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Caroline Dotter

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Erstgutachter: Professor Stephan Klasen, Ph.D.

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Abbreviations

ACP	African Caribbean Pacific countries
AROP	At–Risk–Of–Poverty
AVE	Ad Valorem Equivalent
BMI	Body Mass Index
CBN	Cost–of–Basic Needs
CPI	Consumer Price Index
DHS	Demographic and Health Survey
EBA	Everything But Arms
EPA	Economic Partnership Agreement
ECHP	European Community Household Panel
EU	European Union
FGT	Foster-Greer-Thorbecke
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
HDI	Human Development Index
HDR	Human Development Report
HDRO	Human Development Report Office
HPI	Human Poverty Index
IHDI	Inequality-adjusted Human Development Index
IPL	International Poverty Line
ITC	International Trade Centre
LDC	Least Developed Country
MacMap	Market Access Map
MDG	Millennium Development Goals
MFN	Most Favoured Nation
MICS	Multiple Indicator Cluster Survey
MP	Multidimensional Poverty
MPI	Multidimensional Poverty Index

NPL	National Poverty Line
OECD	Organisation for Economic Co-operation and Development
OPHI	Oxford Poverty and Human Development Initiative
PPP	Purchasing Power Parities
PVOP	Potential Value of Preferences
RoO	Rules of Origin
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
SDG	Sustainable Development Goals
TRAINS	Trade Analysis and Information System
WHO	World Health Organization
WHS	World Health Survey
WTO	World Trade Organization

Meiner Familie

Chapter 1

Introduction

This thesis consists of four essays in the broad spectrum of development economics. They are a critique of the World Bank's $1-a-day poverty line (1), a critique of UNDP's global MPI (2), a proposal of a relative multidimensional poverty index (3), and an analysis of trade costs faced by African exporters when importing into the EU. While the first three essays are in the sphere of poverty measurement, the fourth essay is on the topic of trade and development.

Poverty measurement In recent years, the issue of international poverty measurement gained in importance in public perception as poverty reduction was the first and probably most prominent indicator of the MDGs and now SDGs. Since 1990, the World Bank has produced international poverty estimates. Their poverty estimates provide easily communicable headline figures and allow public attention to be redirected to the important issue of global poverty. Notwithstanding the merits of this measure (particularly drawing attention of politicians and the lay public to this important topic), the World Bank's method of poverty estimation is quite problematic and potentially flawed.

The *first essay* in this thesis explains the World Bank's method, summarizes the main criticism in the literature and adds some additional insights into this rather problematic measure. Previous research has shown [cf. Klasen et al., 2015] that the estimation of the line is flawed. The literature has further criticised the use of PPPs and the CPI in the estimation and subsequent application (estimation of poverty) of the poverty line.

This essay adds to the existing critique, as it questions some of the fundamental assumptions about the line. The World Bank's $1-a-day poverty line claims to be representative of poverty lines in the poorest countries of the world. This essay shows, however, that the poverty line cannot fulfil this claim as poverty outcomes diverge significantly depending on the respective national or international poverty line applied. For example, we observe a divergence of nearly 49 percentage points for the case of Tanzania.

I also discuss the rather weak database used in the estimation of the line. In effect, the international poverty line is the simple average of 15 national poverty lines. These poverty lines are dated and some of them cannot be considered reliable. The sample contains strongly relative poverty lines for the extremely poor countries, Guinea-Bissau, Mali, and Niger; and for some countries the World Bank team has no information on the methodology employed to derive the line.

Summing up all the issues connected with this measure, I argue that the simple average of fifteen poverty lines of varying quality chosen through a statistically inaccurate estimation cannot represent a global standard of "extreme poverty". These issues gain in momentum as this poverty line has been adopted as the first SDG, and the World Bank recently published new (but not improved) global poverty counts exhibiting the identical issues as earlier poverty estimates. Given the prominence of the international poverty line and its importance for development policy, I argue that this poverty standard should be abandoned in favour of a more reliable and consistent measure.

The $1-a-day poverty measure drew international attention to monetary poverty outcomes. However, few would contest the fact that poverty is in and of itself a multidimensional phenomenon. This view has been shaped by nobel laureate Amartya K. Sen's work on the capability approach [cf. among others Sen, 1999*a*,*b*]. According to Sen, one should not simply focus on commodity outcomes to define poverty, but analyse the opportunities people have with a specific commodity bundle (so-called capabilities).
The first attempt at capturing these opportunity bundles and comparing them across countries was made with the introduction of the HDI in 1991. However, the HDI is an aggregate measure comparing the development of countries rather than the poverty outcomes of individuals. In 2010, the HDRO together with OPHI introduced the MPI as a household-level multidimensional poverty measure for over 100 developing countries.
The *second essay* provides a detailed discussion of the achievements and issues of this poverty measure. The conceptual critique in the literature is summed up and reviewed. One of the main points of critique and one of the methodological novelties of the MPI is the use of the dual cut-off approach [cf. Alkire and Foster, 2011*a*] to identify poor households. Previous measures of multidimensional poverty usually use some form of the union or intersection approach. The essay also discusses the neglect of inequality in the multidimensional poverty estimation and the potential relativity of deprivations in certain indicators.
Additionally, the essay provides a detailed empirical assessment the MPI, analyzes some open questions, and provides an alternative formulation. We discuss the choice of datasets employed to estimate multidimensional poverty in the various countries, possible dynamics in multidimensional poverty, and the choice of multidimensional poverty indicators and their cut-offs. Sensitivity tests for alternative formulations of the MPI with different indicators or cut-offs are also provided. In the final section the essay summarizes the revisions made to the MPI by the HDRO in the 2014 Human Development Report.

The *third essay* discusses relative versions of multidimensional poverty measures. The use of relative poverty lines is well-documented in monetary poverty measurement. Most multidimensional poverty measures are considered to be absolute measures (including the MPI) and apply identical thresholds across groups and time. This is in line with Sen's idea that "absolute deprivation in terms of a person's capabilities relates to relative deprivation in terms of commodities, income and resources" [Sen, 1983, p.153]. He argues that there is a place for measures of relative deprivation as long as we measure commodities, rather than capabilities or functionings. While we should aim to measure an absolute notion of poverty in the capability space, such as "being well-nourished" or "going without shame", this may well translate into a relative threshold in

the commodity space.
However, multidimensional poverty measures do not always capture functionings or capabilities directly. While it is relatively straightforward to measure functionings in the broad sphere of health, this is more difficult in the dimensions of living standards or education. To appropriately capture functionings in these dimensions, I argue indicator cut-offs need to be adapted across countries to account for a varying environment, culture, and outcomes in the rest of the society. I illustrate these theoretical considerations using the example of India. India poses an interesting example as we observe vast differences across states, urban and rural areas in the environment and culture. Moreover, poverty outcomes differ significantly. I broadly follow the construction of the global MPI and adapt indicator thresholds in the dimensions education and living standards. We compare poverty outcomes of these relative multidimensional poverty measures to the global MPI.

Trade Costs The *fourth essay* in this thesis estimates the costs faced by exporters from African countries when trading with the EU. Trade has been identified as an important instrument that can enable countries to lift themselves out of poverty. High trade costs may pose an obstacle to this development. Industrialised countries have therefore put several schemes in place to enable trade from poor and least developed countries. These trade preference schemes aim at reducing costs faced by exporters from these countries by offsetting or reducing duties. This forms an explicit exception to the principle of non-discriminatory or most-favoured-nation treatment, which generally does not allow discrimination between trading partners.
These preference schemes are explicitly designed as a development tool. However, their achievements have been ambiguous. Though most trade flows from eligible countries utilise the schemes [cf. Bureau et al., 2007, Candau and Jean, 2005, OECD, 2005], they have failed to generate new flows [Brenton and Ikezuki, 2004]. Thus, they do not fulfil their original purpose of creating new employment opportunities and growth [Collier and Venables, 2007].
This essay analyses the European Union's EBA preference scheme for African LDCs and assesses the cost structure faced by exporters from these countries. To benefit from this exporting scheme, exporters need to prove the origin of their product and comply with certain rules of origin (stating minimum process requirements). This process incurs a certain amount of paper work and may be costly. I examine the phenomenon of low utilisation rates for small trade flows. Using detailed data on imports into EU member states, the exporter's decision to use preferences facing country- and product-specific costs of compliance is explained. Moreover, I model the exporter's choice between using preferences and not using preferences.
Earlier papers approximate the compliance cost with the preference margin alone [cf. Carrere and De Melo, 2004, Francois et al., 2006, Manchin, 2006]. This can, however, only reflect the variable component of compliance costs. I introduce the *potential value of preferences* defined as the product of preference eligible exports and the preference margin (the difference between paying the full duty and the preference scheme duty) as a more appropriate concept to capture these compliance cost. This approach can account for the existence of non-negligible fixed costs. Ignoring these fixed costs would potentially upward bias the variable cost estimator. The effect ought to be stronger for our sample of least developed countries as smaller trade flows are observed from these countries.

Chapter 2

Can the World Bank's International Poverty Line reflect extreme poverty?

Abstract The World Bank's international poverty line has been a success in drawing the attention of policymakers and media to the issue of poverty. This paper summarises the main critique in the literature and adds some additional insights, pointing out the weak database for the estimation of the international poverty line. The author also shows how poverty outcomes at the country level diverge when the international and respective national poverty lines are applied. For poorer countries, we observe a significant over- as well as underestimation of poverty at similar levels of mean consumption. The international poverty line can therefore not fulfil its own claim of being representative of the poverty lines of poor countries. One also needs to question whether this poverty line can be considered as a measure of "extreme poverty" in the sense of the SDGs. Summarising all the issues in the estimation process of this measure, the author argues that the simple average of fifteen poverty lines of varying quality chosen through a statistically inaccurate estimation cannot represent a global standard of extreme poverty. These issues gain momentum as the World Bank recently published new (but not improved) global poverty counts exhibit the identical issues as earlier poverty estimations.

2.1 Introduction

The World Bank's international poverty line has been successful in drawing attention to global poverty and putting the issue on the global agenda. This measure was one of the main indicators of the MDGs and is now indicator number one of the new SDGs. The international poverty line produces a clear, easily communicable, headline figure that can be tracked over time. Due to its (allegedly) clear meaning, it appeals to politicians, the media, and the lay public alike.
When using this measure one should be aware of its limitations. Many users, however, are not

This chapter has benefitted from comments by seminar participants at an OPHI–University of Goettingen workshop. It would also like to thank Stephan Klasen, James Foster, Jose Manuel Roche, Isis Gaddis, and my colleagues at the chair for helpful comments.

familiar with its estimation process and the associated problems. This paper aims to summarise the main points of critique in the literature and tries to add some additional insights. I argue that the $1-a-day poverty line provides a rather crude estimation of global poverty and is a conceptually weak measure.

The main discussion in the literature has primarily focused on the use of Purchasing Power Parities (PPPs) in the estimation of global poverty. Problems in the estimation of the PPPs will be reflected in inaccurate poverty outcomes. There are, however, additional issues in the estimation of the global poverty line. Replicating the international poverty line, Klasen et al. [2015] show that the estimation is statistically inaccurate.

Furthermore, the dataset used to estimate the global poverty line is dated and many national poverty lines used in the estimation cannot be considered reliable. The sample contains strongly relative poverty lines for extremely poor countries, such as Mali and Niger, and for several poverty lines in the sample no information on the underlying methodology can be obtained. This is problematic, as the international poverty line is the average of only 15 countries and the value of single data points has a huge impact in such a small sample.

In this paper, I show that poverty outcomes at the country level differ, at levels of up to 49 percentage points, depending on the poverty line applied (the international or the respective national poverty line). For the case of Tanzania, we observe a poverty incidence of 84.57% when applying the international poverty line and a poverty headcount of 35.7% when applying the respective national poverty line for the year 2000/2001. For richer countries in the sample of Ravallion et al. [2009] the international poverty line could potentially be considered as a lower bound poverty line. However, for poorer countries (those with a mean private consumption expenditure per month below $200) we observe an over- as well as underestimation of poverty at similar levels of mean consumption when the international poverty line is applied (compared to actual poverty outcomes when the national poverty line is applied).

It is doubtful whether the international poverty line may be considered as the "extreme poverty line" in the sense of the SDGs for these poorer countries. While what "extreme poverty" should constitute is open to debate; I argue that the average of (unreliable) poverty lines of a group of countries chosen through a statistically flawed estimation cannot credibly reflect a global concept of extreme poverty. Given the prominence of the international poverty line and its importance for development policy, this poverty standard should be abandoned in favour of a more reliable and consistent measure.

In the next section I will briefly outline the history of the $1-a-day poverty line and how the World Bank arrives at this measure. In section 3, I summarise the main points of critique and add some additional insights. Section 4 shows the divergence between poverty outcomes when the international and national poverty lines are applied. Section 5 summarises and concludes.

2.2 Estimation of the $1-a-day poverty line

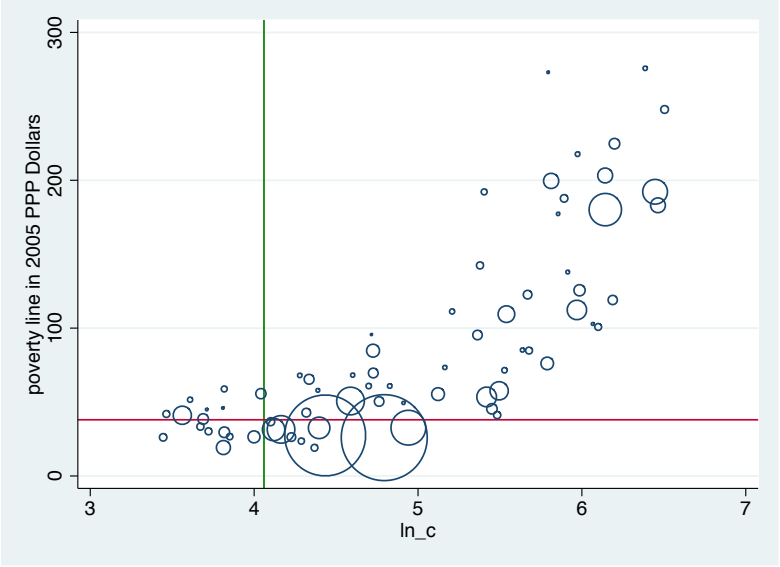
The World Bank's $1-a-day poverty line dates back to the 1990 World Development Report [World Bank, 1990]. This was the first time the World Bank provided global poverty estimates. The line has been updated several times[1] in the last twenty years as new data became available, but the underlying methodology largely stayed the same.

[1] Chen and Ravallion [2000], Ravallion and Chen [1996], Ravallion et al. [2009, 1991].

The international poverty line is determined in the following way: First, poverty lines for developing and low-income countries are collected and converted to international dollars using the latest PPP estimates[2]. In the second step the relationship between average consumption in a country (derived from national accounts) and the level of the poverty line is estimated.
Ravallion et al. [2009] argue that all poverty lines in the sample capture an absolute and a relative component of poverty. This is the reason why we observe higher poverty lines in better-off countries, even though these poverty lines are also deemed absolute. The poor in better-off countries often consume more expensive calories and may spend more on non-food items.
The authors argue that this absolute component of the poverty line can be identified when focusing solely on poverty lines unresponsive to changes in expenditures. This applies to poverty lines found in the poorest countries (as defined through private expenditure in the national accounts). Based on these 'absolute' national poverty lines, a poverty line "representative of the poverty lines found amongst poor countries" [Ravallion et al., 2008, p. 12] is determined. The methods applied to identify this group of extremely poor countries differed across poverty estimations.
In the first poverty estimation for the 1990 World Development Report, Ravallion, Datt and van de Walle (1991) collected poverty lines for 33 countries from both academic and official sources and used a poverty line shared by 6 poor countries (Indonesia, Bangladesh, Nepal, Kenya, Tanzania, Morocco) as the global poverty line. This line equated $1.01 per day at 1985 PPP prices. Chen and Ravallion (2001) updated this line as new PPP estimates (ICP 1993) became available and used the median line of the poorest 10 countries in the original dataset. They arrive at a line of $1.08 per day.
In 2009, Ravallion, Chen and Sangraula collected a new dataset for 74 countries and used newly available PPP estimates (ICP 2005) to convert the poverty lines into international dollars. The relationship between mean consumption levels and national poverty lines in their dataset is presented in Figure 2.1. There we can differentiate a relatively flat part and a part with a positive gradient. They estimated a threshold model to determine the group of countries with absolute poverty lines.
The threshold model identifies a group of 15 countries with national poverty lines unresponsive to changes in expenditure. These are the countries left to the green vertical line in Figure 2.1. To average out country-specific effects and idiosyncratic errors, the mean poverty line of these 15 countries is taken as the global absolute poverty line. Their international poverty line is set at $1.25 at 2005 PPP estimates (red horizontal line in Figure 2.1).
Very recently, the World Bank has provided new poverty estimates based on the 2011 PPP estimates. To ensure maximum comparability of the international poverty line over time, the World Bank team refrained from updating the whole dataset and re-estimating the relationship between PCE and national poverty lines. They have simply updated the poverty lines of the 15 poorest countries, identified in the previous poverty line estimation, using estimates from the 2011 ICP round. The updated international poverty line is identified as the rounded average of these 15 lines, $1.90 at 2011 PPP estimates [Ferreira et al., 2015].
With every new ICP round, we have thus witnessed the introduction of a new global poverty line and new global poverty estimates. While the frequent update of the poverty line may have created a certain amount of confusion as to whether one can still speak of the same poverty

[2]For the initial global poverty estimation, the authors used PPP estimates from the 1985 Penn World Tables [Summers and Heston, 1988]. Later estimations referred to the latest ICP rounds 1993 and 2005.

FIGURE 2.1: Relationship between consumption and national poverty lines



targets, the World Bank argues that one should not ignore newly available and arguably better data in the global poverty estimation.

2.3 Critique

2.3.1 General Issues

Briefly summing up the difficult task of global poverty comparisons, Ferreira et al. [2015, p.2] state that the global poverty measurement aims to compare the "standards of living of widely different peoples, consuming vastly different goods and services, all priced in different currencies". With the method currently applied, however, the World Bank only tackles the issue of prices. Even this issue is dealt with insufficiently.

A global poverty line has to compare the extremely different living situations of a Siberian Lumberjack with a Vietnamese street cook, or a Peruvian miner with a Jamaican fisherman. These vastly different humans have different calorific needs because of their very different constitution and their occupational choice. They consume very diverse diets due to local customs and supply. Finally, they face different food shares in expenditures: Due to a more adverse environment in Siberia and Peru, even the extremely poor need to spend a significantly higher share of their total expenditure on non-food items, such as shelter and heating.

The difficulty of such a global poverty comparison is obvious, yet the World Bank's international poverty line does not account for the vastly different living circumstances of the poor across the world. In contrast, an identical measure is applied across countries (insufficiently accounting for price differences). However, we do know that we already observe significant differences in diet, constitution, and food shares within small countries.

Take the example of the poverty line in Mozambique: Using the cost-of-basic-needs (CBN) approach different poverty lines have been identified for 13 different regions to account for differences within the country. 13 region-specific food bundles are identified that fulfil the same

calorific requirement of 2150 kcal per capita. Similarly, the weighted average of non-food consumption is also calculated separately for these 13 regions. The resulting food share in the poverty line varies between 63% for the capital Maputo city and 81% for the rural areas in the region Manica and Tete. The highest total poverty line is applied in Maputo city (19.515 Meticais per person per day). This line is more than three times the monetary value of the poverty line in rural Nampula (5.972 Meticais per person per day) [World Bank, 2008]. These poverty lines are considered absolute and are developed using the tried and tested CBN method, yet such dramatic differences are observed for a country with less than 20 million inhabitants (at the time of the survey, 2003).

In the sample used to estimate the $1-a-day line, the food share varies between a low 28% for Brazil and nearly 80% for countries such as Chad and Cambodia. Though caloric requirements for most poverty lines refer to the same WHO report [WHO, 1985], they vary dramatically across countries. We observe dietary requirements as low as 1950 kcal per person for urban Pakistan, and as high as 3000 kcal per adult equivalent for Uganda. The varying requirements are due to a different demographic composition across countries and different occupational choices. Nevertheless, these differences across countries are ignored once the international poverty line is estimated.

Moreover, the global poverty line is a per capita measure and cannot account for a varying demographic composition across countries. This not only affects the expected food intake (as discussed above), but non-food consumption is also affected by economies of scale. In effect, this approach may overstate poverty in countries with large households and with a younger population relative to regions with smaller households and fewer children (e.g. China).

2.3.2 Problematic use of PPPs

The main line of critique in the literature and a problem already realized by Ravallion et al. [1991, p.347] is the use of the Purchasing Power Parities (PPP) to convert national poverty lines and income levels. When estimating PPPs, one needs to make several decisions about which assumptions to follow. All of these assumptions may be reflected in the poverty outcomes.[3]

In estimating the global poverty line and converting this line into local currency units, the World Bank relies on PPP estimates from the International Comparison Program (ICP). First, they convert national poverty lines and national account estimates into international dollars to estimate the global poverty line. This global poverty line must then be converted into local currency units and deflated using local CPIs before it can be applied at national household surveys. Recent ICP rounds prompted huge changes in the global poverty line and to an extent in global poverty outcomes. This is certainly one reason why the use of PPPs has been vocally criticised.

There are several issues associated with using PPPs in poverty analysis. While this section does not aim to provide a full account, I will discuss some of the most urgent problems in turn.

PPPs insufficiently reflect prices faced by the poor The ICP relies on local national account estimates to identify appropriate expenditure weights in the estimation of the price index. The quality of the national accounts data for many low-income countries remains very weak

[3]For a detailed discussion refer to Deaton and Heston [2010] and Ravallion [2010] reply to their paper.

however, and it is questionable how much can be inferred from them. More importantly, when using these weights one only compares *mean* consumption. Hence, these weights do not necessarily reflect the consumption patterns of the poor.[4] An alternative would be to calculate PPP conversion factors based on the actual consumption patterns of the poor. These so-called PPPP (Purchasing Power Parities for the Poor) would be more appropriate for estimating poverty.
Ravallion et al. [2008] addressed this problem and used the food component of aggregate consumption PPPs, a strategy also suggested by Reddy and Pogge [2010]. On re-estimating the absolute poverty line, they arrive at a lower absolute (food) poverty line of $0.73 per day ($22.74 per month). However, setting the weight of consumption of non-food goods to zero is quite problematic in and of itself, as even the poorest have undeniable non-food needs. The mean food share for national poverty lines in the sample is 0.564, with the mean share for the 20 poorest countries still being 0.653 [Ravallion et al., 2008].
On a global scale, the food share across countries varies a lot. In the very restricted sample of 74 countries[5] we already observe the food share varying between a low 28% for Brazil and nearly 80% for countries such as Chad and Cambodia. Thus, using food-PPPs, and essentially ignoring non-food needs, may strongly bias (potentially underestimate) the global poverty line.
A more appropriate method would be to re-weight prices according to actual consumption patterns of the poor. Deaton and Dupriez [2011] have pursued this approach and estimated global poverty weighted PPPs using household surveys from 62 developing countries. They find that PPPs for the poor are very similar to ordinary PPPs for their sample of 62 countries. Existing differences are mostly due to data inconsistencies between household surveys and national accounts, rather than from a misled weighting procedure.

Practical difficulties in estimating price data Moreover, one needs to be aware of practical difficulties comparing price data. In the 2005 ICP round considerable effort has been devoted to ensuring the comparability of goods. In earlier PPP rounds, the so-called quality bias[6] may have underestimated PPPs in poor countries (Ravallion, 2010). This however comes at the price that the surveyed goods may be less representative for the local people, and thus may be less meaningful for comparing consumption bundles of the poor.[7]
This problem has been somewhat attenuated in the most recent ICP round. In this round, regional lists of representative goods were first collected and then summarised on a global list. The goods compared in this ICP round may therefore be arguably more representative of local consumption patterns [Deaton and Aten, 2014].
Furthermore, the way "comparison-resistant" items were priced may also have a significant effect on comparing poverty lines. Goods and services for which it is difficult to observe market prices are referred to as "comparison-resistant". This includes housing rents, government services, as well as health and education expenditures. Especially the way housing rents influence PPPs is problematic. For the African and Asian regions, the 2005 ICP had to fall back on imputation. However, for several countries these imputed expenditures have been incredibly low. Deaton (2010) re-estimated PPPs assuming that the expenditure share of rents was identical across

[4] This should pose less of a problem in very poor countries, where the mean consumer may be poor.
[5] the food share is only available for 55 countries.
[6] The fact that brain surgery in Cameroon may be of lower quality than brain surgery in Hong Kong.
[7] This has been nicely summed up by Deaton and Heston (2010),"[PPPs] may be more accurate as an estimate of the relative costs of a Hong Kong businessman posted to Cameroon than as an estimate of the relative costs of living in the two countries."

countries. This raises the PPP in Africa and Asia and reduces the global poverty count by more than 100 million people. While it may be problematic to attach an identical weight to housing across countries[8], Deaton's exercises shows how important it is to have an appropriate method to identify prices for comparison-resistant items.
In the 2011 ICP, great emphasis was put on obtaining rental data. However, in economies without housing markets it is difficult to provide consistent data. For that reason, for the Asia and Pacific region the ICP imputed housing prices in the same way it did in 2005. For Africa and some other regions with scant housing data[9] they followed the strategy proposed by Deaton [2010] and assumed the same relative price of dwelling across countries [World Bank, 2015]. Although increased efforts were undertaken to appropriately price these comparison-resistant items in the new ICP round, the result is still far from ideal and potentially affects global poverty outcomes. While there are valid arguments for and against each of these choices in estimating PPPs, they undoubtedly have a significant effect on poverty outcomes.

Price differences within countries The PPP estimate price indexes for the different countries. However, we also observe significant price differences *within* countries. Especially in poorer countries markets are usually not well integrated and transaction costs are high. National poverty assessments take this into account and adjust poverty lines using regional price indexes. In global poverty assessments this is largely ignored.
The most recent poverty estimation tries to account for rural-urban price variation in Indonesia, India, and China [Ferreira et al., 2015]. However, for all other countries price differences across regions are ignored and even for Indonesia, India, and China a simple differentiation between urban and rural may not be sufficient, as prices vary across regions [Reddy and Lahoti, 2015].

CPI issues Once the global poverty line is estimated and converted to local currency units using PPPs, it is deflated using local CPIs and then applied to national household surveys in order to estimate poverty. The World Bank does this backward estimation of poverty outcomes for all available years (at least until the 1990s). This approach is questionable for two reasons:
First, as noted by Reddy and Lahoti [2015], while the PPP is representative of relative prices of the world economy in the base year, this is not the case for earlier years. Relative prices within countries and the weight of countries in the world economy change and so do their respective PPPs. This is exactly the reason why we need repeated rounds of PPP estimations and are unable to simply extrapolate them. While we usually also observe methodological improvements in more recent rounds, it is unclear as to whether these improvements should in any way "outweigh" the observed changes in the world economy.
Secondly, the quality of local CPIs in non-OECD countries is often poor. They may be subject to political meddling, they are sometimes restricted to urban areas, and weights of the different items may be outdated [Deaton and Aten, 2014]. This may be one reason why the World Bank uses different deflators other than the CPI for some countries (Bangladesh, Cambodia, Lao, Iraq, Malawi, Tajikistan). However, their justification is somewhat weak and it is unclear why exactly these countries are chosen while the official CPI is used for others.
These problems are aggravated the older the national dataset used for estimating poverty is.

[8] Among other determinants, the climate will undoubtedly affect relative housing prices.
[9] Latin America, Carribean, West Asia

First, the PPPs for the year 2011 are certainly less representative of the world economy in 1990 than say 2008. Moreover, the quality of local CPIs has been improved in recent years. Older CPIs in non-OECD countries are in general less trustworthy. Hence, the World Bank's backward calculation of poverty outcomes is questionable and older poverty outcomes are simply less trustworthy.

2.3.3 Estimation issues

As briefly explained above (section 2.2), a threshold model is used to estimate the relationship between household consumption levels and the national poverty line. Applying this model, Ravallion et al. [2009] arrive at the reference group of 15 countries with "purely absolute" poverty lines.

Replicating the specification by Ravallion et al. [2009], Klasen et al. [2015] show that this estimation is inaccurate and that the claim of a simple linear relationship between consumption and the poverty line cannot be rejected. Thus, they find no evidence of a group of countries with absolute poverty lines. They go on to show that with a log-log specification there is indeed evidence of a kink in the relationship, however this would return a larger group of reference countries (19) and a slightly lower global poverty line of $1.21 in 2005 PPP prices. Thus, the underlying estimation of the global poverty line is flawed.

Additionally, one needs to carefully discuss how to arrive at a poverty line that is representative of a group of countries (once a group of countries with poverty lines unresponsive to changes in consumption levels is identified). Without providing further justification, Ravallion et al. [2009] chose to take the simple average of these poverty lines. In fact, it is unclear as to whether a simple average is even appropriate here. For countries where the poverty line is identified at the subnational level (i.e. rural and urban poverty line or state-level poverty lines) a representative national poverty line is usually attained by taking the population-weighted average. This is also the strategy pursued by Ravallion et al. [2009] to arrive at national poverty lines for their dataset. Why they choose a simple average for the global poverty line, but a population-weighted average for national poverty lines remains unclear.

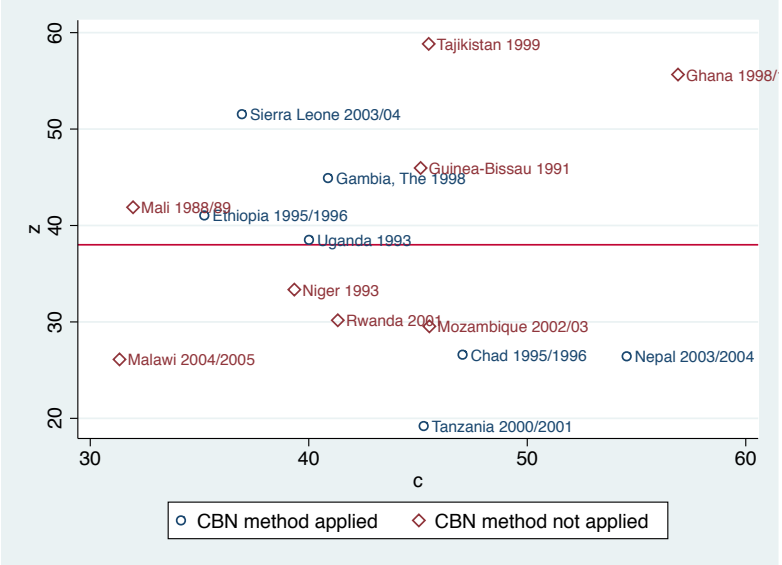
Deaton [2010] alternatively suggests weighing poverty lines by the number of poor people in each country and using all countries in the sample. This would certainly ensure that the result is a truly global poverty line, rather than an average of only 15 countries. One could also argue to weigh the poverty lines in a way that reflects their reliability and the methods used. This brings us to another point worth considering, the weak data base of the $1-a-day poverty line.

2.3.4 Weak data base

The new and the old global poverty lines are attained by averaging the national poverty lines of 15 countries in the sample of 74 countries. The overall sample is quite diverse. Poverty lines are as old as the one from Nigeria 1985/86, though the majority of poverty lines is from the 1990s. While the majority of the lines is developed using (some form of) the cost-of-basic needs approach, 12 % of the sample consists of relative poverty lines and for 14 of the poverty lines the

World Bank team has no information on the methodology used to arrive at these poverty lines [10]. This usually means that an official poverty line is used instead of one that has been determined together with the World Bank or the IMF. In some countries, these official poverty lines may be outdated or have been determined using disputable methods. Moreover, for 9 countries in the sample, the urban poverty lines are used. This is problematic, as urban poverty lines are usually higher than the comparable national poverty lines.

FIGURE 2.2: Age and methods of poverty lines of the 15 poorest countries



Unfortunately, the sample of the 15 countries used in the estimation of the international poverty line is not qualitatively superior to the remainder of the dataset. The cost of basic needs method has only been applied in estimating seven of these fifteen poverty lines (cf. Figure 2.2). Three of these poverty lines are strongly relative lines: For Guinea-Bissau a poverty line has been set at 2/3 of mean expenditure [World Bank, 1994]; for Niger, the rural poverty line equals mean rural income, while the urban poverty line equals 77% of average urban income [World Bank, 1996]; and in the case of Mali, the poorest 40% of the population (yearly per capita expenditure) are considered poor [World Bank, 1993].

Relative poverty lines in these very poor countries are usually lower than respective absolute poverty lines would be. They cannot truly reflect actual poverty levels and are not anchored to a specific subsistence level. For Mali, this actually was the motivation behind choosing a relative poverty line for the national poverty assessment, as setting an absolute poverty line in such a poor country "would not be very meaningful from an operational perspective" [World Bank, 1993, p.9] because it would return very high poverty outcomes.

For three of these poverty lines, Malawi, Mozambique, and Tajikistan, the World Bank team has no information on the method used to determine the line. Checking the respective country reports, however, I find that in Malawi and Mozambique the cost-of-basic needs method has been applied. Only in the case of Tajikistan is there no further information on the method used

[10] They have no information according to the data appendix in Ravallion et al. [2008]. Checking the country reports, I can, however, assert that for three of these poverty lines (Bulgaria, Malawi, Mozambique) the CBN has been used.

to derive the poverty line provided. The poverty line used is the official poverty line provided by the state statistical agency.

The age of the poverty lines is quite mixed. Nine of these poverty lines are older than 15 years (cf. Figure 2.2). The problem with very old poverty lines in the sample is, that the food and non-food consumption patterns they aim to represent are rather outdated. Hence, they are less representative of consumption patterns of the poor *today* and will therefore perform worse in capturing poverty at present. The World Bank did not update the dataset to contain current poverty lines in its most recent poverty estimation. The old and the new global poverty lines may, therefore, do a fair job in capturing global poverty in the past[11], but it is questionable if this poverty line can reflect poverty to date.

These country-specific issues are aggravated as the total data set is not very large. Only 15 countries are used to estimate the global poverty line and it is questionable as to whether idiosyncratic errors can be averaged out. With such a small data set, each single data point has a huge impact.

2.3.5 Summary

Apart from the general problems in measuring global poverty (cf. section 2.3.1), the $1-a-day poverty line has some issues particular to the decisions made in the estimation. While one can question the general approach the World Bank takes in developing a global poverty line, some of the decisions they take in the estimation process could certainly be improved upon and need to be criticised carefully. These decisions may have a potentially huge impact on global poverty outcomes.

The use of PPPs to convert the international poverty line to local currency units entails a slew of changes every time theses PPPs are updated. The choices made in estimating PPPs are open to discussion and have a significant effect on global poverty outcomes. It is also questionable if PPPs are appropriate for converting poverty lines at all, as they do not aim to capture the consumption patterns of the poor population but reflect mean consumption. Moreover, price differences *within* countries are ignored.

Finally, the World Bank deflates the international poverty line using local CPIs to apply the international poverty line to a national surveys. However, the quality of the CPI in non-OECD countries is often poor and the resulting outcome needs to be scrutinised.

Additionally, Klasen et al. [2015] show that the estimation of the global poverty line is incorrect. The group of reference countries the World Bank uses is therefore faulty. A different group of reference countries returns a new poverty line and global poverty outcomes. I argue moreover that the data base used for estimating the global poverty line is weak and that some of the national poverty lines used in the estimation are very old and/or unreliable. If one chooses the strategy of averaging poverty lines, the underlying data points should at least be reliable and representative.

[11] If we ignore all the other issues I discussed above.

2.4 Poverty levels when the international and national poverty lines are applied

In addition to the problems discussed in the previous section, I show that the global poverty line cannot fulfil its claim to measure poverty '[by] the standards of what poverty means in the poorest countries" [Ravallion et al., 2008, p. 23]. I assess whether this claim holds by comparing poverty levels in a set of countries when the $1-a-day poverty line and respective national poverty lines are applied.

As explained above (cf. section 2.2), the $1-a-day poverty line is the average of poverty lines from the 15 poorest countries in the dataset. Thus, national poverty lines are used as original data points and are averaged in order to reduce measurement errors and idiosyncratic differences in the data and methods used. The underlying assumption is that the national poverty lines correctly capture the absolute poverty incidence at the country level and that the $1-a-day poverty line is supposed to measure poverty "by the standards of the world's poorest countries" [Ferreira et al., 2015, p.30].

In the following analysis I will assess whether this claim holds by comparing poverty outcomes when the international poverty line and respective national poverty lines are applied. I will do so for the "old" international poverty line estimated by Ravallion et al. [2009] and will compare this to the poverty outcomes when the new global poverty line of $1.90 is applied.

2.4.1 Comparing poverty outcomes when the international poverty line is applied

Figure 2.3 shows the percentage point difference in the poverty headcount when the global and national poverty lines are applied. We observe that for richer countries the international poverty line appears to understate the number of the poor (compared to poverty outcomes when the national line is applied). This finding could be expected, as the international poverty line aims to be representative of poverty lines in poorer countries.

However, for countries with a mean consumption below $200 per month, one cannot identify an obvious trend. For a similar mean consumption level we observe significant over- as well as underestimations of poverty. The divergence in the poverty headcount for these poorer countries is large. Following the line of argument of the World Bank that the international poverty line is representative of poverty lines in the poorest countries [cf. Ferreira et al., 2015, Ravallion et al., 2009], we would expect similar levels of national poverty at the same mean consumption levels. Analysing the difference in the poverty headcount for the 15 poorest countries (these are the countries with poverty lines used to derive the international poverty line), we even observe a significant divergence in the poverty headcount for countries with nearly identical mean consumption levels (cf. figure 2.4). For the case of Tajikistan, with a mean consumption of $45.49 we observe a poverty headcount of 49.4% if the international poverty line is applied. However, the World Bank's national poverty assessment report finds a poverty headcount of 82.6% for the same year (1999).

In contrast, for Tanzania with a mean consumption of $45.26 we observe a poverty headcount of 84.57% when applying the international poverty line and a poverty headcount of 35.7% when applying the respective national poverty line for the year 2000/2001. Thus, the $1-a-day poverty

FIGURE 2.3: Divergence in poverty headcount for whole sample

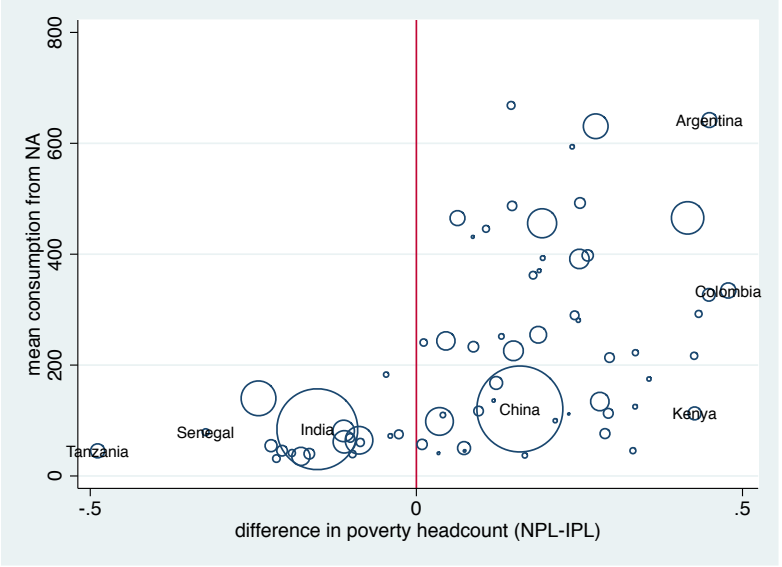
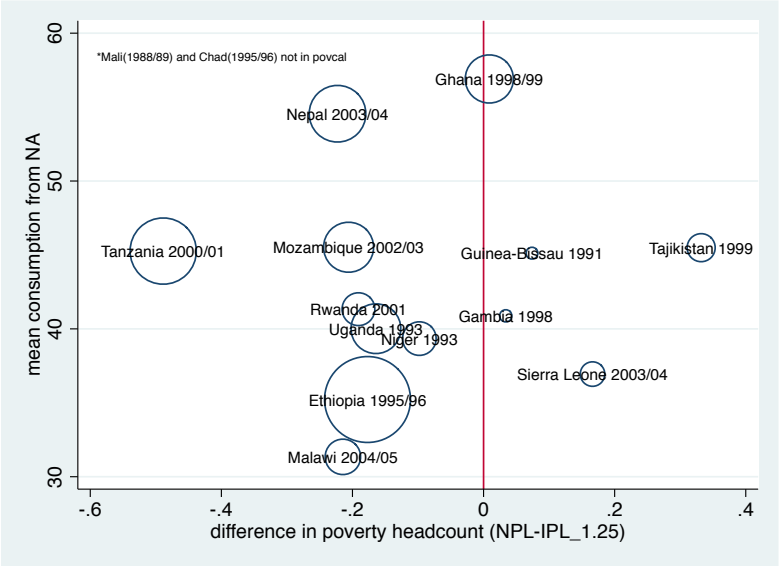


FIGURE 2.4: Divergence in the poverty headcount for the 15 poorest countries when the $1.25 poverty line is applied

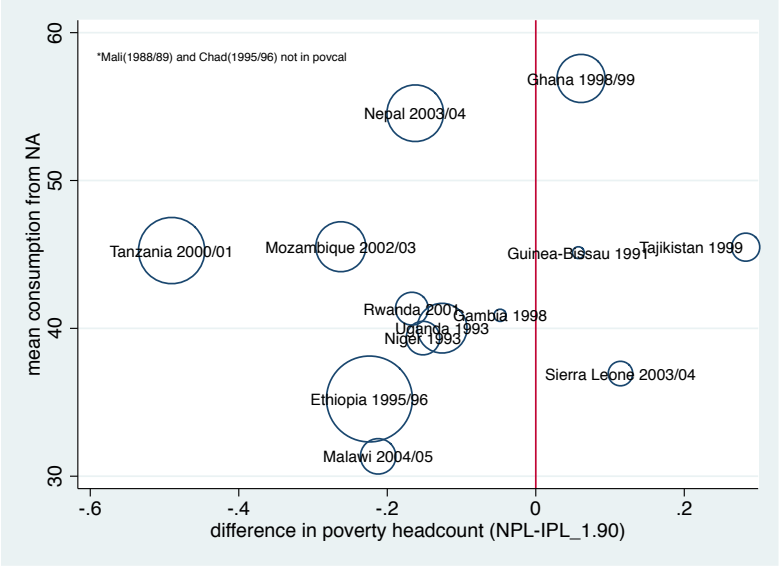


line understates poverty levels by 32.7 percentage points for Tajikistan, while for Tanzania the $1-a-day poverty overstates poverty levels by 49 percentage points.

We observe a similar pattern when the new international poverty line of $1.90 is applied (ref. Figure 2.5). The World Bank used the same 15 countries as in the earlier round of poverty estimations to identify a global poverty line and claims that this global line is representative of poverty lines in these poorest countries. Although the global poverty line finds a higher poverty incidence in Tajikistan (54.32%), the divergence in poverty outcomes for these two cases is still significant. For Tajikistan the global poverty line understates poverty by 28.28 percentage points, while for Tanzania poverty is now overstated by 49.04 percentage points.

We observe a similar over- as well as underestimation of poverty levels when the new global

FIGURE 2.5: Divergence in the poverty headcount for the 15 poorest countries when the $1.90 poverty line is applied



poverty line is applied for all countries but Gambia. While there is an underestimation of national poverty in Gambia when the $1.25-a-day line is applied (poverty headcount at 65.61%), we observe an overestimation of national poverty when the $1.90-a-day line is applied (poverty headcount at 73.80%).

Poverty gap A similar picture is painted when we analyse the difference in the poverty gap instead of the poverty incidence.[12] The poverty gap can reflect the intensity of poverty as it measures the average depths of poverty in the population. Though the poverty gap is not available for all countries, we observe similar trends for poverty outcomes when the international and the national poverty lines are applied respectively. If the international poverty line underestimates (overstates) poverty incidence in a specific country, it also underestimates (overstates) the average poverty depths in this country. Not only are less (more) people in poverty, but they are on average closer (further away) to the poverty line.

The only exceptions in the dataset are China and Gambia where an underestimation in the poverty incidence is accompanied by an overestimation in the poverty gap. In these countries, a share of the population is located very close to the global poverty line and thus the *average* poverty depths is lower when the global poverty line is applied.

Disaggregation by region Disaggregating the difference in the poverty headcount by region[13], one can observe that the international poverty line generally returns higher poverty levels in Asia than the national poverty lines. Moreover, applying the international poverty line "understates" national poverty levels in all other regions but Africa irrespective of mean

[12]The difference in the poverty gap is only available for 45 of the countries in the sample.

[13]The regional grouping follows the World Bank's country and lending group classification (http://data.worldbank.org/about/country-and-lending-groups). The regions South and East Asia are combined into the grouping "Asia".

FIGURE 2.6: Divergence in the poverty gap

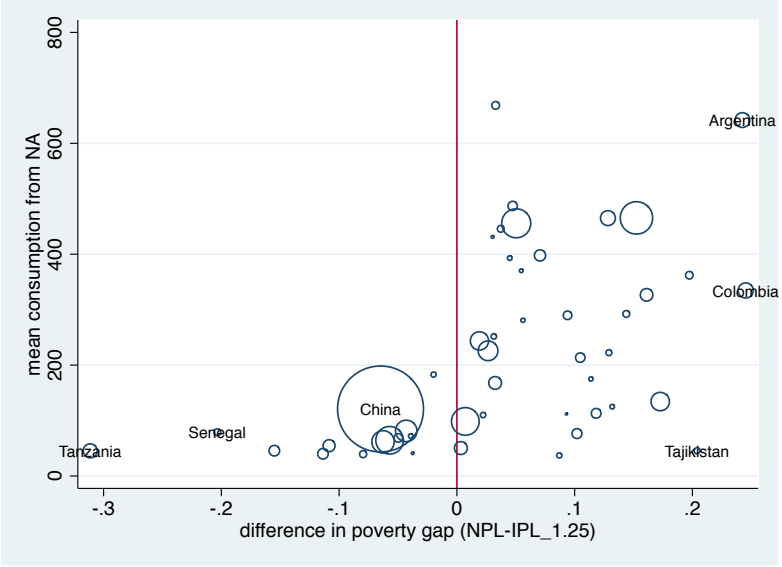
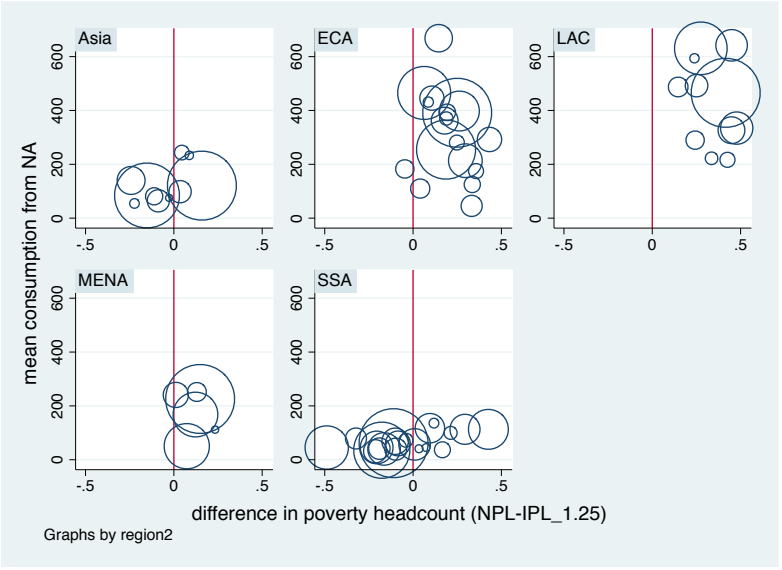


FIGURE 2.7: Divergence in poverty headcount by region



consumption levels in these countries. Only for African countries no general trend for over- or understating poverty levels is apparent (cf. figure 2.7). Nevertheless, the divergence in poverty outcomes for African countries is notable. Thus the international poverty line appears to be a "poverty line representative of the ones found in [African countries]", rather than one representative of poverty lines found in poor countries in general.

2.4.2 Comparing poverty outcomes when the weakly relative poverty line is applied

Ravallion and Chen [2011] further developed the concept of a global relative poverty line, originally introduced by Atkinson and Bourguignon [2001]. The weakly relative poverty line relaxes the assumptions of strong relative poverty lines which are typically anchored to the mean or

median income.

They argue that it is implausible that poverty levels are not affected by distribution neutral growth, which is the case when strongly relative poverty lines are applied. In their opinion, neither welfarist, nor capabilities-based arguments are fully convincing justifications for strongly relative poverty lines. The welfarist approach attaches an implausibly high weight on the relative position, and the non–welfarist, capability–based, justification would assume the cost of social inclusion approaches zero in the limit as a person becomes very poor.

Data on poverty lines from 74 developing countries support their argument: National poverty lines for these countries are increasing with mean income, but the economic gradient is less than unity. Thus relativity in poverty lines is observed, though the dataset mostly contains poverty lines that are considered absolute. Only 12% of the poverty lines in the sample are strongly relative.

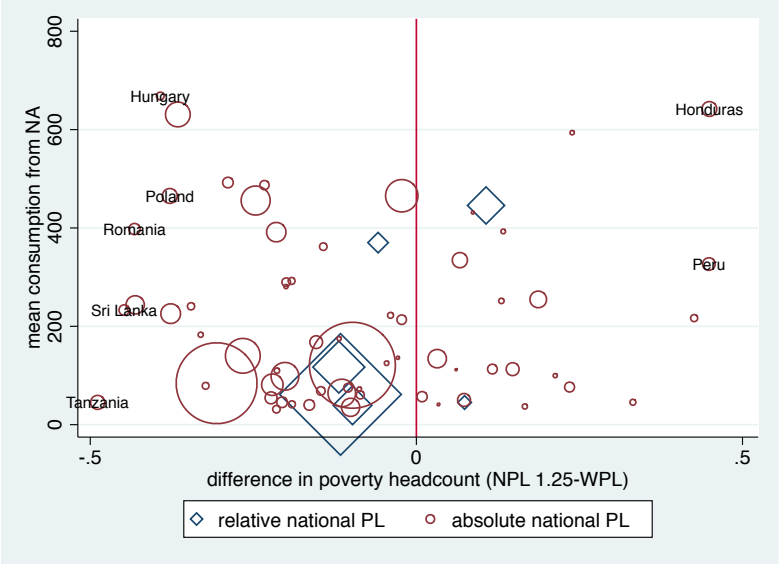
Using data on poverty lines from 74 developing countries (rather than using only the 15 poorest countries, as for the $1-a-day measure), they estimate a global weakly relative poverty line of the form:

$$\begin{aligned} Z_i &\equiv max(Z^*, \alpha + k \times M_i) \\ Z_i &\equiv max(\$1.25, \$0.60 + \frac{M_i}{3}) \end{aligned} \tag{2.1}$$

, where Z_i is the national poverty line in country i and M_i equals the mean consumption level in country i derived from national accounts. The $1-a-day line constitutes the lower bound of their weakly relative poverty line to ensure physical survival, and the poverty line increases by a third with a one unit increase in mean income.

Applying this weakly relative poverty line, we find that poverty levels diverge up to 50 percentage

FIGURE 2.8: Divergence in poverty headcount when the weakly relative poverty line is applied



points depending on the poverty line applied. In contrast to the $1-a-day poverty line, we do not observe a general trend for richer countries. We observe a similar over- as well as underestimation of poverty outcomes for rich *and* poor countries. The divergence in poverty outcomes (captured by the variance in the sample) actually increases when the weakly relative poverty line is applied

as opposed to the absolute $1-a-day line. However, for countries where national poverty lines are considered relative the variance is relatively small (cf. figure 2.8).

2.4.3 Irrelevance of the international poverty line?

To sum up, poverty levels differ significantly depending on what poverty line (national, international, or weakly relative) is applied. Differences in the poverty headcount are up to 49 percentage points (Tanzania). In general, the global poverty line understates poverty in better-off countries. For poorer countries (mean consumption below 200$) we observe a similar over- as well as underestimation of poverty. A regional disaggregation also shows that the international poverty line overstates poverty in Asia and understates poverty in European, Latin American, and MENA countries. Only for African countries no general trend is observable.

Applying the global weakly relative poverty line, the divergence in poverty outcomes even increases. We now observe a similar over- as well as underestimation of poverty for poor and rich countries alike. However, the weakly relative poverty line reflects national (strongly) relative poverty lines better.

Thus, it must be questioned whether the claim that the international poverty line is a "poverty line representative of the ones found in poor countries" (Ravallion, Chen, and Sangraula, 2008, p. 12) can be upheld. Poverty outcomes at the country level differ significantly even for the countries deemed to be the 15 poorest countries in the dataset. The international poverty line thus cannot accurately represent national poverty lines of poor countries.

While there are good reasons to apply a comparable poverty line across countries, some of the country-level outcomes (especially for the 15 poorest countries in the sample) are simply not credible and may not be accepted at the country-level. Hence, the international poverty line is irrelevant for national poverty assessments. This poverty line cannot even be accepted as a lower bound poverty line or as a measure of extreme poverty in the poorest countries. Even though the $1-a-day measure is not intended as a measure to be used for national poverty assessments, the reliability of a measure that gives inconclusive results at the country level must be questioned.

2.5 Conclusion

In this paper, I summarised some of the fundamental problems with the global poverty estimation and analysed how this line performs at the national level. The international poverty line is the average of poverty lines from 15 poor countries. Several issues accrue in the estimation process of this line and in arriving at the global poverty count. First the use of PPPs and local CPIs to convert national poverty lines into international dollars is problematic, as issues with these will be reflected through an inaccurate conversion of poverty lines. The estimation of PPPs is discussed controversially and local CPIs (though discussed much less prominently) are of varying quality. Incorrect CPIs and/or PPPs affect the poverty estimation in two ways: First, national poverty lines are converted to international dollars to estimate the international poverty line. In a second step, this poverty line is then converted back into local currency units to apply the line to national household surveys.

Moreover, Klasen et al. [2015] showed that the original World Bank estimation of the international poverty line is inaccurate and statistically flawed. Additionally, the database used to

estimate the global poverty line is dated and not all data points can be considered reliable.
While one may disagree with the general approach of the World Bank to attain a global poverty line; this approach could certainly be improved upon if one uses appropriate methods and data. The extent these decisions have on global poverty outcomes are unfortunately unknown and will interact with each other. Taking the prominence of the global poverty counts and the importance they have for development policy into account, these issues can, however, not be ignored.
More generally, the World Bank's approach ignores several other important issues in setting a comparable poverty line across countries. Among many other relevant factors, a poverty line should reflect the demographic composition of a country, the environment, and culture. Setting a comparable and consistent poverty line across a large group of countries is certainly no piece of cake, but possible as [Reddy and Pogge, 2010] and [Klasen, 2013] discuss.
In this paper, I also show that poverty outcomes differ significantly when the international and respective national poverty lines are applied at the country level. The divergence in the head-count ratio goes up to 49 percentage points depending on the poverty line applied. While for richer developing countries the international poverty line understates national poverty levels (as could be expected), for poorer countries no general trend is observable. We observe a similar over- as well as underestimation of poverty levels for similar mean consumption levels.
Thus, the international poverty line cannot fulfil its own claim of being representative of poor countries' poverty lines. It does not hold much meaning at a national level and cannot even be considered as a meaningful lower bound for national poverty assessment in these countries. Certainly, this line cannot be considered as a concept of "extreme poverty" in the sense of the SDGs for these countries.
This is due to a combination of several issues; not least but probably most importantly, because a very low standard is applied in the collection of data and estimation of the international poverty line. In essence, the international poverty line is the simple average of national poverty lines of only fifteen countries. The choice of these countries is statistically inaccurate and national poverty lines are of varying qualities. This is not only incomprehensible, given the intellectual and potentially monetary resources available to estimate such a line, but is also unjustifiable, given the importance this line has in the realm of development policy (being one of the MDGs and now SDGs).
Notwithstanding, the success this line had in drawing attention to global poverty, this poverty line is conceptually weak. For a global poverty measure that potentially affects billions, one should apply even stricter standards than for national poverty measures. This is certainly not the case with the current approach. It is therefore high time to abandon this poverty line and develop a new consistent and reliable global poverty line.

Chapter 3

The Multidimensional Poverty Index: Achievements, Conceptual and Empirical Issues

Abstract The Multidimensional Poverty Index (MPI) has been an important contribution to the debate on national and international poverty measurement. With the creation of the global MPI, OHPI and UNDP have provided a household-level multidimensional poverty measure for over 100 developing countries that can usefully complement the widely used $1.25 a day income poverty indicator. Given its link to the concept of human development, it is an important element of the suite of human development indicators maintained and published by UNDP. Nonetheless, there are many open empirical questions and issues regarding the conceptual underpinning of the MPI that need to be discussed and carefully considered. This essay discusses issues with the dual cut-off method for poverty identification, and how inequality could be incorporated in this poverty measure. Moreover, the choice of headline indicator is debated. We also propose a number of changes regarding the empirical implementation. These include dropping the WHS as one of the data sources, dropping the BMI as a nutrition indicator, and changing the age ranges and cut-offs for the education and mortality indicators. Different approaches to deal with the large share of households where information on an MPI indicator is missing are also discussed. The empirical relevance of these changes are analysed using the Demographic and Health Surveys (DHS) for Armenia, Ethiopia, and India. We argue that these changes could pose improvements to the current formulation, but one may need to investigate them further and for a larger number of countries. In a final section, we briefly comment on the HDRO revisions to the MPI in the 2014 Human Development Report, which have been partly based on the recommendations made in this paper.

This paper is based on joint work with Stephan Klasen. We would like to thank Sabina Alkire, Isis Gaddis, James Foster, Sanjay Reddy, Nicole Rippin, Jose Manuel Roche, Suman Seth, and Subbu Subramanian for helpful comments and discussions on these issues. In addition, we want to thank Sabina Alkire and her colleagues at OPHI as well as Milorad Kovacevic, Cecilia Calderon, and the HDRO Office for helpful comments on an earlier version of this paper. Funding from the HDRO in support of this work is gratefully acknowledged. An earlier version of this paper has been published as Caroline Dotter and Stephan Klasen (2014). The Multidimensional Poverty Index: Achievements, Conceptual, and Empirical Issues. UNDP Occasional Papers.

3.1 Introduction

The Multidimensional Poverty Index (MPI) has been published by the HDRO in the annual Human Development Report since 2010. Up until the 2014 Human Development Report (see below), it was based on an index developed by Alkire and Santos [2014] at the Oxford Poverty and Human Development Initiative (OPHI). This indicator is presented and discussed in detail by Alkire and Santos [2014]. It is a particular form of a class of multidimensional poverty indices proposed by Alkire and Foster [2011*a*] using a dual cut-off approach to identify the multidimensionally poor.

Since its introduction, there has been a vigorous debate on the conceptual and empirical merits and problems of the MPI [e.g. Alkire and Foster, 2011*b*, Bossert et al., 2012, Lustig, 2011, Ravallion, 2011, Rippin, 2013, Silber, 2011, among others]. It is impossible to do justice to all the points that have been raised. In particular, it is very difficult to come to definitive judgments on some of the conceptual issues surrounding the MPI. Many of the points raised in this discussion are essentially value judgments about the desirable and undesirable features of the MPI, relative to potential 'competitors'; also, we are not well-placed to weigh in on those debates to which we have not contributed in a substantive manner.

Instead, the aim of this paper will be first to briefly assess whether and to what extent a micro-based multidimensional poverty measure such as the MPI can and has enriched our understanding of poverty and deprivation across the world. Second, we will review the conceptual debate surrounding the MPI and suggest some further avenues of thinking about these issues. More importantly, however, this paper will, thirdly, deal with a range of open empirical questions regarding the MPI: the choice of indicators and cut-offs, the treatment of missing information, and ways to simplify the index.

While we will discuss the merits of different conceptual approaches that would require the MPI to be fundamentally reworked, the more specific recommendations will be on the empirical implementation of the index as currently conceived. The final purpose of the paper is to briefly present and comment on the changes HDRO has made to the MPI in the 2014 Human Development Report, some of which were partly based on recommendations made in this paper.

In the following section, we will briefly explain the structure of the original MPI. This is followed by a discussion of the manifold achievements of the MPI, and a summary of the conceptual critique of the MPI. In section 5, we discuss the open empirical questions of the MPI and present a revised version of the MPI in the following sections. We then summarize our conceptual and empirical proposals. The last section shortly discusses the changes to the MPI in the 2014 HDR.

3.2 The MPI

The Multidimensional Poverty Index (MPI) has been developed by Alkire and Santos [2014] for the 2010 Human Development Report. It is an index of acute multidimensional poverty and is based on the Alkire and Foster [2011*a*] dual cut-off method for poverty identification.[1] The MPI

[1] The Alkire-Foster method extends the traditional approaches of multidimensional poverty identification, the intersection and the union approach. The method employs two cut-offs: First a cut-off within each dimension or indicator is applied to identify who is poor within each dimension. Then poverty across dimensions is aggregated, and the second cut-off is applied to identify poverty across dimensions.

(M0 measure) itself is the product of the MPI headcount H (measuring the share of the population that is multidimensionally poor), and the weighted deprivation share of multidimensionally poor households A (measuring the weighted percentage of indicators, in which the multidimensionally poor are on average deprived).

Alkire and Santos [2014] identify three dimensions to be included in the MPI: health, education, and the standard of living. These dimensions mirror the Human Development Index (HDI). They have been chosen because there is consensus that any multidimensional poverty measure should at least include these three dimensions; for the ease of interpretability; and finally for reasons of data availability. While there are arguments for including additional dimensions such as powerlessness, deprivation of rights, violence, shame, or time use, there is often no data available and much disagreement about which dimensions are appropriate. However, few would dispute the necessity of health, education, and a decent standard of living for a life free from poverty. Whether an individual may be considered deprived in each indicator is determined at the household level. This choice has largely been made for reasons of data availability of some of the indicators.[2]

Following the Alkire-Foster method, Alkire and Santos first define cut-offs in each indicator, aggregate poverty using weights, and then apply a cross-dimensional poverty cut-off. The three dimensions are represented by ten indicators. Health is represented by child mortality and malnutrition. A household and, thus, all its members is deprived in mortality, if any child has died in the family. Similarly, all household members are deprived in nutrition if there is at least one undernourished person in the household. Education is represented by years of schooling and child school enrolment. Years of schooling are used as a proxy for literacy and level of understanding of the household members. An individual is considered literate, if he or she has at least five years of education. Following Basu and Foster [1998], the MPI assumes all household members benefit from one literate household member (of any age). Therefore, the household is considered non-deprived, if at least one household member has five years of schooling. The household is deprived in the enrolment indicator if any of the children of primary school age are not enrolled in school (see below). The living standard is represented by access to electricity, clean drinking water, improved sanitation, flooring (no dirt, sand, or dung floor), clean cooking fuel, and an asset index. Electricity and floor refer to the quality of housing, while drinking water, improved sanitation, and clean cooking fuel have health impacts and are part of the Millennium Development Goals (MDG 7). Finally, a household is deprived in assets if it does not own more than one small asset (radio, TV, telephone, bike, motorbike, or refrigerator) and does not own a car or truck.

After determining the indicator cut-offs, the Alkire-Foster method attaches weights to each deprivation. The MPI applies equal weights across dimensions (each dimension receives a weight of 1/3), and within each dimension indicators are weighted equally. The weighted deprivations are then summed up and the cross-dimensional cut-off is applied. The MPI uses a cross-dimensional cut-off of one third. Hence, a household is multidimensional poor if its weighted deprivations sum up to one third or more.

Alkire and Santos aggregate poverty using a poverty index (M0) of a class of Alkire-Foster poverty measures M(α), which can account for the incidence of multidimensional poverty (H) and the average deprivation share among the poor (A). The M0 poverty measure fulfils several

[2]For a proposal for an MPI at the individual level, see Vijaya et al. [2014].

desirable poverty axioms and is decomposable by indicator and subgroup.

For this analysis, we will illustrate our points regarding the MPI using Demographic and Health

Table 3.1: Descriptive Statistics

	All	Armenia	India	Ethiopia
urban	30.01%	62.30%	30.83%	11.97%
small household (1-3)	14.58%	24.54%	14.32%	12.92%
medium-sized household (4-6)	51.43%	60.75%	51.73%	45.81%
large household (7+)	33.99%	14.72%	33.96%	41.27%
male-headed household	87.83%	71.37%	89.27%	82.93%
'older' household	22.61%	32.97%	21.85%	24.54%
total observations	594,047	24,351	504,968	64,728

Surveys (DHS) from three countries: Armenia, Ethiopia, and India. While this sub-sample can by no means be representative, it provides an interesting example since we can see how our proposed changes affect households in countries with vastly different levels of multidimensional poverty and human development. Moreover, the demographic composition of households varies a lot across these three countries. As can be seen in Table 3.1, the three countries differ substantially in the rates of urbanization, the prevalence of small and large households, and the prevalence of 'older'[3] households.

Table 3.2 also shows a vastly different incidence of multidimensional poverty for the three countries, ranging from 0.6% in Armenia to 90.5% in Ethiopia. Our total sample consists of nearly 600,000 observations, all stemming from the DHS surveys for these countries.

Table 3.2: Multidimensional Poverty across sub-groups and countries

	H	A	MPI
all	54.85%	55.28%	0.303206
urban	20.82%	48.47%	0.100921
rural	69.44%	56.15%	0.389922
Armenia	0.57%	38.24%	0.002194
Ethiopia	90.48%	64.59%	0.584382
India	52.76%	53.17%	0.28055

3.3 Achievements of the MPI

The MPI has not been the first attempt in measuring multidimensional poverty. There have been many multidimensional poverty measures proposed in the literature and applied to individual countries (see also the discussion below on conceptual issues). The main contribution of the MPI, as we see it, vis–à–vis the existing work, is its breadth of country-coverage and its international comparability. In 2010 the MPI was calculated for 104 developing countries using just 3 types of datasets (DHS, MICS, and WHS)[4] and since then a few dozen more countries have been added. For an increasing number of countries, multidimensional poverty at the household level

[3] A household is considered old if the average age of adult household members is above 35.

[4] For Mexico and Argentina, different datasets were used.

has been calculated at two points in time [UNDP, 2014]. Through this broad coverage, the MPI is, in principle, able to make statements about the extent of global multidimensional poverty in a way similar to those the World Bank's $1-a-day poverty line makes about global absolute income poverty. So far it has not been used in this way, but this could be done using appropriate methods that will make plausible assumptions about the MPI poverty in countries where these survey data are not available.[5]

In fact, the data utilized by UNDP to calculate global multidimensional poverty is somewhat more reliable than the one used for the income poverty measure, where the comparability of survey instruments across countries and over time is much less certain [e.g. Devarajan, 2013]. In that sense the MPI should, we believe, most sensibly be seen as the multidimensional analogue, or multidimensional 'competitor' of the international income poverty line. Just as the HDI is the multidimensional analogue to GDP per capita to measure average well-being, the MPI does that on the poverty front. In that sense, it is a real achievement for UNDP and HDRO (as well as, of course, the OPHI, who created this measure in the first place) to be able to provide a multidimensional index that can compete with the $1-a-day poverty line in terms of coverage.

In contrast to the $1-a-day line, it has the huge advantage of measuring well-being outcomes directly, in line with Amartya Sen's functioning and capability approach Sen [1999*a*,*b*]. Hence, UNDP has a macro level well-being indicator based on the capability approach (the HDI and the IHDI to consider inequalities), and a micro-level deprivation indicator, the MPI, at its disposal.

Conversely, we do not see a clear role for the MPI in relation to the Millennium Development Goals and possible post-2015 development goals. The MDGs intentionally considered individual well-being dimensions separately in order to avoid the opacity and possible trade-offs that come with a composite index. In that sense, we would see the possible role of the MPI as an overall monitoring tool to measure multidimensional well-being, but not a measure for which goals or targets should be directly formulated. It should also not replace the focus on reducing deprivation in the individual dimensions of well-being covered by the MDGs.

A second major achievement is that the MPI, through its base on household survey information, is a much more actionable and policy-relevant indicator for countries and agencies than the HDI. One can decompose the MPI by region, by particular groups, and by indicator, thereby allowing countries to directly see which groups suffer most and in which dimensions they are deprived. To capitalize on this advantage, however, it would be important for the UNDP (at the level of the HDRO as well as country offices charged with working on national HDRs and related policy documents) to build up capacity in the use and analysis of the micro data sets that underlie the calculation of the MPI, particularly the DHS and MICS (see the discussion on WHS below). This has not happened to the extent necessary to benefit from this new tool.

Third, by basing its analysis on households, the MPI is consistent with the axiomatic approaches to poverty measurement in ways that the UNDP's Human Poverty Index, proposed in 1996 [UNDP, 1996], was not. The Human Poverty Index combined three aggregate deprivations into a single measure. It was not possible to identify the number of poor people; study the extent of their deprivation, or their regional heterogeneity; or use different aggregation rules to build up the aggregate from the experience of individuals or households. It also allows for an analysis of the joint distribution of deprivations, which the Human Poverty Index could not provide. In

[5] The World Bank faces the same difficulty with their dollar-a-day calculations and has developed approaches for dealing with this. See, for example, Chen and Ravallion [2004]

contrast to the MPI, the HPI remained an aggregate ill-being measure, akin to the HDI but using different dimensions.

Fourth, the MPI does *not* suffer from two defects that have been raised in early discussions about it. Some questioned the accuracy of the MPI: While it is surely the case that some of the indicators (particularly the health indicators but possibly also the education indicators) are measured with error, the data quality is likely to be no worse and often rather better than for aggregate indicators such as life expectancy or GDP per capita. As has been discussed by Devarajan [2013], Harttgen et al. [2013], Jerven [2012] GDP statistics in many parts of the world, but particularly in Africa, are very poor and subject to drastic revisions. As discussed in Klasen and Vollmer [2013], there is no credible adult mortality data for many developing countries (including, again, most of Africa) so that life expectancy data are usually simulated rather than measured. In fact, the DHS has become the main 'official' source for infant and child mortality data in many developing countries and thus is the main source of the simulations for life expectancy. Moreover, the DHS and MICS data generally are no less official than aggregate statistics produced by national statistical offices. Usually, these surveys are done in conjunction with national statistical offices and in most countries these surveys are part of the regular survey program of national statistical offices.

These strengths are mostly due to the fact that the MPI is built up from micro data and uses standardized and roughly comparable household surveys as their base. In principle, one could construct a very different multidimensional poverty measures that would still retain some of the advantages of the MPI just discussed.

3.4 Conceptual Critique of the MPI

Since its launch in the 2010 Human Development Report, the MPI has been vocally criticized and the concept has been hotly debated in the sphere of development research.

The MPI is based on an ordinal version of the dual-cutoff multidimensional poverty measures proposed by Alkire and Foster [2011*a*]. There were closely related multidimensional poverty measures proposed in the literature before Alkire and Foster suggested their measure. These are also based on the (weighted) aggregation of deprivations across dimensions, some using ordinal data. As summarized by Subramanian (personal communication and Jayaraj and Subramanian [2010]), very similar formulations were proposed by Bourguignon and Chakravarty [2003], Brandolini and D'Alessio [1998], Chakravarty and D'Ambrosio [2006], Jayaraj and Subramanian [1997, 2002, 2005, 2007, 2010]; Bossert et al. [2012] also pursued a similar approach in independent work. The main contribution of Alkire and Foster [2011*a*] is the dual cut-off approach which tries to navigate between the allegedly empirically unappealing union and intersection approaches to multidimensional poverty identification.

The union approach considers anyone who is deprived in any poverty indicator to be poor, while the intersection approach considers people who are deprived in all indicators to be poor. Hence, the former approach usually yields very high and the latter very low levels of poverty incidence [Alkire and Santos, 2014]. Indeed, Bossert et al. [2012], Jayaraj and Subramanian [2002, 2007], Rippin [2013] have all used the union approach for identifying the multidimensionally poor. Which should be preferred?

3.4.1 Comparison to union and intersection approach

On the one hand, a strong case can be made for the dual cut-off approach on substantive and empirical grounds. On substantive grounds, one can argue that the simultaneity of deprivations is required for someone to be not only *deprived*, but also to be considered *multidimensionally poor* [Santos et al., 2013].

Moreover, an empirical issue of the union method is that it returns very high poverty outcomes. As shown by Rippin [2013], if one uses the union approach with the MPI indicators and cut-offs, the poverty incidence is over 90% in many countries. This is not only a difficult political sell, but may also be a result of measurement error or instances where the indicators do not cover the particular deprivations well. For example, the MPI presumes households that do not report on the possession of a particular asset (yielding a missing observation in the survey) do not own the particular asset. If the union approach were applied, a household would then be considered multidimensionally poor. Similar measurement errors might exist in the measurements of height and weight, correct ages for enrolment rates, and the like. Or it may be the case that a child has a low weight for age not due to undernutrition, but to a recent bout of illness or simply due to the fact that her parents have (genetically) very light body frames that were transmitted to her.[6] She could also be fasting for religious or other reasons [Alkire and Santos, 2014].

Though these individuals may be deprived in nutrition, a poverty measure should not focus on a fasting but otherwise affluent person. By raising the cut-off to 30% (or some other number that is higher than being deprived in just one indicator), one reduces the chance of such misclassifications[7] and allows policy to focus on the simultaneously deprived.

Both the substantive as well as empirical advantages of the dual cut-off approach over the union approach increase with the number of indicators chosen. If the MPI was composed of 30 indicators, the union approach would be very hard to justify as the vast majority of households are likely deprived in at least one indicator (for reasons to do with a real deprivation suffered in that dimension, particular choices made that lead to an apparent deprivation, or mere measurement error)[8]. One would then vastly inflate the problem of multidimensional poverty, rendering it essentially meaningless.

Conversely, when we apply the intersection approach to a poverty measure with 30 indicators, only very few individuals would be considered poor, as nearly everyone is likely to be non-deprived in at least one indicator. However, reducing the MPI to only 5 or 6 meaningful and well-measured indicators that signify important deprivations would make this problem much less severe. The conceptual and empirical issues of reducing the number of indicators (tackled below) are thus related. We will come back to this question at the end.

Hence, the dual cut-off approach is advantageous to the union approach if we want to focus on households or individuals suffering from joint deprivations. In addition, the approach suffers less from measurement error in single indicators. Moreover, from a policy perspective, it is preferable to both the union and the intersection approach as it produces a clear and easily communicable poverty outcome that is usable for policy actions.

[6] After all, undernutrition definitions based on anthropometrics are based on a statistical likelihood that a person with a low weight for age is actually undernourished [Klasen, 2008].

[7] Of course, there might be other ways of dealing with this. One could reduce the number of dimensions, particularly omitting those where such misclassifications are most likely, or one could raise the cut-offs within a dimension. There are downsides to these potential remedies as well.

[8] See Santos et al. [2013] for examples of deprivations due to choices or measurement error.

On the other hand, the dual-cut off approach may lead to a certain amount of confusion, because it identifies individuals as multidimensionally deprived but not poor. Moreover, it is problematic that these individuals' deprivations are not relevant for the assessment of multidimensional poverty in the whole society, because they fail to surpass the second cut-off. We potentially lose a lot of relevant information about multidimensional deprivations in this society if we solely focus on the MPI headcount and the censored deprivation headcounts.
This approach also creates some formal problems. As discussed by Subramanian (personal communication), it violates monotonicity of poverty measurement among the deprived.[9] As long as people do not surpass the second threshold, we do not care whether they are deprived in none, one, or two indicators and treat them all as non-poor.[10] One solution would be to consider people who are deprived in at least one indicator but below the cut-off as vulnerable (OPHI is working on proposals in this direction), but this then adds another cut-off.
The additional aggregation of deprivations in the dual cut-off approach also adds the problem of choosing weights, and the possibility of potential trade-offs between deprivations [cf. Ravallion, 2011, 2012, among others]. Moreover, deprivations are treated as perfect substitutes below the cut-off and as perfect complements above the cut-off, giving substantial importance to this arbitrarily set cut-off [Rippin, 2013]. Finally, the discontinuous nature of the dual cut-off approach clouds the effects that improvements or deteriorations in specific indicators have on aggregate poverty. The introduction of a second cut-off makes the impact of specific policies much harder to pinpoint, and changes in poverty levels are much harder to understand.

Summing up, one of the main advantages of the dual cut-off approach is that it is generally open to an unlimited number of indicators. It can therefore capture a much broader definition of poverty and can possibly accommodate several culturally-specific concepts of poverty (i.e. including indicators deemed less relevant in some cultures, but more relevant in others). Conversely, if the MPI was focused on fewer indicators (as suggested below) this advantage is not as compelling.
The dual-cut off method is also less sensitive to misclassifications and mismeasurement. Most importantly perhaps, the method enables politicians to focus on the simultaneously deprived. However, considering someone deprived but not poor is somewhat confusing, and the dilemma of choosing weights and the possibilities of trade-offs between indicators is real.
We therefore believe that a stronger utilization of the poverty intensity (in terms of the number of dimensions one is poor) and possibly inequality (see discussion below) would circumvent the issue of very high poverty headcounts when the union approach is used. The resulting aggregate measures would still allow country and individual rankings and a policy focus on those deprived

[9] As shown by Santos et al. [2013] and formally shown in Alkire and Foster [2011*a*], it is, of course, entirely possible to generate a set of axioms that are satisfied by the dual cut-off approach and the aggregation procedure of the MPI. These axioms imply a strong separation between identification and aggregation. In the identification step, the focus axiom implies that we should only focus on those who pass the threshold of being multidimensionally poor; if we do that, then the resulting measure will obey monotonicity in the sense that increasing the deprivation of a poor person increases the MPI. But this is only because we chose to ignore the deprivations suffered by those who do not pass the second cut-off (to obey the focus axiom)! More generally, the strict separation between identification and aggregation, which makes a lot of sense in uni-dimensional poverty measurement, is less compelling in the case of multidimensional poverty measurement, as the adding up of dimensions where a household is poor can already be seen as a form of aggregation; conversely, one may think of identification not as a yes/no question, but a question of degree as proposed by Rippin [2013].

[10] Related to this, discontinuities arise at the cut-off that could have been avoided had the union approach been chosen (Subramanian, personal communication).

in many dimensions. One would then need to choose indicators and indicator cut-offs more carefully. Some of these empirical issues are discussed below (cf. section 5).

3.4.2 Neglect of Inequality

A further conceptual problem is the neglect of inequality in the spread of dimensions across the population. Similar to FGT1 in the uni–dimensional case, only average deprivations (intensity) and deprivation headcounts matter, but we ignore inequality of deprivations among the poor. If deprivations were redistributeds in a regressive fashion among the multidimensionally poor (e.g. those with the most deprivations got a few more, while those with fewer deprivations got a few less but remained multidimensionally poor), this would not change the MPI outcomes at all.
Several researchers have pointed to this issue [e.g. Silber, 2011] and there have been a range of proposals to deal with it, including Chakravarty and D'Ambrosio [2006], Jayaraj and Subramanian [2010], and Rippin [2013]. Alkire and Foster themselves are also working on an approach incorporating inequality in the assessment.
Each of these proposals has particular strengths and weaknesses, however it goes beyond the scope of this paper to discuss all of them in detail. A particularly straight-forward solution has been proposed by Rippin [2013]: In the identification step, she no longer just decides whether an individual is considered poor or not (as is usually done); she assigns different degrees of poverty to households. These poverty degrees are based on the weighted share of deprivations suffered by households. In the aggregation step, she then adds these deprivation scores over the population. Through this approach inequality in the distribution of deprivations across the population is explicitly considered. In households with many deprivations the marginal impact of an additional deprivation is larger than in households with less deprivations. A particular advantage of the approach is that the resulting Correlation-Sensitive Poverty Index can be readily decomposed into a headcount component, an intensity component, and an inequality component. This might be one way to take this issue forward and should be studied more carefully, alongside other proposals that have been made to address this issue.[11]

3.4.3 Choice of the headline indicator

A third conceptual issue that might be worth considering relates more to which part of the MPI ought to be the headline indicator. The MPI may be regarded as the multidimensional competitor or analogue to the $1-a-day measure (where usually only the headcount is reported and is also the target for the 1st MDG). Therefore, it might be worth focusing on the headcount of the MPI as the headline indicator, rather than the product of headcount and average intensity. Moreover, the variation in the MPI between countries and over time is largely driven by the headcount and much less so by the intensity. This can be readily seen in Alkire and Santos [2014], where it is clearly the case that the variance of the poverty intensity A across countries is much smaller than the variance in the headcount H (see also Table 3.2).
Additionally, the intensity is truncated from below by the value of the second cut-off (if the second cut-off is 30%, the average intensity among the poor must, by definition, be larger than

[11] There are, of course, downsides to this approach as well. First, it uses a union-approach to identify who is poor with all the advantages and disadvantages; second, it presumes a particular relationship or substitutability or complementarity between dimensions which is empirically hard to verify and might in any case differ across dimensions.

30%). As discussed above, whether or not to apply a second threshold is controversially debated in the literature. The choice in the value of the cut-off (MPI applies 1/3, but the Alkire-Foster method is open to other choices) is also open to debate. Hence, this truncation, essentially ignoring the intensity of deprivation of the non-poor, is problematic.
Using the dual cut-off method (contrary to the union or intersection approach), the headcount conveys a much stronger political message and may be able to compete with the $1-a-day measure more directly. When applying the union approach, the headcount is not found to be a very intelligible statistic, as many people are likely to suffer some deprivation. There are two ways out of this dilemma: one is to use the union approach for the headcount, but generate a second measure that can determine the intensity and deprivation level (covering all of the deprived). We then consider the entire depth of deprivations, not just the one below the cut-off. In this case, the variance in intensity (and possibly inequality) is, empirically, likely to be much larger. A second, much less elegant, way out would be to use a dual-cut off approach for the headline indicator and a union approach that considers intensity and inequality (such as the one suggested by Rippin [2013]) as a second measure.

3.4.4 Relativity of deprivations

A fourth conceptual issue to consider is the question of relativity of the dimensional cut-offs. Similar to the international income poverty line that is less and less relevant for an increasing number of countries, one might consider whether one should similarly construct a (weakly) relative MPI cut-off that rises with the average well-being in a country (see Ravallion and Chen [2011] for a weakly relative international income poverty line). In the multidimensional context, one could either adjust the dimensional cut-off to reflect rising average standards, or one could lower the second cut-off of the weighted deprivation share necessary to be poor.
Given that the data used for the MPI is categorical and cannot be adjusted smoothly, this would be a conceptually and empirically difficult exercise but well-worth considering. If such a smooth adjustment of the cut-offs proves to be impossible due to the categorical nature of the data, an alternative would be to at least define a second MPI that chooses a higher cut-off for each indicator. One would then have MPI indicator thresholds for poorer and richer countries separately. Alternatively, one could also apply a lower second cut-off at the aggregate index. Both approaches are somewhat comparable to the $2 or $4 poverty lines used in some analyses for richer developing countries.
Again, one has to carefully consider the merits and problems of such an approach [Santos et al., 2013]. First, there is the apparent counter-argument, going back to Sen's famous article "Poor, Relatively Speaking" [Sen, 1983]: he argues in the space of capabilities and functionings, one should measure absolute poverty. However, the resources required to reach such capabilities will differ across countries, thus in the income space a relative poverty measure is to be preferred.
This counter-argument might plausibly hold in the health dimension where we indeed try to measure functionings. Nevertheless, in the standard of living dimension, the MPI does not measure functionings or capabilities, but access to goods that might enable some functionings. This is most clearly the case with the asset count which does not have an absolute functioning interpretation at all. Whether one can consider a certain number of assets adequate really depends on the prevailing standards in a society. Similar arguments can be made regarding floor material,

electricity access, and possibly even with water, sanitation, and cooking fuel, where in richer countries or urban areas the standards chosen might simply be too low.[12]
Likewise, one could argue for varying thresholds in education. While at some level, education (for example literacy) itself can be seen as an absolute capability, whether education allows for active participation in society, business or the economy will also depend on the average level of education prevailing in a society. This would suggest that the standards in health may be considered universal and absolute, but the ones for the standard of living and education could be higher in countries with higher average achievements. It would also suggest that the logic of Sen's argument would imply higher indicator cut-offs in the education and living standards dimensions, rather that a lower second cut-off for calling someone multidimensionally poor in a better-off society Dotter and Klasen [2014*a*].

To conclude this section, it is important to point out that the particular choices inherent in the dual-cut off method underlying the MPI are controversial. One could easily consider the union approach more relevant for identification and then think about weighted deprivation counts as poverty measures that also consider inequality between dimensions. We would also submit that the intensity component of the MPI, within the current dual cut-off framework, is less relevant and that work should begin on considering relative versions of the MPI. It is also important to reiterate two points. First, many of the critiques and suggestions are essentially judgment calls about the merits and problems of particular ways of framing the issue. Ultimately, pragmatic and policy-relevant decisions that also consider data, communication, and interpretability issues will need to be taken by HDRO. Second, the conceptual issues are linked as are the empirical issues. For example, the union approach with the headcount as the main indicator (and an intensity and inequality adjusted second measure) might make a lot more sense if the MPI consists of few very well-measured and meaningful dimensions; conversely, the more indicators, and the more empirical problems with them, the less useful this proposal would be.

3.5 Empirical Issues with the MPI

We will now turn to some empirical issues relating to the particular decisions that have been made about the use of data sets, the choice of indicators, and the dimension- and indicator-specific cut-offs. Here we will simply consider the MPI in its current formulation and thus no longer discuss the conceptual issues we had just raised. We will return to the issue below since the conceptual and empirical issues are linked. In this section, we will not discuss the weights or the basic three-component set-up of the MPI (health, education, and standard of living) as this would go beyond the scope of the paper. We broadly agree with these choices and particularly see a compelling rationale that the dimensions and weights should closely mirror similar decisions made in the HDI.

[12]To take the example of water access, while clean water is the key issue here, whether it is acceptable in a upper middle-income country to have access to clean water 20 minutes away from the house is a legitimate question. Thus the cut-off chosen for the MPI could be relevant for poorer countries and a higher standard would be appropriate for richer countries.

3.5.1 Problematic use of the WHS

A serious problem arises with the use of the three different datasets. While the DHS basically allows a complete assessment of all indicators, the MICS lacks information on the nutritional status of adults. More seriously, the WHS lacks information on children's nutrition (and just has it on the respondent), and also lacks data on school attendance. While the MPI adjusts for these data gaps by reweighting the other component in the same dimension (e.g. if attendance is missing in the education dimension, the years of schooling indicator gets a higher weight), this is not without problems as the different components have different mean deprivation levels and the reweighting systematically biases the results for these countries. Moreover, this practice implicitly assumes, one of the components can proxy for the other one in the same dimension. This is, however, not necessarily the case. There are many households who are deprived in schooling years but not in attendance and vice versa; similarly in the health dimensions, not all households who lost a child also have a person who is undernourished (and vice versa).
A second problem arises particularly with the nutrition indicator: in surveys where only adults are measured there is an automatically lower probability that households will be deprived compared to surveys where both adults and children are measured. The WHS is obviously the more limiting dataset here, and we would therefore strongly suggest that the MPI is based solely on the DHS and MICS. These could be supplemented by individual surveys that meet all the criteria of the DHS and MICS. This approach would reduce the country coverage somewhat, but ensure better comparability and reliability of the results.[13]

3.5.2 Dynamics

One might suspect that the MPI would suffer from the problem of great inertia and low dynamics. The limited literature on dynamics in non-monetary poverty indicators found, these indicators generally respond slower than monetary indicators of poverty [cf. Baulch and Masset, 2003, Günther and Klasen, 2009]. Examining the deprivation indicators used, one would assume we observe little dynamic in the mortality indicator, which is a backward-looking stock measure, the education stock variable, and most of the standard of living indicators. But results from a recent workshop on dynamic comparisons, organized by OPHI and the University of Gttingen, (http://www.ophi.org.uk/workshop-on-monetary-and-multidimensional-poverty-measures/) suggested that there are surprising dynamics in the MPI over time when using new waves of the DHS or MICS. In fact, in some country case studies the dynamics of the MPI are as large as the income poverty dynamics.
For example, Mitra [2016] observes a significant reduction in the multidimensional poverty headcount for Nepal between 1995 and 2010 (80% to 27%). This is accompanied by a similarly strong reduction in monetary poverty (64% to 25%). However, different households are identified as poor when each poverty measure is applied.
Santos [2013] applies different weighting structures and cut-offs when analyzing multidimensional poverty in Bhutan between 2003 and 2007. She observes a significant reduction in multidimensional poverty for all specifications; for a specification comparable to the MPI the multidimensional poverty headcount decreases from 47% in 2003 to 32% in 2007.

[13] As raised by Santos et al. [2013] who broadly support the idea to drop the WHS, of particular concern would the omission of China from the MPI. One option might be to consider whether the China Health and Nutrition survey would be suitable to calculate the MPI; it has limited coverage but is considered quite reliable.

Tran et al. [2015] find for Vietnam, dynamics in consumption and multidimensional poverty between 2007 and 2010 are similar. Nevertheless, the mobility across sub-groups differs; transitions out of and into monetary poverty are usually not accompanied by the same transitions in multidimensional poverty.
Analyzing a sample of 34 countries, Alkire et al. [2015] observe statistically significant reductions in multidimensional poverty in 30 countries. Top-performing countries decreased their original MPI level by 5% to 9% per year. Comparing multidimensional poverty outcomes with the $1-a-day poverty line for 22 countries, they find a clear trend in poverty dynamics is not discernable. In some countries multidimensional poverty reduced faster than monetary poverty, while for others the opposite holds true. Only in the case of Nepal reductions in multidimensional and monetary poverty are fairly uniform.
To some degree this level of dynamics is surprising and the source is not well understood yet. On the other hand, it is reassuring to observe that a multidimensional poverty measure reacts to policy action. While the standard of living indicators (such as access to electricity, clean water) may be easiest to improve from a policy point of view; a change in the MPI is accelerated more by improvements that bear higher weights, such as education and health. In general, multidimensional poverty dynamics and their direction vary greatly across countries and seem to be influenced more by country and policy characteristics, rather than general trends such as GDP growth [cf. Alkire et al., 2015].

3.5.3 Choice of indicators and cut-offs

In the remainder of the section, we discuss individual indicators and the chosen cut-offs. One goal expressed by HDRO has been to look for ways to simplify the MPI, particularly the standard of living dimension. In addition, we will check the robustness of particular choices regarding indicators and cut-offs, and suggest an alternative treatment for ineligible populations. We illustrate these choices for a selection of three countries, India, Armenia, Ethiopia. In the following section, we then propose an alternative version of the MPI that would have some advantages relative to the current formulation.

Standard of Living While the health and education dimensions consist of two indicators each, living standard of the household is captured by six indicators. Are there opportunities for constraining the number of indicators in this dimension? The original living standard dimension consists of the following indicators:

- **asset index**: The household is deprived in this indicator if they do not own more than one of a group of small assets (radio, TV, telephone, bike, motorbike, or refrigerator) and do not own a car or truck.
- **cooking fuel**: The household is deprived if they cook with wood, coal, straw or dung.
- **electricity**: The household is deprived if they do not have access to electricity.

- **drinking water**: The household is deprived if its main source of water does not meet MDG standards[14], or they require more than 30 minutes to fetch water.
- **floor**: The household is deprived if it has a dirt floor (earth, sand, or dung).
- **sanitation**: The household is deprived if its toilet does not meet MDG standards or is shared with another household.[15]

In poorer countries, one typically observes that the standard of living indicators have by far the strongest contribution to multidimensional poverty. Alkire and Santos [2014] found that in countries with a high poverty incidence and MPI, the living standard dimension is the biggest contributor to overall poverty. For 17 of the 104 countries analyzed, the living standard dimension contributes even more than 50% to overall poverty.

Moreover, households in rural areas are more deprived in these indicators than households in urban areas. Comparing the contributions of indicators across India, Ethiopia and Armenia, we find that the living standard indicators contribute nearly 50% to overall poverty in rural areas; though they contribute only around 36% in urban areas [cf. Dotter and Klasen, 2014*a*, Graph B]. Hence, scrutinizing these indicators carefully appears to be relevant.

In principle, all living standard indicators capture separate dimensions of well-being (some being more important than others). The indicators are well-derived following research on the consequences of deprivation in these dimensions and their linkages to the MDGs [Alkire and Santos, 2014, Santos et al., 2013]. Each indicator represents an important constituency and how one can easily streamline them is not obvious. At the same time, some of the indicators are weaker, either conceptually or empirically and (at least for the countries in our analysis: India, Ethiopia, and Armenia) they are relatively closely correlated, so that some simplification is feasible. While recognizing the importance of each dimension, we question whether each indicator can capture what they intend to measure.

Following the need to simplify the MPI, one can discuss the adequacy of some of the standard of living indicators. Some indicators are hard to measure, as the household's benefit depends on the quality of the service. Moreover, there are substantive differences in needs for access (between urban and rural areas and across countries) which might bias the results. We will discuss the different indicators in turn.

The household's benefit of access to the **electricity** grid will depend on the quality and price of the service, as access to electricity is hardly a goal in and of itself. Though electricity has manifold advantages, this cannot be equated with access to the grid. Frequent power outages are common in several developing countries and a low reliability of the grid diminishes the potential use of electricity significantly. In some countries the cost of electricity is very high and access does not actually imply use; in fact, in a substantial number of African countries, households have access but do not use it and in other countries household access is not provided precisely because household incomes are too low to pay for it (even if the hook-up is subsidized). The link to a particular functioning that access to electricity ensures is also somewhat more tenuous.

[14] If the water source is not protected (i.e. open or not protected wells or spring , or surface water such as a river, damn, pond, etc.) or the household relies on an irregular water source such as bottled water or a tanker truck the household is deprived. A protected well or spring (and the use of rainwater) would however suffice to meet this definition of clean water.

[15] A flush toilet or improved pit latrine (ventilated and with slab) would meet this requirement. A household with no sanitation facilities or rudimentary facilities (open lit, pit latrine without slab, composting toilet, etc.) is deprived.

The **sanitation** indicator suffers from the problem of different needs across countries and regions. In more densely populated regions and urban areas, improved sanitation facilities are more important as they prevent the spreading of infectious diseases. Research differentiating between urban and rural areas, find larger effects of improved sanitation on health in densely populated urban areas. This contrasts to small and sometimes insignificant results, when analyzing the effect of improved sanitation in rural areas [cf. Esrey, 1996, Gross and Günther, 2014, Gunther et al., 2010]. This strand of the literature also finds that simple sanitation technology has already had an effect on diarrhea and child mortality.

Finally, the indicator **cooking fuel** appears to be an indicator that is among the last ones to have been improved upon[16] and the indicator cut-offs are disputable. The household is non-deprived in this indicator if the cooking fuel being used has a low environmental impact[17] and a low effect on indoor air pollution.[18] Only to the extent that it causes indoor air pollution can this indicator be seen as an important well-being indicator, mainly due to its health impact. But health is already captured elsewhere. Independently of the undoubted importance of cooking fuel for respiratory diseases, is it unclear why one would want to capture it in the living standard dimension again (particularly if the health argument is the main justification). Whether health effects exist may also depend on whether cooking takes place outside or inside (which depends largely on the climate and cultural practices), and what kind of cooking implements (stoves, open fire, etc) are used. As a result it is somewhat unclear to what extent the use of non-modern fuel sources should invariably be seen as an indicator of deprivation.

In contrast, the categories of **drinking water**[19] and **flooring** are easy to measure and are arguably more objective measures of living standards, additionally they are comparable across countries. We therefore suggest considering only three instead of six living standard indicators: flooring; drinking water; and assets as a category capturing household wealth and potentially also reflecting several indicators that are correlated with asset possession (similar to the function of the income component in the HDI).[20] Consequently, the weights of the remaining three standard of living indicators would then be increased to maintain the total weight of that component of 1/3. This would also reduce the complexity of the living standards indicator and the overall MPI.[21] Moreover, in the three countries we analyze, the remaining indicators are least

[16] This is a result of a recent workshop on dynamic comparisons between multidimensional and monetary poverty (http://www.ophi.org.uk/workshop-on-monetary-and-multidimensional-poverty-measures/).

[17] One reason to include cooking fuel was its association with MDG 7.

[18] Therefore, coal, wood, and animal dung are poor categories, while kerosene is not.

[19] The main problem with the water indicator is that it is based on water source, not on whether the water is actually clean. As shown in Klasen et al. [2012], providing piped water access when quality cannot be assured can significantly lead to worse health outcomes than when households purchase the water from tankers. Also, often water gets contaminated in transport or during storage in the household, issues that are neglected here (for which there is, however, no comparable data).

[20] There is the question of whether the assets included also suffer from some urban bias and whether rural assets should be included. The DHS surveys include some information on land and livestock ownership. But it is very hard to include this data in a systematic fashion. Not owning land or livestock is neither a necessary nor a sufficient condition for deprivation in rural areas (many in rural areas do not work on agriculture) and livestock ownership also depends on geographic endowments, population density, religious traditions, and the like. As a result it is very hard to deduce deprivation from these assets and we propose keeping the current list of assets.

[21] There is also the question of whether one should use some statistical data reduction technique (such as principal component analysis or factor analysis) to create an asset index and use that instead of the individual indicators (see e.g. Alkire and Santos 2010 for a discussion). We caution against the use of such indices for the MPI for several reasons: first, they increase the complexity (and opacity) of the MPI; second, one cannot replace a normative judgment about the importance of certain assets with a statistical procedure (see also Nguefack-Tsague et al. [2010] for a discussion). And third, it is unclear whether such an index should be created at the national level, sub-national level, international level, and whether one should pool data for different time periods to create such an index.

correlated with each other. The three indicators we propose dropping are more highly correlated with each other and with the indicators we retain (see correlation coefficients in appendix Table 3.7 and 3.8). Due to the high correlation with the indicators we retain, we do not lose very much information on the distribution of deprivation across the population.[22]

Enrollment The enrolment indicator considers a household deprived if any school aged-child is not currently enrolled. The school age is determined by looking at the primary school entrance age[23] plus one year[24] and assuming necessary enrolment to be up to grade 8[25]. In many developing countries, however, children enroll at a later age than the official school entrance age, even if they will be enrolled for their whole school life (grades 1-8).
There are manifold reasons why children are enrolled late. Several studies find boys are more likely to be stunted and enrolled later than girls, and more generally poor physical and cognitive development leads to later enrollment [cf. Bommier and Lambert, 2000, Glewwe and Jacoby, 1995]. Parents consider their children not ready for school if they are too small for their age [Fentiman et al., 1999]. Moreover, in some countries boys complete some form of religious education or apprenticeship before enrolling in formal education.[26] In many countries there are also financial barriers that can lead to delayed enrolment. While some children who enrolled late are less likely to complete the education or might perform worse in school [Santos et al., 2013], this is not invariably the case and drop-out would be captured in any case by the enrolment measure. Thus, we suggest reconsidering the current proposition that the entire household is considered deprived in the enrolment indicator if a child that is not enrolled in time, but a year later.

Mortality In its current design, the multidimensional poverty index does not apply a cut-off period for child mortality. Hence, a household may theoretically be deprived in child mortality, if it suffered a child death 50 years prior to the survey. This choice was mainly data-driven, as DHS surveys with information on the time of death for each child were not available for all countries. Nevertheless, this is definitely a second-best solution to account for child mortality and this problem is fully acknowledged in Alkire and Santos [2014]. We therefore suggest only considering under five mortality in the household in the past five years.[27]
In the MICS, the information about year of death is not available in most surveys. But one could get closer to the concept of more recent deaths, if one included only the deaths of children born to younger women in the household (for example women who are below age 40).[28]

Nutrition Malnutrition is a direct indicator of the functioning 'nutrition'. Malnourished individuals are also more susceptible to other health risks and are less able to perform well at work.

[22] We should emphasize that even the three indicators we propose retaining could be improved upon once additional data were available. In the case of water, indicators of water quality would be an important addition and in the case of assets, some sense of age, current value, and state of repair would be useful additions.
[23] Derived from the UNESCO education statistics.
[24] As children with birthdays in the current school year can only enter school in the next school year.
[25] This covers primary and lower secondary education in most countries.
[26] In many parts of Africa, young boys are sent to Madrassas for few years. Similarly, in some East Asian countries it is common for young boys to live in a monastery before enrolling in school.
[27] Whether to limit it to children under five years or not is debatable. Empirically it does not make a large difference [Santos et al., 2013].
[28] This is a suboptimal solution and would leave out some recent child deaths but possibly better than the current solution where the deaths might have occurred decades ago.

Moreover, malnutrition at an early age has life-long effects on development. The MPI considers a household deprived if any household member is malnourished.[29] While the importance of malnutrition itself is indisputable, the indicators used in the MPI are imperfect.

The MPI uses the BMI for adults and weight-for-age for children to determine whether the household is deprived in nutrition. Both indicators cannot reflect micronutrient deficiencies. Especially the BMI is prone to inclusion errors, particularly related to the nutrition transition which also biases the underweight indicator (see below). There are also questions regarding the international comparability of BMI cut-offs and its comparability between males and females. Moreover, this indicator is not available in the MICS to begin with and thus there is an in-built bias from the use of different surveys.[30]

To prevent these potential inclusion errors and deal with the measurement error issues, one could consider determining the household's nutrition status using only observations on children. Combined with dropping the WHS as a data source, this would make the MPI more transparent and comparable across countries. However, households without children in the respective age range could then no longer be deprived in this indicator at all. The issue of households without eligible population is already prevalent in this indicator, but would be aggravated through the exclusion of adults.[31] We address the problem of households without an eligible population below.

Additionally one could use stunting as an indicator of child malnutrition. Stunting is an indicator of chronic undernutrition. In addition, it is less susceptible to influences from the so-called nutrition transition where households across the world (including many poor countries) are switching to foods that contain more calories, fats, and sugar. Household members then gain weight without being substantively better nourished and still often lack required micronutrients. As a result, many children in these households are stunted but of normal weight, and we even observe children that are stunted and overweight [Popkin, 2006, WHO, 2006]. Stunting is therefore a much better indicator of undernutrition as it reacts sensitively to not only the quantity, but also the quality of nutrition. In fact one can show that underweight rates fall over time with the nutrition transition, while stunting rates remain high in many countries, suggesting that the quality of nutrition has not improved [de Haen et al., 2011, Misselhorn, 2010]. Thus the use of stunting as the undernutrition indicator is to be preferred on conceptual and empirical grounds. Even though this would not significantly affect country rankings [cf. Alkire and Santos, 2014], it increases the observed incidence and intensity of multidimensional poverty.

Moreover, one could only consider children above the age of 6 months in the nutrition indicator. This would reflect the very distinct age pattern of anthropometric shortfalls which emerges between 4-6 months, deteriorates until about 24 months and stabilizes thereafter [see e.g. Wiesenfarth et al., 2012]. Households with children below 6 months might therefore erroneously be

[29] This differs across surveys used: If a DHS survey is available for the country, this refers to any child below the age of five or women in reproductive age. When the MICS survey is used, the indicator definition refers to any child below the age of five. For some countries only WHS surveys are used. In this case the household is deprived if the respondent (men or women of any age) is undernourished.

[30] This is a more general issue touching other indicators as well. HDRO uses more comprehensive information if available to get the best estimate for each country. This may, however, reduce comparability across countries. These issues mainly affect the category lists in the water, sanitation, and cooking fuel indicators and therefore do not lead to large changes in the MPI. Nevertheless, it is recommended that it be as consistent as possible throughout.

[31] It is also, of course, problematic that the health portion would then entirely focus on children with no apparent concern for other age groups. Clearly it would be useful to think more fundamentally about a different health indicator such as a health status response by all members of the household. But such data is currently not available in reliable and comparable form.

considered non-deprived, as the anthropometric shortfall has not materialized yet.

Economies of Scale The MPI assumes full economies of scale apply to literacy (measured by schooling years) and in the living standard indicators. For most living standard indicators, the public good assumption is indisputable, though we may observe some rivalry in consumption of assets (and potentially sanitation). Moreover, the household is non-deprived, if any household member has at least five years of education. This follows the concept of effective literacy defined by Basu and Foster [1998], they argue one literate household member is a kind of public good for illiterate members. Their hypothesis is supported by several studies explaining farm-level productivity with household literacy [cf. among others Foster and Rosenzweig, 1996].
Unfortunately, it is impossible to test the robustness of the MPI to the public good assumption in assets, because the DHS only asks whether or not a household owns a specific asset, not how many assets of a type are owned. Nevertheless, we can test the assumption for the education indicator. While it is sensible to assume that illiterate household members benefit from one literate member in the household, the benefit for the illiterate members will presumably be smaller the larger the household.
We therefore consider it necessary for at least 50% of all household members to have five years of education for the whole household to be not deprived in the education indicator.[32] This increases the poverty headcount significantly (approx. 10 percentage points). The change mostly increases the multidimensional poverty incidence for medium-sized households and for households in Armenia [cf. Dotter and Klasen, 2014*b*].

Size Adjustment for Nutrition, Mortality, and the Enrolment Indicator In some indicators the whole household is deprived, if one household member suffers from a deprivation in this indicator (i.e. is malnourished). Hence, larger households have a potentially higher chance of being deprived (in nutrition, mortality, or child enrolment). The whole household is considered deprived, because the household as a whole experiences a negative external effect by the presence of a person deprived in one of these indicators. Also, a human rights perspective could support such an approach [Santos et al., 2013].
Nevertheless, all of these indicators will measure deprivations imperfectly (as discussed in the sections above on enrolment, nutrition and mortality). While the dual cut-off method allows for inclusion errors in one indicator, households falsely categorized into two of the health and education indicators will be considered multidimensional poor. Larger households with more eligible household members in each indicator have a potentially higher chance of being falsely considered poor.
We found, that the original assumption regarding child mortality, nutrition, and enrolments disproportionately affected the poverty status of large households. We change the indicator definitions, in a way that only considers households deprived if one out of five children is deprived in the indicator.[33] This reduced overall poverty modestly (approximately 1 percentage point for whole sample) for all sub-groups and countries. However, for the sub-group of large households

[32] It would possibly be better to restrict this cut-off to adult members (15+) and in future work we will consider this option.

[33] A household is deprived, if at least 20% of all (not only children below 5) children in the household have died. A household is deprived, if at least 20% of all school-aged children are not enrolled. A household is deprived, if at least 20% of all eligible household members are undernourished

we observed a poverty reduction of nearly 3 percentage points. Hence, with the initial, more restrictive assumption, larger households had a higher chance of being considered multidimensional poor.

3.5.4 Treatment of households without eligible population

Several indicators of the MPI explicitly refer to a specific eligible population. The nutrition indicator considers children below the age of five and women at the reproductive age (15-49). The mortality indicator refers to households with men and women in the reproductive age. Moreover, households that never had children cannot suffer from the death of a child. In addition, the enrolment indicator considers only households with school-age children. Households without eligible population are considered non-deprived in the respective indicator. The household's demographic composition may therefore determine its chances of being considered poor or not.
Table 3.3 shows the share of households without eligible population in the respective indicator. As we can see, this is not a marginal problem but affects a large share of households for the three countries we analyze. It is more severe in the enrolment indicator, where over a third of households do not have children of school age and are therefore automatically non-poor in this indicator. In fact, if they have no children at all, it is going to be quite hard for them to be considered multidimensionally poor since they are automatically considered non-deprived in 50% of the indicators.[34]

The relative importance of these households differ across indicators and countries. Older house-

Table 3.3: Relative importance of households without eligible population

	Nutrition (health)	Mortality (health)	Enrollment (education)
All	9.1%	17.84%	36.97%
Armenia	14.81%	23.58%	51.25%
India	8.57%	17.13%	37.90%
Ethiopia	11.07%	21.23%	24.38%
'older' household	28.44%	32.48%	38.24%

holds are more likely to have no eligible population in the three indicators. Typically this is more of an issue in middle-income and transition countries like Armenia. In Ethiopia several households only consist of children and grand-parents and have no men or women at the reproductive age. This is a potentially even bigger problem in countries with a higher HIV prevalence than Ethiopia.
In the following, we will shortly discuss other approaches to deal with the non-eligible population in the MPI: First of all, one could drop households without an eligible population. However, this not only reduces the sample, but the outcomes are also no longer representative since we exclude a significant share of the population. One could also substitute the missing indicator with an indicator from the same dimension, i.e. substitute the enrollment indicator with the literacy indicator for households without children at school-age. This essentially doubles the weight attached to literacy for this specific household, hence a sensible decomposition by indicator will no longer be possible. Nevertheless, we could still decompose by dimension which

[34]This is particularly the case if the MICS are used (where adult nutrition information is not included).

would be quite useful. One could also consider substituting these indicators for children with indicators for adults (ideally for all household members). However, comparable adult indicators in these dimensions are not available for all countries. Indicators that are equally relevant for all household members are also hard to come by. Finally, we could also consider changing the poverty cut-off (k) for households without an eligible population. As the household can only be deprived in less than ten weighted indicators, one would lower the overall poverty cut-off respectively.

We follow a hybrid approach, combining substitution and change of the poverty cut-off. First, we substitute the missing indicators with available indicators from the same dimension. If these indicators are not available, we lower the poverty cut-off for households with no eligible population in either indicator of the dimension (no eligible population for the nutrition and for the mortality indicator). The advantage of this approach is that it makes maximum use of the data without having to rely on imputations or on dubious assumptions of non-deprivation of childless households. The disadvantage is, decompositions by dimensions are no longer possible for those households that have no eligible information for the entire health dimension.

UNDP also acknowledged the serious problem of ineligible population but decided to follow a different route in the 2014 HDRO [Kovacevic and Calderon, 2014]. For households with missing information in the education or health dimension, the remaining indicator receives the entire dimension weight of 1/3. Thus, they substitute the indicator with one from the same dimension as we suggested above. Households with missing information on both indicators are excluded from the MPI and the sample weights are adjusted to account for the exclusion of the household. The sample weight adjustment ensures, the distribution is unchanged across age groups, gender and place of residence (rural and urban).

3.6 A revised MPI

On the basis of the discussion above and sensitivity tests we performed in an accompanying working paper [Dotter and Klasen, 2014*b*], we propose a revised multidimensional poverty measure. In this measure we still follow the Alkire-Foster dual cut-off method, apply the same normative weights, and also consider an overall cut-off of 1/3; of course, these choices could also be reviewed in light of our conceptual discussion above and will be taken up below. However, we apply new indicator definitions and suggest only utilizing DHS and MICS surveys for global poverty estimation.

In our revised MPI, we consider three living standard indicators instead of six: floor (the household is deprived if it has a dirt floor); drinking water (the household is deprived if it has no access to clean drinking water, or they require more than 30 minutes to fetch water); assets (the household is deprived if they do not own more than one small asset and do not own a car or truck). These indicators are arguably more objective and easier to measure, as the household's benefit does not depend on the quality of the service. Moreover, the remaining three indicators are highly correlated with the three dropped indicators, and comparable across countries and regions.

The relative contribution of the living standard dimension is lower, when these indicators are chosen and more in line with its weight of 1/3. It also varies less across countries and urban and rural areas compared to the initial situation with six indicators. It, however, retains substantial

variation in the contribution of the individual living standard indicators.

Moreover, we suggest shortening the enrollment window by two years (i.e. a child in India was considered to be at school age if it was aged between 7 and 15. Now, we only consider children between 9 and 15.) to allow for the late enrollment of children in school. It is common practice in many developing countries for younger children to enter school at a later age for a range of reasons. The original indicator definition considers these households as deprived, while the shorter enrollment window does not. A household is deprived in the new enrollment indicator if more than 20% of its school-age children (when the new enrollment window is applied) are not enrolled.

In the education indicator, we only consider a household as non-deprived if at least half of its adult members have 5 years of schooling. We, thus, assume some economies of scale exist for education in the household, but do not consider education as a pure public good. The original education indicator considers a household with one household member with five years of schooling as non-deprived.

The suggested nutrition indicator does not include adult BMI, as this measure is prone to miscategorization. Stunting is the preferred malnutrition indicator for children. In addition, we suggest only considering children above the age of 6 months to reflect the very distinct age pattern of anthropometric shortfalls which emerges between 4-6 months, deteriorates until about 24 months and stabilizes thereafter [see e.g. Wiesenfarth et al., 2012]. Households with children below 6 months might therefore erroneously be considered non-deprived, as the anthropometric shortfall has not materialized yet. We consider households deprived in the new nutrition indicator, if at least one out of five of the household's children between 6 months and 5 years are stunted.

For the mortality indicator, we only account for the death of children below the age of five in the past five years. The original indicator was a stock variable as it considered the death of any child in the household without age or time cut-off. The MPI is, however, supposed to reflect acute multidimensional poverty. A household is deprived in the mortality indicator if at least one out of five children in the household died in the past five years.

Finally, we also propose a new treatment for households without an eligible population. In the original MPI, households without an eligible population were considered non-deprived in the respective indicator. This reduced the chances of these households being considered multidimensionally poor. Our strategy follows a hybrid approach. First, we proxy malnourishment with adult BMI for households without children. Then, we substitute missing indicators with indicators from the same dimension, i.e. for households without children at school-age we double the weight on the education indicator. Finally, we rescale the overall cut-off k for households where both indicators in one dimension were missing. Households without an eligible population in both health indicators (mortality and malnourishment) can only be deprived in the education and standard of living dimension. We, thus, lower the overall cut-off (k) they face. These households are deprived if the sum of weighted deprivations is above $2/9$[35].

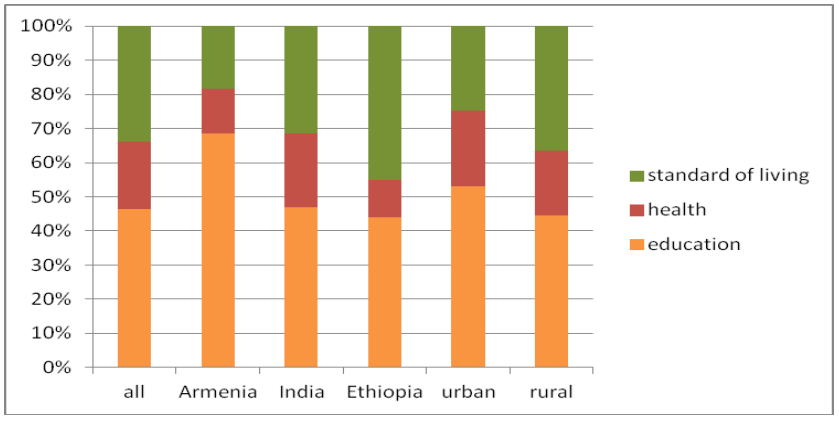
Applying our revised MPI measure, the intensity and incidence of multidimensional poverty is higher. The increase in the headcount of multidimensional poverty is strongest for small households and households in Armenia. Moreover, the poverty rate in large households is lower in the revised measure compared to the UNDP / OPHI estimation. Since we apply a hybrid approach

[35] $2/9 = 1/3 * 2/3$

TABLE 3.4: Revised multidimensional poverty estimation

	H	A	MPI
all	60.28%	61.46%	0.370522
urban	27.22%	55.57%	0.151271
rural	73.24%	62.89%	0.460657
small household	53.53%	59.77%	0.319907
medium-sized household	57.58%	61.70%	0.355257
large household	64.78%	62.89%	0.407391
female-headed household	59.98%	61.41%	0.368327
'older' household	57.44%	60.77%	0.349068
young household	60.02%	62.20%	0.373302
Armenia	2.96%	46.89%	0.013863
Ethiopia	92.25%	69.25%	0.638847
India	57.82%	60.37%	0.349068

FIGURE 3.1: Decomposition by dimension



for households without eligible population in some indicators, a sensible decomposition by indicator is no longer possible. Instead we decompose the MPI by dimension. Though poverty profiles differ by country and region, we observe that education contributes by far the most to multidimensional poverty. In contrast to that, deprivations in the health dimension contribute the least to being multidimensional poor. The increase in the relative contribution of education may to some extent be attributed to the change in the education indicator. In the original MPI, the household was non-deprived if at least one household member had five years of education. We however propose a more stringent criterion, considering households as non-deprived where at least 50% of household members had five years of education.

3.7 Severe Multidimensional Poverty

Alkire and Santos [2014] consider households to be severely poor, if they are deprived in more than 50% of the sum of weighted indicators. They thus define severity of poverty through an adjustment of the second cut-off. Hence, households need to be deprived in several dimensions to be identified as severely poor. We, however, suggest to define severity of poverty not only as multiple deprivations, but also to consider the frequency and intensity of deprivations within the

household. Hence, we adjust indicator cut-offs to identify a household as severely poor, rather than raising the second cut-off as Alkire and Santos do.

The way Alkire and Santos define the severely poor (raising the second cut-off) makes it harder to fall into severe poverty as several original MPI indicators are stock indicators (education, most of the original living standard indicators). Thus, the original severe poverty measure reflects chronic, severe poverty.[36] Moreover, it is nearly impossible for households without eligible population (i.e. without children) to be severely deprived as these households are considered non-deprived in some indicators already.

We propose a different route and adjust indicator cut-offs to identify the severely poor, but keep the overall cut-off of one third. A household is considered severely deprived in education if less than 20% of its household members have 5 years of schooling. Similarly, the household is severely deprived in enrollment, malnourishment, or mortality if more than 50% of its eligible household members are deprived in the respective indicator. Moreover, the household is deprived in assets if it owns no assets. Finally, a household is considered severely multidimensional poor, if the weighted severe poverty indicators sum up to one third. In our restricted sample over 40% of

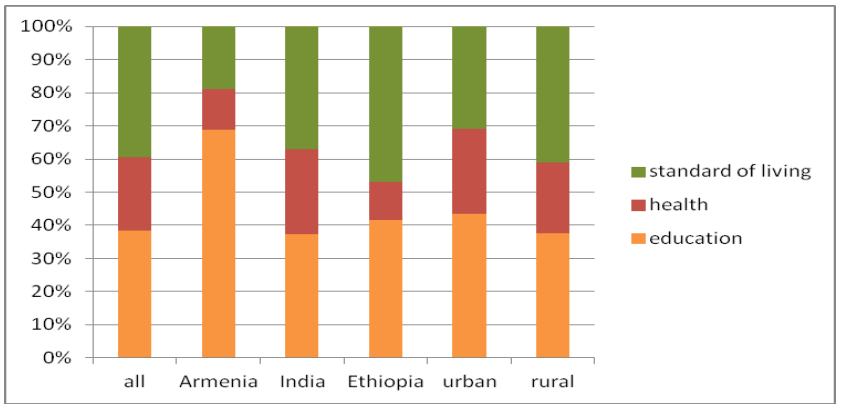
Table 3.5: Severe multidimensional poverty estimation

	H	A	MPI
all	40.29%	58.46%	0.235532
urban	12.06%	54.28%	0.065448
rural	51.38%	59.41%	0.305242
small household	36.76%	58.21%	0.213948
medium-sized household	38.17%	59.49%	0.227105
large household	42.92%	58.47%	0.250946
female-headed household	43.12%	59.89%	0.258286
'older' household	40.92%	58.87%	0.240913
young household	39.19%	58.97%	0.231063
Armenia	0.21%	44.79%	0.000959
Ethiopia	83.28%	65.45%	0.54512
India	35.70%	56.94%	0.203261

the population live in households, which are severely multidimensionally poor (cf. Table 3.5). Severe multidimensional poverty is more prevalent in rural households, large households, and female-headed households. In Ethiopia, most households that are considered multidimensionally poor may also be considered severely poor. This is not so much the case in India, were only around half of the multidimensional poor are also severely poor. In Armenia, less than 10% of the multidimensional poor are severely poor. The poverty profile of the severely poor is similar to the multidimensional poverty profile discussed above (see above Figure 3.1). However, deprivations in the living standards and health contribute more to severe poverty compared to multidimensional poverty (cf. Figure 3.2). Hence, health and the standard of living are more important in understanding severe multidimensional poverty.

[36] Though we still may observe movement out of severe poverty

FIGURE 3.2: Decomposition by dimension



3.8 Conclusion: Combining Conceptual and Empirical Proposals

The MPI is an interesting and highly relevant attempt to provide a multidimensional poverty measure that competes in depth and coverage with the widely used (and problematic) $1–a–day income poverty indicator. We strongly suggest that HDRO continues to use an MPI-type indicator in its future Human Development Reports. However, there are many open questions and issues regarding the conceptual underpinning and alternative formulations of the MPI. These issues need to be discussed and considered carefully. Among the issues we would flag particularly are the use of the union (instead of the dual cut-off) method for identification, and considering inequality in deprivations across people in the MPI (at least in some version of the MPI). We also believe that the headcount is in principle understood better and easier to communicate as a headline indicator, in contrast to the current product of headcount and intensity. Nevertheless, this should also be complemented with a measure that also considers intensity and inequality such as the one proposed by [Rippin, 2013] or a similar measure. These proposals (particularly concerning the union approach) would make more sense if, at the same time, changes in the empirical implementation were made to reduce the indicators used to a set which are of particular importance and are particularly well-measured.

In that vein, we propose a number of changes, including dropping the WHS as one of the data sources, dropping the BMI as a nutrition indicator, and changing the age ranges and cut-offs for the education and mortality indicators. We also recommend focusing on only three living standard indicators (water, floor, and assets). These changes would represent improvements over the current formulation; but we want to emphasize that one would need to investigate these in more detail to come to more definitive conclusions about them. In addition, we suggest tackling the important issue of households without an eligible population. In the current formulation, the poverty estimation may be biased as some households cannot be considered poor in the nutrition, mortality, and enrollment indicator.

3.9 Revisions made to the MPI in the 2014 Human Development Report

In the 2014 Human Development Report, HDRO presented a revised MPI that addresses some of the issues raised above. For ease of comparison, it also published the MPI using the previous method (that is also still used by OPHI) and presented data for changes in the MPI over time using the new approach. HDRO did not change the basic conceptual underpinnings of the MPI. The MPI still utilizes the dual cut-off approach as well as the product of headcount and intensity, and inequality is not considered. Thus, the conceptual issues raised here have not been addressed in the revision. These issues may require more discussion and analysis before such fundamental changes can be implemented. All the changes refer to the empirical issues and all tackle issues identified in the paper above (although sometimes deviating from our proposals in terms of solutions).

A first important change is that, as recommended here, the World Health Survey has indeed been dropped as the survey to track the MPI in countries without a DHS or a MICS. In China, the China Health and Nutrition Survey for 2009 has been used for the MPI calculation. This is a good (and more recent) substitute, although it only covers part of the country. In other selected countries, national surveys that contain the relevant information have been added.

There are more changes to the indicators and cut-offs, many of which relate to the discussion above. More specifically, in the health dimension, the childhood underweight indicator was replaced by a stunting indicator for the reasons outlined above. Moreover, the child mortality indicator now refers to deaths of children that occurred in the past 5 years, as suggested above. In the education dimension, the minimum years of schooling to be non-deprived was raised to 6 years (from 5). This issue was not identified here as a particular problem, but it appears to be a sensible change since it links the minimum years of schooling to completed primary education (which is six years in most countries). Furthermore, the MPI now considers late enrolment, as proposed above. Now a household is only deprived if the children 8-15 are not all in school (rather than 7-15), thereby allowing for late entry to schooling (by one year) that may not be a sign of deprivation. In the standards of living dimension, all six indicators were retained. The only change was that ownership of arable land and livestock is now included as possible assets in the asset indicator to better capture asset holdings in rural areas.

Lastly, HDRO also addresses the issue of the ineligible population that was also raised above. It picks up some of the suggestions made above and reweights information of indicators within a dimension. For households lacking information on both indicators in the health or education dimension (which affects a substantial share of households), HDRO chose a different route to the one proposed above. These households are now dropped from the sample, and the remaining sample is reweighted to make sure that it is still representative of the entire population. Essentially this implies that households without health information are now proxied by similar households (in terms of age and gender composition, as well as place of residence) that have this health information. Details on this procedure can be found in [Kovacevic and Calderon, 2014].

Overall, the changes made to the MPI all appear sensible. They address many of the issues identified in this paper and implement solutions that address the problems within the constraints of data availability. It would be best now to learn from the experience of these revisions over the

next few years and, in the meantime, consider tackling some of the conceptual issues raised in this paper to see whether they merit more fundamental revisions to the MPI.

Appendix

Table 3.6: Relative importance of households without eligible population – improved nutrition and mortality indicators

base	Nutrition (health)	Mortality (health)	Enrollment (education)
all	67.94%	11.82%	36.97%
Armenia	78.51%	15.45%	51.25%
India	66.35%	11.55%	37.90%
Ethiopia	76.38%	12.58%	24.38%
Old hh (above35)	85.30%	33.70%	38.24%

Table 3.7: Correlation coefficients between living standard indicators: Spearman (rank) correlation

	electricity	sanitation	drinking water	Floor	cooking fuel	assets
electricity	1***					
sanitation	0.3855***	1***				
drinking water	0.3196***	0.2205***	1***			
floor	0.5767***	0.4613***	0.3153***	1***		
cooking fuel	0.4524***	0.4855***	0.2837***	0.5668***	1***	
assets	0.4861***	0.4469***	0.2802***	0.4672***	0.4795***	1***

Table 3.8: Correlation coefficients between living standard indicators: Tetrachoric correlation

	electricity	sanitation	drinking water	Floor	cooking fuel	assets
electricity	1***					
sanitation	0.6870***	1***				
drinking water	0.5183***	0.4053***	1***			
floor	0.8336***	0.7011***	0.5191***	1***		
cooking fuel	0.8518***	0.6965***	0.5342***	0.8424***	1***	
assets	0.7440***	0.6693***	0.4710***	0.6728***	0.7147***	1***

Chapter 4

An absolute poverty measure in the capability space (and relative measure in the resource space): An Illustration using Indian DHS data

Abstract In this paper we develop a multidimensional poverty measure that attempts to capture absolute poverty in the capability space. While the measure aims to be absolute in the capability space, it is a relative poverty measure in the resource space. This measure adapts the poverty line to different living standards across time and countries in a concise and plausible way. This poverty measure utilizes the DHS surveys and is based on UNDP's global MPI measure. By using our measure, it is thus possible to estimate multidimensional poverty for a larger number of countries and to compare outcomes to the global MPI. We illustrate our concept using the example of Indian states. Similar to the global MPI, we apply the Alkire-Foster dual cut-off approach [Alkire and Foster, 2011*a*] and broadly follow the global MPI in the choice of indicators, weights, and overall cut-off. However, adaptable indicator thresholds are considered when appropriate. We argue that global MPI indicators in the health dimension are not open to a relative assessment, as they reflect specific health functionings (i.e. being well nourished). In the education and standard of living dimensions, we set indicator thresholds at the median of the reference population. Living standards and the necessary levels of education may vary across societies and are influenced by the environment, culture and customs. Applying the global MPI one observes the living standards contribute the most to multidimensional poverty in poorer countries. Our adaptable measure can better reflect these varying needs across societies.

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4.1 Introduction

The measurement of monetary poverty strongly differs across countries: While absolute monetary poverty lines are typical for poverty measurement in developing countries, the concept of relative poverty is popular in richer countries. Relative income poverty lines are prevalent across Europe and the concept of relative poverty is generally accepted as more appropriate for advanced economies. These strongly relative lines are usually set at a fixed proportion (e.g. 40% –60%) of the mean or median income and try to account for a certain cost of social inclusion [cf. Ravallion and Chen, 2011, for examples]. Recently, Ravallion and Chen [2011] have also proposed a weakly relative poverty line for developing countries. This poverty line lies between a fixed absolute line such as the international $1.25 a day line, and a purely relative one, such as the ones just discussed. By applying a weakly relative poverty line, the income poverty threshold is under proportionately adjusted to an increase in mean incomes.

In addition to monetary poverty lines, there has been a (re-)emergence of multidimensional poverty and deprivation measures in recent years. The most well-known example is probably the UNDP's global multidimensional poverty index (MPI). This measure has been used to calculate multidimensional poverty for over 100 (mostly developing) countries and allows us to compare multidimensional poverty outcomes across the world; it is an absolute concept in the sense that the poverty cut-offs applied do not differ across space or time.

In addition, several country-specific and region-specific multidimensional poverty measures have been developed for (among others): Buthan [Alkire, Dorji, Nahmgay and Gyeltshen, 2014, Santos and Ura, 2008], Colombia [Salazar, Roberto Carlos Angulo Díaz and Pinzón, 2013], Afghanistan [Trani et al., 2013], Germany [Busch and Peichl, 2010, Rippin, 2013], and the EU [among others: Alkire, Apablaza and Jung, 2014, D'Ambrosio et al., 2011, Guio et al., 2009, Whelan et al., 2014]. These different multidimensional poverty measures co-exist side by side and usually the lines are more generous in richer societies. Even if they use the same methodology (i.e. the Alkire Foster dual cut-off approach, see below), it is impossible to compare poverty outcomes as these measures use different datasets and/ or indicators.

While the use of relative poverty lines (in richer countries) is well-documented in monetary poverty measurement, this is not the case for multidimensional poverty measurement. Most multidimensional poverty measures are considered as absolute measures, applying identical thresholds across groups and time. This is in line with Sen's idea that "*absolute* deprivation in term's of a person's *capabilities* relates to *relative* deprivation in terms of commodities, income and resources" [Sen, 1983, p.153]. Sen postulates that there is a place for measures of relative deprivation as long as we measure commodities, rather than capabilities or functionings. While we should aim to measure an absolute notion of poverty in the capability space, such as "being well-nourished" or "going without shame", this may well translate into a relative threshold in the commodity space. He points out that there are enormous differences in the fulfillment of the most basic capabilities across societies (and to some extent even within), such as being educated or meeting nutritional requirements.

Ideally, multidimensional poverty measures would directly measure available capabilities and functionings. However, this is rarely the case. While it is relatively straightforward to measure functionings in the broad sphere of health (e.g. being well-nourished, no considerable health impairment), this is more difficult in the area of living standards and education. Hence, most

indicators used in multidimensional poverty measurement are rather means than ends (sometimes both). As a result, it might be important to consider adaptable or "relative" versions of such multidimensional poverty measures. If multidimensional poverty indicators do not measure functionings directly, the available indicators in the commodity and resource space need to be adapted to varying requirements across societies. In this paper we develop a multidimensional poverty measure that reflects differences across societies to fulfil specific basic functionings. We aim to measure absolute poverty in the capability space, realising that this may translate to varying indicator thresholds across societies.

The adaptable poverty measure developed in this paper can account for varying needs across countries due to different environments, customs and culture. The global MPI finds the standard of living dimension contributes the most to overall poverty in the majority of countries, all of them with high levels of poverty. In 20 of these countries the standard of living contributes even more than 50% to overall poverty. In contrast to this, countries with a low poverty incidence report a lower contribution of the living standard to overall poverty [Alkire and Santos, 2014]. Applying identical thresholds in this dimension has, however, the least motivation; needs in this dimension to fulfil the same basic functionings vary strongly around the world. Applying our adaptable poverty measure we can better account for these differences and find the three poverty dimensions contribute similarly to overall poverty for the example of India.

If we take a relative approach to poverty measurement, the questions as to why we need a multidimensional approach at all and whether existing money-metric relative approaches would not suffice may arise. While few would argue against the notion of multidimensionality of poverty, an important strand in the literature believes money-metric approaches do a fair job in capturing the absolute needs in the capability or functioning space [cf. Ravallion, 2011].

However, there are good reasons as to why we should capture poverty through several indicators: First, prices are usually not available across all relevant dimensions of poverty [Alkire et al., 2011]. The quality of life of a person depends on various non-market goods, which are difficult and sometimes impossible to price. These include the epidemiological atmosphere, access to public goods, or the public provision of various services (e. g. school, health, counselling). Moreover, assessing poverty through several dimensions may provide a more consistent representation of poverty, as subjective feelings of poverty also depend on poverty experiences in the past and future.[1] These can arguably be better represented by the observed living standard, health, and also education (as this may affect future earnings and overall health).

In this paper, we review the existing literature on relative multidimensional poverty measures. Several different approaches exist, however, thresholds in these measures have often been chosen rather ad hoc and without a thorough theoretical justification. We try to develop a more structured, general concept of relative multidimensional poverty that aims to reflect Sen's statement above.

In principle, our concept is applicable to different indices and data sets. For the exercise at hand, we apply it to the Demographic and Health Survey (DHS) for India. This allows us to directly compare our measure to the global MPI. Expanding on the example of India, one could apply this adaptable poverty measure to all countries where DHS surveys are available and thus measure global multidimensional poverty in a concise and comparable way.

India poses an interesting example for the exercise at hand. One can adapt the poverty line to

[1] Most expenditure survey use recall periods of two to four weeks.

different circumstances across states, urban and rural areas. We observe vast differences across states when the global MPI is applied: In Kerala only 15.9% of the population is multidimensional poor, while 81.4% are poor in Bihar [Alkire and Santos, 2010]. Due to the sheer size of India, living conditions, climate, and ethnicities differ vastly across states. Thus, India is a good example to illustrate the effect an adaptable poverty measure has on absolute poverty outcomes. Following the construction of the global MPI, we consider three equi-weighted dimensions in multidimensional poverty measurement: health, education, and the standard of living. We also apply the Alkire-Foster dual cut-off method of poverty aggregation [cf. Alkire and Foster, 2011*a*]. The Alkire-Foster method first applies a cut-off at the indicator level (e.g. BMI below 18.5). Deprivations in each household are then aggregated using weights, and a second cut-off is applied to each person's deprivation score. People are identified as multidimensionally poor, if they fall below this second poverty threshold: in this case, if they experience deprivations in one-third or more of the weighted indicators.

Though this method is not without critics [cf. among others: Ravallion, 2011, 2012, Rippin, 2013, Silber, 2011], it is currently one of the most commonly used methods in multidimensional poverty measurement. It is also the method applied in the most well-known example of multidimensional poverty measurement, the UNDP's MPI. Among its many theoretical merits, it also has the advantage that it produces a clear, policy-relevant headline figure.

When devising an adaptable poverty measure, one could either apply a relative approach at the indicator level, raising the cut-off for not being poor, or lower the second threshold of multidimensional poverty. In this empirical exercise, we stick to the global MPI for the second cut-off of one third to qualify for multidimensional poverty. However, adaptable cut-offs are applied at the indicator level, as discussed in detail below. We follow the UNDP's global MPI in the choice of weights and indicators [Alkire and Santos, 2014, Kovacevic and Calderon, 2014]. We then generate three adaptable poverty measures capturing absolute deprivation in the functioning space: one uses the whole country as reference group, another uses the state as reference group, while the third allows for different urban and rural poverty lines within the state.

Poverty outcomes for the example of India differ vastly, depending on the poverty measure we apply. All adaptable poverty measures find a higher poverty incidence than the global MPI (55.53%). We observe a lower poverty incidence, the smaller the reference group. Our preferred specification allows for different thresholds in urban and rural areas within each state. Applying this measure, we find a poverty incidence of 57.94%. However, as we observe a lower poverty intensity for this poverty measure, the resulting M0 measure lies below the global MPI (global MPI: 0.282, adaptable MP: 0.261). Poverty outcomes appear reasonable, as they do not exaggerate poverty in better-off states, such as Kerala, or underestimate poverty in poorer states. The poverty distribution across different household types is similar across the different poverty measures. However, the adaptable poverty measures find a more equal contribution of the different poverty dimensions to overall poverty. This contrasts to the global MPI, where deprivations in the standard of living contribute the most to overall poverty. Finally, the adaptable measures appear to account better for the incidence of urban poverty.

In the next section, we will review the existing literature on multidimensional poverty measures in EU countries. This is followed by a discussion of different possibilities to adjust a multidimensional poverty measure. In Section 4, we shortly describe the structure of the UNDP

Multidimensional Poverty Index. Section 5 presents our application of an adaptable multidimensional poverty measure for India and compares poverty outcomes to the global MPI. In the conclusion, we summarize our results.

4.2 Multidimensional Poverty Measurement

Early examples of multidimensional poverty measures have been provided by Booth [1894, 1903], Rowntree [1901], and Townsend [1954, 1979] for the United Kingdom. In the 1950s, the use of monetary poverty lines became popular. Mack and Lansley' s book and the accompanying television show "Poor Britain" [Mack and Lansley, 1985] re-directed public and academic interest to the so-called direct or primary method of poverty measurement.[2] Amartya K. Sen's work on the capability approach provided a theoretical justification for this approach [e.g. Sen, 1980, 1987, 1999*a*]. He departs from the welfarist, utility-based approach of measuring poverty and suggests focusing on a person's capabilities. Certain commodities may enable an individual to achieve certain functionings, for example, a certain amount of food will make the individual capable of achieving the functioning "being well nourished". These capabilities differ across individuals for a given commodity attainment, as a certain amount of food may feed one individual sufficiently but leave another one hungry. Since these capabilities or functionings cannot be reduced to a single number or dimension, it is important to consider multiple dimensions of well-being when examining whether an individual or household is poor in the sense of being deprived in basic capabilities.

Following Sen, multidimensional poverty measures have been proposed for several countries in different formats [among others: Bourguignon and Chakravarty, 2003, Klasen, 2000, Majumdar and Subramanian, 2001, Qizilbash and Clark, 2005]. The most prominent example is certainly the Multidimensional Poverty Index (MPI) introduced by UNDP and Oxford Poverty and Human Development Initiative (OPHI) in the 2010 Human Development Report. It was the first attempt to calculate a concise and comparable multidimensional poverty measure for a larger number of countries (104) utilizing DHS, MICS, and WHS surveys. Our adaptable multidimensional poverty measure will build upon the MPI and we will compare our results to it.

Multidimensional Poverty Measures in richer countries In addition to creating multidimensional poverty measures for developing countries, several authors have also developed deprivation and poverty measures for richer countries and regions, such as the EU. Since measures of relative monetary poverty are usually applied in these countries, we will analyse how existing multidimensional measures could be adapted to varying living standards and customs. Some of these multidimensional measures are explicitly deemed relative, while others adapt to varying living standards in more implicit ways or do not aim to do so at all. The following review of the existing literature is only exemplary and by no means exhaustive. Though there also exist several interesting aggregate measures adapting to different customs and living standards, we only focus on individual and household-level examples.

Nicole Rippin [2013] creates a multidimensional poverty index for Germany and compares the

[2] In contrast to the indirect or secondary method of poverty measurement through income or consumption expenditure.

results to the at-risk-of-poverty (AROP) rate (60% of median income) and a subjective poverty index. She utilizes the German Socio-Economic Panel and mainly applies objective indicator thresholds aligned with the existing minimum legal requirements in Germany. Her index includes 13 indicators, among them socially necessary amenities in housing, income disposable below breadline, and 2 subjective health indicators. She develops two indices with different weighting structures: one applies equal weighting, while for the other prevalence weights are applied. The correlation between those two indices is high[3] and the ranking of different German states hardly changes. In the observed period (2002-2010) the multidimensional poverty headcount fluctuates around 3%. Although in her example only the value of the breadline changes over time, this example is in general open to a relative assessment of poverty as legal requirements may differ across countries and time.

Another example for Germany has been provided by Busch and Peichl [2010]. They use the same data set and create a poverty index including adjusted household income (threshold 60% of median income), number of years of education (threshold 9 years), and satisfaction with health status (range of 1 to 10, threshold at the median). They estimate multidimensional poverty in Germany for the years 1985 to 2007, and find that poverty peaked in 1991 at 8.9%. The lowest poverty incidence is found in 1999 with 6.4%. In contrast to Rippin, their poverty measure varies significantly across time. In addition, their indicator thresholds also vary strongly, as all but the education threshold are set at the median.

Halleröd et al. [2006] develop a relative material deprivation index for Britain, Finland, and Sweden. They consider a total of 57 consumption items and activities. The lists of items differ across countries. They develop so-called possession weights, similar to prevalence weights,[4] for the different countries, six different age groups, and households with and without children. The resulting index is comparable across countries and groups within the population, but accommodates different needs and customs across reference populations. The index is relatively unique in the sense that it allows for a multitude of different reference groups. The distribution of their deprivation index is similar across countries, though in Finland a larger fraction of the population has a high deprivation score. The authors argue that the economic situation in the three countries is similar and therefore these results are as expected.[5]

In an earlier paper, Hallerod [1995] applied a similar strategy and developed a deprivation index for Sweden. He builds on Mack and Lansley [1985] and applies consensual weights. The weights are adjusted to differences in preferences between women and men, age groups, household types, and geographic regions. He calibrates the overall multidimensional poverty line on Sweden's relative income poverty line (50% of mean income), so both poverty measures find that 21.3% of the population is poor. Those deprived in both measures are defined as being truly poor.

Bossert, Chakravaty and D'Ambrosio [2013] develop a measure for material deprivation for EU countries. They consider 10 binary indicators capturing material deprivation, and apply consensual weights based on information from the 2007 Eurobarometer survey. Identical weights are considered across the EU, though consensual weights may well differ between countries and sub-populations. Comparing equal and consensual weighting structures, they observe similar

[3] Sperman Rank correlations range from 0.9979 to 0.9982 for 2004.

[4] The weight is determined by the percentage of people wanting, but not having an item. This is in contrast to usual prevalence weights, which only have information on possession of items but not the wish to own it.

[5] However, other studies find that in the Nordic countries multidimensional poverty is usually lower than in the UK due to a more generous social service system [cf. among others: Alkire, Apablaza and Jung, 2014, Bossert et al., 2013, Guio, 2009, Whelan et al., 2014].

outcomes regarding the material deprivation ranking of countries. However, the results are sensitive to the choice of weights for Austria, Estonia, Iceland, and Spain.

Anne-Catherine Guio [2009] develops a material deprivation index for Europe using information on nine discrete items. She applies different weighting schemes (equal-weighted, consensus-weighted, prevalence-weighted) and illustrates the use of a relative, country-specific overall poverty cut-off (300 and 320 percent of the mean weighted deprivation index for each country). She finds that adopting such a relative national threshold hides the existing deprivation diversity across member states. When a relative overall cut-off is applied, the most deprived member states (Poland, Lithuania, Latvia, Slovakia, Hungary, and Cyprus) show the lowest poverty rates.[6] This is due to the fact that in poor countries a large part of the population suffers from various deprivations and is located close to the mean. For the lesser deprived member states, she observes higher poverty rates (e.g. for Luxembourg we observe poverty rates between 8.9% and 19.8%).

She also compares nationally-set and EU-set weights: By applying national and EU prevalence weights, she observes significant differences in the mean index for the poorest countries. National prevalence weights give less importance to the most commonly self-possessed items. Although consensus weights can also vary a lot between countries, the effect on the mean index is less pronounced. For the less deprived countries the choice of weights has little effect, as the different weights are close to equal weighting. Guio also argues, that access to some items has the same normative value across countries. In this case, the equal-weights approach is preferable.

D'Ambrosio, Deutsch, and Silber [2011] utilize the third wave of the European Panel (ECHP) to estimate multidimensional poverty in Belgium, France, Italy, and Spain. They consider a total of 18 ordinal or binary indicators and compare results for the fuzzy approach, the information theory approach, and the axiomatic approach. For the latter, they apply relative thresholds at the indicator (half the mean value of the indicator), aggregate using equal weights, and apply a second relative threshold at the aggregate index (individual is poor, when aggregate index is above 75th percentile). They thus assume, that 25% of individuals are poor in each country. The main objective of the paper is to analyse the overlap in poverty outcomes between the three different approaches. Nevertheless, one can easily see from this example that such a fully relative approach does not provide a lot of meaningful information, as we observe identical poverty outcomes across the four countries.

Whelan, Nolan, and Maître [2014] analyse multidimensional poverty in the EU in 2009. Their multidimensional measure consists of four dimensions with ordinal and binary indicators, and the AROP rate of each country.[7] Within dimensions, they apply prevalence weights across the range of countries and aggregate across dimensions using equal weights. They calibrate dimensional thresholds using the EU at-risk-of-poverty rate. Dimensional thresholds are chosen, so the EU dimensional headcount comes as close as possible to the EU AROP measure (15.7%). Multidimensional poverty outcomes range from 6.7% for Iceland to 59.2% for Romania. In contrast to the AROP measure, multidimensional poverty varies strongly across countries and is in line with average income levels.

Alkire, Apablaza and Jung [2014] have recently developed a multidimensional poverty index for

[6] She observes poverty rates as low as 0.2% for Cyprus and Poland.

[7] They apply factor analysis to identify six dimensions, but end up using only four due to missing data and the effect of location on some indicators.

the EU. It is an individual poverty measure, considering adults (above 16) as unit of identification. They develop 3 measures with different nested equal-weighting schemes that all include the same 12 indicators. Indicators include, the AROP rate (60% of national median), employment in the household, material deprivation, whether the respondent has completed primary education, four indicators capturing the standard of living / environment, and four indicators on health assessment. They define a person as being poor if he/she is deprived in more than one dimension or the equivalent sum of weighted deprivations drawn from several dimensions. Observed country rankings are similar across the three measures, thus the measure is relatively robust to varying weighting structures. The only indicator threshold varying across countries in this measure is the AROP rate. Nevertheless, indicator thresholds could also be adjusted for education or material deprivation.

This review shows that there are different ways to adapt a poverty measure to varying living standards across countries and time. One can calibrate the multidimensional measure on a relative income poverty line, one can apply relative thresholds at the indicator or aggregate index (based on the median or mean), or one could change the weights in the aggregation process. In the following section, we will discuss these different possibilities and develop a concept of an adaptable multidimensional poverty measure.

4.3 Considerations for a multidimensional poverty measurement

By applying the dual cut-off method in the poverty estimation, relative considerations could enter at different stages. The choice of indicators, indicator thresholds, weights in the aggregation process, and the overall cut-off could all be adapted to different living circumstances across societies.

4.3.1 Choice of dimensions and indicators

The choice of capabilities and indicators will to some extent be predetermined by the survey design and availability of data. Alkire [2002] provides a survey of dimensions of human development defined by researchers in psychology, anthropology, and philosophy. While she does not provide a synthesis list, she argues dimensions should be non-hierachical, irreducible, and incommensurable. In addition, Sen has suggested focusing on dimensions that are social influence-able (public policy focus), and are of special importance to the society in question [Sen, 2004].

The dimensions identified in most multidimensional poverty measures are health, education, and the standard of living. These appear to be of importance to all societies around the world. While other dimensions of human well-being may be of equal importance, there is often no data available within household surveys and / or the dimensions are not social influence-able. Few, however, will dispute the importance of these three most basic dimensions of human development. For multidimensional poverty comparisons, indicators within dimensions should be identical across populations. Indicator choice should avoid overlap, and is often dictated by data availability (least number of missing values). The choice of indicators may be refined using statistical techniques, such as exploratory factor analysis.

4.3.2 Choice of weights

Different weighting schemes have been proposed in the literature. Authors have suggested weights determined by multivariate techniques, consensual weights, prevalence weights and equal weights. While there is much merit to statistical techniques, such as factor, principal component, or cluster analysis, the resulting weight structure is often difficult to comprehend for the end user (the lay public, politicians). The overall poverty index can only be used to rank households in the population, but an intuitive interpretation of who is deemed poor is more difficult. In practice, a strongly relative approach is followed and the bottom percentiles are identified as poor. This may, however, make resulting poverty comparisons across populations meaningless, as the examples by D'Ambrosio et al. [2011] and Guio [2009] showed above.

For determining **consensual weights**, individuals are asked whether owning a specific item or taking part in a specific activity is considered "necessary". The advantage of these weights is, that they are non-paternalistic and very open to cultural differences. This is, however, limited to the items in the questionnaire as there are usually no open questions. Nevertheless, these measure suffer from certain disadvantages: First, having foregone certain comforts for a while, the poor may adapt to a certain kind of living and consider this as being the "new normal" and not a necessity. For example, they may get used to having only one meal per day. Another disadvantage is that the non-poor in the society determine what should be relevant for the poor without knowing their specific living situations. Mack and Lansley [1985] found that the voting behavior of the middle class differed strongly from the voting of the poor for certain items, such as TV or cigarettes. The poor deemed these items as absolutely necessary, as they provided the only distraction in their otherwise miserable life and would rather forego other comforts (regular warm meals, decent living circumstances) to be able to keep those items. The middle class, however, cannot fully comprehend the living circumstances of the poor and therefore attach a lower importance to these items. Similarly, a car may be a necessity if the poor live in areas with limited public transport possibilities or have limited mobility. The final issue with such an approach is that such a list needs to be updated regularly to truly reflect the importance of different items in a society.

Prevalence or frequency weights are another popular example. These weights can reflect the importance of owning a specific item in the society. They can thus capture two aspects: a sense of "belonging" to the society because you own the same items (e.g. a TV); and the way a society may be adjusted to certain needs of an individual. For example, in a society where only few people own a washing machine at home, public launderettes are common while it may be difficult to find one in a society where many people have washing machines at home. Similarly, it is less important to own a refrigerator in a society where few people do, because small shops selling perishable goods are more frequent and these goods are sold in smaller quantities.

One issue with prevalence weights is that these weights are only applicable to dichotomous items in the survey. Though ordinal or cardinal indicators can also be converted to binary indicators, this includes a potential loss of information. Applying prevalence weights may also lead to perverse and unintended weighting structures. Analysing multidimensional poverty for Italy in 1995, Brandolini and D'Alessio [1998] found that 19.5% of the population were deprived in terms of health, and only 8.6% were deprived in education. This would lead to education receiving a weight more than twice as high than that of health. Finally, prevalence weights give

less importance to the most common non-possessed items, though these may nevertheless have a high normative or cultural value in the society.

Several researchers resort to applying **equal weights**. This assumes all dimensions or indicators are equally important and no overlaps are observed. One of the advantages is that this structure is easy to comprehend and makes it simple to decompose poverty into the different dimensions. If the choice of dimensions actually follows Alkire's suggestion [Alkire, 2002] of being non-hierachical, irreducible, and incommensurable, equal weighting across dimensions is also the most appropriate structure. Nevertheless, a different weighting structure may be appropriate *within* dimensions.

4.3.3 Choice of indicator threshold

In order to apply the dual cut-off method in multidimensional poverty measurement [Alkire and Foster, 2011*a*] one has to define a poverty line at the indicator and an overall cut-off at the aggregated deprivation index. Both could be adapted to varying circumstances across societies. At the indicator level, one first has to determine whether the available indicator can capture a specific functioning or if indicators are rather just means to a specific end. Following Sen [1983], we argue indicator outcomes may also enable an individual to achieve certain functionings. In the latter case, one would need to adapt indicator thresholds across societies. Health indicators usually belong to the former category, as they reflect specific health functionings (e.g. being well-nourished, being in good health). Additionally, average health levels in the society should not affect the assessment of the individual's health status for ethical reasons. An individual with a poor health status ought to be considered deprived, irrelevant of the health status of other individuals in the society. In the case of the global MPI indicators, health indicators clearly represent functionings. Whether an individual may be considered as being well-nourished should not depend on the prevalence of undernutrition in the rest of the society. Sen [1998] also persuasively argued for mortality as a functioning.

Adaptable thresholds may, however, be appropriate in the education and standard of living dimensions. While education could also be regarded as a goal in and of itself,[8] the role of education for social integration and being without shame likely depends on the local environment [9]. Education outcomes enable the individual to achieve certain functionings, such as taking up a fulfilling and well-paid job, or participating in civic society. The capability of an individual to do so will depend on his / her characteristics and on average achievement levels in the rest of the society.

Take the example of participation in civil society: one may argue that a certain level of education enables civic participation. However, media, public administration, etc. usually do not cater to the least educated member in the society, but at best to the average member. Similarly, a minimum education that may be sufficient in a poorer developing country would not generate certain job prospects in a richer developing or developed country. Such a relative view of education is even more relevant if education is mainly a signalling device of ability, rather than an absolute measure of human capital [cf. Pritchett, 2001, Spence, 1973].

[8] Sen [2003] argues, illiteracy and innumeracy are forms of insecurity

[9] In the same speech, Sen [2003] argues that most aspects of education depend on a gap in education within communities (among groups and genders). Illiterate people then have problems to invoke their legal rights or participate in the political arena.

The standard of living of an individual is defined through the availability of various resources. A sufficient standard of living enables you to have a healthy lifestyle and gives you social acceptance. Allowing for slight differences due to different degrees of urbanization and a different climate, one could argue that the same lifestyle may be healthy across countries. However, the question of social acceptance is inherently relative and outcomes differ vastly across and within countries. It thus seems reasonable to realign poverty thresholds for these indicators to levels in the rest of the society.

After deciding which dimensions will be examined in a relative fashion, one needs to discuss how to do so. Several authors use legal requirements or policy goals. Examples include Rippin [2013] for Germany, or Alkire, Apablaza and Jung [2014] for Europe. However, legal requirements are slow to change. They may be too low or too high, and thus may have little meaning. These requirements may reflect policy priorities, not necessarily priorities in the population. In addition, these thresholds may be difficult to compare across countries and time.

Take the example of education in Germany: The legal requirement is nine years of schooling. However, simply visiting school for nine years and leaving without a degree may not be enough to succeed in the German society. Thus, the legal requirement may be too low as a threshold. In contrast to this, several least developed countries have now introduced compulsory primary schooling. While this significantly increased enrolment rates, this does not translate to universal schooling in the whole society. Sending children to school is still a financial burden on the household and schools in rural areas are scattered and far apart. In addition, most adults have not benefited from this policy. The legal requirement (four to six years of schooling) in these countries may be rather ambitious and won't reflect actual levels of schooling in the society. Thus, education levels that are below the legal requirement could give individuals a relative advantage.[10] We therefore refrain from using legal requirements in this paper.

Some authors have simply adopted relative thresholds from income poverty measurement, e.g. a fraction of the mean or median [D'Ambrosio et al., 2011, Guio, 2009]. This is clearly not appropriate for ordinal variables. Though one may use the median as threshold, a fraction of the median is not appropriate as this also imposes a cardinal structure onto an ordinal variable. Given the ordinal nature of the variables, only the mode or median are appropriate as indicator thresholds. We do not recommend using the mode, as one very often comes across bi-modal structures in which it is usually far from clear which mode to choose in these situations. In the following application, we will therefore use the median as the indicator threshold.

4.3.4 Choice of poverty line

After aggregating deprivations across indicators using weights, one has to choose the cross-dimensional poverty line applied at the aggregated poverty index. It differentiates between those parts of the population who are "simply" deprived in one or two indicators and those that are actually considered poor. One can either choose this threshold on normative grounds or apply a fully relative poverty line.

The latter has been illustrated by Guio [2009] for the example of Europe. She found that adopting such a fully relative national threshold hides the existing deprivation diversity across member states (see above). More importantly, it is not clear how such a relative overall threshold would

[10] Nevertheless, universal primary schooling is an important goal in itself.

be justified. One can justify a relative income poverty line or indicator threshold by arguing that relative deprivation in certain indicators will translate into absolute deprivation in the realm of functionings [cf. Sen, 1983]. However, this argument is meaningless for the aggregate poverty index.

We hence argue for applying an absolute threshold to the aggregate index. Due to the construction of the MPI with three equally weighted dimensions, a poverty line of one third equals being deprived in one of the three dimensions. An individual deprived in either health, education, or the living standard (reflected through several indicators) is therefore considered to be absolutely deprived in the capability space. Whether an individual is deprived in either dimension or indicator is, however, open to a relative appraisal. We argue that this is a more appropriate way to address the relativity in the resource space implied by Sen's 1983 paper cited above. Whether an individual is considered capability-deprived in a certain indicator depends on accepted standards of that indicator in the society or community. This is appropriately captured by changing the indicator cut-offs, instead of lowering the second multidimensional poverty cut-off of one third. This is also the implicit message when comparing indices of (absolute) multidimensional poverty in rich and poor countries where the cut-offs for individual dimensions seem to be higher in wealthier societies or different indicators are chosen altogether.

4.3.5 Choice of reference population

Finally, one has to choose the appropriate reference population. This choice will depend on the context of the analysis and data availability. The group size needs to be big enough to give statistically reliable poverty estimates. How narrowly one should define the reference population is open to debate. Ravallion [2008] argues, "neither psychological, nor economic theories of relative deprivation offer much insight into who constitutes the relevant comparison group.". Research usually focuses on neighbours, coworkers, and friends, but relevant comparison groups may enlarge with access to media [cf. Lohmann, 2015]. Relative income poverty lines are usually set at the national level. Sometimes a differentiation between urban and rural areas is made.

In the multidimensional poverty analysis we observe various approaches. Some researchers set thresholds and weights at the subnational level [cf. Bossert et al., 2013, D'Ambrosio et al., 2011], while others focus on different countries [cf. Whelan et al., 2014] or groups within countries. One extreme example is provided by Hallerod [1995] for Sweden, who adjusts weights to differences in preferences between women and men, age groups, household types, and geographic regions.

Age cohort effects may also be important: Alkire, Apablaza and Jung [2014] find striking differences across age cohorts in health and education. A similar observation is made by Brandolini and D'Alessio [1998] who consequently adjust the education threshold, and apply the level of compulsory education for each cohort as threshold. However, the observation of differences across groups should not automatically lead to variable thresholds. While different outcomes may to some extent reflect different needs, this may also be evidence of existing deprivations.

> *"the dramatic increase in the level of literacy needed for everyday life - from filling forms for public utilities to complying with tax reports, from understanding the working of house appliances to using the transport system - points at an important absolute dimension;"* [Brandolini and D'Alessio, 1998]

A too narrow focus may therefore result in overlooking actual poverty.
In monetary poverty measurement, relevant reference groups are defined at varying geographical levels. As we observe varying prices across and within countries, absolute monetary poverty lines are adapted to those varying prices. For the example of India, different urban and rural poverty lines are estimated by the National Planning Commission. These lines are then adapted to varying prices across states [Planning Commission, 2013]. Thus, for India, we follow this tried-and-tested approach and set poverty thresholds at the state and urban/rural level. We compare this to thresholds at the country and state level.

4.3.6 Summary

In summary, we suggest choosing indicators in the three most basic human dimensions of well-being: health, education, and the standard of living. As these dimensions are non-hierarchical and do not overlap, equal weighting across dimensions is appropriate. Within dimensions though, different weighting structures may be suitable. As we use the DHS dataset and aim to compare our resulting measure to the global MPI, we use the global MPI indicators.
We also argue for applying an absolute threshold to the aggregate index. Constructing the multi-dimensional poverty measure with three equally weighted dimensions, the threshold of one third equals being deprived in one of the three dimensions. An individual deprived in either health, education, or the living standard (reflected through several indicators) is therefore considered to be absolutely deprived in the capability space. In contrast, a strongly relative poverty line may hide existing deprivation diversity across different groups.
Whether an individual is considered capability-deprived in a certain indicator is, however, open to a relative appraisal and depends on accepted standards in the community. We set indicator thresholds in the education and living standard dimension at the median, to capture varying requirements needed to achieve the identical functioning across communities. This accurately addresses the relativity in the resource space implied by Sen's 1983 paper. Hence, this approach enables us to measure absolute multidimensional poverty in the capability space through various indicators.
We expect poverty outcomes across the different Indian states will approximate each other; poverty outcomes in the poorer states will be lower and poverty outcomes in the states with initially lower poverty incidence may be higher. For our preferred specification with varying thresholds across urban and rural areas within the state, the poverty outcomes in urban and rural areas should also align each other. However, poverty outcomes will still differ significantly across states and places of residence, and the ranking is not expected to change too much. This differs to the outcome one would expect when applying a relative monetary poverty line. While inequality among the reference population will certainly gain in importance, this will be to a lesser extent than with a comparable monetary measure.
Several factors interact here: First, the overall cut-off is not chosen on relative grounds. Choosing the overall cut-off on relative grounds, the resulting measure would return similar poverty outcomes across the different states hiding the existing diversity among them. Secondly, we keep the original health thresholds as the indicators reflect direct health functionings. Hence there is still an absolute component to this adaptable poverty measure. Moreover, the indicators assessed in a relative fashion are bounded, contrary to consumption or income. In addition, inequality in

the education indicators is generally lower than for income [Harttgen and Klasen, 2011].
For the case of India, we also observe more inequality in the states with high initial multidimensional poverty (such as Uttar Pradesh) and less inequality in the states with low initial multidimensional poverty (such as Kerala). Thus the ranking should not change to large extent; inasmuch as the relative appraisal would assimilate poverty outcomes, the influence of inequality will ensure poverty outcomes in the initially poor states are still high. This last point is, however, unique to the example of India; high multidimensional poverty outcomes do not naturally imply a high inequality among the multidimensional indicators.

4.4 The Multidimensional Poverty Index

The MPI is an index of "acute multidimensional poverty" and reflects deprivations in core human functionings and rudimentary services. It has been developed by Alkire and Santos [2014] for the 2010 Human Development Report and applies the Alkire-Foster dual cut-off method [Alkire and Foster, 2011*a*] for poverty identification. For the 2014 Human Development Report, UNDP has slightly updated the indicator definitions and adjusted the weighting structure to account for households with missing information or non-eligible population (i.e. no children or women between 15-49) [cf. Kovacevic and Calderon, 2014].
The Alkire-Foster method employs two cut-offs: First an indicator cut-off is applied to identify those who are poor in the specific indicator. Then poverty across dimensions is aggregated using indicator-specific weights, and the second cut-off is applied to this aggregated poverty index identifying the multidimensional poor. The Alkire-Foster method therefore navigates between the traditional approaches of multidimensional poverty measurement, the intersection approach (where only those who are deprived in each dimension are multidimensionally poor) and the union approach (where one is considered multidimensionally poor if one is deprived in any dimension).
Although, this method has also been criticised, it is widely used in multidimensional poverty measurement. Moreover, it is applied in the most well-known example of multidimensional poverty measurement, the UNDP's MPI. Among its many theoretical merits, the Alkire-Foster method also has the advantage of producing a clear, policy-relevant headline figure. Our empirical application of a relative multidimensional poverty measure thus builds upon this method.
In the global MPI, poverty is aggregated using the M0 Alkire-Foster poverty index, accounting for the incidence of multidimensional poverty (H) and the average deprivation share among the poor (A). The M0 poverty measure fulfils several desirable poverty axioms and is decomposable by indicator and subgroup [Alkire and Foster, 2011*a*, Alkire and Santos, 2014]. The MPI itself is a product of the MPI headcount H (measuring the share of the population that is multidimensionally poor), and the weighted deprivation share of multidimensionally poor households A (measuring the weighted percentage of indicators, in which the multidimensionally poor are on average deprived).
The MPI includes three dimensions: health, education, and the standard of living. These dimensions mirror the Human Development Index (HDI). They have been chosen because there is international consensus that any multidimensional poverty measure should at least include these three dimensions, for the ease of interpretability, and finally for reasons of data availability. While there are sensible arguments to include additional dimensions, there is no agreement

about which dimensions are appropriate, often no data is available to reflect these dimensions, and many of the discussed dimensions are not straightforward in their interpretation (i.e. empowerment, culture, safety from violence). However, the necessity of health, education, and a decent standard of living for a life free from poverty is undisputed.
First, cut-offs in each indicator are defined, then poverty is aggregated using indicator-specific weights, and finally a cross-dimensional poverty cut-off is applied. In the global MPI the same poverty cut-offs are applied across countries and years. The global MPI is therefore an absolute measure. The three dimensions of the MPI are represented by ten indicators.
Health is represented by child mortality and malnutrition. A household is deprived in mortality if there was a child death in the household in the past five years or to a woman of age 35 or less. Similarly, all household members are deprived in nutrition if there is at least one malnourished person (child below the age of five or woman) in the household.
Education is represented by years of schooling and child enrolment. Years of schooling are considered as a proxy for literacy and level of understanding of the household members. An individual is considered literate if he or she has at least six years of education. Following Basu and Foster [1998] the MPI assumes all household members benefit from one literate household member. Therefore, the household is considered non-deprived if at-least one household member has six years of schooling. The household is also deprived, if any school-age child is not enrolled.
The **living standard** is represented by access to electricity, source of drinking water, improved sanitation, flooring (no dirt, sand, or dung floor), clean cooking fuel, and an asset index. Electricity and floor refer to the quality of housing, while drinking water, improved sanitation, and clean cooking fuel have health impacts and are part of MDG7. Finally, the household is not deprived in assets if it owns at least one information asset (radio, TV, telephone), and one mobility (bike, motorbike, car, truck, animal cart, motorboat) or livelihood asset (refrigerator, agricultural land, livestock) [Kovacevic and Calderon, 2014].
After determining the indicator cut-offs, the Alkire-Foster method attaches weights to each deprivation. The MPI weighs each dimension equally (1/3) and within each dimension, each indicator is weighed equally. The weighted deprivations are then summed up, and the cross-dimensional cut-off is applied. The MPI uses a cross-dimensional cut-off of one third. Hence, a household is considered multidimensional poor, if its weighted deprivations sum up to at least a third.

4.5 Example India

We illustrate the theoretical considerations discussed above using the example of India and contrast our results to the global MPI. We use the same dataset (the 2005 DHS survey for India), and indicators as the global MPI. Poverty thresholds in the education and standard of living dimensions differ from the global MPI, as these are set at the median. Health outcomes are directly measured and are thus not open to a relative assessment. We therefore apply the identical indicator thresholds as in the global MPI in the health dimension.
Relative poverty lines are often set at the national level. However, for a country as big as India, a national relative poverty line is disputable: The differences in ethnicity, culture, living standard, and climate are too large in this subcontinent with more than 1.2 billion people. To apply the same poverty line when comparing a Bihari farmer with a Bombayite is disputable. On the other hand, one does not want to define these groups too narrowly to avoid the threshold being

meaningless, i.e. comparing a slum dweller in Mumbai only with other slum dwellers in the same city.

The government of India applies separate urban and rural poverty lines within the different states for the estimation of national (monetary) poverty in India [Planning Commission, 2013]. These are still relatively big groups as populations in the different states range from 610,577 in Sikkim to nearly 200 million in Uttar Pradesh (cf. Census of India, 2011). In this illustrative exercise, we follow this choice of reference group. We compare poverty outcomes for this estimation with poverty estimations which use the whole country and the state as reference group. In the following sections, we will shortly discuss the relative cut-offs applied in the education and standard of living dimensions.

4.5.1 Education dimension

The global MPI considers a household as not deprived, if at least one household member has six years of schooling [Kovacevic and Calderon, 2014]. This follows the concept of effective literacy defined by Basu and Foster [1998]. They argue that one literate household member is a kind of public good for the illiterate members. This hypothesis is supported by several studies explaining farm-level productivity with household literacy (cf. among other Foster and Rosenzweig, 1996). Thus, the concept of effective literacy assumes that there exist no rivalries in consumption for the illiterate members. How big the household is and how many literate members live in the household are irrelevant numbers. The household is considered non-deprived if there is already *one* literate household member (household member with six years of schooling).

We set indicator thresholds at the median of the reference population. Though education may also be regarded as a goal in and of itself, its role for social integration and going without shame depends on education levels in one's community. The number of years of schooling necessary to succeed in a society — taking up a meaningful job, invoking legal rights, or participating in civil society — may therefore depend on the education levels in the reference population [cf. Pritchett, 2001, Sen, 2003, Spence, 1973]. Hence, we consider the median of the distribution as the indicator cut-off. Households with education outcomes below the median are considered poor.

For urban areas, the education threshold is well-above the global MPI threshold of 6 years of schooling in most states. Nevertheless, in rural areas we observe much lower thresholds and in general a higher variability of thresholds. Only in Kerala do we observe the same threshold of 9 years for both urban and rural areas (cf. Table 4.1).

The variation in education outcomes across rural areas maybe surprising. However, access to education varies significantly in India across states and areas. Teacher absenteeism is higher in poorer states. Moreover, more remote schools and schools with worse infrastructure (no sanitation, electricity connection, no covered classroom, type of flooring) also face higher rates of teacher absenteeism [Kremer et al., 2005]. In addition, wealth (measured by an asset index) has a strong effect in explaining enrolment rates for India [Filmer and Pritchett, 2001]. Most importantly, however, these varying thresholds reflect policy priorities of the different state governments. While some states committed themselves to the goal of universal literacy early on, other states attach a lower importance to education. [Dreze and Sen, 1999]

Furthermore, several studies found the trade-off between child schooling and labour is higher

Table 4.1: Median levels of schooling per adult (above 12)

state	urban	rural
Jammu and Kahsmir	9	6
Himachal Pradesh	10	8
Punjab	9	5
Uttarchanal	9	6
Haryana	9	5
Delhi	9	8
Rajasthan	8	0
Uttar Pradesh	8	3
Bihar	7	0
Sikkim	9	4
Arunchanal Pradesh	6	3
Nagaland	8	5
Manipur	9	7
Mizoram	8	6
Tripura	8	5
Meghalaya	9	3
Assam	9	5
West Bengal	8	0
Jharkhand	9	3
Orissa	8	3
Chhattisgarh	8	3
Madhya Pradesh	8	2
Gujarat	8	5
Maharashtra	9	5
Andhra Pradesh	9	2
Karnataka	9	4
Goa	9	8
Kerala	9	9
Tamil Nadu	8	5

in rural India [cf. with further resources Borooah and Iyer, 2005], as children have a higher workload in the household and farm. Education may also be valued less in rural areas, resulting in children dropping out earlier. Finally, higher education may be more necessary in the urban area job market. This may be another reason for the higher education outcomes in urban areas.
The second education indicator is child enrolment. In the global MPI, a household is deprived if any child at school age is not enrolled. The school age is determined by looking at the primary school entrance age[11] plus one year[12] and assuming necessary enrolment to be up to grade 8[13]. For India this covers the age group 7-14.
We observe that the median enrolment ratio for all households is 100%. Hence, in the median household all school-aged children are sent to school. Similar to the years of schooling indicator, I set the threshold at the median enrolment ratio in the reference population. In the case of India, we therefore do not deviate from the global MPI threshold. However, in other countries, where the threshold may be lower than one, not all children need to be enrolled in school for the households to be considered non-deprived. This may be justified with household decisions to only enrol one child into secondary education, or only one child at a time.

[11] Derived from UNESCO education statistics
[12] As children with birthdays in the current school year can only enter school in the next school year.
[13] This covers primary and lower secondary education.

4.5.2 Standard of living

The standard of living dimension is fully open to a relative assessment. Whether a specific standard of living is deemed sufficient, depends on the environment and the living standard of one's reference group. While some standard of living indicators only distinguish between having an item, or benefiting from a service (electricity); for other indicators, a varying quality is observed.

The global MPI allows for six equi-weighted living standard indicators: type of flooring, source of drinking water, adequacy of sanitation, type of cooking fuel, access to electricity and an asset index. The household is deprived if either indicator does not fulfil MDG standards, or when the household has no access to the electricity grid. The asset index is an asset count. Households are considered deprived, if they do not own at least one information asset (either radio, TV, telephone), and one mobility (bike, motorbike, truck, animal cart, motorboat) or livelihood asset (refrigerator, agricultural land, livestock) [Kovacevic and Calderon, 2014].

Similar to the education dimension, the relevant indicator cut-off is defined as the median of the distribution. For the living standard indicators of the global MPI where a varying quality can be observed (floor, drinking water, sanitation, cooking fuel), we align the indicators with decreasing quality. We then assess the distribution within the reference population and a household with a quality below the median is considered deprived. For example, if the median in floor is cement, households with a stone floor or worse are considered deprived.

Access to electricity is a dichotomous variable and thus we cannot apply an adaptable threshold. We therefore keep the original global MPI category. For the asset indicator, we count the number of asset categories (information, mobility, livelihood) the household owns and set the threshold at the median of the asset category count. A household is non-deprived if it owns at least as many asset categories as the median of the reference population. In all areas except Meghalaya, the asset median lies below the global MPI threshold of 2. In most states, the median household owns assets in only one category. Median households in urban areas sometimes do not own any of the specified assets. Ownership in the specified assets is higher in rural areas, as many rural households own land or livestock.

For the other living standard indicators, we follow the ordering in the DHS dataset with few changes in the categories floor, sanitation and drinking water.[14] We present the final order in table 4.2. If the household's floor, water source, type of sanitation or cooking fuel does not fit into the existing categories (category "other"), we consider the observation missing.

Flooring In the category floor in the original DHS dataset, cement is above ceramic tiles and below carpet. We reorder the category floor so that cement is below finished and above stone floor. The global MPI defines a household as non-deprived in the category "floor" if the household does not have a sand, dung or dirt floor. The median flooring in most states and areas is cement, brick or better, and therefore above this threshold. However, in rural areas in several states, the norm is a mud or dung floor. Taking the median as threshold in flooring allows us to respond to local customs in flooring. In nomadic or seminomadic societies, for example, unfinished floors are the norm. A household should not be considered poor in these societies because of an unfinished floor.

[14] The global MPI does not change the order in this way.

Table 4.2: Order of the living standard indicators

floor	**water**	**sanitation**	**cooking fuel**
polished stone / marble /granite	bottled water	flush toilet	electricity
carpet	piped water	flush to piped sewer system	lpg, natural gas
ceramic tiles	piped into dwelling	flush to septic tank	biogas
vinyl, asphalt strips	piped to yard / plot	flush to pit latrine	kerosene
parquet, polished wood	tube well water	flush to somewhere else	coal, lignite
finished	tube well or borehole	flush, don't know where	charcoal
cement	dug well (open / protected)	pit toilet latrine	wood
stone	protected well	ventilated improved pit latrine	straw/shrubs/grass
brick	unprotected well	pit latrine with slab	agricultural crop
palm, bamboo	surface water	open pit	animal dung
raw wood planks	protected spring	composting toilet	
rudimentary	unprotected spring	dry toilet	
dung	river/dam/etc	no facility	
sand	rainwater	no facility/bush/field	
mud/clay/earth	tanker truck		
natural	cart with small tank		

Sanitation In the sanitation category we consider composting and dry toilets better than having no access to any sort of sanitation facility. Having access to a shared sanitation facility is regarded better than having no access to any facility, but worse than any other sanitation facility independent of the actual facility at hand. We find that the median in sanitation is generally higher in urban areas. In most states, there is a striking difference between the sanitation standards in urban and rural areas. Exceptions are Goa, Kerala, Delhi, and the northeastern states. While we observe high sanitation standards — different kinds of flush toilets — in urban *and* rural areas in the first three states; We observe uniformly poorer standards in the Notheastern states (pit latrine as median). In most other states, we find flush toilets represent the median in urban areas, while no facilities or shared facilities are the norm in rural areas. In the global MPI, every household without access to an improved sanitation facility (flush toilets or latrines connected to sewer, septic tank, pit; and improved pit latrines) or with a shared sanitation facility is considered deprived. The global MPI can therefore not take into account different needs in urban and rural areas because of a varying population density.
Nevertheless, sanitation research differentiating between urban and rural areas find larger effects of improved sanitation on diarrhoea incidence and malnutrition among children in densely populated urban areas, in contrast to the small and sometimes insignificant results for the effect of improved sanitation in rural areas [cf. Esrey, 1996, Gross and Günther, 2014, Gunther et al., 2010]. Gunther et al. [2010] and Esrey [1996] also find that already simple sanitation technology can have an effect on diarrhoea and child mortality. Therefore, it appears sensible to allow for varying sanitation thresholds in different environments.

Water The original DHS ordering in the water category considers bottled water as the poorest category above the category cart with small tank. This most likely follows the idea that bottled water is no regular source of drinking water such as piped water. In addition it is quite expensive. Households who have to rely on bottled water as their sole source of drinking water could be considered deprived. However, the use of bottled water (instead of piped water) could also be a voluntary choice, rather than a necessity. This hypothesis is confirmed for India when analysing the correlation between the DHS wealth index and the use of bottled water. The highest frequency of use of bottled water is observed for the richer (9.40%) and richest (87.93%) quintile. Thus, the use of bottled water appears to be a voluntary choice by parts of the society who can afford it. Hence, we reorder the water category so that bottled water is the best category. We also define a new worst category: time to the water source is above 30 min. Furthermore, we reorder the water category in a way that improved water sources (protected well, protected spring, rainwater) — as defined by the global MPI — are above unprotected water sources, such as an unprotected well.
In the category of drinking water, the median in urban and rural areas is usually a form of piped water or tube well water. This is well-above the global MPI threshold, which includes rain water, protected spring and well; and all kinds of tube and piped water into the category "improved water source". The only exceptions are Jharkhand, Madhya Pradesh, Meghalaya, and Manipur, where in rural areas the median water source is an unprotected well or spring.
Evidence on the effect of water services on health is mixed. Most research finds a positive impact is contingent on access to improved sanitation facilities [among others: Esrey, 1996, Gunther et al., 2010] and may depend on parental health knowledge [Jalan and Ravallion, 2003].

While historical data shows that large-scale investments in water and sanitation infrastructure may have strong impacts on child mortality, more recent randomised controlled trials find no substantial health impacts [Waddington and Snilstveit, 2009]. Klasen et al. [2012] even find investments in water supply infrastructure in urban Yemen worsened health outcomes in dry mountain areas. Moreover, fetching water at wells or springs may have an important social role to connect and learn amongst women.
As the health effects of different water sources are relatively unclear, we argue that the source of drinking water *mostly* fulfils a role of social acceptance. A household may consider itself poor, if it has to use a worse water source than its peers. This will mostly be a differentiation between in-house and public water sources. In the case of India, members of certain castes are often denied access to public taps and wells and then need to fetch water from faraway places. Our strategy can account for this discrimination and will consider these households as poor, even if the household would not be considered deprived by the global MPI as the water source may still be an "improved water source".

Cooking Fuel The global MPI requires a household to use clean cooking fuel to be considered non-deprived (electricity, lpg, biogas, kerosene). Indoor air pollution from the combustion of biomass fuels is a global health problem mostly affecting women and children [Bruce et al., 2000]. The precise health effects of the kind of cooking fuel used, however, depend mostly on the stove and place of cooking (indoor cooking is more harmful than outdoor cooking). When cooking takes place outdoors, or with an improved stove, indoor air pollution is much lower [among others: Albalak et al., 2001, Chengappa et al., 2007, Grieshop et al., 2011]. Moreover, the use of kerosene also incurs significant health impacts. Though the combustion of kerosene produces far less carbon monoxide than that of solid cooking fuels, women and children are exposed to nitrogen dioxide, benzene and toluene [Muller et al., 2003].
Finally, the choice in cooking fuel is to a large extent determined by cultural preferences and local availability of fuels, and only to a lesser extent by price and income effects [Kowsari and Zerriffi, 2011, Masera et al., 2000]. Some households prefer to use traditional (biomass) cooking fuels out of habit or routine. These local customs appear to be more entrenched in rural areas. In addition, not all kinds of cooking fuels are readily available in rural areas. More recent research shows that we usually do not observe a linear transition from traditional to modern fuels determined by fuel prices and household income. Instead, field research shows that additional factors other than prices and income affect the choice of cooking fuel [cf. for a review of the literature: Kowsari and Zerriffi, 2011].
This is in line with our findings for India: In the vast majority of states, the median cooking fuel in urban areas is LPG or kerosene. Exceptions are the states of Bihar, Jharkhand and Orissa, where households in urban areas use coal; and the state of Kerala where households in urban *and* rural areas use wood as cooking fuel. However, in rural areas cooking usually takes place with wood, though, sometimes straw and agricultural crops are used as cooking fuels.

Summary We find that the adaptable thresholds in the living standard and education indicators are usually well-above the global MPI threshold in urban areas. However, in rural areas the threshold is often below the global MPI threshold. In general, we observe quite a divergence in the median values depending on the place of residence (urban vs rural). the varying threshold

Table 4.3: Indicator thresholds

Indicator	**threshold global MPI**	**threshold India**	**lowest cut-off**	**region**	**highest cut-off**	**region**
schooling	6	7	0	Rajasthan rural, Bihar rural, West Bengal rural	10	Himachal Pradesh urban
enrolment	1	1	1	all regions	1	all regions
sanitation	pit latrine with slab	shared toilet	no facility / bush /field	16 regions, Example: Tamil Nadu rural	flush to piped sewer system	Punjab urban, Delhi urban, Gujarat urban
water	protected well	tube well or borehole	unprotected spring	Manipur rural	piped into dwelling	8 regions, Example: Himachal Pradesh urban
floor	rudimentary	cement	mud / clay / earth	11 regions, Example: Orissa rural	polished stone / marble / granite	Gujarat urban
cooking fuel	kerosene	wood	agricultural crop	Punjab rural, Bihar rural	lpg, Natural gas	25 regions, Example: Jammu and Kashmir urban
assets	1	1	0	11 regions, Example: Goa urban	2	Meghalaya rural, Meghalaya urban

Note: If more than three regions share the same threshold, we only provided one example. The full lists of region thresholds in the standard of living dimension are provided in the Appendix tables 4.5 to 4.9

therefore enables us to reflect the different needs and customs in urban and rural areas. In several of the living standard categories, households in rural areas keep a more traditional style of living. We argue that this may well be a voluntary choice in some circumstances. In addition, households may also have different needs in rural areas (sanitation, water). Finally, all living standard indicators are status symbols in a way. Whether these allow the household to be ranked high or low among its peers is obviously a relative assessment that should take into account the situation in the rest of the society.

4.5.3 Results

We compare our adaptable poverty measure to the global MPI. An absolute poverty line is applied in the health dimension, as the health indicators (child mortality and malnutrition) reflect direct functionings. The cut-offs in the education and standard of living dimension are set at the median of the population, as indicator outcomes in these dimensions enable an individual to achieve certain functionings.

By analysing the poverty outcomes for the original MPI (Appendix 4.10), the multidimensional measure with reference group India (Relative MP(1), Appendix 4.11), the multidimensional measure with reference group state (Relative MP (2), Appendix 4.12), and the multidimensional measure with reference group rural-/urban-state (Relative MP (3), Appendix 4.13), we find that poverty outcomes differ vastly for the whole country, depending the measure applied. All adaptable poverty measures find a higher poverty incidence than the global MPI (55.35%). The highest poverty incidence is found, when we take the whole country as the reference group (65.59%). We find a lower poverty incidence for the smaller reference groups differentiating

between states (62.59%) and differentiating between urban and rural areas within the state (57.94%). The poverty intensity (A) is lowest for all four measures when the rural-urban poverty measure is applied.

The high poverty outcome of relative MP (1) (reference group India) is mostly driven by the higher threshold in the schooling indicator; additionally the threshold in the indicator flooring is higher. While the threshold in the schooling indicator is actually higher for the majority of states when Relative MP (2) and Relative MP (3) is applied, the thresholds in the poorer and often population-rich states (Chattishgarh, Jharkhand, AP, Bihar, Uttar Pradesh, Rajasthan) are lower than the global MPI threshold. This also holds true for most of the standard of living indicators. As argued above (section 4.3.5), we follow the choice in reference population of India's official monetary poverty line. Hence, indicator thresholds are set at the state and urban/rural level. This tried-and-tested approach is our preferred specification. For smaller countries, however, bigger reference groups may be more appropriate.

4.5.3.1 Multidimensional poverty across states

By analysing poverty outcomes across states, we find that the variation in the poverty incidence is in general lower for the adaptable poverty measures. When comparing the global MPI with the adaptable poverty measure allowing for different urban and rural thresholds (Relative MP 3), the increase in the poverty headcount is notable in the states of Delhi (from 14.13% to 44.84%), Mizoram (from 18.57 to 33.18%), Gujarat (from 39.23 to 54.59%), and Goa (from 20.13% to 34.02%). We also observe a significant reduction in the poverty incidence for the state of Rajasthan (from 60.57% to 48.24%).

In these states, we observe comparatively high thresholds in the standard of living and schooling indicators (Delhi and Goa), while at the same time attainment in these indicators is unequally distributed. Thus, the poverty incidence increases. The opposite holds true for the case of Rajasthan, where the indicator thresholds in rural areas are relatively low but the (low) attainment in these indicators appear to be uniformly distributed.

Ranking the states by poverty incidence and comparing the outcome to the global MPI, we still find that Kerala the state with the lowest poverty outcomes even though the poverty incidence increased from 11.64% to 20.89%. However, Bihar is no longer the poorest state. Applying the adaptable multidimensional poverty measure, the poverty incidence in Uttar Pradesh increases from 71.55% to 75.46% and thus becomes India's poorest state.

Rank correlations between the different poverty measures are relatively strong and highly significant. The highest correlation is found between the global MPI and the relative MP (1) with India as a reference group (0.9828), while the least correlation is observed between relative MP (1) and relative MP (2) (state as reference group). This holds for Spearman's rank correlation (cf. Appendix Table 4.14), as well as for Kendall's Tau (cf. Appendix Table 4.15).

Overall, these poverty outcomes appear reasonable. They do not exaggerate poverty in better-off states, such as Kerala, or appear to underestimate poverty in poorer states. The poverty rates for the poorer states, such as Bihar are certainly lower when thresholds are defined for smaller groups, but poverty outcomes cannot be considered unreasonably low.

4.5.3.2 Decomposition of multidimensional poverty by household type

Decomposing the poverty incidence by household type, we observe that the poverty incidence across groups varies depending on the poverty measure applied (cf. Table 4.4). The variation in the poverty incidence across the different groups is lowest for the poverty measure allowing for different urban and rural thresholds within states (relative MP (3)). This is also true for the variation in the M0 measure, the MPI (cf. Appendix Table 4.17, 4.18, 4.19, 4.20).

The effect of household size and gender of the household head on poverty outcomes is relatively

Table 4.4: Decomposition of poverty incidence by household type

	global MPI	relative MP (1)	relative MP (2)	relative MP (3)
small hh (1-3)	47.31%	54.77%	51.82%	41.95%
medium hh (4-6)	51.86%	59.28%	57.09%	51.61%
large hh (7+)	63.23%	73.70%	69.77%	66.50%
female-headed hh	56.54%	66.30%	62.93%	56.78%
male-headed hh	55.21%	65.50%	62.55%	58.08%
rural	68.68%	78.66%	74.09%	60.61%
urban	25.75%	31.11%	32.25%	50.90%

small. However, all adaptable poverty measures find more poverty in urban areas, compared to the global MPI. Allowing for separate urban and rural poverty lines within each state, we unsurprisingly find the highest incidence of urban poverty. Thus, as already stated above (section 4.5.1 and 4.5.2), we argue for different thresholds in urban and rural areas. These can better reflect different living circumstances in urban and rural areas and allow us to accurately represent urban poverty.

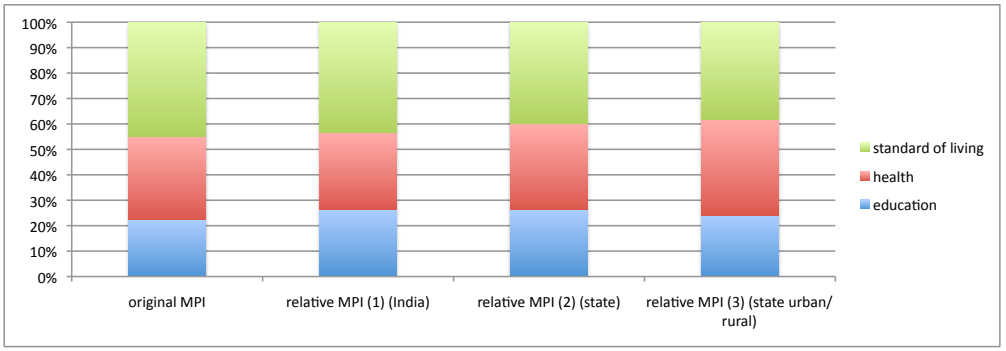
Though the share of rural poverty still outweighs that of urban poverty, we find a more even distribution of poverty across groups when the relative measures are applied. As the poverty incidence across the other household types did not significantly change, our adaptable poverty measures can be considered unbiased.

4.5.3.3 Decomposition across dimensions

By analysing the relative contribution each indicator has on the poverty outcome, we find the importance of the education dimension (enrolment and schooling) in explaining poverty increases when the adaptable measures are applied, while the relative importance of the standard of living dimension decreases. The contribution of the standard of living dimension decreases with the size of the reference group. The contribution of the health dimension also increased when the relative MP (3) is applied (from 32.67% to 37.44%; cf. Appendix Table 4.16), even though indicator thresholds in this dimension are identical across the three measures. For the global MPI, poverty is to a large extent determined by deprivations in the standard of living dimension. In contrast to this, the contribution of the different dimensions is more equal when the adaptable measures are applied.

Because indicator thresholds in the health dimension do not change across the three multidimensional poverty measures, the uncensored deprivation headcount (share of people deprived in this dimension) is identical across specifications. Nevertheless, the censored headcount (share of people deprived in health and considered multidimensionally poor) varies across specifications and is highest when the relative MP (3) is applied. Therefore the relative contribution of this

FIGURE 4.1: Decomposition of poverty by dimension



dimension is highest when the relative MP (3) is applied.

To be considered multidimensionally poor, households need to be deprived in at least a third of the poverty indicators. Due to adaptable thresholds in the standard of living and education dimension, the group of people deprived in one health indicator and (at least) one other indicator differs across the poverty measures. We observe an increase in the correlation between deprivations in the health and education indicators when the relative MP(3) is applied compared to the global MPI, while the change in the correlation between the standard of living indicators and health is unequal. This can explain the increase in the *relative* contribution of the health dimension to overall poverty when the relative MP (3) is applied.

In the education dimension we apply adaptable thresholds. For a significant share of the population the thresholds in the schooling indicator are higher when the relative poverty measures are applied. We thus observe that more people are deprived in this indicator when adaptable thresholds are applied and therefore the relative contribution to overall poverty also increases.

In the standard of living dimension the thresholds in rural areas are often below global MPI thresholds (accompanied by lower outcomes), while in urban areas the thresholds are nearly uniformly above global MPI thresholds. These new thresholds appear to capture the actual living circumstances of the population better and are able to reflect inequality in outcomes. The contribution of the standard of living dimension decreased for all adaptable measures, though the effect is strongest for the state-level poverty measures. Allowing for different urban and rural poverty lines (Relative MP (3)), our poverty measure can account for different environment, customs, and culture.

The harmful effects of cooking with charcoal or wood, for example, are less severe when the cooking takes place outdoors. Similarly, a perceived "poor" type of floor (natural, earth, sand, dung) may be a choice of lifestyle in nomadic societies, while in other societies it would be necessary to at least have cement flooring. One will also observe different needs within countries, as the demand for certain types of sanitation and source of drinking water differs across urban and rural areas. A poverty measure taking these considerations into account could arguably be more relevant in a local context.

On a global scale, Alkire and Santos [2014] found that the standard of living dimension often contributes the most to overall poverty outcomes. This is especially true for the poorer countries in their sample. For 17 of their 104 countries the living standard dimension contributes even

more than 50% to the overall MPI.[15] Applying the same absolute thresholds across countries in this dimension has however the least motivation. Even leaving relative concerns aside, these indicators will, to a large extent, be shaped by environment, climate, and culture. Our poverty measure can capture different needs in the standard of living across societies.

To sum up, the overall poverty incidence changes significantly depending on the poverty measure applied. Differences at the state level are also strong, though the overall ranking of states is similar across measures and rank correlation is high. The differences in poverty incidence across household types (size of household and gender of household head) are small, hence our adaptable poverty measures can be considered unbiased. Nevertheless, the adaptable poverty measures can account better for the incidence of urban poverty, as indicator thresholds are adjusted to the different environment in urban and rural areas.
Decomposing poverty by indicator, we found the relative contribution of the education dimension to overall poverty increased. The importance of the standard of living dimension in explaining poverty decreased. Hence, the contribution of the different poverty dimensions is more equal for the adaptable poverty measures. This contrasts to the global MPI, where the standard of living dimension contributed the most to overall poverty. This observation is accurate for most poor countries in the sample.

4.6 Conclusion

In this paper, we develop three adaptable multidimensional poverty measures. Our poverty measures build upon the global MPI and apply the same database. Poverty outcomes can hence be compared to the global MPI. We illustrate our theoretical considerations using the example of India.
Following the construction of the global MPI, we consider three dimensions: health, education, and living standards; and apply the Alkire-Foster dual cut-off method. Relative concerns could determine the choice of indicator, indicator thresholds, weights and the overall cut-off. We follow the indicator choice of the global MPI for reasons of comparability and data availability. Similar to the global MPI, we also apply the same weights across dimensions. An overall poverty threshold of one third is applied, which is equal to being deprived in one dimension. However, indicator thresholds are adjusted when appropriate.
In the health dimension, the same absolute thresholds are applied as in the global MPI, because the indicators are able to capture direct health functionings. Indicator thresholds in the education and living standard dimension are set at the median of the distribution.
We generate three adaptable poverty measures, one uses the whole country as reference population, one differentiates across different Indian states and Union Territories, and the third allows for different urban and rural poverty lines within the state. All adaptable poverty measures find a higher poverty incidence for India than the global MPI does. The poverty incidence is highest, when the whole country is used as the reference group. Allowing for separate rural and urban poverty lines within the state returns a poverty outcome similar to that of the global MPI. The poverty incidence across states vary significantly when outcomes are compared to the global

[15] Sri Lanka, Mongolia, Peru, Gabon, Zimbabwe, Swaziland, Namibia, Lesotho, Republic of Congo, Kenya, Haiti, Zambia, Chad, Tanzania, Malawi DR Congo, Rwanda.

MPI, though changes in the poverty ranking of states are less striking.
Decomposing the different poverty measures by household type, we find that the different groups contribute similarly to overall poverty across the different poverty measures. Only the urban group contributes more to poverty, when the adaptable measures are applied. Hence, our poverty measure can better account for the incidence of urban poverty. Nevertheless, the adaptable measures find that rural poverty is still significantly higher than urban poverty.
The relative contribution of the living standard dimension to overall poverty is decreased when the adaptable poverty measures are applied, while the importance of the education dimension increases. Overall, the contribution of the three dimensions to poverty is more equal when the adaptable measures are applied. In contrast to this, the standard of living dimension contributed the most to overall poverty in the global MPI. This is the case for all poorer countries in the sample of 104 countries. Our adaptable poverty measure can therefore better account for different living standards and customs across and within countries.
We thus developed a well-balanced poverty measure which can capture differences in culture, environment, and living standards. These are bound to vary across different communities and societies. The adaptable measures appear to better reflect urban poverty and can therefore be considered unbiased.
Amartya K. Sen [1983] argued that we should aim at measuring absolute poverty in the capability and functioning space; but this may well translate into measuring relative deprivations in the realm of commodities and resources. The poverty measure we developed in this paper tries to do so.
Like all poverty measures, our measure also suffers from issues of data availability and accuracy. Furthermore, the measure cannot account for the effect that *individual characteristics* may have on a person's ability to translate a given commodity or educational achievement into certain functionings. However, our adaptable poverty measure can accurately reflect varying requirements of meeting the same absolute needs *across societies*. It thus fulfils a desirable property of a poverty measure as forcefully argued by Amaryta K. Sen.

Appendix

TABLE 4.5: Thresholds in the indicator sanitation across regions

Punjab urban	flush to piped sewer system
Delhi urban	flush to piped sewer system
Gujarat urban	flush to piped sewer system
Jammu and Kashmir urban	flush to septic tank
Himachal Pradesh urban	flush to septic tank
Uttarchanal urban	flush to septic tank
Haryana urban	flush to septic tank
Uttar Pradesh urban	flush to septic tank
Sikkim urban	flush to septic tank
Mizoram urban	flush to septic tank
Chhattisgarh urban	flush to septic tank
Madhya Pradesh urban	flush to septic tank
Maharashtra urban	flush to septic tank
Andhra Pradesh urban	flush to septic tank
Goa rural	flush to septic tank
Goa urban	flush to septic tank
Kerala rural	flush to septic tank
Kerala urban	flush to septic tank
Rajasthan urban	flush to pit latrine
Jharkhand urban	flush to pit latrine
Karnataka urban	flush to pit latrine
Delhi rural	flush to somewhere else
Tamil Nadu urban	flush to somewhere else
Sikkim rural	pit latrine with slab
Arunchanal Pradesh urban	pit latrine with slab
Nagaland urban	pit latrine with slab
Mizoram rural	pit latrine with slab
Tripura rural	pit latrine with slab
Meghalaya urban	pit latrine with slab
Assam urban	pit latrine with slab
Nagaland rural	pit latrine without slab/open pit
Tripura urban	pit latrine without slab/open pit
Assam rural	pit latrine without slab/open pit
Manipur rural	composting toilet
Arunchanal Pradesh rural	dry toilet
Jammu and Kashmir rural	shared toilet (irrelevant of what kind)
Punjab rural	shared toilet (irrelevant of what kind)
Bihar urban	shared toilet (irrelevant of what kind)
Manipur urban	shared toilet (irrelevant of what kind)
Meghalaya rural	shared toilet (irrelevant of what kind)
West Bengal urban	shared toilet (irrelevant of what kind)
Orissa urban	shared toilet (irrelevant of what kind)
Himachal Pradesh rural	no facility/bush/field
Uttarchanal rural	no facility/bush/field
Haryana rural	no facility/bush/field
Rajasthan rural	no facility/bush/field
Uttar Pradesh rural	no facility/bush/field
Bihar rural	no facility/bush/field
West Bengal rural	no facility/bush/field
Jharkhand rural	no facility/bush/field
Orissa rural	no facility/bush/field
Chhattisgarh rural	no facility/bush/field
Madhya Pradesh rural	no facility/bush/field
Gujarat rural	no facility/bush/field
Maharashtra rural	no facility/bush/field
Andhra Pradesh rural	no facility/bush/field
Karnataka rural	no facility/bush/field
Tamil Nadu rural	no facility/bush/field

TABLE 4.6: Thresholds in the indicator water across regions

Jammu and Kashmir urban	piped into dwelling
Himachal Pradesh urban	piped into dwelling
Uttarchanal urban	piped into dwelling
Delhi urban	piped into dwelling
Sikkim urban	piped into dwelling
Gujarat urban	piped into dwelling
Maharashtra urban	piped into dwelling
Goa urban	piped into dwelling
Punjab urban	piped to yard/plot
Haryana urban	piped to yard/plot
Delhi rural	piped to yard/plot
Rajasthan urban	piped to yard/plot
Arunchanal Pradesh urban	piped to yard/plot
Mizoram urban	piped to yard/plot
Meghalaya urban	piped to yard/plot
Madhya Pradesh urban	piped to yard/plot
Andhra Pradesh rural	piped to yard/plot
Andhra Pradesh urban	piped to yard/plot
Himachal Pradesh rural	public tap/standpipe
Uttarchanal rural	public tap/standpipe
Arunchanal Pradesh rural	public tap/standpipe
West Bengal urban	public tap/standpipe
Gujarat rural	public tap/standpipe
Maharashtra rural	public tap/standpipe
Karnataka rural	public tap/standpipe
Karnataka urban	public tap/standpipe
Goa rural	public tap/standpipe
Tamil Nadu rural	public tap/standpipe
Tamil Nadu urban	public tap/standpipe
Jammu and Kashmir rural	tube well or borehole
Punjab rural	tube well or borehole
Haryana rural	tube well or borehole
Uttar Pradesh rural	tube well or borehole
Uttar Pradesh urban	tube well or borehole
Bihar rural	tube well or borehole
Bihar urban	tube well or borehole
Manipur urban	tube well or borehole
Tripura rural	tube well or borehole
Tripura urban	tube well or borehole
Assam rural	tube well or borehole
Assam urban	tube well or borehole
West Bengal rural	tube well or borehole
Jharkhand urban	tube well or borehole
Orissa rural	tube well or borehole
Orissa urban	tube well or borehole
Chhattisgarh rural	tube well or borehole
Chhattisgarh urban	tube well or borehole
Nagaland rural	protected well
Nagaland urban	protected well
Kerala rural	protected well
Kerala urban	protected well
Sikkim rural	protected spring
Mizoram rural	protected spring
Rajasthan rural	rainwater
Meghalaya rural	unprotected well
Jharkhand rural	unprotected well
Madhya Pradesh rural	unprotected well
Manipur rural	unprotected spring

TABLE 4.7: Thresholds in the indicator floor across regions

Gujarat urban	polished stone/marble/granite
Maharashtra urban	ceramic tiles
Mizoram urban	parquet, polished wood
Jammu and Kashmir urban	cement
Himachal Pradesh rural	cement
Himachal Pradesh urban	cement
Punjab urban	cement
Uttarchanal urban	cement
Haryana urban	cement
Delhi rural	cement
Delhi urban	cement
Rajasthan urban	cement
Uttar Pradesh urban	cement
Bihar urban	cement
Sikkim rural	cement
Sikkim urban	cement
Nagaland urban	cement
Mizoram rural	cement
Meghalaya urban	cement
Assam urban	cement
West Bengal urban	cement
Jharkhand urban	cement
Orissa urban	cement
Chhattisgarh urban	cement
Madhya Pradesh urban	cement
Gujarat rural	cement
Andhra Pradesh urban	cement
Karnataka urban	cement
Goa rural	cement
Goa urban	cement
Kerala rural	cement
Kerala urban	cement
Tamil Nadu rural	cement
Tamil Nadu urban	cement
Andhra Pradesh rural	stone
Karnataka rural	stone
Punjab rural	brick
Haryana rural	brick
Arunchanal Pradesh rural	palm, bamboo
Arunchanal Pradesh urban	palm, bamboo
Meghalaya rural	raw wood planks
Jammu and Kashmir rural	dung
Uttarchanal rural	dung
Rajasthan rural	dung
Jharkhand rural	dung
Madhya Pradesh rural	dung
Maharashtra rural	dung
Uttar Pradesh rural	mud/clay/earth
Bihar rural	mud/clay/earth
Nagaland rural	mud/clay/earth
Manipur rural	mud/clay/earth
Manipur urban	mud/clay/earth
Tripura rural	mud/clay/earth
Tripura urban	mud/clay/earth
Assam rural	mud/clay/earth
West Bengal rural	mud/clay/earth
Orissa rural	mud/clay/earth
Chhattisgarh rural	mud/clay/earth

TABLE 4.8: Thresholds in the indicator cooking fuel across regions

Jammu and Kashmir urban	lpg, natural gas
Himachal Pradesh urban	lpg, natural gas
Punjab urban	lpg, natural gas
Uttarchanal urban	lpg, natural gas
Haryana urban	lpg, natural gas
Delhi rural	lpg, natural gas
Delhi urban	lpg, natural gas
Rajasthan urban	lpg, natural gas
Uttar Pradesh urban	lpg, natural gas
Sikkim urban	lpg, natural gas
Arunchanal Pradesh urban	lpg, natural gas
Nagaland urban	lpg, natural gas
Manipur urban	lpg, natural gas
Mizoram urban	lpg, natural gas
Tripura urban	lpg, natural gas
Meghalaya urban	lpg, natural gas
Assam urban	lpg, natural gas
Chhattisgarh urban	lpg, natural gas
Madhya Pradesh urban	lpg, natural gas
Gujarat urban	lpg, natural gas
Maharashtra urban	lpg, natural gas
Andhra Pradesh urban	lpg, natural gas
Karnataka urban	lpg, natural gas
Goa urban	lpg, natural gas
Tamil Nadu urban	lpg, natural gas
West Bengal urban	kerosene
Bihar urban	coal, lignite
Jharkhand urban	coal, lignite
Orissa urban	coal, lignite
Jammu and Kashmir rural	wood
Himachal Pradesh rural	wood
Uttarchanal rural	wood
Haryana rural	wood
Rajasthan rural	wood
Uttar Pradesh rural	wood
Sikkim rural	wood
Arunchanal Pradesh rural	wood
Nagaland rural	wood
Manipur rural	wood
Mizoram rural	wood
Tripura rural	wood
Meghalaya rural	wood
Assam rural	wood
Jharkhand rural	wood
Orissa rural	wood
Chhattisgarh rural	wood
Madhya Pradesh rural	wood
Gujarat rural	wood
Maharashtra rural	wood
Andhra Pradesh rural	wood
Karnataka rural	wood
Goa rural	wood
Kerala rural	wood
Kerala urban	wood
Tamil Nadu rural	wood
West Bengal rural	straw/shrubs/grass
Punjab rural	agricultural crop
Bihar rural	agricultural crop

TABLE 4.9: Thresholds in the indicator assets across regions

Meghalaya rural	2
Meghalaya urban	2
Jammu and Kashmir rural	1
Jammu and Kashmir urban	1
Himachal Pradesh rural	1
Himachal Pradesh urban	1
Uttarchanal rural	1
Haryana rural	1
Delhi urban	1
Rajasthan rural	1
Uttar Pradesh rural	1
Bihar rural	1
Bihar urban	1
Sikkim rural	1
Sikkim urban	1
Arunchanal Pradesh rural	1
Arunchanal Pradesh urban	1
Nagaland rural	1
Nagaland urban	1
Manipur rural	1
Mizoram rural	1
Mizoram urban	1
Tripura rural	1
Tripura urban	1
Assam rural	1
Assam urban	1
West Bengal rural	1
West Bengal urban	1
Jharkhand rural	1
Jharkhand urban	1
Orissa rural	1
Chhattisgarh rural	1
Chhattisgarh urban	1
Madhya Pradesh rural	1
Madhya Pradesh urban	1
Gujarat rural	1
Gujarat urban	1
Maharashtra rural	1
Maharashtra urban	1
Andhra Pradesh rural	1
Andhra Pradesh urban	1
Karnataka rural	1
Karnataka urban	1
Kerala rural	1
Kerala urban	1
Tamil Nadu rural	1
Tamil Nadu urban	1
Punjab rural	0
Punjab urban	0
Uttarchanal urban	0
Haryana urban	0
Delhi rural	0
Rajasthan urban	0
Uttar Pradesh urban	0
Manipur urban	0
Orissa urban	0
Goa rural	0
Goa urban	0

TABLE 4.10: Decomposition of global MPI across states

state	Headcount	Intensity	MPI
India	55.35%	51.03%	.282
Jammu and Kashmir	40.2%	44.56%	.179
Himachal Pradesh	26.9%	40.29%	.108
Punjab	24.41%	44.93%	.11
Uttarchanal	38.74%	45.55%	.176
Haryana	38.97%	47.06%	.183
Delhi	14.13%	44.57%	.063
Rajasthan	60.57%	52.87%	.32
Uttar Pradesh	71.55%	52.38%	.375
Bihar	77.78%	57.32%	.446
Sikkim	30.79%	46.78%	.144
Arunachal Pradesh	51.42%	50.31%	.259
Nagaland	52.09%	51.04%	.266
Manipur	43.22%	44.94%	.194
Mizoram	18.57%	43.45%	.081
Tripura	53.1%	47.85%	.254
Meghalaya	55.41%	52.51%	.291
Assam	63.88%	50.98%	.326
West Bengal	59.08%	51.45%	.304
Jharkhand	74.97%	56.16%	.421
Orissa	64.53%	52.58%	.339
Madhya Pradesh	68.02%	52.81%	.359
Gujarat	39.23%	47.7%	.187
Maharashtra	41.43%	46.21%	.191
Andhra Pradesh	47.85%	47.36%	.227
Karnataka	47.4%	46.04%	.218
Goa	20.13%	41.58%	.084
Kerala	11.64%	38.52%	.045
Tamil Nadu	34.99%	42.32%	.148

TABLE 4.11: Decomposition of relative multidimensional poverty (1) across states (reference group whole country)

state	Headcount	Intensity	MPI
India	65.59%	53.38%	.35
Jammu and Kashmir	41.94%	46.13%	.193
Himachal Pradesh	34.65%	40.86%	.142
Punjab	39.22%	45.22%	.177
Uttarchanal	46.51%	45.86%	.213
Haryana	54.08%	46.81%	.253
Delhi	17.16%	44.78%	.077
Rajasthan	70.55%	53.9%	.38
Uttar Pradesh	81.23%	55.79%	.453
Bihar	86.83%	60.24%	.523
Sikkim	41.19%	46.48%	.191
Arunachal Pradesh	58.33%	51.49%	.3
Nagaland	57.04%	50.53%	.288
Manipur	48.32%	45.02%	.218
Mizoram	24.1%	45.29%	.109
Tripura	64.76%	47.19%	.306
Meghalaya	62.47%	53.82%	.336
Assam	71.51%	52.04%	.372
West Bengal	68.36%	53.75%	.367
Jharkhand	77.4%	58.18%	.45
Orissa	73.79%	54.69%	.404
Madhya Pradesh	73.55%	54.16%	.398
Gujarat	45.73%	48.68%	.223
Maharashtra	49.13%	46.76%	.23
Andhra Pradesh	58.36%	48.51%	.283
Karnataka	57.76%	47.95%	.277
Goa	24.1%	41.81%	.101
Kerala	12.63%	37.72%	.048
Tamil Nadu	36.18%	42.57%	.154

TABLE 4.12: Decomposition of relative multidimensional poverty (2) across states (reference group state)

state	Headcount	Intensity	MPI
India	62.59%	48.69%	.305
Jammu and Kashmir	45.45%	46.1%	.21
Himachal Pradesh	48.11%	43.45%	.209
Punjab	36.15%	45.61%	.165
Uttarchanal	50.01%	47.03%	.235
Haryana	38.94%	47.03%	.183
Delhi	45.26%	43.98%	.199
Rajasthan	58.17%	47.82%	.278
Uttar Pradesh	76.51%	49.03%	.375
Bihar	75.02%	50.54%	.379
Sikkim	42.85%	47.09%	.202
Arunachal Pradesh	50.01%	49.96%	.25
Nagaland	57.93%	51.82%	.3
Manipur	24.86%	47.75%	.119
Mizoram	38.18%	44.8%	.171
Tripura	55.02%	45.35%	.25
Meghalaya	64.45%	53.32%	.344
Assam	68.29%	49%	.335
West Bengal	68.85%	52.66%	.363
Jharkhand	64.24%	50.35%	.323
Orissa	61.6%	45.14%	.278
Madhya Pradesh	68.89%	49.16%	.339
Gujarat	50.51%	49.11%	.248
Maharashtra	63.35%	48.44%	.307
Andhra Pradesh	64.79%	49.18%	.319
Karnataka	44.8%	45.86%	.205
Goa	33.71%	44.05%	.149
Kerala	20.89%	39.73%	.083
Tamil Nadu	46.93%	42.78%	.201

TABLE 4.13: Decomposition of relative multidimensional poverty (3) across states (reference group state urban/rural)

state	Headcount	Intensity	MPI
India	57.94%	45.04%	.261
Jammu and Kashmir	44.27%	44.64%	.198
Himachal Pradesh	32.73%	40.38%	.132
Punjab	30.23%	45.79%	.138
Uttarchanal	45.55%	43.58%	.199
Haryana	43.97%	45.45%	.2
Delhi	44.84%	43.67%	.196
Rajasthan	48.24%	44.68%	.216
Uttar Pradesh	75.46%	45.61%	.344
Bihar	70.17%	45.86%	.322
Sikkim	36.31%	44.86%	.163
Arunachal Pradesh	51.38%	49.88%	.256
Nagaland	48.93%	48.04%	.235
Manipur	35.83%	45.45%	.163
Mizoram	33.18%	43.56%	.145
Tripura	52.04%	43.98%	.229
Meghalaya	58.39%	49.92%	.291
Assam	67.55%	47.47%	.321
West Bengal	52.95%	45.58%	.241
Jharkhand	66.85%	46.13%	.308
Orissa	62.42%	44.38%	.277
Madhya Pradesh	57.57%	46.1%	.265
Gujarat	54.59%	44.92%	.245
Maharashtra	55.68%	43.59%	.243
Andhra Pradesh	53.23%	43.74%	.233
Karnataka	50.77%	44.39%	.225
Goa	34.02%	43.39%	.148
Kerala	20.89%	39.73%	.083
Tamil Nadu	36.21%	40.73%	.147

TABLE 4.14: Spearman Rank correlation

	global MPI	relative MP (1)	relative MP (2)	relative MP(3)
relative MP (1)	98.28% (0.0000)	1		
relative MP (2)	84.83% (0.0000)	83.74% (0.0000)	1	
relative MP(3)	87.09% (0.0000)	87.14% (0.0000)	89.41% (0.0000)	1

TABLE 4.15: Kendall Tau Rank correlation

	global MPI	relative MP (1)	relative MP (2)	relative MP(3)
relative MP (1)	90.15% (0.0000)	1		
relative MP (2)	67.49% (0.0000)	65.52% (0.0000)	1	
relative MP(3)	69.46% (0.0000)	70.44% (0.0000)	71.43% (0.0000)	1

Table 4.16: Relative contribution of indicators to overall poverty

	Global MPI	relative MP (1)	relative MP (2)	relative MP (3)
education	22.5%	26.24%	26.21%	24.11%
health	32.67%	30.32%	33.87%	37.44%
standard of living	44.83%	43.44%	39.92%	38.54%

Table 4.17: Decomposition of global MPI across household type

group	Headcount	Intensity	MPI
small household (1-3)	47.31%	49.68%	.235
medium household (4-6)	51.86%	50.56%	.262
large household (7+)	63.23%	51.95%	.329
female household head	56.54%	53.1%	.3
male household head	55.21%	50.79%	.28
rural household	68.68%	51.76%	.356
urban household	25.75%	46.71%	.12

Table 4.18: Decomposition of relative MP (1) (India) across household type

group	Headcount	Intensity	MPI
small household (1-3)	41.95%	45.39%	.19
medium household (4-6)	51.61%	44.51%	.23
large household (7+)	66.5%	45.5%	.303
female household head	56.78%	45.78%	.26
male household head	58.08%	44.96%	.261
rural household	60.61%	44.35%	.269
urban household	50.9%	47.23%	.24

Table 4.19: Decomposition of relative MP (2) (state) across household type

group	Headcount	Intensity	MPI
small household (1-3)	51.82%	49.41%	.256
medium household (4-6)	57.09%	48.55%	.277
large household (7+)	69.77%	48.79%	.34
female household head	62.93%	49.84%	.314
male household head	62.55%	48.56%	.304
rural household	74.09%	49.19%	.364
urban household	32.25%	45.68%	.147

Table 4.20: Decomposition of relative MP (3) (state urban/rural) across household type

group	Headcount	Intensity	MPI
small household (1-3)	41.95%	45.39%	.19
medium household (4-6)	51.61%	44.51%	.23
large household (7+)	66.5%	45.5%	.303
female household head	56.78%	45.78%	.26
male household head	58.08%	44.96%	.261
rural household	60.61%	44.35%	.269
urban household	50.9%	47.23%	.24

Chapter 5

Compliance Cost and Trade Preferences: The Case of EU Imports from African LDCs

Abstract Previous work has shown that a significant number of preference eligible goods are imported into the EU from developing countries at relatively small values. The rate of preference utilisation for these imports is low and in many cases zero. This paper examines this phenomenon further by using monthly data on EU imports from African LDCs at the lowest level of available aggregation thereby coming close to transaction level data. This paper intends to put a "price-tag" on rules of origin. Earlier research tried to approximate compliance cost with the preference margin, only allowing for a variable component of compliance cost. In contrast to this, my approach acknowledges the existence of non-negligible fixed costs. I introduce the potential value of preferences (*pvop*) defined as the product of preference eligible exports and the preference margin as appropriate concept to reflect compliance costs. The results confirm the existence of non-negligible fixed costs associated with utilising preferences. Furthermore, I find compliance cost vary significantly across countries and products. The cost structure favours exports in unprocessed goods, as compliance costs for these are significantly lower than for other products.

5.1 Introduction

The EU grants preferential access to its market through various free trade agreements (FTAs) and non–reciprocal preference schemes for developing countries, including the Everything-But-Arms (EBA) initiative. These preferences allow exporters from specified countries to export their goods at lower tariff rates to the EU compared to countries without preferential access,

The chapter is based on joint work with Lars Nilsson. Thanks to Michael Pajot for data extraction. The paper has benefitted from comments by participants at the AEL, PEGNET, and ETSG conference. Moreover, I am grateful to Gaaitzen de Vries, an anonymous reader, and two anonymous referees for useful comments on an earlier version. An earlier version of this paper has been published as Lars Nilsson and Caroline Dotter (2012). Small Flows, Compliance Costs and Trade Preferences: The Case of EU Imports from African LDCs. Economics: The Open–Access, Open–Assessment E–Journal, 6 (2012-45): 1–29.

whose exporters are covered by the most-favoured nation tariff. Non–reciprocal schemes are restricted to developing countries, as they are intended as mean to enable developing countries to benefit from trade. This forms an explicit exception to the principle of non-discriminatory or most-favoured-nation (MFN) treatment, which generally does not allow discrimination between trading partners.[1]

Though trade preferences were designed as development tool, their achievements have been ambiguous. Costs to comply with preference regulation are sometimes too high for developing country exporters relative to their potential benefits.

Preference schemes were largely successful in transferring rents to developing countries, as preferential schemes as a whole are largely utilised and only a very small proportion of eligible imports is actually exported outside any scheme [cf. Bureau et al., 2007, Candau and Jean, 2005, OECD, 2005]. Nevertheless, they have failed to generate new flows [Brenton and Ikezuki, 2004] and have been ineffective in delivering improved access to developed country markets because of too strict rules of origin (RoO) [Brenton, 2003, Brenton and Manchin, 2003, Collier and Venables, 2007, Inama, 2004]. Thus, they have failed in generating a sufficient export supply response and have scarcely created new employment opportunities [Collier and Venables, 2007].

In this paper, the European Union's EBA preference scheme for African LDCs is analysed and the cost structure exporters from these countries face when utilising preferences is assessed. Though low preference utilisation rates feature in several developing countries, this is a more serious problem for exporters from small and poor countries compared to larger and more advanced developing countries. The former export less, have fewer exporters and may therefore also be less informed about the existence of preferences. We therefore examine the phenomenon of low utilisation rates further by looking at an especially vulnerable set of countries: African LDCs solely covered by the EBA scheme.[2]

Using detailed data on imports into EU member states, the exporter's decision to use preferences facing country- and product-specific costs of compliance is explained. The exporter's choice between using preferences and not using preferences is modeled; and I introduce the *potential value of preferences* defined as the product of preference eligible exports and the preference margin as more appropriate concept to capture compliance cost.

Earlier research tried to approximate compliance cost with the preference margin. This, however, only reflects the variable component of compliance costs. My approach allows for the existence of non-negligible fixed costs. Ignoring these fixed costs would potentially upward bias the variable cost estimator. The effect ought to be stronger for our sample of least developed countries as smaller trade flows are observed for these countries.

Finally, the estimation results are used to approximate average compliance cost for different country-product groups. Higher cost are observed for products with more stringent rules of origin and at higher levels of processing. Countries exhibiting already a lot of trade in one sector face lower cost. I thus argue, relatively high compliance cost for preferential exports in processed goods may prohibit export diversification for the analysed countries.

In section 2, we will survey the evidence on the use of trade preferences. Based on this, the model

[1] cf. GATT Part 1, Article 1 and the so-called 'Enabling Clause", WTO Decision of 28 November 1979 (L/4903).

[2] Some African LDCs have preferential access to the EU through economic partnership agreements (EPAs) and the EBA scheme. I, however, focus on LDCs solely covered by the EBA scheme. Even though preference margins do not differ between EBA and EPA countries, EPAs are accompanied by liberalization efforts in the countries themselves and offer more generous rules of origin (as they allow for more cumulation).

to analyse the exporter's choice to use preferences or not is developed (section 3) and estimation results are presented in section 4. In section 5 the compliance cost faced by the exporter when using preferences are approximated and analysed. Finally, the results are summarized and I conclude.

5.2 Literature Review

The value and effectiveness of non-reciprocal trade preferences have been debated since the 1970s [cf. Hoekman and Özden, 2005, for an extensive survey of the literature]. Although trade preferences were intended as a means to enable developing countries to benefit from trade[3], their achievements have been ambigious.

For developing country exporters the costs associated with using preferences often appear to be too high relative to the potential benefits of the schemes. Several authors have therefore tried to quantify the cost associated with using preferences. In a seminal paper on rules of origin, Herin [1986] was the first to quantify these. He found, rules of origin were equivalent to an import tariff between 3 and 5 percent.

Manchin [2006] applies Hansen's threshold estimation approach on a gravity equation with the natural logarithm of the utilisation rate as dependent variable on the sample of non-LDC ACP country exports to the EU. She finds a preference margin between 4 and 4.5 percent is necessary for these countries to utilise preferences under the Cotouno regime. Francois et al. [2006] follow Manchin's estimation strategy to analyse the effect preference erosion has on developing country trade. In their opinion, the erosion of the Cotouno agreement would have hardly any effect on trade as compliance costs are too large for developing countries to benefit from Cotouno preferences anyway. Similar thresholds have been found for trade in NAFTA by Carrere and De Melo [2004] and Anson et al. [2005].

Agostino et al. [2010] observe, the impact of the preferential margin depends on the level of costs faced by the exporter ("the lower the costs, the greater the impact of the [...] margin"). They estimate alternative Tobin models explaining preference utilisation rates and assume the difference between observed and predicted values of preference utilisation – the error term – is an approximation to unobserved compliance cost. In a second step they estimate potential effects of the preferential margin and estimated costs on the value of exports using a gravity equation. Their findings indicate that only looking at the margin as approximation to compliance cost may give biased results.

Nilsson [2011*a*] showed preference utilisation rates (defined as the ratio of preferential imports to preference eligible imports) for small trade flows are markedly lower than average utilisation rates. In 2008, more than 90% of preferential import flows represented together about 10% of the value of EU preferential imports from developing countries.[4] The preference utilisation rates for these smaller flows were found to be low. Preferential import flows of less than 10 000 euro were associated with a preference utilisation rate of only 1%.

Nilsson [2011*b*] further examined the issue and demonstrated EU preference utilisation rates decrease with lower values of preferential imports. On average, evaluated at the mean, he found

[3] "Any differential and more favourable treatment provided under this clause shall be designed to facililtate and promote the trade of developing countries[...]."(cf. GATT L/4903 Nr.3).

[4] A preferential import flow is defined as the value of a product imported into the EU at the 8-digit product level from a certain preference beneficiary in a specific year.

a 1% increase in the value of preferential imports is expected to increase the preference utilisation rate by 20% with varying impact between country- and product groups.
Summing up, several authors estimate tariff equivalents of compliance costs and argue the latter are prohibitively high. Others find evidence that utilisation rates can also be explained by the value of the trade flow. Thus, utilisation rates may be determined by the preference margin *and* the value of shipment.

5.3 Modelling exporter's choice

Nilsson [2011*b*] and Agostino et al. [2010] showed the preference margin is not the sole determinant for using preferences, but the exporter's decision to use preferences may also depend on the value of the shipment. This suggests that exporters have to exceed a certain export value before it is profitable for them to use preferences. Using preferences may thus incur a certain fixed cost.
Assuming non-negligible fixed costs exist, the importance (marginal effect) of the preference margin for the decision to use preferences decreases in importance as the value of exports increases. Ignoring the fixed costs and approximating the compliance costs using only the preference margin may give a biased cost estimator.[5] Therefore, I introduce the concept of the *potential value of preferences* to capture the total cost of using preferences. This allows for the existence of non-negligible fixed costs and is thus a more appropriate approximation. The potential value of preferences (*pvop*) reflects the exporter's benefit of using preferences and is defined as the product of the value of preference eligible exports (X) multiplied with the preference margin (m).

$$pvop = X \times m \tag{5.1}$$

The exporter uses preferences, if the value of preferences, or the benefit through preferences exceeds the total costs (C) associated with using them. Thus the potential value of preferences must be larger than the unobservable cost. The exporters decision to either export under preferences or not can therefore be modeled using a discrete choice model. Preferential exports are only observed ($y = 1$), if the costs associated with using preferences do not exceed the associated benefits:

$$\begin{aligned} y &= 1 \ \textit{if} \ pvop - C \geq 0 \\ y &= 0 \ \textit{if} \ pvop - C < 0 \end{aligned} \tag{5.2}$$

The unobservable cost (C) the exporter faces are expected to differ across countries and products. For example, customs procedures differ across countries and the complexity and strictness of rules of origin may differ across products. Therefore country and sector dummies $COUNTRY_c$ and $SECTOR_p$ are introduced to account for these differences and any other fixed unobservable country and product specific effects. Transaction-specific costs are captured by the error term and are expected to equal zero at the country–sector average.[6]
Substituting the difference between the potential value of preferences and the cost function with

[5] Earlier research also acknowledges the existence of fixed costs, but does not account for them when estimating compliance costs (Manchin [cf. 2006, p.1252], Carrere and De Melo [2004, p.14]).
[6] However, within a country–product group exporters will face different costs depending on their effectiveness to deal with these procedures.

the latent variable y^* one can then estimate a discrete choice model of the form:

$$Pr(y = 1) = Pr(y^* > 0|X) = F(X\beta) \tag{5.3}$$

where the explanatory variables X consist of the *pvop* and the dummy variables for country and product ($COUNTRY_c, SECTOR_p$) determining the unobservable costs.
A change in the potential value of preferences is assumed to affect the decision to use preferences stronger for lower *pvop* values compared to higher *pvop* values. Thus the *rate of change* in the *pvop* affects the decision to use preferences, rather than the existing level of *pvop*. To capture this, the natural logarithm is applied to the potential value of preferences, which equals the value of the trade flow eligible for preferences (X) from country c in product p multiplied by the preferential margin (m), where the sub-index k refers to a specific exporting activity or shipment. We thus estimate the following latent variable model:

$$Pr(y_k = 1) = \alpha + \beta \times ln(pvop_k) + \sum_{c=1}^{C} \gamma \times COUNTRY_j + \sum_{p=1}^{P} \delta \times SECTOR_p \tag{5.4}$$

Thus the probability to use preferences for a specific exporting activity depends on the potential value of preferences (*pvop*) this activity faces and a set of country and sector dummies.

5.4 Estimation Strategy

5.4.1 Dataset

Exporters from African LDCs into the EU may benefit from either the EBA scheme or from the Economic Partnership Agreements (EPA) negotiated with a set of ACP countries. This analysis focuses on countries solely covered by EBA. Even though, preference margins are identical for the two programs, one can argue these two sets of countries are significantly different as EPAs are accompanied by liberalisation efforts in the countries, allow for more cumulation in the production process, and are accompanied by additional Aid for Trade flows. Moreover, entering into EPA negotiations may reflect better governance. The set of African LDCs only covered by EBA is made up of 23 countries.
Data on monthly imports of dutiable products into EU member states at the 8-digit level of the Combined Nomenclature for the year 2010 is used. Unfortunately, shipment or transaction-level data is not publicly available. However, by using monthly HS-8 data — data at the most disagregated level — we come as close as possible to shipment-level data. EU monthly import data is from Eurostat (COMEXT) and MFN tariff rates are from the UNCTAD–TRAINS database completed with figures from the ITC's MacMap database.[7] MacMap converts non ad-valorem tariff rates – which are ubiquitous in agricultural and unprocessed goods – to ad valorem equivalents using the unit value based method (UV).[8]

[7] COMEXT is the Eurostat reference database for external trade and the extraction of EU imports statistics was made in February 2012. UNCTAD–TRAINS is a comprehensive computerized information system at the HS-based tariff line level covering tariff, para-tariff and non-tariff measures as well as import flows by origin for more than 140 countries (http://unctad-trains.org/). MacMap (Market Access Map) covers customs tariffs (import duties) and other measures applied by 191 importing countries to products from 239 countries and territories. MFN and preferential applied import tariff rates are shown for products at the most detailed national tariff line level (http://www.macmap.org).

[8] This means that AVEs are calculated by dividing a given NAV tariff by the unit value.

Bourdet and Persson [2012] argue costs of importing into the EU may differ across countries due to a varying effectiveness of custom procedures. For exporters from African LDCs costs could potentially be higher in countries which receive few EBA imports due to less familiarity with shipments from these origins and subsequently more time needed to process them. Therefore, EU member states which receive less than 100 import flows[9] from the set of countries are dropped from the sample.[10]

At shipment level, each individual import flow must have a preference utilisation rate of either 0% or 100% since preferences cannot apply to a share of a product imported. A preference utilisation rate in-between thus tells us that the registered import flow must necessarily consist of more than one transaction where one of the transactions uses preferences and the other one does not.[11] The vast majority of the observations in the sample have utilisation rates of either 0% or 100%. Only 3% of observations have utilisation rates in-between. I choose to ignore these 3% of observations in an attempt to come as close as possible to transaction level data. To further substantiate the shipment-level assumption, the top percentile of export values (80 observations) is dropped. These observations are considered outliers, as very large flows are more likely to consist of several shipments. For 99% of the observations export values are less than 1.17 million euro.

Finally, observation for countries with no preferential exports (Chad, Somalia, and Sudan) are ignored in the estimation of the model. These country parameters would perfectly predict failure, since exporters in these countries do not use preferences, irrelevant of values for all other variables.[12]

5.4.2 Regression Results

The specified model (5.4) is estimated using a logit model and the coefficient effects are presented in table 1 as odds-ratios and changes in the predicted probability to use preferences[13].

The model is successful in explaining the exporter's decision to use preferences or not as more than 86% of observations are predicted correctly. Moreover, the potential value of preferences is a relevant parameter to explain the exporter's use of preferences. A one percent increase in the potential value of preferences increases the odds of using preferences by 1.36 times (cf. table 5.1 column 1). Moreover, I find the effect of the *pvop* is equally made up of the preference margin (m) and the value of exports (X)[14]. Estimation results allowing for a differentiating impact of the two effects are reported in column 2.

Country and product dummies, the later being TDC sections[15], appear to be the main determi-

[9] I tested for a threshold between 50 and 500.

[10] Luxembourg, Finland, Malta, Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Romania, Bulgaria, Cyprus.

[11] Note, however, that the opposite does not hold true, an export flow with a utilisationrate of either 0 or 1 could potentially consist of more than one shipment.

[12] I tested wether leaving out these observations biased my estimation results following a strategy proposed by [Heinze and Schemper, 2002], but found this is not the case. Regression results including these country dummies can be obtained from the author.

[13] The change in the predicted probability to use preferences is for a discrete change of the variable for the dummy coefficient and a one standard deviation change centered at the mean for the potential value of preferences.

[14] The assumption $\beta ln(pvop) = \beta ln(m \times X) = \beta ln(m) + \beta ln(X)$ holds applying an F-Test.

TABLE 5.1: Logit– odds-ratios and predicted probabilities for a one standard deviation change in the continuous variable a discrete change in the dummy variable

	(1)		(2)		(3)	
utilisationrate	odds-Ratio	change in pr.	odds-Ratio	change in pr.	odds-Ratio	change in pr.
ln(pvop)	1.36***	0.2313			1.28***	0.7853
ln(m)			1.32***	0.0572		
ln(X)			1.36***	0.2123		
roo					0.57***	-0.1387
Benin	23.56***	0.5243	23.57***	0.5243	24.9***	0.527
Burkina Faso	44.87***	0.5687	44.83***	0.5686	46.59***	0.5697
Centr. African	3.15	0.2731	3.15	0.273	3.1	0.2692
Congo (Dem. Rep.)	43.68***	0.5796	43.77***	0.5797	44.81***	0.5803
Eq. Guinea	24.04***	0.5263	24.1***	0.5264	22.42***	0.5219
Eritrea	51.08***	0.5484	50.66***	0.5482	48.47***	0.5465
Ethiopia	37.16***	0.61	37.22***	0.61	37.91***	0.6109
Gambia	10.95***	0.4641	11.02***	0.4647	11.92***	0.472
Guinea	8.18***	0.4345	8.19***	0.4345	8.45***	0.4382
Guinea Bissau	2167.92***	0.59	2176.46***	0.59	2169.49***	0.5895
Liberia	2.92	0.2576	2.93	0.2577	2.7	0.2406
Mali	124.55***	0.599	124.71***	0.599	132.06***	0.5998
Mauritania	26.46***	0.56	26.45***	0.5599	26.83***	0.5605
Malawi	21.73***	0.5338	21.92***	0.5344	21.48***	0.5326
Niger	13.33***	0.4822	13.27***	0.4818	14.21***	0.4872
Sao Tome & P.	56.47***	0.5459	56.25***	0.5458	60.72***	0.5471
Senegal	115.81***	0.7821	116.12***	0.7823	122.19***	0.7854
Sierra Leone	4.97***	0.3586	4.96***	0.3581	4.81***	0.3529
Togo	67.98***	0.608	67.91***	0.6079	70.09***	0.6087
TDC1	743***	0.7885	788.8***	0.7904	811.51***	0.7909
TDC2	324.65***	0.7317	341.23***	0.7333	356.17***	0.7344
TDC3	76.96***	0.5608	80.86***	0.5618	83.4***	0.5619
TDC4	128.69***	0.6405	137.18***	0.6424	144.46***	0.6436
TDC5	8.69***	0.4359	8.8***	0.4373	9.15***	0.4413
TDC6	30.59***	0.531	31.66***	0.5324	32.88***	0.5335
TDC7	17***	0.5026	17.62***	0.5052	18.96***	0.5098
TDC8	110.49***	0.5896	113.12***	0.5901	119.8***	0.5909
TDC9	91.35***	0.5719	93.37***	0.5724	98.8***	0.573
TDC11	72.17***	0.6625	76.53***	0.6656	81.38***	0.6684
TDC12	60.92***	0.5755	62.7***	0.5764	61.76***	0.5755
TDC13	49.01***	0.55	50.47***	0.5509	52.98***	0.5518
TDC14	37.02***	0.5471	37.93***	0.548	38.71***	0.5484
TDC15	13.94***	0.4961	14.15***	0.4974	14.98***	0.5021
TDC17	0.61	-0.1144	0.64	-0.1057	0.59	-0.1226
TDC18	13.29***	0.4991	13.44***	0.5002	13.7***	0.5018
TDC20	50.83***	0.5503	51.61***	0.5507	52.85***	0.5509
Mc Fadden's Pseudo-R^2	0.54		0.54		0.54	
Log-Likelihood	-2424.5872		-2424.4811		-2415.2488	
correctly classified	86.04%		86.12%		86.38%	
Area under ROC	0.9349		0.9349		0.9353	
Number of observations	7620		7620		7620	

nant for the exporter's decision to use preferences. In comparison to exporters from the reference country Angola, Senegalese exporters have a 78 percentage point higher probability to use preferences. These strong differences are supported by the fact that only 1.8% of exporters from Angola use preferences, while 76.3% of senegalese exporters do so. Even stronger differences are observed across product groups. Exporters in TDC sections 1 (animal products), 2 (vegetable products), 4 (prepared foodstuffs), and 8 (raw hides, skins and leather) are most likely to use preferences. The odds for using preferences for exporters in TDC1 are 743 times larger than for exporters in the reference group TDC16 (machinery).

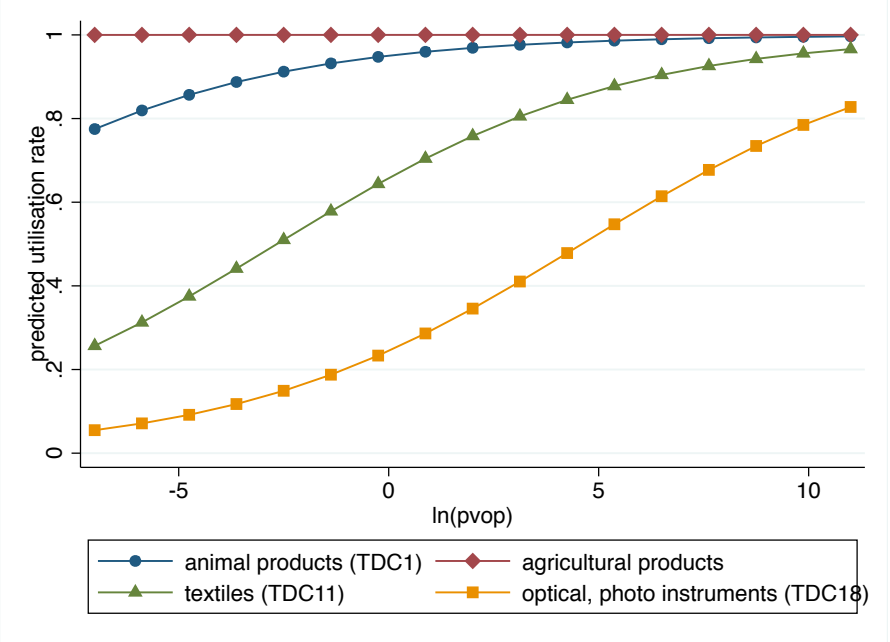
[15]Estimating the model with less aggregated product dummies (i.e. dummies reflecting 2-digit chapter headings of the harmonized schedule) (cf. Appendix Table 5.2 for a definition of the product headings) did not increase the explanatory power of the model. Estimation results for these may be obtained from the author.

As additional robustness check, I test the potential impact of the RoO waiver for exported goods not exceeding the threshold of 6000 euro. Consignments up to a value of 6000 euro may be exported under preferences without a formal certificate of origin. The sole requirement is to fill out a so-called invoice declaration stating that the exported product is of preferential origin according to the rules of origin of the preference scheme.[16] However, a certain fixed cost is still associated with obtaining this certificate and exporters need to be able to present proof of origin on demand. Thus a similar documentation effort is required. If these fixed costs are too large, one would expect less utilisation since the potential value of preferences for small trade flows are lower compared to larger trade flows. In addition, variable costs are identical to the case where no RoO waiver applies.

To test the above, a dummy variable for EU import flows of less than 6000 euro is added to the model. I find, exporters who could use this simplified procedure are actually less likely to use preferences (cf. table 5.1 column 3). Thus, the threshold value may be too low for exporters to make use of it considering non-negilible fixed compliance cost, and other trade costs, such as transport, exhibit economies of scale. The fit of the model also increases slightly (looking at the percentage of correctly classified observations) and therefore column (3) presents the preferred specification.

The effect exporter's country and sector have on the probability to use preferences may be

FIGURE 5.1: Effect of the *pvop* on the utilisationrate for the example Senegal



illustrated by plotting the effect of the potential value of preferences given certain values for products and countries. Figure 5.1 depicts the effect the potential value of preferences has on the estimated probability to use preferences in different sectors for the example of Senegal. For easier interpretation I only plot effects for agricultural products[17] against the three other most important sectors (by frequency of trade). This shows senegalese exporters in agricultural

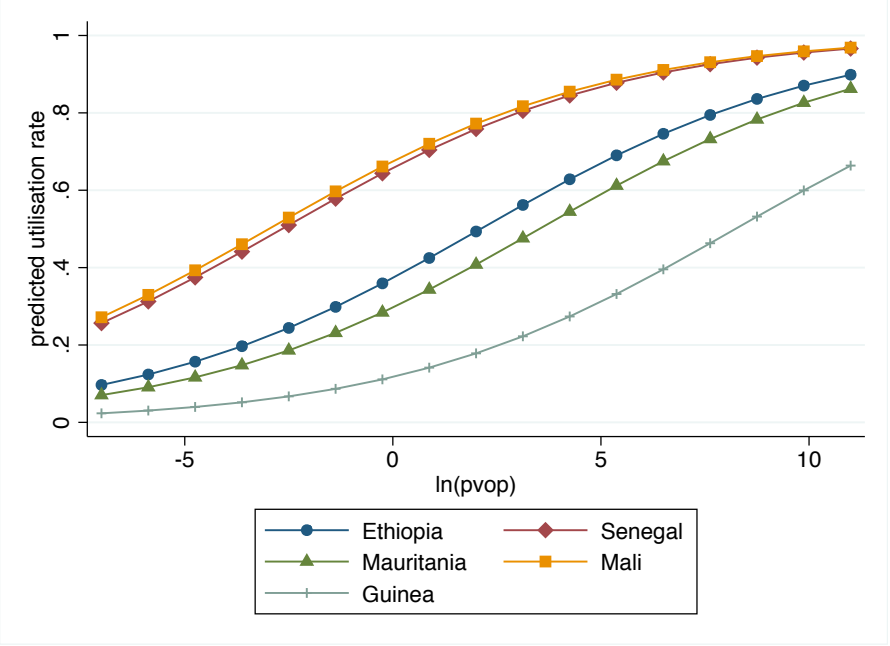
[16] Cf. Art. 80(b) and 89(1) in Commission Regulation 2454/93.

[17] Products are defined as being agricultural products following the WTO multilateral trade negotiation categorization. This covers mostly products in TDC2 (vegetable products), TDC3 (animal or vegetable fats and oils), and TDC4 (prepared foofstuffs, beverages, tobacco).

products and TDC1 (animal products) will always use preferences. But exporters in TDC11 (textiles) and TDC18 (optical, photo precision instruments) strongly depend on the potential value of preferences for their decision to utilise preferences or not. However, at identical values of the potential value of preferences, exporters ins TDC11 are more likely to use preferences.

Moreover, the effect of exporting sectors also differs across countries. Figure 5.2 depicts esti-

FIGURE 5.2: Effect of the *pvop* on the utilisationrate for textiles (TDC11)



mated utilisation rates in TDC11 (textiles) for exporters from five different countries. Comparing the effect exporting from Senegal has compared to exporting from Guinea, one can observe senegalese exporters are more likely to use preferences at *any* potential value of preferences.

One can therefore conclude the potential value of preferences significantly affects the decision to use preferences, but costs to comply with preference regulations also differ strongly across country- and product-groups. These differences may reflect more stringent rules of origin for certain products, a varying quality of national institutions, and the importance of preferential trade for certain countries and sectors. A detailed discussion of these factors is given in the following section.

5.5 Approximating compliance costs

The discrete choice model above was based on the argument that preferences will only be used, if the cost associated with using them are at least as large as their potential benefits.

$$y = 1 \; if \; PVOP - C \geq 0 \tag{5.5}$$

Thus, the estimated probability to use preferences is 0.5[18], if the potential value of preferences equals the (expected) cost for utilising preferences.

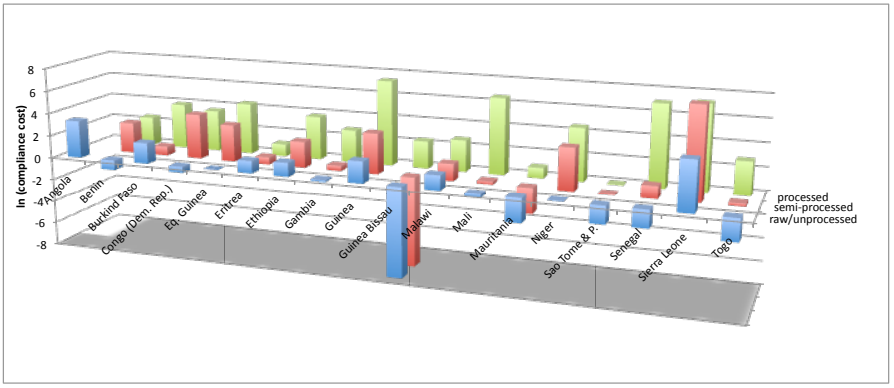
$$Pr(y^*) = 0.5 = F(PVOP - C = 0) \tag{5.6}$$

With this approach average costs associated with using preferences can be determined by estimating the threshold potential value of preferences for using preferences in country-product groups with a sufficient number of observations. I can then analyze how strong these costs vary along country and product-specific characteristics.

I argue, cost estimates are not meaningful if no preferential exports are observed in the specific country-product group. Similarly, if only one preferential export in the country-product group is observed, this may be an outlier or error in the data. Thus, I exclude cost estimates were either rule applies from the following analysis. This is the case for 22 country-product groups. Finally, cost estimates in TDC17, Liberia, and the Central African Republic are ignored as coefficient estimates for these groups were not significant.

Figure 5.3 provides a first idea about potential differences in average costs across countries

FIGURE 5.3: Compliance Cost across level of processing and countries



Source: Author's calculation, Appendix table 5.5

and sectors. The graph displays average costs across countries and sectors, where the latter are grouped according to their level of processing[19]. This makes clear, costs vary significantly across countries, though raw and unprocessed goods *always* face lower compliance cost at the country level. Lowest costs are observed in TDC sections 1 (animal products) and 2 (vegetable products), which cover animal products (mostly fish) and vegetables (cf. Appendix table 5.5).

A reason for the strong variance of costs may be a varying preference margin. Exporters in TDC sections 1 and 2 face higher preference margins than exporters in other categories. While the average preference margin excluding TDC sections 1 and 2 equals 6.9%, preference margins for TDC sections 1 and 2 equal 12.3% and 9.5% respectively.

The higher prevalence of preferential trade in these sectors may also be caused by the relative

[18] I tested wether a threshold of 0.5 is appropriate for our estimation (estimating a ROC curve) and found this to be the case. Results may be obtained from the author.

[19] This grouping follows the the product classification of Broad Economic Categories (BEC).

ease to comply with rules of origin. According to the rules of origin restrictiveness index developed by Cadot et al. [2006] exporters in these two sectors face less restrictive rules of origins.[20] This may have two simultaneous effects: First, cost of compliance across countries will be lower as producers need few, if any, intermediate inputs to produce these unprocessed products. However, for most other products exported to the EU, fragmentation of the production process is the case. The more intermediate inputs exporters need to produce their final product, the more difficult it is for them to fulfill rules of origin which require a certain share of the production process to happen in the country. This may increase variable cost, if it is more expensive to source locally. It may also increase fixed cost, as it is more difficult to prove origin compared to the case where no intermediate inputs are needed.
Secondly, these costs may vary across countries for the same product as producers may have different possibilities to source locally. Furthermore, proving origin may also be easier for exporters from some origins than others because fixed costs could depend on the effectiveness of custom institutions.
Moreover, compliance cost may also be determined by industry clusters, if preferential trade is associated with sunk information cost or learning-by-exporting. I cannot account explicitly for these costs as panel data would be needed for this analysis. However, if sunk information cost exist, large industries with a track record of exporting under preferences would face lower costs of exporting. For producers in sectors where few exports are observed, exporting under preferences would be more expensive[21]. We find the vast majority of preference eligible trade happens in TDC sections 1 (46%) and 2 (16%) which are the sectors with the lowest average cost (cf. Appendix table 5.5). Overall, less processed goods which face lower cost of compliance make up the vast majority of preference eligible trade flows (cf. Appendix table 5.3 and 5.4). This indicates sunk cost play a role in the exporter's decision to use preferences.
Analysing the variance of average compliance cost across country-product groups one finds costs are lowest for preferential exports in primary products, specifically in agricultural goods. This may be caused by less stringent rules of origins in these sectors and high levels of already existing trade. Moreover, differences in costs across countries may originate from differences in the effectiveness of customs and possibilities to source within the country.

5.6 Conclusion

This paper analyses the compliance cost faced by a set of least developed country exporters when exporting into the EU under preferences. In contrast to earlier research, I do not use the preference margin to approximate compliance costs, but introduce the *potential value of preferences* as appropriate concept to capture total cost. I find the potential value of preferences is significant in explaining the exporter's decision to use preferences and argue fixed compliance costs are non-negligible for exporters from LDCs.
Estimation results show, compliance cost differ strongly across countries and sectors. This reflects different rules of origin across products, a varying quality of national institutions, and levels

[20] Cadot et al. [2006] constructed a synthetic index intending to capture the restrictiveness of rules of origin. This ordinal index codes products from 1 to 7 according to the restrictiveness of the applied rules at the 6-digit level of the product nomenclature.
[21] Persson [2012] provides a detailed discussion of the effect of different kinds of costs.

of already existing trade. The cost structure appears to favour exports in unprocessed agricultural and animal products where least stringent rules of origin are observed and where the vast majority of preferential trade occurs. Since market entry cost for preferential exporting in other products are relatively high, trade preferences may reinforce already existing trade structures and may fail to diversify exports from least developed countries. In their current design trade preferences appear to increase the relative cost of exporting more processed goods.

However, the regulatory design of trade preferences is not the only driver as costs differ vastly for one product across countries. Institutions across countries appear to vary in the effectiveness they deal with these regulations. This has negative effects on the exporter's possibility to utilise preferences.

A joint effort of liberalising regulations governing the use of preferences and improving institutions within the country is therefore needed for developing country exporters to benefit from trade preferences. Regulations could be liberalised by reducing the paperwork associated with applying for preferences and relaxing cumulation rules. This would make it easier for developing country exporters to integrate into the global value chain. Moreover, aid should be focused on building institutions within the countries, this would make it easier for exporters to fulfill paperwork associated with preferences.

Finally, my results indicate the existence of sunk cost associated with exporting under preferences as exporters from countries with a lot of preferential trade in one sector face lower costs of exporting. Analysis looking into the duration and importance of trade at the exporter level may shed some further light on this issue. This is an important area for future research.

Appendix

TABLE 5.2: Correspondence between TDC Sections and HS Chapters

TDC Section	Description	HS Chapter
I	Live animals; animal products	01–05
II	Vegetable products	06–14
III	Animal or vegetable fats and oils	15
IV	Prep foodstuffs; beverages, tobacco	16–24
V	Mineral Products	25–27
VI	Products of the chemical	28–38
VII	Plastics; rubber	39–40
VIII	Raw hides and skins, leather	41–43
IX	Wood and articles of wood; cork	44–46
X	Paper or paperboard	47–49
XI	Textiles and textile articles	50–63
XII	Footwear	64–67
XIII	Art of stone plaster cement	68–70
XIV	Pearls; precious stones and metals	71
XV	Iron and steel, base metals and art	72–83
XVI	Mach, elect.equip	84–85
XVII	Transport equip, aircraft, ship	86–89
XVIII	Optic photo cine precision instr	90–92
XIX	Arms and ammunition	93
XX	Miscellaneous manufactured articles	94–96
XXI	Works of art, collectors' pieces	97

TABLE 5.3: Average compliance cost across levels of processing

partner	raw/unprocessed	semi-processed	processed	average cost
Angola	1910			1910
Benin	0	453	316	232
Burkina Faso	65	6	8315	6124
Congo (Dem. Rep.)	0	7971	3761	3067
Eq. Guinea		1601	27989	2921
Eritrea	12	4	11	9
Ethiopia	16	182	5839	3167
Gambia	1	3	635	108
Guinea	78	3215	23167477	14650420
Guinea Bissau	0	0	230	153
Malawi	20	28	523	42
Mali	0	2	3779118	2964968
Mauritania	0	0	8	0
Niger	1	4464	35437	30348
Sao Tome & P.	0	1	1	1
Senegal	0	12	11030941	5088925
Sierra Leone	19546	70251957	19141229	20969174
Togo	0	2	725	467
average cost	29	254712	5110296	2425032

TABLE 5.4: Preference eligible trade across countries and level of processing

partner	raw/unprocessed	semi-processed	processed	Total
Angola	1.77%	0.00%	0.00%	1.77%
Benin	0.48%	0.00%	0.04%	0.52%
Burkind Faso	0.67%	0.26%	0.45%	1.38%
Congo (Dem. Rep.)	0.51%	0.69%	0.36%	1.56%
Eq. Guinea	0.00%	3.55%	0.00%	3.55%
Eritrea	0.00%	0.33%	0.36%	0.70%
Ethiopia	5.23%	2.71%	2.64%	10.58%
Gambia	0.79%	0.03%	0.01%	0.82%
Guinea	0.03%	0.03%	0.13%	0.20%
Guinea Bissau	0.02%	0.00%	0.02%	0.03%
Malawi	16.22%	6.15%	0.02%	22.39%
Mali	0.10%	0.03%	0.28%	0.41%
Mauritania	15.17%	0.20%	0.32%	15.69%
Niger	0.35%	0.00%	0.22%	0.57%
Sao Tome & P.	0.00%	0.01%	0.01%	0.02%
Senegal	34.28%	0.16%	3.58%	38.02%
Sierra Leone	0.14%	0.00%	0.17%	0.31%
Togo	0.84%	0.00%	0.63%	1.48%
Total	76.59%	14.17%	9.24%	100.00%

TABLE 5.5: Average compliance cost across countries and sectors

TDC partner	1	2	3	4	5	6	7	8	9	11
Angola	1,910									
Benin	0	0	305					94		441
Burkina Faso		0	12			1,418		6	16	28
Congo (Dem. Rep.)	0		2	168,653	448	14,131	9	13	39	
Eq. Guinea						21,698			32	
Eritrea	0							4		10
Ethiopia	0	0		7		2,607		8	37	56
Gambia	0	17		880						
Guinea		79	15,982	3,221				5,952	5,488	34,763
Guinea Bissau	0	0	0						0	
Malawi		1	749	21						642
Mali		0		0		18	192	0	0	0
Mauritania	0			8						
Niger		1						923		4,228
Sao Tome & P.	0	1	1							
Senegal	0	0	1	0		28	245	0	0	1
Sierra Leone				24,866			104,139,529			217,964
Togo		0	6	1				1	3	6
average cost	11	4	1,928	330	168,653	3,703	10,128,364	138	153	5,889

Table 5.5 continued

TDC partner	12	13	14	15	16	17	18	20	**average cost**
Angola									1,910
Benin									232
Burkina Faso		203	729	31,695			43,892	205	6,124
Congo (Dem. Rep.)		238							3,067
Eq. Guinea								2,921	
Eritrea									9
Ethiopia	112	470	1,596				95,797	475	3,167
Gambia									108
Guinea							47,421,426		14,650,420
Guinea Bissau	0				343	2,031			153
Malawi								42	
Mali	2	3	10	472	25,613,009		593	3	2,964,968
Mauritania									0
Niger			70,024					25,950	30,348
Sao Tome & P.									1
Senegal	3	13	577		201,605,756	769	4	5,088,925	
Sierra Leone									20,969,174
Togo	13	38	138	6,625			7,553	24	467
average cost	40	149	14,655	6,981	20,045,038	178,782,693	8,600,032	1,823	2,425,032

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