Chen framework is that socio-economic, cultural and health system variables act as background/underlying factors of morbidity and mortality and operates through a set of intermediary variables (proximate determinants) to exert direct influence on risks of disease and outcomes of disease processes in individuals (mortality being one). In simpler terms, socio-economic, cultural and health factors influence proximate determinants of child health state (being healthy or sick) and these in-turn influence risk of diseases and its consequential outcomes (mortality and growth faltering).

Figure 1: Mosley and Chen (1984) child mortality Analytical Framework



Source: Mosley and Chen (1984: 142).

As indicated in Figure 1, socio-economic determinants operate through proximate determinants to affect child survival (Mosley and Chen 1984:141); the determinants in question were identified to include variables at individual level (e.g. productivity[12], norms, traditions and attitudes), household level (income or wealth) and community level (health system, political economy and ecological settings). Mother's education was considered as very influential because of mother's role in taking her own care during pregnancy as well as taking care of the child during vulnerable stages of life (Caselli et al. 2005:243). Proximate determinants in question includes; maternal factors (age, birth interval and equality), environmental contamination (air, food/water/fingers, skin/soil/inanimate objects, insect vectors), nutrient deficiency (calories, protein, micronutrients),

[12] father and mother ability to produce surviving and healthy child, it is measured or influenced by their education, time availability and health condition (Caselli et al. 2005:243).

injuries (intentional or accidental), and personal illness control (personal preventive measures; medical treatment

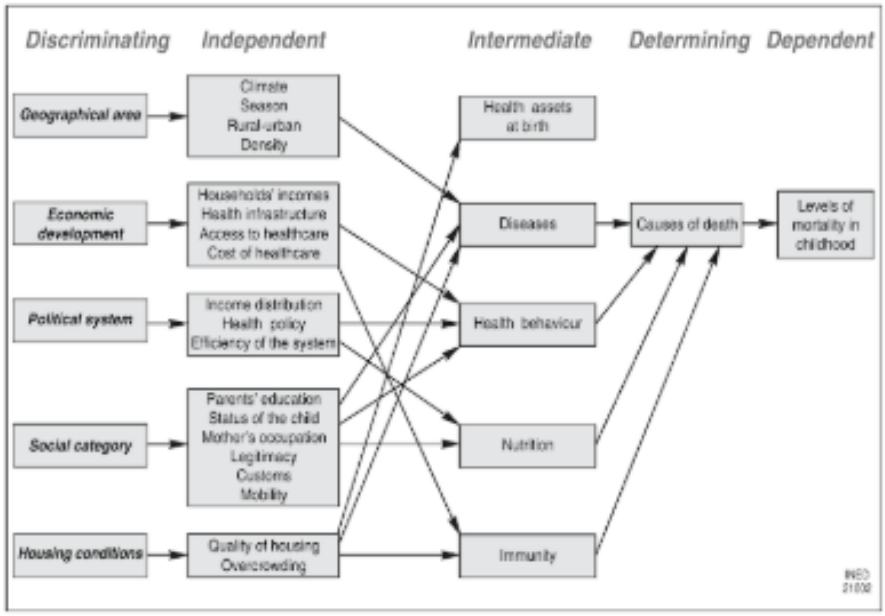
Mosley and Chen (1984) work has been very influential and their framework is widely used in child mortality studies (Hill 2003:138) but it isn't the only one, other frameworks have been developed by Meegama (1980), and Garenne and Vimard (1984).

Meegama (1980) framework distinguish between neonatal mortality, post-neonatal and under-five mortality, it doesn't integrate social and medical sciences approaches. The framework looks at biological determinants of child mortality (grouped into different diseases categories) and then identifies their causes which tend to be linked to socio-economic conditions; framework's application is limited to individual level analysis (Caselli et al. 2005:241)

A Framework developed by Garenne and Vimard (1984) differs from Meegama (1980) in two ways: - first, it's not limited to individual social and economic circumstances as it explores ecological and political circumstances among others; second infant and child mortality is analysed wholesome and not broken-down into subcategories. Depending on the level of causality they classify five different groups of variables that affect mortality these are: -discriminating variables, independent variables, intermediate variables, determining variables and dependent variables.

Discriminating variables include factors that don't exert a direct effect on mortality but can explain spatial differences in mortality, these are broad factors such as geographical characteristics, level of economic development, political systems, social categories, and housing conditions. Independent variables describe different subcategories of discriminating variables which might affect mortality through one or more intermediate variables i.e. further breakdown of discriminating variables, for example, geographical characteristics into climate and season, residence (urban or rural), and population density; and economic development into household incomes and health infrastructure, costs and access (see Figure 2 below). Intermediate variables are ones through which independent variables exert their action/influence on child mortality; they have complex interactions with independent variables, as "there is no specific path to each cause of death (Caselli et al. 2005:242)". Garenne and Vimard (1984) categorized intermediate variables into five groups, namely health status at birth, health behaviours, nutrition, immunity, and diseases. Determining variables are medical causes of death, Garenne and Vimard (1984) argue there is no single cause of death hence didn't explicitly mention these variables.

Figure 2: Garenne and Vimard (1984) child mortality Analytical Framework



Source: Adopted from Garenne and Vimard (1984).

The above-discussed frameworks provide an insight on the intricate nature of child mortality, especially its determinants; they do so by highlight how child mortality involves an interplay of multiple factors (socio-economic, demographic, environmental and biological) which are related through complex interactions. Furthermore, they enable tracing of conduits through which socioeconomic factors impacts child health and survival (Edeme et al. 2014:3) hence these frameworks especially Mosley and Chen (1984) have provided a theoretical backbone for much of empirical studies (in social sciences in general and economics in particular) on effect of socio-economic variables (such as income) on child mortality.

From the discussion on analytical frameworks of child mortality, it can be deduced that child mortality determinants can be grouped into two broad categories, the proximate determinants and underlying determinants of child mortality. Proximate determinants entail factors that directly impact risks of disease and the corresponding disease outcomes (mortality being one) in individuals; these factors include personal behaviours (personal hygiene, alcohol and tobacco use, diet and sexual behaviour), environmental exposure (exposure to infectious or chemical or physical agents.), injuries, nutrition (malnutrition, obesity, and micronutrient deficiency) and personal illness control. Underlying/distal determinants are factors that affect child mortality indirectly and operate through proximate determinants; they include socio-economic factors (household incomes/wealth, education, employment etc), institutional factors (health systems and regulations, environmental interventions and technological development), cultural factors (religious values, traditional beliefs on health and diseases, women role and status in society etc), and other broader factors such as ecological settings, political economy, urbanization etc (John Hopkins University 2006),

To facilitate a better understanding of child mortality determinants, Mosley and Chen (1984) advocated for research efforts to be directed towards studying the association between underlying and proximate determinants of child mortality. But much of empirical work in social sciences (especially in economics field) has been on the effects of socio-economic factors on child mortality. Moreover, much attention has been on socio-economic factors such as income, political economy and health systems, with the issue of relative strength of each factor in explaining child mortality being the subject of intense debates.

2.2. Income and child mortality relationship

The influence exerted by economic conditions on mortality is a long-acknowledged issue at least since biblical times (Preston 2007:484). Income is among economic conditions often associated with child mortality (Mogford 2004), this has remained to be the case even after the widespread adoption of multi-dimensional and non-income measures of development (e.g. HDI). Empirically this association can be traced as far back as mid 19th century when many western countries were moving towards their second stage of demographic transition which was marked with decreasing mortality (driven by exponential growth in their economies and incomes along with scientific and medical breakthrough) and steady birth rate (Van de Kaa 1987).

The theoretical link between income and child mortality can be traced in Becker's (1960) "Economic Theory of Fertility" which identified parents' income and costs of rearing children as key determinants of fertility decisions. Becker economic approach to family and fertility ignited research interest on linking economic factors (particularly income) to demographic issues such as fertility and mortality (Pollak 2003). But recent theoretical formulation of income and mortality relation and ensuing empirical studies draws much inspiration and thoughts from "Preston Curve" by Samuel Preston (1975) and Caldwell's (1976, 1979 and 1982) "Fertility Theory of Intergenerational Wealth Flows". Preston curve depicts the relationship between real per capita income and life expectancy based on cross-sectional empirical investigation for three periods 1900's, 1930's and 1960's; it illustrates existence of negative but non-linear relationship (concave[13]) between income and life expectancy.

Hojman (1996: 282) identified three ways through which income affects child mortality, first, is income's direct and positive impact on health outcomes including child survival chances. Second, is income's indirect effect on child survival through its impact on fertility rate operationalized via birth rate and female participation rate channels. They argued that in short-term demand for children is positively associated with income, but the relationship is reverse in long-term; they also argued higher income is associated with higher female participation, therefore through these two mechanisms higher income results to lower fertility

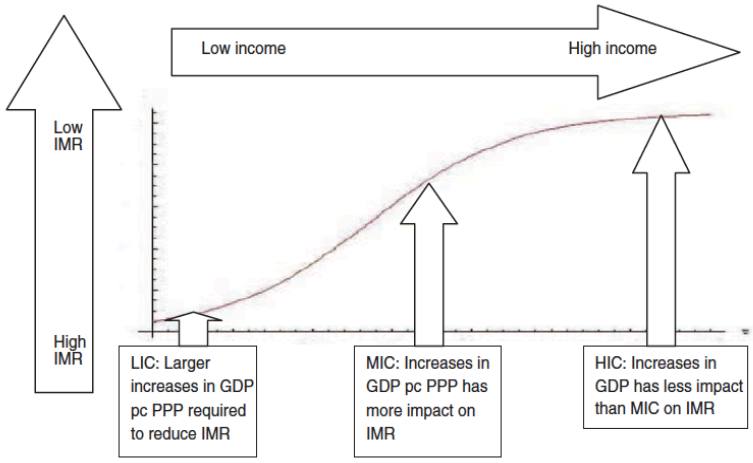
[13] At lower level of per capita income, income increase results in higher gains in life expectancy, but gains diminish at higher levels of per capita income.

and hence lower mortality. The explanations for direct and positive association between income and health outcomes were: - income's impact on private health spending and improved access to health care. Pritchett and Summers (1996: 844) and Asiedu et al. (2015b: 1) reasoned that higher incomes permit more spending on goods and services that directly or indirectly improve health. Burns et al. (2017:74-75) argued that income increase improves access to healthcare as in most developing countries healthcare access depends on the ability to pay.

The relationship between per capita GDP and child mortality was identified to be negative but non-linear. The non-linearity was explained to be due to complex nature of interactions of factors that explains their relationship (Hojman 1996: 282) and the existence of factors other than income and trends that affects child mortality (Pritchett and Summers 1996: 844, O'Hare et al. 2011: 412).

Inspired by Preston (1975) and Pritchett and Summers (1996) empirical investigation of the relationship between income and health outcomes; O'Hare et al (2011) conducted a systematic literature review and meta-analysis of income and child mortality relationship in developing countries. Based on their findings they conceptualized income and child mortality relationship to be a 'sigmoid curve'. They suggested that, "income mortality relationship is weaker at very low-income levels, stronger at middle income levels and disassociates at high-income level (O'Hare et al. 2011: 412)"; at low-income levels larger increase in income is required to reduce child mortality, at middle-income level small increase in income brings larger impact on child mortality and high-income level income has less impact on child mortality (see Figure 3 below).

Figure 3: O'Hare et al (2011) income and child mortality framework



Source: O'Hare et al. (2011: 413)

As Figure above illustrates, as incomes level raises child mortality becomes less associated with income, other factors (health systems, education, culture etc.) becomes more important in explaining gains in child mortality (Schell et al. 2007). Income and child mortality relationship conceptualized by O'Hare et al

(2011) in part helps to explain what has been referred to as "structural shift[14]" in health status and income relationship observed during 1930-1990 period mostly in developed nations (WB 1993).

2.3. Income role versus public health expenditure in child mortality

One of the implications from O'Hare et al. (2011) income and child mortality relationship is that raising per capita incomes might be a more effective way of addressing child mortality and related health outcomes in developing countries (particularly middle-income ones). This assertion was put into empirical investigation by Pritchett and Summers (1996) in which they examined the effect of per capita income on child mortality and life expectancy using cross-country data. Their study found that 40 percent of cross-country differences in mortality improvement is explained by differences in income, with the rest of variations explained by factors such as effective public health programs, equity in income distribution and higher women status. Based on their findings they claimed that "wealthier is healthier" and argued for raising per capita income to be an important part of health strategy in any country (Pritchett and Summers 1996: 844) because "gains from rapid economic growth flow into health gains (Asiedu et al. 2015b: 1)"

Pritchett and Summers (1996) findings have been questioned on two grounds; first, on the existence of reverse causality from health to income i.e. increase in income improve health outcomes but improvement in health also generates growth in incomes (WHO 2001, Gallup and Sachs 2001). Second, on role of other factors in explaining mortality, Cutler et al. (2006) noted that countries with high income also tend to have better institutions, functioning health systems, and higher education levels; such factors would affect child mortality and other health outcomes independent of income (Baird et al. 2011: 847).

Pritchett and Summers (1996) study spiked intense debate on the relative strengths of health expenditure and income in addressing health issues, with some advocating for increased public expenditure on healthcare and others arguing for interventions that raise incomes levels. This debate was exacerbated by Filmer and Pritchett (1997) study which empirically examined the impact of non-health factors (income, income distribution, female education public health spending, the proportion of urban population, access to safe water, religion, degree of ethnolinguistic fractionalization, and geography) on infant and under-five mortality. They found 94 percent of cross-national differences in child mortality to be explained by income, income distribution, female education, ethnolinguistic fractionalization, and predominant religion; income alone was found to explain 84 percent of child mortality (Filmer and Pritchett 1997: 7-13). Surprisingly they found the effect of public health spending to be small (one-seventh of one percent) and insignificant.

[14] improvement in health outcomes without a corresponding change in income.

The relative strength of income (compared to public health spending) in explaining child mortality observed in Filmer and Pritchett (1997) was consistent with results from other studies that employed different techniques and data in estimating income elasticity of child mortality. These studies include Kakwani (1993), Pritchett and Summers (1996), Wang et al. (1996) and Pritchett (1997); the estimated income elasticities in these studies ranged from -0.43 to -0.76 (Filmer and Pritchett 1997: 11). O'Hare et al (2011) meta-analysis of 24 studies that have empirically estimated income and child mortality relationship in developing countries found income elasticity of infant and under-five mortality to be negative in all studies' pooled income elasticities were -0.95 and -0.45 for infant and under-five mortality respectively (O'Hare et al. 2011: 410).

With respect to public health spending impact on child mortality in developing countries, earlier studies (though few due to data limitations) found no evidence of public spending impact (Anyanwu and Erhijakpor 2005: 408) with exception of studies by Anand and Ravallion (1993), Bidani and Ravallion (1997), and Jamison et al. (1996); see Filmer and Pritchett (1997: 22). In summarizing earlier literature on impact of public health spending and other factors on child mortality Musgrove (1996) concluded that, "multivariate estimates of the determinants of child mortality give much the same answer: income is always significant, but the health share in GDP, the public share in health spending, and the share of public spending on health in GDP never are (Musgrove 199 as quoted in Filmer and Pritchett 1997: 21)". A recent survey of literature by Anyanwu and Erhijakpor (2005) found public spending effect on child mortality to range from no impact, limited impact and impact but on specific interventions only.

Examination of empirical studies on socio-economic determinants of child mortality in developing countries suggest income to be a stronger predictor of child mortality (Mogford 2004) than public health expenditure, it also indicates other factors have a significant role to play. One implication of findings from discussed empirical studies is that "policies that encourage economic growth, reduce poverty and income inequality, and increase female education would do more for attaining child mortality reductions than increasing public spending on health (Anyanwu and Erhijakpor 2005: 408)"

Empirical case studies on socio-economic determinants of child mortality in Tanzania are very few, known ones include Mturi and Curtis (1995) and Afnan-Holmes et al. (2015). Mturi and Curtis (1995) used 1992 Demographic and Health Survey data to investigate the determinants of infant and child mortality in Tanzania. They used 'Hazard model' to assess the relative effect of demographic (maternal age at time of birth, birth interval and survival status of preceding child at time of conception of index child and child sex) and socio-economic (maternal education, partner education, rural/urban residence, presence of radio in the household[15] and source of drinking water) factors on risks of child deaths. Birth interval, survival status of preceding child and place of residence[16]

[15] used as a crude proxy for household wealth (Mturi and Curtis 1995: 391)
[16] surprisingly risk of deaths in rural areas was lower than in urban areas

were found to have significant effect on infant mortality. In the case of under-five mortality, maternal age, birth interval, survival status of the preceding child, partner's education, and residence were found to be significant while radio ownership and source of drinking water were insignificant (Mturi and Curtis 1995: 388-391).

Afnan-Holmes et al. (2015) used "health systems evaluation framework" to assess changes in mortality and fertility due to health interventions aspects (coverage, equity, and financial inputs) and non-health factors (per capita GNI and female education). Investigating factors behind the reduction in child mortality in Tanzania observed over two decades (1990 to 2014) was among the four study objectives; they employed Lives Saved Tool (LiST) and multiple linear regression to examine the effect of health interventions and socioeconomic status respectively on child and maternal mortality. Findings from LiST analysis suggested reduction of child mortality to be largely due to increase in coverage of health interventions (39 percent) with immunizations (e.g. Haemophilus influenza type b vaccine) being the most effective on by helping to avert 27% of deaths, followed by insecticide-treated bednets (24%) and HIV interventions[17](17%). Results from final multiple regression model (which excluded female education due to strong correlation with GNI) showed weak (p-value of 0.08) evidence of association between under-five mortality rate and income (Afnan-Holmes 2015: 397-403).

2.4. FDI and child mortality theoretical and empirical relationship

Different scholars and organizations have provided explanations on what FDI entails, minimum ownership required for any foreign investment to classified as FDI (10 percent; IMF 1993, OECD 2008: 17) and its major components. The following is United Nations Conference on Trade and Development (UNCTAD) explanations regarding what FDI entails.

> An Investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate). FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates, both incorporated and unincorporated. FDI may be undertaken by individuals as well as business entities. Flows of FDI comprise capital provided (either directly or through other related enterprises) by a foreign direct investor to an enterprise, or capital received from an investing enterprise by a foreign direct investor. FDI has three components: equity capital, reinvested earnings, and intra-company loans. (UNCTAD 2014:3).

[17] prevention of mother-to-child transmission, antiretroviral treatment, and cotrimoxazole (Afnan-Holmes 2015: 403)

There have been plenty of efforts to provide theoretical explanation for income and child mortality relationship, but little efforts to explain theoretical links between income drivers/determinants (FDI in our case) and child mortality. Limited theoretical literature on FDI and child mortality has translated into limited empirical literature. This on one hand limits the scope on studying child mortality determinants and consequently knowledge generation on the matter; on the other hand, its limits availability of policy instruments for addressing child mortality and other related health outcomes for example, using FDI or other income growth drivers as instrument for protecting children (Sargent and Rawlins 1992) and/or improving country's health status (Hojman 1996: 282).

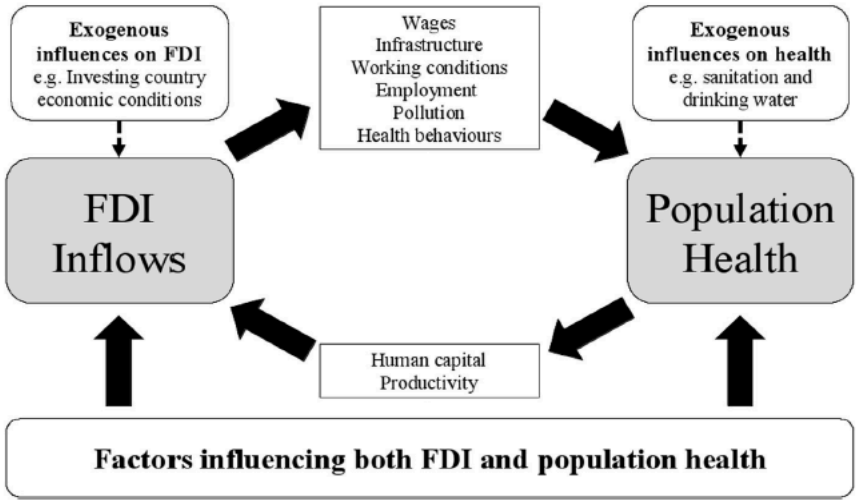
The obvious FDI and child mortality linkage can be through FDI's impact on economic growth[18] (an area that has already been extensively surveyed[19] in economics literature) and income consequent impact on child mortality. Burns et al (2017: 74-75) point out that FDI increases income/wages, this leads to improved access to healthcare which lowers child mortality. Citing various empirical literature (Gilmore and McKee 2005, Hawkes 2005 and Jorgenson 2009a, and 2009b) Burns et al (2017) suggested that FDI could also bring negative health consequences and results in rising child mortality, for example, it could increase consumption of tobacco and unhealthy foods as well as environmental pollution (Clapp 2001: 43). FDI-child mortality relationship is therefore complex and ambiguous one (see Figure 4) as effects can be negative or positive with a potential for bidirectional causality between them[20] (Alsan et al. 2006: 613, Burns et al. 2017: 75).

[18] Neo-classical growth models (Solow type growth models) and endogenous growth models (e.g. Mankiw–Romer–Weil model) provides a theoretical foundation for the FDI and output/income per worker relationship (Borensztein et al. 1998 and Alfaro et al. 2004). FDI affects economic growth through factor accumulation (physical and human capital expansion) and improvements in country's total factor productivity (TFP) due to technological and other positive externalities (Sinani and Meyer 2004, Alfaro and Charlton 2009).

[19] See Almfraji and Almsafir, (2013: 208-211) for literature survey

[20] Countries with better health status (e.g. low mortality and high life expectancy) receives more FDI

Figure 4: Burns et al (2017) FDI and population health framework



Source: Burns et al (2017:75)

As pointed out earlier, there is a scarcity of quantitative literature on FDI effect on health outcomes (child mortality included); This was initially echoed by Alsan et al. (2006) who stated that, "a relationship between population health and FDI has not been established in the empirical literature (Aslan et al. 2006:613)" The issue remains prevalent to date as Burns et al (2017: 74) found in their literature survey that only three studies (Jorgenson 2009a, 2009b, and Alam et al. 2015) have quantitatively investigated FDI impact on health outcomes.

To get a broad sense of the empirical relationship between FDI and child mortality in an environment of limited studies, this paper's empirical review includes studies where FDI isn't the principal regressor (Shandra et al 2005, Dawson, 2010) in addition to those where FDI is principal explanatory variable (Jorgenson 2009 and 2009a, Chuang et al. 2015, and Burns et al. 2017). Studies in which other health indicators (not child mortality) are outcome variable(s) and FDI is explanatory one (Alam et al, 2015), as well as studies which looks at the impact of health indicators on FDI (Alsan et al. 2006, Azemar and Desbordes 2009, Ghosh and Renna 2015, and Asiedu et al. 2015a), are not reviewed.

Review of empirical literature on FDI and child mortality relationship confirms Burns et al (2017: 74) assertion of a complex and ambiguous relationship between them. There is no consistent relationship between FDI and child mortality; some studies found positive and significant effect (Shandra et al. 2005, Jorgenson 2009a and 2009b), negative and significant effect (Dawson 2010, Chuang et al. 2015)) and others no FDI effect (Burns et al. 2017).

Shandra et al. (2005) examined cross-national variations in child mortality in 59 developing counters in relation to economic, social, and political modernization. They employed cross-lagged panel model (CLPM) with OLS used for estimation using data for 1995 and 1980; the stable nature of child mortality (with small incremental year-on-year changes) was argued to be the reason for opting this instead of methods such as fixed-effects (Shandra et al. 2005: 274). FDI stock was used to capture the level of multinational corporation penetration; other explanatory variables included were: economic development (GNP per capita), overall and female education attainment (gross secondary school enrolment), level of political democracy[21], public health expenditure as percentage of GNP, population density, and commodity concentration (value of a nation's most important export commodity as a percentage of its total exports). FDI was found to have positive and significant effect on child mortality with the effect being more severe in less democratic countries (Shandra et al. 2005: 281-286).

Jorgenson (2009a) investigated the effects of secondary sector (manufacturing) FDI on industrial organic water pollution intensity in less-developed countries and consequent effect of pollution on infant and under-five infant mortality. The study used unbalanced cross-country panel for 1980-2000 period and employed various panel regression techniques (cross-sectional time-series Prais-Winsten (P-W) regression and generalized least squares (GLS) or random-effects (RE) panel regression). The results indicate a positive and significant association between manufacturing FDI and industrial water pollution intensity; it also found industrial water pollution to contribute to both infant mortality and child mortality net of health expenditure, development level, fertility rate and democratization (Jorgenson 2009a: 151-152). This implies FDI has an adverse effect with respect to child mortality and the effect is being mediated through industrial water pollution.

Jorgenson (2009b) study is in many ways similar to Jorgenson (2009a) with one minor exception; it examined the effect of overall export intensity on industrial organic water pollution and consequently the effect of pollution on child mortality in addition to manufacturing FDI. The results obtained with respect to FDI were similar to Jorgenson (2009a).

Dawson (2010) used cross-country data of 93 developing countries (for 1985, 1990, 1995, and 2000 periods) to examine the impact of rule of law on under-five mortality while controlling for political and economic factors. FDI stock to GDP ratio was used to capture investment dependence and among control variables along with per capita GDP, income inequality, central government tax revenue as a share of GDP, trade openness and democracy. Fixed-Effect regression was used for analysis. The results indicate the presence of negative but very weak (p-value of 0.1) association between child mortality and FDI (Dawson, 2010: 413).

[21] Bollen (1983) index of political democracy was used

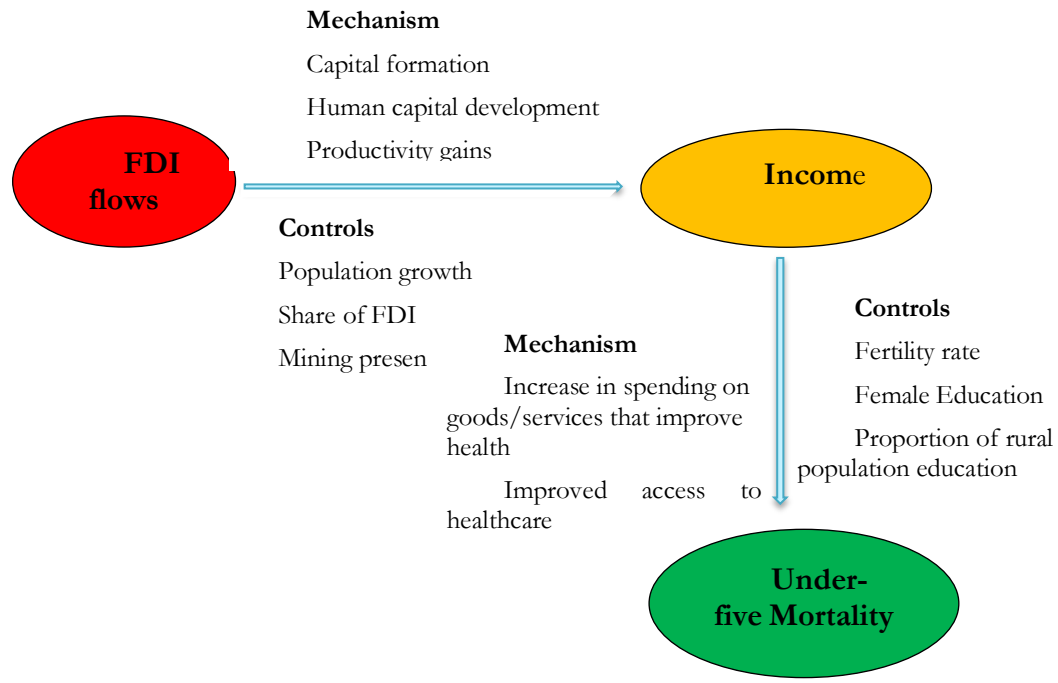
Chuang et al (2015) applied the "theory of ecological unequal exchange" to examine inter-relationships and effects of country's economic (FDI, external debt, export intensity, and manufacturing value share of GDP) and sociodemographic characteristics (female education, rural population, per capita GDP, democracy and health services) on environmental pollution, and consequent effects of environmental pollution on infant and under-five mortality. They used longitudinal data for 66 low-income countries from 1980 to 2010 and employed linear mixed models (models with both fixed and random effects). After controlling for sociodemographic characteristics FDI was found to have beneficial effect with respect to infant and under-five mortality in Latin America and other regions but in Sub-Saharan Africa, the effect was negative but insignificant.

Using panel data for 85 and 31 low- and middle-income countries (LMICs), Burns et al. (2017) investigated the effect of aggregate FDI (for the 1974-2012 period) and industry-specific FDI (for 1987-2008 period) respectively, on health indicators (life expectancy, child and adult mortality). FDI inflows as a share of GDP was the principal explanatory variable; years of schooling, lagged values of civil liberties index, lagged values of per capita GDP and proportion of urban population were control variables. Ordinary Least Square (OLS), Fixed-Effect (FE) and Instrumental Variable fixed effects (IVFE) regressions were employed. The net effect of FDI on infant and under-five mortality was found to be negative but insignificant (Burns et al. 2017: 80).

2.5. Conceptual Framework

Figure 5 below present the conceptual framework guiding this research, as mentioned before this paper main outcome variable is under-five mortality rate (U5MR); FDI effect on U5MR is presumed to be mediated through income (per capita GDP) therefore per capita GDP is adopted as an intermediate variable. FDI flows translates to increase in per capita income; this might be through increasing stock of physical capital (capital formation), human capital improvement and productivity gains (due to transfer of technology and managerial skills). Increase in income in-turn results in lower U5MR, this may be through increased household spending on goods/services that directly or indirectly improve health (e.g. nutritious food and treated water) and improved access to healthcare that resulted from their increased ability to pay for health services.

Figure 5: Conceptual Framework



Source: Author

Chapter 3 Tanzania Context

3.1. Tanzania FDI story

3.1.1. Tanzania reforms journey and FDI

Tanzania FDI story tends to coincide with its economic development and transition story, as a result, FDI performance has shadowed changes and developments in its political economy as the country transformed from central economic planning to a liberalized and globalized one (UNIDO 2014: 22). The country in its earlier independent years, the country adopted socialist policies which among other things entailed state control of the economy and ownership of all major enterprises. As part of socialist policies, the government nationalized majority of private companies (including foreign ones) and restricted private investment both domestic and foreign (Wangwe 1997, Mwase and Ndulu 2008 and Nord et al. 2009). Capital investment was almost exclusively done by the government through state-owned parastatals and foreign capital flows was limited mostly to government-backed loans to state parastatals, therefore, FDI flows was almost non-existent, as a consequence the country virtually had no FDI flows prior to early 1990's: (WB 2007:15).

In the wake dire socio-economic situation[22] that occurred between late 1970's and early 1990's, Tanzania embarked on major socio-economic and political reforms, initially they were part of Structural Adjustment Programs (SAP) under the auspices of World Bank (WB) and International Monetary Fund (IMF). The first wave of reforms was implemented between mid 1980's and early 1990's and focused on trade and economic liberalization with the liberalization of the exchange and trade regimes, agricultural marketing system and domestic prices, and financial sector being implemented (Nord et al. 2009). During this period FDI activities started to pick up but bad investment climate and business environment coupled with severe capital account restrictions meant limited FDI flows into the country.

Mid 1990's marks a significant turnaround in Tanzania economic history in general and FDI in particular; during this period the country embarked on broader macroeconomic and structural reforms. The increased momentum of reforms from mid-1990's onwards can be reflected on economic growth performance and its ability to attract FDI compared to the earlier period. The country's accession to World Trade Organization (WTO) in 1995, macroeconomic stabilization efforts, broad range of cross-cutting and sectoral reforms, and increased investment promotional efforts by the government resulted into increased interest from foreign companies and corresponding outburst in FDI stock and flows.

[22] Thought to have been the outcome of failure of socialist policies and internal and external shocks prompted by Tanzania-Uganda war (late 1970's), global oil crises (1973 and 1979) and global recession of early 1980's (Volcker shock).

Several cross-cutting reforms were adopted with the aim of strengthening the business environment and investment climate hence increase private sectors (domestic and foreign) participation in the economy. Country strengthened its conduct of fiscal and monetary policies and increase the pace of liberalizing its capital account, for example in 2003 foreign investors were allowed to participate in Dar-es-salaam Stock Exchange (BoT[23] 2004: 62). Business environment was improved through - streamlining taxation by abolishing nuisance taxes, introducing Value Added Tax-VAT[24](in 1997) and strengthening tax administration by establishing Tax Revenue Authority (TRA) in 1997; and improving business registration and licensing by establishing Business Licensing and Registration Agency (BRELA) in 1999 among others.

Implementation of cross-cutting reforms went along with privation programs and aggressive investment promotional efforts. The country established Presidential Parastatal Sector Reform Commission (PSRC) in 1993 to oversee privatization of state parastatals and other state-owned assets to local and foreign investors, by 2003 almost all manufacturing and commercial parastatals were privatized (Nord et al 2009: 16-19). Privatization helped attract foreign capital investments in manufacturing and services sectors as a number of commercially viable state-owned enterprises were acquired by foreign investors along with their domestic counterparts.

In an effort to entice local and foreign investment the government also adopted sectoral reforms (alongside cross-cutting reforms discussed above) in energy, telecommunication and mining sectors to name the few. In energy sector, the commencement of National Energy Policy (1992) implementation opened up private participation especially in electricity subsector as Independent Power Producers (IPPs) were allowed in power generation although transmission and distribution remained under the monopoly of the state-owned power utility. This led to investment in power generation mostly from subsidiaries of foreign companies (IPTL, Songas, PanAfrica Energy etc.). To lure investment in large-scale mining, the sector was significantly reformed; through the National Mining Policy (1997) and its corresponding legislation (Mining Act of 1998[25]). Policy and legislative changes helped to provide the Fiscal Regime[26] for mining operations along with fiscal incentives[27] for large scale mining investments, the result was huge FDI inflows into the sector.

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[23] Bank of Tanzania

[24] "introduction of VAT removed relative price distortions on business inputs (IMF 2016: 11)"

[25] The Mining Act was amended in 2008 and 2015, the 2008 amendments addressed huge fiscal incentives and 2015 amendments aimed at bolstering government power to renegotiate existing mining agreements

[26] Tanzania adopted Tax and Royalty Fiscal Regime (Concessionary Licensing System); Muganyizi (2012).

[27] Mining Act (1997) and subsequently Income Tax (1997) exempted mining project from corporate income tax, introduced zero VAT rate for most of mining companies' intermediate goods imports and fiscal stabilization clause (in which fiscal terms of MDAs are not affected by changes in country fiscal system (Muganyizi 2012: 9-12).

Apart from cross-cutting and sectoral reforms, the government also embarked on aggressive investment promotion initiatives to lure both domestic and foreign investors. Efforts included provision of fiscal and other incentives to investors and setting up institutions for promoting, coordinating and facilitating private investments. Policy, legal and regulatory framework for investment activities was reinvigorated through the National Investment Promotion Policy of 1996 and corresponding Tanzania Investment Act[28] of 1997. The Act among other things provided the legal base and mandate for investment incentive packages and established specialized government agency (Tanzania Investment Centre-TIC) for promotion, coordination and facilitation of investment activities in the country i.e. one-stop center for investment. These efforts were supplemented by establishment of Special Economic Zones (SEZ) through the Export Processing Zones Act of 2002; the Act provided mandate for incentives to investors and the established entity (Export Processing Zones Authority-EPZA) for developing infrastructure and other amenities in designated Special Economic Zones and promoting and overseeing investments in these zones. While TIC catered for investments across all sectors EPZA focused on attracting domestic and foreign investments in manufacturing, which special emphasis on boosting export of manufactured goods.

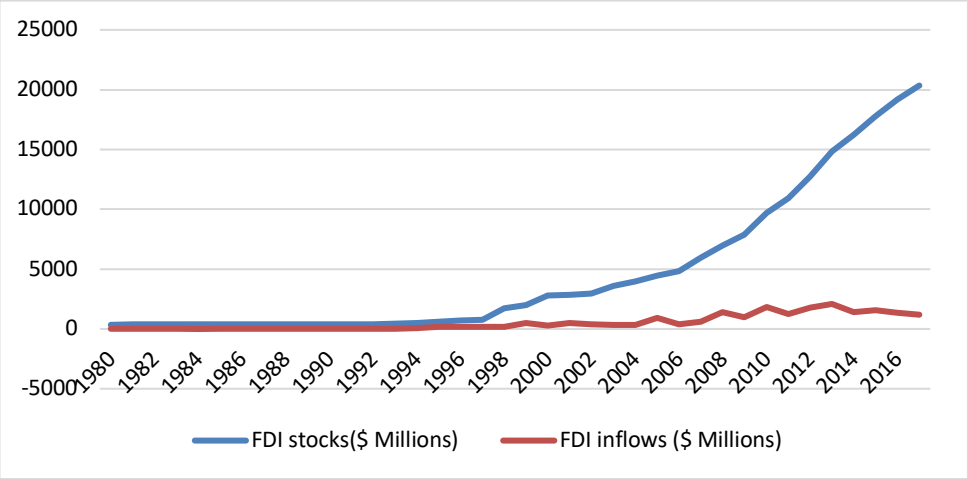
Economic and other reforms coupled with improved business environment and aggressive investment promotion efforts translated into an increase in both FDI stock and flows into the economy. The role played by reforms in attracting FDI is evident when comparing cumulative FDI flows prior to mid-1990's and afterward; 1980-1994 cumulative FDI flows were US$ 127.8 million compared to US$19,880 million registered between 1994 and 2017.

3.1.2. FDI overall trends and performance

Review of trends in Tanzania's inward FDI flows and stocks highlights the discussion narrated above. Tanzania experienced negligible FDI prior to mid 1990's; however, from 1995 there was an explosion of both stock and flows of inward FDI. Figure 6 below shows trends in FDI inflows and stocks from 1980 to 2017; as pointed out earlier prior to 1990's Tanzania had almost zero FDI flows, however both flows and stocks of FDI started to pick up in early 1990'. From mid-1990's FDI stock and flows exploded, from $619.8 million and $150 in 1995 to $20.350.7 million and $1,180.4 respectively in 2017. Observed FDI performance attests to improved investment climate and increased investors' confidence and appetite towards Tanzania. which can be attributed to the implementation of reforms discussed above but also presence natural resources, particularly precious mineral resources and natural gas.

[28] It replaced the National Investment Promotion and Protection Act (NIPPA) of 1990

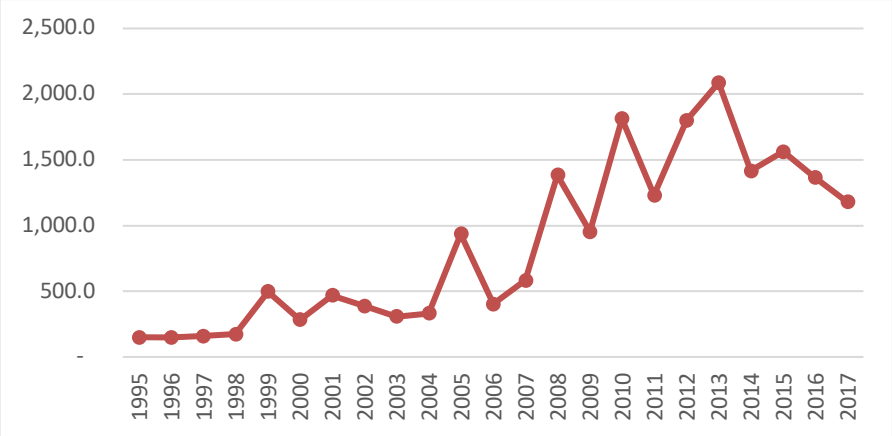
Figure 6: FDI inflows and stocks in 1980-2017(US$ Million)



Source: UNCTAD ((UNCTADSTAT Database)

Although both flows and stock have increased exponentially in recent decades, FDI flows have experienced some upswings and downswings as shown in Figure 7 below.

Figure 7: Tanzania FDI Inflows 1995-2017 (US$ millions)



Source: UNCTAD (UNCTADSTAT Database)

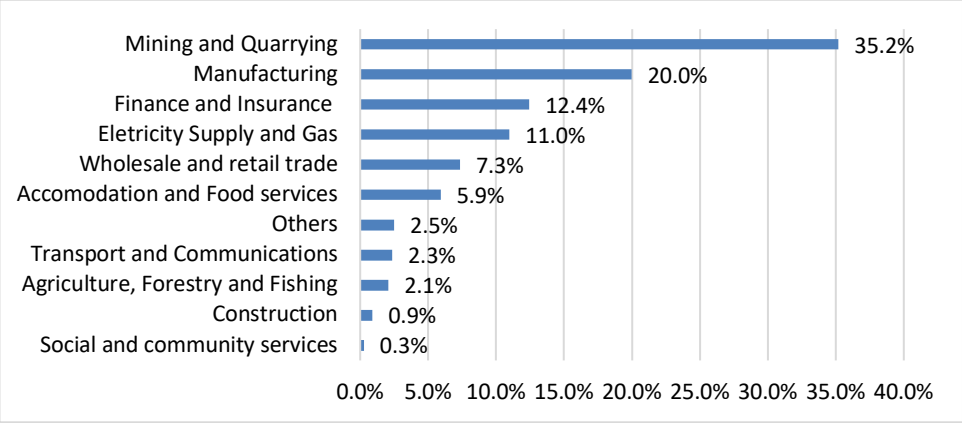
A Number of factors can be associated with the trend noticed in the above figure. Slowing FDI flows in early 2000's is in some cases attributed to number of factors: - political shocks in the wake of 2000 general elections (UNIDO 2014: 23), completion of major FDI in mining sector and decline in privatization related FDI following completion of privatization of manufacturing and other commercially viable enterprises in 2003 (WB 2007: 16, Nord et al 2009:16). Decline in global capital flows in the wake of the Global Financial Crisis of 2008 is attributed to FDI flows decline in 2009. Increased FDI flows from 2009 is associated with surge in investments from natural gas exploration and finance and insurance activities (BoT 2013a: 20 and 2014: 15) where FDI flows reached an

all-time high of US$ 2,087.3 million in 2013[29]. Slowing FDI after 2013 can be attributed to declining investment in natural gas exploration activities as oil companies started to move towards development phase following massive natural gas discoveries.

3.1.3. FDI sectoral trends and pattern

Although FDI has increased enormously in the past two decades, investigation of its pattern across sectors suggests a very skewed distribution towards certain sectors. Mining and quarrying sector has been the largest FDI flows recipient since 1999, receiving an annual average of $324.7 million out of a national average of $922.7 million per annum during the 1999-2013 period (equivalent to 35.2 percent of annual FDI flows). With 20 percent share of annual FDI flows, manufacturing sector has been the second largest FDI recipient followed by finance and insurance (12.4 percent) and electricity and gas (11 percent). The four aforementioned sectors make up more than three quarters (78.6 percent) of average annual FDI flows. With exception of wholesale and retail trade and accommodation and food catering services (Tourism) which commands 7.3 and 5.9 percent respectively, the rest of the sectors combined constituted less than 10 percent (Figure 8)

Figure 8: Sectoral Share of FDI inflows (1999-2013 annual average)

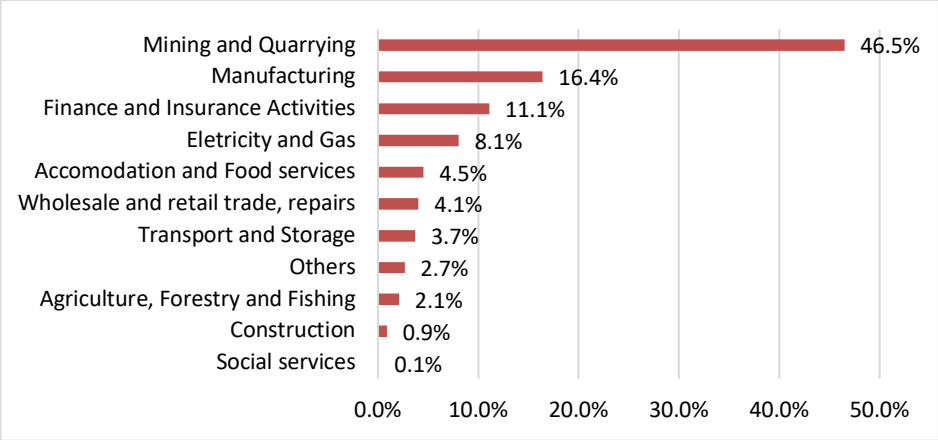


Source: Bank of Tanzania (Tanzania Investment Report)

Figure 9 below depicts cumulative inward FDI flows across different sectors in the year 2013 (last year in which sectoral data are available); the pattern is similar to that of FDI flows with some minor exceptions. Mining and quarry commanded nearly half of national FDI stocks (46 .5 percent), 10 percent more compared to its share of annual FDI flows. Similar to the case of FDI flows, manufacturing and finance and insurance and electricity and gas sectors command second, third and fourth places with 16.4 percent, 11.1 percent and 8.1 percent respectively; the four sectors combined make up 82 percent of total FDI stocks as of 2013.

[29] In 2013 finance and insurance received US$ 752.2 million, five times the cumulative amount received during 2009-2012 period (BoT 2014: 15)

Figure 9: Sectoral share of cumulative FDI stocks as of 2013



Source: Bank of Tanzania (Tanzania Investment Report)

Huge mining FDI was the outcome of large-scale mining[30] activities following the signing of Mining Development Agreements (MDAs) between Tanzania government and multinational mining companies during 1994-2007 mostly for gold. Such MDAs includes:- with Barrick Gold (Canada) for Bulyanhulu Gold Mine in Kahama (Shinyanga region) in 1994; with Resolute Tanzania Limited (Australia) for Golden Pride Mine in Nzega (Tabora region) in 1997; two contracts signed in 1999 with Anglo-Gold-Ashanti for Geita Gold Mine (Mwanza region) and Barrick Gold company for North Mara mine in Tarime (Mara region) and in 2007 with Pangea Minerals Limited (South Africa) which was later acquired by Barrick Gold company in Kahama (Shinyanga region). Increased mining FDI has resulted into increase in gold output with the country becoming the third largest gold producer in Africa after South Africa and Ghana (Schneinder 2014). Additionally, it has increased sector contribution to GDP (from 1.4 percent in 1998 to 4.8 in 2016; Muganyizi, 2012: 15, BoT 2018: 9) and to export earnings (gold composed 27 percent of export value in late 2000's from 2 percent in late 1990's; Magai and Márquez-Velázquez 2011:9).

The relatively large FDI share of Manufacturing sector is said to be the outcome of the privatization program and government industrialization drive among other factors. Privatization program saw sector receiving huge FDI flows in the form of Mergers and Acquisition (M&A) as many large and medium-sized state-owned manufacturing entities (breweries, cement factories, textiles etc) were acquired by foreign firms; for example Tanzania Breweries Ltd (country largest brewer) was acquired by SABMiller (South Africa-England corporation and world's second largest brewer by revenue) and Twiga Cement Company (country largest cement manufacturer) was acquired by HeidelbergCement AG Group (Germany based company and one of the largest building materials companies in the world). Industrialization drive also played a role, in early 2000 the country adopted the "Tanzania Mini-Tiger Plan 2020" whose goal is accelerating economic growth by using Asian Economic Development Model which leans

[30] See Map I for mining operations across Tanzania

on attracting FDI and promoting exports through Special Economic Zones (Ministry of Industry and Trade, 2004).

Electricity and gas sector sizable FDI share started in 2001 with development of Songosongo onshore natural gas reserves for 197Megawatt (MW) gas-powered power plant; this project was joint venture of two state-owned enterprises (national power utility TANESCO and national oil company Tanzania Petroleum Development Corporation-TDPC) and PanAfrica Energy Ltd (a subsidiary whose major owner is Globeleq of United Kingdom). This project prompted government efforts to furnish the contract regime for oil and gas development by drafting regulations for the Petroleum (Exploration and Production) Act 1980 and for the first time to develop a comprehensive petroleum fiscal regime in the form of Model Production Sharing Agreement (MPSA) in 2004. This attracted more interest in the sector and initially led to mild increase in FDI as 5 Production Sharing Agreements (PSA) for onshore gas exploration and development were signed between 2000 and 2005 (Bofin and Pedersen 2017: 12-13).

The prominence of oil and gas subsector with respect to FDI illuminated after Third Licensing Round for offshore gas exploration between 2005 and 2006 and subsequent limited licensing between 2006 and 2008. It resulted in licensing of 8 offshore oil and gas exploration blocks to the likes of StatOil, Exxon Mobil British Gas, PetroBras and Ophir (Bofin and Pedersen 2017: 20-23) and consequently a sharp increase in FDI flows into the sector from annuals flows of under $3 million in 2008 to $290.5 million and $209.4 million in 2011 and 2012 respectively (BoT 2013b: 20). Exploration activities led to massive offshore natural gas discoveries (37 trillion cubic feet-TCF), these discoveries are expected to bring further FDI as oil companies in question are partnering to develop a $30 billion Liquefied Natural Gas (LNG) Terminal; an investment which if sanctioned will be country's largest ever and historic one.

From the discussion above it is implicit that Tanzania FDI is heavily inclined in extractives industries (mining and quarrying and natural gas) as evidenced by their larger shares of FDI flows and stocks in the 1999-2013 period (combined they account for 46.2 percent and 54.6 percent respectively). This sectoral FDI pattern reminiscent of Tanzania's endowment of mineral resources and its huge prospects for hydrocarbons (natural gas); it also confirms assertion that most FDI in developing countries particularly in Sub-Saharan Africa (SSA) are directed towards natural resource-based industries.

3.1.4. FDI Regional trend and distribution

Similar to sectoral FDI pattern, regional distribution of FDI stocks and flows is highly skewed towards very few regions. Dar-es-salaam is the leading FDI recipient followed by Shinyanga and Mwanza; these three regions combined account for nearly 84 percent of 1999-2008 FDI flows and 90 percent of cumulative FDI stocks

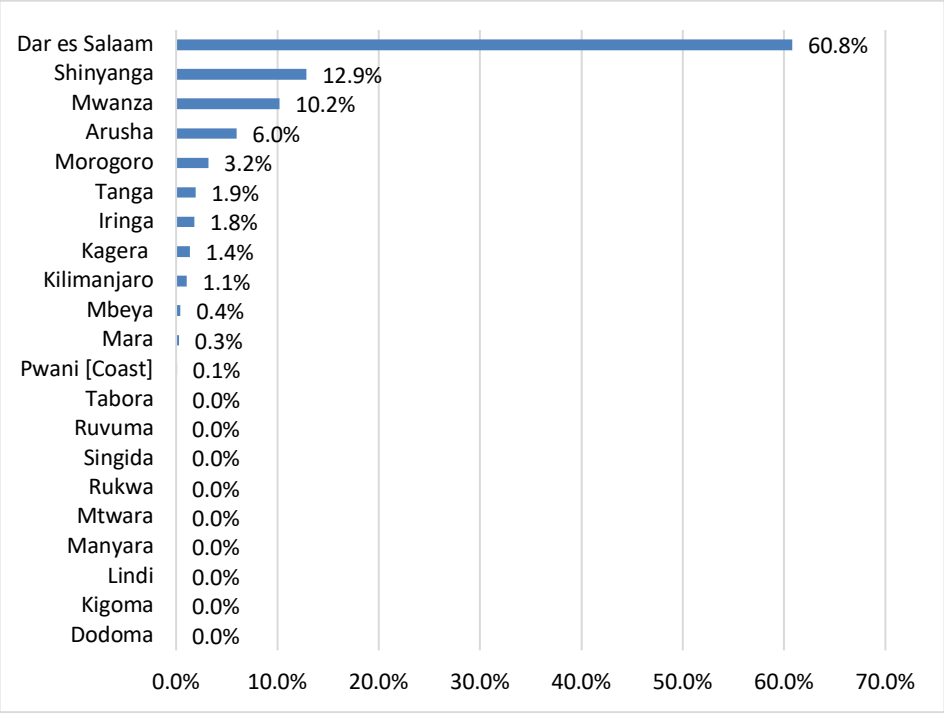
Table 1: Regional FDI flows and shares 1999-2008 (US$ millions)

FDI Flows	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average[a]	Share[b]
Arusha	23.6	12.2	12.8	9.9	24.7	13.4	31.4	-180.7	23.1	5.7	-2.4	-0.6%
DSM	358.3	182.5	290.2	94.3	163.1	192.4	691.3	355.1	418.4	334.5	308	72.1%
Iringa	4.7	0.1	0.5	0.0	0.0	0.0	3.4	10.0	7.7	12.5	3.9	0.9%
Kagera	0.0	0.0	0.0	0.0	0.0	0.0	55.5	1.2	-0.3	0.0	5.6	1.3%
Kilimanjaro	13.9	42.4	12.5	0.0	11.2	7.0	24.8	3.7	1.4	-0.7	11.6	2.7%
Manyara	0.0	0.0	4.9	0.0	0.0	0.0	1.2	1.3	1.5	1.5	1.0	0.2%
Mara	11.5	1.2	0.0	1.4	0.6	0.7	-2.1	-0.1	2.9	0.3	1.6	0.4%
Mbeya	0.3	0.0	0.1	0.1	0.0	0.0	1.6	1.1	4.5	6.4	1.4	0.3%
Morogoro	12.0	31.9	30.7	29.7	3.0	1.2	8.0	14.1	2.6	10.8	14.4	3.4%
Mwanza	21.4	5.0	11.4	6.1	9.5	44.4	89.8	91.0	-4.0	-4.8	27.0	6.3%
Pwani	0.1	0.3	0.1	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.1	0.0%
Shinyanga	84.5	0.0	20.9	228	65.9	39.7	-15.2	49.0	22.9	-18.6	47.7	11.2%
Tanga	5.8	0.7	2.2	1.1	0.0	0.1	6.4	12.2	14.4	10.0	5.3	1.2%
TOTAL	**538.0**	**276.3**	**386.3**	**370.6**	**278.0**	**298.9**	**896.2**	**358.1**	**495.3**	**357.8**	**427.3**	**100.0%**

Source: Bank of Tanzania (Tanzania Investment Report)

Note: a-calculated as average FDI flows for the 1999-2008 period; b-regional share of annual FDI flows calculated based on the average FDI flows for 1999-2008 period; some regions excluded (see Appendix I).

Figure 10: Regional share of FDI stock



Source: Bank of Tanzania (Tanzania Investment Report)

From both Table 1 and Figure 10 above it is evident that large share of FDI goes to Dar-es-Salaam region, multiple factors are attributed to Dar-es-Salaam FDI dominance:- Dar-es-Salaam is commercial and financial capital of the country with headquarters of most companies and organizations; also, it is the most

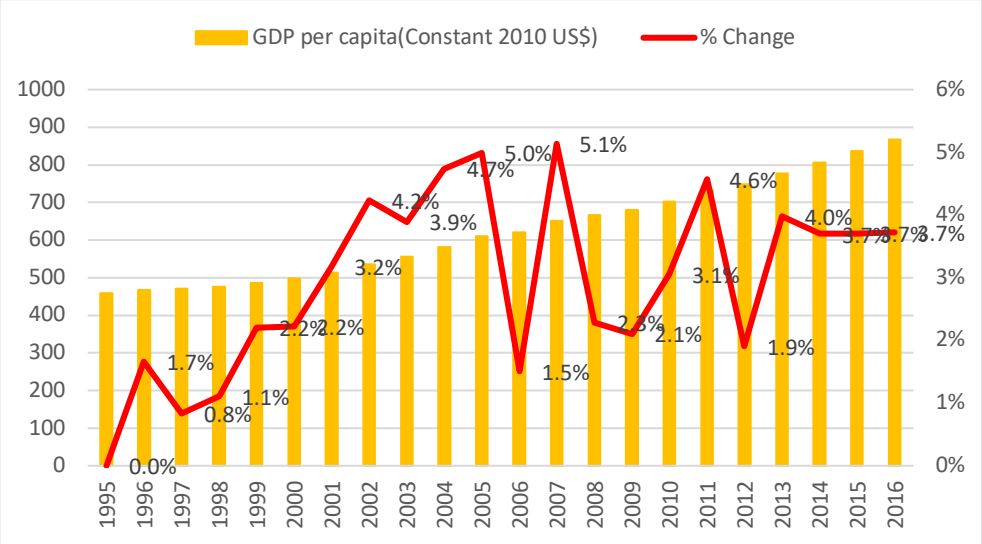
populous region and has the highest income per capita hence a lucrative market; additionally, it has better-developed infrastructure and country's major seaport. Shinyanga and Mwanza sizable FDI shares is mostly due to mineral resource endowment and ensuing large-scale mining operations and to some extent business activities such as fishing and fish processing in Lake Victoria (in the case of Mwanza).

3.2. Economic transformation and Income Gains

With a real per capita GDP of $867.1 (2016 figure) and a Human Development Index of 0.538 (2017), Tanzania at large remains a poor (low-income) and underdeveloped country. However, the country has made significant strides over the past two decades; it has registered an unprecedented economic turn round compared to the situation from late 1970's to early 1990's and managed to make this fundamental transformation of its economy. Its aggregate economy and per capita income have been growing at an average of 6.6 percent and 3.6 percent respectively between 2000 and 2016.

The economic structure has undergone transformation driven by a change in its growth path and its inter-sectoral contribution to GDP (Moyo et al. 2012). From 2000 onwards industrial and services sectors have been the main driver of economic growth, resulting in a declining share of agriculture sector in the economy whilst that of industry and services sectors increasing. The witnessed economic transformation has yielded gains in incomes, per capita GDP has almost doubled (1.9 times or rate of change of 89 percent) between 1995 and 2016 (see Figure 11). These changes initially had small effect in reducing income poverty as basic needs poverty incidence decreased by a mere 1.2 percentage points from 35.7 percent in 2001 to 34.4 in 2007; later they resulted in the highest ever recorded drop in poverty rate in recent decades, a 6.2 percentage point decrease to reach 28.2 percent in 2012 (WB 2015).

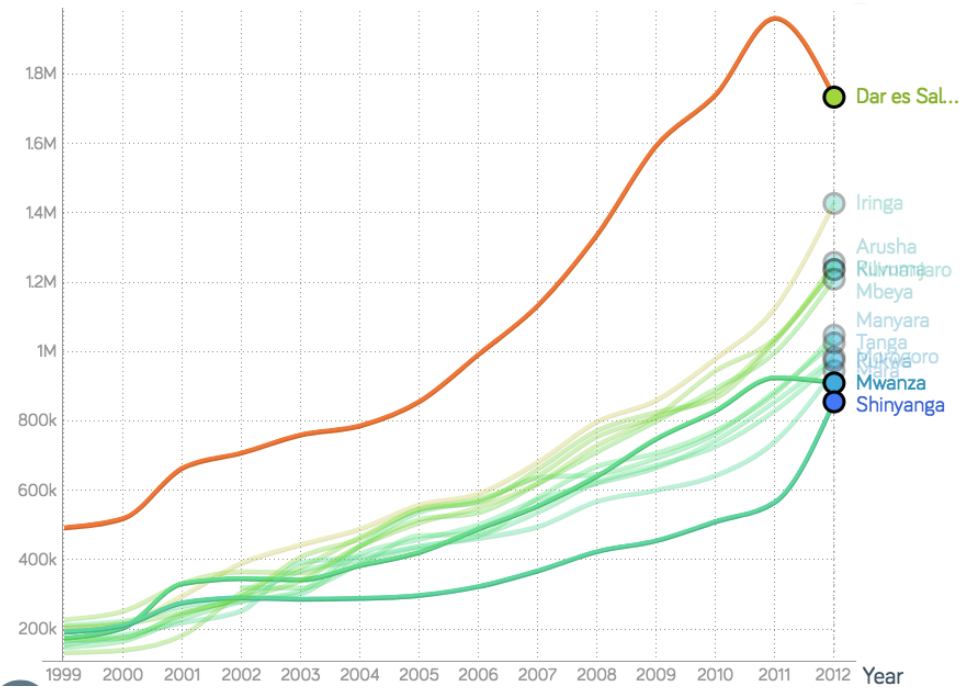
Figure 11: Per Capita GDP and its year-on-year growth 1995-2016



Source: World Bank (World Development Indicators)

It is worth noting that despite the registered overall increase in incomes, both income level and its growth have varied across regions, these disparities are highlighted in Figure 7 below. Per capita Income of Dar-es-Salaam is not only significantly higher than the rest but also it has been increasing at a higher rate than others. Incomes of Shinyanga and Mwanza regions which are second and third largest FDI recipient respectively have remained relatively low and in some cases lower than regions receiving little to no FDI as depicted in Figure 12 below.

Figure 12: Per Capita GDP trend across regions 1999-2012



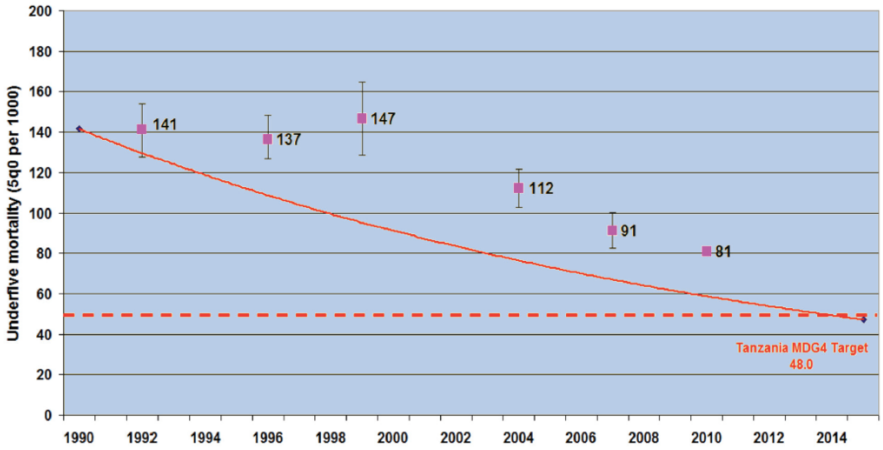
Source: National Bureau of Statistics (NBS)

Note: Values in Tanzania Shillings

3.3. Child mortality trends and performance

Apart from economic achievement, Tanzania has also made headways in other welfare measures, health outcomes in general and child mortality in particular have improved remarkably over time. Under-five mortality rate (U5MR) had initially registered a gradual decline from 141 deaths per 1,000 live births in 1992 to 112 in 2005 (.25.9 percentage change in 13 years); but it later started to decline rapidly, from 112 in 2005 to 49 in 2015 (56.3 percentage change in 10 years; see UNICEF 2017). Remarkable progress in reducing U5MR enabled the country to attain its Poverty Reduction Strategy target (54 deaths per 1,000 live birth; Ministry of Finance and Planning 2016a: 54) while just marginally missing the Millennium Development Goal 4 (MDG4) target of 48 deaths.

Figure 13: Estimated and Projected Under-five Mortality Rates 1990-2015



Source: Ministry of Finance (2012: 58)

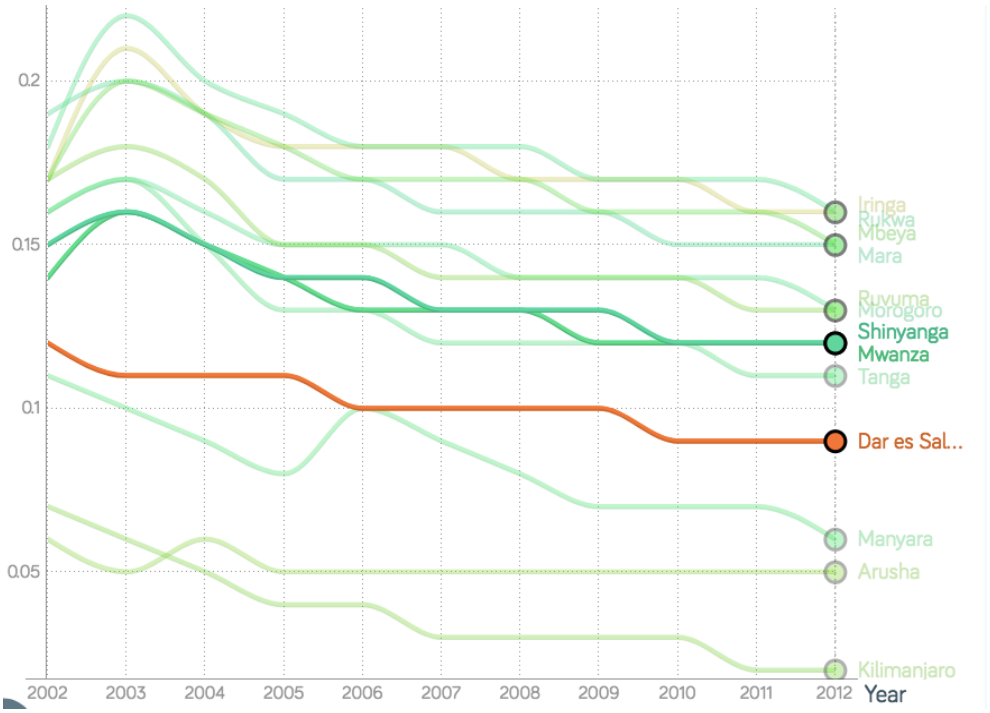
With respect to causes of child mortality, Afnan-Holmes et al. (2015: 399-400) showed that 40 percent of under-five mortality involved neonatal deaths two-third of those deaths were due to birth asphyxia (31%), preterm complications (25%) and sepsis (20%). For deaths occurring beyond neonatal age childhood Infections (pneumonia, diarrhoea and malaria) was identified as a major cause accounting for 55% of deaths; AIDS was found to account for 6%. Nutrition is heralded to be a significant compounding factor in child mortality (2016a: 55).

Noted improvements in child survival have been linked to health and related interventions casing point the "Strategic Plan for Accelerating the Reduction of Maternal and Childhood Death". Improvement in service delivery and increase in coverage and effectiveness of health interventions following decentralization of health, planning, financing and operations was identified as the main contributing factors. For example between 2000 and 2005 implementation of Integrated Management of Childhood Illnesses increased from 19 to 73 percent of all districts, this helped to improve diagnosis, prevention and treatment of malaria which is one of major cause of children deaths; Vitamin A supplementation rose from 14% to 85% and iron supplementation in pregnancy, oral rehydration therapy for children and exclusive breastfeeding of infants all increased (Masanja et al. 2008:1279). Significant child mortality decrease occurred after 2000's which coincidently is the period of noted improvement in incomes, as a resulted child mortality decline is also associated with increase in per capita income (Afnan-Holmes 2015: 404).

Despite overall improvements in child mortality, disparities exist across regions, they are attributed to differences in coverage of maternal and new-born health interventions. Disparities were noted along lines of residence (rural or urban), household wealth/income and mother's education. UNICEF (2017) report indicates that 87 percent of deliveries in urban areas were assisted by skilled birth attendant compared to 55 percent in rural areas, with respect to wealth only

42 percent of deliveries were assisted by skilled attendant among poor households compared to 95 percent of their richer counterparts. 61 percent of newborn children in urban areas receive postnatal care (PNC) compared to 35 percent in rural areas; also, 66 percent of rich households receive PNC compared to 27 percent of poor households. On mother's education the report indicates that 42 percent of deliveries by mothers with no education is assisted by skilled attendant compared to 90.3 for mother with secondary education and 99 with higher education; as a result, children born by less educated mothers are 2.2 times more likely to die during their first months compared to those born to mother with higher education (UNICEF 2017: 3-5).

Figure 14: Trend in Under-five child mortality across regions 2002-2012



Source: National Bureau of Statistics

Figure above plainly communicates disparities in under-five mortality (both level and trend) across regions. For argument's sake, based on mean (Appendix 2) and end of period (2012) U5MR value one could classify regions into three categories:- relatively low U5MR (Kilimanjaro, Arusha and Manyara with UM5R below 100 deaths per 1,000 live births); moderately high U5MR (Dar-es-Salaam, Tanga, Mwanza, Shinyanga, Morogoro and Ruvuma with U5MR between 100 and 150 deaths) and very high U5MR (Mara, Mbeya, Rukwa and Iringa with U5MR above 150). An argument can be made that neither income nor FDI fully explains observed U5MR pattern; for example, regions like Dar-es-Salaam and Iringa which have highest income per person (Figure 12) have moderately high and very high under-five mortality rates respectively, similarly Dar-es-Salaam, Shinyanga Mwanza (thick lines in Figure 14) which have higher FDI share have moderately high U5MR.

Nonetheless under-five mortality pattern seems to be associated with region's ecological/geographical[31] zone, for example Kilimanjaro, Arusha and Manyara which have relatively low U5MR are situated in Northern Highland zone and Iringa, Rukwa and Mbeya which have very high U5MR are all situated in the Southern Highland zone. The implication of observed association between child mortality and regions' ecological/graphical zones is that, ecological/geographical related determinants of child mortality are also crucial for explaining spatial differences in mortality rates as identified by Garenne and Vimard (1984) and Mosley and Chen (1984) child mortality frameworks i.e. proximate determinants (environmental contamination) and discriminating determinants (geographical area) respectively.

The association noted above may be linked to geography and risks of diseases (NBS and Macro International Inc 2009[32]) for example:- malaria is more prevalent[33] in lake zone regions (Kagera, Mwanza, Shinyanga and Mara) and less in regions found in northern and southern highland zones (Arusha, Kilimanjaro, Manyara and Mneya and Iringa respectively) which have relatively cold climate; HIV is more prevalent[34] in southern highlands regions of Iringa and Mbeya , coastal zone region (Dar-es-salaam) and lake zone regions (Shyinyanga and Mara). It also may be linked to economic/cultural practices for example sizable portion of northern highlands regions (Arusha and Manyara) inhabitants are nomadic pastoralists like Masai.

[31] Tanzania mainland regions are classified into six geographical/ecological zones (Appendix I)
[32] 2007-08 HIV/AIDS and Malaria Indicator Survey (https://dhsprogram.com/pubs/pdf/SR150/SR150.pdf)
[33] See Map 2
[34] See Map 3

Chapter 4 Methodology

4.1. Model Identification and Hypotheses

The purpose of this empirical analysis is to determine FDI impact on under-five mortality rate in Tanzania, to do so the paper set out to addresses two main research questions: namely; Does FDI exert an impact on per capita income? and Does income exert an impact on under-five mortality? There is no standard framework for modelling FDI effect on child mortality (Hemmer and Hoa 2002:10); this may be due to absence of a clear theoretical guidance on their relationship resulting into a wide range of choice of regressors and specifications by different studies. As aforementioned in previous chapters, limited theoretical literature on the matter at hand compelled the study to combines different theoretical strands to provide rational theoretical linkage between FDI and child mortality; the consequence of doing so is vivid in the identification of an econometric model(s).

This paper asserts FDI impact on child mortality is mediated through income, it therefore follows Jorgenson (2009a) approach whose methodological aspects are in some respects essentially similar to Hemmer et al. (2002)[35]. Jorgenson empirically examined FDI impact on child mortality by initially investigating FDI impact on industrial pollutions and then consequent pollution impact on child mortality. In similar vein this paper examines FDI impact on under-five mortality sequentially, it first estimates FDI effect on per capita income (GDP) and then consequent impact of per capita income on under-five mortality.

This study adopts two main models whose different variants are estimated to answer research questions at hand. The first model (Equation 1 below) analyse FDI impact FDI on income, FDI-income relationship is among extensively studied issues in economic literature, therefore frameworks and models from previous studies (especially endogenous growth models) helps inform model identification in this regard.

$$Y_{it} = \beta_0 + \beta_1 FDIPC_{it} + \beta_2 X_{it} + \beta_3 FDIshare_{it} + \beta_4 M_{it} + \beta_5 R^j_t + \lambda i + T + U_{it} \quad (1)$$

Where i indexes regions and t time (in years); Y is income measured using per capita GDP; FDIPC is FDI inflows per capita, it is taken as a ratio of region's FDI inflows to its population; X measures log of population, it proxies growth of labour force (one of key determinants of income per worker in growth models); FDIshare is region's share of national FDI flows; M is a dummy which takes value 1 for existence of large scale mining activities in a region and zero otherwise, more than one-third of FDI goes to mining sector, this dummy is taken as a control variable to enhance better examination of FDI effect and interpretation of results; R is dummy for three regions with lions' share of FDI flows j

[35] Hemmer and Hoa (2002) examined FDI effect on poverty by first examining FDI impact on income and consequently income effect on poverty

in superscripts indexes Dar-es-salaam, Shinyanga and Mwanza, it is included as a control variable to distinguish potential income differences between them and the rest given their strong FDI engagement; λ capture region's unobserved and time-invariant characteristics which may be correlated with both FDI and income; T captures time trends; and U is random error term.

Model in Equation 1 above is used to test study's first hypothesis, *H1: FDI has positive and significant impact on per capita income*, therefore expected sign of β_1 is positive. This hypothesis is informed by economic growth theories as well as number of empirical studies (Borensztein et al. 1998, Bengoa and Sanchez-Robles 2003, and Alfaro et al. 2004).

The second model (Equation 2) analyse impact of income on under-five mortality rate (U5MR) the model draws influences from Pritchett and Summers (1996) and Filmer and Pritchett (1997) and is formalized as follows: -

$$U5MR_{it} = \alpha_0 + \alpha_Y LogY_{it} + \alpha_2 TFR_{it} + \alpha_2 FemaleEdu_{it} + \alpha_3 RuralPop_{it} + \alpha_4 M_{it} + \alpha_5 R^j_t + \theta i + T + U_{it} \quad (2)$$

Where U5MR is under-five mortality rate; Y is income (per capita GDP), model 2 use log of income, the rationale behind is non-linearity in income and child mortality relationship identified in some studies (Pritchett and Summers 1996, Filmer and Pritchett 1997, and O'Hare et al. 2012) as well as this paper's empirical investigation conducted using lowess regression whose results suggests a logarithmic functional relationship between U5MR and income (Appendix 3); TFR is total fertility rate which is often hypothesized to be positively related with child mortality rate; FemaleEdu is female education measured by primary school gross enrolment rate for females; RuralPop captures proportions of region population that lives in rural areas; and θ captures unobserved time-invariant heterogeneity across regions.

Public health spending which has been used as one of child mortality regressors in multiple studies is not included in Equation 2; data limitation played a role on it being excluded as regional level public health expenditure could not be obtained. Exclusion of public health expenditure may not necessarily render the model weak as multiple studies have indicated child mortality variation in developing countries to explained by factors other than public health spending, therefore including it to the model will adds little explanatory power (Hanmer et al. 2003:102).

Equation 2 above is used to test study's second hypothesis, *H2; Income exerts negative and significant impact on under-five mortality rate*. This means increase in income (resulting from FDI among others) is expected to reduce under-five mortality and vice versa.

4.2. Variables and Data

4.2.1. Dependent variables

The study ultimate dependent variable is under-five mortality rate(U5MR). this variable measure number of deaths occurring for children below five years children per thousands of live births. Data on child mortality estimates are customary obtained through Demographic and Health Surveys (TDHS surveys conducted by National Bureau of Statistics (NBS) usually after 4 to 6 years. The first TDHS was done in 1992 followed by others in 1996, 1999 (called Tanzania Reproductive and Child Health Survey-TRCHS), 2005, 2010 and 2015 (called Demographic and Health Survey and Malaria Indicator Survey). Housing and Population Census (HPC) also provide estimates for child mortality rates. Using mortality and other demographic data from 2002 population census as well as data from DHS and vital (births and deaths) registrations, NBS in 2006 calculated annualized estimates and projections for child mortality and other socio-economic and demographic indicators (population size and composition, fertility, life expectancy etc.) for all regions; the study uses annualized U5MR estimates from these publications.

Per capita GDP is used as an intermediate variable, it is a dependent variable in Equation 1 above, but its logged value is used as explanatory variable in the Equation 2. Per capita GDP reflects an average income of each individual in the region/nation. Data on this variable are obtained from National Accounts publications by NBS, data used were published at current market (not constant) prices and expressed in Local Currency Unit (Tanzania Shillings).

4.2.2. Independent variables

FDI inflows per capita is obtained by diving region's annual FDI inflows by its population size. FDI data are obtained from Tanzania Investment Reports (reports on Foreign Private Investment/Capital Flows) of which 7 series have been published to date 2001, 2004, 2006, 2009, 2012, 2013 and 2014 Bank of Tanzania in collaboration with Tanzania Investment Centre (TIC), National Bureau of Statistics, Zanzibar Investment Promotion Authority (ZIPA) and Zanzibar's Office of Chief Government Statistician (OCGS) conducts foreign private investment surveys whose sampling frame is obtained from a register of foreign assets and labilities from Bank of Tanzania's Private Capital Flows System (PCFS). Compilation of FDI statistics follows IMF Balance of Payment Manual (BPMS) hence reported FDI transactions comprises of; equity capital; reinvested earnings, and other capital such as non-equity intracompany transactions like loans from foreign affiliates (BoT 2001:11-13, 2009:9-12).

Population measure number of people residing in a particular region in a given time, as aforementioned log of population is used to proxy growth of labour force. Population data are obtained from population census often conducted after ten years (1978, 1988, 2002 and 2012 in Tanzania), censuses provides data on population size, composition and other demographic indicators at national and regional level. Based on intercensal population growth rate and

other demographic details (birth and deaths rate, fertility etc.) annualized population estimates and projection are generated by NBS.

Regional share of FDI is measured as ratio of region's annual FDI flows to national FDI flows, it is included in the model to capture the potential effect of regional FDI distribution given its highly skewed nature.

Total fertility rate (TFR) is used as a control variable for income effect on U5MR, previous studies have indicated fertility to be positively associated with child mortality, high fertility implies lower inter-birth interval which tend to weaken mother's health and increase risks of birth complications, also it leads to shortened breastfeeding. TFR measures average number of children a woman would have if she survives all her childbearing/reproductive years (usually 15 to 49 years); data have been obtained from NBS publications.

Female education is included among the controls for income effect on U5MR; previous studies shows female education to lower child mortality as educated mother has more awareness on maternal care during pregnancy and after giving birth, also educated mothers tend to have more income hence more healthcare access. Gross primary school enrolment for female is used to capture female education, the data is obtained from Population and Housing Census Literacy and Education Monograph by NBS and supplemented by Basic Education Statistics (BEST) published by Ministry of Education, Science and Technology (MoEST).

Proportion of rural population is used as a control variable in U5MR model, it is intended to capture U5MR disparities across residences (rural and urban) as pointed out in UNICEF (2017). Statistically speaking it captures fraction of region's population that resides in administrative areas categorized as rural, data are obtained from same source as population data (NBS).

4.3. Estimation Strategy

The study employs panel data in which Regions are cross-sectional units, given the nature of data panel regression techniques are used for estimation. Commonly used Panel regression techniques includes Pooled Ordinary Least Square (POLS), Fixed-Effect (FE) or Least Square Dummy Variable (LSDV) regression, and Random-Effect (RE) or Generalized Least Squares (GLS) regression. Most empirical studies involving panel data often use pooled OLS along with either Fixed-Effect (FE) or Random-Effect (RE) depending on nature of the data and corresponding results of Hausman and other tests (e.g. Breusch-Pagan Lagrange multiplier (LM)).

Pooled Ordinary Least Square (OLS) regression models were used for baseline estimations FDI effect on per capita income and per capita income effect on under-five mortality; estimations were corrected for heteroskedasticity (by using robust standard errors used). OLS results provide benchmark on nature

of key relationships being investigated in this paper, however their results can be biased due to existence of unobserved heterogeneity across regions (Wooldridge 2010).

To address susceptibility of OLS to potential biasness Fixed-Effect (FE) or Random-Effect (RE) are often used. Fixed-Effect is the most common estimation approach for many panel data, because it helps to examine relationship between variables over-time while controlling for within-cluster variations. Fixed-Effect is also relevant in our case because this study's unit of analysis is Tanzania mainland regions, and it seeks to explain variations in U5MR over time and across regions due to changes in regional FDI flows and other observable time-variant determinants of child mortality (fertility, female education etc.).

Choice of whether to use FE or RE is customary informed by Hausman test whose null hypothesis (H0) is Random Effect is preffered model and alternative hypothesis (Hi) is Fixed-Effect. For H0 to be accepted p-value should exceed 0.05. Results of Hausman test for the FDI impact on income (Equation 1)) supports the choice of FE (p-value is 0.00; see Appendix 4). On income impact on U5MR, the Hausman test results suggest Random-Effect (p-value of 0.55). However, given Fixed-Effect advantages over other panel regression techniques and its argued relevance in the case of our study, Fixed-Effect regression with time dummies is adopted as main estimation techniques for both Equation 1 and Equation 2.

Decision of including time dummies in the fixed-effect models is supported by the test for time fixed effects, this test check if time dummies are needed when running a FE model, it does so by testing if dummies for all years are equal to zero, in case they are zero it implies time dummies are necessarily not needed in FE model. The results for time fixed effects for both models returned a p-value of 0 (Appendix 5) therefore rejecting the null that the coefficients for all years are jointly equal to zero, which implies time dummies are needed.

Previous studies on relationship between FDI and health outcomes have noted the probability of potential bi-directional causality, as there might be a reverse impact running from health to FDI (Alsan et al. 2006, Burns et al. 2016 and 2017). If indeed there is a reverse causality between FDI and child mortality, then there is a potentially for endogeneity problem which would results in biased estimates (Gujarati 2009). To test and account for potential endogeneity requires availability of good "instrument variable(s)" for example Burns et al (2017:77) used gross fixed capital formation and exchange volatility in FDI origin countries as instruments for FDI inflows as these variables were correlated to FDI inflows but not health outcomes of FDI recipient countries. Since valid instrument couldn't be identified, testing for and accounting for endogeneity wasn't done by the study. Another reason for not testing and accounting for endogeneity is the fact that endogeneity due to reverse causality between FDI and population health status is reasonably not expected in the case of Tanzania, because FDI is predominantly determined by presence of extractive resources (mineral

and natural gas), therefore population health status (U5MR included) would have very little or nothing to do with FDI flows into a particular region.

To summarize on estimation approach, the study used a combination of OLS and Fixed-effect models with time dummies for estimation; OLS was used for baseline estimation whilst fixed-effect estimation with heteroskedastic corrected (robust) standard errors was used for main analysis. Due to differences[36] in data availability for the variables used in the study, the sample size was allowed to vary in different estimated models. To test the first hypothesis (positive FDI impact on income) panel data for 14 regions (regions with missing or zero FDI inflows were excluded) was analysed, the sample size in tested models was 127 and a mean number of observations per region was 9.1. In testing the second hypothesis (positive impact of income on U5MR) panel data for 17 regions was analysed; the sample sizes in the tested in models ranged between 153 and 187 and mean number of observations per region was 9 and 11 respectively.

[36] Data on U5MR are available from 2002 to 2012, per capita GDP from 1999 to 2012, regional FDI inflows from 1999 to 2008, and female education from 1999 to 2012 but with missing values in 2007 and 2011.

Chapter 5 Results and Analysis

5.1. Descriptive statistics and bivariate association

Table 2 below presents descriptive statistics for key variables used in the estimation, it present basic statistical measures like mean, standard deviation, minimum and maximum value, and number of observations; since the study used unbalanced panel the number of observations varies across variables and samples.

Table 2: Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max	Obs
Under-five Mortality Rate	0.1320535	0.044274	0.0215	0.2382	187
GDP per capita	526626.9	317802.2	123651.9	1961074	235
FDI per capita	0.0128401	0.0396446	-0.1382582	0.2766633	127
Log of GDP per capita	13.00486	0.590497	11.72523	14.489	235
Population	1876007	683962.1	804025	4364541	235
Log of Population	14.38305	0.3489279	13.59739	15.28902	235
Region's FDI share	0.0555985	0.1592243	-0.4043059	0.7945159	145
Total Fertility Rate	5.51734	1.466455	2	7.46	188
Female education	0.8397109	0.1582751	0.447	1	201
% of rural population	0.7570963	0.1870224	0.035	0.938	187

Source: Author calculation

From the table above the mean value of under-five mortality rate is 0.132 (implying 132 deaths per thousand love birth) with the minimum being 0.0215 (21.5 deaths per thousands) and a maximum of 0.238 (238 deaths per 1,000 live births). These figures point out how U5MR remains relatively high despite its observed decrease over time, it also reveals existence of serious disparities across regions. The mean value of Per capita GDP is Tanzania Shillings (Tsh) 526,626. 9 which is equivalent to US$230.11 (exchange rate of $1=Tsh 2,288.6 quoted on 29/10/2018); this figure attest to how rampant poverty is in the regions and country at large. Standard deviation on the other hand signals prevalence of income inequalities across regions. Regarding FDI inflows per capita, the mean value is 0.012 (in Tsh) with a standard deviation of 0.04, these two figures lay bare the highly skewed nature of FDI distribution across regions, an issue which is exacerbated by presence of negative FDI flows (implying divestment greater than investment) observed for regions some in certain years.

To have a glimpse of the nature of relationship between key variables of interest in the study, the paper investigates a simple bivariate association between variables in question. Since the study involves two principal relationships, two covariance matrices are generated, the first covariance matrix is for variables in

per capita income equation and the second one is for under-five mortality rate equation; covariance matrix tables are in Appendix 6.

From these table, all key explanatory variables in the income model (Equation 1) appear to have positive correlation with per capita GDP with the exception of mining dummy (for presence of large-scale mining operations in a region) and dummies for Mwanza and Shinyanga regions which have negative correlation with income. Ranking their correlation coefficients with income in descending order is as follows; Dar-es-Salaam dummy, FDI flows per capita, regional share of FDI log of population, mining dummy, Shinyanga dummy and Mwanza dummy. Correlation matrix table for under-five mortality model (Equation 2) indicates both positive and negative bivariate correlation between key explanatory variables and U5MR; log of per capita GDP and female education have negative association with U5MR while total fertility rate and proportion of rural population and mining dummy positively correlated with U5MR. Additionally, bivariate association between FDI per capita and U5MR was also investigated and found to be negative but very weak (correlation coefficient of 0.096).

5.2: FDI impact on income

Based on equation (1) on chapter 4, paper first examines FDI impact on per capita GDP of recipient regions, as aforementioned OLS and FE estimation are used. Pooled OLS estimation results are presented in Table 3, these results provide a benchmark of nature of FDI and income relationship along with different control factors. Six models are presented in Table 3, column 1 test the effect of FDI flows per capita on income without any control variables, from column 2 to 5 different control variables are introduced in the model to test sensitivity (robustness) of results, column 6 presents the full model with all controls variables this model has stronger explanatory power relative to others as its R-square (0.414) indicates.

Results from OLS estimation indicates FDI flows per capita exerts positive and statistically significant effect on per capita GDP, the results are robust for almost all models with exceptions of model in column (5) which introduce dummies for mining and regions that's commands significant share of FDI (Dar-es-Salaam, Shinyanga and Mwanza). Log of population is noted to exert positive effect on per capita GDP, the effect is insignificant in column 2 but significant at 10 percent level in column 6. Regional share of FDI has negative but insignificant effect on per capita GDP. These results support the argument for FDI generating positive economic benefits to host countries through its impact on economic growth, employment creation and improved productivity among others. Results from columns 4 and 6 indicate presence of large-scale mining activities in a region has no significant effect on its per capita GDP, different explanations can be provided for this relationship:- first, the capital-intensive and enclaved nature of large-scale mining operations implies very limited direct jobs creation, additionally their weaker linkages with domestic firms and the rest of the economy means investment expansion from FDI has negligible multiplier effect; second, is despite its remarkable growth relative to sectors fuelled by enormous FDI inflows its contribution to aggregate GDP remains low (its 2001-

2013 average contribution to national real GDP was 2.4 percent; see NBS, 2015:14).

Table 3: OLS regression results of FDI impact on Income

	(1)	(2)	(3)	(4)	(5)	(6)
FDI flow per capita	2,661***	2,575***	3,053*	2,581***	866.01	2,537**
	(739.094)	(750.093)	(1,774)	(733.816)	(699.775)	(1,084)
Log of Population		29.779				100.806*
		(39,618)				(55,334)
Region's FDI share			-103.407			-770.975**
			(331,632)			(299,104)
Mining				-42.351		-10.451
				(32.017)		(36.289)
Dar-es-Salaam					338.635***	514.468***
					(101.028)	(125.011)
Mwanza					-3.105	-35.290
					(48.109)	(61.449)
Shinyanga					-101.332***	-95.426*
					(30.042)	(53.564)
Constant	379.113***	-48.780	380.629***	397.480***	383.714***	-1,049
	(18.078)	(565.969)	(18.068)	(26.042)	(17.866)	(780.905)
Observations	127	127	127	127	127	127
R-squared	0.251	0.253	0.253	0.261	0.353	0.414

Source: Author computation

Coefficients estimates are in thousands (000')

*** p<0.01, ** p<0.05, * p<0.1; Robust standard errors in parentheses

OLS estimation results from Table 3 above supports paper's first hypothesis that FDI has positive and significant impact on per capita income. However, it should be noted that OLS estimates might be biased as they don't account for unobserved and time-invariant heterogeneity across regions, therefore definitive conclusions on their relationship cannot be made on basis of these results. Table 4 below presents Fixed-Effect estimation results for different models of per capita income and FDI relationship, time dummies are included in all models. Column 1 contains results for income and FDI model without any control variables; log of regional population (which proxies' growth of labour force) is introduced in column 2 and regional share of FDI flows in column 3, model in column 4 is unrestricted one with all regressors.

Table 4: Fixed Effect regression results of FDI impact on Income

	(1)	(2)	(3)	(4)
FDI flow per capita	418.003*	505.206**	923.258***	994.786***
	(224.625)	(214.752)	(314.784)	(299.202)
Log of Population		-215.972***		-213.27***
		(61.759)		(60.51)
Region's FDI share			-208,812**	-202,784**
			(92.911)	(88.126)
	(24.100)	(22.974)	(23.656)	(22.519)
2001	90.640***	103.985***	88.148***	101.399***
	(24.072)	(23.175)	(23.638)	(22.73)
2002	135.943***	134.555***	135.56***	134.2***
	(23.674)	(22.484)	(23.223)	(22.026)
2003	179.72***	183.029***	179.498***	182.772***
	(23.683)	(22.509)	(23.231)	(22.050)
2004	234.601***	244.266***	234.481***	244.029***
	(23.678)	(22.653)	(23.226)	(22.191)
2005	278.985***	293.386***	269.578***	284.071***
	(23.965)	(23.126)	(23.877)	(23.013)
2006	329.825***	352.687***	330.224***	352.789***
	(23.71)	(23.445)	(23.258)	(22.966)
2007	395.081***	423.305***	390.542***	418.543***
	(23.692)	(23.901)	(23.327)	(23.505)
2008	492.37***	526.473***	480.244***	514.270***
	(24.195)	(24.959)	(24.338)	(25.018)
Constant	189.665***	3,287***	199.131***	3,257***
	(17.321)	(885.745)	(17.504)	(867.76)
Observations	127	127	127	127
R-squared	0.889	0.901	0.894	0.906

Source: Author computation

Coefficients estimates are in thousands (000')

*** p<0.01, ** p<0.05, * p<0.1; Robust standard errors in parentheses

Results in Table 4 shows FDI has positive and significant effect on per capita GDP, results are robust for inclusion of key control variables. The size of FDI effect on per capita income as well as its significance increases with addition of control variables in the model. The size of effect increases from 418,003 in column 1 to 994,786[37] in column 4. Similarly, in column 1 FDI effect is weak (significant only at 10 percent level) but its significance increases to 5 percent

[37] One unit (Tsh) increase in FDI per capita is associated with Tsh 994,786 ($434.7) increase in per capita GDP.

with inclusion log of population and then to 1 percent when regional share of FDI is added. These results support the hypothesis that FDI has positive and significant effect on income, the results are robust for when controlling for population and regional share of FDI.

With respect to population, results show log of population has negative and significant association with per capita GDP, intuitively the effect of population growth on income can be two sided depending on circumstance. Theoretically, within the framework of neoclassical growth models, population growth reflects increase in labour force it thus expected to increase output/income per worker, however the ultimate effect is dependent upon factors such as capital formation (capital per worker), total factor productivity, and labour and capital shares of output. Practically, population growth may negatively affect per capita income if its value outpaces aggregate GDP growth.

Regional share of FDI has negative and significant association with per capita GDP, sectoral distribution of FDI and regional concentration of different sectoral activities can help to provide explanation for this observed result. Two-third of FDI inflows goes to mining, manufacturing and finance and insurance sectors; in terms of regional concentration, mining is heavily concentrated in Shinyanga (three[38] out of six large mining establishments are in Shinyanga) followed by Mwanza, manufacturing and finance and insurance activities are concentrated in Dar-Salaam (region contributes 42% of manufacturing value added; Andreoni 2017: 23-24). Mining 2001-2013 average contribution to GDP was 2.3 percent while manufacturing was 9.3 %, implying with exception of Dar-es-Salaam (whose FDI constitute of manufacturing, finance and other sectors) regional share of FDI may not necessarily be positively associated with income if said FDI is predominantly in mining. This line of argument is supported by OLS results in columns 5 and 6 of Table 3 where coefficient for Dar-es-Salaam dummy is positive and significant while for its negative for Shinyanga and Mwanza (insignificant in Mwanza case).

5.3. Impact of Income on Under-five Mortality

FDI effect on U5MR is presumed to be mediated through income (per capita GDP) and previous subsection was dedicated in analysing FDI effect on income. Since it is already established that FDI has positive and significant effect on income (based on previous subsection estimation results) we then move to examine the impact of income on U5MR. Like in previous case OLS results (reported in Appendix 7) are only used as a benchmark but conclusion isn't drawn from them given their vulnerability to biasness when dealing with panel data.

Table 5 below presents Fixed-effect regression results for impact of income on under-five morality rate for different tested models, time dummies are included in all models. Column 1 include only income as main regressor, from

[38] Bulyankulu, Kahama and Buzwagi gold mines

column 2 to 5 different control variables are introduced to test for results sensitivity, and column 7 is the unrestricted model with all key regressors. This table presents very striking results with respect to relationship between income and under-five mortality, per capita GDP is found to be positively correlated with U5MR, however the relationship is not significant, and it remains so even with addition of different control variables. Findings reject study's the second hypothesis i.e. income exerts negative and significant impact on under-five mortality rate.

The results not only fundamentally differ from those in OLS estimations, they contradict results from many cross-country studies which showed income to improve health outcomes including child mortality (Kakwani 1993, Pritchett and Summers 1996, Wang et al 1996 and Filmer and Pritchett). However, they are not very far off from Afnan-Holmes et al (2015:403-404) whose results indicate existence of weak association between income and child mortality in Tanzania; they argue such weak association might be due to income effect being mediated through improved health sector coverage and other difficult to measure factors that influences child survival. The odd nature of results could be related with the nature of data at hand especially its paucity (in terms of timespan) and skewed nature of income distribution.

FDI effect on under-five mortality is presumed to be taking place indirectly through income, however the attempt was made to investigate potential FDI direct effect on U5MR. This was done by regressing FDI on U5MR, first alone (column 6) and then with all other control variables (column 6 and 7 respectively in Table 5). The results indicate FDI to have positive[39] but insignificant association with under-five mortality; Although FDI is found to have no direct effect on U5MR, its introduction into the model somehow confirms that it indeed operates through income; the coefficient of per capita GDP changes from sign positive to negative. Implying presence of FDI makes income to be associated with improvement in under-five mortality.

With respect to other determinants of under-five mortality, the results indicate total fertility rate to be negatively and significantly associated with U5MR when controlling for income alone (column 2) it however loses significance when other control variables are included; the observed negative relationship differs from perceived theoretical association between them. This can be explained by differing trends in fertility rate across regions; fertility has been declining in some regions while its stable or increasing in others; U5MR and fertility relationship is observed to be positive in regions with falling fertility and negative in those with increasing or stable fertility rates (see Appendix 8).

[39] such relationship was also observed by Shandra et al (2005) and Jorgenson (2009a)

Table 5: Fixed-effect regression results for Income impact on U5MR

	(1)	(2)	(3)	(4)	(5)	(6)	
Log of per capita GDP	0.00234	0.00119	0.00196	0.00197	0.00226	-0.00265	-0.0(
	(0.00551)	(0.00548)	(0.00644)	(0.00546)	(0.00633)	(0.0104)	(0.0
Fertility rate		-0.00525**			-0.00507		-0.0(
		(0.00258)			(0.00329)		(0.0(
Female Education			0.00701		0.0179		0.01
			(0.0123)		(0.0129)		(0.0
% of rural population				0.0829**	0.0758		0.13
				(0.0410)	(0.0505)		(0.1
FDI flow per capita						0.000673	0.00
						(0.0291)	(0.0
2003	0.00978***	0.00979***	0.00907***	0.0100***	0.00782***	0.0105***	0.00
	(0.00218)	(0.00216)	(0.00286)	(0.00216)	(0.00286)	(0.00320)	(0.0(
2004	-0.00163	-0.00171	-0.00295	-0.000776	-0.00497	0.000476	-0.0(
	(0.00254)	(0.00252)	(0.00406)	(0.00256)	(0.00413)	(0.00408)	(0.0(
2005	-0.0129***	-0.0130***	-0.0144***	-0.0116***	-0.0166***	-0.00957*	-0.01
	(0.00297)	(0.00294)	(0.00482)	(0.00300)	(0.00491)	(0.00502)	(0.0(
2006	-0.0148***	-0.0151***	-0.0164***	-0.0133***	-0.0188***	-0.0107*	-0.01
	(0.00328)	(0.00325)	(0.00528)	(0.00334)	(0.00542)	(0.00567)	(0.01
2007	-0.0183***	-0.0186***		-0.0163***		-0.0136*	
	(0.00390)	(0.00386)		(0.00398)		(0.00684)	
2008	-0.0217***	-0.0221***	-0.0233***	-0.0194***	-0.0257***	-0.0163**	-0.01
	(0.00455)	(0.00451)	(0.00674)	(0.00465)	(0.00691)	(0.00814)	(0.01
2009	-0.0250***	-0.0254***	-0.0265***	-0.0223***	-0.0288***		
	(0.00498)	(0.00493)	(0.00714)	(0.00510)	(0.00733)		
2010	-0.0282***	-0.0287***	-0.0296***	-0.0252***	-0.0318***		
	(0.00552)	(0.00547)	(0.00770)	(0.00567)	(0.00792)		
2011	-0.0312***	-0.0318***		-0.0279***			
	(0.00617)	(0.00612)		(0.00633)			
2012	-0.0343***	-0.0349***	-0.0354***	-0.0305***	-0.0371***		
	(0.00707)	(0.00701)	(0.00922)	(0.00725)	(0.00946)		
Constant	0.117*	0.162**	0.117	0.0576	0.0759	0.174	0.08
	(0.0694)	(0.0721)	(0.0835)	(0.0748)	(0.0964)	(0.132)	(0.1
Observations	187	187	153	187	153	91	78
R-squared	0.846	0.850	0.837	0.850	0.845	0.680	0.66

Source: Author computation

*** p<0.01, ** p<0.05, * p<0.1; Robust standard errors in parentheses.

Female education is found to have no significant effect on U5MR both when controlling for income alone (column 3) as well as other covariates (column 5). This might be because of education level used in analysis (primary school) might have little impact on raising maternal education awareness among mothers.

Proportion of rural population exert positive and significant effect when controlling for income alone (column 5) but it loses significance when other control variables are included. The results for proportion of rural population are similar to earlier studies. Time dummies estimate the exogenous effect on under-five mortality, its negative and statistically significant coefficient for most years signifies an overall exogenous decrease in U5MR over-time after controlling for income, fertility rate, female education and proportion of rural population.

Chapter 6. Conclusions

This research set out to empirically investigate the impact of Foreign Direct Investment on under-five mortality in Tanzania using panel data of 17 Tanzania mainland regions from 1999-2012. Considering limited literature and theoretical guidance on the issue being studied, the paper combined theoretical explanations of FDI and income relationships (neo-classical and endogenous growth theories) and income and child mortality relationship to draw theoretical link between FDI and child mortality. FDI impact on under-five mortality is investigated by first examining whether FDI exert an effect on income and then if consequently income impacts under-five mortality. Fixed-Effect regression was used for main analysis.

The paper finds FDI to have positive and significant effect on income net of population growth and regional share of FDI flows, FDI flows per capita alone was found to explain 88 percent of variation in per capita GDP. Concerning the consequent impact of income on under-five mortality study findings indicate income to have no significant effect on under-five mortality; these results differ from many multi-country empirical studies (which found income to have negative and significant effect on child mortality, but they aren't far off from O'Hare et al (2011) conceptualization of income and child mortality relationship (sigmoid curve) and Afnan-Holmes et al (2015) empirical results. O'Hare et al (2011) suggests income and child mortality relationship to be weaker in low-income countries, an income category which Tanzania belongs to.

In general study finds FDI to have no effect in under-five mortality in Tanzania. The observed absence of effect can be attributed to number of factors including: limited timespan of data (Afnan-Holmes 2015:404), nature and pattern of FDI flows (a very skewed sectoral and regional distribution), and acute income disparities across regions. One crucial reason for this lack of effect could be the fact that child mortality may be determined by factors that aren't covered by this analysis due to data limitations or weak theoretical foundations, casing point health spending and other difficult to measure factors that affect child survival.

A good understanding of child mortality dynamics and determinants especially how socio-economic factors and health interventions interacts to improve its outcome is very essential for facilitating well-informed policies and other measures geared towards improving social welfare. This however `requires thorough analysis of child mortality by incorporating many relevant determinants identifying appropriate mechanisms of effects. This necessitates not only availability of high-quality data but also presence of strong theoretical and analytical frameworks, frameworks that goes beyond typical socio-economic factors (income, education etc.). But apparently there are no strong and well-established and strong analytical framework(s) for linking FDI and child mortality; there-

fore, more theoretical and empirical studies is needed in this area especially country case studies as country specific context can help shade more light on the matter than multi-country ones.

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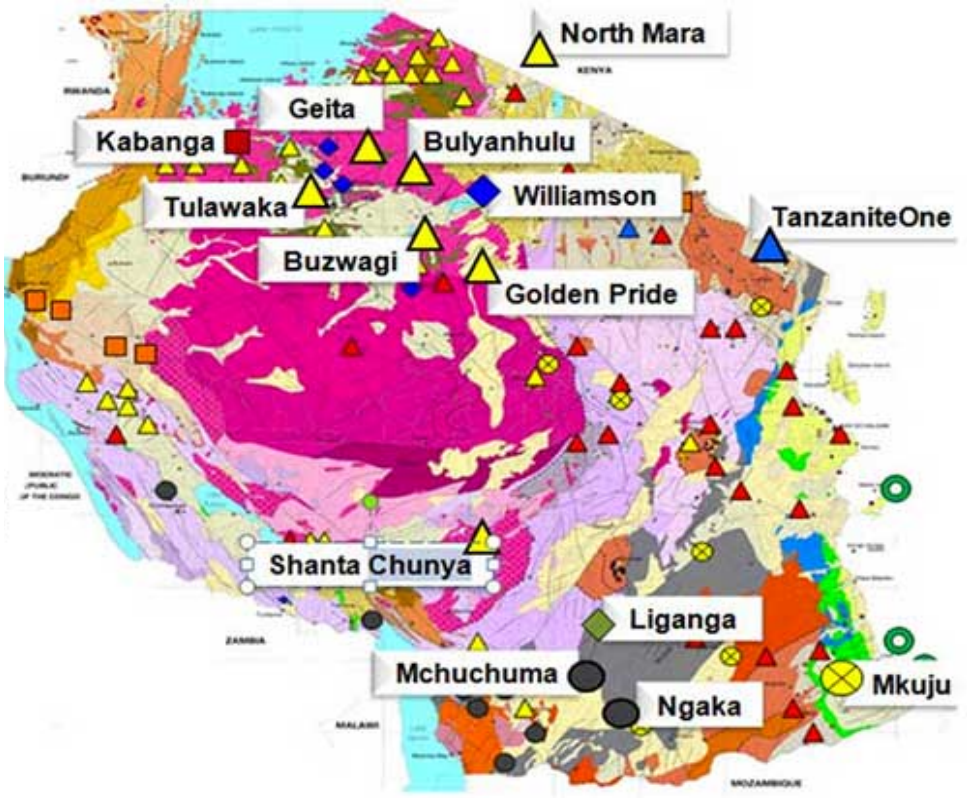
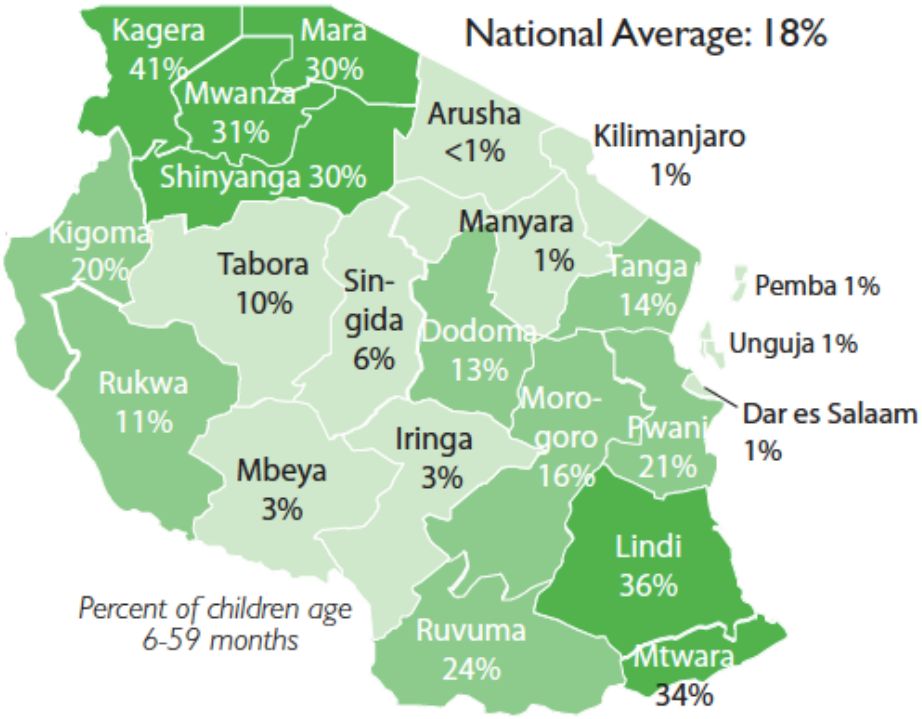
Map 1: Mining Operations across regions



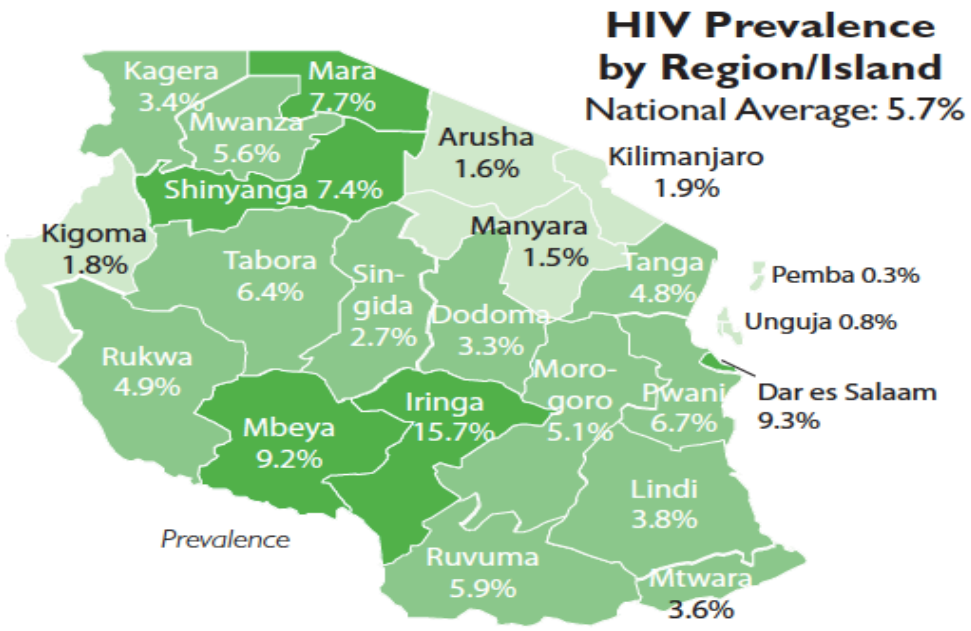
Source: TanzaniaInvest (https://www.tanzaniainvest.com/mining)

Map 2: Malaria prevalence among children below 5 years by region



Source: NBS 2009

Map 3: HIV prevalence by region



Source: NBS 2009

Appendices

Appendix 1: List of Regions included and excluded in analysis

United Republic of Tanzania is a unification of two former sovereign states Tanganyika and Isles of Zanzibar), the country has two government: government of United Republic of Tanzania (URT) and the semi-autonomous Revolutionary Government of Zanzibar (RGZ); the former is responsible for governance of Tanzania mainland and union matters and latter for non-union matters related to Zanzibar islands.

Administratively the country has 31 regions, 26 in Tanzania mainland and 5 in Zanzibar. As of 20001 Tanzania mainland had 20 regions, 6 new regions were added afterwards by subdividing existing ones, in 2002 Manyara region ws formed after subdividing Arusha; in 2011 four new regions were formed namely Njombe, Katavi, Simiyu, and Geita; and in 2016 Songwe region was formed after subdividing Mbeya; these regions haven't been included in the analysis.

Out of 21 regions that existed prior to 2011, four regions had no FDI flows data (Dodoma, Singida, Lindi and Rukwa) and three others had no FDI flows for majority of years and zero flows for other years (Kigoma, Mtwara, and Tabora). Therefore, the analysis for FDI impact on income excluded all these 7 regions while income impact on U5MR excluded the only 4. Table below provide list of regions, their geographical zones, and their inclusion status in analysis.

List of Regions included and excluded in analysis

S/N	Region	Code	Geographical Zone	Inclusion Status
1.	Arusha	ARU	Northern Highland	Included
2.	Dar es Salaam	DSM	Coastal Zone	Included
3.	Dodoma	DOM	Central Zone	Included
4.	Geita	GTA	Lake Zone	Not include
5.	Iringa	IRI	Southern Highland	Included
6.	Kagera	KGR	Lake Zone	Included
7.	Katavi	KTV	Southern Highland	Not include
8.	Kigoma	KGM	Lake Zone	Not include
9.	Kilimanjaro	KIL	Northern Highland	Included
10.	Lindi	LIN	Southern Zone	Included
11.	Manyara	MNY	Northern Highland	Included
12.	Mara	MRA	Lake Zone	Included
13.	Mbeya	MBY	Southern Highland	Included
14.	Morogoro	MOR	Coastal Zone	Included
15.	Mtwara	MTW	Southern Zone	Not include
16.	Mwanza	MWZ	Lake Zone	Included
17.	Njombe	NJM	Southern Highland	Not include
18.	Pwani [Coast]	PWA	Coastal Zone	Included
19.	Rukwa	RUK	Southern Highland	Included
20.	Ruvuma	RUV	Southern Zone	Not include
21.	Shinyanga	SHY	Lake Zone	Included
22.	Simiyu	SMY	Lake Zone	Not include
23.	Singida	SGD	Central Zone	Included
24.	Songwe	SGW	Southern Highland	Not include
25.	Tabora	TBR	Lake Zone	Not include
26.	Tanga	TNG	Coastal Zone	Included

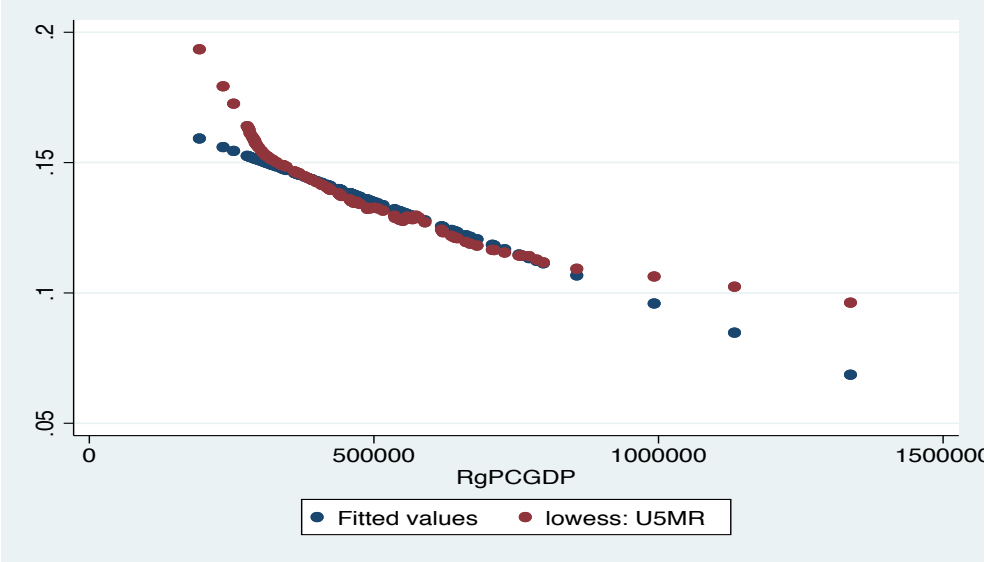
Appendix 2: Mean values of key variables across regions

Region	U5MR	RgPCGDP	RPCFDIf	RPopul~n	TFR	Female~u	RuralPop
Arusha	.0536364	603128.6	-.0038734	1631266	4.563636	.813125	.687
Dar es Salaam	.1013909	1091483	.118408	2820156	2.433333	.8877333	.048
Iringa	.1762273	647249.1	.0026646	1587375	4.362727	.903325	.8023636
Kagera	.1696	345219.7	.0032027	2202619	7.330909	.8039833	.9147273
Kigoma	.1304909	335006.8	.	1559567	7.423636	.784325	.8015455
Kilimanjaro	.0374909	577222.4	.0060238	1626387	3.586364	.8830583	.7707273
Manyara	.0826273	602399.9	.0009034	1245826	6.455455	.8632889	.863
Mara	.1671182	464533.6	.0009146	1566311	7.014545	.8775917	.7874545
Mbeya	.1702818	567023.2	.0006983	2351594	6.190909	.885325	.7880909
Morogoro	.1494182	499386.6	.0070993	1920460	4.754545	.8222417	.709
Mtwara	.1961364	444980.4	.	1207759	4.863636	.846975	.7747273
Mwanza	.1315636	521399.7	.0092069	3057847	5.990909	.8617	.7882727
Pwani [Coast]	.1519182	386282.5	.0001407	957732.7	5.099091	.850575	.7686364
Ruvuma	.1486364	595194.2	-.0000906	1238564	4.981818	.8756833	.8362727
Shinyanga	.1343273	381531.1	.0150433	3043743	7.318182	.7790083	.8986364
Tabora	.1131636	383231.1	.	1929738	7.234545	.692925	.82
Tanga	.1308818	523623.6	.0032373	1810140	4.470909	.8501167	.8121818
Total	.1320535	526626.9	.0128401	1876007	5.51734	.8397109	.7570963

Source: Author calculation

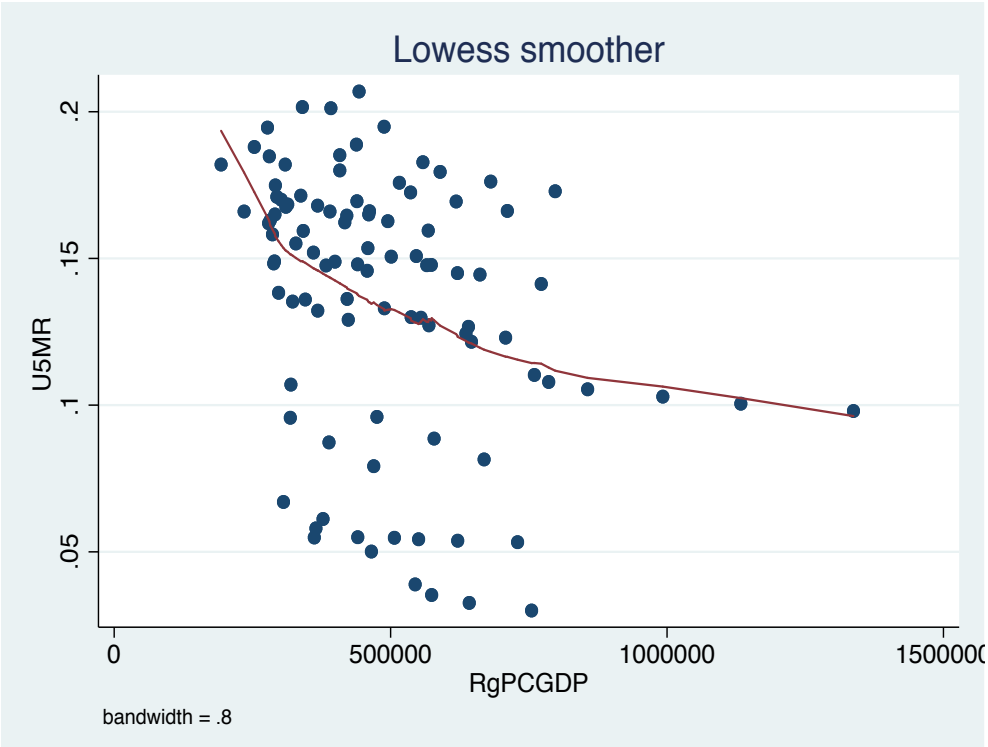
Appendix 3: Test of Non-Linearity between Income and U5MR

Appendix 3-(a): Lowess regression and fitted values for income and U5MR



Source: Author calculation

Appendix 3-(b): Lowess smoother for Per capita GDP and U5MR relationship



Source: Author calculation

Appendix 4: Hausman test results

Appendix 4-(a): Hausman test for Per Capita Income Model

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
RPCFDIf	**2201165**	**2796952**	**-595786.9**	.
logRPopula~n	**532772.3**	**122652.8**	**410119.5**	**123713.9**
RgShare_FDI	**-695990.8**	**-333990.4**	**-362000.4**	**80090.44**

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(**3**) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= **38.59**
Prob>chi2 = **0.0000**

Source: Author calculation

Appendix 4-(b): Hausman test results for U5MR model

	Coefficients			
	(b) fe1	(B) re1	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
logRgPCGDP	**-.0237037**	**-.0267582**	**.0030545**	**.0018887**
TFR	**.0006139**	**-.0013685**	**.0019824**	**.0020807**
FemaleEdu	**-.0101766**	**-.0115199**	**.0013432**	.
RuralPop	**.1645125**	**.0827086**	**.0818038**	**.0479276**

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(**4**) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= **3.07**
Prob>chi2 = **0.5459**

Source: Author calculation

Appendix 5: Test for time fixed effects

Appendix 5-(a): Test for Time fixed effect in Per capita Income model

```
. testparm i.Year

 ( 1)  2000.Year = 0
 ( 2)  2001.Year = 0
 ( 3)  2002.Year = 0
 ( 4)  2003.Year = 0
 ( 5)  2004.Year = 0
 ( 6)  2005.Year = 0
 ( 7)  2006.Year = 0
 ( 8)  2007.Year = 0
 ( 9)  2008.Year = 0

       F(  9,    13) =   54.10
            Prob > F =    0.0000
```

Source: Author calculation

Appendix 5-(b): Test for Time fixed effect in U5MR income model

```
. testparm i.Year

 ( 1)  2003.Year = 0
 ( 2)  2004.Year = 0
 ( 3)  2005.Year = 0
 ( 4)  2006.Year = 0
 ( 5)  2008.Year = 0
 ( 6)  2009.Year = 0
 ( 7)  2010.Year = 0
 ( 8)  2012.Year = 0

       F(  8,    16) =   41.67
            Prob > F =    0.0000
```

Source: Author calculation

Appendix 6: Covariance Matrices

Appendix 6-(a): Covariance Matrices for Income and FDI relation

	RgPCGDP	RPCFDIf	logRPo~n	RgShar~I	Mining	DSM	Mwanza	Shinya~a
RgPCGDP	1.0000							
RPCFDIf	0.5013	1.0000						
logRPopula~n	0.2092	0.3313	1.0000					
RgShare_FDI	0.4293	0.8905	0.3784	1.0000				
Mining	-0.1731	-0.1516	0.3465	-0.1407	1.0000			
DSM	0.5742	0.7816	0.3012	0.8575	-0.2434	1.0000		
Mwanza	-0.0344	-0.0269	0.4129	-0.0173	0.3511	-0.0855	1.0000	
Shinyanga	-0.1644	0.0163	0.4159	0.0914	0.3511	-0.0855	-0.0855	1.0000

Source: Author calculation

Appendix 6-(b): Covariance Matrix for under-five mortality and Income and relationship

	U5MR	logRgP~P	TFR	Female~u	RuralPop	RPCFDIf	Mining
U5MR	1.0000						
logRgPCGDP	-0.3619	1.0000					
TFR	0.4457	-0.6429	1.0000				
FemaleEdu	-0.0601	0.6096	-0.2020	1.0000			
RuralPop	0.2637	-0.6329	0.7385	-0.1042	1.0000		
RPCFDIf	-0.0957	0.3932	-0.4002	-0.0043	-0.6716	1.0000	
Mining	0.2791	-0.2855	0.8234	-0.0396	0.3988	-0.1205	1.0000

Source: Author calculation

Appendix 7: Regression Results Tables and STATA Output tables

Appendix 7-(a): OLS regression results for per capita Income impact on U5MR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log of per capita GDP	-0.0359***	-0.0296***	-0.0501***	-0.0324***	-0.0349***	-0.0359***	-0.0414***
	(0.00581)	(0.00765)	(0.00737)	(0.00748)	(0.00596)	(0.00727)	(0.0104)
Fertility rate		0.00372					0.00526
		(0.00252)					(0.00510)
Female education			0.118***				0.124***
			(0.0316)				(0.0359)
% of rural Population				0.0179			0.156**
				(0.0109)			(0.0721)
Mining					0.00487		-0.00941
					(0.00587)		(0.00995)
Dar-es-Salaam						-0.00399	0.129**
						(0.00765)	(0.0504)
Mwanza						0.000130	0.000123
						(0.00420)	(0.00792)
Shinyanga						-0.00937**	-0.0224**
						(0.00423)	(0.00914)
Constant	0.606***	0.502***	0.685***	0.546***	0.591***	0.606***	0.416***
	(0.0764)	(0.111)	(0.0848)	(0.105)	(0.0792)	(0.0950)	(0.157)
Observations	187	187	153	187	187	187	153
R-squared	0.146	0.157	0.201	0.151	0.149	0.149	0.245

Source: Author calculation

*** p<0.01, ** p<0.05, * p<0.1; and Robust standard errors in parentheses

Appendix 7-(b): STATA Output tables for Fixed-Effect regression on FDI effect on Income

```
Fixed-effects (within) regression               Number of obs      =       127
Group variable: RegionID                        Number of groups   =        14

R-sq:                                           Obs per group:
     within  = 0.9057                                         min =         1
     between = 0.0008                                         avg =       9.1
     overall = 0.3696                                         max =        10

                                                F(12,13)           =   2048.89
corr(u_i, Xb)  = -0.2668                        Prob > F           =    0.0000

                                (Std. Err. adjusted for 14 clusters in RegionID)
```

RgPCGDP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
RPCFDIf	994786.4	243143.3	4.09	0.001	469507.2	1520066
logRPopulation	-213269.8	151335.4	-1.41	0.182	-540210.1	113670.6
RgShare_FDI	-202784.5	139006.5	-1.46	0.168	-503089.8	97520.89
Year						
2000	28721.99	5634.459	5.10	0.000	16549.48	40894.49
2001	101398.8	11243.34	9.02	0.000	77109.05	125688.6
2002	134200.2	15732.16	8.53	0.000	100212.9	168187.4
2003	182772.4	20213.73	9.04	0.000	139103.2	226441.5
2004	244029.1	21067.31	11.58	0.000	198516	289542.3
2005	284071.1	27610.81	10.29	0.000	224421.6	343720.6
2006	352788.7	26590.17	13.27	0.000	295344.1	410233.2
2007	418543.2	33442.55	12.52	0.000	346294.9	490791.4
2008	514269.9	36400.88	14.13	0.000	435630.5	592909.2
_cons	3257012	2167960	1.50	0.157	-1426580	7940604
sigma_u	164461.07					
sigma_e	54833.095					
rho	.89995817	(fraction of variance due to u_i)				

Source: Author calculation

Appendix 7-(c): STATA Output tables for Fixed-Effect regression on FDI effect on Income

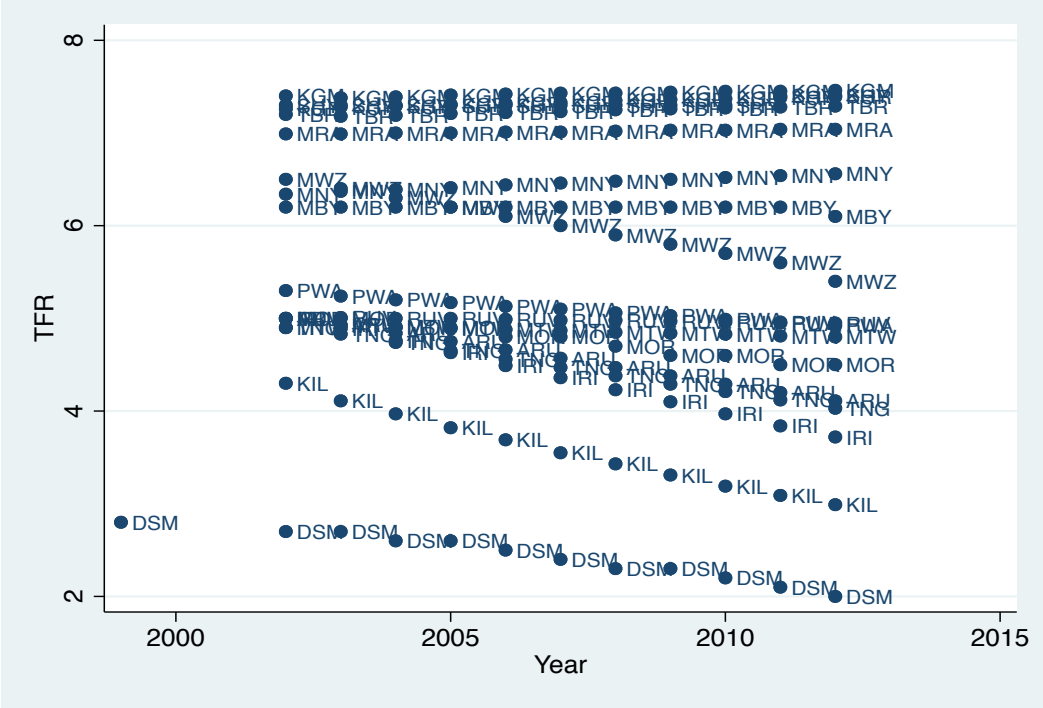
```
Fixed-effects (within) regression               Number of obs      =        78
Group variable: RegionID                        Number of groups   =        14

R-sq:                                           Obs per group:
     within  = 0.6674                                         min =         1
     between = 0.0793                                         avg =       5.6
     overall = 0.0961                                         max =         6

                                                F(10,13)           =    291.34
corr(u_i, Xb)  = -0.3519                        Prob > F           =    0.0000

                                (Std. Err. adjusted for 14 clusters in RegionID)
```

U5MR	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
logRgPCGDP	-.0040731	.0163883	-0.25	0.808	-.0394779	.0313317
RPCFDIf	.0025374	.0296386	0.09	0.933	-.0614929	.0665677
TFR	-.0007886	.010827	-0.07	0.943	-.0241789	.0226018
FemaleEdu	.0155987	.028282	0.55	0.591	-.0455009	.0766984
RuralPop	.1393748	.1611166	0.87	0.403	-.2086965	.4874462
Year						
2003	.008651	.0074811	1.16	0.268	-.007511	.024813
2004	-.0017664	.0095888	-0.18	0.857	-.0224817	.018949
2005	-.0116134	.0108179	-1.07	0.303	-.0349841	.0117573
2006	-.0125535	.0112685	-1.11	0.285	-.0368977	.0117907
2008	-.0170794	.0148823	-1.15	0.272	-.0492307	.0150718
_cons	.0801802	.2825019	0.28	0.781	-.5301279	.6904884
sigma_u	.04652441					
sigma_e	.00790649					
rho	.97193009	(fraction of variance due to u_i)				

Source: Author calculation

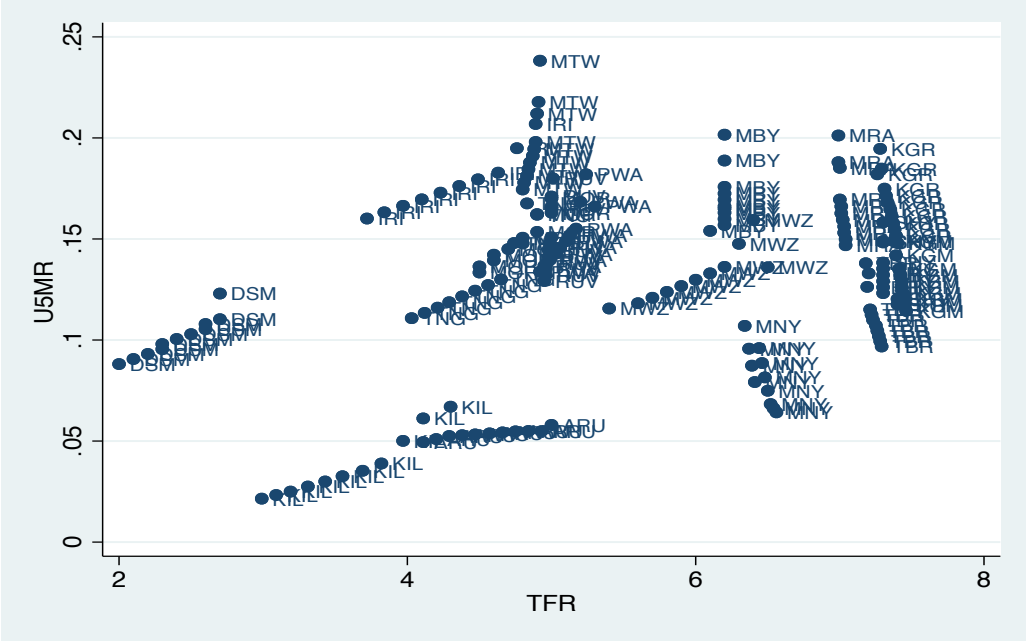
Appendix 8: Fertility trend across regions and its relationship with under-five mortality

Appendix 8-(a): Fertility rate trends across regions



Source: Author calculation

Appendix 8-(b): Fertility and U5MR relationship across regions



Source: Author calculation