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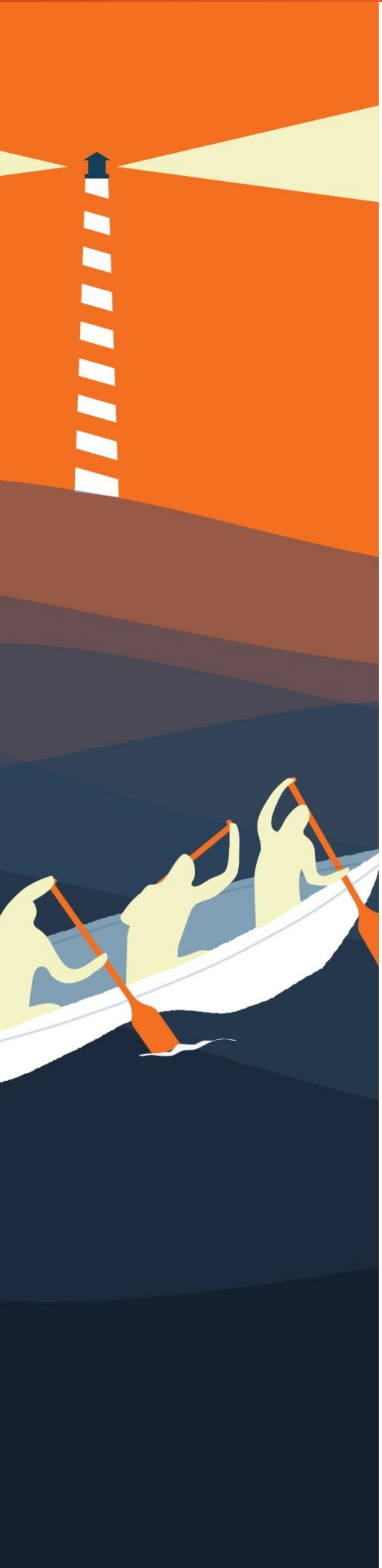

Background Paper

Household Risk Preparation Indices—Construction and Diagnostics

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HOUSEHOLD RISK PREPARATION INDICES—CONSTRUCTION AND DIAGNOSTICS

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Abstract: Recent years have seen growing interest in the conceptualization and measurement of household risk preparedness at the cross-country level. This background paper discusses the challenges faced in the design of composite indices, including indicator selection, aggregation, and weighting, and how they might be addressed in the composition of a risk preparedness measure. A simple risk index is devised, and a series of diagnostic tests conducted in order to demonstrate the robustness of the new measures, and its degree of construct validity.

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1. INTRODUCTION

Risk is pervasive in developing countries, and the standard household risks of sickness, mortality, and unemployment can prove a severe and negative shock for poor and vulnerable families. Many rural households that derive their livelihoods from the land face the risks of droughts, floods, and pests and diseases affecting their crops and livestock, while urban households face risks of crime, fire, and unemployment. When risk is mismanaged, its negative outcomes can be severe, turning into crises with often unpredictable consequences.

A growing range of studies have examined risk and risk-mitigation strategies by poor households. Alderman and Paxson (1994), Morduch (1995, 1999), Townsend (1995) and Fafchamps (1999) have examined household consumption patterns using panel surveys, while Dercon (2002) focuses on the constraints housholds face in using these strategies to respond to shocks. In many developing countries, environmental fluctations are responsible for severe instability of consumption and earnings. Using the 10-year panel data for one of the three International Crops Research for Semi-Arid Tropics (ICRISAT) villages in India, Townsend (1994) reports high yearly yield fluctations (in monetary terms) per unit of land for the dominant crops. Kinsey et al (1998) report a high frequency of harvest failures in a 23-year panel of rural households in a resettlement area in Zimbabwe. Bliss and Stern (1982) estimate that in Palanpur, India, a two-week delay in the onset of production is associated with a 20 per cent decline in yields. Morduch (1995) provides many other examples. Gertler and Gruber (2002) find that in terms of consumption levels, households in Indonesia can protect themselves against only thirty per cent of low frequency health shocks, yet seventy per cent of more minor, high-frequency health shocks.

In the study of household risk preparation, response, and risk coping, scholars have tended to separate the component categories of risk, such as disease, unemployment, or natural disaster. Health shocks, for example, are typically idiosyncratic events affecting households in isolation, whereas environmental hazards, are common shocks which affects groups collectively. As a consequence, insurance may be appropriate as a mechanism of compensating the former, though only central government intervention may be appropriate to dealing with the latter (Dercon 2002). While different causal mechanisms, response strategies, and impacts of different risk categories may have discouraged a uniform analysis of risk, more salient is likely the fact that risk events cross differing disciplinary boundaries, leading many scholars have arbitrarily restricted the analysis to domain-specific risk outcomes.

As a result of this fragmentation, a universal approach to household risk management is more rarely attempted: though there is no a priori reason why the empirical study of risk as a *sui generis* category cannot be undertaken. Across the full range of risk impact mitigation strategies, households tend to protect against shocks in a fairly delimited, and therefore easily ennumerable, set of ways. The first, and perhaps most intuitive means of protecting against exogenous household risks is via the accumulation of savings and assets; with most poor households having some stock of consumer durables, livestock, or tools and physical capital (Filmer and Scott, 2009). Beyond household savings, a second means of responding to exogenous shocks is via access to credit, which allows for consumption smoothing between times of income volatility or the capacity to respond to idiosyncratic consumption requirements, for example, due to the illness of a household member (Islam and Maitra 2012). Thirdly, insurance mechanisms may play a role in allowing households to respond to specific shocks: for example, enrolment and coverage of social insurance programmes, such as pension schemes, health insurance, and unemployment compensation can help vulnerable households mitigate the effects of specific risk events. Fourthly, in addition to formal institutions such as state-provided insurance or programmes which deliver public goods, informal institutions, such as family and friendship ties, can also play a role in reducing the impact of exogenous shocks (Woolcock and Narayan, 2000). Households with a high level of such 'social capital' are more likely to be able to find friends or family members willing to provide care, lodging, and financial support in response to unexpected negative events (Morduch 2006). Finally, beyond the capacity of households to respond to risk *ex post*, due to their stocks of financial, human, and social capital, there are a number of relevant risk reduction factors, most notably the capacity of state to respond to risk events through preventive health measures, disaster relief, and counter-cyclical economic policies. Given such an inventory of risk mitigating strategies, it is possible to draw up a series of indicators reflecting the mechanisms by which households can protect against risk, which would then form the basis of a simple empirical measure of the preparedness of households across countries to face exogenous risk occurrences.

An approach based on risk preparedness would be a useful complement to existing empirical analyses of risk, which tend instead to assess risk by reference to *ex post* hazard rates and estimates of relative risk exposure, such as mortality rates, the rate of newdisease infections, job losses, or the rate and impact of environmental hazards (Sistrom and Garvan 2004). The EM-

DAT database commissioned by the World Health Organisation (WHO), for example, allows for the calculation of the rate of impact of environmental disasters across countries, as well as mortality rates in respect to such disasters, allowing an estimate of risk responsiveness (Foa 2009, World Health Organisation 2008). However, a limitation of hazard based assessments of risk, is that firstly they require a full specification of the risk categories facing households, and secondly, that such a calculation requires not only knowledge of the risk impact (e.g. the effect on the mortality rate), but also the number of hazard events which households have in fact recently faced (e.g. the number of natural disasters in a given time period), and this latter data (in other domains) may be difficult to estimate. By contrast, by measuring the preparedness of households to face risk shocks *ex ante*, as a result of their accumulated physical, human and social assets, their participation in insurance mechanisms, and their access to public goods which facilitate risk responsiveness, we can provide a useful complement to such hazard-based risk measures.

The purpose of this paper is therefore to assess the feasibility and design of a simple index measuring the cross-country preparedness of households to face generic risk events. In doing so, we assess the available indicators that might be used to construct a simple composite index of risk preparedness. Such work, follows an established precedent by which international organizations, think-tanks, and academics have in recent years produced a wide range of composite indices designed to assess such broad social science concepts as governance, risk, or human development. International organizations such as the United Nations and the World Bank have produced aggregate development indicators including the Human Development Index (HDI), the Gender Empowerment Measure (GEM), the Doing Business (DB) indicators, and the Worldwide Governance Indicators (WGI), while think-tanks and consultancies such as Freedom House, the Economist Intelligence Unit, and Transparency International have produced indices such as the Political Rights and Civil Liberties indices, the Quality of Life index, and the Corruptions Perceptions Index (United Nations 2007, Doing Business 2005, Kaufman et al. 1999, Lambsdorff 2006). A review of the phenomenal growth of composite indices conducted by Bandura and Martin del Campo (2006), found that of the 160 composite cross-country indices now in existence, 83% had been generated since 1991 and 50% in the previous 5 years alone, while, before 1991 there were less than 20% of the composite indices found available today.

Composite indices have found such favor because aggregative measures have the ability to summarize complex or multi-dimensional issues in a simple manner, making it possible for policymakers to get a tractable and representative sense of the situation in a given country and in comparison with others; and have substantial ease of interpretation over the use of multiple benchmarks. Composite indices also have strong merits as communicative devices, such as in the context of a report such as the annual World Development Report. Finally, composite indices are an important starting point for debate: until the publication of the Worldwide Governance Indicators (1999) or the Ease of Doing Business Index (2001), for example, ‘good governance’ was largely a catchphrase—yet by defining and measuring this concept, a process of dialogue has begun over what is and ought to be understood by quality of governance, and this has produced substantial innovations, improvements, and fresh data for making comparative claims.

As critics have frequently alleged, when poorly designed, composite indices also carry attendant risks, and one of the objectives of this paper is to minimize the likelihood of such an eventuality through a series of diagnostic tests. Nardo et al. (2005), for example, note how ill-constituted composite measures can send misleading policy messages or invite simplistic policy conclusions. Saltelli and Tarantola (2007), give the case of a sustainability index, cited in a major newspaper, that ‘rewards oil and gas exporting countries higher due to the large budget surplus engendered by a temporary boom in commodities prices’. In this case readers are better informed by examining the separate indicators individually, rather than referring to the aggregate score. An initial objective of this paper is therefore simply to assess whether ‘household risk’ is a suitable category for an aggregative measure—by assessing empirically the validity of various risk measures, and addressing questions regarding the indicator selection, weighting schemes, and how to deal with missing data so as to ensure that any final index reflects a meaningful distillation of the available information. Having done so, the second purpose of this paper is to discuss the methodological decisions taken in the construction of a risk index and the outcomes which arise from these decisions.

Accordingly, this background paper describes some of the methodological challenges, conceptual issues, and conducts brief diagnostic tests in order to demonstrate the reliability and validity of the available indicators and aggregates. Section 2 summarizes the methodological decisions required when constructing aggregate measures, and some of the conceptual issues surrounding indicators of household risk. Section 3 offers a series of brief diagnostic tests designed to refine indicator selection and test the validity of their aggregation. Section 4 briefly discusses the results; and finally section 5 concludes.

2. KEY ISSUES IN INDEX DESIGN

2.1 Indicator Selection

The first major area that the designer of a composite index must decide is with regard to the selection of variables for use in constructing the measure. Specifically, the designer must decide whether to concentrate on just one or two 'key variables', or to adopt a more comprehensive approach using data from a wide range of indicators of varying data quality. An example of an index using a smaller number of select variables is the Human Development Index, which in its most recent iteration uses just six items: life expectancy, the literacy rate, income per capita, and the primary, secondary and tertiary enrolment rates (Human Development Report 2007). At the other extreme, the Worldwide Governance Indicators project constitutes among the most comprehensive exercises in data aggregation, with over 300 indicators from 33 separate data sources (Kaufmann et al. 2007).

The judgment as to whether the index designer should adopt a broad or a narrow selection of indicators depends largely upon the latent variable that the measure is intended to capture. An index of, say, cardiovascular health may reasonably rely on just one or perhaps several indicators, such as active and resting heart rate, blood pressure, and history of myocardial infarction. Here a single indicator may be at once reliable, valid, and representative of a large number of cases. In the case of measuring dimension of governance, for example a measure of the rule of law, no such indicator exists. Researchers should therefore examine a broader array of measures. Some items, such as a rating of contract enforceability by a consultancy organization, may be valid and cover a large number of countries, yet be considered unreliable due to perceptions bias and correlated error with other ratings. Meanwhile another indicator, such as a public opinion survey regarding the incidence of consumer fraud, may be reliable and fairly valid, but cover only a small portion of countries. Using a larger pool of indicators, therefore, is likely to be the only means of accurately measuring that concept.

Another dilemma in index design is the choice between reliability and representation. If the indicator selection is narrow, it is simpler to understand how the index is derived, and the index may gain credibility from the reliability of its sources, assuming these are well selected. However, the risk of a narrow selection is that the indicators chosen may not be relevant to what the index purports to measure: for example, due to its reliance on demographic data, the Human Development Index is sometimes misunderstood as a measure of human capital (that is, physical and mental productive capacity) rather than a measure of human capabilities in general (Fukuda-Parr and Kumar 2004). At the other extreme, a more encompassing selection of indicators improves the ability to validly measure every aspect of a phenomenon, but it can then prove more difficult for readers to understand what the index scores represent. There is no clear set of criteria to determine which approach is more advisable, but in general the 'fuzzier' the concept and the weaker the available data, the more likely only a large pool of indicators can accurately capture the construct in question, whereas a precisely defined concept for which there are strong available measures is best served by presenting such indicators simply and directly.

In the case of household risk, as we shall see, the available indicators have relatively broad country coverage, and are generally free from reliability and validity concerns, which would predispose an index designer in favor of the use of a set of carefully selected indicators - rather than broad-brush aggregation. In addition, as the diagnostics will show, there is a relatively high degree of correlation between the items in each category area, which again gravitates us away from broad indicator choice and in favour of a narrower set. There are, however, at least two dimensions to the collected set of indicators, and this suggests i) at least two sub-components to the construction of any composite index, and ii) that no single indicator can play the role of a 'proxy' for household risk. These issues are addressed further in the diagnostics section of this paper.

2.2 Weighting Scheme

The second consideration is the assignment of weights to indicators in order to produce the final index. Four basic types of solution to this problem can be found among the existing range of composite indices: the use of equal weights among items (Basic Capabilities Index, E-Government Index, Failed States Index); theoretically categorized weights (HDI, Gender Empowerment Measure, Doing Business Index, Environmental Sustainability Index, Economic Freedom Index); schematic weights (EIU Quality of Life Index); and variable weights (Worldwide Governance Indicators, Corruptions Perceptions Index). Equal weighting simply means that each item of data used by an index is averaged in order to produce a final score. For example, the Basic Capabilities Index (formerly the Quality of Life Index) takes a simple average of the rescaled values of the primary completion rate, the child mortality rate, and the percentage of births attended by skilled personnel (Social Watch 2007). Strict use of equal weighting is comparatively rare, and far more common is the categorization of indicators into theoretically derived subcomponents. For example, the Human Development Index assigns its 6 indicators into 3 component areas: a long and healthy life (measured by life expectancy); a good income (measured by income per capita); and skills and knowledge (combining adult literacy, primary school enrolment, secondary school enrolment, and university enrolment). While each of the components has equal weight in producing the final index score, each indicator within them does not: life expectancy and income per capita each account for 1/3 of the variation in final scores, and each of the 4 education variables account for 1/12.

Clustering by thematic area is very common in composite index projects that use a large number of items. Other indices which make use of subcomponents aggregated before the final indexing process include the Doing Business Indicators, which cluster items into 10 different areas relevant to starting, managing, and closing an enterprise, and the Environmental Sustainability Index, which categorizes items from 76 datasets into 21 areas. However, while use of equal weights among theoretically specified subcomponents has the advantage of clarity, it courts potential difficulties. For example, if a measure of 'human capital' clusters subcomponents into three areas—'knowledge', 'health' and 'information'—then it is quite likely that the 'knowledge' and 'information' clusters will overlap substantially, perhaps reflected in a high statistical correlation between the two measures.

A range of statistical procedures have been developed in order to ascertain an appropriate weighting scheme. The first of these is principle components analysis (PCA), which assigns factor loadings based upon whether a subsequent indicator shares a common factor with another variable in the dataset. For example, PCA is likely to weigh down 'knowledge' and 'information' in the above example, as both depend upon a single underlying factor (the skills and education of the population). In practice, however, very few composite indices use PCA weights, in part because it is difficult to explain the process to non-statisticians, in part because the weights themselves change as the data changes over time, but mainly because the results using equal weights and PCA weights tend not to differ substantially (the Doing Business Indicators 2005 report conducts such a comparison, and shows minimal discrepancies). A second method of deriving weights for use in index aggregation is through regression processes. This can be done when a highly valid and reliable measure of the latent variable exists, but only for a restricted subset of countries. In that case the reliable measure can be used as the dependent variable in a regression framework, with the index indicators or subcomponents used as independent variables, and the resulting coefficients used as weights. In essence, such a design tells us what the scores 'should have' been for the reliable indicator, were a larger country sample available. An example of this is the Quality of Life Index produced by the Economist Intelligence Unit in 2005 (EIU 2005). Veenhoven (2005) posits that responses to public opinion surveys asking respondents how happy or satisfied they are at the present time is a reliable, valid measure of human wellbeing. However, this data exists only for those countries in which public opinion surveys have been fielded. Therefore, the designers of the Quality of Life Index designed a regression model using nine indicators as independent variables, such as income per capita, political stability, or gender equality, and use these nine variables to project quality of life estimates for a total of 111 countries.

A clear limitation of the regression approach, of course, is that very rarely does a direct measure of a latent variable exist in the same way that survey data on subjective wellbeing provides a direct measure of people's quality of life. Another limitation with the regression approach to weighting, the PCA approach, and the use of theoretically derived weights, is that in themselves they offer no solution in cases where data may be missing for particular countries.

In general, the decision regarding a weighting scheme must hinge on whether there is appropriate data to allow for the estimation of weights (e.g., some indicator believed to best reflect the 'true' value of the latent variable and suitable for deriving regression weights), or a sufficient strong *a priori* basis to assign weights theoretically (e.g. were human development simply *defined* as the combination of income, skills and health, then an equal-weight scheme would suggest itself a priori). In the case of household preparation for risk, there is certainly no one indicator suitable as a proxy for risk preparedness in general; *a posteriori* derived weights are therefore unlikely to exist as an option. However, we can at least delineate 3-4 broad areas of risk preparation, and then assess using factor analysis and principal components the validity of aggregating these using equal weights, as in the conceptual schema, or some other weighting scheme based on factor analysis results.

2.3 Missing Data

Composite indices can deal with the problem of missing data in one of three ways. The first and simplest solution is casewise deletion: to drop any country for which complete data does not exist. This naturally avoids a great number of methodological tangles, and is the approach used in such indices as the Doing Business Indicators. The Doing Business Indicators utilize a team of over 30 researchers working constantly to extract the required information from their rated governments. Analogous to casewise deleting is indicator deletion: dropping variables which are incomplete for the full set of countries or, as with the Human Development Index, selecting variables for which complete data across the domain of countries is relatively easy to obtain. The Human Development Index, as we have discussed, restricts itself to a small set of fairly narrow topic indicators (such as literacy or income per capita) for which complete data exists. In the absence of either a very narrow indicator set or the resources to collect primary data, casewise or indicator deletion is simply not feasible.

The second solution to the problem of missing data is to impute missing values. Use of imputation is rare in indices produced by international organizations, but relatively more common in academic indices and datasets. The Environmental Sustainability Index (ESI), for example, uses Markov Chain Monte Carlo simulation to impute values for the missing variables in the dataset. Imputation solutions, however, have two potential drawbacks. The first is that imputation is unreliable in cases where appropriate estimation models cannot be determined from available variables. Furthermore, it can lead to highly erroneous results when data is missing for a very large number of countries on a given variable. As Dempster and Rubin (1983) remark, imputation "is seductive because it can lull the user into the pleasurable state of believing that the data are complete after all, and it is dangerous because it lumps together situations where the problem is sufficiently minor that it can legitimately handled in this way and situations where standard estimators applied to real and imputed data have substantial bias." The second problem is that there is a serious problem of legitimacy where nations are rated on a given dimension of country performance based on data that is merely estimated, rather than actual. In such cases, it is very difficult to guard against challenges by critics from countries which are rated poorly in such an exercise that the scores are inaccurate; and it is precisely for this reason that use of imputation is more common among academicians than among international organizations such as the United Nations, the European Commission, or the World Bank.

A third alternative approach to dealing with missing data is to use the existing data entirely (no case-wise deletion) and exclusively (no imputation) in the estimation of the index, and to supplement this with an estimated margin of error, based *inter alia* on the number of missing items. This is the approach of a number of more recent indices such as the Corruptions Perceptions Index (CPI) produced by Transparency International and the World Bank's Worldwide Governance Indicators (WGI), and the Social Development Indices published by the International Institute of Social Studies in the Hague (Foa 2011). Such approaches carry a dual advantage, in that they allow scores to be estimated for a maximal number of countries, and can use a broader range of indicators to triangulate indices for nebulous constructs.

In the case of household risk preparedness, many of the indicators (as listed in the Appendix) have relatively complete cross-country information, typically with data for more than 100 countries. For this reason, incompleteness is less of a problem than with other indicator aggregation projects (e.g. the Worldwide Governance Indicators, Doing Business, or the Social Development Indices), and simple casewise deletion in circumstances of excessive data incompleteness is likely to still yield index scores for a very large number of countries. In the sample index described in this paper, for example, index scores can be calculated for as many as 140 countries based on a strict criterion of removing all scores for countries that do not have data across 3 of the 4 subindex categories for risk (explained in the next section).

2.4 Conceptual Foundations

As the definition of almost all social science concepts are contested among practitioners, a key requirement of construct validity in the social sciences is that concepts be clearly defined and justified (Carmines and Zeller 1976). Yet one of the most frequently neglected areas in index design is the clarification of the conceptual apparatus that underlies the aggregation exercise. All indices are designed on the premise that there is some latent variable or concept that is i) reflected in the range of chosen indicators, ii) of academic or policy importance, yet which iii) cannot be adequated represented in the selection of a single indicator, alone. In the absence of a clear conceptual framework, a composite index is nothing more than the sum of its parts, minus the clarity which comes from knowing the specific content of an individual indicator.

In the case of household risk, what we are trying to measure is the hypothesized capacity of the average household to respond to an exogenous shock, such as the illness of a family member, unemployment, crop failure, or natural disaster, in such a way that the shock event does not lead to *permanent* loss of consumption or wellbeing among household members. *A priori* we believe we can measure this preparedness capacity by identifying the mechanisms by which households are able to protect against such shocks. The first, and perhaps most intuitive means of protecting against exogenous household financial risks is via the accumulation of savings and assets, with most poor households having some stock of consumer durables, livestock, or tools and physical capital (Filmer and Scott, 2009). Beyond household savings, a second means of responding to exogenous shocks is via access to credit, which allows for consumption smoothing between times of income volatility or the capacity to respond to idiosyncratic consumption requirements, for example, due to the illness of a household member (Islam and Maitra 2012). Thirdly, insurance mechanisms may play a role in allowing households to respond to specific shocks: for example, enrolment and coverage of social insurance programmes, such as pension schemes, health insurance, and unemployment compensation can help vulnerable households mitigate the effects of specific risk events. Fourthly, in addition to formal institutions such as state-provided insurance or programmes which deliver public goods, informal institutions, such as family and friendship ties, can also play a role in reducing the impact of exogenous shocks (Woolcock and Narayan, 2000). Households with a high level of such ‘social capital’ are more likely to be able to find friends or family members willing to provide care, lodging, and financial support in response to unexpected negative events (Morduch 2006). Finally, beyond the capacity of households to respond to risk *ex post*, due to their stocks of financial, human, and social capital, there are a number of relevant risk reduction factors, most notably the capacity of state to respond to risk events through preventive health measures, disaster relief, and counter-cyclical macroeconomic policy.

This classification of risk preparedness leads to an identification of four category areas that *a priori* determine household ability to manage risk: i) access to emergency finance (either through credit, or through liquidation of accumulated household assets); ii) the presence of institutions that provide *insurance* against idiosyncratic risk (either via social protection, or via informal networks, such as one’s friends, family and community); iii) possession of human assets (skills and knowledge) that enable individuals to reflexively identify prospective risks and manage them as they arise; and iv) the capacity of the state to provide public goods designed to mitigate common risk hazards (e.g. flood defense, or health and sanitation) as well as respond to large-scale shocks, such as natural disaster or financial crisis, with disaster relief or economic stimulus programs. In the identification of indicators suitable for assessing household risk preparedness, these areas are likely to form a suitable foundation, as well as an *a priori* scheme for aggregating and subsequently weighting indicators to arrive at a final score.

2.5 Indicator Rescaling

Before aggregation can take place, indicators must be rescaled to a common range. The most common means of so doing is via standardization with mean 0 and standard deviation 1 (though these integers are obviously arbitrary, and rescaling can take place within any range desired). However, two challenges may present themselves after rescaling in this fashion, namely i) the excessive influence of outlier values; and ii) differences in the samples over which means and standard deviations have been ascertained, potentially giving excess leverage to certain items. In addition, before aggregating it is often advisable to check for non-linearities in the data, in particular where averaging will take place over missing data.

In order to partially mitigate some of these concerns, a method used in certain index projects (for example the more recent rounds of the Doing Business Indicators) is min-max rescaling. In order to reduce to influence of outlier values the outlier values at either end of the distribution are assigned scores of 0 and 1 (respectively for the minimum and maximum), and all other values scaled linearly within this range. Min-max rescaling also bears the advantage of being extremely simple and intuitive to understand. It does, however, entail the assumption that data is missing at random: for if data is not missing at random, then averaging across missing values may still introduce distortions by virtue of differences in means and standard deviations.

Where these concerns remain salient, a 'maximalist' strategy for dealing with missing data during the rescaling process is imputation, which estimates observations with partially missing data based on those observations that are available. Obviously, after imputation data exists for all countries, and thus is no longer missing-not-at-random, and the means and standard deviations for all indicators are computed based on a common country sample. Yet data imputation is frequently unattractive for both technical and political reasons. As discussed, data for a globally comparable component of a worldwide indicator is likely to have large swathes of the data of any particular variable missing if only because sources most often focus on a particular set of countries with a common geography, polity, or economy. Imputing missing data would yield a low ratio of imputing to imputed data. Furthermore, any imputation method using a maximum likelihood process assumes independence in observations. As countries may have an incentive to not report particular outcomes or to not allow some types of surveys to be done, they are likely not independent, nor would they be conditionally independent as we are not able to observe factors which may condition data availability. Consequently, it may be better to abandon maximum likelihood completely rather than violate its assumptions. Perhaps the most salient limitation, however, is that regardless of why a country's data may be missing, a country may legitimately take umbrage with a score relying heavily on imputed data, which they can claim that an imputation does not accurately reflect their true score. This is especially possible given that imputation methods may impute data to be far outside of the sample or have strange outcomes.

In the case of the indicators used in the measurement of household risk preparedness, data is typically fairly complete across countries, leading to fewer non-missing-at-random concerns; the only partial exception may be in the domain of 'social capital' (whether a household has friends or family on which they can rely for emergency support), which is typically estimated based on surveys that cover around 50-100 countries (such as the World Values Survey), rather than 100-150. Yet this is also only one indicator area among the many areas which constitute household risk readiness, and as such is unlikely to introduce great distortions during the aggregation process. Min-max rescaling is likely an appropriate method, though in the course of the diagnostics we also check for non-linearities among the indicators as well as the appropriate number of outlier values to censor at the upper and lower bounds.

3. DIAGNOSTICS

The long history of the use of composite indicators in the social sciences, in particular in the disciplines of psychology and demography, has led researchers to develop a range of diagnostic tests designed to assess construct validity and indicator reliability. These include tests designed to help identify outlier indicators, assess the degree to which indicators reflect a single underlying dimension, and identify redundancies or assign weights among the indicator set. Notably, techniques such as confirmatory factor analysis, cluster analysis, and calculations of statistical leverage and influence are standard practices in the process of index design and analysis.

This section of the paper therefore provides an assessment of the construct validity of an aggregate measure of household risk preparedness, by presenting the results of tests designed to assess i) the convergence of indicators together into the dimensions assigned to them by the indices of social development (convergent validity); and ii) the appropriate weighting and removal, if required, among the indicators used.

3.1 Selection of Indicators—Indicator Reduction

On the basis of the theoretical subdivision in section 2.4, it is possible to identify a range of 52 indicators across the four categories of household financial assets, social support, human assets, and public services to mitigate risk (these indicators are described in the Appendix). However, it is unecessary that all of these indicators can or should be used in the process of index construction, and consequently a first objective of the diagnostics section is 'indicator reduction': the identification of a most appropriate indicator or indicator set.

One method for reducing the range of indicators is via factor analysis. Factor analysis is used to uncover the latent structure in a set of variables, and the principal factor analysis used here seeks the least number of factors which can explain the greatest amount of shared variance among the variables. Factor analysis can be used to investigate a potential structure for how the variables group together, as well as to identify whether any variables simply don't belong in our framework. In exploratory factor analysis no priors are imposed on which elements are latent to a given construct, and the factor analysis is used to indicate which variables in the item space should be combined together to form an index. Exploratory factor analysis can also help in identifying outlier variables that do not fit within particular subindices, through examination of the factor loadings; where a variable is not loaded highly in common with other variables in a component, this is indicative of weak convergent validity. Finally, factor analysis can help inform insofar as factor analysis extracts the latent components that underlie a set of data, and this can include useful information on the redesign of indices, both in terms of content indicators, but also the conceptual framework that may explain why certain indicators pattern together in a common fashion and others do not. As a prerequisite to this analysis, we employ a regression imputation methodology for the imputation missing data, used only for these diagnostic analyses and not for the generation of the indices themselves.

We begin by using the results of the factor analysis to identify outlier variables within the data. Results of the factor analysis, using the Principle Axis method, are displayed below in Table 1. [6]

factors were extracted, using the varimax rotation to obtain optimal results. As indicators have not been uniformly repolarized, no meaning should be attributed to the presence of a positive or a negative sign on the factor loading. Factor loadings have been highlighted to reflect the association of a particular cluster with that factor.

Table 1. Results of Factor Analysis

Principle axis factoring, varimax rotation, first 6 factors only withdrawn.

Variable	Factor					
	1	2	3	4	5	6
Proportion of Households with Less than $1,000	-0.91	-0.05	-0.03	-0.02	0.15	0.01
Median household wealth per adult, 2010	0.65	0.59	-0.02	0.16	0.13	0.15
Household Wealth per capita, $US (2010)	0.67	0.63	0.00	0.08	0.14	0.15
Access to finance index	0.78	0.36	-0.04	0.17	0.02	0.11
Depositors with Commercial Banks (per 1,000 households)	0.79	0.01	0.01	0.07	-0.13	-0.07
Borrowers from Commercial Banks (per 1,000 households)	0.85	0.16	0.00	0.03	-0.03	-0.01
participation in all social insurance, latest (2005-)	0.63	-0.48	-0.19	-0.04	-0.25	0.21
participation all social protection latest (2005-)	0.71	-0.29	-0.20	0.29	-0.16	0.39
participation all social safety nets latest (2005-)	0.54	-0.19	-0.21	0.48	-0.09	0.31
Health expenditure per capita (current US$) (2010)	0.69	0.58	-0.06	0.07	0.12	0.16
Pension contributors (% of labor force), latest (2000-)	0.91	0.22	0.00	-0.14	-0.02	0.11
Pension contributors (% of working age population), latest (2000-)	0.90	0.25	0.01	-0.15	0.00	0.09
Average test score in math and science, PISA scale, primary to end secondary	0.87	0.31	0.02	-0.26	-0.05	-0.18
Average test score in math an science, only lower secondary	0.88	0.29	0.01	-0.25	-0.06	-0.17
Share of students reaching basic literacy	0.76	0.35	0.06	-0.29	-0.05	-0.22
Share of top performing students	0.85	0.29	0.05	-0.22	-0.05	-0.18
Adjusted net primary school enrollment rate, latest year (2005-)	0.66	-0.11	-0.05	0.29	0.13	-0.46
Adult Literacy Rate, latest year (2005-)	0.87	-0.15	-0.04	0.04	-0.06	-0.08
Net primary school enrollment, latest year (2005-)	0.62	-0.11	-0.08	0.35	0.16	-0.46
Net secondary school enrollment, latest year (2002-)	0.92	-0.11	-0.01	0.10	-0.12	0.00
Pupil-teacher ratio, primary, latest year (2005-)	-0.88	0.07	-0.04	0.00	0.17	-0.02
Pupil-teacher ratio, secondary latest year (2005-)	-0.82	0.11	0.02	0.05	0.11	-0.08
Years of Schooling (2010)	0.90	-0.02	-0.06	0.04	-0.11	0.00
Years of Primary Schooling (2010)	0.70	-0.12	-0.09	0.18	-0.07	-0.07
Years of Secondary Schooling (2010)	0.85	0.04	-0.01	-0.06	-0.11	0.05
Years of Tertiary Schooling (2010)	0.79	0.18	-0.08	0.04	-0.07	0.01
Immunization, BCG (% of one-year-old children) (2010)	0.50	-0.41	0.30	0.07	0.30	0.03
Immunization, DPT (% of children ages 12-23 months) (2010)	0.67	-0.32	0.40	0.04	0.50	0.07

Variable	Factor					
Immunization, HepB3 (% of one-year-old children) (2010)	0.53	-0.41	0.36	-0.02	0.43	0.04
Immunization, measles (% of children ages 12-23 months) (2010)	0.66	-0.37	0.34	0.02	0.44	0.02
Immunization, Pol3 (% of one-year-old children) (2010)	0.67	-0.32	0.38	0.01	0.49	0.07
% who have helped someone find a job in last year (2001)	0.27	-0.08	-0.33	0.53	-0.04	-0.17
% spend time with parents or relatives at least once a month (2000)	0.45	-0.42	0.15	-0.26	-0.25	0.06
% spend time with parents or relatives at least once a year (2000)	0.31	0.27	0.20	-0.60	0.05	-0.09
% spend time with friends once a week (2000)	-0.33	0.49	-0.16	-0.07	0.39	0.21
% visit their siblings at least once a year (2001)	-0.57	0.48	0.02	0.34	0.30	0.06
% who belong to no voluntary associations (2005-7)	-0.18	0.11	0.48	-0.58	-0.02	0.16
Clubs and Associations Index (2010)	-0.31	0.41	-0.17	0.35	0.28	-0.15
% Saying that 'in general, people can be trusted'	0.47	0.30	-0.22	0.10	0.14	0.17
Access to clean water (%)	0.83	-0.12	0.17	0.09	-0.04	0.00
Access to improved sanitation facilities (%)	0.88	-0.10	0.06	0.01	-0.08	0.01
Gross debt as a % of GDP	-0.13	0.35	0.64	0.38	-0.19	0.10
Gross debt as a % of Revenues	-0.34	0.31	0.67	0.19	-0.22	-0.02
Net debt as a % of GDP	-0.17	0.12	0.66	0.49	-0.29	0.00
Net debt as a % of Revenues	-0.28	0.13	0.77	0.26	-0.29	-0.07

Low factor loadings within any cluster are indicative of weak fit within any given factor. The factor analysis also helps to identify indicators that are particularly strongly associated with a particular item cluster. Select Indicators which are loaded especially strongly (e.g. above 0.65) are given below in Table 2. Clearly our taxonomy isn't perfectly confirmed by the factor analysis, but it is quite favorable overall.

Table 2. Strong Indicators, Factor Analysis Results

Strong Indicators		**n**
Proportion of Households with Less than $1,000	Financial and Physical Assets	162
Borrowers from Commercial Banks (per 1,000 households)	Financial and Physical Assets	91
Index of Access to Finance	Financial and Physical Assets	152
Immunization, measles (% of children ages 12-23 months) (2010)	Human Assets	220

Pension contributors (% of labor force), latest (2000-)	Social Assets	127
Years of Schooling	Human Assets	145
Net secondary school enrollment, latest year (2002-)	Human Assets	180
Health expenditure per capita (current US$) (2010)	Human Assets	217
% who belong to no voluntary associations (2005-7)	Social Assets	42
% spend time with friends once a week (2000)	Social Assets	64
% stating that in general, people can be trusted (2000-2010)	Social Assets	103
Gross public debt, as a % of revenues	State Capacity	177
% with Access to Improved Sanitation	State Capacity	217

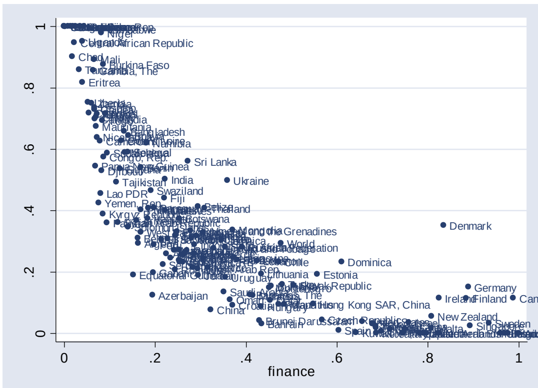
Based on the indicators identified as central to each of the factors, and the relative number of countries covered in comparison to other indicators in that subcategory, we are able to identify the following as the best 'reduced set' of indicators in the risk management domain. First, the proportion of households with less than $1,000 is a central measure of access to financial assets. Not only does the measure have an exceptionally strong theoretical justification as a measure of whether poorer households are ready to respond to risk shocks, but the factor loading within the first dimension (-0.91) is exceptionally high. Second, again within the household access to resources domain, both the proportion of households who have loans from commercial banks, and the more general access to finance index developed by Honohan (2008) load highly (0.79 and 0.78, respectively). However, the country coverage of the access to finance index is substantially greater, at 152 as opposed to 91 cases, making this measure more useful for country comparative purposes; furthermore data for the proportion of borrowing households is not missing at random, with high-income countries disproportionately absent from the data (World Development Indicators 2012). In the domain of human assets, both years of schooling (from the Barro and Lee dataset) and educational attainment (e.g. PISA equivalent test scores) load highly (0.9 and 0.87 respectively); though again the former has a much larger country coverage, at 145 cases, and therefore may be preferable without any great loss of validity. Regarding the health component of human assets, both health spending per capita, and the number of doctors and physicians per 1,000 load heavily, and both have relatively broad country coverage. However on theoretical grounds we may have a slight preference for the latter on account of the sometimes imperfect relationship between health spending and actual health outcomes, whereas the number of doctors per capita, may function as a better indicator of the general degree of access to primary care (Schieber et al, 1993). In addition, we find that among the various immunization rate indicators, immunization against measles appears the most appropriate by both the first and second factors - perhaps because the natural disease ecology of measles, relative to other diseases, is the most randomly distributed. Next, in terms of formal social insurance mechanisms, the measures of social protection published as part of the World Bank's social protection dataset weight highest, but suffer from inadequate country coverage for the purpose of a global index. As a compromise between factor loading and country coverage, however, the proportion of pension contributors, as a percentage of the labor force, has a comparable factor loading on the second dimension to participation in 'all social safety nets' and 'all social insurance', with a much larger sample of countries. Regarding informal social insurance ties, we find that both spending time with parents and spending time with friends are central to a broader measure of social connectedness, as is the general measure of social trust. A decision between these indicators is difficult, however, as the two measure potentially quite different aspects of social capital, reflecting the distinction between what is often termed 'bonding' vs. 'bridging' ties (Woolcock and Narayan 2000). However, studies have often shown that it is the latter (briding ties) which performs strongest in explaining individuals' labour market outcomes and social mobility, a phenomenon referred to as the 'strength of weak ties' (Granovetter 1973). For this reason, social trust may function as the best overall proxy for social connectedness and the ability to call on help in times of need (Fukuyama 1995). Finally, with regard to state capacity, access to improved sanitation facilities also functions as a strongly loaded indicator on the first dimension, while gross public debt relative to revenues also loads highly on the first and also on the third, and (relative to the other public debt measures) has a high country coverage.

Figure 1. Example Selection of Indicators for a Household Risk Preparedness Score

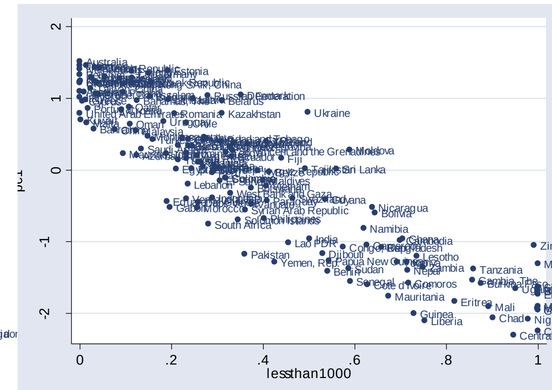
Proportion of Households with less than $1,000 in net assets **Access to Financial Resources (Credit)**	**Household Access to Finance**
Contributors to a Pension Scheme, as % of Workforce **Proportion of Respondents Stating that ‘in general, people can be trusted’**	**Social Protection Assets**
Years of Education **Immunization Rate, Measles**	**Human Assets**
Gross Public Debt, as a Percentage of Revenues **Access to Improved Sanitation Facilities (% Population with Access)**	**State Capacity**

Figure 2. Correlation between Individual Selected Indicators, Composite Averages of Indicators in Given Subdomains, and Factors

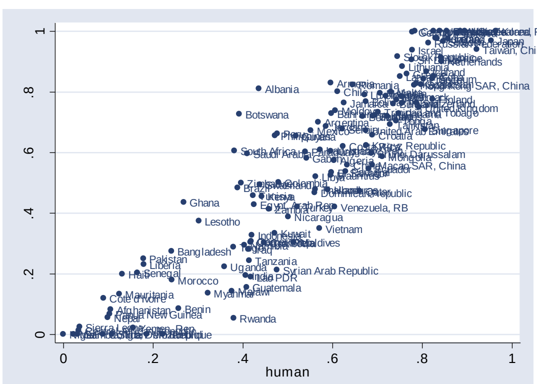
Percentage of Households with Less than $1000 and Financial Assets Subindex



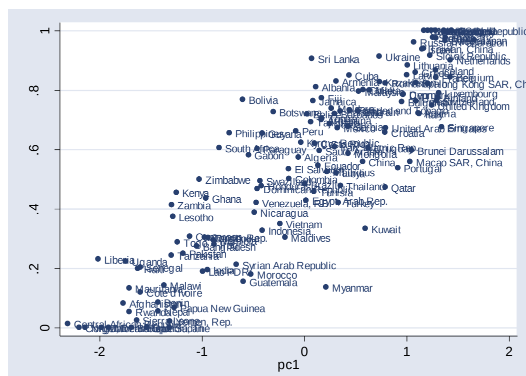
Percentage of Households with Less than $1000 and Factor 1



Years of Schooling and the Human Assets Subindex



Years of Schooling and Factor 1



3.2 Indicator Groupings

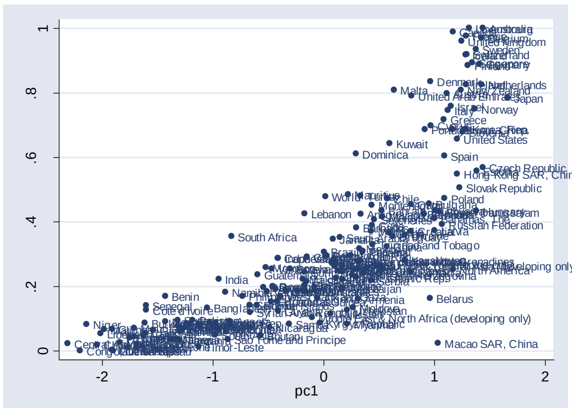
In designing the initial set of risk subindices, some 52 indicators were assigned *a priori* into four categories, of which we have selected eight that can be considered most representative of their domains. In this section of the diagnostics, we now consider more closely the issue of whether indicators are correctly assigned. We do so by deploying the factor analysis results of the previous section, but by examining the relationship between the indicators and the factors that have been extracted. Our second use of the factor analysis results is to conduct confirmatory factor analysis, that is, to assess the appropriateness of the six indices that have been drawn *a priori* from the social development indicators database based on a purely statistical criterion.

These results are shown in figure 3 below. It can be seen that the factors extracted from the set of household risk measures correspond neatly to two of the sub-components; that the first factor, which corresponds broadly with a country's level of economic development, correlates with household assets and with human assets; whereas the second factor, which we may loosely consider a proxy for the degree of social 'solidarity', correlates with indicators for social capital, participation in social insurance, and provision of goods and public services. These appear therefore to be the two broad dimensions of household susceptibility to manage risk—the individual household assets (whether in form of education, health or financial wealth) which enable response to risk events, and the collective assets (social networks, insurance, and public provision) which enable joint responses to common challenges. There is, of course, an aesthetic similarity here to the two broad categories of risk: namely idiosyncratic risk (affecting households individually) and common risk (affecting households in common); though of course this is largely aesthetic, as individual resources can be used to face common challenges, and collective resources can help individuals suddenly faced with idiosyncratic shocks.

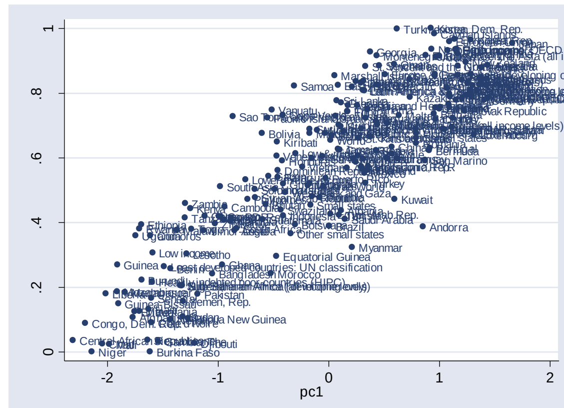
These results provide a good basis for the choice of four equally weighted components, with two corresponding to the individual resources required to manage risk (access to household finances and human assets) and two corresponding to the collective resources required to manage risk (social protection mechanisms, and state capacity to manage and respond to risk events).

Figure 3. Factor Analysis Results and Sub-Indices Compared

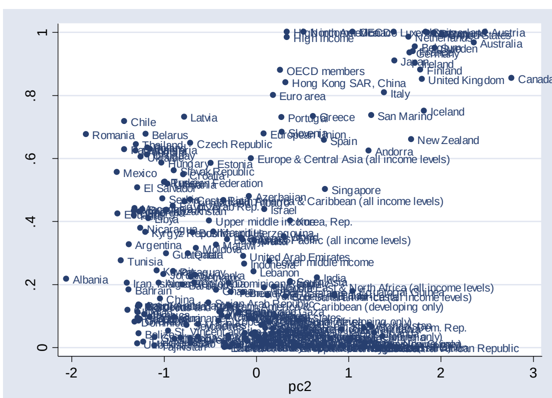
Factor 1 and Financial Assets



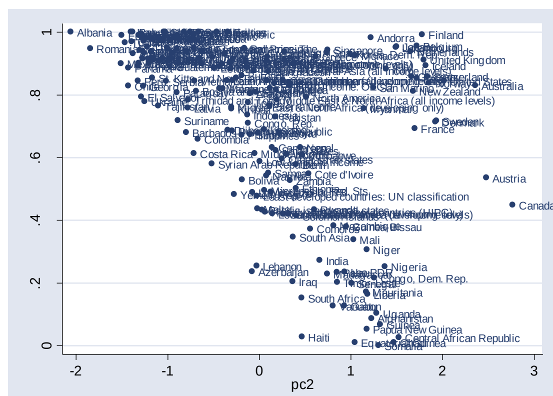
Factor 1 and Human Assets



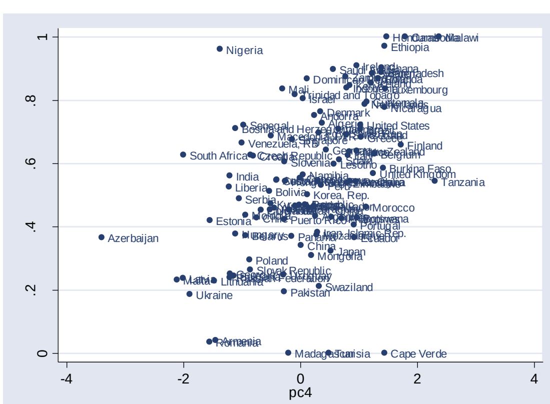
Factor 2 and Social Protection



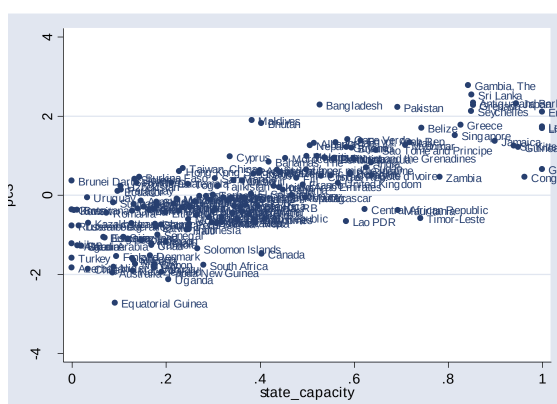
Factor 2 and State Capacity



Factor 4 and Social Capital



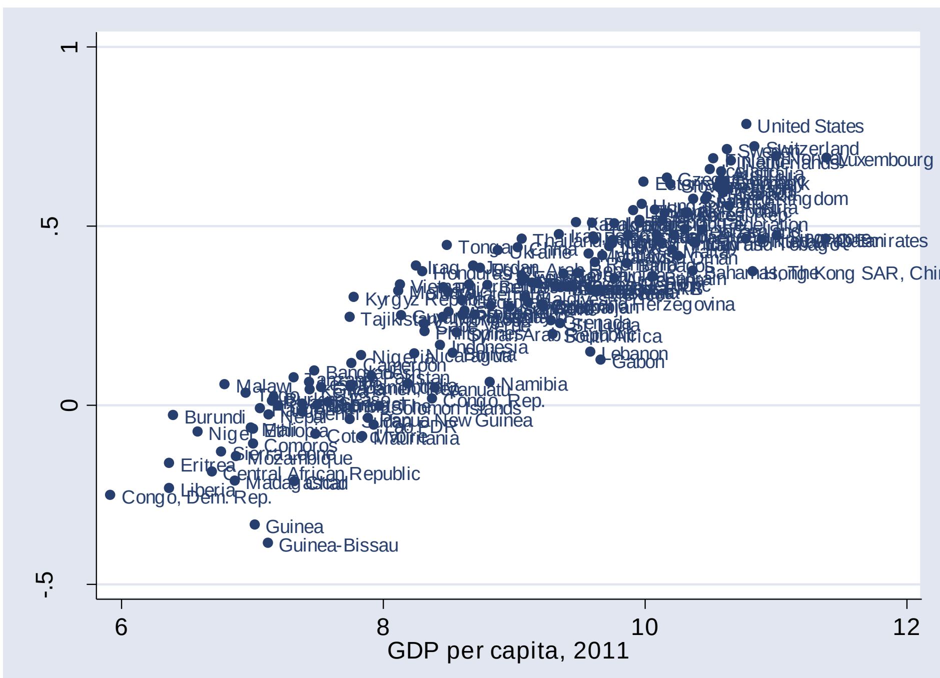
Factor 3 and State Capacity



VI. Composite Results

Based on a simple aggregation of the rescaled values of the indicators proposed in Figure 1, we are able to derive a prototype measure of household risk preparedness. Figure 4 shows the correlation between this measure and log income per capita, based on the most recent available estimate from the World Development Indicators; it can be seen that there is an exceptionally high correlation between economic development and the risk preparedness of households, though also moderate outliers, such as Equatorial Guinea, Gabon, and Namibia.

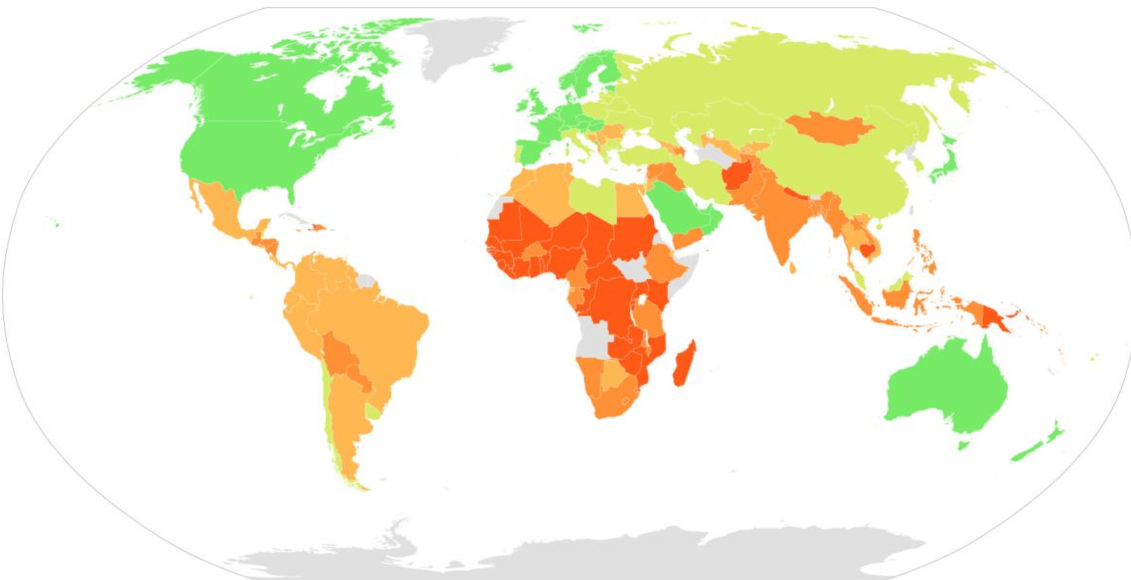
Figure 4. Household Risk Preparedness and Log GDP per Capita



Irrespective of the multiple factors revealed in the previous section, the extent of the correlation between overall risk preparedness and log GDP per capita suggests the latter alone as a powerful proxy for the average risk status of households.

Another useful mechanism for illustrating the range of scores is via a global distribution map: accordingly a map of country scores, divided into five quintiles, is show in Figure 5.

Figure 5. Household Risk Preparedness Index



Notes: Based on a filter of 8 indicators of risk preparedness, with two in each conceptual subdomain (household financial assets, social protection, human assets, and public services). The respective indicators are: households with more than $1,000 in net assets, and household access to finance; proportion contributing to a pension scheme and general social trust; immunization rate against measles and years of education; and public debt as a percentage of revenues and access to improved sanitation facilities (%).

5. CONCLUSION

In recent years, there has been a steady expansion in the range of indicators available for the cross-country study of risk. This paper has considered the range of available indicators for measuring the risk preparedness of households based on *ex ante* considerations, rather than *ex post* calculations of relative risk exposure. We have provided evidence suggesting that a reduced set of indicators exhibit construct validity, understood as the extent to which measures accurately represent their concepts. Applying a range of diagnostic tests to the four subindices created as part of the risk indicators database, we find evidence confirming the clusters developed these four subindices, and have produced a simple illustrative index.

It should be noted that any composite measure produced in this fashion is primarily useful for illustrating global distributions and trends in the risk preparedness of households, and may be less appropriate for the purpose of a dependent or independent variable in econometric analysis. The reason here is relatively simple: our construct has been developed based on an a priori definition of risk prepation, yet in practice there may be distinct mechanisms which explain the susceptibility and preparedness of households to face different kinds of (health, environmental, economic) risk and for this reason greater explanatory leverage may be achieved in examining these separate dimensions, rather than a universal measure. However, given an interest in risk preparation *sui generis*, the diagnostic tests in this paper suggest that we are able to summarize this concept across different societies by aggregating an appropriately limited range of indicators, and provide a score that allows for both comparison across countries and benchmarking of progress in risk reduction over time.

REFERENCES

Arrow, K. (1974). *The Limits of Organization*. Norton, New York.

Bandura and Martin del Campo. (2006). 'Indices of National Performance: A Survey'. New York: UNDP.

Barro, R. (1991). "Economic Growth in a Cross-Section of Countries". *Quarterly Journal of Economics*. 6, 407-444.

Bebbington, A., Guugenheim, S., and Woolcock, M. (2006). "Concepts: Their Context and Their Consequences", In Anthony J. Bebbington, Michael Woolcock, Scott Guggenheim, and Elizabeth A. Olson, eds., *The Search for Empowerment: Social Capital as Idea and Practise in the World Bank*. Connecticut: Kumarian Press.

Berkman, L. and Syme, L. (1979). "Social Networks, Host Resistance, and Mortality: a Nine-Year Follow-Up Study of Alameda County Residents." American Journal of Epidemiology. 109, no. 2: 186-204.

Beugelsdijk, S., de Groot, H., and van Schaik, A. (2004). "Trust and economic growth: a robustness analysis", *Oxford Economic Papers*, 56, 118-134.

Carmines. E. G. and R. Z. Zeller. (1979). *Reliability and Validity Assessment*. Series: Quantitative Applications in the Social Sciences 07-017.

Clarke, D. and S. Dercon (2009). "Insurance, Credit, and Safety Nets for the Poor in a World of Risk", Working Paper 81. New York: United Nations, Department of Economics and Social Affairs.

Chu, Yun-han, Larry Diamond, Andrew J. Nathan, and Doh Chull Shin. (2008). "Comparative Perspectives on Democratic Legitimacy in East Asia," in Yun-han Chu, Larry Diamond, Andrew J. Nathan, and Doh Chull Shin, eds., *How East Asians View Democracy*. New York: Columbia University Press, 1-38.

De, P. (2010). Governance, Institutions, and Regional Infrastructure in Asia. Asian Development Bank Institute Working Paper Series.

Dempster, A., Rubin, D. (1983). "Incomplete data in sample surveys", in Madow, W.G., Olkin, I., Rubin, D. (Eds),Sample Surveys Vol. II: Theory and Annotated Bibliography, Academic Press, New York, NY, pp.3-10.

Dercon, S. (2002). "Income Risk, Coping Strategies, and Safety Nets", World Bank Research Observer, 17 no. 2, 141-66.

Dercon, S., J. de Weerdt, T. Bold and A. Pankhurst, (2006). "Group-based Funeral Insurance in Ethiopia and Tanzania," World Development, 34 no. 4, 685-703.

Doing Business. (2012). *Doing Business Indicators,* World Bank: Washington DC.

Donsbach and Traugott (2007). ‘Editorial’ in *International Journal of Public Opinion Research*, 19(1):3-4.

Durkheim, E. [1897] 1951. *Suicide*. New York: Free Press.

Esteve-Volart, B. 2004. “Gender discrimination and growth: Theory and evidence from India.” DEDPS Working Paper No. 42. London: London School of Economics and Political Science.

Fukuda-Parr and Kumar (eds.) 2004. Readings in Human Development. Oxford: Oxford University Press.

Fukuyama, F. (1995). *Trust: Social Virtues and the Creation of Prosperity*. NY: Free Press.

Granovetter, M. S. (1973). "The Strength of Weak Ties". *The American Journal of Sociology*, 78 (6): 1360–1380.

Guggenheim, S. (2006). “Crises and Contradictions: Understanding the Origins of a Community Development Project in Indonesia”. In Bebbington, Woolcock, Guggenheim and Olson (eds.), *The Search for Empowerment*. CT: Kumarian Press.

Hall, R. and Jones, C. (1999). “Why do Some Countries Produce so Much More Output Per Worker Than Others?” *Quarterly Journal of Economics* 114, 83-116.

Huntington, S. (1968). *Political Order in Changing Societies*. New Haven: Yale University Press.

Islam, A. and P. Maitra (2012) “Health Shocks and Consumption Smoothing in Rural Households: Does Microcredit have a Role to Play?”, *Journal of Development Economics*, vol. 97(2), pages 232-243.

Kaufmann, D., Kraay, A., and Zoido-Lobatón, P. (1999a). “Governance Matters.” World Bank Policy research Working Paper No. 2195, Washington, D.C.

Kaufmann, D., Kraay, A., and Zoido-Lobatón, P. (1999b). “Aggregating Government Indicators.” World Bank Policy research Working Paper No. 2195, Washington, D.C.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2007). “Governance Matters VI: Aggregate and Individual Governance Indicators 1996-2006”, World Bank Policy Research Working Paper No. 4280, Washington, D.C.

King, G. Honaker, J. Joseph, A. and K. Scheve. (2001). "Analyzing Incomplete Political Science Data: An Alternative Algorithm for Multiple Imputation," American Political Science Review, Vol. 95, No. 1.

King, A. and E. Hill. (1993). "Women's Education in the Third World: An Overview," in E. M. King and M. A. Hill (eds.) *Women's Education in Developing Countries: Barriers, Benefits, and Policy*. Baltimore, MD: Johns Hopkins University Press.

Knack, S. (2002). “Social Capital and the Quality of Government: Evidence from the States”, *American Journal of Political Science* 46 (4): 772-785.

Knack, S., and Keefer, P. (1997). “Does Social Capital have an Economic Payoff? A Cross-Country Investigation”, *The Quaterly Journal of Economics* 112 (4):1251-1288.

Lambsdorff, J. G. (2006). "The Methodology of the Corruptions Perceptions Index", Transparency International and the University of Passau, permanent url: http://www.icgg.org/downloads/CPI_2006_Methodology.pdf

Levi, M. Karen S. Cook, Russell Hardin. (2007). *Cooperation Without Trust?* New York: Russell Sage Foundation.

Morduch, J. (2002). "Between the State and the Market: Can Informal Insurance Patch the Safety Net?" World Bank Research Observer, 14 no. 2: 187-207.

Narayan, D. and Cassidy, M. (2001). "A Dimensional Approach to Measuring Social Capital: Development and Validation of a Social Capital Inventory" in *Current Sociology* 49(2): 59-102.

Narayan, D. and Pritchett, L. (1999). “Cents and Sociability: Household Income and Social Capital in Rural Tanzania”, *Economic Development and Cultural Change* 47(4): 871-97.

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., Giovannini, E. (2005) *Handbook on constructing composite indicators: methodology and users guide*, OECD-JRC joint publication, OECD Statistics Working Paper, STD/DOC(2005)3, JT00188147.

Paldman, M. (2000): “Social Capital: One or Many? Definition and Measurement”, *Journal of Economics Surveys*, 14(5), pp. 29-653.

Paxton, P. (2002). "Social Capital and Democracy: An Interdependent Relationship." *American Sociological Review*, 67:254-277.

Saltelli, A. 2007.’ Composite indicators between analysis and advocacy’ , *Social Indicators Research*, 81 , 65-77.Social Watch. 2007. *Social Watch Report*. Montevideo: Social Watch.

Schultz, P. (2002). “Why governments should invest more to educate girls.” *World Development*, 30(2): 207-225.

Schieber, G.J., Poullier, J.P. and L.M. Greenwald (1993), ‘Health spending, delivery, and outcomes in OECD countries’, *Health Affairs*, 12, no.2:120-129.

Seeman, T. et al. (1994). Social ties and support and neuroendocrine function. MacArthur Studies of Successful Aging. *Ann Behavioral Medicine*, *16*:95-106.

Schuster T., Kessler R., and R. Aseltine. (1990). Supportive interactions, negative ineteractions and depressed mood. *Am J Community Psychology*, *18*:423-438.

Sistrom C, and C.W. Garvan (2004). "Proportions, odds, and risk," *Radiology* 230 (1): 12–9..

Stone, W. (2001). *Measuring social capital: towards a theoretically informed measurement framework for researching social capital in family and community life* [Research Paper No. 24]. Australian Institute for Family Studies.

Thomas, D., Strauss, J. and Henriques, M. 1991. "How Does Mother's Education Affect Child Height?" *Journal of Human Resources*, 26, no. 2:183-211.

Tonnies, F. ([1887] 2001). *Community and Civil Society*. Cambridge: Cambridge University Press.

Veenhoven, R. 2005. *World Database of Happiness: Continuous register of research on subjective enjoyment of life.* Available at the website of Erasmus University Rotterdam in the Netherlands: http://worlddatabaseofhappiness.eur.nl

United Nations Development Program. 2007. *Human Development Report*. New York : United Nations.

Urra, F. J. (2007). Assessing Corruption - An analytical review of Corruption measurement and its problems: Perception, Error and Utility. Available on the United Nations Public Administration Network, www.unpan.org.

Woolcock and Narayan. (2000). "Social Capital: Implications for Development Theory, Research, and Policy", *World Bank Research Observer*, Vol. 15, 2, pp. 225-249.

World Bank. 2001. *Engendering development: Through Gender Equality in Rights, Resources, and Voice*. New York: Oxford University Press.

APPENDIX: COMPLETE INDICATOR SUMMARY

Indicator	Source
Physical and Financial Assets	
Household Wealth per capita, $US (2010)	Credit Suisse Global Wealth Databook
Household Wealth per Adult, $US (2000)	Credit Suisse Global Wealth Databook
Household Wealth per Adult, $US (2010)	Credit Suisse Global Wealth Databook
Increase in Household Wealth per Adult, 2000-10 (%)	Credit Suisse Global Wealth Databook
Mean household wealth per adult, 2010	Credit Suisse Global Wealth Databook
Median household wealth per adult, 2010	Credit Suisse Global Wealth Databook
% less than $1,000	Credit Suisse Global Wealth Databook
% less than $10,000	Credit Suisse Global Wealth Databook
% less than $100,000	Credit Suisse Global Wealth Databook
% over $100,000	Credit Suisse Global Wealth Databook
Wealth gini (2010)	Credit Suisse Global Wealth Databook
Access to finance index	Honohan (2008)
Borrowers from Commercial Banks (per 1,000 households)	World Development Indicators
Depositors with Commercial Banks (per 1,000 households)	World Development Indicators
Social Protection and State Capacity	
participation in all social insurance, latest (2005-)	Atlas of Social Protection / World Development Indicators
non-participation all social insurance, latest (2005-)	Atlas of Social Protection / World Development Indicators
participation all social protection latest (2005-)	Atlas of Social Protection / World Development Indicators
non-participation all social insurance, latest (2005-)	Atlas of Social Protection / World Development Indicators
participation all social safety nets latest (2005-)	Atlas of Social Protection / World Development Indicators
non-participation all social safety nets latest (2005-)	Atlas of Social Protection / World Development Indicators
Health expenditure per capita (current US$) (2010)	Health Nutrition and Population Statistics
Pension contributors (% of labor force), latest (2000-)	World Development Indicators 2012
Pension contributors (% of working age population), latest (2000-)	World Development Indicators 2012
Gross debt as a % of GDP	World Development Indicators 2012
Gross debt as a % of Revenues	World Development Indicators 2012
Net debt as a % of GDP	World Development Indicators 2012
Net debt as a % of Revenues	World Development Indicators 2012
Human Assets	
Average test score in math and science, PISA scale, primary to end secondary	Hanushek and Woessmann (2009)
Average test score in math an science, only lower secondary	Hanushek and Woessmann (2009)
Share of students reaching basic literacy	Hanushek and Woessmann (2009)
Share of top performing students	Hanushek and Woessmann (2009)
Adjusted net primary school enrollment rate, latest year (2005-)	World Development Indicators
Adult Literacy Rate, latest year (2005-)	World Development Indicators
Net primary school enrollment, latest year (2005-)	World Development Indicators
Net secondary school enrollment, latest year (2002-)	World Development Indicators
Pupil-teacher ratio, primary, latest year (2005-)	World Development Indicators

Pupil-teacher ratio, secondary latest year (2005-)	World Development Indicators
Years of Schooling (2010)	Barro and Lee (2010)
Years of Primary Schooling (2010)	Barro and Lee (2010)
Years of Secondary Schooling (2010)	Barro and Lee (2010)
Years of Tertiary Schooling (2010)	Barro and Lee (2010)
Immunization, BCG (% of one-year-old children) (2010)	Health Nutrition and Population Statistics
Immunization, DPT (% of children ages 12-23 months) (2010)	Health Nutrition and Population Statistics
Immunization, HepB3 (% of one-year-old children) (2010)	Health Nutrition and Population Statistics
Immunization, measles (% of children ages 12-23 months) (2010)	Health Nutrition and Population Statistics
Immunization, Pol3 (% of one-year-old children) (2010)	Health Nutrition and Population Statistics
Social Assets	
% who have helped someone find a job in last year (2001)	International Social Survey
% spend time with parents or relatives at least once a month (2000)	World Values Survey
% spend time with parents or relatives at least once a year (2000)	World Values Survey
% spend time with friends once a week (2000)	World Values Survey
% visit their siblings at least once a year (2001)	International Social Survey
% who belong to no voluntary associations (2005-7)	World Values Survey
Clubs and Associations Index (2010)	Indices of Social Development
% stating that 'in general, people can be trusted' (2000-2010)	World Values Survey / Global Barometer Series