

Measure for Measure

Systematic Patterns of Deviation between Measures of Income and Consumption in
Developing Countries
Evidence from a New Dataset¹

Carlo Azzarri (FAO and World Bank), Gero Carletto (World Bank), Katia Covarrubias (FAO),
Ana Paula de la O (FAO), Carly Petracco (FAO), Kinnon Scott (World Bank) and
Alberto Zezza (FAO)*

*Corresponding author: alberto.zezza@fao.org

*Conference draft. Not for citation without permission.
12 May 2010*

Abstract: This paper uses an innovative household level database to ask two basic questions related to the well-known issue of income underreporting in household surveys in developing countries: (a) The extent of this underreporting in practice, and (b) whether and how it varies systematically with respondent, household, income, and survey design features. Drawing on rural household data from 17 developing and transition countries, our results indicate that the observed differences between income and consumption are extremely large, being on average 31 percent. We also find evidence of the underreporting being systematically associated with key individual, household and survey characteristics. Agricultural income is the component suffering more than any other from underreporting. Implications for policy analysis and for future research are drawn.

PAPER PREPARED FOR THE
THIRD GLOBAL CONFERENCE
WYE CITY GROUP

ON STATISTICS ON RURAL DEVELOPMENT AND AGRICULTURAL HOUSEHOLD INCOME
May 24-25, 2010

Economic Research Service, U.S. Department of Agriculture
Washington, DC

¹ This research was supported by the collaborative FAO-World Bank project “Improving the Analysis of Sources of Rural Income in Africa”, (FAO Project GCP/GLO/276/WBK). The views expressed in the paper are the authors’ only, and should not be attributed to the organizations they are affiliated with.

“The practical and conceptual difficulties of collecting good income data are severe enough to raise doubts about the value of trying”

A. Deaton (1997), p. 30.

1. Introduction - Investigating the systematic deviations between income- and consumption-based measures of welfare

Measurement of household income in developing countries is notoriously fraught with problems. While it is difficult to establish the extent of the problem, there is a widely shared consensus that income is under-reported (McKay, 2000; Coulombe and McKay, 1995).

Irrespective of its limitations, however, the collection of quality income data remains important. First, income is still used in many countries as a measure of welfare. Traditionally, the majority of countries in Latin America are still basing their poverty figures on income. Countries in Eastern and Central Europe and the Balkans are also slowly moving towards adopting income as a measure of welfare in order to meet some of the statistical requirements for full accession to the European Union. Second, measures of income are necessary to study the sectoral composition of the economy in microeconomic analyses, how households derive their livelihoods, and how productive different household assets and different economic activities are.

However, since consumption expenditure is the preferred metric for poverty measurement, the collection of good consumption expenditure data has received, at least in developing countries, considerably more attention than the collection of income data. In some countries (Integrated) Household Budget Surveys (I-HBS), Living Standard Measurement Study (LSMS) surveys and other similar surveys have collected very little, if any, income data. Practical guidelines have been developed to assist researchers and analysts computing broadly comparable and theoretically consistent consumption aggregates and poverty measures from household surveys (Deaton and Zeidi, 2002; Ravallion, 1998), but much less

information is available *for low-income countries* in terms of looking at income data. The Luxembourg Income Study, the Canberra Group and the Wye Group Handbook, the three major efforts in systematising work on household income data, all share a bias towards working with high- and middle-income countries.

On the other hand, during the 1980s and 1990s development economists started devoting increasing attention to issues related to rural non-farm income and employment and the diversification of the rural economy (FAO, 1998; Haggblade et al., 2007). Serious doubts soon began to emerge concerning the comprehensiveness, comparability and coverage of the available data. Much of the literature was based on country case studies, lacking statistical representativeness at the national level. Those based on Census data were strong on coverage, but often collected limited information on employment (e.g. only the primary occupations) and consequently very little, if any, information on income. Studies based on nationally representative household surveys often used data coming from very different survey instruments and lacking a comparable definition of income and its components, as well as a standardised way of treating the data. Lanjouw and Feder (2001) identified data comparability and coverage issues as major shortcomings of this strand of literature.

This paper is an output of the RIGA project, which started in 2005 as a collaboration between FAO, the World Bank and American University in Washington, DC with the aim of overcoming some of these issues with income data comparability, furthering our understanding of the sources of income in rural areas, and generating lessons for improving the collection of rural income data. The project has since created a database of 32 household living standards surveys from which a set of income aggregates and other measures of well-being were constructed in a methodologically consistent manner.

The paper looks systematically at how income and consumption measures deviate based on (a) the composition of income; (b) household and individual characteristics; and (c)

the basic characteristics of the survey instruments used in collecting both income and consumption data. Implications for analysis and data collection are drawn.

The structure of the paper is as follows. Section 2 presents a brief review of the literature with a view to develop hypotheses to be tested later in the paper with the support of the RIGA dataset. Section 3 discussed the data and methods, whereas section 4 presents the results of the data analysis. Section 5 offers some concluding remarks and suggestions for future work.

2. Literature Review

Under-Reporting of Income. The literature on income and consumption measurement in household surveys is quite extensive, and it identifies several features that are linked to the extent and direction of measurement error. In this section we provide a brief and selective account of contributions to this literature with a view to develop hypotheses around which to organize the empirical part of our paper.

Overall, the literature on income and consumption measurement through household surveys supports the notion that income is under-reported. Evidence of income under-reporting is available in studies of both developed (Weinberg 2004; Branch 1994; Crystal and Shea 1990; Atkinson and Micklewright 1983) and developing countries (McKay, 2000; Psacharopoulos et al. 1997; Martini et. al 1996; Coulombe and McKay, 1995; Alderman 1993; Berry 1985). One goal of this paper is to review the first, basic hypothesis that comes from this literature: *Hypothesis 1: Income is under-reported in developing countries living standard and income and expenditures household surveys.*

McKay (2000) looks at this question using household surveys collected in the 1980s and 1990s in eight developing and transition economies. His results point to income measures being generally (though not always) lower than corresponding consumption figures, and the

degree of correlation between per capita measures to vary anywhere between 0.1 and 0.8. Besides revisiting this question with additional, more recent survey data and employing consistent methodologies and definitions across countries, we also attempt to put some additional effort in identifying ranges and possible systematic patterns for the extent of income under-reporting.

Although the underreporting of income is recognized as a systematic problem in much of the literature, there is no consensus on the sources of this discrepancy. We identify four sets of issues that we hypothesize may be related in different ways to biases in income reporting: individual characteristics of the respondent and other household members; household characteristics (in particular we will look at wealth and demographic composition); features of the income source; questionnaire design.

Individual Characteristics. Individual characteristics that the literature shows to be related to biases in survey response (and specifically income reporting) include gender, age, and educational attainment. A recent study conducted in Malawi presents evidence of differences in reporting of household income between husbands and wives. The authors conducted joint, as well as separate interviews for the household head couple of 200 households in Southern Malawi. Their findings are that in the majority of cases husbands do not accurately estimate their wives' income, with husbands underestimating the income 66% of the time (Fisher, et al. 2009). Important determining factors identified by the study include: the husband's education (the higher it is the more accurate his estimation of total household income); the wife's education (the higher it is the more likely the husband is to underestimate her income); and the composition of the household (the more working-age members in the household the more likely he will underestimate income).

McKay (2000) identifies the lack of written records for household businesses and self-employment activities as making it difficult for the respondent to account for the costs

incurred in the activity. Vijverberg and Mead (2000) review the literature on the collection of data on household enterprises and conclude that “negative profits appear to be lower in countries with a higher general educational level”, and link that to the possibility of more accurate income reporting by more numerate respondents. Thus, the second hypothesis we will test in the paper pertains to individual characteristics: ***Hypothesis 2 – The extent of income under-reporting varies systematically with respondent and household member individual characteristics. Specifically, we expect it to be higher for older, illiterate, respondents. Gender differences between respondents and income earners will also result in higher under-reporting, all else equal.***

Household Characteristics. Systematic underreporting may also be related to household level characteristics. One set of issues relates to sampling, non-response, and intentional under-reporting prevalence among richer households. Higher income households are thought to be under sampled due to difficulties in accessing them (Deaton 2000). Work at the Inter American Development Bank that analyzed 18 Latin American countries found that the top 10% of the income sample had incomes similar to that of a well educated professional, but not that of households with the highest income, from which the authors infer that the full spectrum of income is not being captured (Székely and Hilgert 2007).

Secondly, evidence that high income households may be more likely to under report their income is provided by Deaton 2000; Grootaert 1993; Anand and Segal, 2008; Bhalla 2002; Korinek et al. 2006; Korinek, et el. 2006; and Gottschalk and Smeeding 1999 among others. Mistiaen and Ravallion (2003) utilizing US data find a strong and significant, negative correlation between income and survey compliance. Additional analysis of US data (Berry 1985) demonstrates the problem with properly surveying higher income households; as incomes from capital investments, i.e. financial assets, rental income, and own businesses, are difficult to capture and form a larger share of income among the highest income households.

Data from India support these conclusions and suggest that between 20% and 40% of the difference between survey income and national accounts could be attributed to undercounting among the very rich (Banerjee and Piketty 2003).

As we said earlier based on the study by Fisher et al. (2009), the demographic composition of the household may also have an impact on the extent of income under-reporting, with a greater number of working age adults resulting in more substantial under-reporting. This literature drives our third hypothesis: ***Hypothesis 3 - The extent of income under-reporting varies systematically with household characteristics, in particular richer and larger households tend to under-report income more.***

Income Sources. In addition to the observable individual and household characteristics that impact income reporting, the source of income itself also plays a large role in the quality of its reporting.

Wage employment is generally seen as the easiest income source to report accurately on. By matching Census and Social Security data in Micronesia, Akee (2007) is able to examine earnings volatility and self reporting errors for wage employment. The results suggest that the reporting error is centered around zero and is “mean-reverting,” indicating that over time the error will return to its average value. Thus, the implication of this work is that wage income is reported correctly. As noted by Deaton (1997, p. 29) for agriculture and family business “incomings and outgoing are likely to be confused” and the only way to try and measure income is to impose a complex accounting framework on the data collection.

With regards to self-employment, specific issues with data collection include the lack of financial record-keeping, the blurring of lines between the household and the household enterprise, ownership across multiple households, and inputs purchased in one period that may be sold in another period (McKay 2000; Mel, et al. 2009; Joshi et al. 2009). Grootaert (1993) analyzing panel data from Côte d’Ivoire (1985-1988), finds that the majority of

household enterprises reported negative net income from their activities. A more recent study of Sri Lankan microenterprises also finds that firms underreport their revenues by around 30%, and that the use of account diaries (which were introduced by the study) can have a significant impact on the reported revenues and expenses (Mel, et al. 2009). Joshi et al. (2009) find that out of their sample of Indian informal enterprises less than 4% keep any sort of book of accounts, which leads to reporting inaccuracies for households that do not.

The importance of income source in the literature leads to the fourth hypothesis:
Hypothesis 4 – The extent of under-reporting varies systematically with the sources of income, in particular income from own-account agriculture and other self-employed activities tends to suffer from underestimation more than wage income

Questionnaire Design. Besides individual, household, and income source characteristics, questionnaire design obviously plays a major role in determining the outcome of any data collection effort. Factors such as recall periods, the number of items/questions the respondent is prompted with, and how the questions are asked all have an impact on the resulting measure, for income as for any other complex concept that is measured.

Recall/reference periods influence the reporting of both income and consumption. Several papers cite recall period as a serious issue for researchers to overcome (Sahn and Stifel 2002; Deaton 1998; Deaton 2000; Deaton 2002; Gibson, et al. 2003; Grootaert 1993; Mel, et al. 2009; Glewwe 2007; Whalley and Yue 2009), and the continuing debate over the proper recall period is just as extensive (Saunders and Grootaert 1980; Deaton and Grosh 1998; Pettersson 2005; Scott, et al. 1980; Glewwe 2005). When the recall period is too short, an accurate picture of the household might not be captured, i.e. there is a high potential for under or over estimation if the recall period selected was atypical. If the recall period is too long, the potential to lose accuracy augments as respondents forget more of their income or purchases when the period of recall lengthens. In preparation for the Ghana Living Standards

Survey, a small recall experiment of 135 households was conducted to identify the ideal recall period. Households were administered the same consumption module nine different times with varying bounded recall periods of one, two, three and seven days. The report concluded that one day is the most accurate recall period and that reported expenditures drops off nearly three percent for every additional day of recall (Scott and Amenuvegbe 1990). Survey length variation in India between 1989 and 1999 found similar results, shorter recall periods increased the expenditures reported (Deaton 2005). Another approach to these matters was pursued by Gibson, Huang, and Rozelle (2003), who simultaneously collect expenditure data over four different time intervals that rely on varying lengths of recall – monthly, bimonthly, quarterly, and biannually using the China’s Household Income and Expenditure Survey 1997. The authors found that use of any of the extrapolation methods would not affect the mean of annual expenditures when compared to the 12-month diaries; however, accuracy of dispersion is reduced leading to overestimation of poverty and inequality (Gibson, et al., 2003).

Additional survey design issues arise from the elements included in consumption and income modules. One example comes from the Ecuador 1994 and 1995 surveys. Between these two surveys, without specific government intervention combined with a sluggish economy, the consumption based poverty rate fell from 52% to 45%. Lanjouw and Ravallion (1996) identify a change in the survey design as a possible culprit of such an unrealistic result: in 1994 the survey contained 73 expenditure items, while the 1995 list was increased to 94 items, including more non-food items.

A survey experiment in El Salvador administered a long and short version of the consumption module to similar households in an attempt to identify systematic differences (Jolliffe 2001). Two different versions of the consumption survey were administered as part of the Encuesta de Hogares de Propósitos Múltiples de El Salvador.² Using tests of stochastic

² The long questionnaire was based on items included in previous surveys and was comprised of 72 food items and 25 non-food items. The short version consisted of 18 food categories and 6 non-food items; additionally, the

dominance the author found that for 95% of the sample the long survey consumption is greater than that of the shorter survey consumption, resulting in the short survey identifying one million more people as severely poor than the long survey (Jolliffe 2001). Similar results were found by Pradhan (2001) in his analysis of the Indonesia's Susenas Survey. Pradhan finds that a shorter questionnaire, which is comprised of 23 questions compared to the 320 questions of the longer survey, results in a higher consumption measurement error, while also resulting in higher poverty rates.

A survey design experiment implemented in Tanzania to gather labor data found similar results, with more questions resulting in greater accuracy. The authors tested two elements of survey design, first, the level of screening (one versus three screening questions) and second, the respondent (individual reporting versus proxy reporting). Bardasi et al. (2010) report that the differences that occur are a result from the interaction between survey design and individual characteristics. They find that the lack of proper labor screening questions results in lower labor force participation of women and lower wage employment rates for both sexes; while the use of a proxy respondent produces lower labor force participation and lower agricultural employment for men, along with lower hours of work conducted by female.

Survey design issues were also tested with informal enterprises in India utilizing the 56th round of the National Sample Survey in 2000 and 2001. The respondents were asked a set of questions regarding their enterprise which enabled researchers to calculate both a derived profit (based on multiple expenses and revenue questions) and a direct profit measure (based on a single question). On average they found that the profits from single, direct question were lower than the derived profits based on multiple questions (Joshi et al. 2009). Based on this literature, our fifth and final hypothesis is generically formulated as follows: ***Hypothesis 5 – Questionnaire design matters and can reduce the extent of income under-reporting.*** In

experiment varied the recall period in each survey – the short version used a recall period of 7 days, while the long version asked if a product was consumed in the last six months and then asked the frequency of consumption in the last month.

section 4 we will apply this more specifically to elements of the survey design our data allow testing for.

3. Methods and Data

The dataset. The RIGA database is constructed from a pool of several dozen Living Standards Measurement Study (LSMS) and other multi-purpose household surveys made available by the World Bank through a joint project with the Food and Agriculture Organization of the United Nations (FAO).³ From this pool of possible surveys, the choice of particular countries was guided by the desire to ensure geographic coverage across the three principal developing regions (Asia, Africa, and Latin America) and transition countries in Eastern Europe, as well as adequate quality and sufficient comparability in codification and nomenclatures. Furthermore, an effort was made to include a number of IDA (International Development Association) countries as these represent developing countries with higher levels of poverty and are therefore of particular interest to the development and poverty reduction debate. Using these criteria, survey data from the list of countries in Table 1 were utilized.

[TABLE 1 ABOUT HERE]

The construction of income aggregates that are comparable across countries was the principal output of the RIGA database.⁴ Income sources in this dataset are classified according to a number of different criteria. One common initial division is between agricultural and non-agricultural activities although defining this distinction in a concise manner is potentially problematic. A second common division of income, for both agriculture

³ Up to date information on the RIGA database can be found at <http://www.fao.org/es/ESA/riga/>

⁴ Details of the construction of the income aggregates can be found in Carletto, Covarrubias and Krausova (2007).

and non-agricultural activities, is between wage employment and self-employment. Additionally, transfer payments, either from public or private sources are included. Along these lines, seven basic categories of income have been identified: 1) crop production; 2) livestock production; 3) agricultural wage employment, 4) non-agricultural wage employment; 5) non-agricultural self employment; 6) transfer; and 7) other.⁵

Of particular relevance to the analysis in this paper, is the categorization into *agricultural income* (from self-employment in crop and livestock activities), *wage activities* (comprising both agricultural and non-agricultural wage), and *non-agricultural self-employment*. This leaves transfer and other income as separate categories which will receive little attention in this paper.

Households are also classified according to their degree of specialization and diversification by using two different thresholds, and defining a household as specialized if it receives more than 50 or 75 percent of its income from a single source, and diversified if no single source is greater than that amount.⁶

For each of the countries listed in Table 1, household income aggregates and a comparable set of household variables were created in order to facilitate the analysis of the data. As an indicator of welfare levels we used the consumption expenditure aggregates that accompanied the datasets, each of which had been constructed in a largely comparable fashion according to widely accepted and internationally recognized criteria. The final set of

⁵ Other refers to miscellaneous non-labor sources of income, such as gross rental income or interest from savings accounts.

⁶ These thresholds are arbitrary and other definitions of diversification and specialization are possible. The extent of diversification is clearly affected by the choice of the threshold, which is around 10 percent or less in all cases when using the 50 percent definition and climbs to around 90 percent when using the 100 percent definition. The broad patterns, however, do not change with the choice of the threshold.

data used for this analysis includes 17 nationally representative, comparable datasets with a consistent set of variables.⁷

A first question we try and address in this paper is that of quantifying the magnitude of the observed under-reporting in actual income and expenditure surveys. While our sample is not representative of all such surveys undertaken in the last one or two decades, it has several desirable features. First, it includes countries from all the developing regions and for countries at different level of development, with different rates of literacy, and different economic structures. Secondly, it only includes surveys that put a particular effort in collecting income data. The RIGA data do not include surveys that prompted respondents directly about their income, but only surveys where net income could be calculated based on extensive survey modules on the revenues and benefits from all the income sources of the household. We therefore trust that the ranges we observe in this sample are reasonable approximation of those that can be expected in surveys with a similar overall design and approach.

One difficulty in trying to quantify the measure of under-reporting is of course that we do not have a gold-standard, a benchmark we can consider the ‘true’ income value against which to compare the income measured by the surveys. We will in this paper be mainly using the difference between per capita income and per capita consumption, which conceptually should be equal to household (dis-) saving, and will from time to time inaccurately refer to that as the extent of income underestimation. When it will be necessary to get rid of the scale/unit-of-measure effect across countries we will normalize it by dividing by the value of consumption.

We of course recognize that consumption and income are entirely different concepts, and there is no reason why they should be the same, particularly in the short-term⁸, and that

⁷ Note that the data come from national surveys designed to be representative of the population although in most cases the poor have been over sampled. Thus most calculations presented in the paper use sample weights to provide accurate estimates of the true values for the rural population.

⁸ See Deaton (1990) for a discussion.

there are problems using what could be a measure of savings (a concept with its own economic meaning) to equate it to measurement error. It is also important to emphasize that (1) consumption itself is measured with error; (2) the biases and patterns of consumption and income measurement error may deviate in different ways, making it more difficult to make generalization about the behavior of the income measure based on comparisons with consumption. Wary of these problems, in the discussion of our results we will (a) show how much of the observed difference between income and consumption does seem to be attributable to measurement error; and (b) interpret the results with caution and trying to always take into account the possible direction of the bias linked to these conceptual and practical difficulties.

Methodology. In the next section we use information from our dataset to gauge whether the data support the hypotheses we have developed in Section 2 based on the analysis of the literature. For each of the hypotheses we present a descriptive analysis largely based on cross-tabulations, and as we do that we also provide some quantification of the magnitude of observed income under-reporting and of its relative changes with other relevant factors. We then combine that with multivariate regression analysis to explore how robust the bivariate relationships are to the simultaneous introduction of a larger set of control variables.

Specifically, to attempt to capture how specific household characteristics may be influencing the degree of income under-reporting of households with different characteristics, we estimate 17 individual country regressions of the following relationship:

$$D = \alpha + \beta_1 HH_CHARS + \beta_2 ASSETS + \beta_3 SPECIAL + \varepsilon \quad [1]$$

The dependent variable D is the difference between income (Y) and consumption (C) expressed as a fraction of C . HH_CHARS is a vector of household characteristics that includes sex, age, education and marital status of the household head, and the demographic composition of the household (number of working age adults and of children below age 15).

ASSETS is, following Filmer and Pritchett (2001), a principal component index of household assets intended to proxy the level of household wealth, while being measured independently from income and consumption in the survey. The choice of assets incorporated depended on the country in question but generally it includes household durables (TV, VCR, stove, refrigerator, etc.) as well as household infrastructure (running water, brick walls, etc.). By definition, the mean of these indices is at or near zero. While the measures are not quantitatively the same across country, they are comparable in the sense that they measure assets consistently with a higher value indicating a higher asset position⁹.

SPECIAL is a vector of dummies related to whether the household is specialized in agricultural, wage, non-agricultural self-employment, or transfers (diversified and other households being the reference category). The regressions also include an independently, identically distributed error term, ε . Household subscripts have been omitted from the notation for simplicity.

4. How large is the extent of income under-reporting? What drives it?

Hypothesis 1 – Income is generally under-reported in developing countries living standard and income and expenditures household surveys

We have noted earlier that the existence of substantial differences between income and consumption data is well documented in the literature (Deaton, 1997; McKay, 2000). Table 2 reports some basic statistics on how income and consumption measures relate in the surveys we analyze. The countries in the Table are ordered from the richer to the poorer (in PPP per capita GDP in the survey year). In the vast majority of cases income appears to be lower than

⁹ ‘Agricultural’ assets (land, livestock, machinery) are not included as we want this variable to include overall wealth rather than participation in a specific productive activity. The values of the indices are not comparable across countries, though the method of construction is comparable and in all cases the values go in the same direction: more is better. Thus while for the econometric analysis the sign of the parameter is comparable across countries, the magnitude of the effect is not.

consumption, often by a large margin. As observed by Deaton (1997, p. 30) the large, systematic extent of household dissavings these figures imply is most likely an indication of the fact that income in household surveys is grossly under-estimated, even more so as we also know consumption expenditure to be underestimated. Of the 17 countries in the table only two (Albania and Vietnam) have average income greater than consumption. The data, it appears, overwhelmingly support the general validity of Hypothesis 1.

The breadth of our data also provides an opportunity to attempt some loose generalizations regarding the magnitude of income under-reporting. When comparing country sample averages, the measure of income is only about 71 percent of consumption, with a very large span of variation with income being anywhere from 28 (Tajikistan) to 137 (Vietnam) percent of consumption (Albania being the only other country with average income higher than consumption expenditure). Our preferred indicator for capturing the difference between income and consumption is however the difference between the two per capita measures, expressed as a share of per capita of consumption. When we look at the household level averages for this indicator, income is on average one third (32 percent) lower than consumption expenditure. In all the surveys where the difference is negative (the only exception is Vietnam) the income shortfall ranges from 11 to 72 percent.

The observed correlations between measures of income and consumption are also pretty low, with the average correlation coefficients being 0.36 for the per capita measures and 0.51 for the household measure. The observed range of the correlations is between virtually zero (Nigeria) and 0.59 (Panama) for per capita income and consumption, and between 0.36 (Bulgaria) and 0.63 (Panama) for the household variable.

[TABLE 2 ABOUT HERE]

If we assume that on aggregate savings are likely to be positive (and we would argue that this is a safe assumption), these can be interpreted as lower bound estimates of the degree

of income under-reporting in our sample of countries. The magnitude of the observed differences could hardly be more striking, and point to the need to better understand the patterns of under-reporting in order to devise ways to collect better income data in future surveys. In order to do that, we will now go beyond these average figures to look into how the extent of underestimation may vary systematically with individual and household characteristics (including welfare) as well as with sources of income.

Hypothesis 2 – The extent of under-reporting varies systematically with respondent and household member individual characteristics.

In particular we want to test whether extent of under-reporting will depend on the education of the respondent and her gender. One caveat on this part of our analysis is that the income questions in our surveys are often answered by different respondents, with different rules applied in different surveys. Also, in several of our datasets we do not have the respondents' information for some or all sections of the surveys. For these reasons we conduct our analysis on the characteristics of the household head, making the implicit heroic assumption that the household head is the most likely respondent. Given this high level of imprecision our results on this particular point are to be interpreted with care.

Literacy. The literacy or numeracy of respondents are thought to have an impact on the accuracy with which income is reported is (Vijverberg and Mead, 2000). Figure 1 graphs the observed difference between our indicator of income underreporting in each of the 16 countries separately for households with literate and illiterate household heads. In most cases a visual inspection of the graphs does not lend support to the hypothesis that, controlling for the level of welfare, illiteracy of the household head is associated with a larger degree of underreporting of income. In four countries however (Cambodia, Kenya, Malawi, Pakistan) the hypothesis seems to hold, and the line for literate households lies consistently above the

line for non-literate ones. In three more cases the overall trend is similar but the ranking is reversed for one quintile (Albania, Panama) or is the same in a couple of quintiles (Bangladesh). The weakness of the relationship is confirmed by the result of the multivariate analysis (Table 3), where a statistically significant negative association is found in only five of 17 country regressions (and the coefficient is actually positive and significant in one case).

This result may not be conclusive because for at least two reasons. The first, which we already mentioned, is the possibility that the household head's education may not be a good enough predictor of the respondent's¹⁰. The second is that given the nature of our indicator, what we are really testing is whether income under-reporting is larger than consumption under-reporting for less literate households/individuals.

[FIGURE 1 ABOUT HERE]

Gender. As shown in the literature review section, according to some studies women report income information somewhat more accurately, and all individuals tend to report more accurate information on the income earned by individuals of the same sex. We therefore want to see whether our data support the hypothesis of systematic differences in income underreporting along gender lines. As for the literacy issue above our results are very tentative as we cannot really control for the gender of the respondent, but only for the gender of the household head. Also, our measures of income and consumption are aggregated at the household level and cannot be directly linked to individual information.

It is not straightforward to argue a priori whether male or female heads of households should be expected to be able to report more accurate household income information. If female headship was associated with fewer male income earners (for example because of the death or exit from the household of a male husband) we would then expect this variable to be associated with more precise income reporting. If on the other hand most of the income is

¹⁰ The result in the multivariate analysis does not change if we use average household education instead of household head literacy.

earned by men even in female headed households, one would expect female headship to be associated with less accurate income figures.

[FIGURE 2 ABOUT HERE]

Both the descriptive analysis (Figure 2) and the coefficients on the female headship variable in Table 3 confirm that there is no clear association between female headship and income underreporting. The histograms in Figure 2 show how the sample is almost evenly split between countries where female headed households underreport more or less than male headed ones. Some weak evidence that the under-reporting may be somewhat more common and more substantial among female headed households comes from the fact that the three countries where the differences are larger are all countries where female headed households under-report more. The latter result is corroborated by the regression analysis (Table 3), where in five cases the coefficient on the female headship variable is positive against only two in which it is negative (in the other ten no relationship is found).

Hypothesis 3 - The extent of income under-reporting varies systematically with household characteristics

Income under-reporting and household wealth. A widely accepted tenet of the literature is that the rich tend to under-report income more. This is in fact one of the reasons why consumption expenditure is preferred to income as a measure of welfare in many low income countries (Deaton and Zeidi, 2002). Quantifying the extent of the underreporting in different ‘wealth groups’ is complicated by the presence of measurement error in both income and consumption. This is clearly shown by comparing panels A and B in Figure 3. According to whether we rank households by quintiles of income or consumption the pattern of income under-reporting goes in opposite directions. As Deaton (1997: p. 31) puts it “households who

overstate their incomes will also, on average, overstate their savings, while households who overstate their consumption will correspondingly understate their savings”.

[FIGURE 3 ABOUT HERE]

Panel C tries to address the issue by ordering households according to quintiles of our principal component wealth index, which is measured independently from income and consumption. When households are ranked across quintiles of the assets index, the result is somewhat surprising. The sample is split between countries where the degree of under-reporting increases with wealth, those where it actually decreases, and those where no clear trend can be discerned. The median value for our indicator of income under-reporting is fairly constant across wealth index quintiles going from -0.26 in the first quintile to -0.29 in the fifth. These descriptive results, therefore, do not seem to lend support to the proposition that income under-reporting be larger for richer households. The sign of the coefficients on the wealth index variable in the regression model, however, appear to reverse that result. Once we control for other factors, wealthier households do appear to underestimate income more in 12 of the 17 country regressions. This is in fact one of most consistent results across all the regressors in our model.

Income under-reporting and household demographic structure. If income data is collected by asking one or a limited number of respondents it is likely that the quality of the data reported decreases as the number of breadwinners in the household increases. Proxy respondents will likely have less precise information on the earnings of the other household members. On the other hand, if households with more children have a higher propensity to consume one would expect the difference between income and consumption measures to be smaller in these households – but this time reflecting the lower amount of savings, not measurement error. Another way in which the number of children may be playing out in this relationship, is through the possible correlation between certain types of expenditure and

household demographics. If for instance specific components of consumption expenditure that tend to receive particular attention in these surveys (e.g. food) are also more important in households with children, we would expect measures of consumption expenditure to be higher the higher the number of children, other things being equal. In this case we would expect our measure of income under-reporting to be larger, but this time because of measurement error in the consumption variable¹¹.

We test these hypotheses by controlling for household demographics in our regression model. While the results are quite mixed for the coefficient on the number of working-age adults in the household (positive in three cases and negative in another three), the evidence appears to be firmly in support of the hypothesis we just outlined for the number of children. Out of the 17 country regression 11 times the estimated coefficient turns out to be negative and statistically significant, while it is not significantly different from zero in the other six cases.

Hypothesis 4 – The extent of under-reporting varies systematically with the sources of income, in particular income from own-account agriculture and other self-employed activities tends to suffer from underestimation more than wage income

Figure 4 goes more in depth than Table 2 into the observed differences between income and consumption measures in the RIGA surveys. The figure includes three graphs for each country, one for households specialized in agricultural activities, one for households specialized in wage activities, and one for households specialized in non-agricultural self-employment activities¹². Diversified households and household specialized in transfer income are not reported.

¹¹ We tested whether the fact that we use per capita measure (instead of adult equivalents) may be affecting our results and this is not the case. When we perform the same analysis using total household income and consumption the results are qualitatively the same.

¹² We use the 50 percent threshold to define households as being specialized in an activity. We also experienced with a 75 percent threshold and the results we present are robust to the change in definition. We chose to use 50 percent mainly because that yields larger sample sizes in each group.

Each graph includes three density distribution lines, one for consumption, one for income, and one for the difference between the two. The vertical straight line in each graph indicates the national poverty line. The reason for splitting the sample of each country into the three household categories mentioned above, is that we want to emphasize in this section how the extent of the observed differences between the income and consumption distributions changes depending on where the households source the majority of their income. When we graph the same lines for the entire sample, we observe that the income distribution always lies to the left of the consumption expenditure distribution (Appendix Figure 1). When the sample is split into these three different sub-groups, important additional observations can be made.

[FIGURE 4 ABOUT HERE]

The difference between Y and C is in the majority of cases largest for agricultural specializers. For wage specializers, on the other hand, the income and consumption expenditure distributions do trail each other pretty closely, even though in a majority of cases the income distribution is still to the left of the expenditure distribution. For non-agricultural self-employed, the deviations are again quite large, with greater variability in the shape of the income distributions than is the case for the agricultural specializers.

An alternative way to look at this is to concentrate on the shape and position of the distribution of the difference. The density distribution of the difference is mostly in the negative part of the horizontal axis, indicating that for a majority of households income as measured by these surveys is lower than consumption expenditure. The mode of the difference distributions tends to be furthest to the left for agricultural specializers, followed in most cases by non-agricultural self-employed. For wage specializers the line is often centered around zero, indicating that in a majority of cases the difference between income and consumption within that group of household is only marginally negative or positive. The density distribution tends to decline quite rapidly for positive values, which shows that –

particularly for agricultural specializers- relatively few households in all countries report a level of income substantially higher than their consumption expenditure.

The observed differences in distributions among the three groups clearly point to the existence of systematic differences in measurement error in the income variable with the income source. There are no reasons to expect systematic differences in the measurement of consumption expenditures among these groups, or at least not large enough to be driving the trends we observe in Figure 4. The main source of systematic difference between the three groups in terms of consumption expenditure is likely to be related to the valuation of own consumption, but this is a term that also forms part of the income aggregate so that difference would cancel out in our analysis. There may in addition to that be differences in the way income from different sources is spent or saved, but these are likely not to be large enough to drive the results.

Concerning a comparison of the magnitude of the observed differences across specialization types (and by implication by sources of income) it is somewhat difficult to make generalizations as the variation within each group is quite wide, the highest being between -1.20 and 1.42 for self-employment specializers. The median values for the three categories do however convey once again the idea of both the magnitude and the relative size of the under-reporting of income by source (Figure 5). Farming is by far the highest with a median value of -0.44 and most of the countries well below -0.3, followed by self-employment (median of -0.26 and 7 out of 17 countries below the -0.3 threshold) and wage specializers (median of -0.14 and only 3 countries below -0.3).

[FIGURE 5 ABOUT HERE]

The results of the regression analysis (Table 3) strongly support the hypothesis that farm income is the component of income that is most under-reported. The coefficient on the dummy for farm specializers is negative and significant in 13 cases, and not significantly

different from zero in the other four (the reference category being ‘diversified households’). This is the most consistent finding across our set of individual country regressions. Wage income is on the other hand mostly associated with a lower degree of income underreporting (11 cases), although in 6 cases the relationship is actually negative and significant. The results for self-employment may seem surprising as we expect self-employment income to be generally associated with larger under-reporting (and hence a negative coefficient), while in fact the coefficients point in 7 out of 17 cases to lower under-reporting when compared to diversified households. This is only an apparent contradiction, however, as the results are in fact to be consistent with a priori expectations when one considers that in all the countries in our sample (with the exception of Pakistan) the relative majority of the income of the diversified households comes from farm and non-farm self-employment activities combined.

Hypothesis 5 – Questionnaire design matters and can reduce the extent of under-reporting

In order to reduce the extent of income under-reporting in future surveys it is important to understand how questionnaire design can contribute to more accurate measurement. To test the extent to which income is under-reported due to features of questionnaire design, we rely on four additional, earlier rounds of the surveys in Albania, Ghana, and Pakistan. We picked these three countries as these are cases in which we could observe year-on-year differences in questionnaire design that are relevant to our analysis.

In particular we focus here on differences in the collection of agricultural revenue data, as these are prime suspects as far as the under-reporting of agricultural income is concerned. Figure 6 graphs the density distributions of agricultural revenues over land owned for the two survey years in Albania. When comparing the 2002 and 2005 survey results in Albania it is immediately apparent how the 2005 lies to the right of the 2002 distribution (Figure 6). The two surveys are identical in the way agricultural revenue data are collected,

except for the fact that the 2005 surveys prompted the respondents specifically about 44 crops as opposed to 33 in 2002. This confirms, not surprisingly, that asking more detailed questions on agricultural revenues can be an effective way to improve information on farm income.

[FIGURE 6 ABOUT HERE]

A similar case can be illustrated with data from Pakistan and Ghana where, on the contrary, the number of agricultural revenues questions was reduced between the successive survey years. In Pakistan the number of crops households were explicitly prompted about fell from 39 in 1991 to just 7 in 2001, and the questions greatly simplified by dropping questions on seed and feed use and own consumption of crops. As a result the agricultural gross income distribution moved decisively to the left. Figure 7 clearly shows how the 1991 stochastically dominates the 2001 series. In other words the former is always to the right of the latter, regardless of the point at which the difference between the two is drawn.

[FIGURE 7 ABOUT HERE]

Similarly in Ghana three questions on home consumption, amount used for seeds and amount given to pay laborers were dropped from the questionnaire between the 1992 and 1998 surveys. As a result, the revenue distribution moved significantly to the left, with a clear peak at values only marginally above zero (Figure 8). Clearly, similar effects can play out on the cost side of the net income equation, but given that net income seems more than anything plagued by underestimation, increasing the cost side will not solve the problem. Given the analysis in this paper, it seems that the emphasis in future data collection efforts should be largely on collecting more and better revenue as opposed to cost data.

[FIGURE 8 ABOUT HERE]

What do aggregated data say? A ‘macro’ exploration of hypotheses 2 and 4. Besides trying to explain the variation in income under-reporting within national household surveys, it is also interesting (both for data analysts and data gatherers) to also understand whether there

are systematic variation across countries, depending on key country characteristics. Building on some of the hypotheses discussed above based on micro-level data, we now examine whether regularities emerge when similar questions are asked at the macro-level. In particular, we will use aggregate country data to explore the relationship between income under-reporting on the one hand and literacy and the share of agriculture in GDP on the other. We will also explore whether any relationship can be identified between income under-reporting and level of GDP, as the latter is related to a number of factors that can be in principle related to income under-reporting, such as education, the sectoral composition of GDP and employment, the share of the informal sector in the economy.

We start from the latter. Here the hypothesis we are looking at is whether in relatively richer countries income is measured more accurately than in poorer ones. There are in principle several reasons one would expect this hypothesis to hold. Richer countries tend to have a lower share of agricultural GDP (agricultural being a particular difficult income source to measure), a smaller informal sector (again more difficult to measure), and lower levels of illiteracy. Also, one would expect appropriate book-keeping to be more common in richer countries, and that in turn to facilitate income data collection.

In Figure 9 the countries in our dataset are ordered by level of GDP, from the richest (Panama, at the left end) to the poorest (Malawi, at the right end). While the average for the poorest half countries is certainly lower than for the richer half, the data do not seem to corroborate the hypothesis as four of the poorest five countries have rates comparable to those of the richest five. One should interpret this evidence with extreme care, as it may very well be that threshold effects may kick in at higher levels of welfare. In the limited sample we work with, and within the range of GDP per capita these countries are included in (from about 650 to 8200 PPP US dollars per person/year) no systematic relationship appears to hold. This result clearly does *not* have any implications for those countries at higher levels of GDP that

rely much more on income in their statistical systems and analysis of household welfare. The result does however seem relevant for countries similar to those in our sample, and should act as a reminder that even in state of the art surveys the quality of income data still leaves much to be desired. Much can and should be done to improve our understanding of how quality can be improved and better income data collected.

[FIGURES 9 & 10 ABOUT HERE]

When we reorder the countries by share of agriculture in GDP, the relationship is still quite weak, albeit somewhat stronger than in the previous case. Given the limited sample size, however, it is difficult to make any definite conclusions. Figure 10 reports the same values as Figure 9, but with the countries slightly reordered starting from the one with the lowest share of agricultural GDP (Panama, 8 percent) and moving to the one with the highest share (Nepal, 38 percent). The average rate of under-reporting in the five countries with the highest share of agricultural GDP is 43 percent, versus 22 percent in the five countries with the lowest share (and the story does not change regardless of how one divides the sample). What this suggests is that the expectation that income is more difficult to collect in highly agricultural economies finds some support in this descriptive exploration of the aggregate data.

We hardly find any relationship at the aggregate level between literacy rates and income under-reporting (not shown). This is consistent with the limited evidence of a relationship between these two variables that we noted at the micro-level.

5. Summary and Conclusions

This paper uses an innovative household level database to ask two basic questions related to the well-known issue of income underreporting in household surveys in developing countries: (1) What is the extent/range of this underreporting in practice, and (2) does income underreporting vary systematically with respondent, household, income, and survey design

features. The paper also provides a cursory exploration of the data to ascertain whether any pattern could be identified of differences in income under-reporting being related to key country characteristics (income level, sectoral composition of the economy, literacy). These are important questions both for the analysis of income information from household surveys, as well as for the implications for the improvement of the income component of future data collection efforts.

Drawing on data from 17 developing and transition countries, our results indicate that the observed differences between income and consumption are extremely large, being on average 31 percent and in four cases over 50 percent (the maximum value being 72 percent).

We also find evidence of the underreporting being systematically associated with some individual, household and survey characteristics. Older, less educated household heads tend to underreport income more. The degree of underreporting appears to also be strongly associated with the income source. This emerged clearly both in the descriptive as well as in the multivariate analysis, and our findings identify very clearly agricultural income to be the component suffering more than any other components from underreporting.

In all countries in our sample households that receive a majority of their income from agriculture are the ones for which the degree of underreporting is largest. They are also the most likely to be reporting negative income. Income from non-agricultural self-employment is also affected, although with patterns that are somewhat less consistent across countries than is the case for agricultural income. Wage specializers, on the other hand, tend to report income figures that are reasonably close to consumption expenditure figures. We also find evidence supporting the well established proposition that the extent of underreporting tends to increase with household-level welfare: richer households appear to under-report more.

Taken together these results point to the fact that any analysis of income composition and of the association between level of welfare and sources of income based on household

survey data is necessarily going to be fraught with problems stemming from the biases in measurement error we just described¹³. Estimates of the share of agricultural and self-employment income in highly informal economies, for instance, are likely to be underestimated to a degree that is difficult to capture with any level of accuracy. The observed negative association between agricultural income and poverty is probably robust enough to issues of measurement error, but the fact that biases in measurement by welfare level and income source intersect in ways that we are not able to quantify with accuracy, pose a problem on analysis that look at issues such as the contribution of different sources of income to poverty reduction. Analyses of returns to sector-specific assets are also going to be badly affected by measurement error in these domains.

The analysis in this paper points to two parallel agendas for action. The first is in the domain of data collection, and relates to intensifying the efforts to collect better income data, particularly on agricultural income. The paper has clearly shown how questionnaire design does have important implications for the quality for the data generated by the surveys. The fact that age and literacy of the respondents affect the outcome also points to the need to ensure particular care in survey design and fieldwork to try and minimize the measurement error when working with illiterate survey respondents.

Additional work is needed to explore more in depth how different component of income and different aspects of survey methodology affect how income is measured.

The second agenda is an agenda for future research. While we have started putting some numbers to the extent of income underreporting and to its ‘sectoral composition’, much of the variance in income under-reporting remains unexplained. Also, the variability in the observe magnitude in under-reporting is such that it is difficult at this stage to think of an ‘adjustment factor’ one may use to correct observed income data in future surveys. More

¹³ Analysis of welfare and inequality issues that try to reconcile income and consumption-based measures will also be affected, but this is an area on which there have been substantial contributions from the literature and that we have therefore kept away from in this paper.

analysis is needed to carefully assess how different issue we have identified in this paper have implications for measurement error, and to try and quantify at least some plausible ranges of adjustment factors that could be applied with confidence to income data, or to develop methodologies to consistently estimate the degree of income underreporting in household surveys.

6. References

- Akee, Randall K. Q. (2007). Errors in Self-Reported Earnings: The Role of Previous Earnings Volatility, Institute for the Study of Labor Discussion Paper No. 3263
- Alderman, Harold (1993). Obtaining Useful Data on Household Incomes from Surveys, in J. von Braun and D. Puetz, eds., *Data Needs for Food Policy in Developing Countries: New Directions for Household Surveys*.
- Anand, Sudhir, and Paul Segal (2008). What do we know about global income inequality?, *Journal of Economic Literature*, 46(1): 57–94.
- Atkinson, A. B. and Micklewright, J. (1983). On the Reliability of Income Data in The Family Expenditure Survey 1970-1977, *Journal of the Royal Statistical Society*, 146(1): 33-53.
- Banerjee, Abhijit V. and Thomas Piketty (2003). Top Indian Incomes, 1956-2000, Massachusetts Institute of Technology Department of Economics Working Paper Series 03-32.
- Bardasi, Elena, Kathleen Beegle, Andrew Dillon, and Pieter Serneels (2010). Do Labor Statistics Depend on How and to Whom the Questions Are Asked: Results from a Survey Experiment in Tanzania, World Bank Policy Research Working Paper No. 5192.

- Bavier, Richard (2008). Reconciliation of Income and Consumption Data in Poverty Measurement, *Journal of Policy Analysis and Management*, 27(1): 40–62
- Berry, Albert (1985). On Trends in the Gap Between Rich and Poor in Less Developed Countries: Why We Know so Little, *Review of Income and Wealth*, 31(4):337-354.
- Bhalla, Surjit S (2002), Growth and Poverty in India – Myth and Reality, in G. Rao(ed.), *Development Poverty and Fiscal Policy: Decentralization of Institutions*, Oxford University Press, Oxford.
- Branch, E. Raphael (1994). The Consumer Expenditure Survey: A Comparative Analysis, *Monthly Labor Review*, 117(12): 47-55.
- Bundell, Richard, Hamish Low, Ian Preston (2008). Decomposing Changes in Income Risk Using Consumption Data. Working Papers, The Institute for Fiscal Studies.
- Cahalan, Don (1968). Correlates of Respondent Accuracy in the Denver Validity Survey, *Public Opinion Quarterly*, 32:607-621.
- Coulombe, Harold, and Andrew McKay (1995) “An Assessment of Trends in Poverty in Ghana, 1988-92”, PSP Discussion Paper No. 81, Poverty and Social Policy Department, World Bank, Washington D.C. (November).
- Crystal, Stephen and Dennis Shea (1990). Cumulative Advantage, Cumulative Disadvantage, and Inequality Among Elderly People, *The Gerontologist*, 30(4): 437-443.
- Deaton, Angus and Margaret Grosh (1998). Chapter 17: Consumption, in Grosh, Margaret, and Glewwe, Paul (eds.), *Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 years of the Living Standards Measurement Survey*, vol. 2. The World Bank, Washington, D.C., pp. 105–137.
- Deaton, Angus (2000). Counting the world’s poor: problems and possible solutions, *The World Bank Research Observer*, 16(2): 125-147.

- Deaton, Angus, and Salman Zaidi (2002). Guidelines for Constructing Consumption Aggregates For Welfare Analysis, World Bank.
- Deaton, Angus (2005). Measuring Poverty in a Growing World (or Measuring Growth in a Poor World), *The Review of Economics and Statistics*, 87(1):1-19.
- Fields, Gary, and Efe Ok. 1999, "The Measurement of Income Mobility: An Introduction to the Literature", in J. Silber, ed., *Handbook of Inequality Measurement*. Kluwer: Dordrecht.
- Fisher, Monica, Jeffery J. Reimer and Edward R. Carr (2009). Who should be Interviewed in Surveys of Household Income?, *World Development*, Forthcoming.
- Gibson, John, Jikun Huang, and Scott Rozelle (2003). Improving Estimates of Inequality and Poverty from Urban China's Household Income and Expenditure Survey. *Review of Income and Wealth* 49(1): 53-68.
- Glewwe, Paul (2005) An Overview of Questionnaire Design for Household Surveys in Developing Countries, in: *Household Sample Surveys in Developing and Transition Countries*, United Nations, Department of Social and Economic Affairs, Statistics Division, Studies in Methods, Series F, No 96.
- Glewwe, Paul (2007). "Measurement Error Bias in Estimates of Income and Income Growth Among the Poor: Analytical Results and a Correction Formula." *Economic Development and Cultural Change*.
- Gottschalk, P. and Smeeding, M. (1999) Empirical Evidence on Income Inequality in Industrial Countries, Luxembourg Income Study Working Paper No. 154.
- Grootaert, Christiaan (1993). How Useful Are Integrated Household Survey Data for Policy-Oriented Analyses of Poverty?, World Bank Poverty and Social Policy Division, Africa Technical Department Working Paper 1079.

- Hall, Robert E., and Frederic S. Mishkin (1982). "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households." *Econometrica* 50(2): 461-482.
- Husmanns, Ralf, Farhad Mehran, and Vijaya Verma (1990). *Surveys of Economically Active Population, Employment, Unemployment and Underemployment: An ILO Manual on Concepts and Methods*, ILO: Geneva.
- Husmanns, Ralf (2004). Measuring the Informal Economy: From Employment in the Informal Sector to Informal Employment, Policy Integration Department Bureau of Statistics International Labour Office Working Paper No. 53.
- Japelli, Tullio, and Luigi Pistaferri (2009). Does Consumption Inequality Track Income Inequality in Italy? Naples, Center for Studies in Economics and Finance.
- Jolliffe, Dean (2001). Measuring Absolute and Relative Poverty: The Sensitivity of Estimated Household Consumption to Survey Design, *Journal of Economic and Social Measurement*, 27 (1-2): 1–23.
- Joshi, Kaushal, Rana Hasan, and Glenita Amoranto (2009). Surveys of Informal Sector Enterprises – Some Measurement Issues, Asian Development bank Economics Working Paper Series No. 183.
- Korinek, Anton , Johan A. Mistiaen and Martin Ravallion (2006). Survey Nonresponse and the Distribution of Income, *Journal of Economic Inequality*, 4(1): 33-55.
- Lanjouw, Peter and Martin Ravallion (1996). How Should We Assess Poverty Using Data from Different Surveys?, World Bank Policy Research and the Poverty and Social Policy No. 3.
- Martini, Alberto P., Anna Ivanova, and Svetland Novosyolova (1996). The Income and Expenditure Survey of Belarus: Design and Implementation. *Statistics in Transition*, 2 (7).

- McKay, Andrew (1998). Should the Survey Measure Total Household Income?, in Grosh, Margaret, and Glewwe, Paul (eds.), *Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 years of the Living Standards Measurement Survey*, vol. 2. The World Bank, Washington, D.C.
- McKay, Andrew (2000). Should the Survey Measure Total Household Income? in: *Designing Household Survey Questionnaires for Developing Countries: Lessons from Fifteen Years of Living Standard Measurement Study*, Grosh, M., & Glewwe, P. (Eds.), The World Bank, 83-104.
- Mel, Suresh de, David J. McKenzie, and Christopher Woodruff (2009). Measuring Microenterprise Profits: Must we Ask How the Sausage is Made? *Journal of Development Economics*, 88: 19–31.
- Meyer, Bruce D., and James X. Sullivan (2003). "Measuring the Well-being of the Poor Using Income and Consumption." *The Journal of Human Resources*, 38(Special Issue on Income Volatility and Implications for Food Assistance Programs): 1180-1220.
- Mistiaen, Johan A. and Martin Ravallion (2003). Survey Compliance and the Distribution of Income, World Bank Policy Research Working Paper 2956.
- Moore, Jeffrey C., Linda L. Stinson, and Edward J. Welniak, Jr. (2000). Income Measurement Error in Surveys: A Review, *Journal of Official Statistics*, 16(4): 331-362.
- Psacharopoulos, George, Samuel Morley, Ariel Fiszbein, Haeduck Lee and Bill Wood (1997). *Poverty and income distribution in Latin America: The Story of the 1980s*. The World Bank: Washington, D.C.
- Pettersson, Hans (2005) Survey design and sample design in household budget surveys, in *Household Sample Surveys in Developing and Transition Countries*, United Nations, Department of Social and Economic Affairs, Statistics Division, Studies in Methods, Series F, No 96.

- Pradhan, Menno (2001). Welfare Analysis with a Proxy Consumption Analysis, Tinbergen Institute Discussion Paper No. 092/2.
- Ravallion, Martin (2001a). Measuring Aggregate Welfare in Developing Countries: How well do National Accounts and Surveys Agree?, World Bank Policy Research Working Paper Series No. 2625.
- Ravallion, Martin (2001b). Growth, Inequality and Poverty: Looking Beyond Averages, *World Development*, 29(11) 1803-1815.
- Sahn, David E. and David C. Stifel (2002). Exploring Alternative Measures of Welfare in the Absence of Expenditure Data, *The Review of Income and Wealth*, 49(4): 463-489.
- Saunders, Christopher & Christiaan Grootaert (1980) Reflections on the LSMS Group Meeting, The World Bank Living Standards Measurement Study Working Paper No.10.
- Scott, Christopher, Paulo.T.A de Andrew., & Ramesh Chander (1980) Conducting Surveys in Developing Countries: Practical Problems and Experience in Brazil, Malaysia, and the Philippines, The World Bank Living Standards Measurement Study Working Paper No.5.
- Scott, Christopher and Ben Amenuvegbe (1990). Effect of Recall Duration on Reporting of Household Expenditures: An Experimental Study in Ghana, World Bank Social Dimensions of Adjustment Working Paper No. 6.
- Scott, Kinnon, Diane Steele and Tilahun Temesgen (2005). Chapter XXIII : Living Standards Measurement Study Surveys, in *Household Sample Surveys in Developing and Transition Countries*. United Nations, New York.
- Székely, Miguel and Marianne Hilgert (2007). What's Behind the Inequality We Measure? An Investigation Using Latin American Data, *Oxford Development Studies*, 35(2): 197 – 217.

- Vanneman, Reeve, Cecily Darden Adams, and Amaresh Dubey (2006). Income, Consumption, and Assets in India. Prepared for presentation at the Annual Meeting of the Population Association of America, New York, 2007.
- Vijverberg, Wim P.M., and Donald C. Mead (2000). Household Enterprises, in Grosh, Margaret, and Glewwe, Paul (eds.), *Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 years of the Living Standards Measurement Survey*, vol. 2. The World Bank, Washington, D.C.
- Whalley, John and Ximing Yue (2009). Rural Income Volatility and Inequality in China, *CESifo Economic Studies*, 55(3-4): 648–668.
- Weinberg, Daniel H. (2004). Income Data Quality Issues in the Annual Social and Economic Supplement to the Current Population Survey. Prepared for American Enterprise Institute-University of Maryland Seminar on Poverty Measurement, October 12, 2004.

TABLES

Table 1 – List of RIGA Surveys Used

Country	Name of Survey	Year of Survey
<i>Africa</i>		
Ghana	Ghana Living Standards Survey	1998
Kenya	Integrated Household Budget Survey	2004-2005
Madagascar	Enquête Permanente Auprès Des Ménages	2000-2001
Malawi	Integrated Household Survey 2	2004-2005
Nigeria	Living Standards Survey	2003-2004
<i>Asia</i>		
Bangladesh	Household Income-Expenditure Survey	2000
Nepal	Living Standards Survey II	2003-2004
Pakistan	Integrated Household Survey	2001-2002
Vietnam	Living Standards Survey	1997-1998
<i>Eastern Europe</i>		
Albania	Living Standards Measurement Survey	2005
Bulgaria	Integrated Household Survey	2001
Tajikistan	Living Standards Survey	2003
<i>Latin America</i>		
Bolivia	Encuesta de Hogares	2005
Cambodia	Household Socio-Economic Survey	2003-2004
Guatemala	Encuesta de Condiciones de Vida	2000
Nicaragua	Encuesta Nacional de Hogares Sobre Medición de Niveles de Vida	2001
Panama	Encuesta de Niveles de Vida	2002-2003

Table 2 - Comparing Estimates of Income and Consumption Per Capita

Survey	Mean Total Monthly Income per capita	Mean Total Monthly Consumption per capita	Ratio of per capita Income to per capita Consumption	Median Ratio of per capita Income to per capita Consumption over per capita Consumption	Mean Ratio of per capita Income to per capita Consumption over per capita Consumption	Mean per capita Monthly Savings (Income minus Consumption)	Correlation between per capita Monthly Income and Consumption	Correlation between Household Monthly Income and Consumption (Logs)
Panama 2003	127	170	0.748	-0.264	-0.162	-43	0.591	0.628
Bulgaria 2001	102	142	0.718	-0.271	-0.170	-40	0.231	0.357
Albania 2005	11,929	11,015	1.083	-0.108	0.154	913	0.389	0.514
Guatemala 2000	353	616	0.573	-0.399	-0.307	-263	0.578	0.594
Bolivia 2005	411	457	0.899	-0.139	0.070	-46	0.515	0.624
Nicaragua 2001	503	691	0.728	-0.236	-0.110	-188	0.330	0.549
Pakistan 2001	769	1,103	0.697	-0.235	-0.246	-334	0.397	0.474
Nigeria 2004	2,020	2,645	0.763	-0.145	-0.646	-626	-0.071	0.440
Vietnam 1998	379,188	276,404	1.372	0.030	0.497	102,784	0.332	0.446
Kenya 2005	1,976	3,237	0.610	-0.543	-0.349	-1,261	0.272	0.592
Cambodia 2004	43,271	111,032	0.390	-0.707	-0.558	-67,762	0.347	0.461
Tajikistan 2003	14	52	0.278	-0.725	-0.670	-38	0.364	0.359
Ghana 1998	54,009	101,959	0.530	-0.468	-0.335	-47,950	0.272	0.469
Nepal 2003	1,131	1,714	0.660	-0.273	-0.132	-583	0.381	0.538
Bangladesh 2000	705	959	0.735	-0.209	-0.202	-254	0.373	0.578
Madagascar 2001	106,559	127,766	0.834	-0.178	0.017	-21,207	0.510	0.597
Malawi 2004	883	2,064	0.428	-0.660	-0.511	-1,181	0.408	0.458
mean	35,526	37,766	0.709	-0.325	-0.215	-2,240	0.366	0.510
min	14.420	51.963	0.278	-0.725	-0.670	-67,762	-0.071	0.357
max	379,188	276,404	1.372	0.030	0.497	102,784	0.591	0.628

Table 3 - Regression results

	Albania 2005	Bangladesh 2000	Bolivia 2005	Bulgaria 2001	Cambodia 2004	Ghana 1998	Guatemala 2000	Kenya 2005	Madagascar 2001	Malawi 2004	Nepal 2003	Nicaragua 2001	Nigeria 2004	Pakistan 2001	Panama 2003	Tajikistan 2003	Vietnam 1998	+ve & significant	-ve & significant
Female Heade Household	-0.076	0.050	-0.026	0.019	-0.015	-0.167***	-0.052	0.024	0.066	-0.085***	0.025	-0.166*	-2.947***	0.133***	-0.126***	0.002	0.122*	2	5
	0.106	0.036	0.079	0.074	0.020	0.056	0.035	0.030	0.108	0.025	0.047	0.084	1.026	0.021	0.042	0.028	0.063		
Single Head of Household	-0.019	0.003	-0.059	-0.119	-0.014	-0.067	0.023	-0.053	-0.024	-0.007	0.033	0.158**	1.742*	-0.067***	0.085**	-0.011	0.009	3	1
	0.088	0.029	0.077	0.077	0.033	0.045	0.029	0.034	0.094	0.024	0.055	0.071	0.928	0.019	0.036	0.026	0.088		
Age of Head	0.043***	0.001	0.022**	0.007	0.006	0.006	-0.002	0.003	-0.011	0.001	0.003	0.012**	0.097	-0.011***	-0.001	0.000	0.005	3	1
	0.009	0.003	0.009	0.008	0.004	0.007	0.002	0.006	0.013	0.002	0.005	0.006	0.085	0.002	0.005	0.002	0.013		
Age of Head Squared	-0.000***	0.000	-0.000***	0.000	0.000	0.000	0.000**	0.000	0.000	0.000	0.000	-0.000**	-0.001	0.000***	0.000	0.000	0.000	2	3
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000		
Literacy of Head	-0.036	0.012	-0.008	-0.001	-0.023**	-0.102*	-0.029	0.064**	-0.209*	-0.008	-0.025	-0.092***	-0.712*	0.021	-0.038	0.009	-0.070	1	5
	0.074	0.014	0.008	0.01	0.009	0.053	0.019	0.026	0.114	0.016	0.030	0.031	0.375	0.014	0.046	0.019	0.069		
Number of HH Age15 - 60	-0.032*	-0.009	-0.008	-0.070***	-0.002	-0.023	0.049***	0.002	0.012	0.000	-0.007	0.009	0.034	0.011***	0.044***	-0.006*	-0.023	3	3
	0.017	0.006	0.022	0.019	0.005	0.014	0.010	0.016	0.020	0.006	0.008	0.011	0.095	0.004	0.011	0.003	0.017		
Number of HH Age<15	-0.071***	-0.023***	-0.023	-0.067***	-0.023***	-0.005	-0.003	0.004	-0.061***	-0.021***	-0.027***	-0.031***	-0.064	-0.005*	-0.014*	-0.005	-0.072***	--	11
	0.015	0.004	0.015	0.021	0.007	0.010	0.003	0.006	0.017	0.004	0.008	0.009	0.080	0.003	0.008	0.003	0.018		
Wealth Index	-0.081***	-0.022*	-0.008	-0.106***	-0.094***	-0.034	-0.068***	-0.014	-0.134***	-0.013***	-0.060***	-0.098***	-0.042	-0.026***	-0.064***	-0.032***	-0.109***	--	12
	0.021	0.013	0.028	0.037	0.018	0.028	0.021	0.018	0.031	0.004	0.011	0.022	0.109	0.007	0.014	0.007	0.027		
Farm Specialization	-0.430***	-0.187***	-0.556***	-0.143	-0.125***	0.005	-0.206***	-0.403***	-0.534***	-0.021	-0.273***	-0.209***	-0.483*	-0.651***	-0.207***	0.003	-0.339***	--	13
	0.059	0.022	0.107	0.107	0.040	0.070	0.020	0.035	0.200	0.025	0.039	0.059	0.261	0.026	0.037	0.025	0.046		
Wage Specialization	0.261***	0.052***	-0.245*	0.306***	0.511***	0.178**	0.156***	0.198***	-0.481**	0.163***	0.273***	0.205***	1.655***	-0.171***	0.392***	-0.045*	-0.117**	11	6
	0.076	0.016	0.129	0.089	0.045	0.081	0.024	0.053	0.211	0.027	0.046	0.059	0.315	0.022	0.039	0.027	0.057		
Self Employment Spec.	1.366***	0.128***	-0.357***	-0.747**	0.132***	0.133	0.262***	0.045	-0.063	0.203***	0.027	0.271***	0.382	0.056	0.049	0.061	1.960***	7	2
	0.198	0.026	0.115	0.344	0.040	0.105	0.053	0.065	0.218	0.036	0.051	0.102	0.234	0.045	0.046	0.164	0.116		
Transfers Specialization	-0.281***	0.237***	-0.438***	-0.215**	-0.153*	-0.249**	-0.060**	0.008	-0.880***	-0.258***	0.127**	0.091	-0.030	-0.314***	-0.057	-0.089***	-0.544***	2	11
	0.070	0.028	0.120	0.088	0.080	0.097	0.023	0.043	0.243	0.042	0.058	0.077	0.530	0.026	0.057	0.030	0.064		
Constant	-0.849***	-0.181***	0.166	-0.293	-0.745***	-0.195	-0.407***	-0.419***	0.856***	-0.464***	-0.103	-0.291**	-0.504	0.231***	-0.412***	-0.618***	0.502*		
	0.224	0.061	0.223	0.267	0.084	0.179	0.049	0.134	0.325	0.055	0.124	0.134	1.949	0.063	0.138	0.067	0.297		
R2	0.2819	0.0745	0.0369	0.1542	0.1623	0.0191	0.1288	0.0673	0.0404	0.0301	0.1255	0.0906	0.0041	0.1598	0.1283	0.0296	0.2940		
Obs.	1636	5024	1723	799	9268	3212	3830	8216	1961	9673	2694	1823	13910	9838	2910	2612	4241		

FIGURES

Figure 1- Income underreporting by literacy status

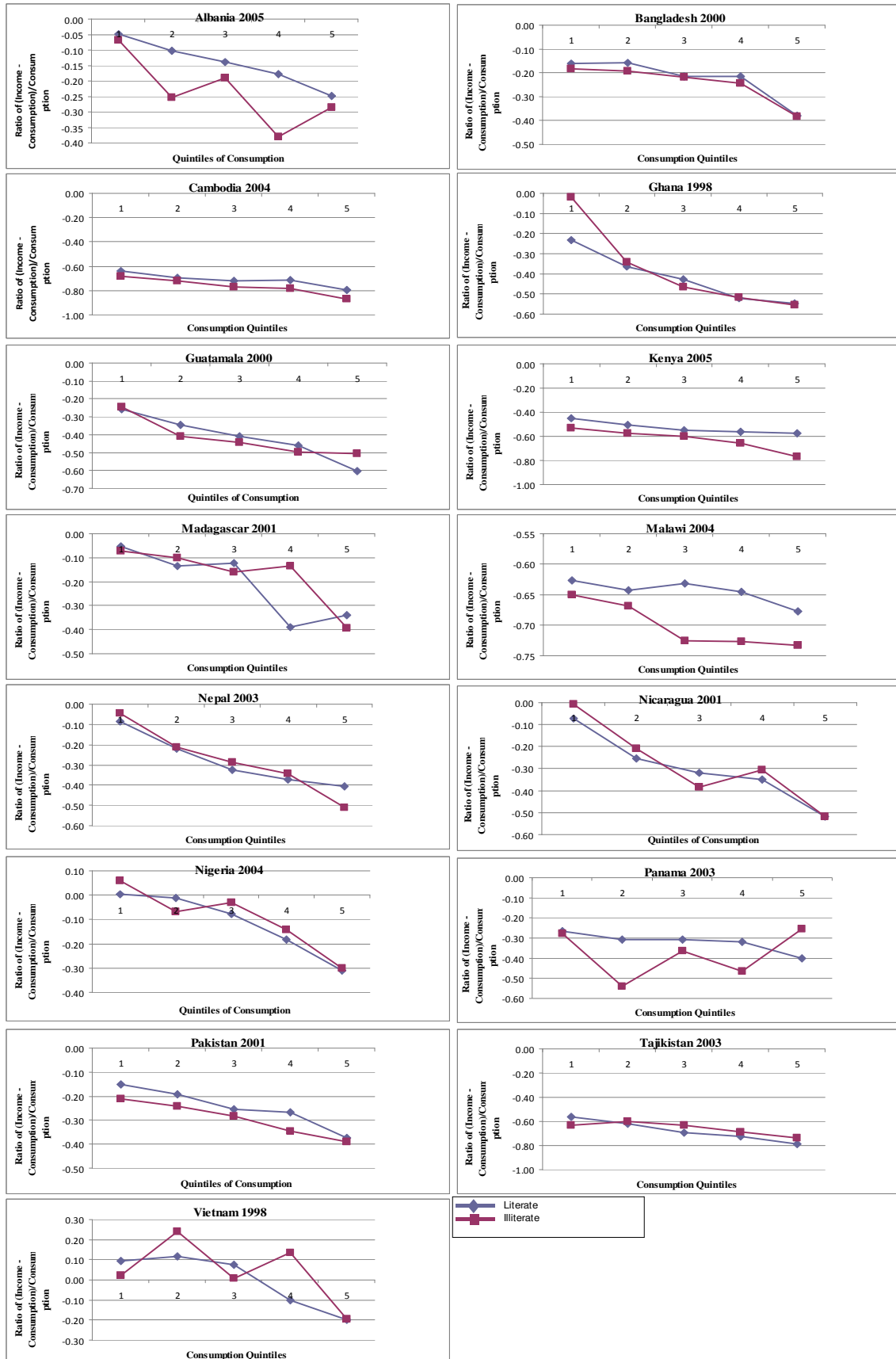


Figure 2 – Income Under-Reporting by Male and Female Headed Households, Sorted by Level of GDP per capita

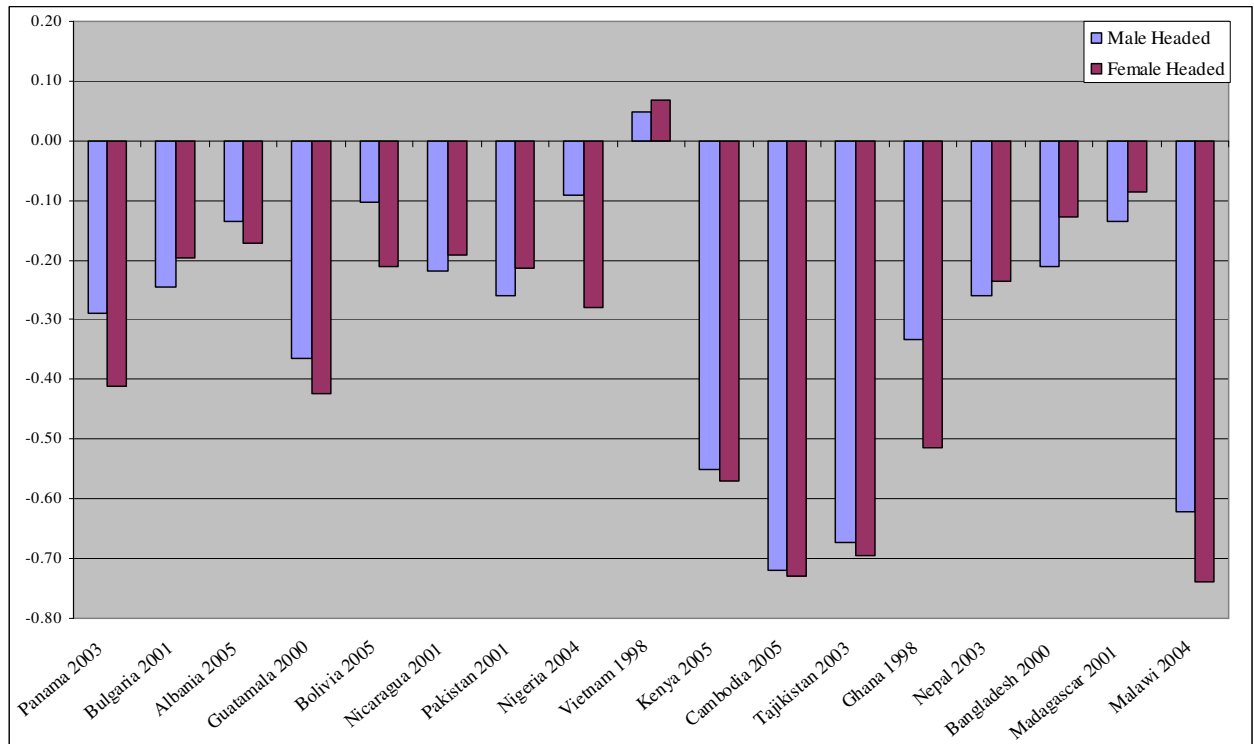


Figure 3 –Income Minus Consumption Normalized by Consumption by Income Quintiles (Panel A), Consumption Quintiles (Panel B) and Wealth Index (Panel C)

Panel A

Panel B

Panel C

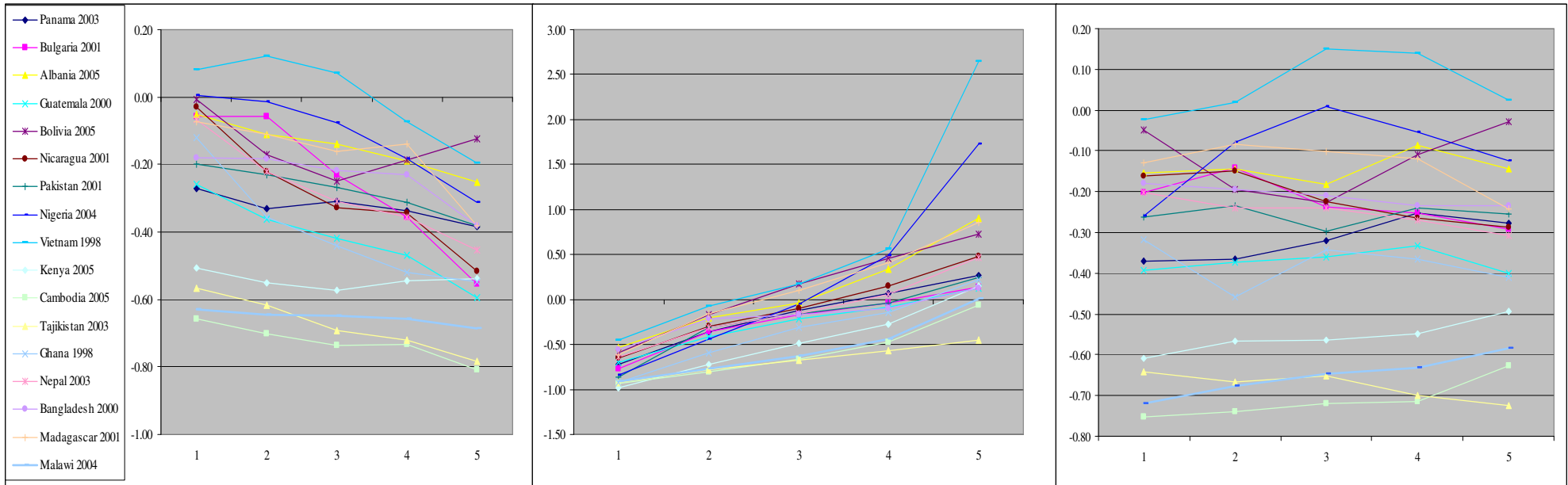
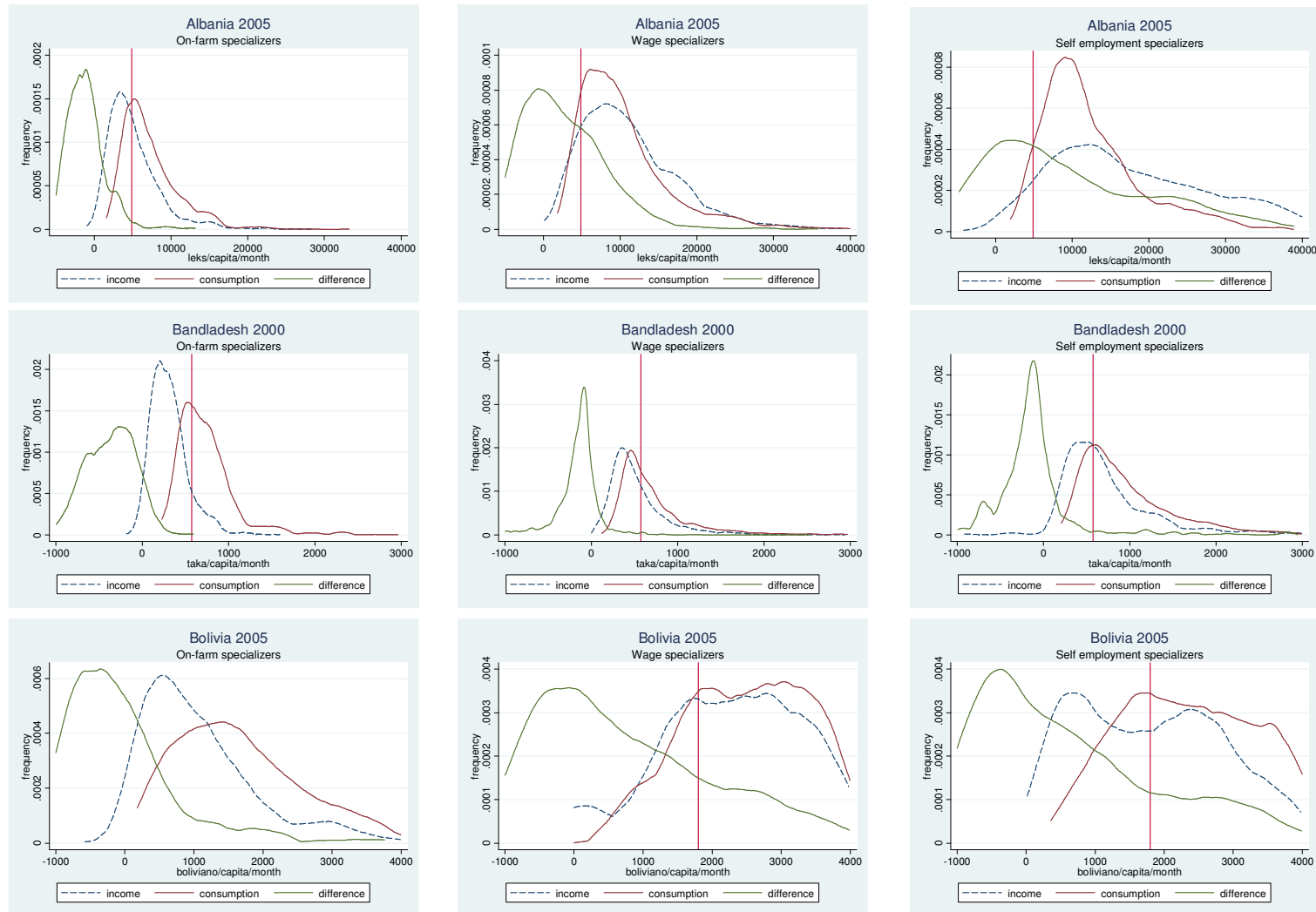
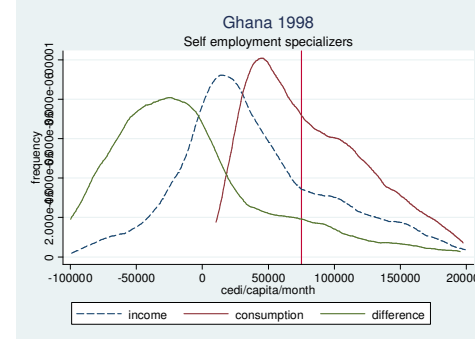
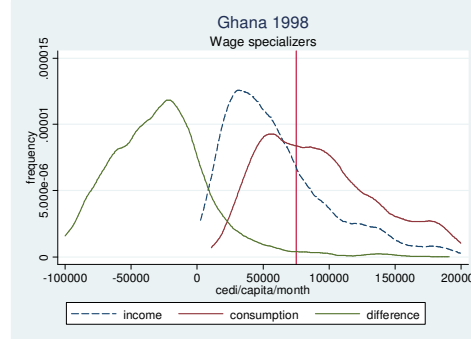
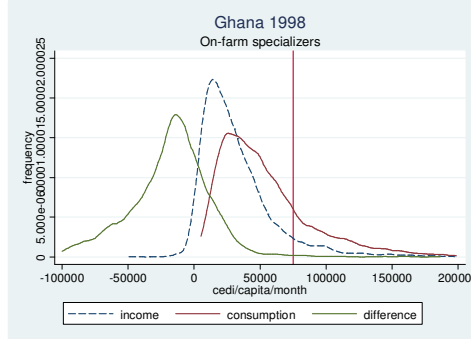
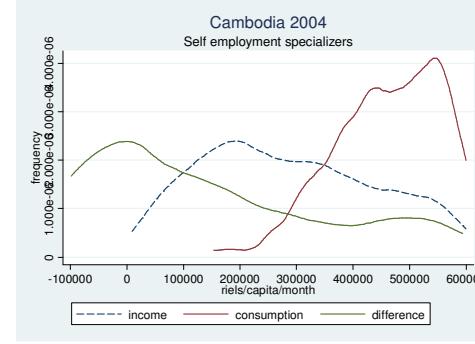
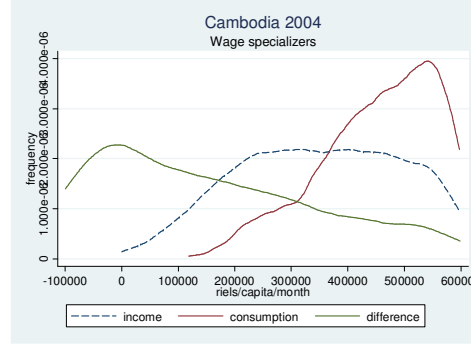
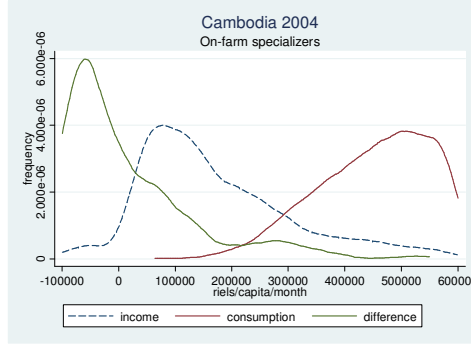
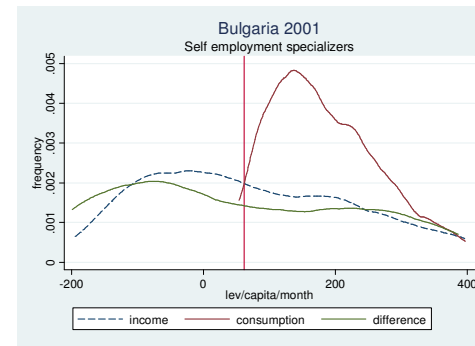
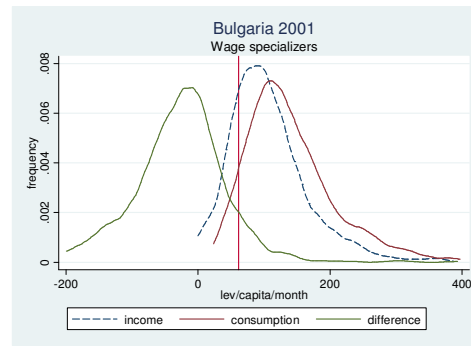
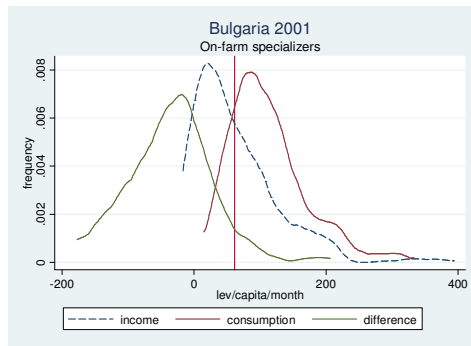
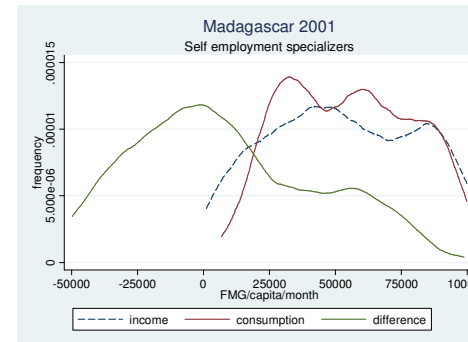
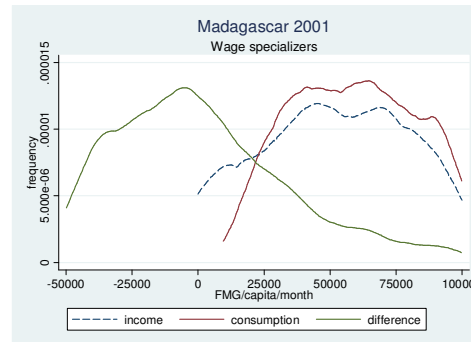
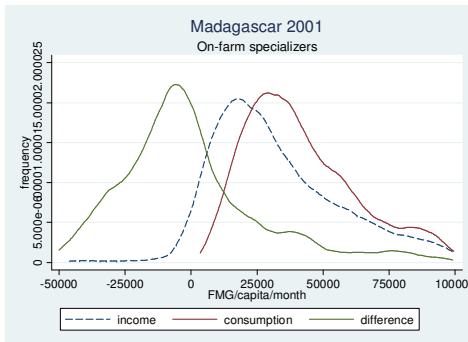
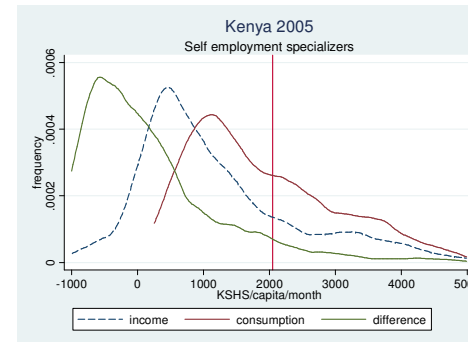
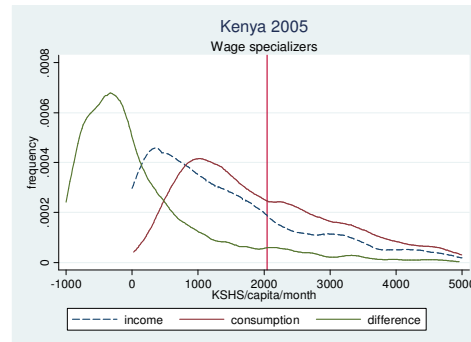
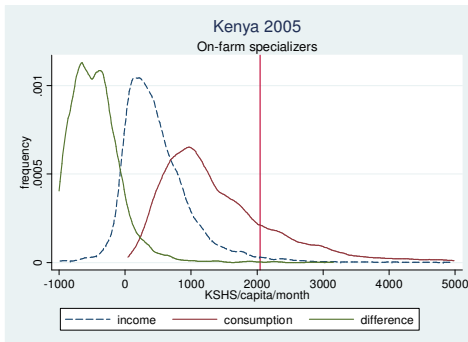
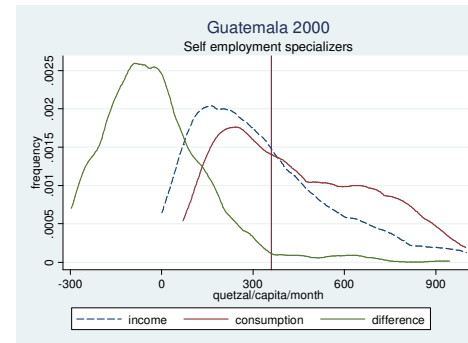
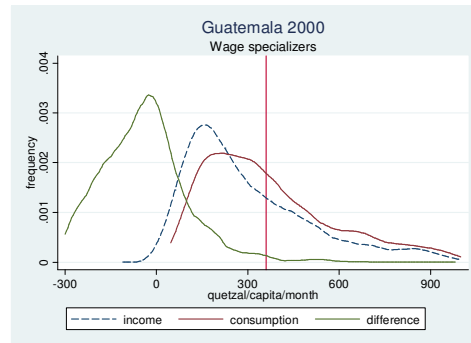
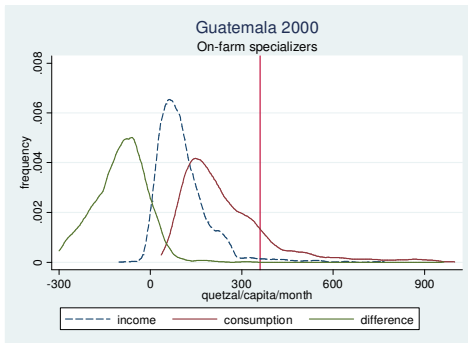
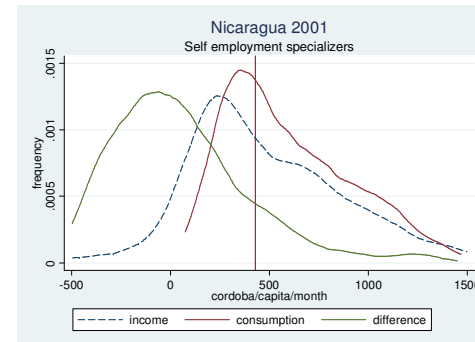
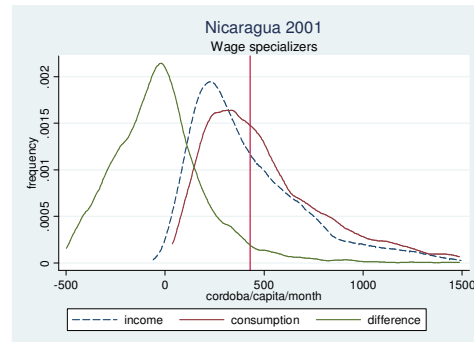
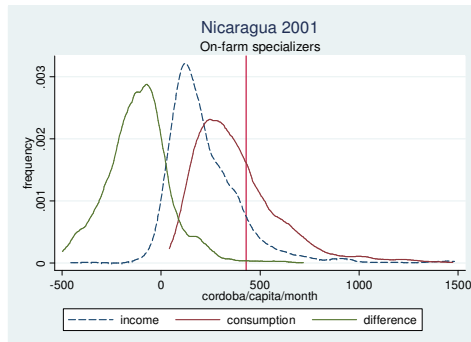
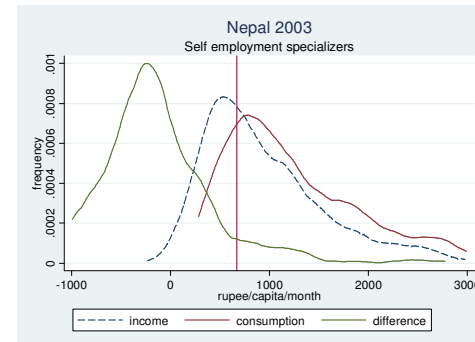
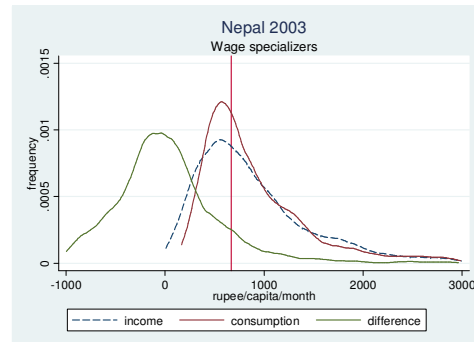
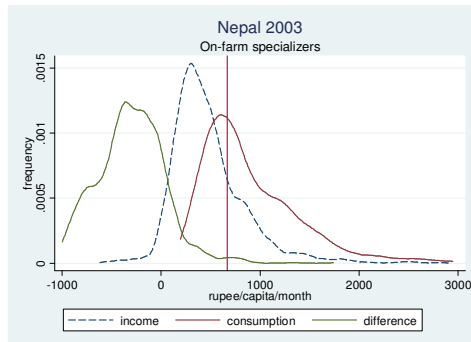
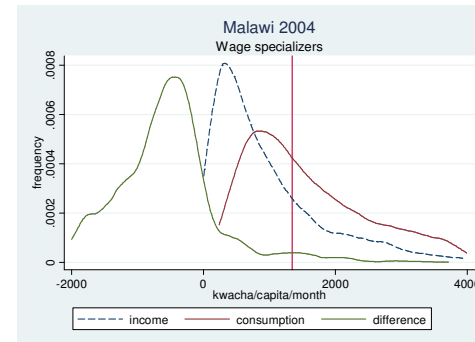
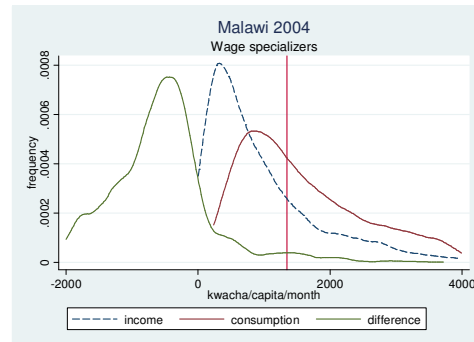
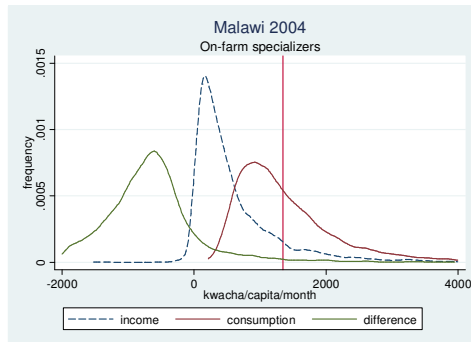


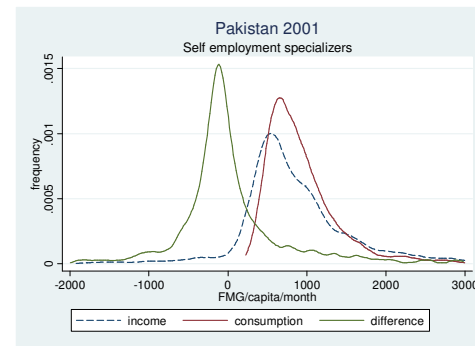
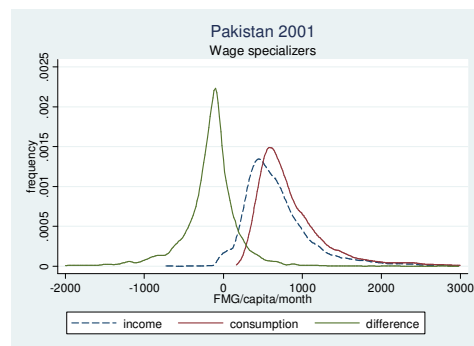
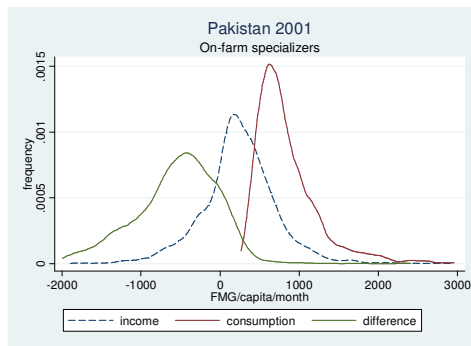
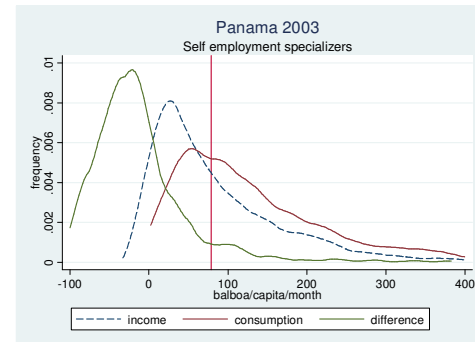
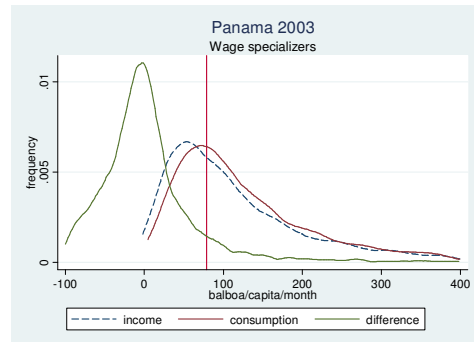
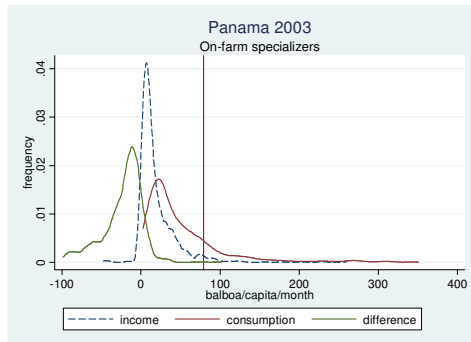
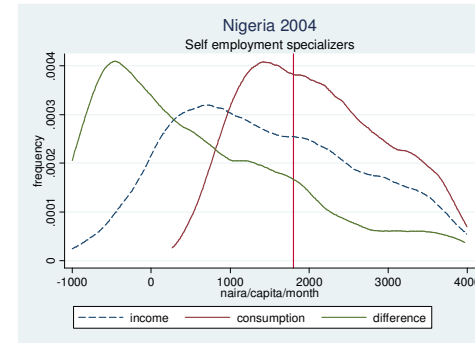
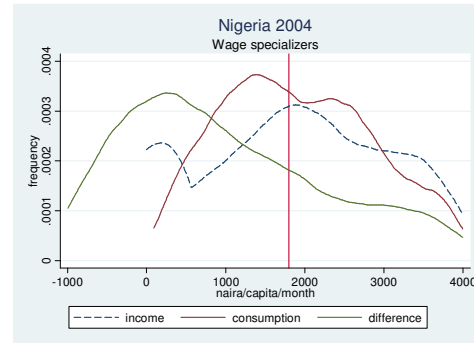
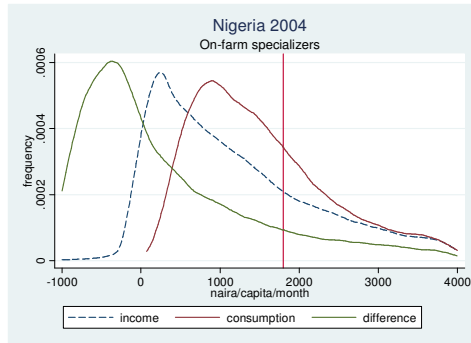
Figure 4 – Income and consumption density distributions by specialization typology











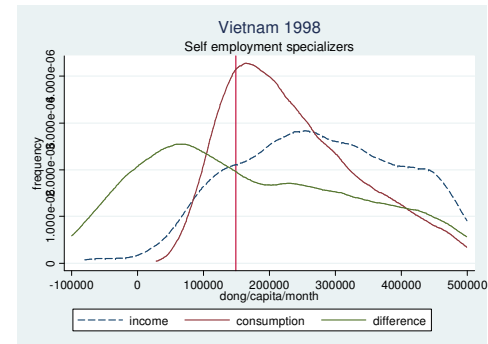
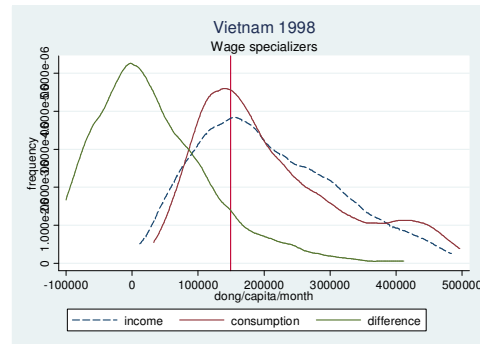
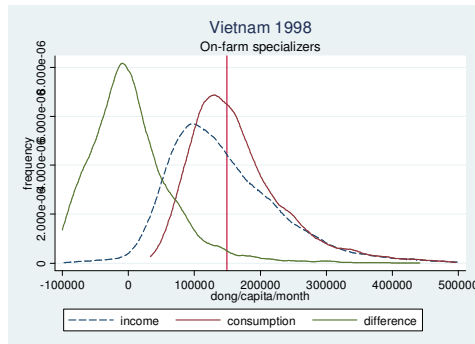
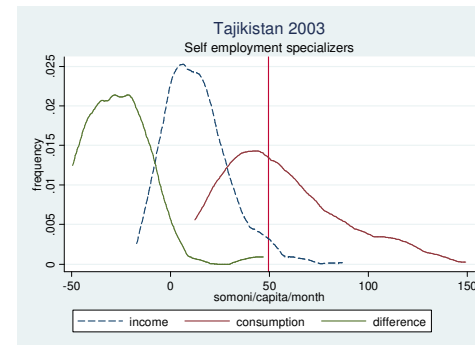
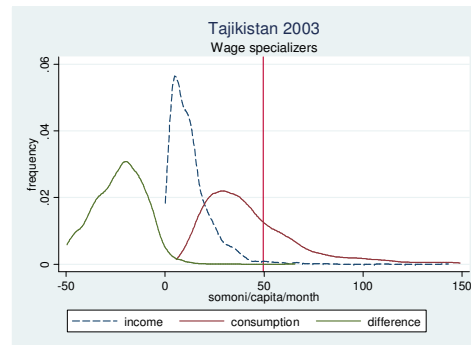
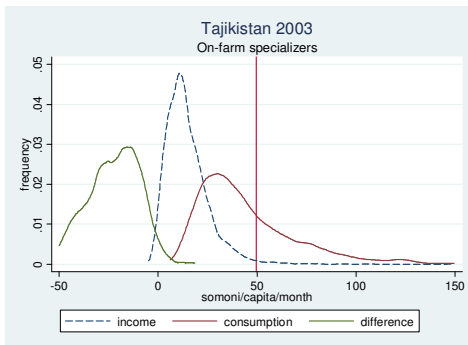


Figure 5 – Median underreporting by income specialization categories

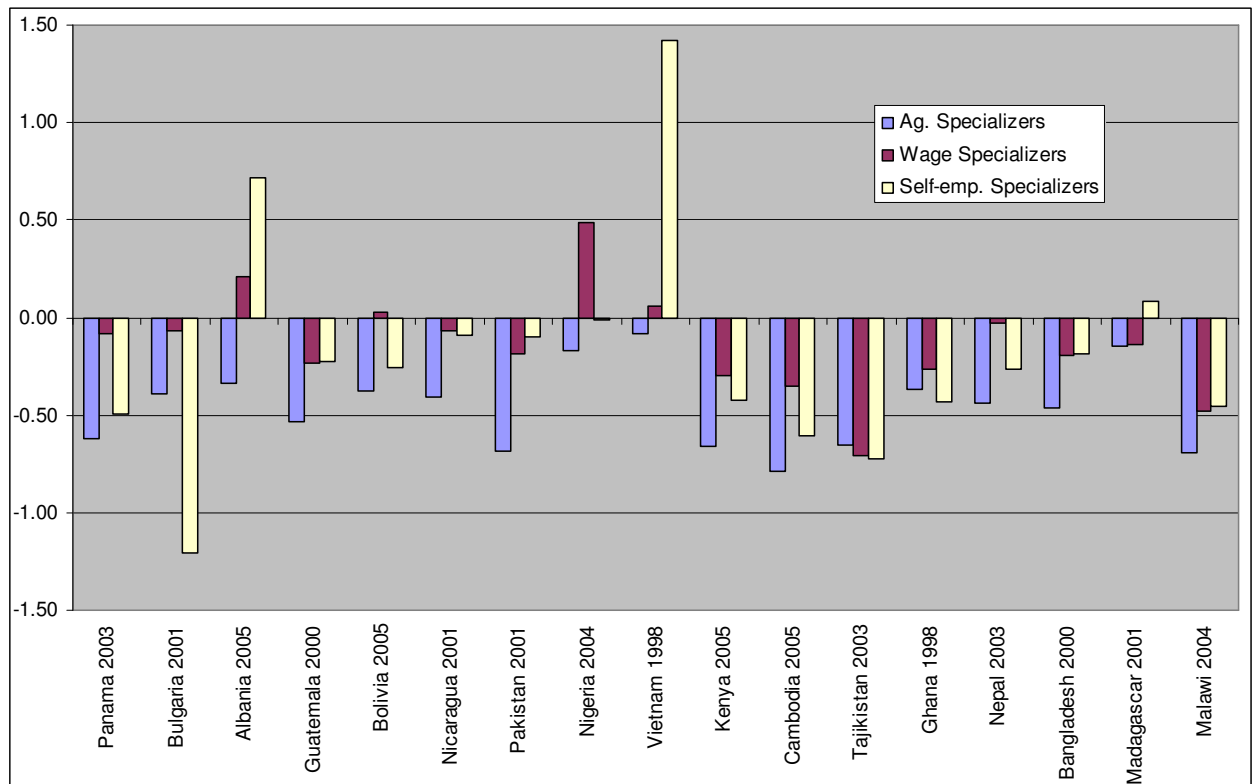


Figure 6 – Kernel Distribution of Crop Revenues over Land Owned for Albania 2001 and 2005

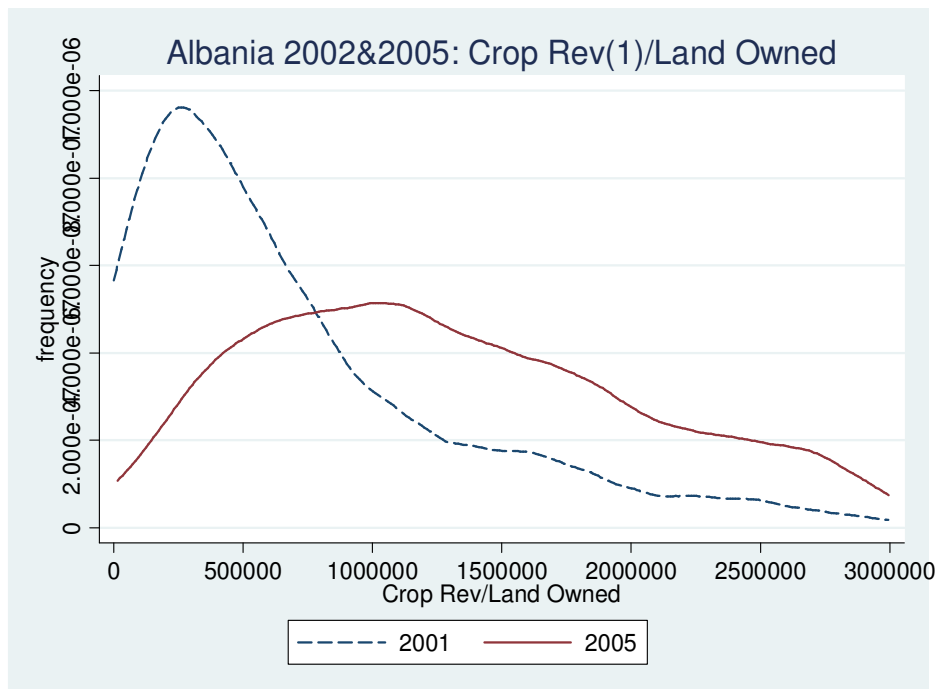


Figure 7 – Stochastic Dominance of Agricultural Income over Land Owned for Pakistan 1991 and 2001

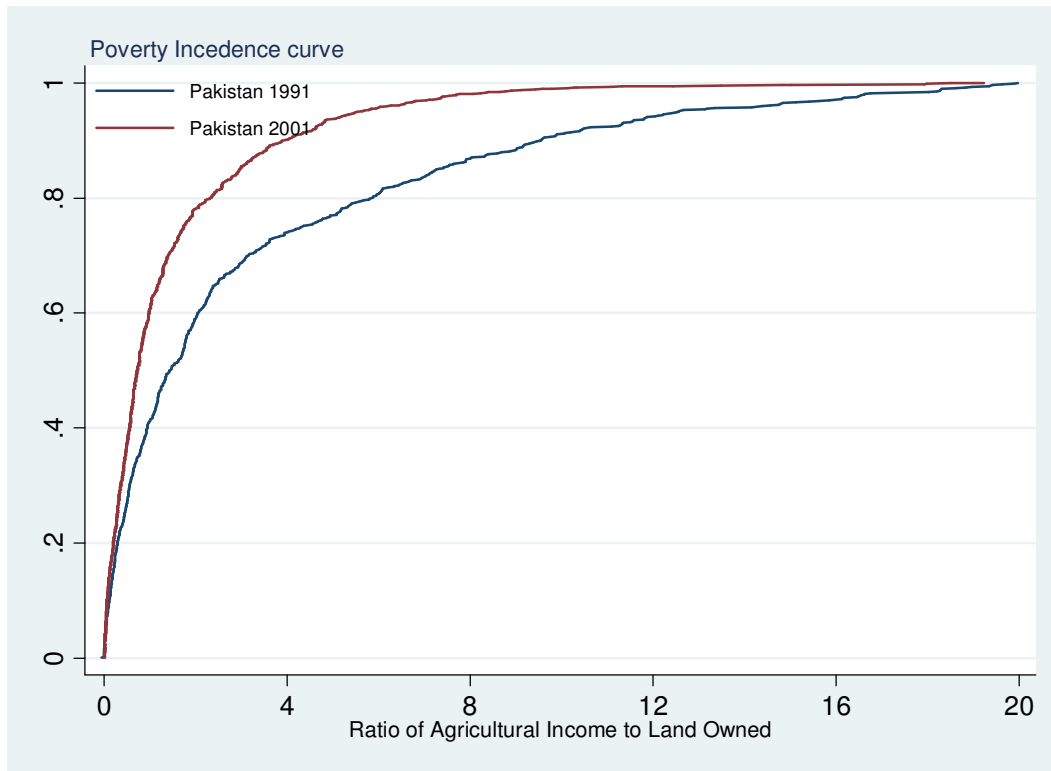


Figure 8 – Kernel Distribution of Crop Revenues over Land Owned for Ghana 1992 and 1998

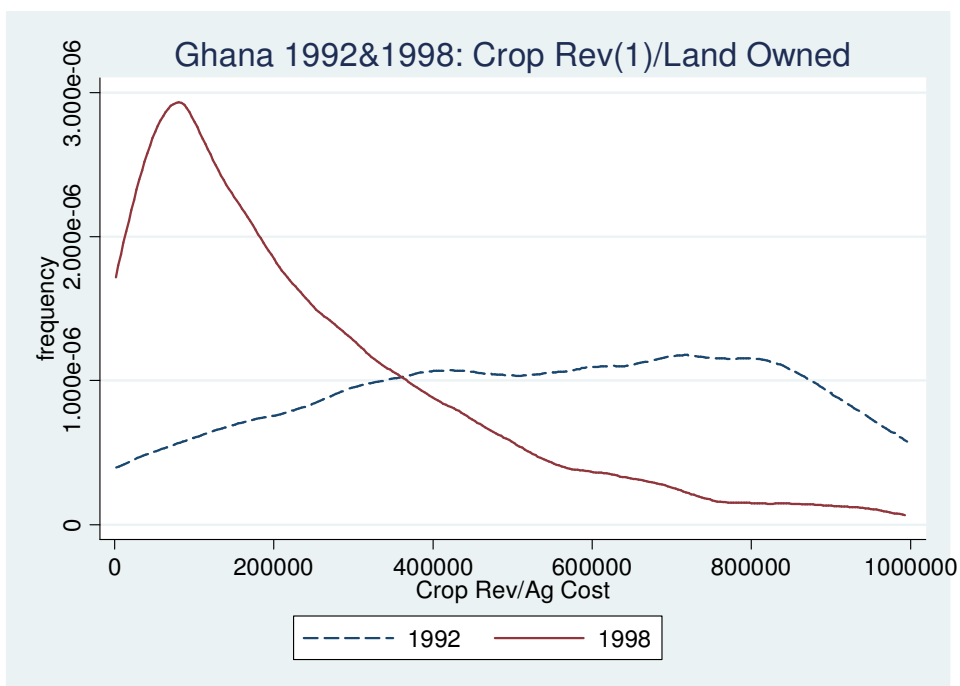


Figure 9 – Income underreporting sorted by level of GDP per capita

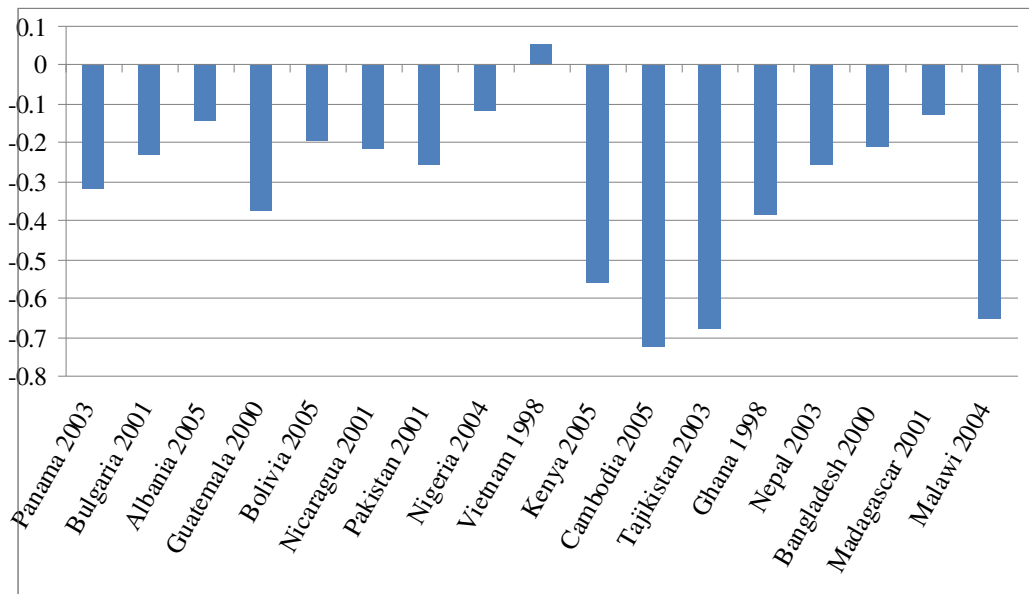
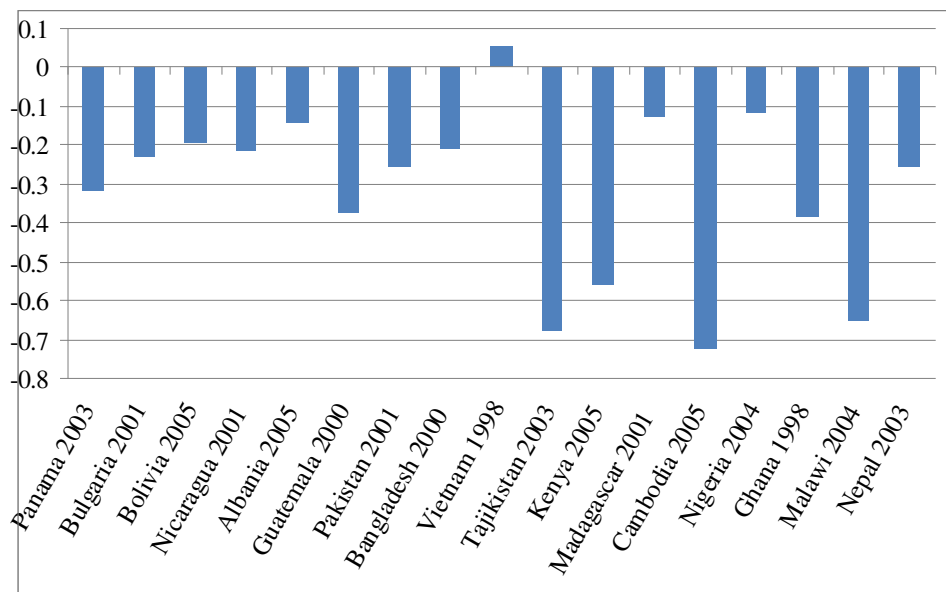


Figure 10 – Income underreporting sorted by the share of Agriculture of GDP



Appendix Figure 1 - Income and consumption density distributions – overall sample

