

AN APPROACH TO MODELLING MEDICARE BENEFITS

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I. SUMMARY OF TASK AND CONCLUSIONS

Tasks 6 and 7 asked INFORUM to study the issues relating to modelling the effects of the Hospital and Supplemental Insurance (Medicare) program on Personal Consumption Expenditures (PCE) of medical care. Specifically, we were to investigate the feasibility and desirability of directly linking Medicare transfers to expenditures for medical care. We were to determine whether the program is more appropriately modelled as an income transfer or as a price subsidy. We also address the modelling issues associated with directly linking Medicare to medical PCE and the issues relating to treating the program as either an income or price subsidy.

Section I briefly summarizes all subsequent sections. Section II discusses the three types of transfers and examines the demand effects of each transfer type. Section III briefly explains the portions of the LIFT PCE system that are relevant to the current discussion. Section IV puts forth and evaluates several proposals for modelling the demand effects of Medicare benefits. Section V discusses areas for further work. Section VI concludes.

There are three types of government transfers: income transfers, in-kind transfers (commodity transfers) or price subsidies (in-kind subsidies). The literature is in agreement that in-kind transfers and price subsidies are not equivalent to an income transfer of the same size. An income transfer is an unrestricted cash payment to an individual -- the recipient of the transfer has full discretion over how to spend the transfer. Medicare does not transfer unrestricted cash income to consumers and thus is not an income transfer. An in-kind transfer is a grant of a non-legally transferable commodity, where the recipient has no obligation to purchase further amounts of the commodity. Medicare is not an in-kind transfer since recipients do not receive free quantities of medical care, but instead may purchase medical care at reduced prices. A price subsidy is a transfer that allows the consumer to choose the quantity he wishes to purchase, but at a below-market price. Since Medicare recipients determine the amount of care they purchase and the price of the care is subsidized (Petrie 1993), we conclude that the program is a consumer price subsidy. Since Medicare is a price subsidy, Medicare program outlays should be linked directly to the amount of care purchased with the subsidy.

Yet another way to think of Medicare is as a government-run health insurance program. With

¹Ralph M. Monaco, Margaret McCarthy, Amy Carr, Dan Waldo and Clopper Almon provided useful comments, advice and guidance for this paper. This paper was supported by the Health Care Financing Administration. The author takes full credit for any errors or omissions remaining.

its structure of deductibles and coinsurance, Medicare looks very much like insurance. Health insurance payments, unlike other forms of insurance, however, are reimbursements for specific expenditures. Insurance is typically thought of as a reimbursement to the insured for "bad events." For example, collision insurance pays the auto owner the amount required to repair his vehicle, regardless of whether or not he repairs the vehicle. Health insurance policies, however, only grant benefits when expenditures have occurred. For example, a cancer patient does not have the option of refusing treatment but receiving instead a cash payment for the cost of the foregone treatment. Owners of stolen cars, however, do receive such checks and are not required to purchase a replacement automobile. Thus, any health insurance payments to persons are linked to expenditures on medical care.

Currently, Medicare is treated as a pure income transfer by INFORUM's LIFT.² Treating Medicare as an income transfer, rather than as a price subsidy, leads to inaccurate estimates of the effects of a change in the Medicare program because these two types of transfers are not equivalent. A-priori, we cannot state whether treating Medicare as an income transfer generates "excess" demand for medical PCE.³ Using LIFT's current income and price parameters, we find that we understate the effects of a change in the size of the Medicare program on medical care spending by consumers.

We believe the program should be modelled as a consumer price subsidy and not as an income transfer. Since Medicare and other third-party payments account for over 80 percent of health care spending (Letsch et al. 1992), correctly modelling their effects will greatly improve forecasts of medical care expenditures and the long term properties of LIFT.

II. TYPES OF TRANSFERS AND THEIR DEMAND EFFECTS

There are three ways that a government can directly influence individuals' command over goods and services: pure income transfers (or lump-sum payments); in-kind transfers (or commodity gifts); and price subsidies. Most government programs, and in particular, all government transfer programs, belong to one of these three categories, but it is often difficult to determine which definition is appropriate. For example, a government-run low-income housing project is often considered an in-kind transfer since the recipient receives a fixed quantity of housing (one apartment) and the benefit cannot be sold or exchanged. However, since the program is restricted to low-income persons, the program can also be thought of as reducing the

²The Long-Term Interindustry Forecasting Tool was developed at the University of Maryland under the guidance of Clopper Almon. McCarthy (1991) gives an excellent overview of the model. Pollock (1986) describes the current treatment of Medicare in LIFT.

³See appendix.

price of leisure and thus is a price subsidy. Under strict neoclassical theory, virtually none of the government transfer programs that we traditionally think of as cash transfers are "income" transfers since eligibility is often restricted by employment status, income level or illness.⁴

A pure income or cash transfer, is, by definition, an unconditional (at least as far as economic status is concerned) lump-sum transfer of a fully fungible commodity, like cash. We define an income or cash transfer as any transfer where eligibility is not contingent upon the recipient using the funds for the purchase of specific goods. In other words, the benefit may be spent in a completely discretionary manner.

An in-kind transfer is one in which the recipient directly receives an amount of a good that can not be legally resold (or equivalently, a voucher with no legal cash value) and where eligibility is not restricted to those who purchase a quantity of the good in excess of the transfer. The Food Stamp program is one such program since it allows the recipient to purchase only one commodity (food) and eligibility is not contingent on the person purchasing any food in excess of the benefit.⁵ In contrast, the Medicare program is not an in-kind transfer since recipients do not receive free amounts of medical care but instead bear some portion of the cost of all care they consume.⁶

A consumer price subsidy is a transfer in which the individual determines the amount of the good he will purchase, but the price he pays is subsidized by the government. Medicare recipients determine the amount of care they receive, but are billed at the Medicare coinsurance rate (Petrie 1993), making the program a price subsidy and not an in-kind transfer.

The National Income and Product Accounts' Table 3.11, "Government Transfer Payments to Persons," shows the government transfer programs that the NIPA consider income transfers. LIFT treats all of these programs as income transfers. Using the definitions given above, it is clear that not all of these programs are income transfers. However, this uniform income transfer treatment could still generate the same results as categorizing each transfer appropriately. Unfortunately, this is not the case because the three transfer types have dissimilar effects on consumption demand.

A pure income transfer shifts out the budget constraint parallel to the original budget constraint (see figure 3). An in-kind transfer, such as Food Stamps, shifts the constraint outward,

⁴We are only concerned with the direct effects transfers have on PCE and not how these programs affect the labor-leisure decision. For the remainder of this study, we ignore any secondary effects a transfer program might have and only consider the direct effect on PCE.

⁵We assume that the Stamps can not be sold. If the stamps had a legal cash value, then the program would be an income transfer since the benefit would be indistinguishable from a cash grant.

⁶Depending on the type of care purchased, a deductible must be met before Medicare eligibility is established and coinsurance is almost always charged (Petrie 1992).

but kinks the budget constraint at the point where the distance along the horizontal axis equals the size of the in-kind transfer (see figure 4) -- forcing the consumer to purchase a minimum amount of the good (the transfer). A price subsidy rotates the budget constraint, leaving the vertical intercept unchanged, but the horizontal intercept further to the right (see figure 2). This encourages the consumer to increase consumption of the subsidized good (except in the abnormal case of a Giffen good).⁷

The Two Good Case

To illustrate the effects of these various programs we construct a two-good model with a composite good **C**, and a second good **X**. Figure 1 shows the initial budget constraint faced by a consumer and the indifference curve, U_0 , which is tangent to the budget constraint. The consumer purchases the bundle B_0 ($C=177.8$, $X=22.2$) --- the point of tangency.⁸

A price subsidy of fifty percent on **X**, costs the government \$67 and increases demand for **X** by 111.11 units to a total **X** consumption of 133.33 units (see figure 2). The cost to the government equals one-half times **X** consumption or \$67.

A pure income transfer of \$67 shifts the budget constraint to the right (see figure 3) -- and allows the consumer complete control over how the transfer is spent. The transfer costs the government \$67. He purchases bundle B_2 , $X= 29.63$ and $C = 237.37$. Purchases of **X** increased by 7.50.

Figure 4 shows the effect of a \$67 in-kind transfer of good **X** by the government. The government has given the consumer \$67 worth of **X** (or since P_x equals 1, 67 units of **X**). The consumer is forced to consume B_3 where **X** equals 67. Had the consumer been able to sell amounts of **X**, the program would be an income transfer with results equal to figure 3. The government transfer fully displaced the commercially purchased amount of **X**. Figure 5 compares the income transfer to an equal-cost in-kind transfer. As can be seen in the figure, the in-kind transfer generates more demand for **X** than does the income transfer.

In this model, a price subsidy will always generate more demand for the subsidized good than an equally costly income transfer program. Figure 5 shows the demand for **X** when the price of **X** is subsidized 50 percent and when the consumer receives a \$67 income transfer. The price subsidy also costs the government \$67. As can be seen in the diagram, demand for **X**, the subsidized good, is higher under the subsidy than under the income transfer.

⁷Zellner and Traub (1987) provide an excellent non-mathematical discussion of the effects of these transfers.

⁸Initial Prices equal 1.0
Initial Income equals \$200

**Note: Subsidized Good -- X on Horizontal Axis
Composite Consumption Good -- C on Vertical Axis**

Figure 1 -- Initial Conditions

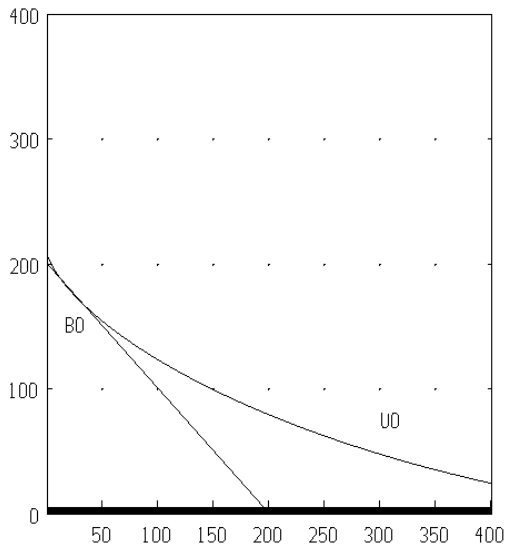


Figure 2 -- 50% Price Subsidy

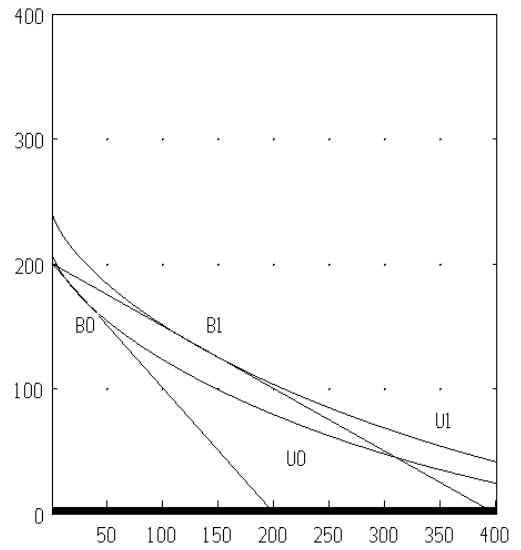


Figure 3 -- Transfer of \$67 (Subsidy Also Shown)

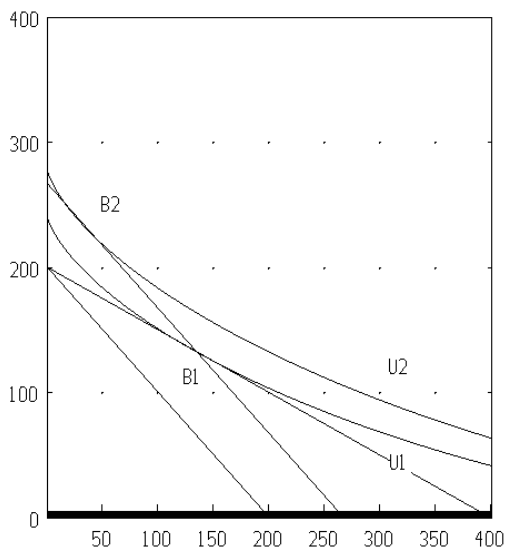
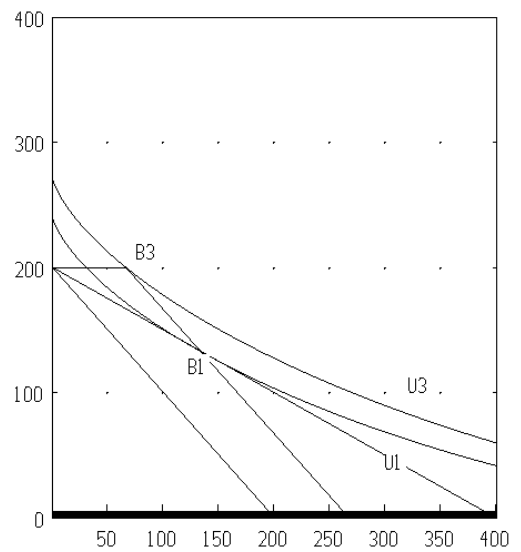
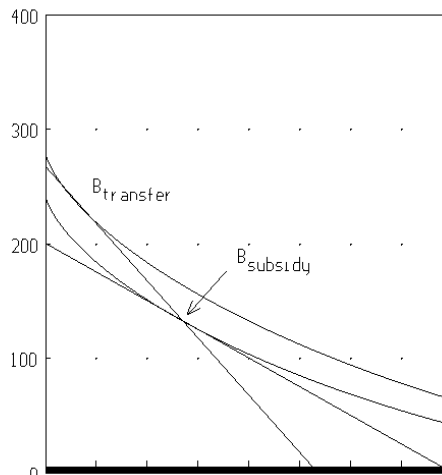


Figure 4 -- In-Kind Transfer of 67 Units (Subsidy Also Shown)



That price subsidies (figure 2) are not equivalent to cash transfers (figure 3) in their effects on welfare and consumer demand is well accepted in economic theory. It is also generally accepted that because some commercial purchases are displaced, in-kind transfers are not equivalent to income transfers (Smeeding 1977; Zellner and Traub 1987; Moffitt 1989). Most of the literature has concentrated on measuring the welfare loss associated with in-kind transfers (Smeeding and Moon 1980; Clemmer 1984; Schwab 1985; Moffitt 1989; Crews 1993). Smeeding and Moon (1980) incorrectly treat the Medicare program as an in-kind transfer rather than a price subsidy.

Figure 5 -- Comparison of Transfer and Subsidy



Zellner and Traub (1987) examine the effect on commercial purchases of a commodity when the government provides an in-kind transfer of the good. They found that for certain foods, in-kind transfers can quickly displace all of the commercially purchased quantities. Little has been done to analyze the welfare effects of a price-subsidy program like Medicare though the analysis is similar to the effects of a negative tax.

Medicare consists of two programs: Hospital Insurance (HI) and Supplementary Medical Insurance (SMI). The first, HI, can be thought of as being a true price subsidy over only certain expenditure ranges because a deductible must be met before HI coverage activates and after 90 days of hospitalization for a particular "spell of illness", coverage ceases (Petrie 1993).⁹ Thus, only charges incurred after the deductible, but before exhaustion of benefits, are subsidized. SMI, however, subsidizes all costs incurred after the deductible is met (Petrie 1993).¹⁰

The program can be considered a government-run insurance program (Pauly 1986; Hurd 1990; Jacobs 1991; Phelps 1992). The consensus is clear that health insurance increases the demand for medical care (Feldstein 1973; Rosett and Huang 1973; Newhouse and Phelps 1974; Phelps and Newhouse 1974) because it subsidizes the price of care. The effects on medical demand caused by this price subsidy will almost certainly differ from the effects caused by an equal dollar value cash transfer.

The Multi-Good Case

⁹Medicare recipients may also draw on a "lifetime" reserve fund of 60 hospitalization days which can be used if the recipient exhausts the 90 days covered in a benefit period.

¹⁰For a discussion on why Medicare subsidies increase demand even when the deductible is unmet, see Keeler et al. 1977.

However, LIFT, like the real world, has more than two goods. In a multi-good world, it is not clear which will create more demand for the subsidized good: a price subsidy or an income subsidy that costs the government the same amount as the price subsidy. The size and direction of this bias depend on the budget share and the income elasticity of the subsidized good. In general, if the subsidized good has close complements, then there is a greater chance that an income transfer will generate more demand for the subsidized good than the price subsidy.¹¹ This is potentially important for our work since Medicare does not subsidize the purchase of Drugs -- a close complement to medical services. However, we find that given our current budget shares and income elasticities, we underestimate the effect that changes in Medicare will have on medical services demand.

In addition to the downward bias caused by modelling the program as an income transfer, there is an additional downward bias in our forecasts of medical PCE because part of the dollar value of the price subsidy (Medicare) is unspent by LIFT. This is because LIFT constrains total PCE so that:

$$\sum PCE_{category} = Disposable\ Income * Spending\ Rate$$

Since the spending rate is near .95, a dollar of price subsidy, when treated as an income transfer, will generate one dollar of additional disposable income but will generate only 95¢ of additional spending. Thus, the under-forecasting of medical PCE is compounded by allowing only a fraction of the spending to occur. This means that simulations that attempt to evaluate the effects of various alternate health care financing proposals will underestimate the effect of Medicare funding changes on medical services PCE.¹²

III. FORECASTING PCE IN THE LIFT MODEL

PCE is forecasted in LIFT by a system of expenditure functions. These functions use age, demographic factors, relative prices and income to help forecast PCE by category (Janoska 1994). Disposable income as reported on line 25 of NIPA Table 2.1 - "Personal Income and Its Disposition" is used as the income variable by the PCE equations. LIFT constructs Disposable income using a Personal income variable constructed as shown below:

$$NIPA\ Personal\ Income = Wages + Salaries + Other\ Labor\ Income$$

¹¹ Part of the "savings" created by the subsidy must be spent on the unsubsidized complementary good. If the government subsidizes the purchase of Left shoes, but not Right, (shoes being perfect complements), much of the subsidy is wasted since one shoe is virtually useless. If the government had simply given individuals money, more pairs of shoes would have been purchased than under a subsidy. This of course means that there is a greater number of Left shoes purchased under the transfer than under subsidy.

¹²This leakage is less serious than the problems caused by misallocating Medicare funds to other PCE categories.

+ Proprietors' Income + Rental Income + Dividends + Interest
+ **Transfer Payments**

Disposable Income = NIPA Personal Income - Personal Taxes and Non-taxes

Transfer payments appear in NIPA table 3.12 "Government Transfers To Persons." Medicare is included in these transfers by NIPA convention. LIFT makes no distinction between a price subsidy program like Medicare and an income transfer such as Old-Age, Survivors, and Disability Insurance (Social Security). The dollar value of the transfer is treated as if it were a completely discretionary form of income. As discussed above, except under the conditions given in the appendix, the two types of transfers are not equivalent.

We believe that, since the program is a price subsidy, it should be modelled as such. Currently, LIFT treats all health insurance programs (private and government) as income transfers.¹³ These programs are not income transfers but are price subsidies. We have exempted private health insurance from our discussion, but we believe that PCE forecasts would be improved greatly by treating these programs as price subsidies. Correctly modelling Medicare and private health insurance would not only improve the PCE forecasts, but could also improve the macroeconomic simulation properties of the model because of the link between government expenditures, the deficit and general macroeconomic conditions (Monaco 1994).

IV. OPTIONS: DESCRIPTION AND COST-BENEFIT ANALYSIS

In this section we present four alternative plans for revising the method LIFT models the effects of Medicare benefits. For each option, we give a simple description and outline the costs and benefits.

Maintain Status Quo

As always, one option is to do nothing. Medicare would continue to be modelled as a pure income subsidy and in the absence of user intervention, we would continue to under-forecast medical services PCE and over-forecast non-medical services PCE.¹⁴ Since this proposal requires that no changes be made in LIFT, the marginal cost and marginal benefit are both zero. In our opinion, this is the worst case scenario since it does nothing to correct the problems we have already discussed. However it does so at zero cost.

¹³Private health insurance primarily consists of employer contributions for health insurance.

¹⁴Since analysis using LIFT is relevant only in terms of difference from base, this bias does not present a problem in analyzing the effects of policy changes -- unless such policy changes alter the funding pattern of medical care.

Direct Link Between Medicare and Medical Services PCE

This solution would directly link Medicare to Medical PCE on a dollar per dollar basis. Disposable income would be redefined as "Discretionary" income or NIPA Disposable Income less Medicare. A new spending rate would be calculated based on spending from Discretionary income. Equations would be estimated to forecast private demand for medical services (NIPA Medical services PCE net Medicare financed services). Total medical services would equal the sum of these two components, Private and Medicare.

For this approach to solve the problem of either over-stating or under-stating the effects of Medicare on medical services PCE, it must be true that an in-kind transfer is equivalent to a price subsidy. This approach also assumes that there is a one-to-one link between increases in demand and increases in the in-kind transfer. As shown in the appendix, these assumptions may be logically inconsistent with each other.

We believe this approach is little better than maintaining the status-quo, since we still model the demand effects of Medicare incorrectly and we do so after incurring some implementation costs. The proposal is appealing on a certain level since it does link Medicare and medical PCE, but we believe there are better ways to implement this link.

Ad-hoc or "Back of the Envelope" Linking

This approach is very similar to the Direct Link approach. However, instead of imposing a one-to-one link, we would develop estimates of the displacement effect. For example, we could impose a one-to-two link -- \$1 of Medicare would generate \$2 of medical services PCE. This approach would approximate modelling the program as a price subsidy since we would be displacing some of the commercially-purchased good. Implementing this approach in the model would be no more difficult than the Direct Link proposed above and would move us closer to modelling Medicare benefits as price subsidies.

The size of the linkage could be based on the estimates or assumptions of LIFT users. This approach is both a strength and a weakness. The benefit is flexibility, since it allows a much wider range of simulations. The weakness is that the size of the displacement is arbitrary. Estimates of the displacement effect could be made, but proper estimates would require adjusting income and price to treat Medicare as a price subsidy. Since this work would be required if we modelled the program as a price subsidy, we believe that the extra effort should be invested in modelling Medicare benefits as a price subsidy.

Price Subsidy Approach

This alternative has INFORUM modelling Medicare as a price subsidy with a link between Medicare transfers and medical PCE. The size of Medicare could be expressed as either a percent of producer price or as a dollar amount. If expressed as a percent of price, LIFT would

determine the consumer price based on the producer price and this "wedge" between producer and consumer price. LIFT would then forecast medical PCE and determine the total dollar size of the Medicare program. Alternatively, if expressed as a total program size, LIFT would calculate the wedge and determine the subsidy as a percent of price.

We would remove the Medicare program from NIPA Personal income, and treat it as a wedge between producer and consumer price in the medical services PCE categories. This in turn would create new non-NIPA PCE deflators for the health care PCE categories. We would use these new deflators when estimating the system of PCE equations and when estimating PCE by category. Treating Medicare as a price subsidy would also require that we create a new non-NIPA Personal Income variable -- essentially NIPA Personal income net of Medicare benefits.

The size of Medicare could be set or forecasted in terms of total dollars spent or as a percent of producer price. LIFT would then calculate and report which ever of these two that was not specified. NIPA style numbers would be recreated to allow for direct comparisons between LIFT and other forecasts based on NIPA numbers.

Treating Medicare as a price subsidy would also link Medicare benefits to health services expenditures. Since the program would reduce the price of medical care faced by consumers, Medicare transfers could only be spent on medical care. Changes in the Medicare program would cause medical PCE to change through the price effect. Similarly, increases in demand would increase the size of the Medicare program.

We outline the estimation procedure below:

- Step 1. Redefinition of income variable used by PCE system as follows:

$$LIFT \text{ Disposable Income} = NIPA \text{ Disposable Income} - Medicare \text{ Benefits}$$

- Step 2. Redefine price deflators used by PCE system as follows:

$$DEFL'_i = C_i * DEFL_i$$

where C_i , the coinsurance rate, is given by:

$$C_i = 1 - \text{subsidy rate}_i = 1 - \frac{Nominal PCE_i - Medicare_i}{Nominal PCE_i}$$

$DEFL'_i$ = LIFT PCE Deflator, category i

$DEFL_i = \text{NIPA PCE Deflator, category } i$
 $\text{Nominal } PCE_i = \text{Nominal PCE in Category as Defined by NIPA}$
 $\text{Medicare}_i = \text{Medicare Spending, category } i$

- Step 3. Estimate parameters for the current system of PCE equations, but use the newly defined disposable income and deflators as independent variables.

This approach assumes that the average coinsurance rate equals the marginal insurance rate across all individuals. This assumption leads to a bias (Newhouse et al. 1979) since, coinsurance rates vary across individuals and average coinsurance rates do not equal marginal rates. Because we cannot measure the true marginal coinsurance rate, we assume that the average rate equals the marginal rate.

Our price parameters will be biased for another reason as well -- deductibles. Keeler et al. (1977) show how deductibles will bias our price parameters in an unknown direction. Keeler et al. (1977) and Newhouse et al. (1979) show that by either eliminating individuals with deductibles from the data set or lumping individuals together who have the same deductible, the bias is eliminated. These solutions cannot be implemented here because our data does not provide information on who has a deductible in their insurance policy or the size of the deductible. We acknowledge that our estimated parameters may be biased, but feel that the size of the bias is small relative to the improvement gained through modelling Medicare benefits as a price subsidy.

So that these new equations could be used by LIFT, we would need to implement several changes. First, LIFT would be modified to construct and use the new Disposable income variable (NIPA disposable income less Medicare benefits) in the PCE equations. Second, LIFT would be modified to construct and use the new deflator ($C * DEFL$) in the PCE equations.

For these equations to generate forecasts, forecasts of either the subsidy rate or Medicare benefits would have to be provided.¹⁵ LIFT would be modified so that either the subsidy rate or the amount of Medicare would be known. Once either value is known, the other can be determined as follows:

We know that the dollar size of the Medicare program is given by:

$$\text{Medicare Benefits}_i = s * \text{Nominal } PCE_i = s DEFL_i \text{ Real } PCE_i$$

where:

thus:

¹⁵These values could either be specified exogenously or equations could be developed.

$$\text{Real PCE} = G(\text{DEFL}_i, s, \text{Income}, \text{DEFL}_{\text{other}})$$

$$\text{Medicare Benefits}_i = s \text{ DEFL}_i G(\text{DEFL}_i, s, \text{Income}, \text{DEFL}_{\text{other}})$$

We would solve the above equation for whichever of the two, subsidy rate (s) or Medicare Benefits_i, is unknown.

This approach requires a considerable amount of start-up cost in terms of data work, revamping the estimation routines and modifying LIFT. Most of these costs would be incurred under the "ad-hoc" approach described above. The only additional cost would be modifying LIFT so that it could handle wedges between producer and consumer prices (consumer price subsidies). We believe that the amount of effort required to implement this proposal -- treatment as a price subsidy -- compared to implementing any of the other alternatives is a cost that is far below the expected benefit.

V. RELATED AREAS OUTSIDE THE GOALS OF TASKS 6 AND 7

Until this point, we have specifically narrowed our discussion to the Medicare program and have avoided discussing the modelling of Medicaid and private health insurance. We believe that the improvements suggested with respect to Medicare should be extended to include private health insurance payments. The modelling of private health insurance payments should not differ from the modelling of government-run health insurance payments. The effects of the two programs on medical care demand should be identical -- only the agency paying for the care changes.

Medicaid, however, is a price subsidy/in-kind transfer hybrid. First tier services (hospitals, physicians, diagnostic tests, etc.) have no coinsurance rate but may have a "nominal" fee associated with the service.¹⁶ Second tier services (dental care, drugs, eye glasses, etc.) may have coinsurance but this varies by state (Phelps, 1992). We are unsure how to model Medicaid payments but believe that a price subsidy or a one-to-one direct link approach is more correct than the current pure income transfer treatment.

VI. CONCLUSION

¹⁶In practice, the "nominal" fee is extremely small compared to the cost of the service provided -- for example, a \$5 charge for emergency room treatment.

The effect of an income transfer on consumer demand will generally differ from the effect of a price subsidy. The treatment of a price-subsidy program as an income transfer will lead to inaccurate forecasts of the effects of a change in the transfer program. LIFT's current treatment of the Medicare program is one example of this. We have described how Medicare could be treated as either an in-kind transfer or as a price subsidy by LIFT. Modelling Medicare in this manner has great importance since the size of the Medicare program relative to total medical PCE means that correctly modelling Medicare will significantly improve our forecasts of medical PCE.

APPENDIX

Notation:

P_x^0	Initial Price of Good X (the subsidized good)	
$P_x^1 = (1-s)P_x^0$	Subsidized Price of Good X, where $0 < s < 1$	
P_{else}	Vector of Prices for all Other Goods	
M_0	Initial Income	
$M_1 = M_0 + M_{Tran}$	Income After Income Transfer	
$G(P_x, P_{else}, M)$	Marshallian or Normal Demand Functions	
$X_0 = G(P_x^0, M_0)$	Initial Demand	
$X_1 = G(P_x^1, M_0)$	Demand under Subsidy	$= \Delta P_x (\partial G / \partial P_x) + X_0$
$X_2 = G(P_x^0, M_1)$	Demand under Income Transfer	$= \Delta M (\partial G / \partial M) + X_0$
E^m	Marshallian Own Price Elasticity, Good X	$= (P_x / X) * (\partial G / \partial P_x)$
η	Income Elasticity, Good X	$= (M / X) * (\partial G / \partial M)$
α	Budget Share, Good X	$= P_x^0 X_0 / M$

When will $\Delta X^{Transfer} = X_2 - X_0 > \Delta X^{subsidy} = X_1 - X_0$ when the cost of subsidy equals cost of transfer ?

$$\begin{aligned} \Delta P &= \Delta P = P_x^1 - P_x^0 = (1-s)P_x^1 - P_x^0 = -sP_x^0 \\ \Delta M &= -\Delta P X_1 = sP_x^0 X_1 \\ X_1 &= \Delta P (\partial G / \partial P_x) + X_0 = -sP_x^0 (\partial G / \partial P_x) + X_0 \\ X_2 &= \Delta M (\partial G / \partial M) + X_0 = -\Delta P X_1 (\partial G / \partial M) + X_0 = sP_x^0 X_1 (\partial G / \partial M) + X_0 \end{aligned}$$

We exclude the pathological case of a Giffen Good, therefore $X_1 - X_0 > 0$

Thus, $\Delta X_{Transfer} > \Delta X_{Subsidy}$ as $X_2 > X_1$

$$sP_x^0 X_1 (\partial G / \partial M) + X_0 > -sP_x^0 (\partial G / \partial P_x) + X_0 \quad \text{Simplifying gives us:}$$

$$X_1 (\partial G / \partial M) > -(\partial G / \partial P_x) \quad \text{Substitute for } X_1:$$

$$-sP_x^0 (\partial G / \partial P_x) (\partial G / \partial M) + X_0 (\partial G / \partial M) > -(\partial G / \partial P_x) \quad \text{Multiply both sides by } P_x^0 / X_0 \text{ and simplify:}$$

$$-sP_x^0 (\partial G / \partial M) E^m + P_x^0 X_0 (\partial G / \partial M) / X_0 > -E^m \quad \text{Multiply First Term by } X_0 M / X_0 M = 1 \text{ and simplify:}$$

$$-s\eta\alpha E^m + P_x^0 X_0 (\partial G / \partial M) / X_0 > -E^m \quad \text{Multiply Second Term by } M / M = 1 \text{ and simplify:}$$

$$E^m - s\eta\alpha E^m + \eta\alpha > 0 \quad \text{(Equation 1)}$$

An Income Transfer will generate more demand than a price subsidy if the above equation holds.

$\Delta X^{in-kind} = X_3 - X_0 = \Delta X^{subsidy} = X_1 - X_0$, the cost of subsidy equals cost of transfer and a 1:1 link holds, IFF

$$E^m - s\eta\alpha E^m + \eta\alpha = 0 \quad \text{From Equation 1}$$

For the assumption of a one-to-one link to be true, $\partial G / \partial M = 1.0$ Thus, $\eta = M / X_0$. Substitute:

$$E^m - s(M / X_0) (P_x^0 X_0 / M) E^m + (M / X_0) (P_x^0 X_0 / M) = 0$$

Simplify and solve for E^m to give us:

$$E^m = \frac{-P_x^0}{1 - s P_x^0} = \omega(s, P_x) \text{ (Equation 2)}$$

Except for a few cases, this equation will not hold. Thus, a one-to-one link will not give us the same results as modelling the program as a price subsidy. By imposing a one-to-one link, the size and direction we misstate the effects on PCE of increases in the Medicare program depend on E^m , the subsidy rate and the price of medical care. Since the derivative of equation 2 with respect to both s and P_x is less than zero, we know that as price or the subsidy changed, we would move away from the point where the in-kind transfer was equivalent to a price subsidy.

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