SLUTSKY DECOMPOSITION OF PRICE EFFECTS IN PUBLIC HEALTH CARE

By

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Abstract: This paper employs the Slutsky decomposition of the effect of price change to identify impacts of user fees on access to public health care. The paper starts with a theoretical outline that relates user fees to quality of health care before carrying out the Slutsky decomposition to identify the income and substitution effects of user fees in public health care. Delivery efficiency is observed as an important factor that shapes the impact of user fees on demand for health care. The findings suggest that introduction of user fees in public health care without appropriate measures to boost quality of the services, may have negative effects on demand. Thus, delivery efficiency of public health services matters as it fuels the effect of a price change.

INTRODUCTION

Issues of universal access, particularly by the poor, are of major concern in countries that have introduced fees in public health care. The concern arises from the findings that fees exclude those who cannot afford to pay (Mwabu *et.al.* 1996, Mushi D., 2001; Booth *et.al* 1992; etc). At the sametime, exemption and waiver systems have been observed to be inefficient as they fail to target those who are in need of them most (M'sambichaka *et.al*, 2003).

To the contrary, there are studies, which indicate that fees with improved quality increase access to public health services. Clearly, we could argue that fees and quality have to go together in order to minimize dropouts in public health services. Thus, it is not only the level of user fee that matters in access to public health care, but also the level of improvement in quality that is generated from the user fee revenue. Simply put, delivery efficiency matters. This is the core issue pursued in this paper. Can improved delivery efficiency reduce the negative effect of user fees in public health care?

THEORETICAL ARGUMENTS

Consider a strictly quasi-concave utility function of the form

$$U^h(Q, X_h, Y_h) \text{---------------------------------}(1)$$

Where X_h is consumer h consumption of public health care, Q is quality of the public health care and is private consumption for the same individual. Consider the price of health care as a sum of $q_x + \mu$ where is transport and time cost of accessing public care, and μ is a user fee charged by health facilities in order to improve quality of health services such that

$$Q = f(\mu) \text{---------------------------------}(2)$$

Quality improvement and the user fee can be related as follows:

$$Q = \mu^\beta \text{---------------------------------}(3)$$

so that the user fee can be expressed as

$$\mu = Q^{\frac{1}{\beta}} \text{---------------------------------}(4)$$

Clearly, β is an efficiency parameter, which shows the rate of transformation of the user fee into quality of health care. Invariably, we could consider β as the delivery efficiency. Thus, we note that β is an exogenous variable in the quality of health care, and so with the health care demand function.

METHODOLOGY

User fees were introduced in public hospitals in Tanzania from 1994. In 1995, there was a study on the preliminary impact on usage, quality and affordability in selected district hospitals (Mushi

1996), which observed that access to public hospitals was a decreasing function of user fees. The study constituted baseline information on the effects of user fees in Tanzania. Between 1999 and 2000, a similar survey was carried out in the same public hospitals. The two sets of data constitute a panel for which we can derive intertemporal changes in quality of health care and attendance in the respective public health facilities.

Simply defined, delivery efficiency is the quality of health care generated from each unit of fees collected. But quality of health care is difficult to measure and compare (Gowrisankaran and Town 1999); it should reflect patients' satisfaction with the services. (Shortbridge, 1974; Palmer, 1976 and Black, 1990) This paper avoids the complexities of measurement of quality of health care by compiling indices of consumers' satisfaction. (Appendix 1). The indices are then used to compute delivery efficiency. Thus, we define delivery efficiency as household satisfaction per unit of hospital spending from user fee-revenue; implying that we work with the ratios of satisfaction per unit of expenditure from user fee revenue as proxy for quality.

Using the imputed indices of quality for 1995 and 2000, we can compute intertemporal changes in quality of health care and attendance, and thereby estimate the elasticity of attendance with respect to quality.

Introducing user fees without an offsetting improvement in quality implies an increase in the real price of public health care. And by further analysis with Slutsky decomposition of the effect of price change, we can identify the substation and income effects of user fees.

THE SUBSTITUTION AND INCOME EFFECTS OF USER FEES

Studies on health care define demand as the probability that a household will seek medical care in the event of illness. Mushi (2001) estimated probabilitistic demand for health care in three districts of Bagamoyo, Usangi and Kisarawe. Based on his results, we derive the compensated demand change or the substitution effect of user fees. Considering all other forms of health care different from allopathic care as informal providers, we provide a theoretical verification of Slutsky decomposition as follows.

Let X denote consumption of allopathic health care and Y denote non-formal health care such as traditional and self-care. Disaggregating the sources of care, we observe that in the event of illness, the probability that care is sought is 1. Individuals must seek care.[2] The probability distribution for X and Y is such that:

$$P(X) + P(Y) - P(X \cap Y) = 1 -----------(5)$$

Assuming further that introduction of user fees reduces the chances of joint consultation in formal and informal providers for each episode of illness demand for X and Y will change as follows;

$$P(X) + P(Y) = 1 --------------(6)$$

$$dP(Y) = \frac{\partial P(Y)}{\partial P(X)} dP(X) = -dP(X) ------(7)$$

An increase in the demand for informal health care implies a decrease in the demand for allopathic health care.

Equation (7) is useful in the derivation of the income effect of a user fee from the Slutsky equation. We deduce Slutsky decomposition from equations 1-7 as follows:

$$\Delta Y_j \approx \frac{\partial Y_j(P,m)}{\partial \mu} \Delta \mu = \frac{\partial h_j(P,U)}{\partial \mu} \Delta \mu - \frac{\partial Y_j(P,m)}{\partial m} X_j \Delta \mu ---(8)$$

Where ΔY_j stands for the change in the consumption of informal care, μ is the user fees as defined earlier, and h_j (P, U) is the compensated demand for informal care. P is the price vector, and m is income. Since it is identically true that

$$h_j(P,U^*) \equiv Y_j(P, e(P,U^*)) -----------(9)$$

the compensated demand change for the user fee is estimated by the change in the probability of usage in public charging hospitals (following equation 7). The demand for formal and informal health care changes by the same probability, but with opposite signs. Following Mushi's (2001) estimates of the effect of user fees on the probabilistic demand for health care for Bagamoyo and Kisarawe, we can infer the compensated demand change for informal care (or change in consultation in formal providers) and compute the Slutsky substitution and income effects for Kisarawe and Bagamoyo.

RESULTS

We observe from Table 1 that Bagamoyo district was the worst affected by the introduction of user fees. Patients' attendance declined in Bagamoyo more than in Kisarawe, while Usangi had completely opposite effects. We also note that quality declined in all the three facilities but more in Bagamoyo followed by Kisarawe. This had a proportionate impact on attendance.

Table 1: *Summary of inter-temporal statistical ratios: 1995/ 96 - 1999/2000*

Facility Name	%Change in attendance	%Change in quality*	Estimated attendance-quality elasticity	Estimated delivery efficiency***
Bagamoyo	-71	-27.09	-25	0.04
Usangi	64	-7.57	80	0.22
Kisarawe	-13	-12.09	-11	NA

* The values are computed from household assessment of quality

NA means 'not available'.

***Household satisfaction per unit of hospital expenditure.

The last column in the table shows the estimated delivery efficiency. In fact, Usangi hospital appears to have generated more satisfaction per unit of revenue than Bagamoyo. This explains

the observed extraordinary improvement in attendance in Usangi. However, similar data for Kisarawe are not available.

Table 2 is the Slutsky decomposition of the effect of price change on demand.

Table 2: *Substitution and income effects for Kisarawe and Bagamoyo*

Facility name	ΔX_i^* $(\frac{\partial X_i(P,n)}{\partial u}\Delta X_i)$	ΔY_j^* $(\frac{\partial Y_j(P,n)}{\partial u}\Delta Y_j)$	Δh_j^* $(\frac{\partial h_j(P,U)}{\partial u}\Delta Y_j)$	Income effect $(\frac{\partial Y_j(P,n)}{\partial n}X_j\Delta Y_j)$
Kisarawe	0.23	-0.23	-0.003	-0.027
Bagamoyo	-0.062	0.062	0.71	-0.068

N.B. Figures represent averages for the districts.

ΔX_i^* = the effect of the user fee on demand for modern health care

$\Delta Y_j^{'}$ = the effect of the user fee on the of informal health care

$\Delta h_j^{'}$ = the substitution effect.

Formal and informal sources of health care seem to be substitute for each other for Bagamoyo; and as a result, consumption of health services in public facilities declined. The weak substitution effect (for Kisarawe) indicates that there has been quality improvement that levels down the negative effect on demand. To the contrary, the relatively stronger substitution effect (for Bagamoyo) implies deterrence to public health care because quality improvement has not managed to suppress the negative effect of user fee on demand. Thus quality cum delivery efficiency of public health care matters in determining the effects of user fees.

We note further that the income effect for both districts is negative, implying that poverty reduces access to charging public health facilities.

Also, it is observed that Bagamoyo being more income poor than Kisarawe had a proportionately bigger effect on attendance. Thus, Bagamoyo suffered more from the effects of user fees than Kisarawe.

CONCLUSION

The findings of suggest that introducing user fees in health care without appropriate measures to boost quality of services compromises universal access to public health care. If public health care delivery system suffers too much from inefficiencies, a user will result into a less than proportionate change in quality, and thereby reduce medical consultation in public facilities.

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KISARAWE: HOUSEHOLD ASSESSMENT OF QUALITY IN HEALTH FACILITIES
(MAXIMUM = 5 POINTS) 1=very poor, 2=poor, 3=average, 4=good, 5=very good

Facility Type	Drugs	Cleanliness	Staff	Meals	Wards	Laboratory	Queuing	Handling	Prices	Group Score	Group rank
Referal Hospital	2.00	2.50	2.75	2.75	3.00	2.75	2.50	2.50	2.25	2.56	5
Government Dispensaries	3.00	3.41	3.35	(.13)	.96	1.13	2.72	3.25	(4.93)	(2.54)2.55	6
Government Health Centres	2.70	3.48	3.22	(.09)	2.52	2.96	2.57	3.35	(4.74)	(2.85)2.97	4
Government District Hospitals	3.14	3.62	3.51	1.73	3.08	3.43	2.97	3.24	3.11	3.09	3
Private Mission Facilities	4.67	4.50	4.50	.28	3.78	4.22	4.06	4.83	3.33	3.8	2
Private Non Mission Facilities	4.33	4.33	4.33	.00	2.67	4.00	4.00	4.33	3.33	3.48	1
Item Score	3.31	3.64	3.61	0.83	2.67	3.08	3.14	3.58	3.62	(3.05)3.24	
Item Rank	(5)4	1	(3)2	9	8	(7)6	(6)5	(4)3	(2)3		

N.B: (.) Stands for item rank if in-patient services (meals and wards) are excluded

MWANGA: HOUSEHOLD ASSESSMENT OF QUALITY IN HEALTH FACILITIES MAXIMUM SCORE 5 POINTS

Type Of Health Facility		Drugs	Cleanliness	Staff	Meals	Wards	Laboratory	Queuing	Handling	Prices	Total score	Group rank	Total Excl. Price	Rank Excl. Price
REFERRAL HOSPITALS		4.14	4.00	4.14	3.29	4.00	3.86	2.86	2.86	2.29	3.49	1	3.64	1
REGIONAL HOSPITALS		2.00	2.00	2.00	.00	2.00	4.00	2.00	1.00	2.00	1.89	6	1.88	7
GOVERNMENT DISPENSARIES		2.00	3.00	4.00	.00	.00	3.00	2.00	3.00	5.00	2.44	5	2.13	6
GOVERNMENT HEALTH CENTRES		3.32	3.76	3.06	1.09	3.09	3.15	2.38	3.28	4.76	3.10	2	2.89	5
GOVERNMENT DISTRICT HOSPITALS		2.97	3.35	3.35	2.50	3.47	3.41	2.41	3.00	3.47	3.10	2	3.06	3
PRIVATE MISSION		3.79	3.94	3.12	.35	2.71	2.76	3.82	3.79	2.18	2.94	4	3.04	4
PRIVATE NON MISSION		4.08	3.96	3.35	.38	2.92	3.04	3.88	3.81	1.88	3.03	3	3.18	2
ITEM-SCORE		3.19	3.43	3.29	1.09	2.60	3.32	2.77	2.96	3.08	2.86		2.83	
ITEM RANK		4	1	2	9	8	6	7	3	5				
ITEM SCORE	PUBLIC	2.89	3.22	3.31	1.37	2.51	3.48	2.33	2.63	3.50	2.81		2.72	2
	PRIVATE	3.94	3.95	3.23	0.37	2.81	2.90	3.85	3.80	2.03	2.99		3.11	1
ITEM RANK	PUBLIC	5	4	3	9	8	2	7	6	1				
	PRIVATE	2	1	5	9	7	6	3	4	8				

MWANGA: HOUSEHOLD ASSESSMENT OF QUALITY IN HEALTH FACILITIES MAXIMUM SCORE 5 POINTS

Type Of Health Facility		Drugs	Cleanliness	Staff	Meals	Wards	Laboratory	Queuing	Handling	Prices	Total score	Group rank	Total Excl. Price	Rank Excl. Price
REFERAL HOSPITALS		4.14	4.00	4.14	3.29	4.00	3.86	2.86	2.86	2.29	3.49	1	3.64	1
REGIONAL HOSPITALS		2.00	2.00	2.00	.00	2.00	4.00	2.00	1.00	2.00	1.89	6	1.88	7
GOVERNMENT DISPENSARIES		2.00	3.00	4.00	.00	.00	3.00	2.00	3.00	5.00	2.44	5	2.13	6
GOVERNMENT HEALTH CENTRES		3.32	3.76	3.06	1.09	3.09	3.15	2.38	3.28	4.76	3.10	2	2.89	5
GOVERNMENT DISTRICT HOSPITALS		2.97	3.35	3.35	2.50	3.47	3.41	2.41	3.00	3.47	3.10	2	3.06	3
PRIVATE MISSION		3.79	3.94	3.12	.35	2.71	2.76	3.82	3.79	2.18	2.94	4	3.04	4
PRIVATE NON MISSION		4.08	3.96	3.35	.38	2.92	3.04	3.88	3.81	1.88	3.03	3	3.18	2
ITEM-SCORE		3.19	3.43	3.29	1.09	2.60	3.32	2.77	2.96	3.08	2.86		2.83	
ITEM RANK		4	1	2	9	8	6	7	3	5				
ITEM SCORE	PUBLIC	2.89	3.22	3.31	1.37	2.51	3.48	2.33	2.63	3.50	2.81		2.72	2
	PRIVATE	3.94	3.95	3.23	0.37	2.81	2.90	3.85	3.80	2.03	2.99		3.11	1
ITEM RANK	PUBLIC	5	4	3	9	8	2	7	6	1				
	PRIVATE	2	1	5	9	7	6	3	4	8				

BAGAMOYO DISTRICT: HOUSEHOLD ASSESSMENT OF QUALITY IN HEALTH FACILITIES (MAXIMUM SCORE 5 POINTS)

TYPE OF FACILITY-GROUP	DRUGS	CLEANL	STAFF	MEALS	WARDS	LABORA	QUEUING	HANDLING	PRICES	Group score	GROUP RANK
REFERRAL HOSPITALS	3.00	2.50	3.13	2.38	2.63	3.25	2.50	2.75	3.13	2.81	3
GOVERNMENT DISPENSARIES	2.71	3.26	3.03	(.00)	.50	.65	2.41	3.21	(5.00)	(2.31)2.25	6
GOVERNMENT HEALTH CENTRES	2.42	3.25	3.36	(.25)	2.58	2.26	2.60	3.30	(4.86)	(2.76)2.82	4
GOVERNMENT DISTRICT HOSPITALS	2.96	2.91	3.04	.15	2.93	2.80	2.24	2.43	3.13	2.51	5
PRIVATE MISSION FACILITIES	4.38	4.38	4.48	.38	2.24	4.10	4.24	4.10	2.67	3.44	1
PRIVATE NON MISSION FACILITIES	3.80	3.80	3.68	.00	1.80	3.20	4.16	3.84	2.56	2.98	2
ITEM SCORE	3.21	3.35	3.45	(0.53) 0.7	2.11	2.71	3.03	3.27	(3.56)2.9	(2.8)2.8	
ITEM RANK	(5)4	(3)2	(2)1	9	8	7	(6)5	(4)3	6 (1)		