Chapter 41

The Impact of Vertical and Horizontal Inequality on the Fairness in Financial Contribution Index

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Introduction

The concept of fairness in household financial contribution to the health system was introduced by WHO in The World Health Report 2000 (1). In this context, fairness was defined as an equal burden where every household would pay an equal share of its capacity to pay to the health system. The ratio of a household’s health payments to its capacity to pay is called the household financial contribution (HFC). If all households contribute the same share of their capacity to pay, the HFC of each household will equal the ratio of a country’s total health expenditure to its total capacity to pay (2). An index of fairness in financial contribution (FFC) was defined to measure dispersions from the equal burden criterion. It was constructed to vary from 0 to 1, with 1 representing perfect fairness.

The deviations from perfect fairness can be separated into two distinct effects: a vertical effect and a horizontal effect. The vertical effect refers to the situation where households with different incomes contribute different proportions of their incomes. Horizontal inequality refers to the situation where households facing similar economic conditions pay different proportions of their incomes. Extreme horizontal inequality occurs when households face catastrophically high health expenditures, here defined as 40% or more of their capacities to pay. Moderate horizontal inequality is associated with smaller differences across households faced with similar financial conditions.

The publication of an index of fairness in financial contribution for 191 countries in The World Health Report 2000 generated considerable debate among policy-makers, international organizations, and the academic world (3–8). It was argued that the FFC index treats progressive and regressive contributions to the health system equally (4;6). In a progressive system, the rich pay a higher share of their incomes than the poor. In contrast, in a regressive system, it is the poor that pay a higher share. According to the critics, the FFC framework ignores the fact that most societies seek to ensure progressive financial contributions because it treats any deviations from equal burden equally; both progressive and regressive contributions are considered unfair. In theory, they argued, the FFC index could penalize a country for being “too progressive” in health financing contributions.

The purpose of this chapter is to investigate empirically the sources of inequality underlying the FFC index. In this analysis it will be possible to test if any countries are penalized for having health financing systems that are “too progressive.” The analysis is based on micro-level household survey data from 59 countries. The next section of the chapter introduces the approach used to decompose the observed unfairness into vertical, extreme horizontal, and moderate horizontal inequality. Section three presents the survey data. Section four reports the empirical results on the effects of removing the various inequality components from total unfairness. This is accomplished by a counterfactual analysis that illustrates how much more fair (or less unfair) the health financing system would have been without the various inequality effects. The last section discusses the findings.

Methods

The household financial contribution (HFC) represents the household’s financial burden due to health system payments. It is a ratio that relates total household expenditure for health (HE) through general taxes, social health insurance contributions, private health insurance premiums, and out-of-pocket payments, to the household capacity to pay (CTP).
Household capacity to pay for health services $CTP_i$ is not defined as its total effective income but as effective income minus subsistence needs $(SE)$ (2). This is because households must first meet certain basic needs before health system payments become relevant and economically feasible. In The World Health Report 2000, the actual food expenditure of households was used as a measure of subsistence needs. However, a certain amount of food spending is on non-essential items. For this reason, a food poverty line estimated from the survey data for each country is now used to approximate subsistence needs. Details on the derivation of this poverty line are provided in Xu et al. (9).

This food poverty line is fixed in any country and is equal for all households regardless of their income levels. Because a constant (the food poverty line) is deducted from each household's income, the ratio of health expenditure to total effective income will be lower than the ratio of HE to CTP for all households. The deduction of subsistence expenditures changes this proportion a lot more for poor households, where subsistence needs are a much higher proportion of their total incomes, than for rich households. It means that if all households pay the same proportion of their capacities to pay, the richer pay higher proportions of their total income than the poor—the system is progressive. It also means that after the subsistence deduction, any departure from equal proportional contribution of CTP is considered unfair—the concern for progressivity has already been accounted for in the deduction.

The FFC index is defined as:

$$HFC_i = \frac{HE_i}{CTP_i}$$  \hspace{1cm} [1]$$

According to the definition of fairness in equation [2], in the absence of any inequality (vertical, extreme horizontal or moderate horizontal) the FFC index equals 1. Departures from this objective generated by any of the three inequality effects are measured by the extent to which the index departs from 1. The difference between the perfectly fair FFC and the one that is observed ($\Delta FFC = 1 - FFC$) can be partitioned into a vertical effect ($\Delta FFC_v$), a catastrophic spending effect ($\Delta FFC_c$), and a moderate horizontal effect ($\Delta FFC_b$) as:

$$\Delta FFC = 1 - FFC = \Delta FFC_v + \Delta FFC_c + \Delta FFC_b$$  \hspace{1cm} [4]$$

If the summary measure of the HFC distribution where there is no vertical effect is denoted by $FFC_o$ and the original distribution incorporating all the effects (the starting point) by FFC, the vertical effect can be written as:

$$\Delta FFC_v = FFC_v - FFC$$  \hspace{1cm} [5]$$

Now, if $FFC_c$ is the distribution where there is no vertical and no catastrophic effect, the catastrophic effect (net of the vertical effect) can be written as:

$$\Delta FFC_c = FFC_c - FFC_v$$  \hspace{1cm} [6]$$

The moderate horizontal effect can be obtained from the residual as:

$$\Delta FFC_b = 1 - FFC_c$$  \hspace{1cm} [7]$$

**Separation of Vertical Effects**

Observed HFC in any country can be written as a function of household expenditures:

$$HFC_i = f(exp_i) + \varepsilon_i$$  \hspace{1cm} [8]$$

The relationship is not linear, and piecewise linear regression can be used to approximate non-linear relationships with the advantage that the parameters are determined by the underlying data and no parametric assumptions about functional form are needed (10). In a fairly financed system, each household would contribute an equal share of its capacity to pay to the health system. This equal burden contribution was defined as $HFC_o$ in equation [3]. Without vertical inequality, households would be observed to pay:

$$HFC_i = HFC_o + \varepsilon_i$$  \hspace{1cm} [9]$$

where $HFC_o$ denotes household $i$'s health financing contribution after dropping the vertical effect. The residual $\varepsilon_i$ is the horizontal effect that would still exist and is estimated from the piecewise regression of equa-
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The counterfactual FFC in the absence of the vertical effect \((FFC_v)\) can be estimated using the \(HFC_v\) from equation [9], and the contribution of the vertical effect to the observed FFC is then estimated as:

\[
FFC_v = 1 - \frac{\sum_{i=1}^{n} [HFC_v - HFC_o]}{n} \tag{10}
\]

where \(HFC_v\) represents \(HFC_o\) re-estimated for the counterfactual distribution of health expenditures in the absence of the vertical effect using equation [3].

**Separation of the Effect of Catastrophic Spending and Moderate Horizontal Effects**

After eliminating the impact of the vertical effect on the index, the next step is to remove the effect of catastrophic expenditure. This is done by estimating the counterfactual distribution of HFC in the absence of catastrophic health spending. The threshold used for defining catastrophic health expenditure is somewhat arbitrary and in order to facilitate cross-country comparison, it has been set at 40% of the household capacity to pay (9).

Using this threshold, observed household financial contributions (HFC) were truncated at 40% for the households who paid catastrophic shares of their capacities to pay. In order to pool the risk of catastrophic health expenditure, the payments that exceeded 40% of capacity to pay were reallocated to households paying less than 40%. The ratio \((\alpha)\) describes the average additional contribution that would need to be made by all households without catastrophic health expenditures (assuming no vertical effect):

\[
\alpha = \frac{\sum [(HFC_v - 0.4) | HFC_v \geq 40\%] \cdot CTP_i}{\sum (CTP_i | HFC_v < 40\%)} \tag{11}
\]

The new HFC for each household \(i\) excluding catastrophic payments \((HFC_c)\) would then be:

\[
HFC_c = HFC_v + \alpha \quad \text{if} \quad HFC_v < 40\% \tag{12}
\]

\[
HFC_c = 0.4 \quad \text{if} \quad HFC_v \geq 40\%
\]

The corresponding FFC index that excludes the effect of catastrophic spending \((FFC_c)\) is computed as:

\[
FFC_c = 1 - \frac{\sum_{i=1}^{n} [HFC_c - HFC_o]}{n} \tag{13}
\]

\(HFC_c\) is \(HFC_o\) in the absence of the vertical effect and the effect of catastrophic expenditures (see equation [3]).

Moderate horizontal effects are estimated using equation [7] as described above.

**Data Sources**

The analysis is based on national representative household surveys from 59 countries. The surveys were conducted between 1991 and 2000, sample sizes ranging from 1,103 households in Sweden to 62,946 in the Republic of Korea. Most of the surveys from developing countries were Living Standards Measurement Studies while Household Budget surveys or Income and Expenditure surveys were used for other countries. Details on the type of survey, survey years, and sample sizes are given in Chapter 42.

**Results**

**Removing the Vertical Effect**

A comparison of the estimates of the FFC, index with the original FFC for the 59 countries indicates that the vertical effect had a very small impact on total inequality (Figure 41.1). The counterfactual FFC in

![Figure 41.1 Decomposing the FFC index: removing the vertical effect](image-url)
the absence of the vertical effect would have been no more than 1.5% greater than the observed FFC in all but three countries, and the difference is never more than 5%. The rank order correlation coefficient of FFC and FFC\(_v\) is also very high at 0.996, with 88% of countries staying at the same rank or changing rank by a maximum of two places after the removal of the vertical effect. The three countries where the impact of the vertical effect was the greatest were Azerbaijan, Viet Nam, and Jamaica. In Jamaica, for example, the FFC index improves from 0.787 to 0.823 as a result of removing the vertical effect, an increase of 4.5%.

To explore the relationship between the progressivity and regressivity of health payments and the impact of the vertical effect on the FFC described above, Figure 41.2 plots the impact of the vertical effect on FFC (shown as the percentage change in the FFC as a result of eliminating the vertical effect) against the concentration index of HFC for all countries. This concentration index shows the progressivity of the household financial contribution to health and is bounded at the lower extreme by –1 (when the entire burden of paying for health falls on the group with the lowest capacity to pay) and 1 at the upper extreme (when the entire burden falls on the group with the greatest capacity to pay). A negative concentration index indicates that the poor contribute a larger share of their capacity to pay than the rich, or regressivity. A positive index indicates progressivity in contributions with respect to capacity to pay.\(^1\)

The results show that the distribution of observed HFC was progressive, i.e. the concentration index was positive, in 19 countries and regressive in the remaining 40. The three countries in which the impact of removing the vertical effect on the FFC was earlier shown to be the greatest (Azerbaijan, Viet Nam, and Jamaica) also had the most regressive HFC distributions using the concentration index. Removing the vertical effect in these countries would improve the FFC by up to 4.5%. On the other hand, progressivity in the HFC distribution is associated with a positive vertical effect in 19 countries. However, removal of this vertical effect improves the FFC by more than 0.5%. This indicates that, as Wagstaff (4) and Shaw (6) suggest, an index of fairness based on deviations from equal burden can penalize countries whose health financing contributions are highly progressive, but the resulting impact on the FFC is negligible.

**Removal of the Effect of Catastrophic Spending**

Catastrophic spending was defined to occur when households contribute 40% or more of their capacity to pay to the health system. Figure 41.3 depicts the observed FFC for each country on the horizontal axis. The triangles show the relationship between FFC and FFC\(_v\), or the FFC after the vertical effect has been removed, on the vertical axis. This part of Figure 41.3 shows the decomposition of the FFC index: removing both vertical and extreme horizontal effect.

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**Figure 41.2** Concentration index of HFC (CI_HFC) vs. percentage increase in FFC after removing the vertical effect

![Graph showing CI_HFC vs. percentage increase in FFC](https://via.placeholder.com/150)

**Figure 41.3** Decomposing the FFC index: removing both vertical and extreme horizontal effect

![Graph showing observed FFC vs. FFC after removing vertical and extreme horizontal effect](https://via.placeholder.com/150)
reproduces Figure 41.1 showing that removal of the vertical effect makes very little difference to the FFC. The vertical axis also shows the relationship between FFC and FFCv. After removing the effect of catastrophic payments on top of the vertical effect in the manner described above, the FFC improves considerably and is much fairer in most countries (FFCv is closer to 1 than the original FFC and FFCc). This is especially noticeable in countries where the initial FFC was less than 0.875, i.e. those countries where financial contributions were distributed across households least fairly. After the removal of catastrophic payments, the FFC for most countries would be concentrated around 0.9, suggesting that policies such as the introduction of health insurance have the potential to dramatically improve the fairness of the health financing system in many settings. With such actions, the resulting degree of fairness would be relatively similar across countries.

Removing the Moderate Horizontal Effect

The moderate horizontal effect refers to the remaining effect that is not due to the vertical effect or to catastrophic payments. This is shown to contribute a relatively high proportion of total unfairness in Figure 41.4—the FFC would be between 0.05 and 0.1 units higher in its absence. It is comparatively more important, not surprisingly, in countries where the vertical and extreme horizontal effects are low so that in the OECD countries, for example, the main cause of inequality is related to the moderate horizontal effect. This contrasts with findings from earlier research on inequality in health care financing in the OECD countries which highlighted the importance of regressivity in financial contributions to health (e.g. the vertical effect) (11–13).

The importance of the horizontal rather than the vertical effect in determining the fairness in the distribution of HFC is also reinforced by the lack of any relationship between the redistributive effect (RE) and the FFC index. The RE is a measure describing the extent to which income distribution becomes more or less equal after health contributions by households are subtracted from household income. The RE is bordered by –1 at the lower end, negative values indicating that health payments make the after-health payment income distribution more regressive. Positive values (the maximum value is 1) are obtained when the impact of payments on the after-payment distribution is progressive. Figure 41.5 plots the FFC index against RE. There is no clear relationship between the two indices in the survey data for these 59 countries. The

![Figure 41.4 Sources of unfairness (1-FFC)](image-url)
FFC and RE capture different concerns, the former focusing on the fairness of burden that financial contributions impose on households, and the latter focusing on the impact of financial contributions on progressivity in the income space (14). The FFC also uses a cubic function, giving more weight to households at the tail of the distribution, e.g. households with catastrophic expenditures. In contrast, RE is not especially sensitive to the tail of the distribution, but is influenced more by households located in the middle part of the distribution. Murray et al. (14) show that the RE is also relatively insensitive to horizontal inequality, whereas the FFC index captures horizontal inequalities more systematically, as illustrated above.

Conclusions and Discussion

This decomposition analysis of the FFC in 59 countries has showed that vertical inequality played a minor role in the total inequality in household financial contributions captured by the FFC index. Instead, the FFC was sensitive to horizontal inequality. Moderate horizontal inequality is important in all countries while in some, extreme horizontal inequality associated with catastrophic health expenditure is significant as well.

These findings differ from those of earlier studies suggesting the importance of vertical inequality in household contributions to health using the RE as an indicator. There are two ways to think about inequality or fairness in this context: one is defined in the income space addressing the impact of payments on household income, while the other considers the financial burden on households in what has termed the burden space (14). The redistributive effect (RE) belongs to the first class of measures and it is concerned mainly with the progressivity of payments in terms of income. The FFC index conforms to the second approach where concern lies with departures from the equal burden principle.

It should be noted, however, that while the overall health financing system may display vertical fairness, individual financing sources can still include a substantial degree of vertical unfairness. Though the effects may be balanced out when all payments, public and private, are considered simultaneously, certain payments may affect various households differently. For example, out-of-pocket payments are often unexpected and their impact on poor households might be different from the impact of taxation or insurance premiums, which are more predictable.

Certain limitations of the data used in the analysis need to be considered when drawing conclusions for policy. Firstly, some of the surveys undertaken in the early 1990s might not reflect the impact of more recent reforms in health system financing. Some countries may, therefore, have fairer or more unfair systems than implied by the numbers reported in this paper. Secondly, some survey data are of lower quality than others. Efforts are continually being made to identify high quality and more recent household surveys. Thirdly, there is variation in the recall periods used to ask questions related to health service utilization and the associated expenditure. Some surveys use a one month recall period, some use three months, some use one year, and some use combinations such as one month for outpatient services and three months or a year for inpatient services. This has been a concern in the analysis of catastrophic expenditures. A short recall period will have a smaller memory bias than a long recall period, while the latter may capture catastrophic expenditures better than the former. The direction of biases generated by different recall periods is not self-evident. Preliminary regression results indicate that no systematic relationship exists between recall period and catastrophic payments. However, this is an issue that needs to be investigated more in the future.

Despite this, the policy implications of the findings are straightforward. In countries with a relatively high degree of unfairness, the principal means to improve fairness in the health financing system is to introduce risk-sharing mechanisms that help to avoid catastrophically high health payments and reduce the likelihood that people with similar capacities to pay contribute different proportions of their non-subsistence income. One probable reason for the differences in the degree
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Notes

1 It should be emphasized that the concentration index is estimated here with respect to HFC, which is a ratio that already incorporates capacity to pay, and consequently an element of progressivity accruing through the subsistence deduction. The other alternative would be to estimate the concentration index with respect to health expenditures, the numerator of HFC. This would not be consistent with the estimation of FFC and would make the comparison of the concentration index and the vertical component of the FFC less appropriate. Because the HFC has progressivity built in through the deduction of the subsistence component, even a neutral concentration index (one that equals 0) indicates a progressive distribution with respect to income from which no subsistence expenditure deduction has been made. Similarly, a progressive HFC distribution indicates an even more progressive distribution with respect to the pre-deduction total income distribution.

References


