POLICY RESEARCH WORKING PAPER 2715

Paying for Health Care

Quantifying Fairness, Catastrophe, and Impoverishment, with Applications to Vietnam, 1993–98

Adam Wagstaff
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Egalitarian concepts of fairness in health care payments (requiring that payments be linked to ability to pay) are compared with minimum standards approaches (requiring that payments not exceed a prespecified share of prepayment income or not drive households into poverty). The arguments and methods are illustrated using data on out-of-pocket health spending in Vietnam in 1993 and 1998.

The World Bank
Development Research Group
Public Services for Human Development
November 2001

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Summary findings

Wagstaff and van Doorslaer compare egalitarian concepts of fairness in health care payments (requiring that payments be linked to ability to pay) and minimum standards approaches (requiring that payments not exceed a prespecified share of prepayment income or not drive households into poverty). They develop indices for both sets of approaches.

The authors compare the "agnostic" approach, which does not prespecify exactly how payments should be linked to ability to pay, with a recently proposed approach that requires payments to be proportional to ability to pay. They link the two approaches using results from the income redistribution literature on taxes and deductions, arguing that ability to pay can be thought of as prepayment income less deductions deemed necessary to ensure that a household reaches a minimum standard of living or food consumption.

The authors show how both approaches can be enriched by distinguishing between vertical equity (or redistribution) and horizontal equity, and show how these can be quantified. They develop indices for "catastrophe" that capture the intensity of catastrophe as well as its incidence and also allow the analyst to capture the degree to which catastrophic payments occur disproportionately among poor households. Their measures of the poverty impact of health care payments also capture both intensity and incidence.

To illustrate the arguments and methods, the authors use data on out-of-pocket health spending in Vietnam in 1993 and 1998—an interesting application, since 80 percent of health spending in that country was out-of-pocket in 1998. They find that out-of-pocket payments had a smaller disequalizing effect on income distribution in 1998 than 1993, whether income is measured as prepayment income or as ability to pay (that is, prepayment income less deductions, regardless of how deductions are defined). The underlying cause of the smaller disequalizing effect of out-of-pocket payments differs depending on whether the benchmark distribution is prepayment income or ability to pay.

The authors find that the incidence and intensity of catastrophic payments—in terms of both prepayment income and ability to pay—declined between 1993 and 1998, and that both the incidence and the intensity of catastrophe became less concentrated among the poor. They also find that the incidence and intensity of the poverty impact of out-of-pocket payments diminished over the period. Finally, they find that the poverty impact of out-of-pocket payments is due primarily to poor people becoming even poorer rather than the nonpoor becoming poor and that in Vietnam in 1998 it was not expenses associated with inpatient care that increased poverty but nonhospital expenditures.

This paper—a product of Public Services for Human Development, Development Research Group—is part of a larger effort in the group to investigate the links between poverty and health. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Hedy Sladovich, room MC3-607, telephone 202-473-7698, fax 202-522-1154, email address hsladovich@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at awagstaff@worldbank.org or vandoorslaer@econ.bmg.eur.nl. November 2001. (48 pages)

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We are grateful to Naoko Watanabe for help on work leading up to this paper, and to participants at a seminar at the World Bank for helpful comments on earlier related work.

Contents

1. Introduction

Much has been written recently about equity or fairness in health financing, the financial protection function of health systems, "catastrophic" health care costs, and the impoverishment associated with health care outlays. The World Health Organization (WHO), for example, in its 2000 World Health Report (WHR) *Health Systems: Improving Performance* (World Health Organization 2000) proposed and estimated values of a fairness of financing contribution (FFC) index, and argued that providing financial protection to households is an important goal of any health system. The International Labour Organization (ILO), in a forthcoming report *Toward Decent Work: Social Protection in Health for all Workers and their Families* (Baeza et al. 2001) discusses the importance of considering "catastrophic" health care costs and of modifying insurance systems to provide protection against them. Reflecting the importance of the theme in its *Voices of the Poor* consultative exercise (Narayan et al. 2000), the World Bank in its 2000/2001 World Development Report (WDR) *Attacking Poverty* (World Bank 2000) emphasized the impoverishing effects of ill health in general and of the costs of health care in particular. Furthermore, the 1997 strategy paper for its health sector (World Bank 1997) committed the Bank to "working with countries to reducing the impoverishing effects of ill health...."

Two distinct strands of thinking are evident in this debate. One is based on egalitarian notions of equity or fairness. A common theme here is that payments for health care ought to be linked not to usage of health services but rather to ability to pay, and the concern is with the degree of inequality in one or other variable. The other focuses on minimum standards. Here there is some divergence of view, but in each case the concern is not with inequality in any variable but rather with a variable exceeding or falling short of a threshold. One approach sets the threshold in terms of proportionality of income. The concern is to ensure that households do not spend more than some pre-specified fraction of their income on health care (call it z). Spending in excess of z is labeled "catastrophic". The idea is, in effect, to ensure that households have at least $(1-z)$ of their income to spend on things other than health care. The other approach sets the minimum in terms of the absolute level of income. The concern here is to ensure that spending on health care does not push households into poverty—or further into it if they already there. These two approaches are fundamentally different—neither is "right", and the choice between them must be made on normative and ideological grounds.

Our purpose in this paper is not to advocate a particular position, but rather to shed some new light on the measurement issues involved and to explore the inter-relationships between the various measures and the approaches. We present measures of fairness, catastrophe in health spending and impoverishment, relate them to the previous literature, and compare them with one another. We illustrate the various measures empirically using data on out-of-pocket payments for health care in Vietnam. This is not an uninteresting case study. In 1998, around 80% of health spending in Vietnam was paid out-of-pocket. Unsurprisingly, in the World Bank's recent *Voices of the Poor* consultative exercise (Narayan et al. 2000), payments for health care came across as a major concern of poor people in Vietnam. Three key changes occurred in Vietnam during the 1990s which make the study of Vietnam and the period chosen additionally interesting (World Bank et al. 2001). First, user fees in the public sector rose. The increase was especially pronounced for hospital care, where fees appear to have risen by over 1000% in real terms between 1993 and 1998, but were also noticeable in commune health centers even though these were still supposed to be free in 1998. Second, there was a large rise in fees for private clinics and doctors. These apparently rose by nearly 600% over the period 1993-98. Third, expenditures on drugs actually *fell* over the period 1993-98, due to a 30% fall in the real price of medicines during the period in question. The latter seems to have been due in part to deregulation of the pharmaceutical sector and in part to increased donor assistance in drug supplies. Fourth, social health insurance was introduced in 1993 (World Bank et al. 2001). Initially, this was on a compulsory basis for formal sector workers and civil servants. However, more recently the scheme has been opened up to others on a voluntary basis—including the family members of insureds. By 1998, 12% of the Vietnamese population was covered by social insurance, a little over half of these being covered on a voluntary basis. Compulsory social insurance covers some of the costs of both inpatient and outpatient care, and also pays for drugs used in inpatient treatment. The voluntary scheme has two levels of coverage, the less generous (and less expensive) of which covers only inpatient care, while the higher-priced more generous package includes outpatient care and some drug costs. Most voluntary enrollees have opted for the less costly package. Insurance coverage is most common among the higher income groups.

It is important to be clear what we are *not* doing in this paper. Any assessment of the fairness of a health care system requires looking not just at what people pay for health services *but also at how much they use services* (van Doorslaer, Wagstaff, and Rutten 1993). Health care payments and health service utilization are, in other words, both key "focal" variables whose distributions have to be examined in any assessment of the fairness of a health care system. For each focal variable there is a distribution that is

considered to be fair (the "target distribution"). The actual distribution of each focal variable reflects the characteristics of *both* the health care financing system *and* the health care delivery system. For example, the split between pre-payment and out-of-pocket payments influences not only the distribution of the prices people pay at the point of use for their health services (and hence the distribution of payments), but also their use of health services (and hence the distribution of utilization). Likewise, most characteristics of the health care delivery system (e.g. whether there is a GP who plays a gatekeeper function) influence not only the amount of health services people use (and hence the distribution of utilization) but also which type of services they use and hence how much they pay for them (and hence the distribution of payments). An assessment of whether a distribution of payments is fair is *not* therefore an assessment of whether the financing system is fair, any more than an assessment of whether a distribution of utilization is fair is an assessment of whether the delivery system is fair. Rather these exercises ought to be seen simply as assessments of "equity in health care payments" and "equity in health care utilization" respectively. In this paper, our focus is exclusively on the former. It therefore sheds light on only one of the two issues that need exploring in any analysis of equity in health care financing. Elsewhere we have suggested (Wagstaff, Van Doorslaer, and Paci 1991; Wagstaff and Van Doorslaer 2000) and employed (Van Doorslaer et al. 1992; Van Doorslaer et al. 2000) methods for assessing equity in the utilization of health care.

It is also worth being explicit about the rationales that underpin concerns over the two focal variables—health care utilization and payments for health care—since these are often not considered self-evident. Concern over the first can be thought of as deriving in part from the fact that health is considered a precondition for people to survive and flourish as human beings, in part from the fact that health is subject to potentially large "shocks" which are unforeseen and are rarely the result of a deliberate choice by the individual concerned, and in part from the presumption that health care is the appropriate way to restore health status following such a "shock" (Culyer and Wagstaff 1993). The rationale for the concern over the second focal variable also appears to derive in part from the fact that health care utilization is a response to an unforeseen and unsolicited "shock", but also in part from the fact that health care utilization can be sufficiently costly to represent a threat to a household's ability to purchase other goods and services that may, like health care, make a difference to its members' ability to survive flourish as a human beings (Culyer 1993). The most obvious example of these other goods and services is food. But clothing, shelter and energy are other important examples. Thus irrespective of whether a particular treatment enables a person to regain his or her former

health status following a health "shock", if the expenditure associated with it compromises the household's ability to feed itself, this in itself is a matter for concern.

The paper is organized as follows. We start in sections 2-4 with the egalitarian approach. The common theme here is that payments for health care ought to be linked not to usage of services but rather to ability to pay (ATP). The first strand of this literature we explore—in section 2—acknowledges the ATP principle and the motivation for it, but takes the view that since policy-makers rarely if ever specify either how ATP is to be defined or how payments should be linked to ATP, the best way forward is simply to measure the degree of progressivity of existing payments on gross income (Wagstaff et al. 1992; Wagstaff, van Doorslaer, van der Berg et al. 1999) or the degree of income redistribution resulting from this progressivity (Wagstaff and Van Doorslaer 1997; Van Doorslaer et al. 1999). Since no target distribution is specified for payments, this approach does not generate any information on the degree of inequity in the distribution of payments for health care. We call this approach the "agnostic" approach. The second strand of literature, which is more recent and which we explore in section 3, is more ambitious and tries to quantify inequity (World Health Organization 2000). It both defines ATP and stipulates what the relationship between payments and ATP should be. In sections 2 and 3, we employ the methods developed in the literature on the progressivity and redistributive effect of taxes (Lambert 1993; Pfahler 1990; Wagstaff and van Doorslaer 2001). These have been widely employed in the literature we cover in section 2 and have the advantages of being informative and having properties that are well understood. As one of us has argued elsewhere (Wagstaff 2000), these methods have advantages over the index proposed by WHO in its WHR and used to date in the second strand of the egalitarian literature. One of the aims of the present paper is, in fact, to ground the ATP approach in a sounder measurement methodology. Having done this in section 3, the paper then moves to section 4 where it is argued that although the methods employed in sections 2 and 3 are attractive, they have the disadvantage of focussing on vertical differences. They ignore the fact that much of the inequity in payments for health care arise from horizontal inequity, not least because people on a given income can spend quite different amounts depending on whether they are struck by illness. In section 4, we show how the measurement in both sections 2 and 3 can be improved by use of an approach that allows vertical and horizontal inequities to be quantified (Aronson, Johnson, and Lambert 1994; Aronson and Lambert 1994; Wagstaff and Van Doorslaer 1997; Van Doorslaer et al. 1999).

Sections 5 and 6 then address the minimum standards approaches. In section 5 we explore the idea that health care payments above a threshold can be considered "catastrophic" and we propose and implement a variety of measures that capture the

incidence and intensity of catastrophe in health spending. We also present measures that capture the degree to which catastrophic health spending is concentrated among the poor. Section 6 addresses the issue of impoverishment—the extent to which people are made poor—or more poor—by health spending. We present measures that capture the impoverishing effects of health spending, distinguishing between the incidence and intensity of impoverishment, and showing how one can assess the extent to which greater intensity is due to people being made even poorer by health spending or by people becoming poor through such spending. In our coverage of both catastrophic health spending and impoverishment, we illustrate the measures with data on out-of-pocket payments from Vietnam for both 1993 and 1998. In the case of impoverishment, we show the differential impacts of hospital costs and other health care spending. Section 7 contains a summary and offers some conclusions.

2. Progressivity and income redistribution

One approach, then, is simply to measure the degree of progressivity of the payments distribution and the income redistribution associated with it. Some theoretical results from the tax literature help clarify the relationship between these concepts, as well as the link between them and ability to pay.

2.1. Progressivity and redistributive effect: Some theoretical results

2.1.1. Progressivity

Let pre-payment income (the analogue of pre-tax income in the tax literature) be x, and health care payments be T (the analogue of taxes). There are two useful results from the tax literature. The first concerns progressivity. We can measure the progressivity using Kakwani's (1977) index. Denote Kakwani's index of progressivity of health care payments on pre-payment income by π_T^K, which is defined as twice the area between the Lorenz curve for pre-payment income, $L_X(p)$, and the concentration curve for health care payments, $L_C(p)$. (The p in parentheses here indicates the person's or household's rank in the pre-payment income distribution.) The concentration curve for payments is formed by plotting the cumulative share of payments on the vertical axis against the cumulative proportion of households (or individuals) ranked by pre-payment income on the horizontal axis (Figure 1). Thus we have:

$$(1) \qquad \pi_T^K = 2\int_0^1 \left[L_X(p) - L_T(p)\right]dp = C_T - G_X,$$

where G_X is the Gini coefficient for pre-payment income and C_T is the concentration index for health care payments. π_T^K is positive if the concentration curve for payments lies below the Lorenz curve for pre-payment income, indicating that payments are progressive on pre-payment income. A zero value of π_T^K indicates proportionality, while a negative value indicates regressiveness.

2.1.2. Redistributive effect and the link with progressivity

Progressivity of payments on pre-payment income implies that payments exert an equalizing effect on the income distribution. The income distribution will, in other words, be more equal "after" payments than "before". This can be seen from the second relevant result from the tax literature, which concerns redistributive effect. We can measure the redistributive effect as the reduction or increase in income inequality associated with the move from the pre-payment to post-payment income distributions. If we ignore any re-ranking of households in this process (an issue to which we return in section 4 below), we can measure redistributive effect using the Reynolds-Smolensky (RS) index (Reynolds and Smolensky 1977). Denote the RS index of redistributive effect of health care payments by π_T^{RS}, which is defined as twice the area between the Lorenz curve for pre-payment income, $L_X(p)$, and the concentration curve for post-payment income, $L_{X-T}(p)$ (Figure 1). Thus we have:

$$(2) \qquad \pi_T^{RS} = 2\int_0^1 [L_{X-T}(p) - L_X(p)]dp = G_X - C_{X-T},$$

where C_{X-T} is the concentration index for post-payment income. π_T^{RS} is positive if the concentration curve for post-payment income lies above the Lorenz curve for pre-payment income, indicating that payments reduce income inequality. A zero value of π_T^{RS} indicates zero redistributive effect, while a negative value indicates pro-rich income redistribution. The π_T^{RS} index is linked to the Kakwani index π_T^K by the following relationship:

$$(3) \qquad \pi_T^{RS} = \frac{1}{(1-t)}\pi_T^K,$$

where t is the payment share—i.e., the share that payments make up, on average, of pre-payment income. Thus redistributive effect is an increasing function of progressivity, so that payments that are progressive on pre-payment income make for a distribution of post-payment income that is more equal than the distribution of pre-payment income. This redistributive effect is larger the more progressive payments are on pre-payment income, and the larger is the payment share, t.

The measurement of progressivity and redistributive effect thus responds to the concern identified above with the distribution of health care payments, namely that redistributive effect tells us how much more unequal (or equal) health care payments make the distribution of income. This is clearly of interest if our concern is with the level and distribution of income households have available for purchasing food and other "necessities" after they have paid for their health care. But it does not tell us whether payments are equitably distributed. The second-sub-strand of literature covered in section 3 tries to do this.

2.2. Progressivity and redistributive effect of out-of-pocket payments in Vietnam

Before turning to this strand of literature, we present results on the progressivity and redistributive effect of out-of-pocket payments in Vietnam in the years 1993 and 1998. The data we use are taken from the 1992-93 and 1997-98 Vietnam Living Standards Surveys (VLSS) undertaken jointly by the government of Vietnam and the World Bank. For the purpose of this exercise, the household is taken as the sharing unit for income and payments (both being assumed to be shared equally across household members), but the individual is taken as the unit of analysis. In the case of the 1997-98 survey (which is not nationally representative) the sample is weighted using sampling weights. Household pre-payment income is measured by total household consumption, gross of out-of-pocket payments for health services. Household post-payment income is simply pre-payment income so defined *net* of out-of-pocket payments. Pre-payment and post-payment income are both defined to be gross of food consumption. Both pre-payment and post-payment income are defined on a per capita basis. Out-of-pocket payments are derived in both years from two questions on health spending over the last 12 months, one specifically on inpatient care, the other on all other goods and services associated with the treatment and diagnosis of illness and injury.

Table 1 shows, for each of the two years, the values of x (pre-payment income), T (out-of-pocket payments), t (the income share of out-of-pocket payments), G_X (the Gini coefficient for pre-payment income), C_T (the concentration index for out-of-pocket payments), π_T^K (the Kakwani index of progressivity of out-of-pocket payments on pre-payment income), C_{X-T} (the concentration index for post-payment income vis-à-vis pre-payment income), and π_T^{RS} (the Reynolds-Smolensky index of redistributive effect for out-of-pocket payments vis-à-vis pre-payment income). It shows that the income share t of out-of-pocket payments fell because income rose faster than out-of-pocket payments. Out-of-pocket payments were regressive on pre-payment income in 1993, but were close to proportional in 1998. Inequality in pre-payment income fell very slightly between 1993 and 1998, but inequality in out-of-pocket payments rose. The degree of

redistributive effect was negative (i.e., pro-rich) in both years but was much smaller in 1998 than 1993, in part because of the reduction in regressivity but in part because of the reduced share of out-of-pocket payments in pre-payment income (the reduction in t).

3. How much progressivity and income redistribution is fair?

Measuring the progressivity and redistributive effect of health care payments on pre-payment income does not tell us whether or not they are equitable *per se*. To answer this question one needs to adopt positions with respect to both the definition of ATP and the appropriate link between payments and ATP.

The WHO's 2000 WHR (World Health Organization 2000) does both. It argues that ATP should be defined as the household's non-food spending, this being argued to be a good indicator of a household's long-term "normal" living standards. One can think of this approach as taking the household's pre-payment income, deducting its food expenditure (as a proxy for non-discretionary expenditure), and then deducting (or adding) any income windfalls (or shortfalls) compared to the household's "normal" income. Denote ATP by y and any deductions allowed in moving from pre-payment income to ATP by $D(x)$. Thus we have:

$$y = x - D(x). \tag{4}$$

Using some results from the tax literature, we can explore this issue further and link the concept of ATP to the concepts of progressivity and redistributive effect.

3.1. Progressivity, redistributive effect and ATP: Some theoretical results

3.1.1. Progressivity and ability to pay

Following Pfähler (1990), the index of progressivity of health care payments on pre-payment income, π_T^K, can be decomposed into two parts: a part capturing the progressivity of payments on ATP; and a part capturing the progressivity of deductions on pre-payment income:

$$\pi_T^K = \pi_R^K - \frac{\delta}{(1-\delta)}\pi_D^K. \tag{5}$$

Here π_R^K measures the progressivity of payments on ATP, defined as

$$(6) \qquad \pi_R^K = 2\int_0^1 [L_Y(p) - L_T(p)]dp = 2\int_0^1 [L_{X-D}(p) - L_T(p)]dp = C_T - C_{X-D},$$

so that π_R^K is positive—and hence payments are progressive on ATP—if the concentration curve for ATP, y, lies above the concentration curve for payments, T. In eqn (5), δ is the average deduction rate; i.e., deductions, D, expressed as a proportion of pre-payment income, x. π_D^K in eqn (5) measures the progressivity of deductions on pre-payment income, and is defined as

$$(7) \qquad \pi_D^K = 2\int_0^1 [L_X(p) - L_D(p)]dp = C_D - G_X,$$

which is positive if the Lorenz curve for pre-payment income lies above the concentration curve for deductions.

From eqn (5), it is evident that the progressivity of payments on pre-payment income reflects not just the progressivity of payments on ATP, but also the progressivity of deductions on pre-payment income. Thus if deductions are a higher proportion of pre-payment income for the better-off than the poor (i.e., if D is progressive or income-elastic), π_D^K will be positive and deductions will exert a dampening effect on the progressivity of payments on pre-payment income. By contrast, if deductions are a smaller proportion of pre-payment income for the better-off than the poor (i.e., D is regressive or income-*inelastic*), π_D^K will be negative and deductions will exert an enhancing effect on the progressivity of payments on pre-payment income. Payments will be more progressive on pre-payment income the higher is δ (deductions as a proportion of pre-payment income) and the more income-inelastic deductions are.

One of the implications of this is that if one's interest is in seeing whether payments are appropriately linked to ATP, a progressivity analysis of payments on pre-payment income will not help. WHO (World Health Organization 2000) argues that payments for health care *should be proportional to ATP*. In other words π_R^K ought to be zero, or equivalently there should the same degree of inequality in payments as there is in ATP. In this sense, then, levying payments for health care in proportion to ATP is egalitarian. From eqn (5), it is clear that estimates of the progressivity of payments on pre-payment income cannot help us discern whether this condition is satisfied.

3.1.2. Redistributive effect and ability to pay

Similar problems arise in the context of redistributive effect. Following Pfähler (1990), the RS index of health care payments, π_T^{RS}, can also be decomposed into two

parts. The first part captures the redistributive effect deriving from the payment structure (vis-à-vis ATP), while the second captures the redistributive effect brought about by the deductions. We have:

$$(8) \qquad \pi_T^{RS} = \frac{(1-\delta-t)}{(1-t)}\pi_R^{RS} - \frac{t}{(1-t)}\pi_D^{RS},$$

where π_R^{RS} measures the redistributive effect of payments attributable to the relationship between payments and ATP. This is defined as:

$$(9) \qquad \pi_R^{RS} = 2\int_0^1 [L_{Y-T}(p) - L_{X-D}(p)]dp = C_{X-D} - C_{Y-T},$$

so that π_R^{RS} is positive—and hence the link between payments and ATP has a pro-poor redistributive effect—if the concentration curve for ATP lies below the concentration curve for income after health care payments *and* deductions, *Y-T*. In other words, π_R^{RS} is positive if there is more income inequality before payments (but *after* deductions) than after payments (and after deductions). In eqn (8), π_D^{RS} measures the redistributive effect associated with the deductions, and is defined as

$$(10) \qquad \pi_D^{RS} = 2\int_0^1 [L_{X-D}(p) - L_X(p)]dp = G_X - C_{X-D},$$

which is positive if the Lorenz curve for pre-payment income lies below the concentration curve for ATP.

From eqn (8), it is evident that the redistributive effect of payments is an increasing function of the redistributive effect deriving from the link between payments and ATP (assuming $1-\delta-t>0$), and is a decreasing function of the redistributive effect brought about by the deductions. The link with progressivity can be made clear by noting that by analogy with eqn (3), we have:

$$(11) \qquad \pi_R^{RS} = \frac{t}{(1-\delta-t)}\pi_R^K,$$

$$(12) \qquad \pi_D^{RS} = \frac{\delta}{(1-\delta)}\pi_D^K,$$

which upon substitution into eqn (8) yields:

$$(13) \qquad \pi_T^{RS} = \frac{t}{(1-t)}\pi_R^K - \frac{t\delta}{(1-t)(1-\delta)}\pi_D^K,$$

so that the redistributive effect of payments is an increasing function of the progressivity of payments on ATP and a decreasing function of the progressivity of deductions on pre-payment income.

If ATP and fairness are defined along the lines proposed by WHO, and a system achieves these desiderata, payments for health care in that system will bring about an amount of income redistribution equal to $-[t\delta/(1-t)(1-\delta)]\,\pi_D^K$. This is positive—i.e., post-payment income inequality will be less than pre-payment income inequality—if deductions are income-inelastic. Thus pro-poor income redistribution in the move from pre-payment to post-payment income is compatible with equity in the sense defined by WHO. But, of course, such redistribution could be due also—at least in part—to progressivity of payments on ATP, which would violate WHO's definition of equity. Simply knowing how redistributive health care payments are on pre-payment income (i.e., the value of π_T^{RS}) does not allow one to distinguish between these two scenarios.

3.2. Fairness of out-of-pocket payments in Vietnam

In section 2.2, it was established that over the period 1993-98 in Vietnam out-of-pocket payments became less regressive (indeed became mildly progressive) and the redistributive effect became less pro-rich (indeed became mildly pro-poor). These changes might be interpreted as equity-enhancing changes. But the Pfähler-type decompositions using the WHO definitions of ATP and fairness tell a less optimistic story (see column [a] of Table 2).

Over the period 1993 to 1998, food spending became less concentrated among the better-off (C_D fell). Looked at in terms of deductions and ATP, this means that poorer households had to shoulder a larger share of the burden of food expenses in 1998 than in 1993. Equity requires that this be borne in mind. Payments would need to have a less disequalizing (or more equalizing) effect on income to compensate for the shift in the distribution of food costs to the disadvantage of the poor. Thus the aforementioned evidence that out-of-pocket payments had a smaller pro-rich redistributive effect in 1998 than in 1993 does not necessarily mean that equity in the payments distribution increased. Some reduction in pro-rich redistributive effect would have been required simply to allow the poor to stand still—relatively speaking. To some degree, this imperative is reduced by the smaller share of food costs in 1998—reflected in the (slight) reduction of δ from 50.8% to 49.7%. Looking at π_R^K and π_R^{RS}, we see that out-of-pocket payments became less regressive on ATP in 1998 compared to 1993, and that this reduced regressiveness of out-of-pocket payments on ATP was associated with less income redistribution in 1998. But the changes were smaller than the changes *vis-à-vis* the pre-payment distribution.

Furthermore, as to be expected give the income-inelasticity of the food spending distribution, out-of-pocket payments are more regressive and produce a larger redistributive effect when assessed *vis-à-vis* the distribution of ATP than when assessed *vis-à-vis* the distribution of pre-payment income.

The upshot is that from the point of view of out-of-pocket payments, equity—defined à la WHO—improved between 1993 and 1998 but not by as much as is suggested by the progressivity and redistributive effect indices *vis-à-vis* pre-payment income. The reason is that over the period 1993-98 food spending became less concentrated among the better-off, so that although the distribution of pre-payment income became slightly more equal, the distribution of ATP became more *un*equal.

3.3. Some unresolved issues concerning fairness and ATP

The attraction of defining ATP and stipulating a target relationship between payments and ATP is that one ends up with a clear-cut answer to the question of whether a distribution of health care payments is equitable or not. The usefulness of adopting this approach is entirely contingent, however, on the acceptability of the value judgments made—that ATP can be defined as pre-payment income (or rather total household consumption) less food spending; and that equity requires that payments be *proportional* to ATP. Both are open to debate.

3.3.1. Should food deductions be flat rate?

The first is, in effect, the issue of how deductions, $D(x)$, ought to be defined to move from pre-payment income to ATP. One obvious question is whether one ought to deduct actual food spending or a food allowance indicating the cost of reaching a target level of nutrient intake (say, 2100 calories a day). Some people, of course, are so poor they have too little income to meet even such basic requirements. In Vietnam, in 1993, for example, 23% of individuals had too little money to purchase enough food to reach 2100 calories a day. In such cases, it seems sensible to set ATP equal to zero, in just the same way as someone whose pre-tax income is lower than the tax allowance is deemed (in the absence of a negative income tax system) to have zero taxable income.[1] Deducting an allowance for food costs will clearly alter the average of ATP and its distribution, as well as the deduction rate δ.

[1] Alternatively, the full cost of reaching 2100 calories could be deducted leaving such individuals with a negative ATP. Proportionality in this case would require that health care payments be *negative*, which is clearly an unhelpful benchmark.

Applying this idea to Vietnam in 1993 and 1998 produces the results indicated in column [b] of Table 2. The costs of reaching 2100 calories a day have been calculated to be 750 and 1287 thousand Dong respectively (current prices) (Glewwe, Gragnolati, and Zaman 2000). Column [a] for each year shows the effect of defining $D(x)$ as the per capita food spending of the individual's household, while column [b] shows the effect of deducting a food allowance corresponding to 2100 calories but constraining ATP to be non-negative. Unsurprisingly, the second case produces a distribution of deductions that is less pro-rich than the first case (cf. the values of C_D). The value of δ (the average deduction rate) falls in the move from full deductibility to the food allowance. The element of progressivity of payments on pre-payment income attributable to the deductions is higher for case [a] than case [b]. Unsurprisingly, because the progressivity of payments on pre-payment income remains the same, the regressiveness of payments on ATP rises. We conclude, therefore, that payments appear more regressive on ATP when the latter is defined as pre-payment income less a flat-rate food allowance than when it is defined as pre-payment income less actual food spending.

3.3.2. Should deductions reflect only food costs?

With respect to deductions, there is, of course, the issue of whether $D(x)$ should reflect food costs only or whether it should reflect other costs that might be considered to be non-discretionary. The costs of shelter (e.g. rent), clothes, heating and energy are obvious examples. But what about the costs of, say, water, garbage disposal and education? Again, there is the issue of whether one should deduct actual expenses incurred or whether one should deduct an allowance. The latter approach is less straightforward than in the case of food, where it is relatively easy to agree on a target level of food intake (say, 2100 calories a day) and then compute the cost of reaching it. The obvious alternative is to adopt the national or international poverty line as the appropriate value for $D(x)$. The difficulty with this is that it is intended to cover not just the costs of food and other key non-food items such as shelter, energy, clothing, and so on, but also the costs of health care. This is not a trivial issue in countries like Vietnam where around 5-6% of household consumption is devoted to out-of-pocket payments for health care. Clearly, one would need to adjust the national or international poverty line downwards to reflect this when coming up with a figure for $D(x)$.

We have done this exercise for Vietnam for 1993 and 1998, using the national poverty lines computed by the World Bank and the Government of Vietnam (Glewwe, Gragnolati, and Zaman 2000). These were constructed by computing the annual cost of reaching 2100 calories per person per day (in current prices 750 and 1287 thousand Dong in 1993 and 1998 respectively), and then adding to this amount a sum to cover non-food

consumption. In the case of 1993, the amount added was the average non-food spending of households in the third quintile (411 thousand Dong), this being the quintile whose average food intake came closest to 2100 calories per person per day. In the case of 1998, the figure of 411 thousand Dong was simply inflated by the value of the price index for non-food items with 1993 as the base year (1.225), giving a non-food element to the poverty line for 1998 of 1287 thousand Dong. We then took out from the non-food elements of the 1993 and 1998 poverty lines amounts to cover the costs of health care. In the case of 1993, people in the third quintile averaged 70 thousand Dong (current prices) per person per year on out-of-pocket payments for health care. We then computed a Laspeyres price index for the health sector for Vietnam for 1998, using data for 1993 and 1998 on contacts per person per year and out-of-pocket payments per contact, broken down by provider type and by quintile of per capita consumption (World Bank et al. 2001). For all quintiles combined, this gave a figure for 1998 of 1.289.[2] This compares to a figure for all non-food items of 1.225 and a figure for the overall CPI of around 1.430.[3] Applying this index value to the health spending component of the poverty line for 1993 gives a figure for 1998 of 90 thousand Dong (=70x1.289). The non-health poverty lines for 1993 and 1998 were thus 1091 and 1700 respectively, which were then used as values for $D(x)$. As in the case of the deductions for food costs, individuals with a negative ATP were assigned a zero ATP.

The results of this exercise are shown in column [c] of Table 2. Evidently, deductions are less regressive on pre-payment when defined in terms of an allowance for all goods and services (except medical care) than when defined in terms of simply an allowance for food (π_D^K is less negative). However, since δ is much larger when the more generous deduction is used, the progressivity-enhancing effect of deductions is larger. Out-of-pocket payments emerge as more regressive on ATP when deductions cover non-food as well as food items, and more regressive than when deductions are set equal to actual food spending. However, the pattern across the two years is the same whichever of the three deductions is used—out-of-pocket payments became more regressive on ATP despite becoming less regressive (in fact becoming progressive having been regressive) on pre-payment income.

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[2] One might argue that the index value for the 3rd quintile ought to be used rather than that for the sample as a whole. There was, however, no discernible trend in the Laspeyres price index across quintiles. The values for the bottom through top quintiles were respectively: 1.085, 1.288, 1.147, 1.009 and 1.304.

[3] The lower rate of price inflation in the health sector reflects real reductions in the out-of-pocket payments per contact for all provider types except public hospitals, but this reflected in turn the large reduction in the real price of drugs and medicines—20-30% between 1993 and 1998—more than offsetting the steep rise in fees among all providers, especially public providers

3.3.3. Should payments be proportional to ATP?

In principle, then, requiring that payment be proportional to ATP has the attraction of providing an answer to the question how progressive payments ought to be on pre-payment income, or equivalently how much narrower or wider income inequalities ought to be post-payment than pre-payment. In practice, however, as has been seen, there is the problem that how one defines ATP—i.e., how one defines the "deductions" $D(x)$—appears to have an important influence on one's conclusions concerning the fairness of the distribution of health care payments and changes in equity.

Quite aside from this issue, there is the issue of whether policymakers everywhere would endorse the value judgment that health care payments ought to be proportional to ATP. Although the WHO claims that this value judgment seems to be the one that receives majority support in an opinion survey from a convenience sample (Murray et al. 2001), it is obvious that one might argue that—in much the same way as those with zero ATP are *de facto* exempt from contributing—ceilings or maximum contributions could be set at a certain level of ATP above which payments are not to required to rise any further. Irrespective of the—inevitably arbitrary—choice of a target distribution of payments as a function of ATP, the framework presented in this section is helpful to unravel the various factors that have an influence on the difference between the actual distribution and desired distribution.

4. Vertical vs. horizontal inequity

So far in the paper the focus has been on vertical issues—how people with different prepayment incomes or different abilities ought to pay for their health care relative to their income. In the case where payments are required to be proportional to ATP, measurement proceeds by searching for departure from proportionality in the vertical relationship between payments and ability to pay (as captured by π_R^K), or by comparing inequality in income after deductions and before health care payments with inequality in income after deductions *and* health care payments (as captured by π_R^{RS}). In the case where the requirement of proportionality to ATP is not assumed, measurement proceeds by searching for departure from proportionality in the vertical relationship between payments and prepayment income (as captured by π_T^K), or by comparing inequality in pre-payment income with inequality in post-payment income (as captured by π_T^{RS}). In each case, the focus is on vertical differences, and, in the case of the ATP approach, on *vertical equity*.

There is another aspect of equity, namely *horizontal equity*—the issue of how far people with similar abilities to pay end up spending similar amounts on health care. In the context of health financing, and especially out-of-pocket payments, this is especially important, since the randomness of ill health makes it highly likely that people with similar incomes will end up paying very different amounts, with some paying nothing and others paying very large amounts. Indeed, it seems likely that these horizontal inequities—if that is what they are—may well dominate the vertical differences. This contrasts with, say, the case of the personal income tax for which the techniques developed above have been developed. There, it is differential treatment of people with different incomes that is likely to be more important than unequal treatment of people with similar incomes (Wagstaff, van Doorslaer, van der Burg et al. 1999).

Horizontal inequity matters for two reasons. First, it may give rise to people having different positions in the income distribution "before" and "after" health care payments. If everyone at a given income paid the same, people's rank in the pre-payment and post-payment distributions would be identical. If, on the other hand, people at a given income pay different amounts, some reranking will occur. This "reranking" came out in the Bank's *Voices of the Poor* exercise in Vietnam. In Lao Cai—in the mountainous north of the country—one 26-year old man revealed how the hospital costs associated with his daughter's severe illness had resulted in him moving from being one of the richest in his community to being one of the poorest. Reranking matters in part because it might be considered unfair in its own right, but also because it violates the assumption of no reranking that underlies the framework above and the empirical results based upon it. But there is a second reason for wanting to get to grips empirically with horizontal inequity, which is that even if reranking is of no special ethical significance per se, horizontal inequity most certainly is. Furthermore, the causes of horizontal inequity and the policy responses to it are different from those relating to vertical differences. Muddling up vertical and horizontal inequities is unhelpful for both understanding the causes of inequity and thinking about policies to reduce it. This section outlines a framework that allows one to distinguish empirically between the two and also allows the phenomenon of reranking to be incorporated and indeed quantified.

4.1. Decomposing redistributive effect

In eqn (2) above, we assumed away the possibility of reranking. If reranking occurs, redistributive effect needs to be measured as:

$$(14) \qquad RE = 2\int_0^1 [L_{X-T}(p') - L_X(p)]dp = G_X - G_{X-T},$$

where $G_{X\text{-}T}$ is the Gini coefficient for post-payment income and the p' in parentheses indicates the ranking in the *post-payment* distribution. *RE* is positive if the Lorenz curve for post-payment income lies above the Lorenz curve for pre-payment income, indicating that payments reduce income inequality. *RE* will coincide with π_T^{RS} only if there is no reranking in the move from the pre-payment to the post-payment income distribution. *RE* has been shown by Aronson, Johnson and Lambert (AJL) (Aronson, Johnson, and Lambert 1994) to depend on four key factors and to be decomposable as follows:

$$(15) \qquad RE = V - H - R,$$

where

$$V \equiv \left(\frac{t}{1-t}\right)\pi_T^K,$$

$$H \equiv \sum \alpha_x G_{F(x)},$$

and

$$R \equiv G_{X-T} - C_{X-T}.$$

In eqn (15), households are divided into groups of pre-payment equals, and redistributive effect is partitioned into three components: a vertical component, *V*, capturing the different payments made by the various groups of pre-payment equals; a horizontal inequity component, *H*, capturing the different payments made by households with similar pre-payment incomes; and a reranking component, *R*, capturing the movements of households up and down the income distribution in the transition from the pre-payment to post-payment income distributions. *V* is measured by $[t/(1-t)]\pi_T^K$, where the Kakwani index of progressivity is computed using the *average* payments made by members of the household's pre-payment income group rather than each household's *actual* payments. *V* thus indicates the amount of income redistribution attributable to the fact that, on average, households at different points in the income distribution do or do not pay different amounts for their health care. *H* is classical horizontal inequity. Inequality in post-payment income is measured in each group of pre-payment equals via a Gini coefficient, $G_{F(x)}$. A weighted sum of these Gini coefficients is then computed, with the α_x as weights, defined as the product of the population share and post-payment income share of households with pre-payment income *X*. The final term *R* is measured by the difference between the Gini coefficient for *X-T* and the concentration index for *X-T*, where in the latter case households are ranked by the pre-payment income.

In principle, reranking and horizontal inequity are distinct concepts. However, in practice, they are hard to separate not least because the more likely reason for reranking

is, in fact, the existence of horizontal inequality. This is shown in Figure 2 in the case where payments are progressive on pre-payment income, X, and hence post-payment income, X-T, increases in pre-payment income but at a decreasing rate. The average post-payment income at any level of pre-payment income can be read off the function in Figure 2. There will, however, be variations around this mean. These variations are reflected in a "fan" emanating from the point on the post-payment income function corresponding to the pre-payment income level in question, branching out to the post-payment income axis. For example, a household with a pre-payment income of $1100 might pay $250 in health care payments, ending up in the post-payment distribution behind the average household with a pre-payment income of $1000, which spends only $1000. Thus reranking is *caused by* horizontal inequity. Given this, it seems unwise to try to make too much of the distinction between R and H. This is reinforced by the fact that although in the population at large there will be households on the same pre-payment income; in a household survey such instances are rare. In empirical work, it therefore becomes necessary to define equals by reference to *bands* of pre-payment income, within which, for the purpose of the exercise, households are deemed to be equal. The choice of bandwidth inevitably affects the computed value of H, but also affects the computed value of R. Specifically, it seems to be the case that as the bandwidth is narrowed, H falls and R rises, though their does not seem to change much. In what follows we emphasize the sum of H and R, rather than their individual values.

4.2. The sources of redistributive effect of out-of-pocket payments in Vietnam

RE can be computed simply as the difference between G_X and G_{X-T}. To compute π_T^K (or more precisely the concentration index for out-of-pocket payments, C_T) and C_{X-T} one has to decide on appropriate groups of pre-payment equals. In this illustration, pre-payment equals were defined by expressing pre-payment income as a multiple of the overall poverty lines for 1993 and 1998. Households below the poverty line z_{pov}^x were divided into eight groups, the first comprising households with a pre-payment income between 0% and 12.5% of the poverty line, the second comprising households with a pre-payment income between 12.5% and 25% of the poverty line, and so on. Households with a pre-payment income of between 100% and 200% of the poverty line were divided into just four groups, along similar lines, while those with pre-payment incomes in excess of 200% of the poverty line were divided into just three groups. To put this into perspective, nearly 60% of households fell below the poverty line in 1993, and nearly 40% did in 1998. With groups of prepayment equals defined, it is straightforward to compute C_T on the grouped data, and to form the ranking variable to compute C_{X-T}. Using

the former and G_X, one can compute π_T^K, and using the latter and G_{X-T} one can compute R. This leaves H, which can be computed as a residual.

Table 3 shows the decomposition results of RE on pre-payment income for 1993 and 1998. In 1998, the redistributive effect of out-of-pockets was less than half of what it was in 1993. Although all four components—i.e., t, π_T^K, H and R—were reduced in absolute value, it is clear from the percentage distributions that most of the reduction is due to the reduced regressiveness of the out-of-pocket payments. Whereas in 1993, the vertical component V accounted for about 47% of total RE, its share of RE in 1998 was reduced to only 5.7%.

4.3. The AJL decomposition and the ATP approach—results for Vietnam

The AJL decomposition can also be applied to the ATP approach. The approach outlined in section 3 is useful if all deviation from proportionality of payments to ATP arises from vertical inequity. In this case, π_R^K and π_R^{RS} will convey the information required. But if there is horizontal inequity, π_R^{RS} will reflect this as well as vertical inequity. By employing the AJL decomposition, one can quantify: (a) the extent to which people with *different* abilities to pay end up paying similar proportions of their ATP toward health care (V): (b) the extent to which people with *similar* abilities to pay end up paying similar proportions of their ATP toward health care (H); and (c) the extent to which people change positions in the income distribution of as a result of health care payments (R).

We applied the AJL methodology to the ATP approach, using per capita pre-payment income (i.e., consumption) less actual food spending as the measure of ATP. Equals were defined by in the same way as with pre-payment income but now using multiples of the poverty line exclusive of food payments (i.e., z_{pov}^y) to generate the groups of ATP "equals". Table 4 shows the results of this exercise for 1993 and 1998. As in the case of pre-payment income, the total redistributive effect decreased between the two years. In contrast to the previous table, however, the percentage contribution to RE of the vertical component V increases from 42% in 1993 to 63% in 1998, despite the reduction in t from 12.6% to 10.7%. This is due to the increased regressiveness of out-of-pocket payments on ability to pay, as shown by the decrease in π_T^K.

5. Minimum standards and catastrophic health care costs

The egalitarian approach, through the measurement of redistributive effect, captures the share of pre-payment income being spent on health care (captured by t in eqn (3) or (15) for example), as well as how unequal this share is across the income distribution (captured by π_T^K in eqns (4) and (14)). But it does *not* respond to the concern that payments might be "too large". It is to this concern that the minimum standards approach responds. Two sub-strands of literature can be identified, both of which are built up around the notion that a focal variable ought not to exceed or fall short of a threshold. One sub-strand sets the threshold in terms of proportionality of income. The concern in this case is to ensure that households do not spend more than some pre-specified fraction of their income on health care, and spending in excess of this threshold is labeled "catastrophic". The second sub-strand sets the minimum in terms of the absolute level of income. The concern here is to ensure that spending on health care does not push households into poverty—or further into it if they are already there. We consider each in turn, beginning in this section with catastrophic expenses.

The ethical position underlying this sub-strand of literature is that no one ought to spend more than a given fraction (say z_{cat}) of their income on health care. A figure for z_{cat} is inevitably arbitrary, and it would clearly depend on whether income was defined in terms simply of pre-payment income, x, or in terms of some measure of ATP, $y=x-D(x)$. If the latter, clearly one ought to consider the various issues discussed above concerning how $D(x)$ is to be defined. If $D(x)$ is to cover only food expenditures, should it cover actual expenses or should it be a flat-rate allowance? If the latter, what should be done with individuals whose pre-payment incomes fall short of the allowance? In this exercise, these last two strategies are problematic, since y could become zero or negative. In the case where y is zero, the ratio of health care spending to income is undefined, and individuals with negative values of y will end up with smaller (in numerical size) values of T/y than those with small health spending and/or large incomes.

5.1. Measuring the incidence and intensity of catastrophic health care costs

Suppose one has settled on whether x or y will be used, on the definition of $D(x)$ in the event the latter is to be used, and on an approach to circumvent the problems noted above. Suppose too that a threshold z_{cat} has been agreed for T/x or T/y above which expenses are to be considered "catastrophic". The obvious summary measure of the extent to which a given sample of individuals has been exposed to catastrophic expenses (defined along these lines) would be the number (or fraction) of individuals whose health care costs as a proportion of income exceeded the threshold. The horizontal axis in Figure

3 shows the cumulative share of the sample, ordered by the ratio T/x, beginning with individuals with the largest ratio. Reading off this parade at the threshold z_{cat}, one obtains the fraction H_{cat} of the sample whose expenditures as a proportion of their income exceed the threshold z_{cat}. This is the *catastrophic payment headcount*. Thus let O_i be the catastrophic 'overshoot', equal to $T_i/x_i - z_{cat}$ (or $T_i/y_i - z_{cat}$) if $T_i/x_i > z_{cat}$ and zero otherwise, and let $E_i=1$ if $O_i>0$. Then the *catastrophic payment headcount* is equal to:

$$(16) \qquad H_{cat} = \frac{1}{N}\sum_{i=1}^{N} E_i = \mu_E ,$$

where N is the sample size and μ_E is the mean of E_i.

The difficulty with this measure is that this fails to capture the height above which individuals exceeding the threshold actually exceed it. This presumably matters. By analogy with the poverty literature, one could define not just a catastrophic payment headcount but also a measure analogous to the poverty gap, which we call the *catastrophic payment gap* (or *excess*). This captures the height by which payments (as a proportion of income) exceed the threshold z_{cat}. We divide this through by the sample size to get the average excess G_{cat}. Thus we measure the intensity or severity by defining the average *'gap'* (or excess) of catastrophic payments as

$$(17) \qquad G_{cat} = \frac{1}{N}\sum_{i=1}^{N} O_i = \mu_O ,$$

where μ_O is the mean of O_i. The *mean positive 'gap'* is:

$$(18) \qquad MPG_{cat} = \sum_{i=1}^{N} O_i \;/\; \sum_{i=1}^{N} E_i = \mu_O / \mu_E .$$

We therefore have:

$$(19) \qquad \mu_O = \mu_E \cdot MPG_{cat}$$

In other words, the overall mean catastrophic 'gap' equals the fraction with a positive gap times the mean positive gap.

5.2. *Incidence and intensity of catastrophic out-of-pocket payments in Vietnam*

We measured O_i by the ratio T/x (i.e., out-of-pocket payments as a fraction of pre-payment income), and set thresholds (i.e., z_{cat}) at 2.5%, 5%, 10%, and 15%. Table 5 (a) presents these results. We then re-did the exercise with O_i defined as the ratio T/y (i.e., out-of-pocket payments as a fraction of ATP), where y was defined as pre-payment income less *actual* food spending. The ratio T/y thus gives the share of non-food

consumption absorbed by out-of-pocket payments. In this second case, we used thresholds of 10%, 15%, 20%, 25%, 30% and 40% and the results are in Table 5 (b).

The tables show that in 1993, for instance, as much as 38% of the sample recorded out-of-pocket payments in excess of 5% of their pre-payment income and that 34% of the sample spent more than 15% of their non-food consumption on out-of-pocket expenditure. Inevitably, in both years, and for both income shares, both the proportion of the sample exceeding the threshold (H_{cat}) and the mean excess (G_{cat}) fall as the threshold (z_{cat}) is raised. More interesting is the fact that for both income shares and for all the thresholds in the range explored, both the proportion exceeding the threshold and the mean excess were lower in 1998 than in 1993. This suggests that, in general, the catastrophic character of out-of-pocket payments was reduced over the period in question. In Table 5 (a), the mean positive gap MPG_{cat} has decreased (slightly) for the first two thresholds, but increased (slightly) for the two highest thresholds. It is therefore clear that most of the decline in the mean overall gap G_{cat} is due to the decline in the headcount H_{cat} . In Table 5(b), the MPG_{cat} for ability to pay is always lower in 1998.

5.3. Measures that reflect that catastrophic costs matter more for the poor

There is a difficulty with the approach outlined above, namely that it is blind as to whether it is poor or better-off individuals who exceed the threshold. It seems likely most societies will care more if it is an individual in the lowest decile whose spending (as a share of its income) exceeds the threshold than if it is one in the top decile. One way of shedding light on this is to see how the proportions of those exceeding the threshold vary across the income distribution. This can be done formally using a concentration index for E_i, which we define as C_E. A positive value of this will indicate a greater tendency for the better-off to exceed the payment threshold, whilst a negative value will indicate a greater tendency for the worse-off to exceed the threshold.

A difficulty is that the headcount, μ_E, and the concentration index, C_E, could move in different directions over time. Or the former might be higher in country A than country B, but the latter might be lower in country A than B. In such circumstances, it would be useful to have an index trading off the two dimensions. We can do this by constructing a weighted version of the headcount that takes into account whether it is mostly poor people who exceed the threshold or better-off people. We do this by weighting the variable indicating whether the person has exceeded the threshold, E_i, by the individual's rank in the income distribution. Let r_i denote person i's absolute rank. This is equal to 1 for person 1, 2 for person 2, and N for person N. Then define

$$(20) \qquad w_i = 2\frac{N+1-r_i}{N}.$$

Thus w_i is equal to 2 for the most disadvantaged person, declines by $2/N$ for each one-person step up through the income distribution, and reaches $2/N$ for the least disadvantaged person. Thus the difference in w_i between the most disadvantaged person and the second most disadvantaged person is the same as the difference between the second most advantaged person and the most advantaged person. If we weight the E_i by the w_i, we get:

$$(21) \qquad W_{cat}^{E} = \frac{1}{N}\sum_{i=1}^{N} w_i E_i .$$

We have the following result (the proof of which is in the Appendix):

Result 1. Given the weighting used in (21), the index W_{cat}^{E} can be written as:

$$(22) \qquad W_{cat}^{E} = \mu_E \cdot \left(1 - C_E\right).$$

Thus we can modify the catastrophic payments headcount by weighting the dummy status indicator, E_i, by the person's rank in the income distribution, giving larger weights to poorer people. The weighting scheme chosen results in an attractive and simple summary measure that is simply the catastrophic payment headcount multiplied by the complement of the concentration index. If those who exceed the threshold tend to be poor, the concentration index C_E will be negative, and this will raise W_{cat}^{E} above μ_E. Thus the catastrophic payment problem is worse than it appears simply by looking at the fraction of the population exceeding the threshold, since it overlooks the fact that it tends to be the poor who exceed the threshold. By contrast, if it is *better-off* individuals who tend to exceed the threshold, C_E will be positive, and μ_E will overstate the problem of the catastrophic payments as measured by W_{cat}^{E}.

We can apply the same logic to the catastrophic payment excess. We define a concentration index for the overshoot variable, O_i, which we denote by C_O. Then we can define an analogue of W_{cat}^{E}, which can be shown to be equal to:

$$(21) \qquad W_{cat}^{G} = \mu_O \cdot \left(1 - C_O\right).$$

A tendency for large excesses to be concentrated among poorer individuals results in a negative value of C_O, which will raise W_{cat}^{G} above μ_O—the "excess payment problem" is worse than it appears simply by looking at the mean catastrophic payment excess, since

this overlooks the fact that the large catastrophic payments are concentrated among the worse off. By contrast, if it is the *better-off* individuals who have the largest excesses, C_O will be positive, and μ_O will overstate the severity of the catastrophic payment problem as measured by W_{cat}^G.

5.4. The poor and catastrophic out-of-pocket payments in Vietnam

Table 5 (a) shows that at the lower thresholds, the incidence of "catastrophic" health costs is more concentrated among the poor in both years, though more so in 1998 than in 1993. By contrast, at the higher thresholds the incidence of "catastrophic" health costs is more concentrated among the *rich* in both years, and more so in 1998 than in 1993. The better-off are more likely to overshoot the threshold by a larger amount in both years whatever the threshold, and for each threshold there is more concentration of "overshooting" among the better-off in 1998 than in 1993. This coupled with the results mentioned above indicates that whilst at low thresholds it is the poor who are more likely to exceed them, they do not spend so far above the threshold as do the better-off. Since the concentration indices are all positive, the index W_{cat}^G is smaller than the mean catastrophic excess, μ_{cat}^G. Catastrophic costs are thus less of a "problem" in both 1993 and 1998 than they would have been if the large "catastrophes" had been concentrated among the poor.

The story is somewhat different in terms of ability to pay (or non-food consumption). First, Table 5 (b) shows that the incidence of "catastrophe" is *always* more concentrated among the poor, in both years, and for all thresholds. Another difference with respect to the same exercise based on prepayment income is that the magnitude of the "catastrophic overshoot" of ability to pay is more concentrated among the poor, but much more so in 1993 than in 1998. Only at higher thresholds in 1998 does it become more concentrated among the rich. Because most concentration indices are negative, the rank-weighted indices tend to be higher than the headcount-based measures. In general, both the x-based and the y-based approaches give very similar results in terms of the rank-weighted welfare measures: when taking into account people's location in the income ranking in either the incidence (W_{cat}^E) or intensity (W_{cat}^G), the measures decrease with rising thresholds but the index values are always higher in 1993 than in 1998. In other words, the catastrophic out-of-pocket expenditure "problem" has unequivocally lessened over the period in question.

6. Minimum standards and impoverishment

There is still a difficulty with the "catastrophic" payment approach, namely that it is blind as to how far "catastrophic" payments cause hardship. It seems likely most societies will be more concerned about someone exceeding the threshold by, say, five percentage points if their income is $0.75 a day than if it is $30 a day. An alternative perspective is that of impoverishment, the core idea being that no one ought to be pushed into poverty—or further into poverty—because of health care expenses. This position is evident in the discussions in the World Bank's 2000/2001 WDR (World Bank 2000) and in its *Voices of the Poor* consultative exercise (Narayan et al. 2000). In a sense, this approach gets to the heart of the concerns over health care payments—that health care utilization is a response to an unforeseen and unsolicited "shock" and can be sufficiently costly to represent a threat to a household's ability to purchase other goods and services that may, like health care, make a difference to its members' ability to survive flourish as a human beings.

6.1. Measuring the impoverishing effects of health care costs

Figure 4 provides a simple framework for examining the impact of out-of-pocket payments on the two basic measures of poverty—the headcount and the poverty gap. It also allows us to relate progressivity and redistributive effect to poverty impact. The figure is a variant on Pen's parade. The two parades plot income (before and after out-of-pocket payments) along the y-axis against the cumulative percentage of individuals ranked by pre-payment income along the x-axis. Reading off each parade at the poverty line gives the fraction of people living below poverty, while the area below the poverty line above each parade gives the poverty gap. It is assumed in Figure 4 that the poverty line is the same for post-payment income as for pre-payment income—this is an issue we return to in a moment.

Formally, the relevant concepts and measures can therefore be defined as follows. Let z_{pov}^{pre} be the pre-payment poverty line (which may be different from the post-payment poverty line for reasons discussed below) and x_i be individual i's pre-payment income. Then define $P_i^{pre}=1$ if $x_i < z_{pov}^{pre}$. Then the *pre-payment poverty headcount* is equal to:

$$(24) \qquad H_{pov}^{pre} = \frac{1}{N}\sum_{i=1}^{N} P_i^{pre} = \mu_{P^{pre}},$$

where N is the sample size. Denote by g_i^{pre} the pre-payment poverty gap, which is equal to $x_i - z_{pov}^{pre}$ if $x_i < z_{pov}^{pre}$, and zero otherwise. The average *pre-payment poverty gap* is defined as:

$$(25) \quad G_{pov}^{pre} = \frac{1}{N}\sum_{i=1}^{N} g_i^{pre} = \mu_{g^{pre}},$$

the *normalized pre-payment poverty gap* as

$$(26) \quad NG_{pov}^{pre} = \frac{G_{pov}^{pre}}{z_{pov}^{pre}}$$

and the *mean positive pre-payment poverty gap* as

$$(27) \quad MPG_{pov}^{pre} = \sum_{i=1}^{N} g_i^{pre} \Big/ \sum_{i=1}^{N} p_i^{pre} = \mu_{g^{pre}} / \mu_{P^{pre}}.$$

We therefore have

$$(28) \quad \mu_{g^{pre}} = \mu_{P^{pre}} \cdot MPG_{pov}^{pre}$$

In other words, the average (pre-payment) poverty gap equals the fraction with a positive gap times the mean positive gap. Replacing the pre-payment poverty line z_{pov}^{pre} by the post-payment poverty line z_{pov}^{post}, and all other superscripts 'pre' by the superscript 'post' gives the analogous post-payment measures.

The measures of poverty impact of out-of-pocket payments are then simply defined as the difference between the relevant pre-payment and post-payment measures, i.e.,

$$(29) \quad PI^{H} = H_{pov}^{post} - H_{pov}^{pre},$$

$$(30) \quad PI^{G} = G_{pov}^{post} - G_{pov}^{pre}, \text{ and}$$

$$(31) \quad PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}.$$

6.2. Impoverishment, progressivity and redistributive effect—the links

What determines the poverty impact of out-of-pocket payments? And what are the links between poverty impact, on the one hand, and progressivity and redistributive effect, on the other? In this sub-section we present some results for the case where the poverty line remains the same before and after health care payments.

Intuitively, one would expect that poverty impact would be linked to progressivity. This is indeed the case. Figure 5 compares three post-payment income distributions corresponding to three different payment structures, each with the same value of t—one proportional on pre-payment income, one progressive, and the other regressive. In all three cases, and for all income levels, post-payment income is less than the pre-payment income, and therefore poverty (however measured) is higher after out-of-pocket payments than before. However, the three payment structures will, in general, give rise to different poverty impacts. At a certain income level—the break-even point—the three structures give rise to the same post-payment income. Up to this income level, post-payment income is highest under the progressive payment structure and lowest under the regressive structure. Thus if the poverty line is below this break-even income level, the poverty impact of out-of-pocket payments is smallest under the progressive payment structure and greatest under the regressive payment structure. Inevitably, beyond the break-even income level, post-payment income is highest under the regressive structure and lowest under the progressive structure. Thus if the poverty line is above the break-even level, the poverty impact of out-of-pocket payments is greatest under the progressive structure and smallest under the regressive structure. In general, then, providing the poverty line is not too high (i.e., not higher than the break-even income level), the poverty impact of out-of-pocket payments will be greatest if out-of-pocket payments are regressive and smallest if they are progressive.

Like redistributive effect, poverty impact depends not just on progressivity but also on the share of income absorbed by health care payments. Figure 6 shows the effect of raising the value of t, holding the index of progressivity constant. The effect is to push the post-payment Pen parade downwards by the same percentage of pre-payment income at each income rank. Thus, like redistributive effect, the poverty impact is larger, for a given value of Kakwani's progressivity index, the larger is t.

Given the various influences on poverty impact discussed above, it ought to be clear that looking at progressivity alone might give a misleading picture of poverty impact. Figure 7 shows two alternative health care payment structures—one progressive, the other regressive. In the progressive structure, health care payments absorb a fairly high proportion of pre-payment income, while in the regressive structure, they absorb, on average, only a very small fraction of pre-payment income. There is, as before, a break-even income level, which—given the differences in t and the progressivity index in this example—occurs at a relatively low income rank (a little over 30%). Below this break-even level, pre-payment income is higher under the progressive structure—the percentage of income absorbed by health care payments on average is high but the structure is progressive. Above the break-even level, pre-payment income is higher under the

regressive structure—the structure is regressive but the percentage of income absorbed by payments is small on average. If the poverty line is below the break-even level, the poverty impact is greater under the regressive payment structure, but if the poverty line is above the break-even level, the poverty impact is greater under the *progressive* structure. Thus, if a progressive structure absorbs a large proportion of pre-payment income, it may well give rise to a larger poverty impact than a regressive structure absorbing a small proportion of pre-payment income.

6.3. How do out-of-pocket payments add to poverty in Vietnam?

There are two obvious candidates for the poverty line that emerge from our earlier discussion of the deductions $D(x)$. The first is a food poverty line giving the cost of reaching 2100 calories a day. This is often termed an extreme poverty line. Clearly, this is applicable whether income is pre-payment or post-payment. In each case, one is asking whether the person's pre- or post-payment income is sufficient for them to purchase enough food to produce 2100 calories per day. Clearly, some individuals may cross such a poverty line as the result of spending on health care, and some may sink further below it. By comparing the headcounts and poverty gaps before and after health care spending, one can get a sense of its impoverishing effects, whether in terms of additions to the number of people classified as extremely poor or in terms of deepening poverty among the extreme poor.

The second obvious poverty line is the amount used above in the more generous deduction for food and non-food items. The difficulty here is that the poverty line for pre-payment income ought to include an element for health spending, whilst the poverty line for post-payment income ought not. As in computing the deduction $D(x)$, one needs to extract an amount from the poverty line corresponding to health spending to arrive at the post-payment poverty line z_{pov}^{post}. This means that whilst some people may not be poor before health spending and be poor after it, there will be some who are marginally poor before health spending but *not* poor after it (they spend nothing on health care or they spend appreciably less than the health spending component of the pre-payment poverty line). Thus, whereas in the case where the extreme poverty line is used poverty will necessarily be higher "after" health spending than "before", in the case where the poverty line covers food *and* non-food items, poverty may, in fact, be higher pre-payment than post-payment.

In applying these methods to the data on out-of-pocket payments in Vietnam, we employed a food (extreme) poverty line and a broader-based poverty line using the amounts used in the deductions in the fairness analysis above. In the case of the food

poverty line, the same amounts were used for the pre-payment and the post-payment lines—750 and 1287 thousand Dong for 1993 and 1998 respectively. In the case of the broader poverty line, a lower line was set for post-payment income, reflecting the fact that health care payments have to be met from pre-payment income but have already been met at the post-payment stage. The pre-payment and post-payment poverty lines for 1993 were set at 1160 and 1091 respectively, while the corresponding lines for 1998 were set at 1790 and 1700 respectively.

Figure 8 shows the chart of Pen's parade for households (individuals are used in the analysis that follows) for pre-payment income and extreme poverty in 1998. Overlaid on the chart are the out-of-pocket payments of each household. In some cases, households are clearly pushed further into extreme poverty by out-of-pocket payments, whilst in others they are pushed below the extreme poverty line having started out "before" out-of-pocket payments above it.

Table 6(a) shows that in the case of the food poverty line, out-of-pocket payments increase the headcount ratio by 4.4 percentage points in 1993 and by 3.4 percentage points in 1998. The poverty gap comparisons across years are most meaningful when *normalized* poverty gaps are used (i.e., poverty gaps are divided through by the poverty line). Out-of-pocket payments increase the normalized gap by only 1.4 percentage points in 1993 and by only 0.8 percentage points in 1998. In both years, around three quarters of the addition to the poverty gap was from previously poor people being further impoverished by out-of-pocket payments, and only one quarter was attributable to previously non-poor people being pushed into extreme poverty as a result of out-of-pocket payments.

From Table 6(b) it is clear that out-of-pocket payments have a smaller impact on the headcount in the case of the broader-based poverty line. This reflects the lower poverty line for post-payment income. Indeed, there is no assurance—as indicated above—that the impact of out-of-pocket payments on the headcount will be positive in this case. In the event, out-of-pocket payments increase the headcount ratio but by only 0.4 percentage points in 1993 and 0.5 percentage points in 1998. These low increases reflect the fact that the percentages of the sample becoming poor through out-of-pocket payments (1.9% in 1993 and 2.3% in 1998) are almost matched by the percentages of persons who were among the pre-payment poor but *not* among the post-payment poor (1.5% of the sample in 1993 and 1.7% in 1998). The need for the use of the normalized poverty gap is, of course, even greater in this case than in the case of the food poverty line, given that the poverty line is different pre-payment and post-payment, as well as across years. In 1993, the normalized poverty gap is 0.4 percentage points higher post-

payment, while in 1998 out-of-pocket payments increase the normalized gap by 0.2 percentage points.

6.4. The impoverishing effects of hospital vs. other health costs in Vietnam

The impoverishment measurement methodology can be used to quantify the different poverty impacts of hospital and other health spending. In the 1998 Vietnam data, we separated hospital expenses (defined as costs associated with inpatient care over the previous 12 months) and all other health care costs over the previous 12 months. On average, the former account for around 20% of the total.

Table 7 shows the results of an analysis of the poverty impacts of these two categories of expense, using the extreme food-based poverty line in order to explore which of the two types is the main source of impoverishment. Looking at hospital costs, the increase in the headcount (PI^H) is a mere 0.5 percentage points, while the value of PI^H associated with non-hospital expenses is 2.9 percentage points. The values of the impact on the mean poverty gap(PI^G) are 1.07 and 8.54 respectively. Clearly, and perhaps in contrast to prior expectations, non-hospital expenditure has a larger poverty impact in Vietnam than hospital expenditure. What is striking for hospital costs, however, is that although most of the rise in the poverty gap is still due to poor people getting poorer, this element is proportionally less than in the case of non-hospital expenses. In other words, the share of the rise in the poverty gap accounted for by deepening poverty among the pre-payment poor is smaller in the case of hospital costs than in the case of non-hospital costs.

7. Summary and conclusions

As noted in the Introduction, much has been written recently about equity or fairness in payments for health care, "catastrophic" health care payments, and the impoverishing effects of health care outlays. The aim of this paper is to clarify the meaning of these terms, to show how each might be measured, and to compare the different measures. We illustrate each using household data on annual out-of-pocket expenditures on health care taken from the 1992-93 and 1997-98 Vietnam Living Standards Surveys (VLSS).

We distinguish between two strands in the literature—approaches inspired by egalitarian concepts of equity, and approaches focusing on "minimum standards". Underlying the egalitarian approach is the view that payments should be linked directly *and continuously* to ability to pay (ATP) rather than to usage of health services. The

minimum standards approach has an element of this idea, but focuses on the extent to which payments exceed a "catastrophe" threshold, or force households below a poverty line or further below it if already there.

We label the first of the egalitarian approaches we consider the "agnostic" approach, since the linkage of payments to ATP is simply measured by the degree of progressivity of such payments on pre-payment income and by the degree of income redistribution they generate. In Vietnam out-of-pocket payments were regressive on pre-payment income and widened the income distribution (i.e., were associated with pro-rich redistributive effect). By contrast, in 1998, out-of-pocket payments were mildly progressive and associated with a small amount of pro-poor redistributive effect.

The "agnostic" approach does *not* tell us how equitable payments are—only how progressive they are on pre-payment income. The second egalitarian approach we consider—proposed recently by the World Health Organization and labeled in the paper as the ATP approach—suggests a target distribution for out-of-pocket payments and hence allows one to quantify inequity. The equity "yardstick" proposed by WHO is that payments should be proportional to ATP, and one aspect of inequity to be measured is the extent to which payments deviate from proportionality with respect to ATP. This can measured by examining the progressivity of payments on ATP (a zero value of the progressivity index of payments on ATP, π_R^K, being the equity goal) or by examining the redistributive effect of payments with respect to ATP (a zero value of the index of redistributive effect of payments with respect to ATP, π_R^{RS}, being the equity goal). The two conditions are equivalent, since proportionality with respect to ATP leaves the ATP distribution intact. ATP can be thought of as pre-payment income less a deduction for expenses deemed necessary to achieve a minimum subsistence level of consumption. Setting up the analysis along these lines allows us to obtain some useful decomposition results from the tax literature. These shed light on the relationship between the progressivity and redistributive effect of payments on pre-payment income and on ATP. For instance, eqn (13) in the paper shows that the degree of redistributive effect of payments with respect to pre-payment income depends on the payments share, t, the progressivity of payments on ATP, π_R^K, the deductions share, δ, and the progressivity of deductions on pre-payment income, π_D^K. If payments are proportional to ATP ($\pi_R^K = 0$), there will still be some redistributive effect if the deductions are non-proportional to pre-payment income. If, for example, deductions are income-inelastic (making up a higher share of pre-payment income for the poor than the better-off), equity—defined in terms of payments being proportional to ATP—will result in some pro-poor income redistribution.

In the empirical illustration of the ATP approach, we show how by varying the definition of deductions, the progressivity of payments on ATP and on pre-payment income varies. We defined deductions first as *actual* food expenditure (à la WHO), second as a flat rate poverty line deduction for food only, and third as a flat rate poverty line deduction for *all* goods and services other than health care. The results showed that, irrespective of the deduction definition used, equity—as measured by (% changes in) π_R^K—improved between 1993 and 1998, but the improvement was greater in the case of the flat rate food poverty line and overall poverty line deductions than in the case of actual food expenditure.

We then consider a third approach within the egalitarian tradition that further broadens the scope of the analysis by not focusing exclusively on vertical differences but instead incorporating horizontal differences as well. The previous two approaches do not adequately capture this as they implicitly assume that there is no reranking when going from the pre-payment to the post-payment income distribution, and assuming that all of the redistributive effect is due to progressivity. In practice, people do change ranking as a result of payments and different people at the same pre-payment income end up paying dramatically different amounts of their income toward health care. As the tax literature shows, the total redistributive effect in such cases (RE^{AJL}) ought to be computed as the difference between a vertical equity component (V) attributable to the degree to which, on average, payments are progressive, and the sum of a horizontal equity component (H) and a reranking component (R). This decomposition can be applied to the agnostic approach or to the ATP approach. One implication for the latter is that payments could be proportional to ATP on average (V=0), and yet payments could produce redistributive effect because H and R are non-zero (households at a given level of ATP pay different amounts on health care). The ATP proportionality yardstick could thus be re-interpreted to mean that V, H and R all be zero, or that RE ($=V-H-R$) is zero. The latter would allow for the possibility that a positive V due to payments being progressive on ATP is exactly offset by the (pro-rich) redistribution induced by horizontal inequity (the negative value of $H+R$ is exactly equal to $-V$).

In the case of Vietnam, the total redistributive effect of out-of-pocket payments with respect to *both* pre-payment income *and* ATP is negative in both years, but RE fell (in absolute size) between 1993 and 1998. In the case of RE with respect to pre-payment income, no equity interpretation can be given to the reduction of RE_X^{AJL}, whereas in the case of RE with respect to ATP, the reduction in RE_Y^{AJL} can be interpreted as moving closer toward an equitable distribution which leaves ATP unchanged. The reasons for the reduction (in absolute size) of RE is different in the two cases. In the first (RE with

respect to pre-payment income), payments became less regressive in Vietnam over the period 1993-98 and absorbed a smaller share of pre-payment income. *V* thus unambiguously fell in absolute size (i.e., became less negative). *H* and *R* also fell but by much less. Most of the reduction in *RE* with respect to pre-payment income was thus due to reduced vertical income redistribution. Indeed, in 1998 *V* accounted for only 6% of the total value of *RE* with respect to pre-payment income compared to 47% in 1993. In the case of *RE* with respect to ATP, out-of-pocket payments became *more* regressive, but because the share of ATP absorbed by them fell substantially, *V* once again fell in absolute size, but only by a small amount. By contrast, *H* and *R* fell quite considerably. Most of the reduction in *RE* with respect to ATP was thus due to reduced horizontal inequity (and consequent reranking) rather than to the reduction in the absolute size of *V*. Indeed, the share of *RE* accounted for by vertical redistribution actually increased in this case.

We then turn in the paper to minimum standards (or threshold) approaches. In the first, the threshold is in terms of payments, and set as a proportion of pre-payment income. In the second, the threshold is set in terms of post-payment income, in terms of a poverty line. Payments resulting in people crossing the first threshold are classified as "catastrophic" while payments resulting in people crossing the second are classified as "impoverishing". For both approaches, we define indices which can be used to measure both the incidence and intensity of the catastrophic or impoverishing impact. For the catastrophic impact measure, we also show how it can be made sensitive to the location of its occurrence in the income distribution—"catastrophic" payments presumably matter more for poor households than better-off ones.

In general, using the minimum standards "yardstick", things appear to have improved in Vietnam over the period considered. Both the incidence and the intensity of "catastrophic" payments fell, whether defined in terms of pre-payment income or ATP. The incidence and intensity also became less concentrated among the poor. Furthermore, the incidence and intensity of the poverty impact of out-of-pocket payments were both much lower in 1998 than in 1993. We also show how the methods can be used to see to what extent the poverty impact is due to poor people getting poorer or previously non-poor people falling into poverty, and which types of out-of-pocket expenditure can be held responsible for most of the impact. We found that in the case of Vietnam most of the poverty impact is due to the poor getting even poorer and to non-hospital care outlays rather than payments for hospital care.

Appendix

Proof of Result 1.

Substituting (16) in (17), and expanding gives

$$
\begin{aligned}
W_{cat}^{E} &= \frac{1}{N}\sum_{i=1}^{N} 2\left[\frac{N+1-r_i}{N}\right]E_i \\
&= \frac{2}{N}\sum_{i=1}^{N}\left[\frac{N+1}{N} - R_i\right]E_i \qquad \text{(A1)} \\
&= \frac{2}{N}\sum_{i=1}^{N} E_i - \frac{2}{N}\sum_{i=1}^{N} R_i E_i \quad \text{for large } N.
\end{aligned}
$$

In eqn (A1), R_i is the person's relative rank (ranging from 0 to 1). Eqn (A1) can be simplified. The first term is equal to $2\,\mu_{cat}^{E}$. The second can be simplified using the following expression for the concentration index given in Kakwani et al. (Kakwani, Wagstaff and Van Doorlsaer 1997):

$$
\text{(A2)} \quad C_{cat}^{E} = \frac{2}{N\mu_{cat}^{E}}\sum_{i=1}^{N} R_i E_i - 1,
$$

so that the second term in (A1) is equal to $(C_{cat}^{E}+1)\ \mu_{cat}^{E}$. Substituting these expressions for the first and second terms of eqn (A1) gives eqn (18) in the text.

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Table 1: Progressivity and redistributive effect of out-of-pocket payments with respect to prepayment income in Vietnam, 1993–98

	1993	*1998*	*% change*
x	1,386	2,771	99.9%
T	82	149	80.6%
$t = T/x$	5.7%	5.4%	-5.8%
G_X	0.3566	0.3517	-1.4%
C_T	0.3028	0.3570	17.9%
π_T^K	-0.0537	0.0053	-109.8%
C_{X-T}	0.3598	0.3514	-2.3%
$\pi_T^{RS} = t/(1-t)\ \pi_T^K$	-0.0032	0.0003	-109.2%

Table 2: Progressivity and redistributive effect of out-of-pocket payments with respect to ability to pay in Vietnam 1993-98

	Deductions					
	[a]		*[b]*		*[c]*	
	Actual food exp		*Food poverty line*		*Total poverty line*	
	1993	*1998*	*1993*	*1998*	*1993*	*1998*
δ	50.8%	49.7%	49.3%	45.0%	64.2%	56.3%
π_R^K	-0.1630	-0.1149	-0.3554	-0.2581	-0.4799	-0.3568
C_{Y-T}	0.4872	0.4856	0.7032	0.6430	0.8736	0.7638
π_R^{RS}	-0.0214	-0.0137	-0.0450	-0.0279	-0.0908	-0.0500
C_D	0.2509	0.2300	0.0461	0.0297	0.1188	0.0710
π_D^K	-0.1057	-0.1218	-0.3104	-0.3221	-0.2377	-0.2807
$C_{X-D} = C_Y$	0.4659	0.4719	0.6582	0.6151	0.7828	0.7138
π_D^{RS}	-0.1093	-0.1202	-0.3017	-0.2634	-0.4262	-0.3621

Table 3: Decomposition of redistributive effect on prepayment income (x) into vertical, horizontal and reranking components, Vietnam 1993-98

	1993	*1998*
x	1,386	2,771
T	82	149
t	5.9%	5.4%
G_X	0.3336	0.3517
G_{X-T}	0.3393	0.3542
C_{X-T}	0.3377	0.3528
$RE = G_X - G_{X-T}$	-0.0057	-0.0024
π_T^K (on grouped data)	-0.0421	-0.0025
C_T *(on grouped data)*	0.2915	0.3493
$V=[t/(1-t)]\ \pi_T^K$	-0.0027	-0.0001
H	0.0014	0.0010
$R= G_{X-T} - C_{X-T}$	0.0016	0.0013
$H+R$	0.0030	0.0023
V %	46.8%	5.7%
H %	-24.9%	-39.4%
R %	-28.3%	-54.9%
$H+R$ %	-53.2%	-94.3%

Table 4: Decomposition of redistributive effect on ability to pay (y) into vertical, horizontal and reranking components, Vietnam 1993-98

	1993	1998
y	652	1,394
T	82	149
$t = T/y$	12.6%	10.7%
z^{y}_{pov}	426	503
G_Y	0.4509	0.4871
G_{Y-T}	0.4786	0.5046
C_{Y-T}	0.4713	0.4988
$RE_Y = G_Y - G_{Y-T}$	-0.0277	-0.0174
π^{K}_{T} *(on grouped data)*	-0.0800	-0.0915
C_T *(on grouped data)*	0.3709	0.3957
$V=[t/(1-t)]\ \pi^{K}_{T}$	-0.0116	-0.0109
H	0.0088	0.0033
$R = G_{Y-T} - C_{Y-T}$	0.0073	0.0032
$H+R$	0.0162	0.0065
V %	41.7%	62.7%
H %	-31.8%	-4.0%
R %	-26.4%	-33.3%
$H+R$ %	-58.3%	-37.3%

Table 5: Incidence (headcount) and intensity (or gap) of catastrophic out-of-pocket payments in Vietnam, 1993-98

Table 5(a): Share of prepayment income (T/x)

	1993				*1998*			
Threshold level z_{cat}	*2.5%*	*5%*	*10%*	*15%*	*2.5%*	*5%*	*10%*	*15%*
Headcount measures								
H_{cat}	60.97%	38.19%	18.40%	9.26%	55.47%	33.02%	14.20%	7.73%
C_E	–0.0161	–0.0113	0.0125	0.0068	–0.0391	–0.0290	0.0279	0.1123
W^E_{cat}	61.95%	38.62%	18.17%	9.20%	57.63%	33.98%	13.80%	6.86%
Gap measures								
G_{cat}	4.06%	2.85%	1.51%	0.84%	3.41%	2.34%	1.24%	0.71%
MPG_{cat}	6.66%	7.47%	8.21%	9.06%	6.14%	7.09%	8.76%	9.20%
C_O	0.0057	0.0151	0.0298	0.0408	0.0513	0.0932	0.1829	0.2794
W^G_{cat}	4.04%	2.81%	1.47%	0.80%	3.23%	2.12%	1.02%	0.51%

Table 5(b): Share of ability to pay (T/y)

	1993						*1998*					
Threshold level z_{cat}	*10%*	*15%*	*20%*	*25%*	*30%*	*40%*	*10%*	*15%*	*20%*	*25%*	*30%*	*40%*
Headcount measures												
H_{cat}	46.89%	33.39%	24.35%	17.89%	13.19%	6.92%	41.52%	28.33%	19.26%	13.95%	10.34%	5.13%
C_E	–0.0991	–0.1097	–0.1214	–0.1324	–0.1252	–0.1219	–0.1373	–0.1350	–0.1267	–0.1076	–0.0836	–0.0076
W^E_{cat}	51.54%	37.05%	27.30%	20.25%	14.84%	7.77%	47.22%	32.15%	21.70%	15.45%	11.20%	5.17%
Gap measures												
G_{cat}	7.12%	5.13%	3.70%	2.66%	1.90%	0.92%	5.66%	3.93%	2.76%	1.94%	1.33%	0.61%
MPG_{cat}	15.17%	15.36%	15.20%	14.85%	14.38%	13.30%	13.64%	13.88%	14.32%	13.90%	12.91%	11.88%
C_O	–0.1168	–0.1210	–0.1236	–0.1208	–0.1180	–0.1202	–0.0936	–0.0731	–0.0505	–0.0210	0.0126	0.0867
W^G_{cat}	7.95%	5.75%	4.16%	2.98%	2.12%	1.03%	6.19%	4.22%	2.90%	1.98%	1.32%	0.56%

Table 6(a): Poverty impact of out-of-pocket payments in Vietnam, 1993-98

	Food poverty line	
	1993	*1998*
Poverty lines		
z_{pov}^{pre}	750	1287
z_{pov}^{post}	750	1287
Poverty headcounts		
H_{pov}^{pre}	23.4%	15.0%
H_{pov}^{post}	27.7%	18.4%
$PI^{H} = H_{pov}^{post} - H_{pov}^{pre}$	4.4%	3.4%
Poverty gaps		
G_{pov}^{pre}	38.05	40.56
G_{pov}^{post}	48.18	50.24
$PI^{G} = G_{pov}^{post} - G_{pov}^{pre}$	10.13	9.68
Normalized poverty gaps		
NG_{pov}^{pre}	5.1%	3.2%
NG_{pov}^{post}	6.4%	3.9%
$PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}$	1.4%	0.8%
Prepay PG prepay poor (A)	907078	3074346783
PG increase prepay poor (B)	182475	540819857
PG increase prepay nonpoor (C)	58965	193279823
A as % of (A+B+C)	79%	81%
B as % of (A+B+C)	16%	14%
C as % of (A+B+C)	5%	5%
B as % of (B+C)	76%	74%
C as % of (B+C)	24%	26%

Table 6(b): Poverty impact of out-of-pocket payments in Vietnam, 1993-1998

	Overall poverty line	
	1993	*1998*
Poverty lines		
z_{pov}^{pre}	1160	1790
z_{pov}^{post}	1091	1700
Poverty headcounts		
H_{pov}^{pre}	54.0%	37.4%
H_{pov}^{post}	54.4%	37.9%
$PI^{H} = H_{pov}^{post} - H_{pov}^{pre}$	0.4%	0.5%
Poverty gaps		
G_{pov}^{pre}	199	171
G_{pov}^{post}	192	166
$PI^{G} = G_{pov}^{post} - G_{pov}^{pre}$	-7.79	-5.05
Normalized poverty gaps		
NG_{pov}^{pre}	17.2%	9.5%
NG_{pov}^{post}	17.6%	9.7%
$PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}$	0.4%	0.2%
# entering	454	1721643
# leaving	365	1311036
# staying	12517	27019071
Total # pool of poor (N)	23839	75806642
% entering pool of poor	1.9%	2.3%
% leaving pool of poor	1.5%	1.7%
% staying in pool of poor	52.5%	35.6%
Total pool of poor (%)	100.0%	100.0%

Table 7: Poverty impact of total, hospital and other out-of-pocket expenditure, Vietnam 1998

	Total	*Hospital*	*Other*
Food poverty lines			
z_{pov}^{pre}	1287	1287	1287
z_{pov}^{post}	1287	1287	1287
Poverty headcounts			
H_{pov}^{pre}	15.0%	15.0%	15.0%
H_{pov}^{post}	18.4%	15.4%	17.8%
$PI^{H} = H_{pov}^{post} - H_{pov}^{pre}$	3.4%	0.5%	2.9%
Poverty gaps			
G_{pov}^{pre}	40.56	40.56	40.56
G_{pov}^{post}	50.24	41.63	49.09
$PI^{G} = G_{pov}^{post} - G_{pov}^{pre}$	9.68	1.07	8.54
Normalized poverty gaps			
NG_{pov}^{pre}	3.2%	3.2%	3.2%
NG_{pov}^{post}	3.9%	3.2%	3.8%
$PI^{NG} = NG_{pov}^{post} - NG_{pov}^{pre}$	0.8%	0.1%	0.7%
Prepay PG prepay poor (A)	3074346783	3074346783	3074346783
PG increase prepay poor (B)	540819857	54727806	508083771
PG increase prepay nonpoor (C)	193279823	26725566	139066114
A as % of (A+B+C)	81%	97%	83%
B as % of (A+B+C)	14%	2%	14%
C as % of (A+B+C)	5%	1%	4%
B as % of (B+C)	74%	67%	79%
C as % of (B+C)	26%	33%	21%

Figure 1: Lorenz curve of pre-payment income and concentration curves of payments and post-payment income

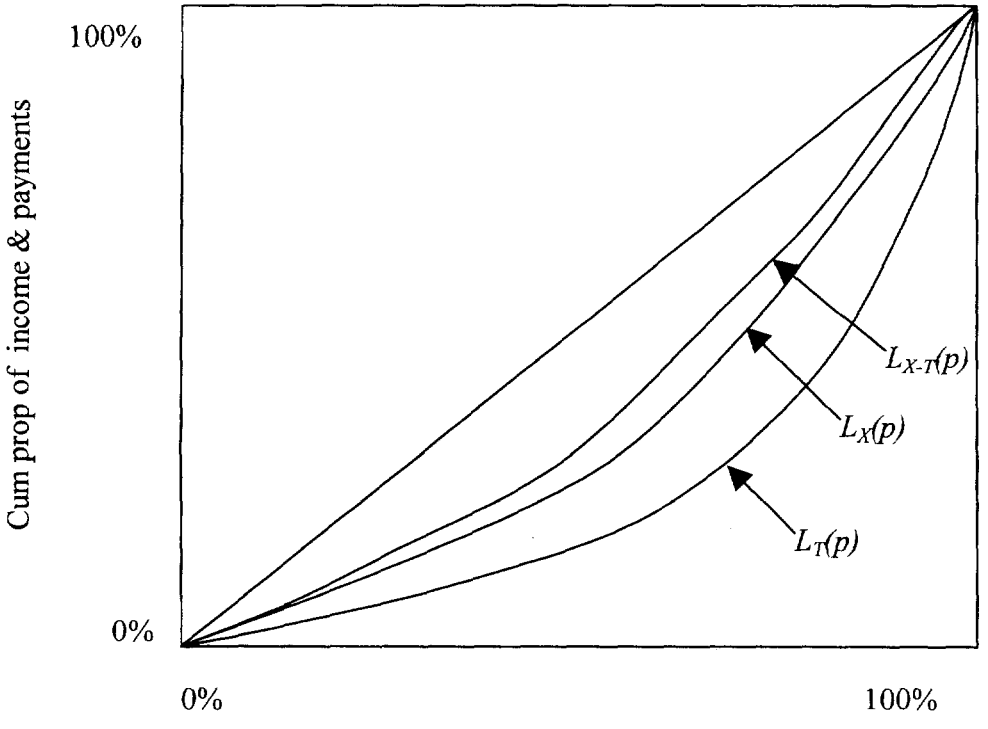


Figure 2: Horizontal inequity and reranking

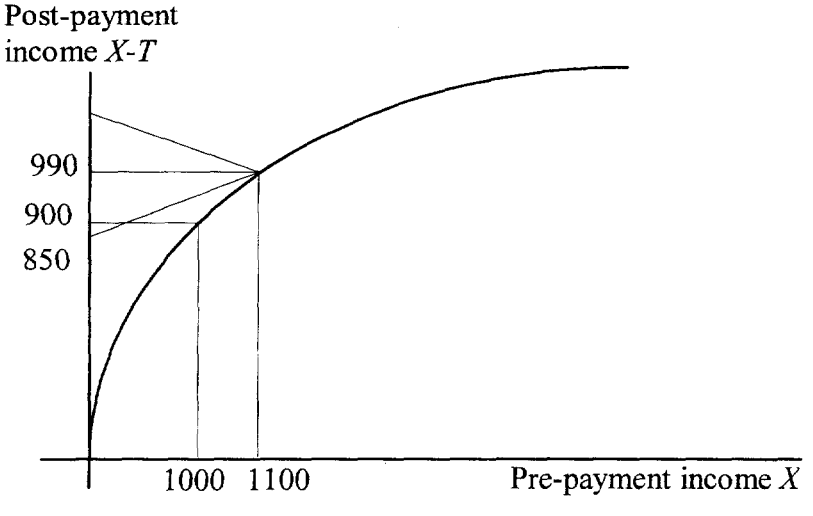


Figure 3: Catastrophic out-of-pocket expenditures as share of pre-payment income, by cumulative % of population

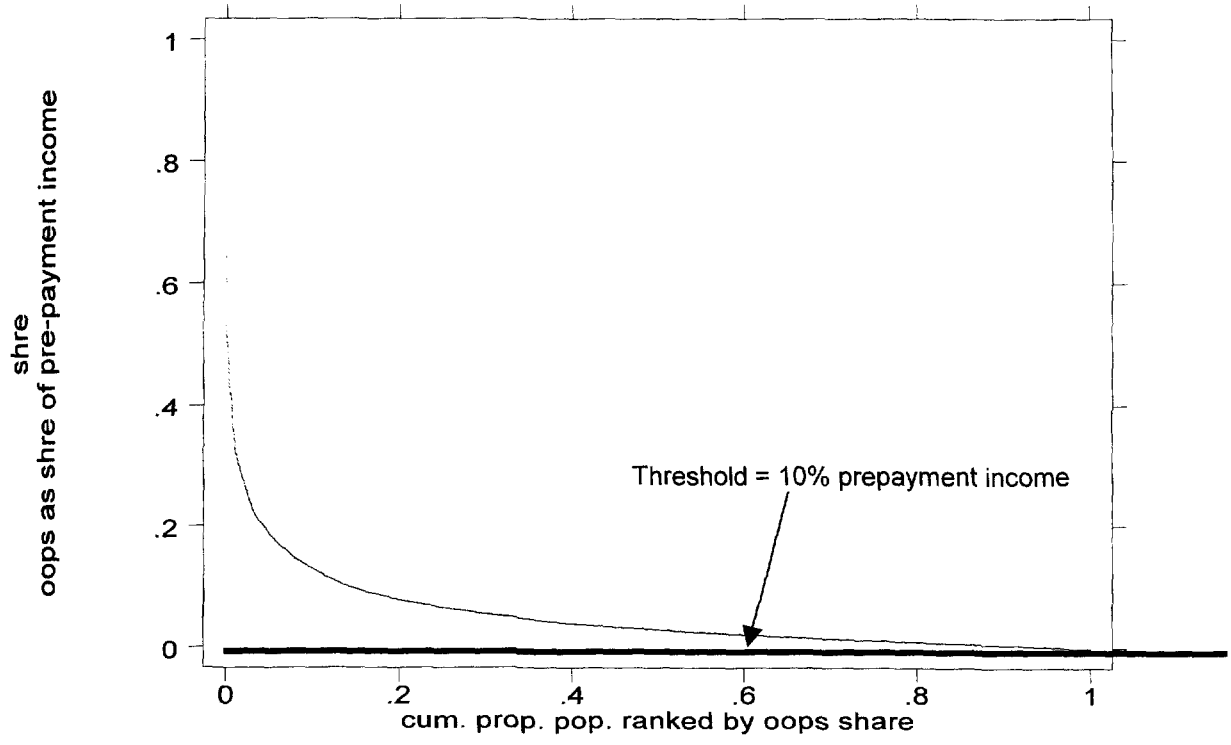


Figure 4: Poverty impact on Pen's Parade —before and after out-of-pocket payments

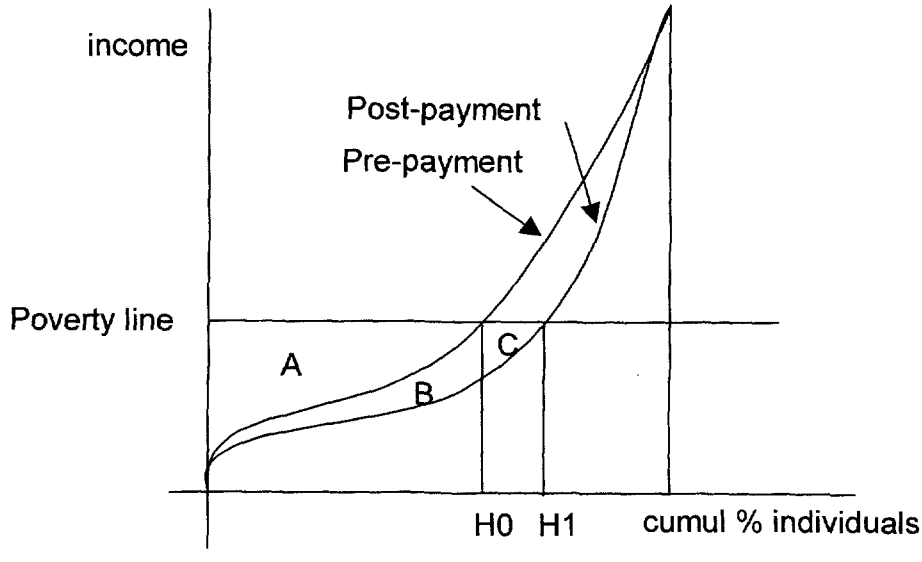


Figure 5: Poverty impact and the break-even level of income at which post-payment income is independent on degree of progressivity

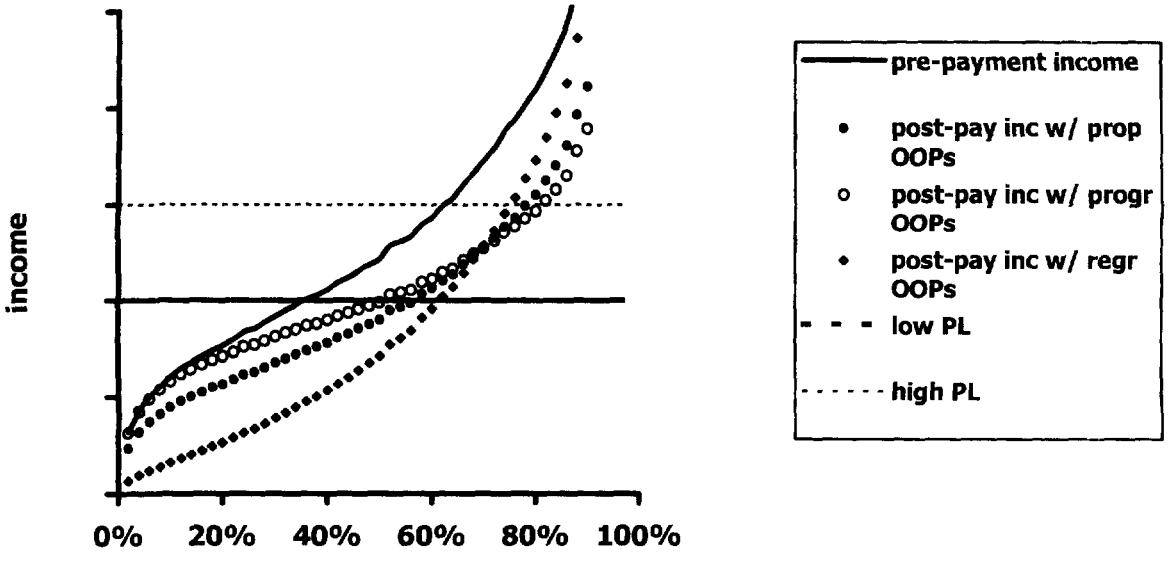


Figure 6: Poverty impact and the share of (progressive) payments

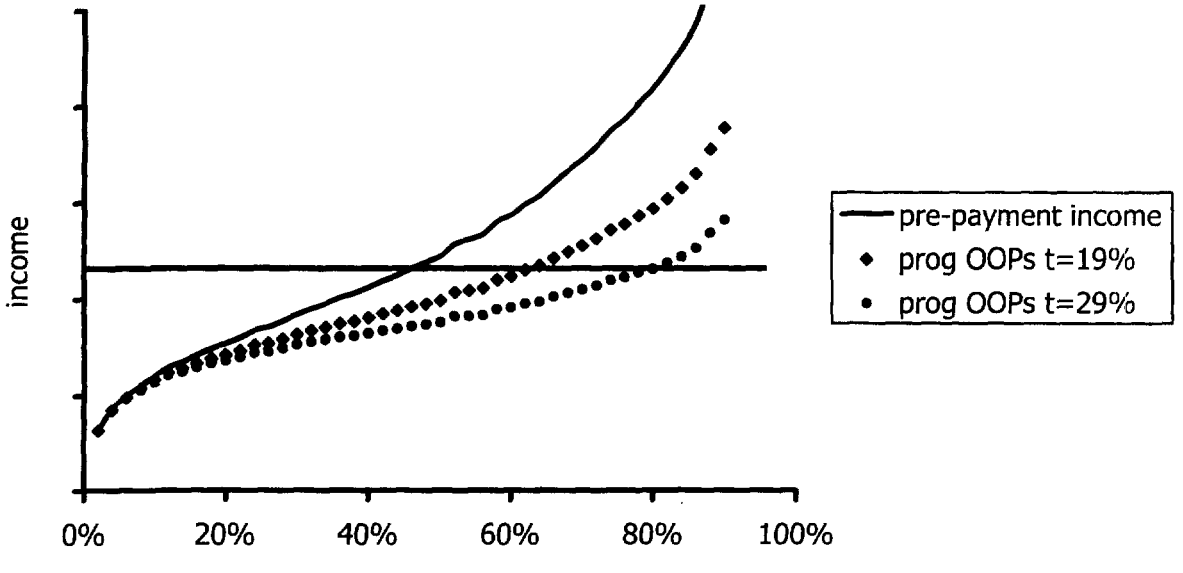


Figure 7: Poverty impact, progressivity and level of payments

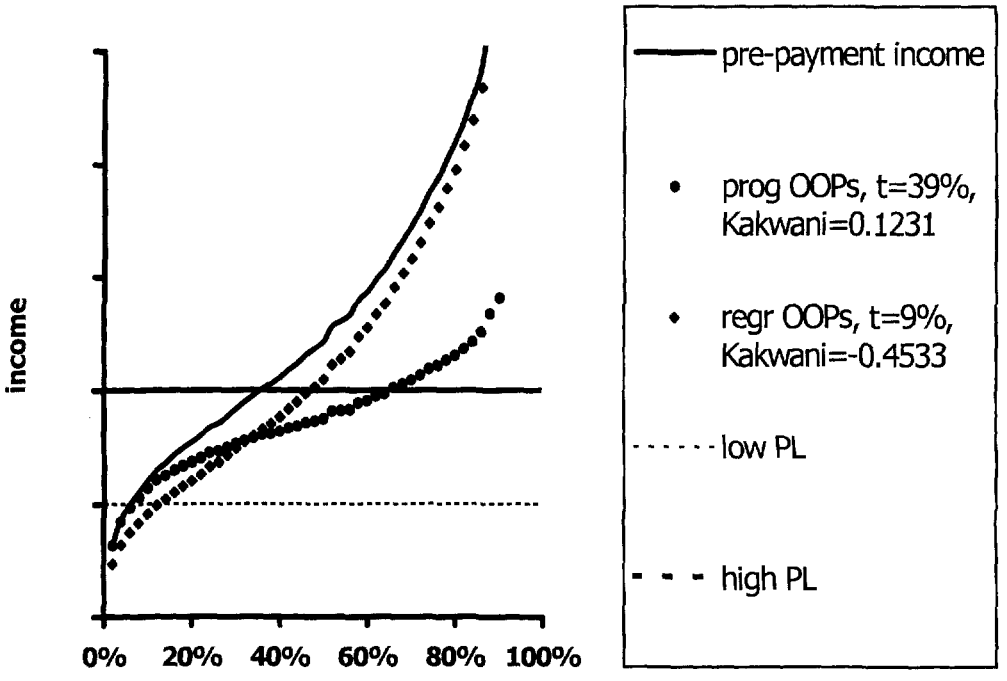
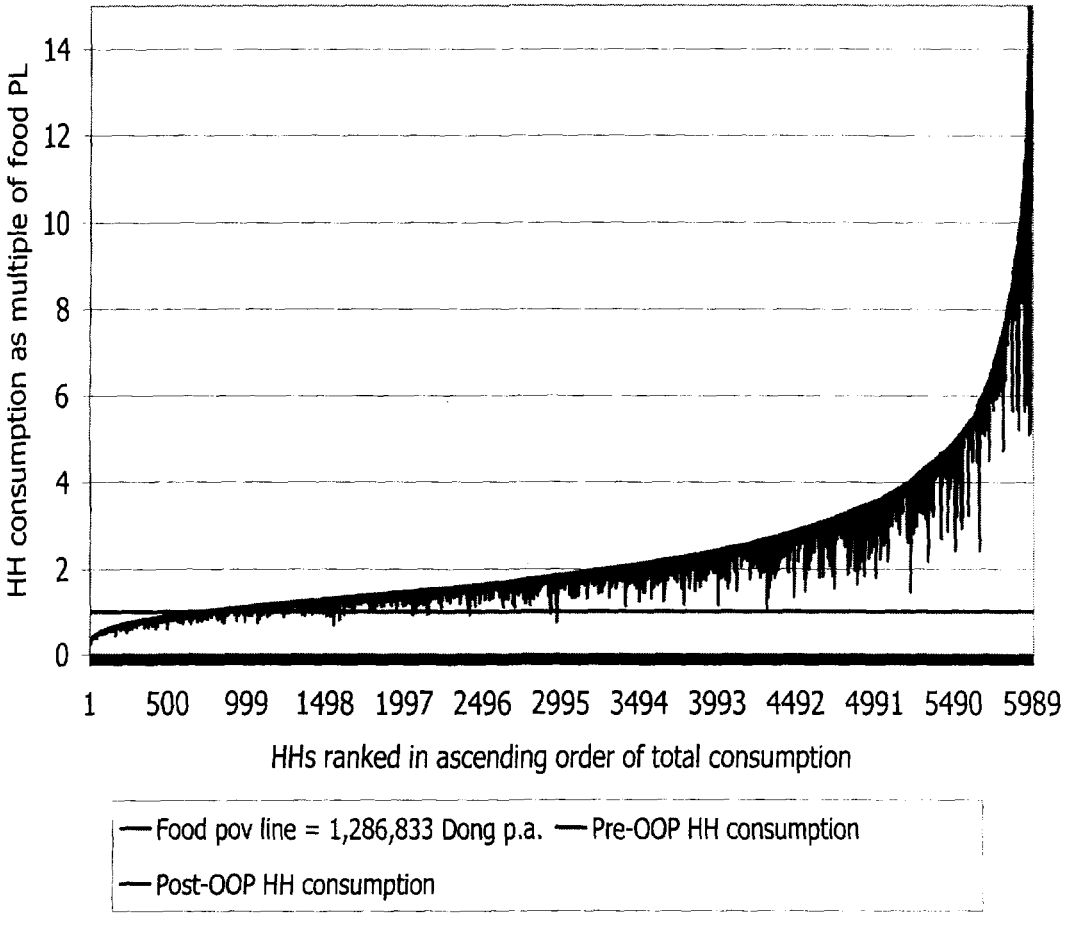


Figure 8: Extreme poverty, pre-payment and post-payment income, Vietnam 1998



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