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The Luxembourg Income Study

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Abstract The Luxembourg Income Study (now known as LIS) provides public access for research purposes to harmonized unit-record data sets for multiple countries, in addition to providing summary statistics from those data, including poverty and inequality measures. LIS is a well-managed and undeniably important global public institution for research on inequality and social policy in rich countries. However, LIS's eligibility criteria, country coverage, timeliness and some of its measurement practices limit its usefulness for many other purposes. The paper identifies a number of issues that would need to be addressed by a truly global micro-data base for studying poverty and inequality.

Keywords Income · Poverty · Inequality · Household surveys · Data access

1 Introduction

The Luxembourg Income Study (officially renamed "LIS" in 2011) is a non-profit organization, founded in 1983. LIS's primary aim is to facilitate the creation of, and access to, "harmonized" data files at unit-record level on household incomes, employment and other characteristics for multiple countries. LIS started with a small set of rich countries but has since expanded to include some middle-income developing countries.

Over 20 years ago I reviewed Smeeding et al. (1990), the first published volume from LIS (Ravallion 1992). My review began by agreeing with Tony Atkinson's (1990, p.xvii) comment (in the opening sentence of his introduction to the Smeeding et al. volume) that LIS is "...one of the most exciting developments in applied economic research in recent years." This paper asks whether LIS is still exciting at 30 years of age.

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The paper begins with an overview of LIS and its usage. It then looks at the coverage, timeliness, accessibility and quality of LIS.[1] In keeping with the topic of this special issue, the focus will be on LIS's use for international comparisons of income distributions. Other applications, such as in studying labor supply, are not explicitly considered, although some of the material here will still be relevant to those applications.

2 An overview of LIS

The idea for LIS emerged at an international conference on poverty in 1982 when a number of researchers using household-level data realized that there were gains from pooling their knowledge in the interest of making better cross-national comparisons (Smeeding et al. 1985). The founding director was Tim Smeeding, who has been closely associated with the project since its inception.[2] Janet Gornick has been the director since 2006.

LIS's main office is in Luxembourg, with a satellite in New York, at CUNY. The website lists 18 staff, 12 in the Luxembourg office (though many are jointly funded with non-LIS functions). LIS is not only a data provider but also an independent research center, doing original research on LIS data.

The current budgeted cost of LIS's core data and research activities appears to be about €1 million per year.[3] The largest donor is the Luxembourg Government; additional funds come from about 25 governments and institutions, all in the rich world. Aside from the Luxembourg Government, there appears to be little or no official donor commitment to long-term funding of LIS. Funds are renewed on an *ad hoc* basis. (There is limited cost recovery from users.) One would not normally expect the overall level of the voluntary contributions attained this way to be sufficient to assure that a public good such as LIS is supplied at what could reasonably be considered the optimal level. In my judgment, some (but not all) of the deficiencies identified by this review are consistent with the view that LIS is indeed underfunded.

2.1 How is LIS different to other data sources?

The LIS output closest to the various databases reviewed in this special issue is LIS's "Key Figures." This provides summary tables on selected country-level poverty and inequality measures, such as the Gini index. The summary statistics in Key Figures are calculated by LIS staff from the LIS micro data, which cover 40 countries at the time of writing.[4] Of course, there are other places to obtain such summary statistics. The World Income Inequality Database (WIID) of the World Institute for Development Economics Research (WIDER) gives 5,300 Gini indices for 145 countries. It is known that the comparability of the numbers

[1] The LIS office also supports the Luxembourg Wealth Study (LWS) which provides micro data on assets and debts. There are currently 12 countries in LWS, all "rich countries." LWS is not covered by this review.

[2] Others closely involved in creating LIS include Serge Allegrezza, Marc Cigrang, John Coder, Robert Erikson, Lee Rainwater (LIS's first research director) and Gaston Schaber.

[3] For the Luxembourg office, this is expected to be €1.3 million in 2014, of which 60 % is for the core LIS activities with which this paper is concerned. (The rest comprise various self-financing activities such as training workshops.) A similar accounting of the cost of the CUNY office is not available but Janet Gornick thought an extra 20 % would be reasonable. This brings the total for the core activities to about €940,000.

[4] This is the number of countries listed on the LIS website early October 2013, under "LIS Database by country."

in such compilations is questionable (see, for example, Atkinson and Brandolini 2001). The World Bank's PovcalNet is the source of the summary measures on poverty and inequality found in the Bank's World Development Indicators (WDI), as in (for example World Bank 2013). PovcalNet provides both fixed and some user-driven calculations of poverty and inequality measures for "developing countries," defined as Part 2 member countries of the World Bank (at the time the dataset began around 1990).[5] There are pros and cons of each source. It terms of coverage, while WIID is the largest (by far) it is probably the least methodologically consistent internally, while LIS is the smallest but most consistent. PovcalNet and the WDI are somewhere between the two.

However, the distinctive feature and value-added of LIS is not Key Figures but rather the access it provides to a set of harmonized micro data files derived from survey data sets supplied by participating (governmental and non-governmental) statistical agencies at the country level. To preserve confidentiality, access to the micro data is remote, meaning that program code is sent to LIS rather than being run by the user directly on the data.

While LIS was way ahead of its time in the 1980s, today there are a number of similar products, though serving somewhat different needs. The University of Michigan's ICPSR provides a valuable archive of deposited data sets used in past research studies, mostly academic. These include numerous surveys data sets though they tend to be more specialized surveys, and there is no attempt to have broad country coverage or to harmonize data. The University of Minnesota's IPUMS-I provides access to Census data at the micro level for 74 countries. The World Bank's Comparative Living Standards Project (CLSP) provides a harmonized set of files for the surveys for developing countries done under the Living Standards Measurement Study (LSMS). The FAO's Rural Income Generating Activities (RIGA) database provides access to income and selected other constructed variables in unit-record form for 19 developing countries. There are also some regional initiatives such as SEDLAC, which provides summary statistics on poverty and inequality across 24 countries in Latin America.

LIS is probably more standardized than any other library of micro data sets, with the possible exception of CLSP. Of course, there are limits to the harmonization. For example, some surveys do not ask for income taxes paid or social security contributions since respondents quite often do not know these things (and, in any case, net income is considered the better welfare indicator). Harmonization is also costly and naturally there is a trade-off with limited resources. Other compilations of data have done less (some far less) than LIS to standardize the data, but have attained greater (often much greater) coverage of countries and over time. Where the data provider chooses to be in this trade-off depends (of course) on the objective of the data tool.

Many users will not appreciate how much work is required to create properly documented and reasonably harmonized micro data from the diverse sources files. Harmonization requires that common units are used and common definitions, although there are constraints to the latter, such that the harmonization is never complete or even well-defined. There are naturally limits to harmonization in the LIS model. In the short-term, LIS must of course take the survey as given. However, LIS does provide feedback to the various source agencies on any problems it encounters and LIS is directly involved in various internal forums

[5] In the interests of full disclosure I co-founded (with Shaohua Chen) PovcalNet while working in the World Bank's research department. The data tool was devised to allow replication of the World Bank's global poverty measures, and to allow users to test their sensitivity to alternative assumptions, and to support other poverty monitoring efforts.

on data standards.[6] This is nonetheless a somewhat different model to the LSMS and CLSP. The LSMS entails facilitating and implementing surveys on the ground in the countries concerned. This difference stems from the fact that the LSMS has a mandate for statistical capacity building at country level. LSMS surveys use a similar format across countries, though it is unclear that one could reasonably call them "harmonized." In practice there is variation across the surveys, stemming from the fact that staff work with local counterparts to modify the survey instrument to fit local needs. There is a trade-off between harmonization across countries in the data collection stage and the relevance of the survey to local conditions, including local policy concerns.

2.2 Usage and influence of LIS

LIS appears to have a loyal core group of around 200 regular users, year-after-year, with varying numbers of new users joining each year and others leaving.[7] Over 2007–10, the total count of users with new or renewed registrations in the current year (what LIS calls "active users" although it is unclear just how active they are) was a reasonably steady 400 per annum. Over 2010–12, this rose to over 1,000 active users.[8] This sharp rise in registrants came mainly from new users, and could well reflect interest in the social impacts of the Great Recession and the Euro crisis. The number of processed jobs (specific task submissions to LIS) averaged 51,000 per year over 2007–12. This is roughly double the number in 2002 (26,000), although the count did not show any net increase over 2010–12.[9] Users come mainly (91 %) from LIS's contributing countries. So this tool appears to be mainly of interest to "rich world" researchers, which will not be surprising when we look more closely at coverage in Section 3.

LIS research outputs can be tracked using LIS's own working paper series (WPS) since researchers using LIS data must publish their results in this series (while not preventing other publication outlets).[10] There are over 600 Working Papers on the LIS WPS site at the time of writing, with 565 different authors. (Tim Smeeding is clearly the most prolific of the LIS authors, with 82 LIS working papers having him as an author or co-author). The main topics of the LIS papers have been the measurement of poverty and inequality, and the incidence of social spending, often from a comparative perspective. Oddly, the search tool on the LIS's WPS website does not allow one to enter a personal search request (one is confined to pre-set "key words.") So I created my own file of all the abstracts of LIS WPS and searched on that file. In terms of frequency, the top 30 substantive words in the abstracts are (with word counts):[11] income (336), countries (318), poverty (297), inequality (277), social (259), differences (226), States (1999), data (187), distribution (158), policy (150), national (177), welfare (136), family (130), household (124), comparative (119), effects (114), work

[6] This includes the Canberra Group meetings in the 1990s, and various OECD expert groups and meetings at the United Nations Statistical Commission.

[7] Over 2007–12, the mean count of continuing users (active users less new users) was 242 with a standard error of only 7.2.

[8] The information in this paragraph is drawn from a presentation made to the LIS Board in 2013 by Thierry Kruten of LIS, which was kindly passed onto me by Janet Gornick.

[9] This is puzzling. On the presumption that the new users tend to be less able programmers one might expect them to need more, not fewer, runs. Possibly the newly-attracted registrants were just not as active.

[10] The count includes various series, the one labeled "LIS" being the largest with 597 papers at the time of writing.

[11] I ignore some words for obvious reasons, like "paper," "study," "using" and "LIS."

(109), women (97), children (94), measures (91), Luxembourg (88), cross (85), rates (82), redistribution (79), changes (77), analysis (75), employment (72), age (70), transfers (67) and earnings (60).

A second source of data on LIS's influence on research is the set of journal articles mentioning LIS. An "all text" search for "Luxembourg Income Study" in EconLit identifies 527 articles in academic journals.[12] The first was in 1987, although this was only an announcement about LIS, in the *Review of Income and Wealth* (RIW). The first LIS paper published in an academic journal was Buhmann et al. (1988), by LIS staff and also published in RIW, which has since published 120 papers that refer to LIS, more than any other journal.

Figure 1 plots the counts of papers, for both WPS and articles in EconLit mentioning LIS.[13] The time profiles make sense, given the lags between a WP and the final journal article. Both series show signs of a recent decline in output although this is not as easily identified using the count of journal articles, possibly reflecting publication lags.[14] It is puzzling that the decline in research output have not come with declining usage of the data. Possibly usage has shifted from publishing researchers to others, such as users in governments or international agencies.

LIS had found applications in research across the political and social sciences, not just economics; for example, in 2005 LIS won an award from the American Political Science Association for its contribution to the field of comparative politics. And the applications have not been confined to academic research. So in assessing LIS usage it is important to cast a wider net than is possible with EconLit or scanning the more academic WPs.

Objective indicators with a broad coverage can be found in two Google tools. The first is the Google Ngram Viewer, which counts the incidence of any word or phrase in digitized writings on the internet. This shows a steady rise in the incidence of references to "Luxembourg Income Study" in digitized books from 1983 until about 2000.[15] There has been a leveling off since then, though the incidence has stayed fairly firm. Second, a search for references to "Luxembourg Income Study" in Google Scholar (GS) delivers a count of 8,700, of which 349 are found in material on the internet dated in LIS's first 10 years (1983–1992), 2,420 are in the next 10 years (1993–2002), with 5,740 since 2003.[16] So citations to LIS have continued to accumulate, with no sign of any recent decline; indeed, two-thirds of the citations are from internet documents in the last 10 years. Of course, such a rise in citation counts partly reflects the growth of digitized content with the expansion of the internet.[17]

[12] Entering just "LIS" retrieves a large amount of irrelevant content. However, it appears to be rare to refer to LIS without at some point using the phrase "Luxembourg Income Study."

[13] At the time of writing the EconLit journal entries only go up to June 2013; the data entry for 2013 in the Figure is set at three times the recorded count for that year.

[14] The Figure also gives a non-parametric kernel regression. Using instead a parametric regression of the WPS count on year and year-squared both coefficients are significant at the 0.01 % level. For the journal article count both coefficients are significant at the 3 % level. (The zeros for the first three years were dropped.) Dropping the observation for 2013, the coefficients are only significant at the 6 % level.

[15] By "incidence" I mean references to "Luxembourg Income Study" as a % of all words in Google Books that year.

[16] Google Scholar casts a wider net that other bibliographic tools that are confined to more academic working papers and journal article. Using "LIS" instead does not adequately identify the relevant citations.

[17] For example, about the same share of the total number of references in Google Scholar to "living standards measurement" and "poverty measurement" are since 2003.

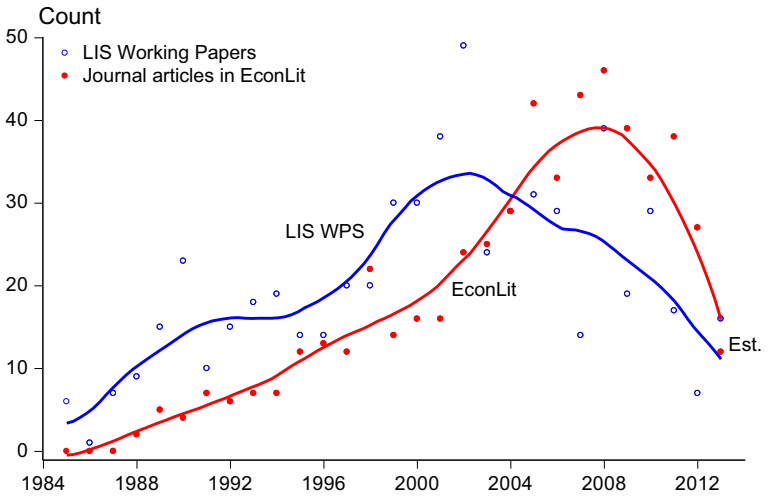

Fig. 1 Counts of LIS working papers and journal articles mentioning LIS by year

3 Coverage, frequency and timeliness

The 40 countries in LIS at the time of writing represent 62 % of the world's population. They are by no means a random sample of the world. This can be seen from Fig. 2, which gives the probabilities of being included in LIS and PovcalNet. Inclusion is plotted against log GNI per capita, for all 175 countries in the world for which GNI is available in the WDI. The Figure also gives non-parametric regression functions, interpretable as the mean probability of inclusion at a given income level. While there is a clear "rich-country bias" in LIS, it is the opposite for PovcalNet, reflecting the World Bank's mandate of fighting absolute poverty in the developing world. However, it remains that 70 % of countries are in the region of common support (the interval of GNI which contains representatives from both).[18]

Thirty years ago one might have explained the rich-country bias of LIS evident in Fig. 2 on the grounds that survey data were not readily available for poor countries. But that is clearly no longer true, as is also evident from Fig. 2. At the time of writing, PovcalNet includes distributional data on consumption or income from 850 national household surveys for 127 developing countries. Granted the micro data are not publically available for many of these countries, though nor are they for all current LIS countries (which is why they have the confidentiality restrictions that determine their mode of data access). And while data quality is uneven, that is clearly also true amongst current LIS countries. While one still hears rather poorly informed claims about the "low quality" data in developing countries, I would contend that the majority of the national household surveys done by statistical offices in the developing world today meet the standards expected of surveys done in the rich world. Poor data quality in developing countries is now a lame excuse for excluding those countries.

[18] Outliers exaggerate this somewhat; if one eliminates the top two GNIs in the PovcalNet countries then the region of common support drops to an interval of GNI per capita containing 52 % of the world's countries.

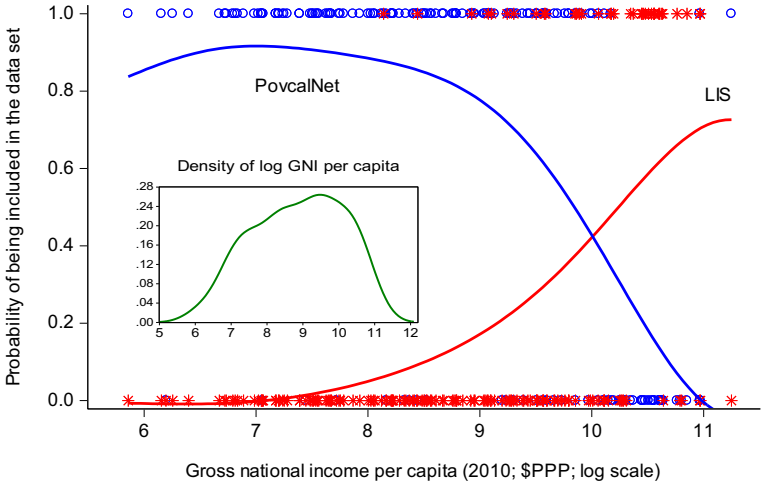

Fig. 2 Probability of being included in LIS and PovcalNet

LIS plans to expand coverage further in the coming years, but one would have to say that progress has been slow so far. Ten years ago, LIS included 130 surveys for 29 countries (Smeeding 2004). At the time of writing it has 211 surveys from 40 countries. However, by my count only 27 surveys from 2002 onwards are for developing countries as defined by PovcalNet. Yet over the same period, the coverage of PovcalNet went from 450 surveys for 97 countries to 850 surveys for 127 countries. So it is clear that only a small proportion – less than 10 % – of the extra surveys for developing countries that became available over this period made it into LIS. Some of the expansion in survey availability was for "low-income countries" which LIS has never aimed to represent, although that is a choice LIS has made, not something imposed on LIS. Today's world has a continuum of countries at different income levels, and it is no longer very meaningful to make a sharp distinction between "low-" and "middle-income" countries, or even "middle-" and "high-income." The separation of "rich-country" databases from "poor-country" databases is hard to defend today.

Most LIS countries now have multiple survey rounds going back to the early 1980s. But this too has an economic gradient, as seen in Fig. 3.[19] Richer countries have more surveys in LIS, reflecting its origins as a "rich-world" data archive. There is a mean of 4.2 surveys per country (median of 4). Italy has the most, at 11.

Over half (60 %) of LIS's global population coverage is accounted for by the two most populous countries, China and India. However, any knowledgeable user interested in those two countries will be disappointed by LIS's survey coverage. Both countries have only one survey. A closer scrutiny of why this is so points to some of the problems LIS faces.

The China survey is not from the governmental statistics office – the National Bureau of Statistics (NBS); alas, NBS micro data sets are deemed to be a State secret, which restricts learning within and outside China. This is unfortunate and arguably inconsistent with "the intellectual approach of seeking truth from facts" (Du Runsheng 2006, p.2) that has been prominent since the reform path started by Deng Xiaoping in 1978. By my understanding

[19]The figure only counts surveys with a live link.

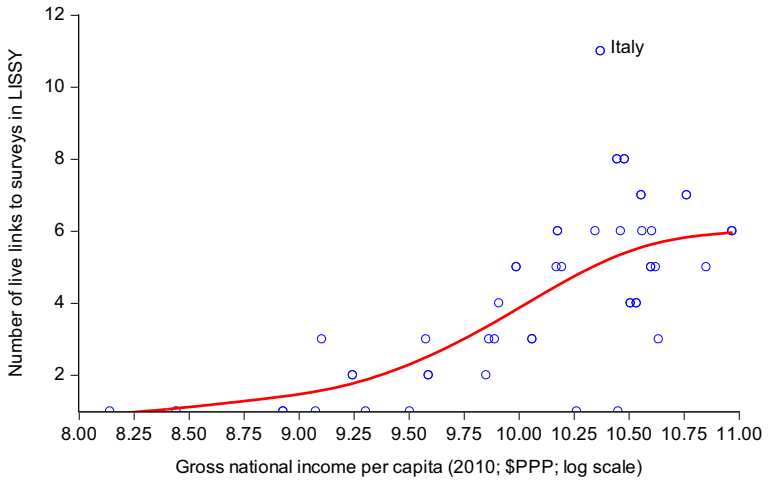

Fig. 3 Number of surveys in LIS by country

of the law, the only way a "LIS-type" solution using remote access could work is that the micro data continued to sit on NBS's servers, but the software allows users to have remote access without being able to download the micro data. This is *technically* feasible.

Similarly to China, the one survey for India, for 2004, is not the Government's National Sample Survey (NSS) data, now in its 68th round with about 20 surveys since 1970. The NSS is one of the oldest and most respected surveys in the developing world. The most recent micro data have just become available, for the 68th round for 2010–11. Unlike China, these data have been public access since the mid-1990s (with some user fees). The NSS surveys are clearly not in LIS because they rely on collecting data on consumption, rather than income.

Timeliness of data is important for most users. The most recent micro data sets for a number of countries are in the early to mid-2000s. Averaging across all 40 countries in LIS at the time of writing, the mean year of the latest survey is 2006; the median is 2005 and the range is 1997 to 2010. Figure 4 gives the histogram of the latest year of the surveys in LIS. Bi-modality is evident. There is one group of 14 countries with survey data for 2010, which is reasonably recent by current international standards.[20] Then there is a lower mode at 2004, with a sizeable spread around this mode. However, many countries do have more recent surveys than found in LIS.[21]

These lags will clearly put off many users when they know that more recent surveys are available elsewhere for many of these countries. Given that other data compilations draw on more recent data for overlapping countries, LIS's own processing needs are clearly part of the reason. While the harmonization process takes time, some potential users will no doubt

[20]The 14 countries are Colombia, Germany, Greece, Ireland, Israel, Italy, Luxembourg, Russia, Slovak Republic, Slovenia, South Africa, Spain, the United Kingdom and the United States.

[21]I can verify this for Brazil, China, Hungary, India, Mexico, Peru, Poland and Romania; there may be other surveys I am unaware of. And in all of these cases the "LIS lag" exceeds two years; the largest is 14 years, for Romania.

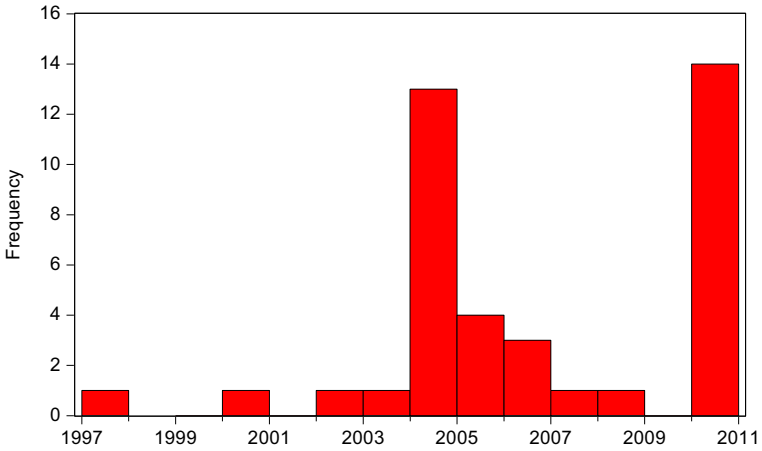

Fig. 4 Histogram of the year of the latest survey in LIS

wonder why the raw data is not put up in advance, also recognizing that some users will not need the LISSified files.[22]

4 Accessing LIS data

Users of LIS do not have direct access to the micro data. The aim is that users get the summary tables they want from the micro data but do not actually have any contact with the micro data. This is done to respect confidentiality agreements with the governmental statistics offices or other agencies from which LIS obtained the primary data. For some countries the micro data are already public; it is not clear why LIS does not provide users with the harmonized unit-record data in such cases. The relevant data tool in LIS is called LISSY.

One must register to obtain access to LISSY but this is easy. For students (anywhere) and non-student researchers in certain countries, access to the micro data is free. Whether non-students are liable to pay a fee depends on where they live. If your country of residence (or institution) has registered for LIS and paid the required fees then you have free access. At the time of writing there are only 19 countries for which both student and non-student researchers have free access.[23] Users from designated "high-income countries" pay €500 per quarter (or €2000 per year), while those from designated "middle-income countries" and "low-income countries" pay half and one quarter of these amounts respectively. LIS does not allow commercial users at any price. This is a requirement of some data providers and donors (rather than LIS). It is a puzzling restriction with no clear justification to my mind. What is wrong with commercial usage, at reasonable fees?

To submit a data request users first obtain a password and username and sign a pledge to abide by LIS rules. Users need to submit their own programs to run remotely on the desired

[22] The website does identify surveys received but for which harmonization is in progress.

[23] At the time of writing I did not include those counties for which the LIS website says "free until date x" when x has passed. Since then LIS has provided extensions and updated the site.

LIS micro data set. The request (in text format with a standardized header) must use SAS, SPSS or Stata (by far the most popular package now for LIS submissions). (LIS is planning to add R, the only truly open source statistical package.) If the code is free of errors then one usually obtains the results quickly – in a matter of minutes unless a manual check is deemed necessary. Data results are returned to the same email address and must be in a summary form that preserves confidentiality. The system is available 24 hours a day, 7 days a week. Delays arise if manual intervention is called for, such as when a user account has to be renewed or the submitted program risks violating LIS rules.

One attraction of LISSY is that one can pool data for multiple countries in a single run; for example, one might combine all the surveys for (say) Europe, or all the surveys for that matter. One can then estimate a cross-country regression for (say) household income, with country and year-specific variables (or country/year fixed effects) as well as the usual household characteristics. Capacity problems can also be expected with large jobs. One LISSY user reported to me an example of a very large job of this sort that crashed with the (rather unhelpful) message: "Your job has been refused." However, with the help of LIS staff it was possible for this user to partition the job to run properly. The impression I get from the users I consulted in preparing this paper is that LIS staff are quite responsive to queries, albeit with the inevitable delays (such as due to different time zones).

I did a trial run of LISSY for the purpose of this review. I chose to compare spending on social transfers in Australia (my country of origin) with the United States (my country of residence). Using the latest survey rounds, 2010 for the U.S. and 2003 for Australia, I regressed "social security transfers" (essentially public transfers for social protection and assistance, including public pensions but excluding private pensions) as a share of total income on (log) household size, a dummy variable for the US, and the interaction of these two variables. A simple Stata program returned my results in two or three minutes. (I found that the share of income from social transfers declines significantly with household size in both countries, though slightly less quickly in the US, and the share of income from social transfers is lower in the U.S. than Australia at any given household size.)

To those of us who are more used to having the micro data files, LISSY's remote access method may feel a little clumsy, although it works quite well. One does sometimes like to look at the unit-record data to check something, but losing this option is probably not a concern for most users. Some data manipulations that are easy with direct access to the micro data would clearly be a challenge with LISSY's remote access mode, such as merging household-level data bases with external geographically-referenced data, such as on public spending or infrastructure.

There are two other ways users can access the LIS data, with the choice depending on what one wants from the data. While the main value-added of LIS is clearly the access to micro data that it facilitates, Key Figures provides summary statistics across the 40 LIS countries for multiple years in most cases. Key Figures is the LIS output that most resembles the other data compilations reviewed in this special issue, and it appears to be widely consulted as an authoritative source of poverty and inequality indices.[24]

No registration with LIS is required to access Key Figures. The data compilations are almost certainly more internally consistent than other compendiums, although this comes at the price of more limited coverage. However, there are concerns about some of the measurement practices underlying these data, which I will return to in Section 6.

[24] Key Figures also provides a set of employment data by gender that is not reviewed here.

The second route to the LIS data is the Web Tabulator,to which this review now turns.

5 Democratizing research: Web Tabulator

To reap the benefits of open data the community of users also needs open tools for data analysis, without which the cost of entry can be high for many potential users. I expect that there are a great many people who could learn from LIS data but do not know how to write code in Stata (say).

Fortunately the technology has improved, so it is now possible to give users access to the data for analysis without being able to "take away" the data. Web Tabulator does just that. Users can make their own tabulations from the primary data (only household data at this point) and this can be done quite easily. One does not need to know any software program. This is an important innovation for LIS.

I also took Web Tabulator for a test drive for the purpose of this review, again comparing social transfers in Australia and the US. The latest survey rounds in Web Tabulator were for 2003 and 2004 – a 10 year lag that is a lot longer than those currently working on developing countries have come to expect. And the Web Tabulator data for the U.S. lags 10 years behind the LISSY data.

Table 1 is the result of my test drive. The table gives mean social transfers as a % of mean gross income for the "poor" and "non-poor" defined by a relative poverty line set at 50 % of the country median (following a standard LIS practice that I will return to below). I also stratified by household size. We see that the poor depend more on social transfers than the non-poor. While this holds in both countries, the shares are higher for Australia at all household sizes. In both countries, we see again that the share of social transfers in income tends to be lower for larger households. I found Web Tabulator to be easy to use and I had my table within 10 minutes of opening the tool.

My trial suggested that Web Tabulator could be improved greatly. There are small annoyances, such as the fact that the variables are not defined within the data tool – one needs to go outside it to search. And "social security transfers" are abbreviated as "social transfers" in Web Tabulator, which creates confusion.

Table 1 An example of the calculations that can be done using LIS's Web Tabulator

Mean social transfers as a % of mean gross income		Poverty status (relative to 50 % of median)	
Household size	Country and year	Not poor	Poor
One person	Australia 2003	30.81	106.74
	United States 2004	33.32	80.27
Two persons	Australia 2003	27.07	108.50
	United States 2004	23.19	65.17
Three persons	Australia 2003	15.61	91.57
	United States 2004	7.67	42.20
Four persons	Australia 2003	10.23	76.82
	United States 2004	5.32	35.87
Five persons or more	Australia 2003	13.90	73.07
	United States 2004	6.88	33.83

The biggest limitation is that (as yet) there is not that much one can actually do analytically with Web Tabulator – just simple descriptive tabulations of the pre-set variables. It is no substitute for LISSY, but Web Tabulator could be much more powerful without requiring knowledge of the software used by LISSY. One cannot even do simple manipulations of the small set of "canned" variables.

In any future developments to the Web Tabulator idea more variables should be included, anticipating user applications. And the tool needs to include more options for manipulating the variables and more analytic functions. With limited resources, LIS clearly faces a hard choice between investing in Web Tabulator and addressing the pressing coverage and timeliness issues for its core database in LISSY. But more could be done with existing resources if LIS adopted new software tools from other sources. There would seem to be a strong case for replacing the existing Web Tabulator with a tool serving the same end but based instead on the entire LISSY data base. The World Bank's research department has devised a software solution called ODAT (an extended version of the analytic front end of CLSP) with powerful statistical capabilities yet preserving full confidentiality and allowing users without any knowledge of statistical software to derive versions of Table 2, and much more.[25] Web Tabulator users would have a more powerful tool, no harder to use. And I expect that for many users of LISSY, this new version of Web Tabulator will suffice. This could be up and running quickly at modest cost.

6 LIS practices

Since its inception, LIS has emphasized standardization to enhance international comparability and policy relevance. This has entailed imposing common protocols. Here I am concerned that some LIS practices are open to question or even hard to defend – not least in the developing countries of the world that LIS has been aiming to embrace, albeit with limited success so far.

Before turning to specifics, beyond some early contributions (such as Buhmann et al. 1988) the LIS website and "LIS literature" in the WPs seems a little short on methodological content. I would have liked to see more work documenting and critically assessing LIS protocols, such as in constructing "comparable" income aggregates and welfare metrics and dealing with thorny issues such as the valuation of income-in-kind. Such methodological work is important for both current users (given that the methodological choices can matter to, for example, policy inferences) and future efforts at data harmonization by others.

6.1 Processing protocols

Prior to around 2000, LIS used an odd coding rule that replaced missing monetary variables in the primary data with a zero, so that a zero became ambiguous – it could either mean zero or that the data are missing (which are of course very different things). Thankfully, this has been replaced by better coding practices. However, it remains that LIS does not do its own imputations for missing values. The problem for the types of comparisons that LIS

[25] ODAT was developed by Qinghua Zhao at the Bank. ODAT is in trials with China's NBS and is planned to become publically available (free of charge) for other applications late 2013. ODAT has the full capabilities of R, but does not require programming in R. A simple user-friendly interface is used.

Table 2 Five different households who are equally well off according to LIS

Household	Household income ($/day)	No. adults	No. children	Income Per person	Income per equivalent single person (LIS square-root scale)	Income Per equivalent single adult (alternative scale)
A Small	$5.00	1	0	$5.00	5.00	5.00
B Medium, nuclear	$10.00	2	2	$2.50	5.00	3.76
C Medium + grandparent	$10.00	3	1	$2.50	5.00	3.51
D Large, nuclear	$15.00	2	7	$1.67	5.00	3.20
E Large and extended	$15.00	6	3	$1.67	5.00	2.81

Note: The alternative scale assumes that children cost 70 % of adults and that the scale parameter is 0.8

is designed for is that the extent of missing values (such as for income) is unlikely to be random, within or between countries. Furthermore, imputation practices vary across survey data providers, and are sometimes less than ideal. Various imputation/matching methods address item nonresponse by exploiting the questions that are in fact answered (see, for example, Little and Rubin 1987). However, the devil is in the details, and I have come across examples in which the imputation method was far from sound, due to the absence of obvious covariates for matching (to find otherwise "similar" comparators for imputing the missing values), even when in fact the variables are data.

It would be a lot of work to systematically impute using best practices from the literature. I can't judge whether the benefits would outweigh the costs. However, it is surely odd that LIS puts such emphasis on assuring comparability of the income data when it is *not* missing but ignores the potential biases from diverse and often absent imputation methods.

Another issue that users should be aware of is that LIS summary statistics on income distribution are based incomes that have been deliberately truncated. Incomes are top-coded, meaning that they are truncated at 10 times the median (Lustig et al. 2013). Along with others, I have an aversion to top coding of reported incomes (or expenditures). My general presumption is that high-income respondents to household surveys under-state their incomes, so LIS's top-coding makes matters worse. LIS also employs bottom coding in Key Figures, at 1 % of mean income. Also households with zero income are excluded from the calculations reported in Key Figures. These practices are puzzling and I can see no justification. Some households do have zero or low income at some times; consumption, of course, is another matter.[26]

These coding practices leave me skeptical of summary measures on inequality and poverty in Key Figures. A strength of LIS is that users can construct their own measures from the micro data, but this adds greatly to the costs facing those users who simply want reliable, comparable, summary statistics.

6.2 LIS's favored welfare indicator

The best single indicator of economic welfare available in LIS is probably "disposable household income" defined as "total monetary and non-monetary current income net of income taxes and social security contributions." With recent changes in LIS, this concept now includes income-in-kind (with appropriate backward revisions as well), although it still does not include imputed rent or the value of public health and schooling services.

LIS excludes surveys that do not have household income data. This might seem a natural restriction; this is after all the Luxembourg *Income* Study. However, we should remind ourselves why we care about income in this context, which is its bearing on human welfare, for the purpose of assessing the extent of poverty or inequality. There are users of LIS (myself included) who prefer a standard (comprehensive) consumption aggregate over current income as a metric of welfare. We might well agree that *permanent income* is the most relevant income concept for judging welfare, and that it is also more relevant for measuring the true level of poverty or inequality, given that current income includes predictable transient or life-cycle income differences. (Policies too are rarely concerned with reasonably predictable short-term income losses.) However, while current income measured in a survey would only rarely accord with permanent income, current consumption does reveal permanent income under certain conditions. That is an attractive property.

[26] Web Tabulator has a box one can tick to include the zeros; deleting them is the default.

It must be acknowledged that this property of consumption does require some strong assumptions, notably that credit markets work well enough to allow households to smooth consumption as they see fit. In reality there are borrowing constraints stemming from asymmetric information. Advocates of using income data in preference to consumption often point to these constraints. However, recognizing the existence of credit market imperfections does not justify believing that current income is a better welfare metric than consumption. We need not presume that markets are perfect to still expect that consumption will be smoothed to some extent in the face of income fluctuations. Households can save and they do have foresight.

Another argument sometimes made for preferring income measures is that they better reflect "potential consumption." But this too is questionable. First, we can question whether potential consumption is a valid welfare indicator. A poor farmer may get a bumper harvest once in 20 years, but he can hardly be judged to be no longer poor, even in that fortunate year. Second, even if we accepted that potential consumption was what we are after, income is hardly a good measure; we would surely want to know liquid wealth, and here too actual consumption may well be revealing about potential consumption.

On top of these more theoretical arguments, household consumption is probably better measured than income in many cases, especially in developing countries. When incomes fluctuate over time (such as due to seasonality in agriculture) it is very difficult to measure them in surveys, and this is often not even attempted. Incomes also contain illegal earnings or components hidden from taxation that households will be disinclined to reveal in a survey. Consumption surveys are less prone to these problems. The gaps between grossed-up aggregates from surveys and the closest comparable measures in the National Accounts have often been of concern (though reflecting errors in both sources, as well as different concepts). However, these gaps appear to be a bigger problem in general for income surveys in developing countries than consumption surveys (Ravallion 2003), although poor survey instruments for measuring income are also a problem (in the worst case, asking "what is your income?" will hardly ever give a reliable answer; a much better practice is to build it up from specific detailed components, which can take many pages of a questionnaire).

The choice will clearly also depend on the context. For example, when rain-fed agriculture is a more important source of income, consumption surveys will be more appealing. The fact that LIS started out in rich countries (and still does not represent poor countries well) has influenced its choice, although it has been argued that consumption is also a better measure of economic welfare for LIS-type purposes in rich countries (Slesnick 2001, on the U.S.). What is clear is that a truly "global LIS" would need to embrace consumption surveys, which have been more popular (for good reasons) in the developing world (including in the Bank's LSMS).[27]

Another source of concern relates to how LIS adjusts for differences in household demographics. What is called "equivalized income" in LIS is household income divided by the square root of household size. LIS's use of the square-root scale appears to have been influential, with non-LIS researchers adopting this scale on the grounds that LIS does so. Such equivalence scales are invariably rather arbitrary. There are well-known, and deep, identification problems in estimating such scales based on observed demand behavior alone (Pollak and Wales 1979).

[27] For further discussion on measuring consumption properly see the excellent overview in Deaton and Zaidi (2002).

It is not clear why LIS adopted the square root scale and not something else, and why there is no allowance for the fact that children tend to have lower consumption demands than adults. Taking the square root implies substantial economies of scale, especially given that imputed rents for housing are excluded (noting that the scope for economies of scale is greater for housing than most other demands on incomes).

Lay users of the summary data will not easily understand the implications of this square-root scale, and if they did they may well question it. Providing users something like my Table 2 would help. Here I give stylized data on household income and demographic composition for five households. According to LIS, members of all five households are equally well off. I am sure I am not the only person who would question that claim. Household E with 6 adults and 3 children and a total income of $15.00 per day is deemed by LIS to be no worse off than a single adult with an income of $5.00 per day. To test sensitivity I also give income per equivalent single adult for an alternative scale that allows for lower expenditure needs of children than adults and more modest scale economies in consumption. (Specifically the scale is $(NA+0.7NC)^{0.8}$ where NA is the number of adults and NC is the number of children.)

The kind of sensitivity to scale parameters evident in Table 2 is well understood amongst researchers, and is also known to have potentially important implications for social policies (especially policies that involve demographic characteristics, such as family allowances, which will become less "pro-poor" in their incidence the more one allows for economies of scale). The first academic paper using LIS (and by LIS staff) tested the sensitivity of measures of poverty and inequality to the choice of scale parameters and concluded that:

> "The results of our analysis indicate that choice of equivalence scale can sometimes systematically affect absolute and relative levels of poverty and inequality and therefore rankings of countries (or population subgroups within countries). Because of these sensitivities, one must carefully consider summary statements and policy implications derived from cross-national comparisons of poverty and/or inequality." (Buhmann et al. 1988, p.115)

Unfortunately, many users of Web Tabulator or Key Figures will not be aware of this warning. It seems that LIS's research arm might have better informed its data arm!

Nor is it clear that consistent comparisons of real income distributions across countries should use a common equivalence scale. The parameters of such a scale – the differential allowance for children's needs and the adjustment for economies of scale – can be expected to vary with consumption patterns. For example, in richer countries, the share of income spent on food (for which there is no scale economy) tends to be lower while the share for housing (with more potential for economies of scale) is higher. Users with the required programming skills can construct their own scales from LISSY but those using Key Figures cannot.

6.3 Prices

My 1992 review complained that LIS had not used Purchasing Power Parity (PPP) rates for exchange rate conversions. This becomes especially important when LIS expands to include developing countries where official exchange rate conversions understate real incomes given the existence of non-traded goods (especially services). There has been some progress on this front. Web Tabulator uses PPP rates. However, the means and medians given in Key

Figures are not in PPP $'s but local currency units at the time of the survey. It would be more useful to give the mean and median in constant prices at PPP.

There does not appear to be any adjustment for spatial differences in price levels within countries, as is now common for developing countries. Again context matters; most goods prices probably vary less spatially in rich countries than poor ones (given poorer infrastructure), although housing is an important exception and has a high budget share in rich countries.

It is puzzling why adjustments for inflation for data collected at different times are only done if the inflation rate exceeds 10 %. This is creating unnecessary measurement error.

6.4 Poverty measures

From a global perspective, the bulk of past poverty measurement practice has been polarized between a "rich world" in which income-based measures of relative poverty dominate and a "poor world" in which absolute poverty measures have been the norm and consumption-based welfare measurement has been seen as best practice. LIS Key Figures (and the poverty classifications in Web Tabulator) are in the former camp.[28] LISSY users are (of course) free to make absolute comparisons by introducing their own (sub-national or national) price deflators.

However, research using LIS has mainly relied on making comparisons of relative distribution across countries. The phrase "absolute poverty" is mentioned nowhere on the LIS site and by my count no more than 40 of the 600 LIS WPS make absolute poverty comparisons.

Nor are LIS's relative poverty measures in Key Figures and Web Tabulator beyond question. The LIS tradition has been to use a poverty line set at half the country's median. (Key Figures also gives results for 40 % and 60 % of the median.) There is an extensive literature on such relative poverty measures.[29] There has also been much debate. One issue in the literature is whether the poverty line should be fixed relative to the mean or relative to the median (Saunders and Smeeding 2002; Easton 2002; De Mesnard 2007). The median is more robust to measurement errors at the extremes, although poverty lines set as a constant proportion of the median can have perverse properties when the Lorenz curve shifts, as demonstrated by De Mesnard (2007).

However, whether the line is set at a constant proportion of the mean or median, there is a more serious objection, namely that such a poverty measure will have the seemingly perverse property that if all incomes grow by the same proportion the measure will be unchanged. This yields some surprising poverty comparisons. We are told in Key Figures that the incidence of poverty in India is lower than in China, and only slightly higher than for the United States. (The website gives a poverty rate for India in 2004 of 20 % as compared to 17 % for the same year for the US; the poverty rate given for China in 2002 is 25 %.) Of course, once you set a poverty line as a constant proportion of the mean or median you end up with a measure of relative distribution, divorced from absolute levels of living. Pooling all the observations given in Key Figures the correlation rate between the LIS poverty rate and the Gini index is very high 0.92 ($n = 211$).

Users who want to make inter-country comparisons might be advised to augment the LIS poverty measures in Key Figures with absolute measures from other sources. Users should

[28] The mean and median income are provided in Key Figures, but with no real comparability across countries or over time (as already noted).

[29] Ravallion (2012) provides a commentary and references.

also be wary of using these data for comparisons over time for a given country. For example, we are told that the poverty rate for the United Kingdom rose from 5 % in 1969 to 15 % in 2010. And I suspect that if I was to dig a bit in the LIS data I would find situations in which measured poverty fell during recessions.

The usual defense for such measurement practices is to say that these measures allow for relative deprivation – that people care about their income relative to the mean or median of their country of residence. But as long as we think that poverty is absolute in the space of welfare (or capabilities) one can only derive these strongly relative poverty measures if welfare *only* depends on relative income (own income relative to the median). In other words, one needs to assume that welfare does not depend on own-income at given relative income. This must surely be considered a very strong assumption. Maybe it can defended as plausible in some very rich European countries – maybe Luxembourg? – but it can hardly be plausible in most of the current LIS countries, let alone the largely excluded developing world.

Another defense one hears of these measures is that they embrace the costs of "social inclusion," which are deemed to rise with average income. Here too one might readily agree that there are such costs and that they rise with average income, but question whether they are directly proportional to the mean or median. And when one carries this argument to poor countries, one is likely to *under-state* the costs of social inclusion using such measures (Ravallion 2012).

There are now better ways of measuring relative poverty. Ravallion and Chen (2011) propose a "weakly relative poverty measure" that can allow for relative deprivation and costs of social inclusion but does not entail setting the line at a constant proportion of the mean or median.[30] The elasticity of the poverty line to the mean starts out at zero in the poorest countries (purely absolute poverty measures) but then rises with the mean, though only reaching an elasticity of unity as mean income goes to infinity. Ravallion and Chen show that their schedule of weakly relative lines fits the data on national poverty lines well. Truly global measures of poverty following this approach are now available (Ravallion and Chen 2013).

LIS's preferred measurement practices accord with practices in a number of the LIS countries but certainly not all. Indeed, even in 1990, it could not be argued that absolute poverty is irrelevant to the seven rich countries then in LIS, since one of those countries (the United States) uses absolute poverty lines. Today's LIS includes many more countries that also use absolute measures. If LIS Key Figures and Web Tabulator were to be relevant to all the LIS countries then they would need to include absolute as well as relative measures. And this would clearly be essential if LIS was to be considered a *globally* relevant data base.

7 Some problems under the surface

There are some deeper problems in LIS's underlying survey data that matter to some of the uses made of LIS, including in international comparisons. LIS should not be singled out

[30]This builds on an approach proposed by Atkinson and Bourguignon (2001), but with the important difference that our measure allows the cost of social inclusion to have a positive lower bound. Foster (1998) also proposed a "hybrid line" given by the weighted geometric mean of an absolute and a (strongly) relative line. While this is also "weakly relative," it has a constant elasticity, whereas the elasticity rises from zero to unity in the Ravallion and Chen proposal – consistently with the data on national lines.

for criticism in not addressing these problems, as they are shared by virtually all data sets. Nonetheless, users should be well aware of them. We might also expect prominent data providers such as LIS to show leadership in the flagging these problems and pointing to possible solutions.

A case in point is survey *non-response bias*. Some proportion of those households sampled for a survey either refuse to be interviewed or are impossible to reach at home. This is often called "unit nonresponse" (as distinct from item nonresponse, as discussed in Section 6.1). Some surveys make efforts to avoid unit nonresponse, using "call-backs" to non-responding households and fees paid to those who agree to be interviewed. Nonetheless, the problem is practically unavoidable and nonresponse rates of 10 % or higher are now common; indeed, I know of national surveys for which 30 % of those sampled did not comply.

The bigger concern is that nonresponse is clearly not random. More likely, compliance falls with income; this is consistent with evidence for the U.S. (Groves and Couper 1998, based on compliance with the long schedule of the U.S. Census administered to a random sample).

There are methods that can be used to correct for selective response. Using the same survey data for the U.S. found in LIS, Korinek, Mistiaen and Ravallion (KMR) (2006) show how the latent income effect on compliance can be estimated consistently with the available data on average response rates and the measured distribution of income across geographic areas.[31] This allowed KMR to re-weight the data. They found a significant negative income effect on U.S. survey compliance. After correcting for this, measured inequality is higher, with about 5 % points added to the Gini index. A higher overall mean is also called for. In terms of the impact on measures of poverty, the downward bias in the mean tends to offset the downward bias in measured inequality. The tendency for low-income groups to be over-represented (because of their higher compliance probabilities) still means that the poverty rate tends to be over-estimated, though KMR find that the impact is small up to poverty lines normally used in the U.S.

I would hazard to guess that these problems are at least as severe for the international comparability of measures of poverty and inequality as the problems addressed by the standardizations done by LIS, though the effects do not necessarily go in the same direction. Consider the Gini index of income inequality in the U.S. for 2004. The "raw" Gini index based on income per person from the Current Population Survey reported by KMR is 44.8 %. After LISification, the Gini index for the same year from the same survey is 37.2 % (from Key Figures). That is a large downward revision. By contrast, the KMR correction for selective compliance in the CPS brings the Gini index for 2004 up to 49.2 %. The same upward adjustment to the LIS Gini index would bring it to 41.6 %, a few points below the unstandardized figure.

The traditional household survey faces many new challenges today. There is a perception that survey response rates are declining across the globe, although I have not seen evidence. In addition to concerns about under-reporting and selective compliance, there are worries about out-of-date sample frames, infrequency of surveys, lags in processing, questionnaire length, robustness to changes in questionnaire design, heterogeneity in the interpretation of survey questions including subjective scales, and weak integration with other data sources. There is not much discussion of these deeper problems

[31] Korinek et al. (2007) go more deeply into the estimation method and its robustness.

on the LIS website, or the working papers.[32] More work on these topics is surely needed.

8 Conclusions

The landing page of the LIS website says that "Our mission is to enable, facilitate, promote, and conduct cross-national comparative research on socio-economic outcomes and on the institutional factors that shape those outcomes." If we take "cross-national" to embrace the world as a whole, then LIS can only claim partial success in its mission. While LIS has made some progress toward expanding country coverage to include "middle-income" countries and adding multiple surveys over time, it has not made as much progress on these fronts as it might have, especially given the huge expansion in survey-data availability globally. Indeed, very few of the new national household surveys available globally have made it into LIS. While we are seeing an overlap in the "poor world" and "rich world" data sets, alongside the convergence in their economies, the "rich-country bias" of LIS is still evident.

The reality today is that LIS is still a tool serving inequality and social policy analysts doing strictly relativist comparative work on income distribution across mainly rich countries. There is a clear niche for LIS in this role and the service that LIS provides its community of users in rich countries for about €1 million per year makes it good value. Credit must go to LIS's donors, management and staff for providing this important public good.

However, neither the present LIS nor the various data tools that have emerged in recent years serve the large and clearly growing demand for a truly global survey-data archive, linking up to other databases at national and sub-national levels. Resources have undoubtedly constrained progress, but so have LIS's long-standing practices and protocols. LIS can stay the valued tool that it is for comparative research on rich countries. However, to become an exciting research tool for *global* micro-data analysis in today's world, LIS would have to broaden its coverage considerably, become more timely, and more flexible and eclectic in its eligibility criteria and measurement practices, and more open to non-specialist users in its modes of data access. Importantly, LIS would need to embrace measurement practices more common, and often more defensible, in poorer countries. That need not preclude keeping many of its current practices, although some of those (such as the use of strongly relative poverty measures) would seem hard to defend even in rich countries. The key point is that a globally relevant LIS would need to be more open to practices across the globe.

The questions remain: Can LIS rise to this new challenge, recognizing that this would require many changes? Or will the new comparative data tools that have emerged for the developing world morph into the new global tool for comparative analysis that is needed today? The Gornick et al. (2015) response to the present paper does not offer much hope that LIS will rise to the challenge anytime soon. But who might?

[32] A forward by Tony Atkinson to a new LIS volume is one of the few references to these problems I could find: see (Atkinson 2013).

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