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Do Poorer Countries Have Less Capacity for Redistribution?

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Abstract

Development aid and policy discussions often assume that poorer countries have less internal capacity for redistribution in favor of their poorest citizens. The assumption is tested using data for 90 developing countries. The capacity for redistribution is measured by the marginal tax rate on those who are not poor by rich-country standards that is needed to cover the poverty gap or to provide a poverty-level of basic income, judged by developing-country standards. For most (but not all) countries with annual consumption per capita under $2,000 (at 2005 purchasing power parity) the required tax burdens are found to be prohibitive—often calling for marginal tax rates of 100 percent or more. By contrast, the required tax rates are quite low (1 percent on average) among all countries with consumption per capita over $4,000, as well as some poorer countries. Most countries fall into one of two groups: those with little or no realistic prospect of addressing extreme poverty through redistribution from the "rich" and those that would appear to have ample scope for such redistribution. Economic growth tends to move countries from the first group to the second. Thus the appropriate balance between growth and redistribution strategies can be seen to depend on the level economic development.

This paper—a product of the Director's Office, Development Research Group—is part of a larger effort in the department to help inform development aid and policy choices aiming to reduce poverty. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at mravallion@worldbank.org.

Do Poorer Countries Have Less Capacity for Redistribution?

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1. Introduction

Some people in even the poorest countries would not be considered poor in the US, say. And all developing countries have access to redistributive policy instruments. These facts have not gone unnoticed by aid donors. The government of a rich country hoping to reduce poverty in poor countries will (understandably) be disinclined to give its aid to a country that has ample internal capacity to address its poverty problem through redistribution from people at a similar standard of living to taxpayers in that rich country. Yet, while the idea that different countries have different capacities for redistribution comes up often in aid discussions, it is invariably assumed that it can be adequately proxied by a measure of average income. I do not know of any past effort to formalize and test that assumption.

The issue of country capacity for redistribution also arises (at least implicitly) in discussions of development policy within developing countries. It is often argued that "sustained poverty reduction is impossible without sustained growth."[2] To accept this claim one must essentially reject its corollary: "sustained poverty reduction is impossible through income redistribution." Yet I can find no demonstration of that point in the literature.

The governments of all developing countries have access to tax and spending instruments with distributional impacts, and significant impacts on poverty and inequality by such means appear to be feasible.[3] Progressive income tax systems are not yet as important in developing countries as in most developed ones, though this is changing and there appear to be feasible options in developing-country settings.[4] Indirect taxes with distributional impacts are widespread.[5] On the spending side, there are many actual or potential instruments available even in poor countries including workfare programs and targeted transfers.[6]

Whether the available policy instruments are actually used and how effective they are—how well they are designed and implemented—depend on the redistributive efforts of countries, stemming in no small measure from their political will for redistribution. That is a different

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[2] This specific quote is from Kraay (2006, p.61) although it is just one of many statements of this view that can be found in the literature and heard in development policy discussions over many decades.

[3] See, for example, Ferreira et al. (2009) on redistributive policies in Brazil since the mid-1990s and Robalino and Warr (2006) on their potential in Thailand.

[4] See the discussion in Alm and Wallace (2006).

[5] Gemmell and Morrissey (2005) provide a useful review what is known about the distributional impacts of taxation in developing countries.

[6] The van de Walle and Nead (1995) volume contains a number of relevant papers. For an overview of the methods found in practice, with details on many examples, see Grosh et al. (2008). For a recent overview of the evidence on conditional cash transfer policies see Fishbein and Shady (2009).

concept to their capacity for redistribution, which is what matter to development aid and policy choices. At any one time, the scope for redistribution as an anti-poverty strategy is naturally constrained by both the extent of poverty in a country and the affluence of the country's rich, which determines the potential tax base. However, the literature does not contain a systematic assessment across countries of how much the existing distribution of income constrains redistribution prospects. There are also deficiencies in past measures for assessing the capacity for redistribution, as reviewed in section 2 of this paper.

The paper tries to fill this gap in knowledge by quantifying how much the distribution of income constrains the scope for redistribution as a means of reducing poverty in developing countries. It is assumed that an external aid donor wants to know: Which countries have distributions that yield little or no potential for internal redistribution as a means of addressing the problem of poverty? Are these necessarily the poorest countries by standard measures? Is the capacity to redistribute to the poor stable over time? And how does it respond to economic growth?

To address these questions, the paper provides a simple but intuitively appealing (inverse) measure of the capacity for redistribution, namely the marginal tax rate (MTR) on the "rich"—those living in a developing country who would not be considered poor by rich country standards—that is needed to provide the revenue for a specific redistribution. At a sufficiently high MTR, the redistribution can be considered "prohibitive," although it is a judgment call just how high is "too high." It is at least suggestive that MTRs rarely exceed 60% in rich countries.[7] Two types of redistributions are considered: a progressive tax on the rich sufficient to cover a given proportion of the aggregate poverty gap and various "basic income" schemes financed the same way.

The following section motivates the paper's approach with reference to the literature while Section 3 provides a more formal treatment. Section 4 presents estimates for 90 developing countries, and discusses their implications. It will be shown that for most low-income developing countries the MTRs on the rich needed to cover even half the aggregate poverty gap are likely to be prohibitive, but that such redistribution appears to be more feasible in many middle-income countries. The concluding section summarizes the results and notes some caveats.

[7] Immervoll (2004) estimates effective MTRs for the countries of the European Union.

2. The proposed measure and its antecedents in the literature

The simplest way one might measure the capacity for redistribution is by normalizing the aggregate poverty gap—the sum of all income shortfalls from the poverty line per capita—by the overall mean income. This has long been interpreted as a measure of a "country's *potential* ability to meet the challenge of poverty" (Sen, 1981, p.190).[8] A variation on this measure is instead to normalize the poverty gap by the aggregate income of the non-poor defined as those living above that poverty line; the aggregate income can be either gross income or income net of the poverty line. This can be interpreted as the tax that would be needed on the non-poor to cover the poverty gap. The earliest examples I know of are Anand (1977) and Kawkani (1977) both using survey data for Malaysia in 1970. Anand (1977, p.11) reported that "..if poverty were to be eliminated by a transfer from the non-poor to the poor, the non-poor would need to sacrifice 8.3 percent of their income (or 12.7 percent of their income in excess of poverty line income)."

However, when we confront the problem of how an aid donor might assess a developing county's capacity for redistribution, one can question whether these past measures use an appropriate normalization. Aid donors will surely not be indifferent to how incomes are distributed above the poverty line when assessing the capacity for redistribution to the poor. It is clearly not acceptable to say that a country has a high capacity if (given its income distribution) redistribution would require putting almost all the tax burden on people living just above the poverty line. Some countries have a greater affluence—with more people living well above the poverty line—than others, and this must be brought into the picture.

The desirability of financing assistance for the poorest by taxing the middle class is questionable on both intrinsic and instrumental grounds. In assessing a poor country's capacity for redistribution it can be argued that citizens of a rich country would find it intrinsically (ethically or politically) unacceptable to expect a poor country to address its poverty problem by taxing people who would be considered poor in the rich country. Popular judgments about "inequality" appear to give greater weight to redistributions from the rich to the poor than redistributions amongst the middle class or from the middle class to the poor.[9] The instrumental arguments point to the expected role of the middle class as agents of progress and also the likely

[8] Also see the discussion in Kanbur (1987).

[9] Amiel and Cowell (1999, Chapter 4) study attitudes to redistribution in a series of experiments, in which people were asked to say which of two hypothetical distributions was more "unequal," and this was repeated for various redistributions. Respondents were found to be much more likely to identify redistributions from one income level to a higher one as making the distribution "more unequal" as the income gap between the two levels rose.

incentive effects on those near the poverty line.[10] Aid donor might also question the political feasibility within developing country of asking middle-income groups to shoulder the burden of poverty relief.[11]

This paper's main proposed measure of country capacity for redistribution focuses instead on the implied tax burden on the "rich" that would be needed to generate sufficient revenue to cover the aggregate poverty gap, or some proportion. In other words, a "middle class" is identified that is not subject to redistribution—essentially building "middle-class exemptions" into past measures of the tax burden of eliminating poverty.

But what level of income defines the "rich"? Various *ad hoc* definitions have been used in the literature (see, for example, Danziger et al., 1989) but, in the context of the problem studied in this paper, there is a natural approach. The paper argues that only those who are <u>not</u> poor by Western standards should be considered eligible for bearing the required tax. This is motivated by the presumption that aid donors would not ask—and it would surely be morally objectionable if they did—developing countries to deal with their poverty problem by redistribution from those who are poor by the standards prevailing in the donor countries. Progressivity can be built into the hypothetical redistributive tax, to better reflect country differences in the capacity to pay of those living in developing countries that are not poor by rich-country standards.

There are other ways that the poverty gap has been used in the literature, related to the concerns of this paper. Instead of asking what tax rate on the "rich" is needed to cover the poverty gap one can set the tax rate at 100% and ask who would needs to pay it. This gives Medeiros's (2006) "affluence line"—defined as the income level above which the total income in excess of that level is sufficient to cover the poverty gap with a 100% MTR. People living above this line are identified as the "rich" by Medeiros and on calculating the line for Brazil he finds that the rich represent 1% of the population in 1999. As will be shown later, Medeiros's

[10] The middle class is widely seen to be instrumentally important to economic development; the arguments made are that the middle class fosters entrepreneurship, results in a pro-growth shift in the composition of consumer demand, and makes it more politically feasible to attain policy reforms and institutional changes conducing to growth. For further discussion of these arguments and references see Ravallion (2009).

[11] Under certain conditions, the type of redistribution assumed here from the "rich" to the "poor," with middle-incomes untouched, may even emerge as a public choice equilibrium. This would require the usual conditions for the median voter theorem (the issue to be voted on is one dimensional and the utility function is single-peaked in that dimension) plus the assumption that the decisive voters care sufficiently about poverty and are concentrated around the median, which is (as usual) below the mean. (If voters did not care sufficiently about poverty then some form of "Director's law" would come into play, with redistribution from the tails to the middle.)

line need not exist in poor countries, and (indeed) does not exist in a non-negligible number of countries in the data used for this study. When it exists, it has the seemingly odd feature that an increase in the extent of poverty, leading to a higher poverty gap, automatically implies that there are more "rich" people. Aside from these concerns, Medeiros's "affluence line" does not help in addressing the question posed by this paper, since the capacity to pay relative to the poverty gap is fixed by construction (at unity).

There are also measures of country performance against poverty that penalize higher incomes of the non-poor. Kanbur and Mukherjee (2007) have proposed a measure of "poverty-reduction failure." This says that country A has done worse than B if A's resources—again defined by the incomes above the poverty line—are greater, even if the extent of poverty is the same in A and B. Instead of deflating the poverty gap by the income of the non-poor this measure essentially inflates the poverty gap by those incomes. Kanbur and Mukherjee characterize a class of indices of poverty-reduction failure satisfying a set of seemingly desirable axioms and present calculations for 90 developing countries. However, while it is an interesting measure in its own right, this does not capture in any intuitively obvious way the "capacity for redistribution." In particular, a higher income share held by the non-poor should presumably increase that capacity even though it signals greater poverty reduction failure.

All of the measures discussed above are anchored to the poverty gap. A strand of the literature has also discussed various proposals for a "basic-income" (also called a "guaranteed income" or "citizenship income") which provides a uniform (un-targeted) transfer to everyone, whether poor or not.[12] This has been proposed for both developed and developing countries (Standing, 2008). Advocates typically propose that it should be financed by a progressive income tax, with an exemption for the poor (Raventós, 2007). I will also consider some stylized basic income schemes as anti-poverty policies.

Building on these ideas, the following section provides a more formal treatment of the paper's proposed measures, before implementing them in section 4.

[12] The Wikipedia entry on basic income provides a good overview of the idea and its history. An academic journal, "Basic Income Studies," is devoted to research on the idea.

3. A more formal exposition

Following the above discussion, one can state three desirable properties for a measure of the capacity for redistribution:

Increasing in the poverty gap: The lower the aggregate poverty gap to higher the capacity for redistribution.

Increasing in incomes of the "rich": The greater the total income of the rich the higher the capacity for redistribution.

The middle-class are exempt: Those who are neither "poor" nor "rich" are not considered eligible to either benefit from or lose from redistribution.

In deriving a precise measure with these properties, it can be agreed that "poverty" is to be identified by prevailing poverty lines in developing countries. But should one use the prevailing lines in each country, which tend to rise with average income (as shown in Ravallion et al., 2009) or impose a common international line? That depends on the purpose of the exercise. If one is only interested in domestic policy in a given country then one would naturally want to use cut-off points appropriate to that country. The present paper focuses instead on cross-country comparisons, as relevant to aid allocations, for which there is a case for imposing a common international line, such that two people with the same standard of living (measured by their command over commodities) are treated the same way no matter where they live.

How should the potential tax base for redistribution be defined? As noted in the previous section, one can question both the desirability and political feasibility of taxing middle-income groups in developing countries to finance assistance for the poorest. In assessing the capacity for redistribution, I will assume that the potential tax base is defined by those who are not-poor by Western standards, and (again) I will impose a common standard. More precisely, the "rich" are defined here by the standards of what "poverty" means in a representative rich country, giving a poverty line z_r, and the target group is defined by what poverty means in a representative poor country, giving the line $z_p < z_r$.[13] Following Ravallion (2009) those living between z_p and z_r can be interpreted as the developing world's "middle class." The values of z_p and z_r are taken as given, though I will test sensitivity to the choice of z_p.

[13] Pritchett (2006) argues that z_r should be considered the "upper bound" to the range of admissible poverty lines for measuring the extent of global poverty, with z_p as the lower bound.

A discontinuity in how the tax burden varies with income in a neighborhood of z_r should clearly be avoided if the middle class is to be exempted (since a sharp jump in the tax burden at z_r would imply that some of those taxed are middle class based on post-tax income). This can done by postulating a simple linear tax schedule, with a constant marginal rate on all income in excess of z_r. This is automatically progressive, with an average tax rate of zero for $y \leq z_r$ but with a rising average tax rate for $y > z_r$ (but constant marginal rate). The revenue generated is used to finance redistribution in favor of the poorest, sufficient to reduce the aggregate poverty gap by a faction *k* of its current value; if *k*=1 then all the poor are brought up to z_p.

The main calculations reported later in this paper follow the literature in using the poverty gap as the basis for setting the revenue. However, I will also consider a "basic income" scheme with much weaker informational requirements.

3.1 Poverty gap as the revenue requirement

The main (inverse) measure of the capacity for redistribution is the marginal tax rate on incomes above z_r that is needed to generate sufficient revenue to cover a given proportion, *k*, of the aggregate poverty gap relative to z_p. This tax rate is denoted τ_k and yields a tax in amount $\max[(y - z_r)\tau_k, 0]$ on income *y* in the interval [0, $y^{\max}$] with a continuous cumulative distribution function (CDF), denoted $F(y)$, with mean μ. The MTR can be written as:

$$\tau_k(z_p, z_r) = \frac{k\int_0^{z_p}(z_p - y)dF(y)}{\int_{z_r}^{y^{\max}}(y - z_r)dF(y)} \quad (k > 0) \qquad (1)$$

The numerator is the proportion of the aggregate poverty gap relative to the poor-country poverty line that needs to be covered by the hypothetical tax. The denominator is the tax base: the aggregate income above the rich country poverty line net of the latter (which is essentially tax-exempt). The value of *k* is a parameter to be chosen. (One can set $k > 1$ to allow for imperfect targeting or administrative costs.) Note that this is not the only measure that satisfies the three properties identified at the beginning of this section. However, the functional form in (1) has the intuitively appealing interpretation as a marginal tax rate.

There are two other ways of writing (1) that are helpful in understanding the measure and calibrating it to data. On applying integration by parts to both the numerator and denominator one can re-write (1) in the following form, permitting the graphical representation in Figure 1:

$$\tau_k(z_p,\, z_r) = \frac{k\int_0^{z_p} F(y)dy}{y^{\max} - z_r - \int_{z_r}^{y^{\max}} F(y)dy} \tag{2}$$

Consider the CDF in Figure 1, giving the proportion with income below each point on the horizontal axis. The numerator is *k* times the aggregate poverty gap, which is the area under the CDF from zero up to z_p, marked "A" in the unbroken CDF in Figure 1. The denominator is the tax base (the total income in excess of z_r), which is the area marked "B," above the CDF and above z_r, but below the line for "1". The MTR required to cover the poverty gap (*k*=1) is the ratio of area A to B. Equation (1) can also be written in the following form, which is convenient for calculating τ_k from existing data sets such as *PovcalNet*:

$$\tau_k(z_p, z_r) = \frac{kPG(z_p)z_p}{\mu - (1-PG(z_r))z_r} \tag{3}$$

where $PG(z)$ is the poverty gap index:

$$PG(z) = \int_o^z (1 - y/z)dF(y) \quad z = (z_p, z_r) \tag{4}$$

The following remarks can be made about the properties of $\tau_k(z_p, z_r)$:

(i) It is strictly positive (since the mean income of those living above z_r must exceed z_r) but it can exceed unity (since the poverty gap below z_p can exceed the total income above z_r).

(ii) It is strictly increasing in both arguments. This is obvious with respect to z_p. Note that $\partial[(1-PG(z_r))z_r]/\partial z_r = 1 - F(z_r) > 0$ implying that $\tau_k(z_p, z_r)$ is strictly increasing in z_r.

(iii) In the special case $\tau_1(z_p, z_p)$, the measure collapses to that found in Anand (1977), Kakwani (1977) and subsequent literature in which the poverty gap is normalized by income of the non-poor net of the poverty line.

(iv) It can also be readily shown that $1 - \tau_1(z_p, z_p)/\tau_1(z_p, z_r)$ is the share of the total tax burden that is borne by the middle class ($z_p < y < z_r$).

(v) If there exists a solution for z_r^* defined implicitly by $\tau_1(z_p, z_r^*) = 1$ then it is the "affluence line" proposed by Medeiros (2006) for Brazil. Note, however, that this line does not exist if $\tau_1(z_p, z_r) > 1$ for all $z_r > z_p$.

Will poorer countries necessarily have higher values of τ_k and (hence) lower capacity for redistribution? It is evident from Figure 1 that a downward shift in the CDF at all points (the strong form of first-order dominance) will unambiguously lower τ_k. However, this is a strong condition, which is unlikely to hold in many cross-country (and inter-temporal) comparisons. It is the fact that the CDFs of different countries (and at different times) intersect that creates the ambiguity about whether richer countries have greater capacity for redistribution. The outcome depends (in part) on whether the higher mean income tends to lower $PG(z_p)$. Empirically, one finds that countries with a higher mean tend to have lower poverty measures,[14] which would tend to lower the amount of redistribution needed. However, this is not a hard and fast rule; the exceptions arise from differences in relative distribution (roughly speaking, "inequality"). A higher mean also increases the total resources available, which will tend to lower the required tax rate. However, the distributional shifts accompanying a different mean can also reduce the tax base for redistribution, and this can happen even if a higher mean comes with a lower $PG(z_r)$ (as well as lower $PG(z_p)$). The dashed line in Figure 1 gives an example in which the mean clearly increases (the area above the CDF but below the line for "1"), poverty falls for both z_p and z_p, but the capacity for redistribution falls, through the distributional effects at the high-income end of the scale.

Another parameter of the distribution that might be expected to matter (independently of the mean) is inequality. It is sometimes argued that poor countries tend to have low inequality—echoing the famous Kuznets curve, which postulates that inequality will be low in both the poorest and richest countries—casting further doubt on their capacity for redistribution. Yet it is known that there is little relationship between the level of inequality in a country and its mean income.[15] Some poor countries also have relatively high inequality, so they may well have more scope for redistribution than better off but less unequal countries.

However, there is a further reason to question the relevance of inequality *per se*. The relationship between τ_k and any standard measure of inequality is ambiguous in theory.[16] A given change in the Gini index—the most widely used inequality measure—can have very

[14] For a recent overview of the literature and new evidence on this point see Ferreira and Ravallion (2009).
[15] For further discussion see Bruno et al. (1998) and Ferreira and Ravallion (2009).
[16] This is a distinct issue to that of whether high inequality countries have a greater capacity for reducing inequality. Here the interest is in the relationship with the capacity to reduce poverty through redistribution.

different outcomes for the poverty gap index. It is often assumed that higher "inequality" implies a higher poverty gap (or some other standard measure), though that strictly only holds for certain changes in the Lorenz curve.[17] But if we assume that higher inequality implies a higher *PG* at a given mean, then there are two offsetting effects on the tax rate: on the one hand it increases $PG(z_p)$ but on the other it also increases $PG(z_r)$ at a given mean. Intuitively, higher inequality probably means that there is more poverty, but it probably also means that there are more rich people with the capacity to help address that poverty through redistribution. Which effect dominates is an empirical issue.

The upshot of these observations is that the relationship between the capacity for reducing poverty through redistribution and either mean income or income inequality is hard to predict on *a priori* grounds. It is an empirical issue whether poorer or less unequal countries have less capacity for redistribution.

3.2 "Basic income" as the revenue requirement

The revenue needed to cover the poverty gap is the natural benchmark for measuring the cost of redistribution to the poor, and it the benchmark used in past measures. However, it is likely to underestimate the tax burden in practice, given that such perfect targeting of the poor could be quite costly. On top of the administrative cost there will be incentive effects on behavior, given that perfect targeting implies a 100% marginal tax on the poor (in that transfer receipts fall $-for-$ as pre-transfer income increases). While one can address this by choosing $k>1$, that still assumes that the poverty gap is known for each person.

By contrast, in a basic income scheme every person, whatever their income, is given the same sum of money. In this context, one can suggest two such schemes, one providing z_p to each person, and one providing the average poverty gap to each person (in both cases the transfer is paid whether the person is poor or not); the implied MTRs on those living above z_r are $\tau_1(z_p, z_r)/PG(z_p)$ and $\tau_1(z_p, z_r)/F(z_p)$ respectively.[18] Notice that the second scheme does not bring everyone up to the poverty line.

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[17] For example, Kakwani (1993) derives analytically the elasticities of the poverty gap index with respect to the Gini index under the assumption that the Lorenz curve shifts by a constant proportion at all points.

[18] Note that $PG(z_p)z_p = (z_p - \mu_p)F(z_p)$ where μ_p is the mean income of the poor. The second basic income scheme provides $z_p - \mu_p$ to every person.

These are arguably rather extreme alternatives to the poverty-gap scheme discussed above, in that the basic income scheme essentially requires no information for identifying the poor (though it assumes perfect information on who is rich). Yet a great deal of information is available in practice. As a result of this assumption, the implied MTRs are clearly going to be higher; indeed, the ratio of the tax rate on the rich needed to cover the poverty gap exactly to the tax rate required for a basic income set at the poverty line is identically equal to the poverty gap index, which is 7.6% for the developing world as a whole in 2005 using $1.25 a day (Chen and Ravallion, 2008). The required tax rates for a "global" basic-income scheme will be 13 times higher, though differences in administrative costs may well reduce this differential.

4. Estimates for developing countries

Two "poor-country" poverty lines are considered. The first is $1.25 (converted using 2005 PPPs for consumption); this is the average national poverty lines found in the poorest 15 countries (Ravallion et al., 2009). The second is $2.00 a day at 2005 PPP, which is the median poverty line for all developing counties with the available data. In setting the "rich-country" poverty line I shall use $13 a day at 2005 PPP, which is the poverty line per person for a family of four in the US; see US Department of Health and Human Services.

So the hypothetical redistribution is from those living in each developing country who are not poor by US standards to those who are poor by the standards of either the poorest countries (giving the $1.25 line) or developing countries as a whole (giving the $2 line). For notational brevity, the MTR required to reduce the poverty gap for the $1.25 line when $z_r = \$13$ is denoted $\tau_k(1) \equiv \tau_k(1.25,13)$, while $\tau_k(2)$ is the corresponding value for the $2 line.

The data are from *PovcalNet*, which facilitates estimation of τ_k in the form of equation (3). The estimates were possible for 89 countries with at least some poverty assessed by the $1.25 a day line and at least two surveys over time (to allow inter-temporal comparisons). The underlying surveys provide distributions of household consumption expenditure or income per person. (The difference between consumption and income is ignored for the present purpose.)

Table 1 gives the poverty gap indices and the implied values of $\tau_1(1)$ and $\tau_1(2)$. Since marginal tax rates cannot reasonably exceed 100%, I truncate them at this figure. (This also helps deal with concerns about how well the upper tail of the income distribution is measured in

surveys.) The average poverty gap index rises from 9.4% for the $1.25 line to 18.6% for the $2 line and 70.4% for $13. These reflect both the differences in the proportions of the population under each line (the headcount index of poverty)—the mean values of which are 15.2%, 41.6% and 93.8% for $1.25, $2 and $13 respectively—and the differences in mean incomes of those under each line relative to the line.

Before discussing the implications for the question posed in the title, it is instructive to first consider a few country examples, and I will focus on Brazil, China and India for this purpose. For Brazil in 2005, covering the poverty gap for $1.25 a day would only require a MTR of 1% on those who are not poor by US standards. Even for the $2 a day line, the necessary marginal rate would only be 4% (Table 1). The required tax rates would also have been higher for Brazil in 1981 (say) than 2005, but still quite low; for example, $\tau_1(2)$ would have been about 11% in 1981, as compared to 4% in 2005. Recall that these are international lines, and they are lower than the poverty line commonly used in discussing poverty in Brazil, which is about $3 a day at 2005 PPP; filling the poverty gap for this line would call for a MTR of about 12% on those living over $13 a day.

Next consider China, which actually has an anti-poverty program quite similar in spirit at least to the stylized program modeled here; I refer to China's *Dibao* program, which aims to fill the poverty gaps relative to (municipality-specific) poverty lines. The marginal tax on Chinese living above the US poverty line that would be needed to cover the poverty gap for $1.25 a day is 37% in 2005, i.e., all those living above $13 a day would need to pay a tax of roughly one third of the difference between their income and $13 to bring everyone in China up to the $1.25 a day line. China's national poverty line is closer to $1 a day, which would only requite a MTR of 30%. However, the tax rate needed to cover the $2 a day poverty gap would require a prohibitive rate of 100%. Also, if one repeats these calculations in 1981 (the earliest available national surveys for China), covering the poverty gap through redistribution would have been impossible: the required MTR would have been far greater than 100%. The poverty gap was so large then, and the country so poor, that redistribution was not a realistic option.

The capacity for redistribution in India is far more limited than in China or (especially) Brazil. Indeed, it would be impossible to raise enough revenue from a tax on Indian incomes above the US poverty line to fill India's poverty gap relative to the $1.25 a day line; the required

MTR would exceed 100%. Indeed, even at a 100% MTR, the revenue generated could fill only 20% of India's aggregate poverty gap.

Turning to the 90 countries as a whole, one finds that the (unweighted) mean $\tau_1(1)$ is 41.6% while for $\tau_1(2)$ it is 52.4%. Looking at the distributions around the mean it can be seen that these averages for $\tau_1(1)$ and $\tau_1(2)$ are deceptive given that the distribution of the implied MTRs is strikingly bi-modal, as is evident in Figure 2, panel (a). Almost half (45) of the countries have $\tau_1(1) < 20\%$, while $\tau_1(1) = 100\%$ for 29 countries. For the \$2 line, one finds that 36 of the countries have $\tau_1(1) < 20\%$ and 37 have $\tau_1(1) = 100\%$. The reason for this bi-modality will soon become clear when we look at the relationship with the mean.

It is instructive to compare the proposed measure with the past approaches to assessing the capacity for redistribution that include everyone that is not poor by developing-country standards in the tax base (setting $z_p = z_r$ in equation 1). The corresponding mean marginal tax rates are 18.4% and 37.4% for \$1.25 and \$2 respectively—appreciably lower than when the middle class is exempted. Nonetheless, despite the tax progressivity, the large middle-class population shares mean that the bulk of the tax burden is borne by the middle class. Across the full sample, the mean share borne by those living between \$1.25 and \$13 a day is 78.1% while the mean share borne by those between \$2 and \$13 is 62.0%. In half the countries the share borne by those between \$1.25 and \$13 a day exceeds 86.5% while it exceeds 73.2% for \$2 and \$13 interval. Also note that the measures obtained when one includes the middle class in the tax base for redistribution do not exhibit the same degree of separation as when it is excluded; indeed, there is no sign of bi-modality for the \$1.25 poverty line (panel (b) of Figure 2). Note, however, that $\tau_1(z_p, z_p)$ is 100% or higher for seven countries using $z_p = \$1.25$ and 24 countries using \$2. Thus $\tau_1(z_p, z_r) > 1$ for all $z_r > z_p$ (noting that $\tau_1(z_p, z_r)$ is strictly increasing in z_r), implying that Medeiros's (2006) "affluence line" does not exist for these countries.

Armed with the τ_k measure, we can turn now to the question posed in the title of this paper. There are many combinations of parameters, but the main results can be illustrated well with a few graphs. Figure 3 plots $\tau_k(1)$ against the survey mean while Figure 4 does the same for private consumption expenditure (PCE) per capita from the national accounts (matched as

closely as possible to the survey year). Figures 5 and 6 plot $\tau_k(1)$ for k=0.5, 1.5 against PCE.[19] Figure 7 gives a similar plot for τ_1 using $2.00 a day. Each figure gives the conditional mean tax rate at each level of PCE calculated using a non-parametric regression function.[20]

We see that better-off countries (in terms of the mean) tend to require lower marginal tax rates. The one third (29) of countries for which the estimate of $\tau_1(1)$ is 100% (or higher) tend to be the poorest countries; two thirds (19) of those countries are in Sub-Saharan Africa. The average tax rate (τ_1) for the 48 countries with PCE under $2,000 per year is 70% for the $1.25 line and 81% for the $2 line. These are clearly very high MTRs by any standards. Even with k=0.5 the required MTR is 100% for 20 of the 48 countries with PCE under $2,000, and it is over 50% for the majority. The mean $\tau_{0.5}$ is 59% and the median is 60%.

Overall there is a reasonably strong negative correlation between τ_k and PCE; for example, the correlation coefficient is -0.70 for $\tau_1(1)$ and -0.76 for $\tau_1(2)$,[21] and the elasticity of $\tau_1(1)$ w.r.t. PCE (as estimated by a log-log regression) is -2.37 (t=-12.66) and -1.72 (t=-11.03) for $\tau_1(2)$.[22] The relationship is nonlinear in logs, as can be seen from the following regressions:

$$\ln \tau_{1i}(1) = \underset{(-2.72)}{-8.18} + \underset{(5.23)}{7.03} \ln PCE_i - \underset{(-6.78)}{0.97} (\ln PCE_i)^2 + \hat{\varepsilon}_i \quad R^2=0.73;\ n=87 \qquad (5.1)$$

$$\ln \tau_{1i}(2) = \underset{(-3.73)}{-9.49} + \underset{(6.47)}{7.25} \ln PCE_i - \underset{(-7.87)}{0.93} (\ln PCE_i)^2 + \hat{\varepsilon}_i \quad R^2=0.72;\ n=87 \qquad (5.2)$$

Nonetheless, the turning point is at a low level—a PCE of around $450 per year for the $1.25 line and $600 per year for $2.

As mean consumption rises, the average MTR falls sharply, to 20% or less for countries with PCE over $2,000 per year (for the $1.25 a day line) or $4,000 a year for the $2 line. For the 17 countries in the sample with PCE of $4,000 a year or higher the average tax rate required to fill the $1.25 a day poverty gap is 0.8%, and that required for the $2.00 poverty line is 2.4%. These are very low tax burdens. It is clearly the sharp economic gradient at middle levels (with PCE between $1,000 and $3,000) that creates the bi-modality evident in Figure 2.

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[19] For most of the figures I use PCE rather than the survey means for two reasons. First, past classifications of countries used in assessing aid allocations have been based on the national accounts. Second, there are concerns that the relationship with the survey mean is contaminated by common measurement errors. However, the main results are robust to this choice.

[20] These are kernel regressions using the *Eviews* default parameters.

[21] The correlations are slightly stronger using the survey means (r=-0.72 and -0.81).

[22] All t-ratios are based on White standard errors, to correct for heteroskedasticity.

Nonetheless there is an overlap in the support of the distributions of PCE amongst low capacity versus high capacity countries. Using 10% as the cut-off point for $\tau_1(1)$ divides the sample in two roughly equal groups (40 countries have $\tau_1(1)$ <10%, 49 have $\tau_1(1)$ >10%,). Figure 8 gives the density functions of PCE for these two groups. Amongst the 48 countries with PCE less than $2,000 (slightly above the median of $1718) one finds that six are high capacity countries ($\tau_1(1)$ <10%) while amongst the 39 countries with PCE over $2,000, six are low capacity countries.

There is evidently a sizable variance around the conditional means in these Figures; at any given level of mean consumption some countries have a greater capacity for redistribution to the poor than others. Amongst the countries with PCE under $2,000 the value of $\tau_1(1)$ varies from 1% to 100%, with a standard deviation of 39% (and mean of 68% as already noted). The required tax rates exceed 50% for 31 of the 48 countries with PCE under $2,000. But the tax rates are less than 30% for 13 of these countries, though they fall off sharply below that figure, with eight countries amongst those with PCE under $2,000 having $\tau_1(1)$ <20% and six having $\tau_1(1)$ <10%. The distribution is much tighter at relatively high consumption levels; for example, the range for $\tau_1(1)$ amongst countries with PCE over $4,000 is 0.1% to 5.9%, with a standard deviation of 1.5% (and mean of 0.8%).

In principle, there are two possible (proximate) reasons why some poor counties have unusually low τ_k 's given their mean: they could have low $PG(z_p)$'s or high $PG(z_r)$'s (equation 3). Empirically both factors appear to be important. If one focuses on the 48 countries with PCE less than $2,000, their mean *PG*(1) is 15.3% and mean *PG*(13) is 83.2%; the sub-sample of 17 countries have mean *PG*(1) is 11.2% and mean *PG*(13) is 81.7%. The poor countries with relatively greater capacity for redistribution tend to be those with less poverty (by both developing country and US standards), possibly reflecting past policies as well as historical/institutional conditions.

However, it is clear that this high conditional variance at low PCE is not due to differences in the degree of inequality as conventionally measured. When the log Gini index is added to equation (5.1) it has a positive coefficient of 0.72 but this is not significantly different from zero (t=0.87); when added to (5.2) the coefficient is 0.03 (t=0.05). (The natural Gini was

similarly insignificant when added to (5.1) or (5.2).) Nor was there any sign of a significant interaction effects between PCE and the Gini index. One can question whether the Gini index is the best measure of inequality for this purpose. I also tried the quintile shares and the ratio of the top quintile's share to that of the poorest quintile and poorest two quintiles, but these were individually and jointly insignificant when added to either (5.1) or (5.2). It is clearly not those developing countries with high (or lower) inequality that have a greater capacity for redistribution to the poor at a given mean.

Comparing the values of τ_k between the earliest survey and the latest, one finds a strong correlation (r=0.67 for both the \$1.25 and \$2 lines). Table 2 gives the contingency table. The two clear and persistent country groupings evident in Figure 2 were also present in the earlier survey rounds, namely those countries with a low capacity for redistribution (τ_k =100%) and those with τ_k < 20%, say. I also found that the pattern in the relationship with PCE was fairly similar in the earlier surveys to Figures 3-7. However, the elasticities w.r.t. PCE tended to be lower; the regression-based elasticities were -1.38 (t=-6.75) for $\tau_1(1)$ and -0.81 (t=-6.21) for $\tau_1(2)$ for the earlier surveys (as compared to -2.37 and -1.72 respectively for the latest available surveys). It appears that a steeper economic gradient in the capacity for redistribution has emerged over time.

Turning to the relationship between changes in τ_k over time and economic growth rates, Table 3 gives the estimated growth elasticities of $\tau_1(1)$ as well as for the poverty gap; the elasticities are estimated by the regression coefficients of the annualized log differences of each variable on the annualized log difference of the mean, with a control for the log of the initial mean so as to pick up the aforementioned fact that the elasticity has risen over time. Results are given for both the survey mean and PCE per capita. The precise elasticities are sensitive to that choice.[23] Nonetheless, some clear patterns emerge. Growth tends to reduce the poverty gap and increase the capacity for redistribution, and these effects are statistically quite strong, though more so for the survey means than consumption from the national accounts. However, it is also clear that there is a large variance in the impact of a given rate of growth on the capacity for

[23] Correlated measurement errors in the survey means and the poverty measures are probably biasing upwards the latter regression coefficient, but there is also likely to be an attenuation bias in the regression coefficient using PCE growth rates due to poor matching of survey dates with national accounting periods and differences in what is being included in the two measures.

redistribution; even for the growth rates in the survey means, the values R^2 in regressions for the annualized log difference in $\tau_1(1)$ and $\tau_1(2)$ are only about 0.39 and 0.29 respectively.

Table 3 also gives the growth elasticities for the measure of "poverty-reduction failure"(PRF) proposed by Kanbur and Mukherjee (2007). The following special case of their class of measures is used, corresponding to the poverty gap index:

$$KM(z_p) \equiv [\mu - (1 - PG(z_p))z_p]PG(z_p)/z_p \quad (6)$$

This measure also has a negative growth elasticity for the \$1.25 poverty line, though it is smaller and with a lower t-ratio than for $\tau_1(1)$,[24] and drops even further using the \$2 line (Table 3). In fact the PRF index co-moves with the MTR. Across the 89 countries in this study there is a strong positive relationship; the regression coefficient of $\ln KM(1)$ on $\ln \tau_1(1)$ is 0.36 (t=9.80) while it is 0.17 (t=3.34) for the \$2 line. Comparing growth rates instead, the regression coefficient of the annualized log difference in $KM(1)$ on the annualized log difference of $\tau_1(1)$ is 0.49 (t=7.88) while it is 0.23 (t=4.02) using the \$2 line.[25] Countries with greater poverty-reduction failure tend to be the ones with lower capacity for redistribution (and this holds for changes over time as well as in levels).

Finally, consider the "basic-income" schemes described in section 3. It is plain that these will require higher marginal tax rates on the rich, but how much higher? For a basic income scheme in which every person receives z_p the implied MTR exceeds 100% for all except 21 countries, and the lowest tax rate is 25.4%. Again the tax rates tend to be lower for less poor countries; the correlation coefficient with PCE is -0.52. But amongst the 48 countries with PCE under \$2,000 (say), in only three cases is the required tax rate less than 100%.

For the basic income scheme providing a uniform transfer of the mean poverty gap to everyone, the tax rates are less than 100% for 45 countries (a median of 99%) and are as low as 5%. For six countries the tax rates under 10%, and for 14 they are under 20%. Figure 9 plots the

[24] This is to be expected given that there is a positive growth effect on the incomes of the non-poor, so that the PRF index has a lower elasticity than the poverty gap; on the other hand, the positive growth effect on the incomes of the rich means that the growth elasticity of the marginal tax rate is higher (in absolute value) than is the elasticity of the poverty gap.

[25] This positive co-movement between these two measures might be surprising given that $\tau_1(z_p)$ deflates the poverty gap by the incomes of the "rich" while $KM(z_p)$ inflates it by the incomes of the "non-poor." However, this effect is dominated by the common dependence of the two measures on the poverty gap.

tax rates against PCE per capita.[26] The correlation coefficient is -0.64; the relationship is clearly weaker than for $\tau_1(1)$ (comparing figures 4 and 9). The tax rates are 100% or more for 33 of the 48 countries with PCE under $2,000 (say).

These basic income schemes would clearly require prohibitive marginal tax rates on the rich for most (though not all) countries and especially amongst the poorest countries. The tax rates drop if instead one treats all those who are not poor ($y > z_p$) as the tax base, rather than just those who are not poor by US standards. The MTRs on the non-poor needed to assure a basic income of $1.25 a day are then less than 100% for 59 countries, with an overall mean of 58.1% and median of 53.2%. The lowest rate is 10.2% and there are 19 countries for which the tax rate is less than 20%. Figure 10 plots the required tax rate against PCE. However, the required MTRs are still prohibitively high for the bulk of countries with PCE under $2,000; for this group of 48 countries, the mean tax rate is 82.9% and it is 100% for 28 of them.

5. Conclusions

In assessing a developing country's capacity for attacking poverty with its own resources, a potential aid donor will presumably prefer the richest citizens of that country to carry the largest burden and (in particular) the donor will not want people to contribute if they are poor by rich-country standards (whether they live in a rich country or a poor one). Yet the results reported here indicate that past measures of the capacity for redistribution (implicitly) impose the bulk of the cost on people who would be considered poor in rich countries. The proposed alternative measures makes a more appealing assumption about how the burden is to be allocated amongst those living above the poverty line: the burden is set to zero until one reaches a standard of living that would not constitute poverty in a representative rich country, and then rises as a share of income in excess of the rich-country poverty line.

On implementing this measure using data for 90 developing countries, the paper finds that developing countries fall into two distinct groups. The first appears to have little or no scope for making a serious impact on the problem of extreme poverty through internal redistribution from those who are not poor by Western standards. The second group appears to have far more scope for such redistribution. Most of the poorest countries in terms of mean consumption fall

[26] There are so few countries with a tax rate less 100% for the first basic income scheme that the Figure is uninformative.

into the first group. The marginal tax rates needed to fill the poverty gap for the international poverty line of $1.25 a day are clearly prohibitive (marginal tax rates of 100% or more) for the majority of countries with consumption per capita under $2,000 per year at 2005 PPP. Even covering half the poverty gap would require prohibitive MTRs in the majority of poor countries. Yet amongst better-off developing countries—over $4,000 per year (say)—the marginal tax rates needed for substantial pro-poor redistribution are very small—less than 1% on average, and under 6% in all cases.

Of course the capacity for redistribution varies amongst countries at any given level of mean consumption. And the variance is highest amongst the poorest countries; there are even a few of poor countries where the poverty gap could be covered by seemingly light taxation of the rich. (Similarly, there is a sizeable variance in the impact of a given rate of growth on the capacity for redistribution.) These differences bear little relationship to a standard measure of inequality, but reflect the deeper parameters of the distribution of income in each country that have generated lower poverty to start with.

Basic-income schemes financed by progressive income taxes also require prohibitive marginal tax rates in the poorest half of developing countries. Indeed, if the tax burden is confined to those who are not poor by developed-country standards, then providing a basic income of $1.25 a day would call for marginal tax rates of 100% or more for three-quarters of countries. Even for middle-income developing countries, this type of redistribution only starts to look feasible if one allows for a basic income appreciably less than $1.25 a day and/or significant tax burdens on the middle class.

This inquiry offers support for focusing development aid on poorer countries—on the grounds that they have less scope for addressing poverty internally. The emphasis often given to the role of economic growth for poverty reduction in poor countries can also claim support from these findings, given that they cast doubt on the feasibility of redistribution from the rich to the poor as a poverty-reduction strategy in poor countries. While the poorest countries appear to have weak capacity for attacking poverty through income redistribution—given the sheer weight of poverty and thinness of the rich strata in their starting distribution— with sufficient economic growth the tax rates on the rich required for covering the poverty gap start to fall rapidly. So it makes sense for the relative emphasis on growth versus redistribution, and the reliance on external aid, to change with the level of economic development.

This paper's various measures of the capacity for redistribution clearly leave out things that would be relevant to a complete assessment at country level. The paper has focused on what can be thought of as the "first-order" constraint on redistribution from the rich to the poor, stemming from the properties of the initial distribution of income. There are other country-specific constraints that could be important in practice (though they are also ignored by past measures of the potential for redistribution and poverty reduction failure). There will of course be country-specific administrative costs in implementing both the taxes and the transfers needed. There will also be efficiency costs that one would want to bring into a complete assessment of the capacity for redistribution. There may well be benefits too, such as when redistribution relieves credit constraints facing poor investors (including in human capital). To some extent these costs and benefits are endogenous to policy choices, and should not then be considered constraints. But it can still be acknowledged that the measure used here is missing some country-specific constraints on the scope for redistribution. Arguably, taking account of the administrative costs and incentive effects would expand the size of the first group of countries (for which there is less scope for redistribution). However, there may well be efficiency gains (notably though the relaxation of credit constraints facing the poor) with the opposite effect.

Some of these other factors will no doubt also vary with the overall level of economic development. It does not seem plausible that these costs would tend to be lower in poor countries; indeed, if anything one would expect the opposite, to the extent that economic development brings greater governmental capacity for effective intervention in most areas of the economy. I would conjecture that a broader accounting of the factors relevant to the capacity for redistribution would strengthen this paper's main finding that poorer countries tend to have less scope for domestically financing a redistribution strategy for fighting extreme poverty.

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Figure 1: Cumulative distribution of income

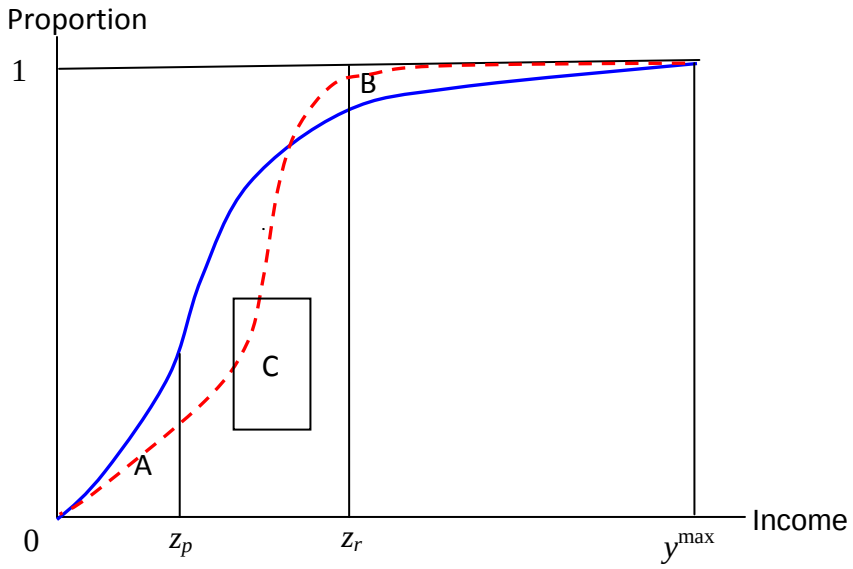
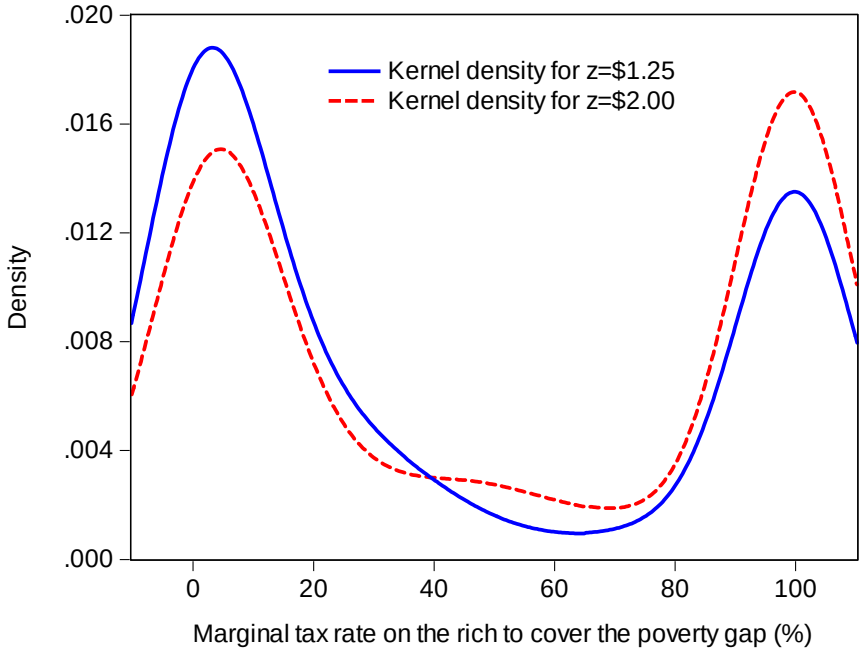


Figure 2: Density functions for marginal tax rate needed to cover the poverty gap for $1.25 a day and $2.00

(a) This paper's measure, excluding the middle class from the tax base for redistribution



(b) Including the middle class in the tax base

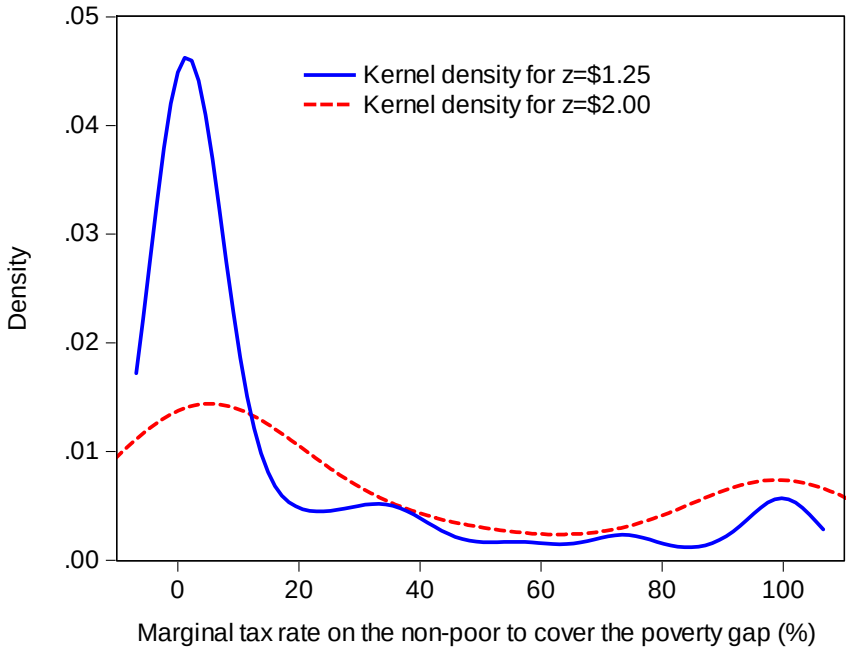


Figure 3: Marginal tax rate needed to cover the poverty gap for $1.25 a day poverty line plotted against survey means

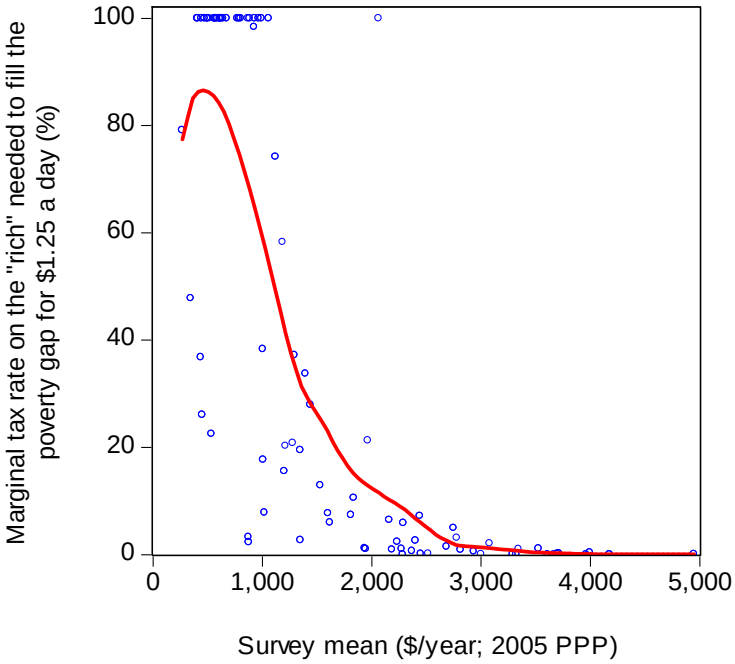


Figure 4: Marginal tax rate needed to cover the poverty gap for $1.25 a day poverty line plotted against PCE

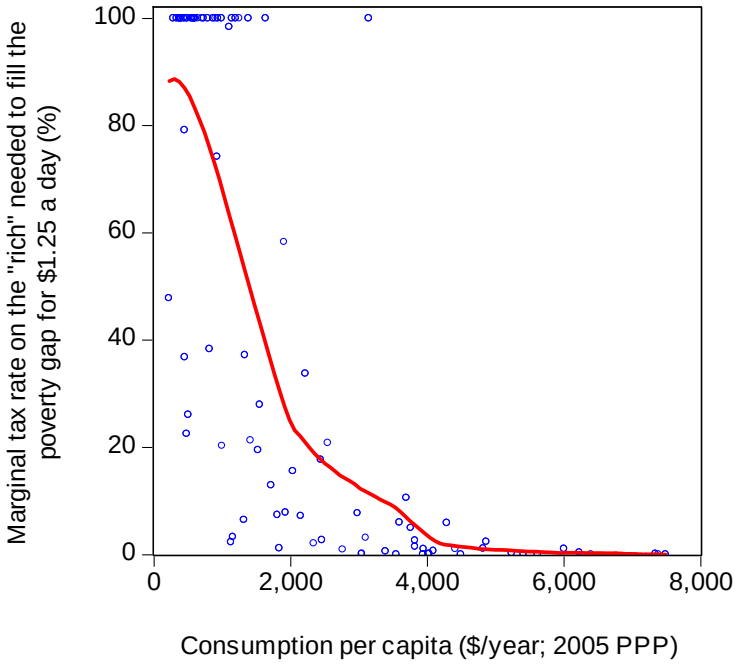


Figure 5: Marginal tax rate needed to cover half the poverty gap for $1.25 a day

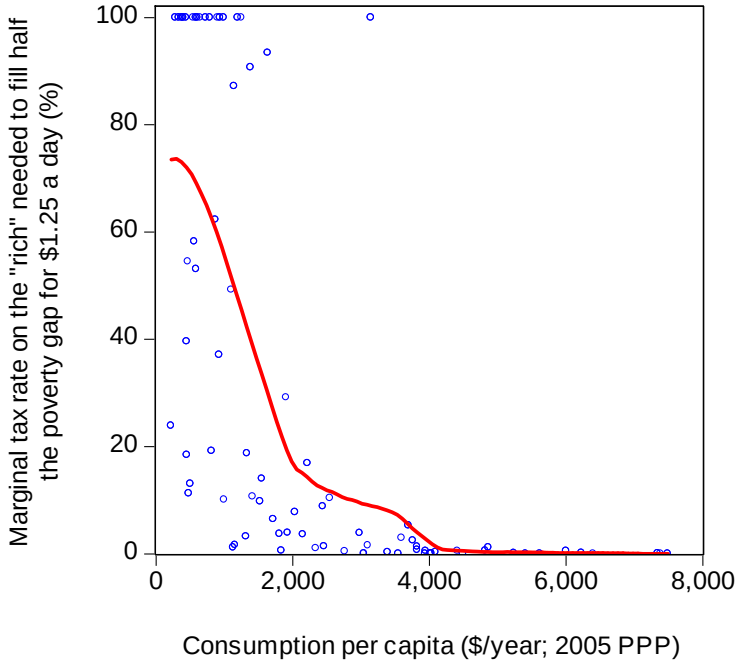


Figure 6: Marginal tax rate needed to cover 1.5 times the poverty gap for $1.25 a day

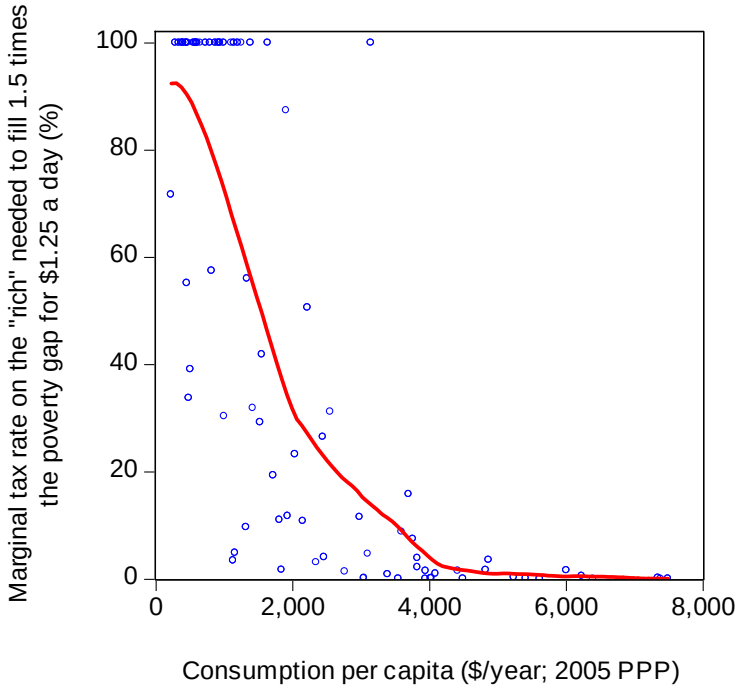


Figure 7: Marginal tax rate needed to cover the poverty gap for $2 a day poverty line

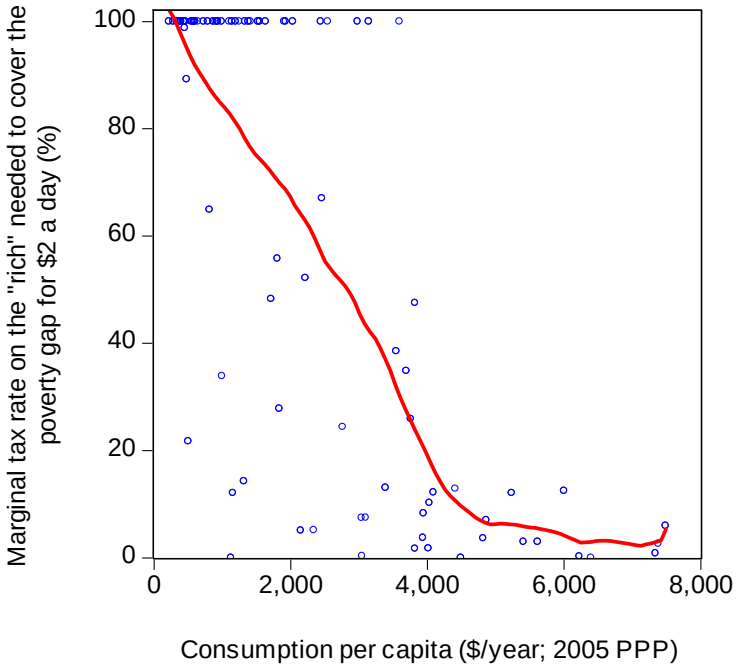


Figure 8: Distribution of consumption amongst countries

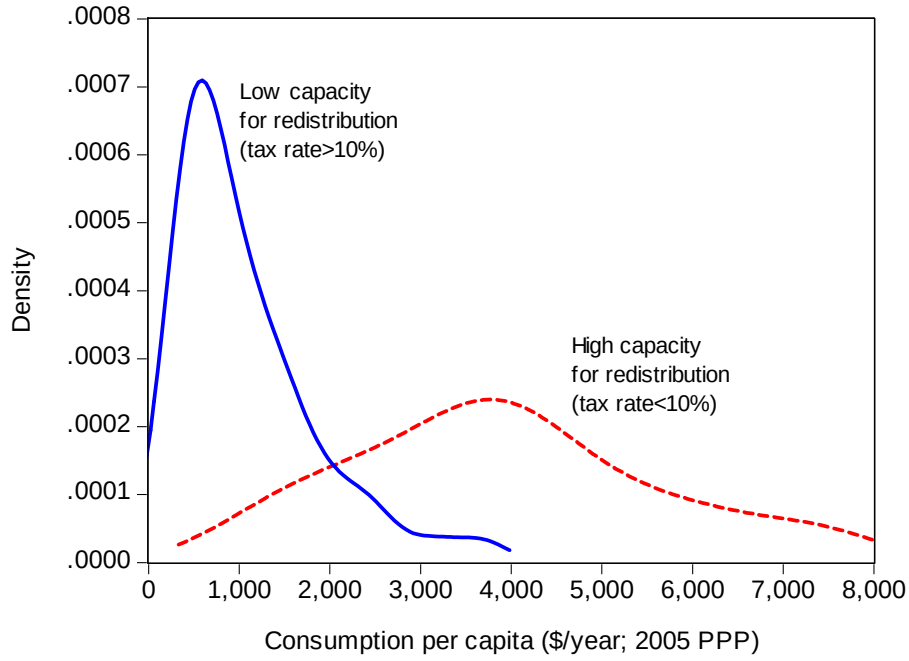


Figure 9: Marginal tax rates on the rich im[plied by basic income of the mean poverty gap

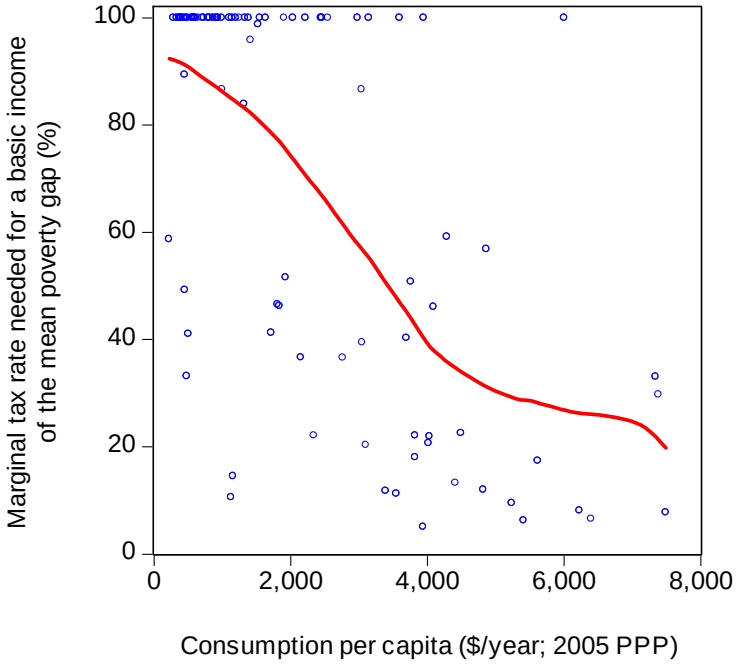


Figure 10: Marginal tax rates on those living above $1.25 a day needed to provide a basic income of $1.25 a day

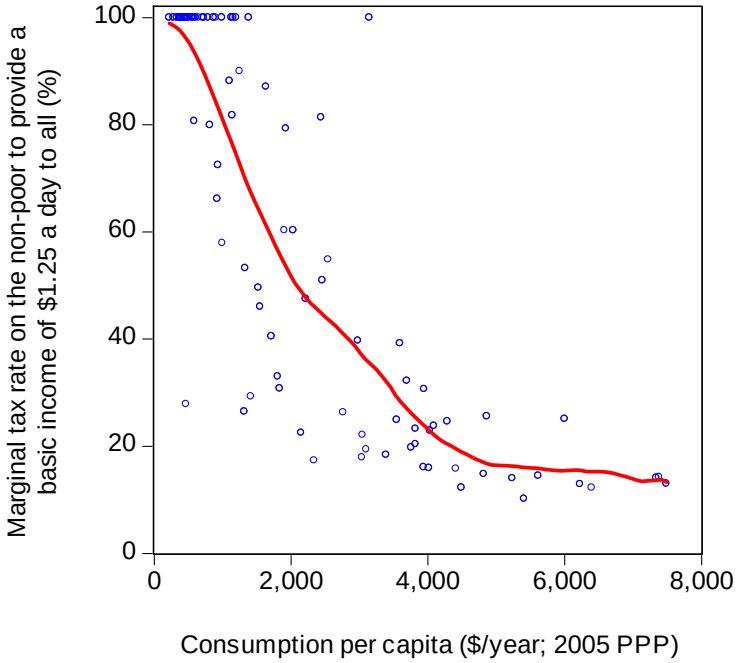


Table 1: Poverty gap indices and implied marginal tax rates on those living over $13 a day needed to cover poverty gaps for those living under $1.25 and $2 a day

			Poverty gap index ($PG(z)$)			Marginal tax rate (τ_k)	
	Survey year	Survey mean ($\bar{y}$) ($/month)	z_p=$1.25	z_p=$2	z_r=$13	z_p =$1.25	z_p =$2
Albania	2005	162.16	0.17	1.45	60.63	1.00	8.50
Algeria	1995	120.12	1.36	6.45	70.09	27.94	100.00
Argentina	2005	332.99	0.99	3.59	41.9	0.36	1.32
Armenia	2003	84.03	1.93	11.27	79.8	17.65	100.00
Azerbaijan	2005	135.06	0.01	0.04	65.86	5.97	23.89
Bangladesh	2005	47.46	13.08	33.81	87.86	100.00	100.00
Bolivia	2005	203.51	9.7	15.48	61.5	7.19	11.47
Bosnia and Herzegovina	2004	347.92	0.07	0.18	30.68	0.04	0.09
Botswana	1993.9	127.71	11.04	22.29	75.94	12.88	26.00
Brazil	2005	278.68	1.59	5.93	44.37	1.03	3.84
Burkina Faso	2003	46.85	20.27	39.26	88.47	100.00	100.00
Burundi	2006	28.96	36.39	56.06	100	47.75	73.56
Cambodia	2004	64.43	11.32	27.99	84.58	100.00	100.00
Cameroon	2001	77.28	10.17	23.65	81.45	98.35	100.00
Central African Republic	2003	41.78	28.3	45.3	89.43	100.00	100.00
Chile	2003	412.3	0.27	1.27	33.5	0.07	0.32
China	2005	107.90	4.07	12.59	73.76	37.19	100.00
Colombia	2003	231.62	6.05	10.88	60.08	3.12	5.60
Costa Rica	2005	309.35	0.49	2.3	42.77	0.22	1.05
Côte d'Ivoire	2002	101.11	6.82	17.62	77.67	20.23	52.26
Djibouti	2002	93.5	5.29	14.58	77.04	74.13	100.00
Dominican Republic	2005	244.61	0.89	4.32	52.76	0.58	2.84
Ecuador	2005	229.33	3.16	7.64	48.12	4.96	12.00
Egypt, Arab Rep.	2004.5	112.51	0.39	3.45	72.92	2.73	24.14
El Salvador	2003	172.05	6.7	11.61	57.08	100.00	100.00
Ethiopia	2005	51.36	9.6	28.86	87.13	100.00	100.00
Gambia, The	2003	80.59	12.05	24.88	80.71	100.00	100.00
Georgia	2005	116.46	4.36	10.93	71.79	33.73	84.56
Ghana	2005.5	77.7	10.49	22.31	80.89	100.00	100.00
Gautemala	2006	200.24	3.46	8.94	62.22	2.59	6.68
Guinea	2003	36.99	32.24	50.25	90.77	100.00	100.00
Guinea-Bissau	2002	48.43	16.52	34.83	87.76	100.00	100.00
Guyana	1998	180.14	3.9	6.94	60.26	6.44	11.47
Honduras	2005	163.9	10.18	16.73	63.15	21.27	34.95
India	2004.5	53.49	10.56	29.46	86.66	100.00	100.00

Indonesia	2005	85.06	2.43	12.85	81.47	7.83	41.41
Iran	2005	197.67	0.34	1.8	54.9	0.67	3.54
Jamaica	2004	274.33	0.02	0.92	46.57	0.01	0.55
Jordan	2006	210.05	0.1	0.62	53.29	0.15	0.93
Kazakhstan	2003	133.69	0.48	3.91	66.79	7.69	62.67
Kenya	2005.4	112.42	6.1	15.11	74.58	19.47	48.23
Kyrgyz Republic	2004	73.11	4.43	16.84	100	2.30	8.75
Lao PDR	2002.2	51.08	12.11	31.05	87.13	100.00	100.00
Lesotho	2002.5	72.38	20.76	33.05	82.53	100.00	100.00
Lithuania	2004	308.1	0.2	0.46	35.61	0.14	0.33
Macedonia	2003	276.87	0.12	0.65	41.86	0.10	0.53
Madagascar	2005	44.82	26.52	46.93	100	22.48	39.79
Malawi	2004.3	34.12	32.31	51.78	91.5	100.00	100.00
Malaysia	2004	204.31	0.06	1.37	53.2	0.12	2.70
Mali	2006	49.13	18.79	36.5	87.61	100.00	100.00
Mauritania	2000	88.33	5.66	15.89	77.87	100.00	100.00
Mexico	2006	330.37	0.13	0.96	41.34	0.05	0.37
Moldova, Rep.	2004	106.75	1.68	7.88	73.78	20.79	97.51
Mongolia	2005	72.88	6.24	17.24	100	3.25	8.99
Morocco	2007	161.42	0.54	3.15	63.67	1.16	6.74
Mozambique	2002.5	36.58	35.4	53.56	100	36.77	55.64
Nepal	2003.5	56.18	19.71	37.82	87.42	100.00	100.00
Nicaragua	2005	151.18	5.23	12.26	68.6	7.36	17.24
Niger	2005	41.46	28.08	46.65	90.1	100.00	100.00
Nigeria	2003.7	39.46	29.57	46.89	90.02	100.00	100.00
Pakistan	2004.5	65.76	4.35	18.74	83.6	100.00	100.00
Panama	2004	293.93	2.7	6.82	49.15	1.10	2.79
Paraguay	2005	256.62	3.42	7.33	51.1	2.05	4.40
Peru	2005	224.04	1.96	6.27	56.12	1.47	4.72
Philippines	2006	98.99	5.48	16.35	75.87	58.25	100.00
Poland	2005	305.54	0.04	0.12	35.65	0.03	0.09
Romania	2005	189.66	0.3	0.86	54.75	1.06	3.04
Russia	2005	300.95	0.04	0.26	37.74	0.03	0.18
Rwanda	2000	33.76	38.21	55.68	92.03	100.00	100.00
Senegal	2005	66.86	10.8	24.66	83.19	100.00	100.00
Sierra Leone	2003	51.2	20.3	37.53	87.16	100.00	100.00
Slovak Republic	1996	348.4	0.02	0.31	23.17	0.02	0.26
South Africa	2000	153.14	8.18	18.31	68.72	10.55	23.62
Sri Lanka	2002	100.06	2.64	11.85	76.33	15.52	69.66
Swaziland	2000.5	47.15	29.38	45.84	88.93	100.00	100.00
Tajikistan	2004	73.72	5.06	16.76	81.4	100.00	100.00
Tanzania	2000.4	22.5	46.84	64.38	100	79.11	100.00
Thailand	2004	190.47	0.03	1.95	58.23	0.05	2.93

Trinidad and Tobago	1992	186.26	1.05	3.88	57.16	2.37	8.74
Tunisia	2000	182.41	0.46	3.01	58.61	0.93	6.10
Turkey	2005	234.6	0.88	2.64	50.6	0.85	2.56
Turkmenistan	1993	37.66	25.82	44.86	100	26.05	45.27
Uganda	2005	52.68	19.11	36.37	86.99	100.00	100.00
Ukraine	2005	250.21	0.04	0.12	41.16	0.09	0.26
Uzbekistan	2003	51.42	15.04	33.18	87.26	100.00	100.00
Venezuela	2005	190.84	4.51	8.37	59.08	5.90	10.95
Vietnam	2006	82.78	4.62	16.2	79.32	100.00	100.00
Yemen, Rep.	2005	84.02	4.18	14.76	79.8	38.32	100.00
Zambia	2004.25	43.11	32.76	48.27	89.36	100.00	100.00
Mean (unweighted)	2003.37	141.05	9.43	18.60	70.37	41.59	52.43

Note: calculations from *PovcalNet*.

Table 2: Contingency table for marginal tax rates from earliest and latest available surveys

Count of number of countries		Marginal tax rate for latest available survey (k=1; %)						
		[0, 20)	[20, 40)	[40, 60)	[60, 80)	[80, 100)	100	**Total**
		z_p=\$1.25 a day (Phi=0.89; Cramer's V=0.44)						
Marginal tax rate for earliest available survey (k=1; %)	[0, 20)	35	5	0	1	0	4	**45**
	[20, 40)	4	0	0	1	0	3	**8**
	[40, 60)	3	0	1	0	0	1	**5**
	[60, 80)	0	2	0	0	0	0	**2**
	[80,100)	0	0	0	0	0	0	**0**
	100	3	3	1	0	1	21	**29**
	Total	**45**	**10**	**2**	**2**	**1**	**29**	**89**
		z_p=\$2 a day (Phi=0.89; Cramer's V=0.40)						
	[0, 20)	24	0	1	0	0	0	**25**
	[20, 40)	3	1	0	0	1	4	**9**
	[40, 60)	5	0	1	0	0	2	**8**
	[60, 80)	0	0	1	0	0	3	**4**
	[80,100)	1	0	1	0	0	2	**4**
	100	3	5	1	3	1	26	**39**
	Total	**36**	**6**	**5**	**3**	**2**	**37**	**89**

Table 3: Growth elasticities

	Elasticity with respect to growth in:	
	Survey mean	PCE from national accounts
Poverty gap for \$1.25 ($PG(1)$)	-2.72 (-5.41)	-1.39 (-2.44)
Poverty gap for \$2 ($PG(2)$)	-1.84 (-8.77)	-1.04 (-3.05)
Marginal tax to cover poverty gap for \$1.25 ($\tau_1(1)$) (truncated)	-3.42 (-4.47)	-1.55 (-2.15)
Marginal tax to cover poverty gap for \$1.25 ($\tau_1(1)$) (un-truncated)	-5.26 (-7.75)	-2.54 (-2.48)
Marginal tax to cover poverty gap for \$2 ($\tau_1(2)$) (truncated)	-2.79 (-5.34)	-1.39 (-2.81)
Marginal tax to cover poverty gap for \$2 ($\tau_1(2)$) (un-truncated)	-4.54 (-7.02)	-2.59 (-3.31)
Poverty reduction failure for \$1.25 ($KM(1)$)	-1.08 (-2.08)	-0.89 (-1.93)
Poverty reduction failure for \$2 ($KM(2)$)	0.04 (0.14)	-0.42 (-1.52)

Note: Regression coefficients of the annualized log difference in each variable on the annualized log difference in the survey mean or PCE per capita, with t-ratios in parentheses, based on White standard errors. All regressions included a control for the (log) initial mean or PCE. "Truncated" marginal tax rates are bounded above by 100%.