Introduction and Overview

Following the proclamation of the Millennium Development Goals, the public perception of the miserable living conditions of the developing countries’ poor people increased considerably. More than a billion people declared to be poor cautioned society, political authorities and economic researchers to deal more intensively with the extreme harm of the poor. Poverty developed to one of the main topics of present economic policy debates. Recent World Economic Summits of Heiligendamm and Toyako dealt specifically with the economic development of Africa and Asia to reduce global poverty and with the political action necessary to provide food safety all over the world. Privately organized events like ‘Live 8’ or ‘Stand Against Poverty’ encouraged, globally, thousands of people to take action against poverty by jointly pressuring political leaders to increase financial aid. Public and private efforts aimed at implementing poverty alleviation policies to decrease the amount of people suffering under poor housing conditions, inadequate nutritional intake or insufficient education.

Implementing successful poverty alleviation policies requires essential targeting of poverty causing factors. Therefore policy makers are in need of (1) a concept of poverty and its classification, (2) a thorough understanding of the underlying mechanism that lead to poverty and (3) empirical methods to analyze (1) and (2). This dissertation claims to contribute to the latter by proposing and applying specific statistical methodologies to analyze the extent of poverty and its underlying factors based on recent household surveys in developing countries.

Empirical development economics

The measurement of poverty and the analysis of poverty-causing factors are largely based on the application of statistical methods. As in economics generally, research on poverty focusses particularly on issues, where empirical data is available, by formulating theoretical hypotheses – most often on causal relationships – which will then be tested by estimation. There is perhaps no other area of science, where the application of quantitative methods on statistical data to test theoretical assumptions is as prominent as in economics. The prevalent application of math-
mathematical statistics in empirical economics lead Ragnar Frisch and Joseph Schumpeter as early as the 1930’s to constitute the term *econometrics* and to establish the *Econometric society*. In the editorial of the first issue of *Econometrica* Frisch (1933) noted: “Experience has shown that each of those three viewpoints, that of statistics, economic theory, and mathematics, is a necessary, but not by itself a sufficient, condition for a real understanding of the quantitative relations in modern economic life. It is the *unification* of all three that is powerful. And it is this unification that constitutes econometrics.”

While much of early development economics was entirely theoretical (see e.g. Rosenstein-Rodan (1943); Leibenstein (1957); Sen (1973)), there has been a clear shift in the last two decades towards mainstream empirical, i.e. econometrical, economics (Ray, 2007). As Mookherjee (2005) notes: “Development economics is increasingly becoming an empirical discipline today.” This phenomenon can be ascribed to two main trends of recent decades. On the one hand, technical progress and the implementation of user friendly statistical software greatly facilitated the application of complex and computationally extensive statistical methods. More importantly, however, data availability expanded extensively. Since the beginning of the 1990s, household survey data, providing requisite information at the individual level, has become available for most developing countries. Application of miscellaneous methodologies has since enabled researchers to measure and compare the extent of poverty, to identify and quantify its driving factors or to evaluate competing poverty reduction strategies.

The present prominence of empirics has recently brought a discussion into development economics that has already had a longstanding tradition in mainstream economics. The discussion is about the actual value added of empirical research. There are basically two main concerns. (i) The econometric validity of empirical results is often, especially in the case of causal regression analysis, disputable. The key problem in regression analysis is to infer causality from simple correlation. Seven decades ago, Keynes (1939) already expressed his concern about the usefulness of causal inference based on regression analysis by commenting on the “slippery problem of passing from statistical description to inductive generalization in the case of simple correlation”. (ii) The first concern directly provokes the second. To circumvent possible econometric biases empirical papers focus nowadays on combating the econometric problems. Therefore, authors concentrate on specific phenomenon that may be analyzed, given the data, in a solid way. This comes at a cost: generalization of the often microscopic results is seldom reasonable.1

1For a recent debate on theory versus empirics in development economics see Mookherjee (2005) whose article is followed by comments from Bardhan (2005), Basu (2005), Banerjee (2005), and Kanbur (2005). For a general critique on the application of econometrics see Hendry (1980).
These concerns have clearly to be taken into account for further (development) economic research. There is, however, no doubt that much progress has already been made to circumvent some of the cumbersome problems of econometrics and that empirical findings have, in Ragnar Frisch’s sense, indeed provided notable contributions for a better understanding of the quantitative relations in modern economic life.

From a development economics perspective, empirical methods have proved to be particularly useful in poverty analysis. Research on poverty measurement facilitated the comprehension of the extent of poverty and its evolution over time and space. In a recent contribution, Ravallion et al. (2008) used regression analysis to revise the international “$1 a day” poverty line. Based on new empirical data, the authors propose an absolute international poverty line of $1.25. Empirical findings like these contribute to poverty reduction by enabling decision makers to target specifically those groups of the world population who are in particular need of poverty alleviation programmes.

Such as poverty measurement, causal poverty analysis may contribute significantly to poverty reduction by identifying driving factors of poverty. To circumvent the problem of endogeneity described above, recent contributions have focussed on the application of instrumental variables in regression analysis and the use of randomized controlled trials. Randomized controlled trails (RCT) involve the random allocation of different interventions (treatments or conditions) to subjects to create exogenous benchmark groups. If RCT are not available, econometric methods may help to create artificial experiments which may then serve as benchmarks. Using a RCT, Miguel and Kremer (2004) found that children going to schools, where de-worming medicine was distributed, came to school more regularly. In a similar paper Chattopadhyay and Duflo (2004) conclude that panchayats headed by a woman are performing significantly better, e.g. in the provisioning of water. Identified driving factors of poverty, like women as political leaders or de-worming of children, serve as starting point to deduce effective policy interventions.

The papers of Ravallion et al. (2008), Miguel and Kremer (2004) and Chattopadhyay and Duflo (2004) show two things: (i) the relevance of empirical development economics for effective poverty reduction policies and (ii) the impressive progress of empirical analysis since the times of Keynes (1939) or Hendry (1980).

The enormous potential of statistical analysis in poverty research has, however, still not been sufficiently exploited. Quite the contrary, the scope for analytical poverty research widens continuously: constant appearance of new compre-

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2In this case, the data was based on a RCT since de-worming medicine was distributed to children of randomly assigned schools in Western Kenya.

3Panchayats are local government bodies at the village level in India.
hensive data sets, such as the release of household panel data in more and more developing countries, broadens the area of application while rapid progress in natural science entails steady development of new methodologies.

This dissertation is a collection of three independent essays that deal with the application of econometric methods, based on household survey data, in the context of poverty research. All studies consider well-known statistical concepts that have yet not been applied to the research questions under consideration. By this means, the papers contribute to research in development economics in two ways. The application of recent methodologies allows gaining better insight and deriving new findings on the measurement of poverty and its underlying factors. Simultaneously, the application is conducive to narrow the gap between the comprehensive statistical toolbox and its still limited application in development economic research.

The first chapter deals with the concept of poverty comparisons when the well-being indicator, income, is observed over consecutive periods. The second chapter studies the determinants of spatial inequality in household income in Burkina Faso, by decomposing overall inequality in inequality within and between nested spatial levels. The third chapter analyzes the relation between a child’s nutritional status, derived from its stunting and wasting z-score, and its survival probability, to resolve the paradox of high mortality but low malnutrition rates in the Lake Victoria region of Kenya.

Three essays in empirical development economics

A concept for multiperiod poverty comparisons

Research on poverty measurement is closely connected to the seminal work of Sen (1976). Sen distinguishes between two fundamental issues: identifying the poor within the population by setting a poverty line and constructing a poverty index to measure the extent of deprivation. Based on an axiomatic approach Sen constructs a poverty measure capable of performing ordinal welfare comparisons.

Following Sen, research on poverty measurement evolved into two strands of literature: (i) the construction of poverty indices to measure poverty and (ii) the generation of poverty orderings to compare poverty. The first strand, poverty measurement, deals with the attempt to construct summary poverty indices that capture several concepts of poverty and satisfy various poverty axioms (see e.g. Foster et al. (1984); Atkinson (1987); Zheng (1997)). Beyond the poverty head count, to measure the fraction of people below the poverty line, the concepts include, among others, the poverty gap to capture the average extent of individual poverty and the squared poverty gap to measure the inequality among the poor. Among the numerous proposed poverty axioms, researchers agreed on a core set
of axioms each poverty measure should satisfy: focussed, continuous, monotonic and distribution sensitive.\(^4\)

The various proposed measures impose implicitly the need for the second strand of the literature. Any choice of poverty measure is arbitrary and may lead to different outcomes. The second strand, poverty orderings, approaches exactly this arbitrariness by proposing methodologies that yield rankings of poverty which are robust to alternative poverty measures. Another arbitrariness in poverty measurement results from the setting of the poverty line. Poverty line construction is usually based on minimum nutritional intake. Since there is no exact level of food intake requirements different reasonable poverty lines are supposable (Atkinson, 1983). The literature on poverty orderings examines the rankings of distributions of one or more indicators of well-being to yield poverty comparisons which are robust to a wide range of poverty measures and poverty lines (see e.g. Atkinson and Bourguignon (1982); Atkinson (1987); Foster and Shorrocks (1988a,b,c); Duclos et al. (2006b)).

**Essay 1** follows the second strand of literature by elaborating a concept for *multiperiod* poverty comparisons. Above the choice of a suitable poverty measure and poverty line, the paper deals with the question how poverty can be measured and compared when the indicator of well being is observed over several points in time. Specifically, **Essay 1** proposes a concept to compare an individual’s well-being over consecutive periods as well as to compare well-being of two different individuals observed at two concurrent periods. The proposed methodology allows for multiperiod poverty comparisons that are robust to any specific poverty index, to any arbitrary setting of the poverty line and to any aggregation procedures of individual incomes over time. The elaborated concept, which is, following Atkinson (1987) and Duclos et al. (2006b), based upon the stochastic dominance methodology, is illustrated by performing multiperiod poverty comparisons for Indonesia and Peru. Showing considerable dependence of poverty orderings on the aggregation procedures of income over time, the results emphasize the relevance of the approach.

**Econometric analysis of spatial inequality**

Causal poverty analysis, based on regression models, allows identifying driving factors of households’ living standards. A peculiar discussion has taken place in development economics about the importance of geographic factors in explaining observed spatial variation in household income (see e.g. Ravallion and Wodon (1999); Jalan and Ravallion (2002); De Vreyer et al. (2009); Grimm and Klasen...
INTRODUCTION

Several developing economies show areas that are persistently poor. Two divergent views exist in explaining why some regions perform better than other regions within the same country. Areas could be poor due to a spatial concentration of households with similar, poor, characteristics. According to this view, geographic endowments do not play a role in determining households’ income. On the other hand, geographic capital might be correlated with living standards of different regions. Differences in area-specific factors, like climate or altitude in terms of pure geographic factors, or infrastructure in terms of area endowments, may directly have a causal role in determining households’ welfare.

Using different regression techniques Ravallion and Wodon (1999), Jalan and Ravallion (2002) and Benson et al. (2005) analyze if differences in households’ living standards across spatial entities within a country are entirely accountable to a spatial segregation of people with similar endowments, or to geography per se. All studies conclude that it is not solely a spatial correlation of differences in mobile non-geographic characteristics that makes areas poor. Specific factors of a households area of residence matter by restraining households income growth and by altering returns to private endowments.

While all these studies suggest that poverty reduction efforts have to be targeted at the sub-national level, they do not provide a decomposition of the variance in living standards observed within and between nested spatial units. Consequently, the studies cannot weight the influence of the different spatial units on the variance in income levels. Essay 2 suggests a novel methodology to address this issue by building a multilevel random coefficient model able to decompose the variance in living standards across four spatial levels; households, communities, provinces and (agro-climatic) regions. Knowledge of the relevance of each spatial level for household income generation is particularly important from a political point of view: Since there may be constraints on the ability to target household characteristics, targeting spatial units effectively seems crucial.

Based on the proposed multilevel modeling approach, Essay 2 decomposes the sources of spatial disparities in incomes among households in Burkina Faso. The results show that spatial disparities are not only driven by the spatial concentration of households with particular endowments but to a large extent also by disparities in community endowments. Climatic differences across regions do also matter, but to a much smaller extent.

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For a discussion on the importance of geographic factors in a cross country setting see e.g. Acemoglu et al. (2001); Hall and Jones (1999); Gallup et al. (1998).
Empirical analysis of child mortality and undernutrition

**Essay 1** and **Essay 2** focus on monetary poverty, i.e. low levels of income and consumption, respectively. Households in developing countries also suffer from other dimensions of poverty. While poverty has initially been regarded as a monetary phenomenon, its multidimensionality is now widely accepted (Sen, 1987; Strauss and Thomas, 1998). Most of the concepts for the measurement and analysis of poverty have therefore been developed in a way that they are also applicable to non-monetary indicators of well-being, such as the health, nutritional or educational status of an individual (see e.g. Bourguignon and Chakravarty (2003); Duclos et al. (2006b). Deprivation in the multiple dimensions of poverty should hence be taken into account when measuring poverty, and the underlying mechanism that lead to observed outcomes should be analyzed to deduce effective poverty reduction policies.

Two of the still most challenging problems in the fight against poverty are the prevalent high rates of undernutrition and child mortality. One of the major causes of child mortality is thought to be undernutrition itself. Pelletier et al. (1995) claim that undernutrition is the underlying cause of more than 50% of all child deaths in the world. The close relationship between a child’s nutritional status and its survival probability is challenged when nutrition and mortality outcomes are analyzed in the Lake Victoria Region of Kenya. **Essay 3** shows that there is no other region in Sub-Saharan Africa where the pattern of low levels of malnutrition together with dramatically high rates of mortality is as pronounced as around Lake Victoria.

**Essay 3** investigates the role of cultural, geographic, and political factors on the relationship of anthropometric outcomes of children and Under-5 mortality rates in Kenya with an explicit focus on the unique situation of the territory around Lake Victoria. Based on linear and nonlinear multilevel regression analysis to control for unobserved household and community characteristics the driving factors of mortality, stunting, and wasting are analyzed jointly.

The findings point to a unique interplay of cultural, geographic and political factors in the Lake Victoria region which are responsible for causing the described paradox. The results do not only demonstrate the relevance of considering and understanding the country specific context when analyzing child health outcomes but also that the common practice to make inferences about health status based on anthropometric outcomes has to be done with strong caution and can easily lead to erroneous results.