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Who Benefits from Health Sector Subsidies? Benefit Incidence Analysis

Subsidization of health care from the public purse is commonplace. Ensuring that public spending on health care is pro-poor is a stated goal of international organizations, such as the World Bank, as well as many national governments. This may stem from a desire to ensure the poor have access to health care, considered a basic human right. But pro-poor spending on health care can also be pursued for its instrumental value in raising the health of the population and so the productivity of the labor force and, consequently, economic growth. Public subsidization of health care may also be motivated, or at least justified, by sector-specific equity objectives, such as equal treatment for equal need. Public health care can also be used as an instrument of broader poverty alleviation and redistribution policy when redistribution through cash transfers is severely impeded by information and administrative constraints (Besley and Coate 1991). Whether or not such justifications for public spending on health care are convincing depends on the distribution of the benefits from this spending. Who gains most? Is it the poor? Or does a substantial proportion, even a disproportionate proportion, of the spending go to the economically better-off? These are the questions addressed by benefit incidence analysis (BIA).

BIA describes the distribution of public spending across individuals ranked by their living standards (Aaron and McGuire 1970; Brennan 1976; Meerman 1979; van de Walle and Nead 1995). In its most simplistic form, it is an accounting procedure that seeks to establish who receives how much of the public spending dollars. Recipients are usually distinguished by their relative economic position, but the geographic distribution of spending could also be examined or the distribution across characteristics such as ethnicity or age. A more ambitious form of BIA attempts to estimate the extent to which public spending changes the distribution of final income, that is, income net of taxes and gross of in-kind transfers. As with tax incidence, this requires identification of the behavioral response to public spending (van de Walle 2000). For example, to what extent does public spending on health care crowd out private spending, and how does this vary with income? Or more indirectly, to what extent does public health care change gross incomes by affecting labor supply and saving decisions? Answering such questions requires detailed econometric analysis to identify the counterfactual distribution of income that would exist if there were no public spending on health care. In this chapter,

we discuss the more simple form of BIA, which aims to describe the distribution of public health spending across an income distribution that is taken as given. We also confine attention to the distribution of average spending and do not consider the benefit incidence of marginal dollars spent on health care (Lanjouw and Ravallion 1999; Younger 2003).

Living standards need not be measured by income. Any of the measures discussed in chapter 6 could be used. If an ordinal measure, such as a wealth index, is chosen, then it is possible only to determine whether the distribution of public health care is pro-poor or pro-rich and not the extent to which, abstracting from behavioral responses, public spending changes some cardinal measure of inequality in living standards.

Having chosen a measure of living standards, there are three principal steps in a nonbehavioral BIA of public health spending. First, the utilization of public health services in relation to the measure of living standards must be identified. Second, each individual's utilization of a service must be weighted by the unit value of the public subsidy to that service. Finally, the distribution of the subsidy must be evaluated against some target distribution. In this chapter, we discuss each of these three steps in turn.

Distribution of public health care utilization

Microdata from a health or multipurpose household survey are required to estimate the distribution of public health care utilization across individuals in relation to living standards. Three factors deserve particular consideration in relation to the choice of survey. First, it must contain data on both health care use and some measure of living standards. Second, it should distinguish between public and private care. Third, the recall periods for health care utilization should be sufficiently long such that the sample of observed users is not too small but not too long such that recall bias is large. For health services that have a higher frequency of utilization, such as ambulatory care, the optimal recall period is probably in the range of 2 to 4 weeks, and most surveys use a period in this range. For inpatient care, the recall period should be longer. It is typically 12 months.

Only health services that are subsidized from the state-controlled budget should be considered. Public health programs and services financed from Overseas Development Assistance (ODA), user fees, and social insurance are relevant, provided the respective revenues are used at the discretion of the state. Difficulties arise if a survey does not distinguish between public and private care. In that case, private insurance cover, if available, might be used to distinguish between public and private patients. Otherwise, a BIA can be conducted only if the private sector is sufficiently small such that it can be ignored.

Calculation of the public health subsidy

Examination of raw utilization data does not capture variation in the quality of health care received and in payments made. Nor does it facilitate aggregation across services to determine the distribution of the total health sector subsidy. Both extensions require estimates of unit subsidies.

Box 14.1 *Distribution of Public Health Care Utilization in Vietnam, 1998*

Data are from the 1998 Vietnam Living Standards Survey (VLSS). Living standards are approximated by household consumption per equivalent adult. Five categories of health care are examined: inpatient days, hospital outpatient visits, visits to commune health centers, visits to polyclinics, and a residual category (domestic medical visits and visits to “other government facilities”). For all categories, except inpatient care, the survey distinguishes between public and private care. Because there were only 4 private hospitals in Vietnam of a total of more than 800 at the time of the survey (World Bank 2001), we simply assume all inpatient care is public care. Inpatient days are reported for a 12-month reference period, the other categories for the previous 4 weeks.

In the table below, we present, for each category of care, the cumulative percentage of total utilization accounted for by each quintile of household consumption. Figures in bold indicate significant differences from the respective population shares at 5 percent or less. Poorer groups receive less than their population share of hospital care at all quintiles. This is confirmed by tests indicating that the 45-degree line dominates both concentration curves for hospital care. This pro-rich bias is also indicated by the concentration indexes, which are positive and significantly different from zero. In contrast, utilization of commune health centers is pro-poor. There is no significant bias in the utilization of polyclinics and other public health services.

Distribution of Public Health Care Utilization in Vietnam, 1998

<i>Cumulative shares</i>	<i>Hospital care</i>		<i>Commune health center visits</i>	<i>Polyclinic visits</i>	<i>Other public health services</i>
	<i>Outpatient visits</i>	<i>Inpatient days</i>			
Poorest 20% (standard error)	8.90% (0.9949)	10.29% (1.2141)	22.65% (1.8860)	22.91% (5.7815)	13.22% (2.9644)
Poorest 40%	23.45% (1.6629)	27.74% (2.0465)	47.83% (2.4084)	32.81% (6.2628)	47.09% (6.3806)
Poorest 60%	43.58% (2.3987)	47.66% (2.4772)	77.86% (1.9943)	59.29% (6.8524)	59.00% (6.0599)
Poorest 80%	66.07% (2.7376)	70.36% (2.5702)	90.60% (1.4456)	78.24% (6.5783)	79.63% (4.5689)
Test of dominance against 45° line	–	–	+		
Concentration index (robust standard error)	0.2436 (0.0368)	0.1784 (0.0370)	–0.1567 (0.0335)	0.0401 (0.1042)	0.0056 (0.0777)

Note: For shares, bold indicates significant difference from population share at 5%. For concentration indexes, bold indicates significant difference from zero at 5%. Standard errors for concentration indexes are robust to heteroskedasticity and within cluster (commune) correlation. Dominance tests: – indicates the 45-degree line dominates the concentration curve (pro-rich)
+ indicates concentration curve dominates 45-degree line (pro-poor)
Blank indicates nondominance.

Dominance is rejected if there is at least one significant difference in one direction and no significant difference in the other, with comparisons at 19 quantiles and 5% significance level. Quintile shares and their standard errors were computed, along with the dominance tests, using the dominance ado described in chapter 7. Concentration indexes computed as described in chapter 8.

Source: Authors.

Definition of public subsidy

The service-specific public subsidy received by an individual is as follows:

$$(14.1) \quad s_{ki} = q_{ki}c_{kj} - f_{ki},$$

where q_{ki} indicates the quantity of service k utilized by individual i , c_{kj} represents the unit cost of providing k in the region j where i resides, and f_{ki} represents the amount paid for k by i . The total public subsidy received by an individual is as follows:

$$(14.2) \quad s_i = \sum_k \alpha_k (q_{ki}c_{kj} - f_{ki}),$$

where α_k are scaling factors that standardize utilization recall periods across services. One might standardize on the recall period that applies for the service accounting for the greatest share of the subsidy. For example, where this is inpatient care, reported over a one-year period, then $\alpha_k = 1$ for inpatient care and, for example, $\alpha_k = 13$ for services reported over a 4-week period.

Unit costs

The starting point for the costing component of a BIA is total public recurrent expenditure on health care. Ideally, this should be disaggregated down to geographic region, then to facility (hospital, health center, etc.) and, finally, to service (inpatient/outpatient, etc.). At this disaggregate level, unit cost is calculated by dividing total recurrent expenditure by total units utilized. If accounts are not sufficiently detailed to allow net public expenditure to be identified by region and facility, then all units of a given service must be weighted by the same unit subsidy estimated. In such circumstances, aggregation across services is the only purpose served by application of unit subsidies. Within a particular service, the distribution of the subsidy and the distribution of raw utilization will differ only in their means. Nevertheless, such aggregation can still be informative, allowing the incidence of the total health sector subsidy to be established and this incidence to be decomposed into that arising from differential use of services and that arising from differential subsidies across services.

Aggregate health accounts data are required to determine total public expenditure on health and its disaggregation to regions and facilities. For accuracy and consistency, the data should come from a unified system of National Health Accounts (NHA). In practice, data limitations mean that this ideal scenario is rarely achieved, although see O'Donnell et al. (2007) for BIA studies based on NHA. Moving from facility-specific to service-specific expenditures can be difficult given the joint use of many health resources across a range of services. The detailed information necessary to distinguish between expenditures on, for example, outpatient and inpatient services might be available only from facility-level cost surveys. Data from such surveys can be used to estimate cost functions from which the unit costs of services can be recovered. Without NHA, disaggregation of public health expenditures down to the service level is likely to prove difficult and require the imposition of various assumptions and approximations. The robustness of results to these approximations should be checked through sensitivity analysis.

Aggregate service utilization figures can either be estimated from survey data or taken from administrative records. The relative accuracy of these two approaches will vary across services and countries. Application of survey utilization rates has the advantage of consistency. Unit cost is calculated by dividing aggregate expen-

diture by the weighted sum utilization reported in the survey data, where weights are expansion factors indicating how many individuals in the population are represented by each sample observation. Expenditure on each (survey) individual is quantity multiplied by unit cost. Summing these individual expenditures across all observations and applying the population expansion factors, one arrives back at total public expenditure on a service.

User fees

The simplest method of allocating user fees is to divide aggregate user fee revenue reported in official accounts by an estimate of total utilization and to assign the resulting average payment to all users. Equivalently, one can apportion public expenditure net of official user fee revenue in proportion to utilization. If the net public expenditure figures are available at a region-facility-service level, then variation in fee payments across region-facility-service groups is taken into account but not variation across individuals within groups. Individual variation in fees paid can be taken into account if the survey provides reliable data on payments made for public health services. This would be important, for example, if there were fee exemptions for the poor.

Some surveys ask the amount paid for each public health service. In this case, the public subsidy can be calculated as in equations 14.1 and 14.2. Alternatively, if the survey gives only the total amount paid for all public health services, then modify equation 14.2 to

$$(14.2') \quad s_i = \sum_k \delta_k q_{ki} c_{kj} - f_i,$$

where f_i is the payment for all public health care and δ_k is a scaling factor that standardizes the recall periods for the utilization variables on the recall period that applies to the total payment variable.

Survey estimates of aggregate user fee revenues may not match the official figures. Apart from sampling and nonsampling error, the discrepancy can be explained by payments that are kept locally and not remitted to the central administration or by unofficial payments that are paid not to the facility but to personnel at the facility. The appropriate treatment of user payments in such cases depends on the objective of the analysis. If it is simply to identify the distribution of net expenditures made by the central government in an accounting fashion, then reported payments in excess of official revenue could be ignored. However, if the aim is to identify the incidence of net benefits from government-supported health services, then one seeks an estimate of the difference between the value of services consumed and the payments made for them by the individual, irrespective of whether all of the payment is remitted to the central government. In the instance that payments, official or unofficial, are made to fill the gap between the cost of the care provided and the available budget, then, in principle, they should be added to both costs and payments and so can be ignored in computation of the subsidy. On the other hand, if the payments are rent extracted by providers, then they reduce the real value of the subsidy to the individual and should be subtracted in calculation of the real subsidy. Most surveys do not distinguish between payments remitted to the center and those kept locally, and it is not possible to discern whether payments are used to raise quality or are rent extraction. The distribution of official user fee revenue remitted to the center

could be estimated by scaling all reported payments by the ratio of total official user fee revenue to aggregate payments calculated from survey data. One could test the sensitivity of results to this treatment of payments against subtracting all payments reported in the survey. Waiting and travel time also reduce the net benefit from care received by the individual and should, in principle, be valued and subtracted in computation of the subsidy. Survey data do not, however, usually permit this.

Box 14.2 *Derivation of Unit Subsidies—Vietnam, 1998*

National Health Accounts are not available for Vietnam, and so we estimate unit subsidies from public spending accounts. Total recurrent public expenditure on health was more than 5 trillion Vietnamese dong (D) in 1998 (\$1 = D 13,987) (World Bank 2001). That covers all spending on health programs and services provided by public health facilities and financed from the state budget, user charges, social health insurance, and external donors. The public accounts do not disaggregate by facilities within regions. We therefore impose the same unit costs across all users irrespective of their geographic location. Although this is common practice in BIA studies (Castro-Leal et al. 2000), it is regrettable. It means that geographic variations in the quality, as opposed to the quantity, of health care are not taken into account. Such variations can be substantial (Das and Hammer 2005).

At the national level, the public accounts disaggregate central and provincial government recurrent health spending by facility, that is, hospitals, polyclinics, and commune health centers (World Bank 2001). Public spending financed from other sources is not disaggregated by facility. Because health insurance finances hospital care only, total revenue from health insurance is added to the government expenditure on hospitals (World Bank 2001). Officially, user fees are charged for hospital and polyclinic care only. For baseline estimates, we divide total user fee revenue between hospitals and polyclinics in the same proportions as apply for government revenue (World Bank 2001). Finally, total public spending financed from ODA (World Bank 2001) is divided between hospitals, polyclinics, and health centers in the same proportions as apply for central and provincial government expenditures. By that allocation method, we arrive at the facility-specific public expenditures given in the first column of the table below. The total across facilities represents 59 percent of total recurrent public health spending.

Public Health Expenditure, Unit Costs and Subsidies, Vietnam 1998

	<i>Recurrent public exp. D millions</i>	<i>Total utilization '000s</i>	<i>Unit cost D</i>	<i>Total user fees</i>		<i>Mean unit subsidy</i>	
				<i>Official D m.</i>	<i>Reported D m.</i>	<i>Scaled user fees^a D</i>	<i>Reported user fees^b D</i>
Hospital care	2,704,424			429,128			
Inpatient		52,779 (days)	49,320		2,464,000	42,988	23,800
Outpatient		35,388 (visits)	2,865		1,154,000	1,990	1,690
Comm. health centers	269,101	43,520 (visits)	6,183		48,762	6,183	5,393
Regional polyclinics	34,062	3,973 (visits)	8,572	7,152	17,039	7,916	6,402
Total allocated	3,007,587			436,280	3,634,960		

Source: Authors' calculations from World Bank, SIDA et al. 2001 and VLSS.

Note: a. Calculated from user fees reported in VLSS scaled to sum to official user fee revenue.

b. Calculated from actual user fees reported in VLSS (not scaled).

Box 14.2 (continued)

As is often the case, the accounts do not distinguish between hospital expenditures on inpatient and outpatient services. Cost function estimates from a survey of 80 percent of public hospitals (Weaver and Deolalikar 2004) give the cost of an inpatient day at more than 17 times that of an outpatient visit. From that estimate of relative cost, plus aggregate public expenditure on hospitals and the total utilization of the respective services, the unit costs of an inpatient day and outpatient visits are derived (see table above, column 3). The unit costs of visits to health centers and to polyclinics are calculated by dividing total public expenditures on these facilities by respective total utilization figures, estimated from the VLSS. The resultant costs seem somewhat high in comparison to the estimated unit cost of a hospital outpatient visit. In a full report, sensitivity of results to these estimates of unit costs would be checked.

There is a tremendous difference between reported payments for public health services and official user fee revenue in Vietnam. The official accounts indicate total user fee revenue of D 436 billion in 1998 (World Bank 2001). This is only one-eighth of the total amount individuals report paying for care in public hospitals, polyclinics, and commune health centers (excluding payments for drugs). In fact, the total amount reported in user payments exceeds total recurrent public expenditure on these services (see table above).

Given the difference between official and reported user payments, we experiment with two methods of calculating the public subsidy. In each case, we apply equations 14.1 and 14.2 above, but use different estimates of individual specific user payments. Under the first method (2nd from final column of the table above), we set user fees in commune health centers to zero (officially they do not exist) and scale reported user fees in hospitals and polyclinics by the ratio of official to reported aggregate user payments for these services. Under the second method (final column), we use the actual user fees reported for all services, not including payments for drugs. Patients are usually responsible for purchasing their own drugs. In both cases, we set negative values of the subsidy to zero.

Each mean unit subsidy given in the table indicates the average, across users, of the subsidy per unit of the respective service. So, for example, when user payments are scaled to sum to official fee revenue, inpatients receive a subsidy, on average, equal to almost D 43,000 per day, or more than 80 percent of the cost. However, the value of this subsidy falls by almost 50 percent if it is calculated on the basis of what patients actually report paying.

Some individuals may report payments in excess of production costs. If one is simply interested in who receives the (positive) subsidies from the health care system, then negative values of the subsidy should be set to zero. However, if one is interested in how the subsidy is financed and, in particular, the extent to which there is cross subsidization, then the distributions of both positive and negative subsidies need to be examined.

Evaluating the distribution of the health subsidy

Once individuals have been categorized by their living standards and the value of the health sector subsidy received by each individual has been calculated, the distribution of the subsidy can be traced in relation to living standards. For example, cumulative shares of the subsidy received by living standard quintiles might be presented (see table in box 14.3). For a more complete picture of the distribution, the health subsidy concentration curve can be graphed as in the figure in Box 14.3.

To evaluate the distribution of the subsidy, the analyst must refer to some target distribution and in doing so impose a distributional objective. One alternative is to compare the distribution of the subsidy with population shares. Do the poorest 20 percent of individuals receive more or less than 20 percent of the subsidy? In the figure in Box 14.3, that amounts to comparing a concentration curve with the 45-degree line. This is appropriate if the goal is to ensure that the subsidy is pro-poor, which requires that the subsidy concentration curve dominate the 45-degree line. If the subsidy were considered part of an individual's final income, then an alternative distributional objective would be for final income to be more evenly distributed than presubsidy income. That is, the subsidy should be inequality-reducing, closing the relative gap in welfare between the rich and the poor. This requires that the subsidy concentration curve dominate the Lorenz curve, which is obviously much less demanding than domination of the 45-degree line. Domination of the Lorenz curve may be referred to as *progressivity*, or *weak progressivity*, of the subsidy, as opposed to absolute or strong progressivity in the case that the concentration curve dominates the 45-degree line (Castro-Leal et al. 2000; Sahn and Younger 2000).

The concentration index (see chapter 8) provides a summary measure of absolute progressivity of the subsidy. The Kakwani index, which is defined as twice the area between a concentration curve and the Lorenz curve, can be used as a summary measure of weak progressivity (Kakwani 1977).¹ The index is calculated as $\pi_k = C - G$, where C is the concentration index for the subsidy and G is the Gini coefficient of the living standards measure. The value of π_k ranges from -2 to 1 . It is negative (positive) if the concentration curve dominates (is dominated by) the Lorenz curve. In the case in which the concentration lies on top of the Lorenz curve, the Kakwani index is zero.²

¹The Kakwani index was originally introduced as a measure of tax progressivity (Kakwani 1977). Its use as a measure of progressivity of health care financing is discussed in chapter 16.

²This is a sufficient but not a necessary condition for the Kakwani index to be zero, which could also arise if the concentration and Lorenz curves cross.

Box 14.3 *Distribution of Health Sector Subsidies in Vietnam, 1998*

In the table below, we present cumulative quintile shares of the service-specific subsidies and for the total subsidy across all services. In computing the service-specific quintile shares, we scale all user payments to sum to official user fee revenue (see box 14.2). The subsidy shares are broadly consistent with those for raw service utilization given in the table in box 14.1. Cumulative quintile shares for the total subsidy are given both with and without scaling user payments. Irrespective of the treatment of user payments, the poorest quintile's share of the subsidy is less than 20 percent but greater than its share of total consumption. At higher quintiles, the cumulative subsidy shares deviate from the respective population share only if reported user payments are scaled. However, tests indicate that the subsidy concentration curve is dominated by the 45-degree line under both treatments of user payments and that it always dominates the Lorenz curve. Subsidy concentration curves (with scaled user payments) and the Lorenz curve are graphed in the figure. The concentration curve for the total subsidy follows that of the inpatient subsidy most closely. This reflects the fact that inpatient care receives by far the largest share of public spending in Vietnam (87%—see table below).

Box 14.3 (continued)

With one exception (outpatient), the dominance tests and the Kakwani indices services indicate that the subsidies are inequality-reducing or weakly progressive. But only the subsidy to commune health centers is pro-poor or strongly progressive. The subsidy to hospital care and the total subsidy are pro-rich. It may be concluded that public health care subsidies in Vietnam help close the relative gap in welfare between rich and poor but raise the absolute gap.

Distribution of Public Health Care Subsidies in Vietnam, 1998

Cumulative shares	Equivalent household consumption	Hospital care				Other public health services	Total subsidy	
		Out-patient	Inpatient	Commune health center	Polyclinic		Scaled user fees	Reported user fees
Poorest 20% (standard error)	8.78% (0.0429)	10.21% (1.3456)	10.98% (1.3099)	22.65%* (1.886)	23.18%* (5.9155)	13.22% (2.9644)	12.29%* (1.1219)	14.81%* (1.5426)
Poorest 40%	21.38% (0.0880)	24.75% (2.1043)	29.44%* (2.1703)	47.83%* (2.4084)	33.48% (6.3918)	47.09%* (6.3806)	31.87%* (1.8559)	37.70%* (2.4110)
Poorest 60%	37.19% (0.1360)	45.50%* (3.0206)	50.12%* (2.5461)	77.86%* (1.9943)	59.88%* (6.8763)	59.00%* (6.0599)	53.11%* (2.1498)	60.43%* (2.5184)
Poorest 80%	58.17% (0.1793)	67.65%* (3.2196)	73.02%* (2.5157)	90.60%* (1.4456)	78.52%* (6.6011)	79.63%* (4.5689)	74.88%* (2.1076)	81.25%* (2.0504)
Test of dominance								
-against 45° line		-	-	+			-	-
-against Lorenz curve			+	+	+	+	+	+
Concentration								
Index ^a (robust standard error)	0.3229 (0.0083)	0.2160 (0.0450)	0.1444 (0.0378)	-0.1567 (0.0335)	0.0298 (0.1035)	0.0056 (0.0777)	0.1106 (0.0319)	0.0115 (0.0343)
Kakwani Index (robust standard error)		-0.1069 (0.0506)	-0.1785 (0.0427)	-0.4797 (0.0376)	-0.2932 (0.1031)	-0.3174 (0.0792)	-0.2124 (0.0365)	-0.3115 (0.0379)
Subsidy shares								
(scaled user fees)		0.0213	0.8688	0.1010	0.0088		1.0000	

Note: For shares, bold indicates significant difference from population share (5%) and * indicates significant difference from consumption share (5%). For concentration and Kakwani indexes, bold indicates significant difference from zero at 5%. Standard errors for concentration and Kakwani indexes are robust to heteroskedasticity and within cluster (commune) correlation.

Dominance tests: - indicates the 45° line/Lorenz curve dominates the concentration curve

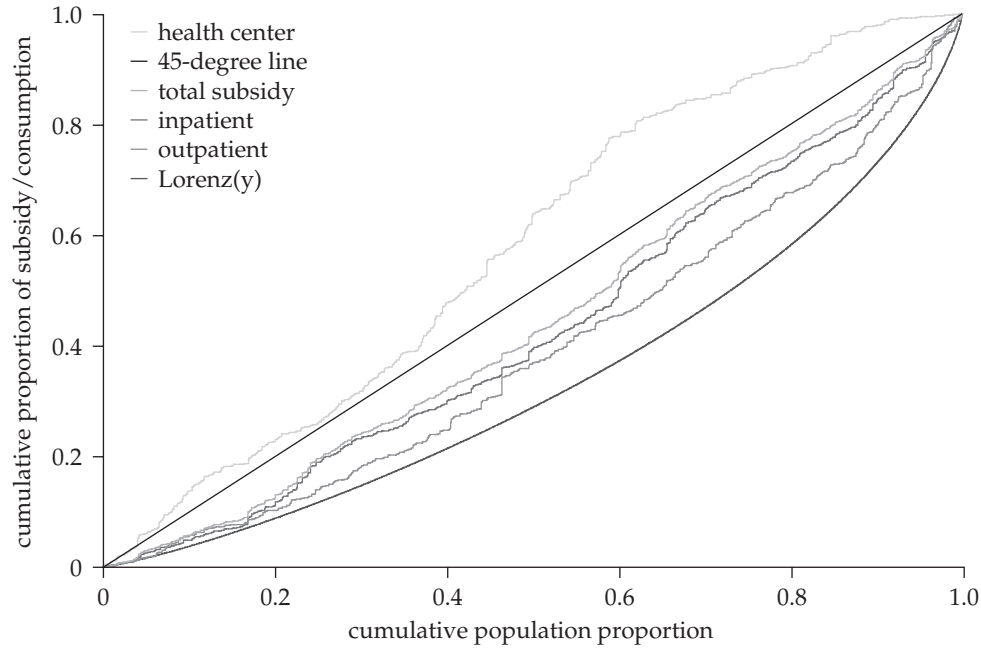
+ indicates concentration curve dominates 45° line/Lorenz curve

Blank indicates nondominance.

Dominance is rejected if there is at least one significant difference in one direction and no significant difference in the other, with comparisons at 19 quantiles and 5% significance level.

a. Gini index for equivalent household consumption.

(continued)

Box 14.3 (continued)*Concentration Curves for Health Sector Subsidies and Lorenz Curve of Household Consumption, Vietnam 1998*

Source: Authors.

Computation

Quintile shares, dominance tests, and concentration indices can be computed as described in chapters 7 and 8. Because a Kakwani index is the difference between a concentration index and a Gini index, both of which can be computed by the convenient regression method (see chapter 8), its value can be computed directly from one convenient regression of the following form:

$$(14.3) \quad 2\sigma_r^2 \left[\frac{s_i}{\hat{\mu}_s} - \frac{y_i}{\hat{\mu}_y} \right] = \alpha + \beta r_i + u_i,$$

where s_i is the health subsidy to individual i , $\hat{\mu}_s$ is an estimate of its mean, y_i is the living standards measure and $\hat{\mu}_y$ an estimate of its mean, and r_i is the weighted fractional rank in the living standards distribution and σ_r^2 is its variance. The OLS estimate of β is an estimate of the Kakwani index. A standard error for the index can be obtained directly from the convenient regression although in this case, it is not possible to take into account the sampling variability of the estimated means used in the transformation to obtain the left-hand-side variable.

The weighted fractional rank variable (`rank`) should first be computed as explained in chapter 8. Then, in Stata, the appropriate convenient regression would be estimated as follows:

```
qui sum rank [aw=weight]
sca var_rank=r(Var)
```

```

qui sum subsidy [aw=weight]
sca m_sub=r(mean)
qui sum y [aw=weight]
sca m_y=r(mean)
gen lhs=2*v_rank*(subsidy/m_sub-y/m_y)
regr lhs r [pw=weight], cluster(commune)

```

where y is the (cardinal) living standards measure and, in this case, sample weights and cluster sampling are taken into account.

References

- Aaron, H., and M. C. McGuire. 1970. "Public Goods and Income Distribution." *Econometrica* 38: 907–20.
- Besley, T., and S. Coate. 1991. "Public Provision of Private Goods and the Redistribution of Income." *American Economic Review* 81(4): 979–84.
- Brennan, G. 1976. "The Distributional Implications of Public Goods." *Econometrica* 44: 391–99.
- Castro-Leal, F., J. Dayton, L. Demery, and K. Mehra. 2000. "Public Spending on Health Care in Africa: Do the Poor Benefit?" *Bulletin of the World Health Organization* 78(1): 70.
- Das, J., and J. Hammer. 2005. "Which Doctor? Combining Vignettes and Item Response to Measure Clinical Competence." *Journal of Development Economics* 78: 348–83.
- Kakwani, N. C. 1977. "Measurement of Tax Progressivity: An International Comparison." *Economic Journal* 87(345): 71–80.
- Lanjouw, P., and M. Ravallion. 1999. "Benefit Incidence, Public Spending Reforms and the Timing of Program Capture." *World Bank Economic Review* 13(2).
- Meerman, J. 1979. *Public Expenditure in Malaysia: Who Benefits and Why?* New York: Oxford University Press.
- O'Donnell, O., E. van Doorslaer, R. P. Rannan-Eliya, A. Somanathan, S. R. Adhikari, D. Harbianto, C. G. Garg, P. Hanvoravongchai, M. N. Huq, A. Karan, G. M. Leung, C.-w. Ng, B. R. Pande, K. Tin, L. Trisnantoro, C. Vasavid, Y. Zhang, and Y. Zhao. 2007. "The Incidence of Public Spending on Health Care: Comparative Evidence from Asia." *World Bank Economic Review* 21(1): 93–123.
- Sahn, D., and D. Younger. 2000. "Expenditure Incidence in Africa: Microeconomic Evidence." *Fiscal Studies* 21(3): 321–48.
- van de Walle, D. 2003. "Behavioral Benefit Incidence Analysis of Public Spending and Social Programs." In *The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools*, ed. F. Bourguignon and L. A. Pereira da Silva. Washington DC: World Bank and Oxford University Press.
- van de Walle, D., and K. Nead, eds. 1995. *Public Spending and the Poor: Theory and Evidence*. Baltimore, MD: Johns Hopkins University Press.
- Weaver, M. and A. Deolalikar. 2004. "Economies of Scale and Scope in Vietnamese Hospitals." *Social Science & Medicine* 59(1): 198–208.
- World Bank. 2001. *Vietnam Growing Healthy: A Review of Vietnam's Health Sector*. Hanoi: The World Bank.
- Younger, S. D. 2003. "Benefits on the Margin: Observations on Marginal Benefit Incidence Analysis." *World Bank Economic Review* 17(1): 89–106.

