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Fiscal Incidence When Both Individual Welfare and Family Structure Matter: The Case of Subsidization of Home-care for the Elderly

by

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Abstract

Demographic ageing in Western countries has increased the pressure on children of elderly parents to provide care privately as an alternative to more costly institutionalization, and this pressure is likely to intensify. While some papers have recently investigated the optimal structure of family policy in this context, there is little work so far on the distributional impact of programs whose purpose is to subsidize the care of seniors who remain at home.

We investigate analytically and with simulation the measurement of the fiscal incidence of programs that subsidize home care for the elderly, when both individual welfare and family structure matter. The definition of welfare incidence, the comparison of welfare-based incidence with budgetary incidence for non-cooperative and cooperative families, and the calculation of the shifting of program benefits between family members, some of whom may be altruistic, are key issues in the analysis. The integration of individual welfare, family structure and benefit shifting provides a new perspective on the study of the distributional consequences of home-care programs.

Key words: home care subsidy, fiscal incidence, family structure, altruism, shifting
JEL categories: H22, I18, D13

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1. Introduction

Demographic ageing in OECD countries has increased the pressure for the children of elderly parents to provide more home care as an alternative to more costly institutionalization.[1] Because personal contributions - in both time and money - by family caregivers only ameliorates a difficult situation, it is not surprising that governments in many OECD countries are also finding themselves under pressure to increase public support for elderly home care. Subsidizing home care rather than institutional capacity allows them to maintain expenditures in other important policy areas while responding to the demands of increasingly burdened (adult) children. In this paper, we investigate analytically and with simulation the fiscal incidence among children and parents of a program that subsidizes home care for elderly parents.

There has been some research concerning the impact of public programs on the living arrangements of the elderly and on the extent of informal care giving of the children, including Hoerger, Picone, and Sloan (1996), Pezzin and Schone (1997, 1999), Bittman and Folbre (2004), Stabile, Laporte, and Coyte (2006), Viitanen (2007), Bryne, Goeree, Hiedemann and Stern (2009) and Orsini (2010). And the optimal structure of public support for the family has been considered to some extent in the literature, for example by Balestrino (2004) and Pestieau and Sato (2008). But to the best of our knowledge, there has been no work so far on the distributional impact of programs designed to subsidize the care of seniors who remain at home, a type of policy that is becoming increasingly important in many countries.

To analyze the fiscal incidence across parents and children of a public subsidy for home care, it is necessary to deal with several related issues that have not yet been combined in this context. At the most general level is the longstanding problem with the use of budgetary amounts rather than individual welfare as a metric for the attribution of net benefits. The structure of the family - whether children and parents act non-cooperatively or cooperatively, as well as the nature and role of altruism among family members – is a second set of issues that must be integrated into an assessment of the incidence of a family-related program like assisted homecare. Both the welfare and the budgetary consequences of public subsidies for home care of the elderly are different in these two types of families. And finally there is the related matter of the definition and calculation of the shifting of the subsidy between the generations. The resulting integration in the paper of a concern with welfare as well as with budgetary incidences, family structure and benefit shifting between the generations provides a new perspective on the study of the distributional consequences of home-care programs.

Work on welfare-based incidence of public expenditure has been sparse since the seminal contribution of Aaron and McGuire (1970). Early incidence studies, as well as most contemporary work, conveniently uses budgetary amounts as a metric, as for example in the work of Gillespie (1964, 1980), Pechman (1974, 1985), Suits (1977), Vermaeten, Gillespie, and Vermaeten (1995) and many others. This is so despite the work of Aaron and McGuire, Maital (1973), and Martinez-Vazquez (1982) that showed how the translation of budgetary incidence into welfare terms substantially affects incidence calculations.[2] One should note that even though the price-subsidy program we analyze does not involve the provision of a public good, budgetary changes are not in

[1] The financial cost of home care is usually less than that of institutional care. See Weissert, Musliner, Lesnick and Foley 1997, Hux et al. 1998, and Hollander and Chappell 2002.

[2] Welfare has been used as a metric in some computable general equilibrium (CGE) studies such as Piggot and Whalley (1987). But these are computable models while, to the best of our knowledge, there remains a striking absence of analytical work on incidence when welfare matters.

principle identical to welfare changes.[3]

In the paper we pay special attention to the comparison of analyses that alternatively use welfare or budgetary amounts as a metric. Fiscal incidence is an important input into policy design and program evaluation. While welfare is theoretically superior as a metric, it would be much simpler to accumulate appropriate evidence and to translate it into practical policy advice if budgetary amounts rather than welfare could serve as a basis for assessing distributional impacts.

The nature of family structure has been well considered in the economics literature. Such work includes Manser and Brown (1980) and McElroy and Horney (1981) on the cooperative family, Lundberg and Pollak (1994), Konrad and Lommerud (2000), and Chen and Woolley (2001) on noncooperative bargaining, and Chiappori (1992), Browning and Chiappori (1998), and Apps and Rees (1997, 2007) on the collective household, among other contributions. But to the best of our knowledge, there is little work that integrates family structure into fiscal incidence analysis. We will investigate the role of family structure in the allocation of time, the purchase of formal care and the consequent distribution of benefits to parents and children.

The last of the three major elements that we incorporate into the incidence analysis is shifting. Unlike tax shifting, which is a classic topic in public finance - for a recent survey, see Zodrow 2005 - the shifting of benefits, whether of services or of subsidies, remains under researched (Exceptions include Shoup, 1988). In particular, there is little discussion in the literature about the nature of the short and long run horizons that must be distinguished in order to define the shifting of benefits on the expenditure side of the public budget. In assessing the distributional impact of home care subsidies, where family structure is obviously involved, it is also necessary to deal with the possibility that program benefits may be shifted between the generations.

The analysis proceeds in the following manner. We first construct a model of individual behavior for parents and children in the presence of a tax-financed (price) subsidy for home care for elderly parents, when the children may be altruistic and families are non-cooperative. After summarizing the key conceptual steps required for any incidence study, we carry out these steps for the home care subsidy. Both welfare-based and budgetary-based incidence indexes are developed. We look for situations in which budgetary incidence may serve as a proxy for the theoretically superior welfare based calculations. Using simulations because of the complexity of the resulting models, we next explore the importance of assumptions about the altruism of children and about family structure for the calculation of benefit shifting and net incidence across the generations. A final section concludes. Ancillary calculations and simulations are provided in an Appendix.

2. A behavioral model of a non-cooperative family when children are altruistic

We begin the analysis with a behavioral model of a non-cooperative family in the presence of a subsidy to elderly parents for home-care. A cooperative family will be introduced in a later section of the paper.

We assume that all families are identical and that every family is composed of an elderly parent and

[3] On the importance of price changes for incidence analysis, albeit in different contexts to that considered here, see Brennan (1976) and Browning (1978).

one child. Equivalently, we may think of the model as applying to a family of two parents and one or more children where there is no disagreement between the parents, and the children also always act cooperatively among themselves.[4] To make it clear that we do not consider strategic interaction among siblings, or among parents, we proceed as if there were one parent and one child.

The parent is infirm and requires home care, presumably as a substitute for institutionalization[5]. The home care required includes formal and informal components. The parent buys formal services from the market. The child is altruistic to some extent and spends time taking care of the parent, and also buys some formal care from the market to supplement the purchase of it by his or her parent. We also assume that the parent prefers the company of the child, and so purchased time is not a perfect substitute for the personal attention provided by the child.

The government subsidizes a portion of the cost of formal care purchased by the parent only. This subsidy is targeted on the elderly parent, and so the child's purchase of formal care is not eligible for a subsidy.

As noted, the parent and the child act non-cooperatively to determine home care provision. It is important to understand why the non-cooperative case may be relevant. At some point, the child would rather give money to their parent instead of spending more time with him or her, while the parent continues to prefer the child's attention to a money transfer. We think that this disagreement is typical among families in developed countries and that in such a situation, use of a non-cooperative Nash model of the family may be appropriate.

Assuming that utility is Cobb-Douglas, so that a change in the price of home care will affect all components of agent choices, the utility of the parent (p) is:

$$U(x_p, m, s, h) = a \log(x_p) + b \log(m+s) + c \log(h), \quad (1)$$

where x_p is the numéraire consumption of the parent, $m+s$ is the total hours of formal care received by the parent, of which m hours of formal care is purchased by the parent and the other s hours of formal care is purchased by the child, and h is the total hours that the child spends to take care of the parent. As usual we let $a+b+c=1$, and because the parent prefers the child's attention to purchased care, the Cobb-Douglas coefficient of formal care $m+s$ is less than that of informal care, h, i.e. $b < c$.

The parent's utility is maximized by choice of numéraire consumption, x_p, and formal care consumption, m, subject to the budget constraint

$$y(1-t) = x_p + q(1-t_s)m, \quad (2)$$

where y is the amount of the fixed pension income of the parent. t is the uniform income tax rate applied to both the parent and the child. Here taxes are levied only to pay for the home care subsidy. The price of numéraire consumption is normalized to 1, the price of formal care is q per hour, and t_s is the rate of non-taxable subsidy that the government gives to the parent. With the government subsidy, the effective price of the formal care purchased by the parent is $q(1-t_s)$ per hour.

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[4] Interested readers may wish to see Pezzin, Pollack and Schone (2007) or Knoef, Kooreman and Kalmijn (2007) for an analysis of strategic interactions among siblings in arranging home care for their parents.

[5] The form of and cost of institutional care is not formally present in the model.

Following Becker (1981), we assume the utility of the child (c) depends on that of the parent.

$$U(x_c, l, x_p, m, h, s) = [(1-d)\log(x_c) + d\log(l)] + rU_p(x_p, m, s, h), \quad (3)$$

where, x_c is the numéraire consumption of the child, l is the leisure enjoyed by the child, U_p is the utility of the parent, and r is the degree of altruism towards the parent. The elements in the square bracket represent the utility of the child in the absence of altruism. The child maximizes (3) by choice of (x_c, h, s) subject to his budget constraint.

$$w(T-h-l)(1-t) = x_c + qs, \quad (4)$$

where $T = L + h + l$, with T the child's total available time in a day, L the child's working hours, h the number of hours that the child provides home care to the parent, l the hours of leisure enjoyed by the child, and w the child's wage rate.

The indirect utilities of the parent and the child in the presence of the subsidy in the long run, that is, when the subsidy is in place and fully adjusted to, V_p and V_c, are[6]:

$$V_p = \log[wT(1-t) + \frac{y(1-t)}{(1-t_s)}] + a\log(1-t_s) + Z_p, \text{ where } Z_p \text{ is a constant and } Z_p = -\log(1+r) + a\log(ra) + b\log(rb) + c\log(rc) - b\log(q) - c\log[w(1-t)], \quad (5)$$

and

$$V_c = (1+r)\log[wT(1-t) + \frac{y(1-t)}{(1-t_s)}] + ra\log(1-t_s) + Z_c, \text{ where } Z_c \text{ is a constant, and } Z_c = -(1+r)\log(1+r) + (1-d)\log(1-d) + d\log(d) - (d+rc)\log[w(1-t)] + rZ_p. \quad (6)$$

In incidence terms, expressions (5) and (6) represent post-fisc welfare in the long run for the parent and the child respectively.

Note that because of the form of the parent's utility (1), the child at an interior solution (6) will always provide some informal care ($h>0$). But formal care purchased by the parent or the child, m or s, could be zero in this situation.

When the government budget is balanced, total tax revenue equals total expenditure: $t(Y_p + Y_c) = t_s q m$,[7] where Y_p and Y_c are the taxable gross income of the parent and the child in the presence of the tax and the subsidy, and before the tax payment. Using this government budget constraint and the solutions to the optimization problem of the parent and the child, we can derive for later use the tax rate in the post-fisc situation with full adjustment of the parent and the child in the long run, t^{LR}:

$$t^{LR} = \frac{\frac{y}{(1-t_s)} - \frac{ra}{(1+r)}[wT + \frac{y}{(1-t_s)}]}{\frac{y}{(1-t_s)} - \frac{ra[wT + y/(1-t_s)]}{(1+r)} + \frac{(1+r-d-rc)(y+wT)}{t_s(1+r)}}. \quad (7)$$

[6] The solutions to the maximization problem are provided in the Appendix.

[7] Because all the families are assumed to be identical, the number of families is omitted in the government budget.

3. The net incidence of a price subsidy for home care

Having outlined the underlying behavioral model, we can proceed with the incidence analysis.

Fiscal incidence analysis can be boiled down into five key steps, a summary of which is not easy to find despite the vastness of the literature. These five steps are: (i) the choice of a counterfactual experiment; (ii) the treatment of the government budget in the counterfactual; (iii) the choice of a metric for incidence calculations; (iv) the choice of a benchmark income for the purpose of defining an incidence index; and, finally (v) allowance for shifting. In conducting the incidence analysis, we compute both a welfare-based incidence measure along with the traditional budgetary-based index. We proceed deliberately, and as quickly as possible, through each step, some of which are more complicated in the present context than others.

3.1 Choice of the counterfactual

The first step is to choose a counterfactual experiment which effectively defines the policy to be analyzed. This and the next step are straightforward in the present context and we can be brief.

We may consider replacing the existing subsidy program with another policy in a *differential incidence analysis*. Or we may analyze the implications of an existing home-care subsidy by comparing it to a pre-fisc situation in the absence of the subsidy and of the revenue required to finance it in a *balanced budget analysis*.[8]

In this paper, we pursue a differential analysis by comparing the situation when the subsidy is in place to a counterfactual in which the price subsidy is replaced by an equal-cost set of lump-sum transfers. This choice focuses our attention on the consequences of changing the relative price of home-care. It is convenient to regard the situation with the subsidy in place as the initial situation '0'. In the counterfactual situation '1', we hypothetically remove the price subsidy, maintain the tax system, and return the tax-revenue collected to taxpayers.

3.2 Defining the government budget in the counterfactual

The second step is to define precisely the nature of the government budget in the counterfactual. The change in revenue or expenditure as a result of the application of the counterfactual must be exactly allocated across citizens.[9] For example, when an expenditure program is hypothetically eliminated, the freed-up government funds can be returned to citizens through a reduction in a tax rate. Alteration of a tax rate requires the assessment of additional behavioral adjustments consistent with the economic model underlying individual behavior. For analytical work such as that conducted below, a lump sum allocation of public funds in accordance with the budget restraint is a useful simplifying assumption, one that we adopt.

We assume that the price subsidy is removed and replaced with an equal-cost set of lump sum transfers, R_i. , Let R_i be proportional to the taxable income in the presence of the price subsidy, so that $R_p = f \cdot Y_p$ for the parent and $R_c = f \cdot Y_c$ for the child. To maintain the government budget when

[8] A classic example of the differential approach is Pechman (1985). Gillespie (1964) provides the seminal balanced-budget analysis.

[9] This is done in both the welfare-based studies of Aaron and McGuire (1970) and Piggot and Whalley (1987), and in the budgetary based studies such as that of Vermaetan et al. (1995).

the subsidy program is assumed away, we must have $R_p + R_c = f(Y_p+Y_c) = t_s qm$ in the counterfactual situation, while also observing government budget balance: $t^{LR}(Y_p + Y_c) = t_s qm$. Therefore, in this case, $f = t^{LR}$, $R_p = t^{LR}Y_p$ and $R_c = t^{LR}Y_c$, so that returning the subsidy lump sum in proportion to income is equivalent to returning the actual tax payment. This is a further simplifying assumption that eliminates changes in income distribution as a result of the application of the counterfactual.[10]

3.3 Choosing a metric: budgetary amounts versus welfare changes

The third step in incidence analysis is to choose a metric for the measurement of net benefits. Most fiscal incidence studies used budgetary amounts as a metric - see for example, Browning (1978) or Vermaetan et al. (1995). Only a few studies have used welfare as a metric, following the seminal work of Aaron and McGuire (1970). Here, we use both welfare and budgetary amounts in order to compare the resulting incidence calculations. As we noted earlier, it would be convenient if a budgetary incidence could be used as a proxy for welfare based incidence. The analysis below is designed to allow consideration of this possibility.

We first consider the use of budgetary amounts as a metric for calculating net benefits and then turn to welfare-based measures. A standard budgetary formula for the net benefit (NB) incident on group i in a particular situation is[11]

$$NB_i = G_i + TR_i - T_i \,, \tag{8}$$

where G_i is the monetary value of the service received by group i, TR_i is the amount of the government direct transfer to group i, and T_i is the total tax that the group pays. This budgetary balance must in principle be measured in both the initial situation and in the counterfactual with the overall net benefit from the program being given by the difference between the two:

$$NB_i = NB_i^0 - NB_i^1 \,. \tag{9}$$

In the present context, the benefit to the parent in the long run is $TR_p = t_s qm$, and the benefit to the child in the long run is $TR_c = 0$. The tax paid by the parent is $t^{LR}Y_p$ and the tax paid by the child is $t^{LR}Y_c$. So the net benefits received by the parent and the child in the post-fisc situation after all behavioral adjustments are:

$$NB_p^0 = TR_p - T_p = t_s qm - t^{LR}Y_p, \tag{10}$$

and

$$NB_c^0 = TR_c - T_c = 0 - t^{LR}Y_c. \tag{11}$$

[10] When the return of funds to individuals is defined to be distributionally neutral in real terms, a differential analysis can be resolved into the combination of two balanced budget ones (Browning, 1978). The differential incidence effects of replacing tax or expenditure type A with type B will then be equal to the difference in the balanced budget incidence of A less that of B, since the compensating policy changes in the latter two analyses are by definition distributionally neutral.

[11] This definition of net benefits is consistent with the "net residual" measurement in Musgrave and Musgrave (1980, p274). Another definition of the net benefit in budgetary terms is the difference between the pre-government total income and post-government total income (see, for example, Meerman 1980). The difference between these two approaches depends on the general equilibrium effects of the policy under consideration.

In the counterfactual, neither the parent nor the child receives a subsidy. They both pay tax, and receive a lump-sum transfer equal to their tax payment. The net budgetary benefits in the counterfactual state (denoted by superscript 1) for both the parent and the child are zero,

$$NB_i^1 = R_i - T_i = t_i^{LR} Y_i - t_i^{LR} Y_i = 0. \quad (12)$$

Thus the overall net benefits of the parent and the child in the long run are:

$$NB_p^0 - NB_p^1 = (t_s qm - t^{LR} Y_p) - 0, \quad (13)$$

and

$$NB_c^0 - NB_c^1 = (- t^{LR} Y_c) - 0. \quad (14)$$

Alternatively, one might assume that in the long run, a part of the budgetary benefit from the subsidy is shifted from the parent to the child in proportion to the latter's purchase of formal care when the subsidy is in place. However, we do not so, since this prejudges the outcome of the simulation analysis of shifting to be conducted later (where it turns out that this sharing rule is wrong).

We now turn to the calculation of welfare-based incidence. We note again that although there is no public good in the model, this does not eliminate the problem of using budgetary based incidence as a proxy for a welfare-based measure. The equivalent variation (EV) and the compensation variation (CV) are the two most-widely used welfare-based measures of the effects of a public policy on individual welfare. In computable equilibrium work on incidence such as that of Piggot and Whalley (1987), the EV is chosen over the CV because the EV always uses the observable current price vector as a benchmark price, while the CV uses the counterfactual price vector. The EV is also appropriate for the assessment of a program that is already in place, the perspective that we have adopted in defining the counterfactual. We shall use the EV in what follows.

The EV can be defined implicitly using the indirect utility function V. It is the amount of income that must be taken away from an individual in state 0 (in the presence of the subsidy) in order to leave the individual just as well off as in the counterfactual (See, for example, Just, Hueth, and Schmitz, 2004).[12] That is:

$$V(p^0, Y^0 - EV) = V(p^1, Y^1) = V^1, \quad (15)$$

where Y^0 and Y^1 are the income of the individual in the benchmark and in the counterfactual state respectively, and p^0 and p^1 are the prices in the benchmark and in the counterfactual state respectively. A positive (negative) EV implies a net welfare gain (loss) from the policy in the benchmark state.

The EV for the parent in the long run is defined by $V_p^0[q(1-t_s), y(1-t^{LR}) - EV_p] = V_p^1[q, y(1-t^{LR}) + R_p]$. The EV for the parent is therefore

$$EV_p = [wT(1-t^{LR})(1-t_s) + y(1-t^{LR})] - (1-t_s)^{(b+c)}[y(1-t^{LR}) + t^{LR} y + wT(1-t^{LR})]. \quad (16)$$

Similarly, the child's' EV from the subsidy after all behavioral adjustments by the child, implicitly defined by $V_c^0[q(1-t_s), Y_c(1-t^{LR}) - EV_c] = V_c^1[q, Y_c(1-t^{LR}) + R_c]$, is:

[12] Here the counterfactual involves a tax which is returned lump sum, just as in the budgetary incidence calculation.

$$EV_c = [wT(1- t^{LR})+y\,(1- t^{LR})/(1-t_s)] - (1-t_s)^{-ra/(1+r)}[\, wT(1- t^{LR}) + y(1- t^{LR})+ t^{LR}Y_c]. \qquad (17)$$

3.4 Choosing a benchmark income

We also need to choose a benchmark income for the purpose of defining a fiscal incidence index to compare the net burden on parent and child. One could also allocate benefits across income groups more generally using knowledge of family formation by income class, though we shall not do so here. Income is almost always used as a benchmark for the purpose of defining beneficiary groups because it is thought to be highly relevant to the design and evaluation of public policies.

There are at least three choices for benchmark income y_i that have been widely used in the literature. They are: *pre-fisc income*, *post-fisc income*, and a type of income lying between pre-fisc and post-fisc income referred to as *broad income* (Vermaetan et al. 1995). Pre-fisc income is private factor income in the absence of the fiscal policy in question. To compute pre-fisc income, shifting of taxes and benefits in the long run must be unwound to determine income in the absence of the policy under investigation. Post-fisc income is the income observed in the post-policy state which includes any government transfer payments and the benefits of government purchases, and is net of the corresponding tax payments. Broad income is essentially pre-fisc income plus transfer payments.

We shall use post-fisc income for the benchmark income relative to which net benefits are to be compared, because this is a natural choice for normalizing the welfare-based EV measure, and because we want to compare budgetary incidence and welfare incidence. In this case, no adjustment to benchmark (observed post-fisc) income for shifting is required.

Using post-fisc income as the benchmark income for the distribution of net benefits, the long run budgetary fiscal incidence index (BFI) of the parent may then be defined as[13]:

$$BFI_p^{LR} = \frac{NB_p^0 - NB_p^1}{Y_p^{post-fisc}} = \frac{(t_s qm - t^{\mathrm{LR}} Y_p) - 0}{Y_p^{post-fisc}}, \qquad (18)$$

where $Y_p = y$, $Y_p^{post\text{-}fisc} = y\,(1-t^{LR})+t_s qm$.

And the budgetary fiscal index of the child in the long run is:

$$BFI_c^{LR} = \frac{NB_c^0 - NB_c^1}{Y_c^{post-fisc}} = \frac{(0 - t^{\mathrm{LR}} Y_c) - 0}{Y_c^{post-fisc}}, \qquad (19)$$

where, $Y_c = wT - (rc+d)(wT+y)/(1+r)$, and $Y_c^{post\text{-}fisc} = Y_c\,(1-t^{LR})$.

The welfare-based fiscal incidence indexes (WFI) using post-fisc income as the benchmark income for the parent and the child are

[13] An alternative way to measure budgetary fiscal incidence would be to define incidence according to savings of money spent on formal care. (Mel McMillan, private communication). This approach is essentially lies between a budgetary approach and a welfare-based measure. We do not pursue it further in this paper.

$$WFI_p^{LR} = \frac{EV_p}{Y_p^{post-fisc}} = \frac{[wT(1-t^{LR})(1-t_s) + y(1-t^{LR})] - (1-t_s)^{(b+c)}[wT(1-t^{LR}) + y(1-t^{LR}) + t^{LR}y]}{Y_p^{post-fisc}} \quad (20)$$

and

$$WFI_c^{LR} = \frac{EV_c}{Y_c^{post-fisc}} = \frac{[wT(1-t^{LR}) + y(1-t^{LR})/(1-t_s)] - (1-t_s)^{[-ra/(1+r)]}[wT(1-t^{LR}) + t^{LR}Y_c + y(1-t^{LR})]}{Y_c^{post-fisc}}. \quad (21)$$

In (20) and (21) we can see the roles of the subsidy rate for home care, t_s, the tax rate in the long run situation, t^{LR}, the child's degree of altruism towards the parent, r, the parent's taste parameters, a, b, and c, and the income measures of the parent and the child, y, wT, and Y_c.

The parent's welfare change is a result of the subsidization of consumption and the trade-off between market care and attention by the child. The change in welfare for the child is the outcome of the child's adjustments of purchase of formal care and time use and the parent's behavioral adjustments, when the parent's purchase of market care is subsidized. And as shown in equation (7), the equilibrium tax rate that balances the government budget is also a result of these adjustments.

3.5 Allowing for shifting of program benefits

The fifth and final step of incidence analysis is to allow for the shifting of taxes and benefits. Shifting affects the distribution of net benefits among agents. As already pointed out, shifting may play an even more important role if a pre-fisc or broad definition of income is used as the benchmark income.

The analysis of the shifting of tax burdens has been at the center of tax incidence studies at least since Harberger's (1962) seminal work on the corporate income tax in general equilibrium. But there is virtually no theory concerning the shifting of benefits, in large measure, one suspects, because it is thought that such a comprehensive framework would be hard to actually apply, and the shifting of benefits is ignored in almost all incidence studies.

Shoup (1988) argued for, but did not provide, an analysis of the shifting of benefits. One of his examples concerns a city park constructed in the neighborhood of a rental residence. When the park is just constructed, the tenants living nearby receive the full benefit of the park. However, over time the benefit from the park leads to a rent increase. In the long run, part or all of the benefits from having the park nearby is shifted from the tenants to the landlord. It would be a mistake, Shoup argues, if all the benefits from the park were to be allocated to the tenants.

To study the shifting of benefits, we need a theory of behavior and a counterfactual distinguishing the incidence of program benefits in the short and the longer run, of a sort analogous to that used in the study of tax shifting. Shifting may be then defined as the difference in benefit incidence over the two horizons. In a corporate income tax study, for example, assumptions need to be made about how adjustments in the capital stock occur over short and longer runs in response to taxation. The short run is often defined as a situation in which the capital stock is fixed and thus bears the full tax burden, while the long run allows for capital mobility of some sort that leads to shifting of the tax burden from capital to labor. Similar assumptions are needed in the study of expenditure incidence.

We shall assume that in the short run, for any given degree of altruism, the child's behavior is fixed at the levels that would occur if there were no subsidy program. The parent, however, is assumed to fully adjust to the subsidy and to the child's behavior at the outset. In other words, the short run

involves the absence of adjustment by the child only.[14] Here we have in mind a chain of events precipitated by the subsidy, which in the first instance is paid to the parent, and which the child may know about but cannot adjust to in the short run. Other assumptions are possible, and the literature gives little guidance.[15]

Accordingly, let the child in the short run maximize utility as if his or her parent was not subsidized. The parent's budget constraint is then regarded by the child as $y = x_p+qm$, instead of $y(1-t) = x_p+q(1-t_s)m$, and the child's budget constraint is seen to be $wT(T-h-l)=x_c+qs$, instead of $wT(T-h-l)(1-t) = x_c+qs$. The child's problem in the short run then amounts to the following:

$$Max\ U\ (x_c, l, x_p, m, h, s) = [(1-d)\ log\ [w(T-h-l)-qs] + d\ log(l)] + rU_p\ (x_p, m, h, s),$$
where $x_p = y - qm$. (22)

The equilibrium tax rate in the short run is thus affected by the behavioral response to the subsidy by the parent and by the behavior of the child in the short run, so that $t^{SR}(Y_p^{SR} + Y_c^{SR}) = t_s q m^{SR}$. After substitutions, this short run tax rate is

$$t^{SR} = \frac{\frac{byt_s}{(1-t_s)} - ra(1-c)wTt_s + a(1+rc)yt_s}{\frac{byt_s}{(1-t_s)} + (1+ r - d - rc)(1-c)(wT + y)}. \quad (23)$$

We can then use t^{SR} in (23) to calculate budgetary and welfare incidence indexes for the child and for the parent when the child has not fully adjusted to the post-fisc situation. The exact form of these short-run fiscal incidence indexes are provided in the Appendix.

Shifting is measured by the difference in fiscal incidence indexes for the child and the parent over the two horizons. These differences between budgetary and welfare indexes over the two horizons, though easy to derive, have complicated closed forms which are best relegated to the Appendix.

4. A comparison of incidence indexes and shifting analyses

With the exception of two special cases which are presented analytically, and in view of the algebraic complexity of the incidence indexes, it proves useful to explore the budgetary and welfare incidence indexes we have defined and the shifting of net benefits using simulation.

To simulate the indexes under various conditions, we use data related to the Medicaid subsidy for home health care, in part because Medicaid is the single largest source of financing for long-term care in the United States (Kaiser, 2005), and in part because data can be assembled in a reasonably consistent manner for this case.

[14] If the parent also does not adjust in the "short-run", the behavioural solution is then simply same as in the pre-fisc case.

[15] An alternative short run situation is one in which the child makes consumption decisions as if there were no subsidy, but he does respond to changes in the parent's behaviour. Simulations (not reported here) suggest that there is little difference between this setting and the one discussed in the text, at least for the parameter values we use.

The data we used are from various sources. The Medicaid subsidy for formal home care and the income of the parents are from the Medical Expenditure Panel Survey (MEPS, 2007 wave) provided by U.S. Department of Health and Human Services. The target population are those 65 years and older who are covered by Medicaid (The MEPS has 579 seniors in the sample). The average age of the sample population is 75.34 and their average income is $12081.83 annually or $33.10 daily. A subsidy rate for formal care is obtained by dividing the average amount of home health expenditure covered by Medicaid by the average total home health expenses of the sample population, so that the subsidy rate is $t_s = 0.3929$.

The child's wage rate and the hourly price of formal care are from the Occupational Employment Statistics (2007 wave) of the U.S. Bureau of Labor Statistics. The child's wage rate is the average hourly wage rate of the labor force for all occupations, and the price of formal home care is approximated by the average hourly wage rate of home health aid workers.[16] These data imply that in our simulated family, the child earns $19.56 per hour and the price of formal home care is $10.03 per hour. The child's total time available for work, leisure, or home care is assumed to be 12 hours a day.

We also assume that the parent's preference for numéraire consumption, for formal care, and for informal care are represented by Cobb-Douglas coefficients $a = 0.5$, $b = 0.2$, and $c = 0.3$, and that initially the child is altruistic towards to the parent to the degree of $r = 0.25$, a figure that appears to be in accord with some existing empirical work.[17] We treat the situation with $r = 0.25$ as our baseline case, and then gradually increase the degree of altruism to study its role in the incidence calculations. In the baseline case, when the government budget is balanced, a subsidy rate of 0.3929 must be financed with a tax rate of 0.0332 in the long run and 0.0115 in the short run for a non-cooperative family, and at the rate of 0.0943 for the cooperative family to be considered later.

The above setup is such as to generate a child in our synthetic family who does not purchase any formal care for the parent in the long run, as shown by Figure 2 below. In the long run after all behavioral adjustments have occurred, formal care purchased by the parent therefore stays at around 1.5 hours per day. This is a corner solution for the family we have modeled. Simulations (not illustrated) show that only when the child's wage rate is higher than $28 per hour (versus about $33 a day for the parent) will the child start to purchase formal care. On the other hand, the figure shows that informal care provided by the child increases steadily with the assumed degree of altruism. The sensitivity of the patterns in the figure to variations in wage level of the child and income of the parent will be considered further later on.

[16] This is a standard practice in the literature.

[17] Using a sample of German Socio-Economic Panel (2000-2002), Schwarze and Winkelmann (2005) estimated the degree of altruism as the correlation between the happiness of parents and children. They found that the altruism between parents and children is equal to 0.25 in a linear model. Hamoudi and Thomas (2006) conducted a field experiment on the families included in the Mexican Family Life Survey (2005). In their study, the degree of altruism is measured as the percentage of endowment allocated to others. They found that the altruism of men and women towards strangers or neighbours ranged between 0.247 and 0.323.

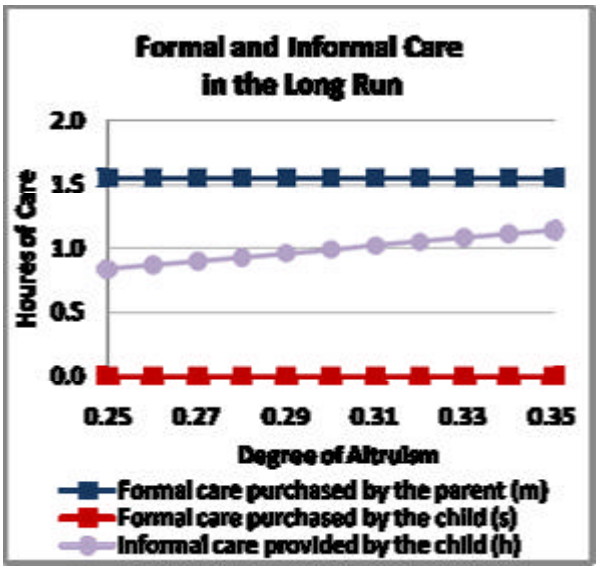

Figure 2: Formal and Informal Care Received by the Parent and Altruism in the Non-Cooperative Family After All Behavioral Adjustments

4.1 A comparison of incidence indexes in the long run

We now compute incidence indexes for members of our hypothetical family when its members are non-cooperative in the sense referred to earlier, and all family members fully adjust to the subsidy.

The resulting relationship between fiscal incidence indexes and the degree of altruism is shown in Figure 3. Here a positive (negative) BFI represents a gain (loss) from the subsidy-tax program in terms of budgetary benefits, and a positive (negative) WFI represents a gain (loss) in terms of welfare changes. For example, a BFI = -1% for the child means that the child bses about 1% of income as a result of his behavioral responses to the fiscal policy bundle that includes a subsidy to the parent and a tax levied to finance the subsidy. A WFI = 10% for the parent means that the parent gains in terms of welfare because of the presence of the subsidy-tax bundle, and that the gain of welfare for the parent is equivalent to 10% of his income.

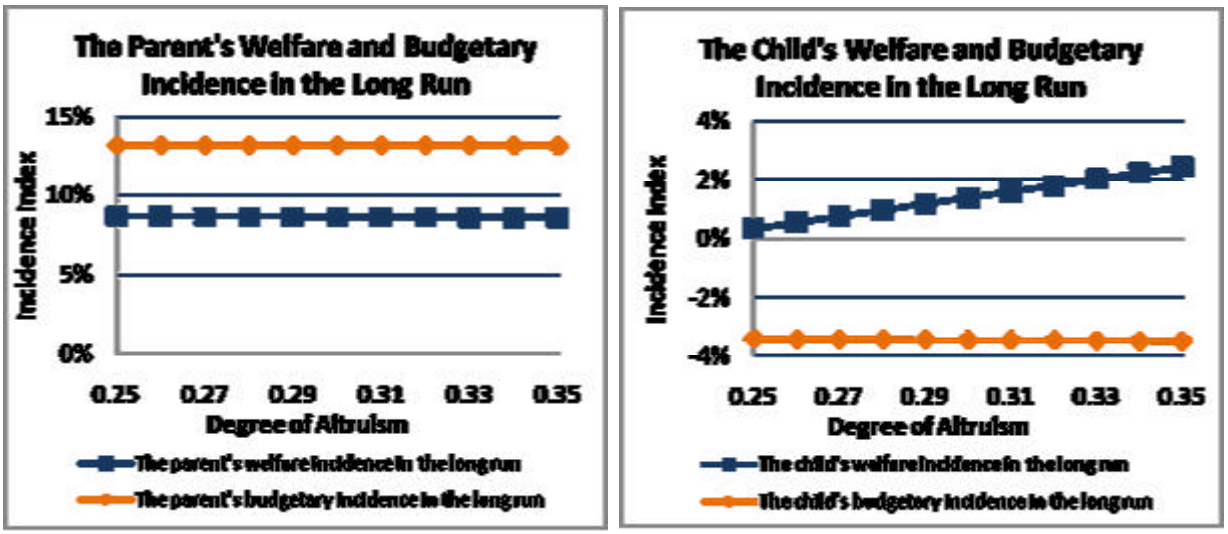

Figure 3: Welfare vs. Budgetary Fiscal Incidence in the Long Run

We see that simulated WFI and BFI indexes are different for both the parent and the child regardless of the degree of altruism. The parent's welfare gain from the subsidy is around 8% of his post-fisc income, lower than his budgetary gain of about 13%. The opposite story applies for the child: the welfare incidence for the child is positive while his budgetary incidence is negative.

We may understand these results in the following way. The parent gains in terms of budgetary amounts because he receives the full subsidy as a benefit while the cost of the subsidy - the required tax payment - is shared by the child. Welfare incidence for the parent is different essentially because this depends not just on the change in his own after-tax income, but also on the contribution of informal care by the child.

The budgetary incidence for the child is always negative because the only budgetary change for the child resulting from the subsidy-tax bundle is his tax payment (see equation 19). But the child benefits indirectly from the subsidy in terms of welfare via the altruism channel, which leads to a positive welfare incidence. Note that as the degree of altruism of the child increases, his welfare incidence gradually increases, reflecting the personal return from the increasing amount of informal care he provides.

4.1.1 Special cases in which budgetary and welfare indexes are analytically equivalent

As the above simulations illustrate, long run welfare and budgetary incidence indexes will generally be different, as a consequence of the interdependence of family members via altruism and via the general equilibrium consequences of the tax payments for the home-care subsidy policy. But can we find particular circumstances in which the two indexes are equivalent? The answer is yes, but these cases are exceptions that will not give much comfort to those wishing to use budgetary indexes in the present context.

Consider, first, the special case when the degree of altruism is zero, so that the child does not contribute any formal or informal care to his parent, and the family is effectively dissolved. In that

case, the child does not interact with the parent *over any horizon*, and there is no difference in short and long run incidence for the child or the parent.

The budgetary and welfare incidence when the degree of altruism is zero in both the long run and the short run, for the two generations are then:

$$WFI_p^{r=0} = \frac{y(1-t)-(1-t_s)^b y}{Y_p^{post-fisc}}, \text{ and } BFI_p^{r=0} = \frac{\frac{bt_s(1-t)y}{(1-t_s)} - ty}{Y_p^{post-fisc}}. \quad (24)$$

and

$$WFI_c^{r=0} = \frac{-tY_c}{Y_c^{post-fisc}}, \text{ and } BFI_c^{r=0} = \frac{-tY_c}{Y_p^{post-fisc}}. \quad (25)$$

The differences between the two types of incidence indexes are then

$$WFI_p^{r=0} - BFI_p^{r=0} = \frac{[1-\frac{bt_s}{(1-t_s)}]y(1-t)+ty-(1-t_s)^b y}{Y_p^{post-fisc}} \neq 0 \quad (26)$$

and

$$WFI_c^{r=0} - BFI_c^{r=0} = \frac{-tY_c-(-tY_c)}{Y_c^{post-fisc}} = 0. \quad (27)$$

We state these results as proposition 1:

> ***Proposition 1:*** *For the home-care subsidy program, a BFI index is equivalent to a WFI index only when there is no altruism, and then only for the child.*

The reason for the equivalence of BFI and WFI here is simply that, with no altruism or behavioural adjustments by the child, changes in income due to the payment of the child's taxes are equivalent to changes in his welfare in terms of the equivalent variation.[18]

In contrast, whenever there is a behavioural adjustment to a program or tax, there will be a divergence between incidence calculated using budgetary and welfare metrics. In our example, a price subsidy alters the relative cost of formal care and induces the parent to re-optimize his consumption decision. For the parent, the subsidy program not only changes his post-fisc income but also leads him to adjust his consumption of formal care. The change of income is reflected in both budgetary and welfare incidence while the adjustment of the consumption decision is captured only by the welfare incidence analysis. As shown in equations (24) and (26), even when the family is dissolved, welfare and budgetary incidences for the parent are different because of the behavioural adjustments of the parent to the subsidy.

[18] Even when $r = 0$, the child responds to the tax, but this adjustment only reduces his income. His consumption pattern does not change. This similarity in BFI and WFI reflects the close relationship between the monetary and welfare measurement of wellbeing. The equivalent variation translates a welfare change into an adjustment in income. This translation is based on the assumption that marginal utility of income is constant (so that changes in income and changes in price make no difference to the amount of the commodities afforded). See Hicks (1942).

This leads to the second case where we can show analytically the equivalence of the two kinds of incidence indexes, this time for the parent. If the parent receives a lump-sum transfer, R_p, rather than a price subsidy, t_s, *and* there is no altruism in the family, the welfare and budgetary incidence of the parent are

$$WFI_p^{r=0} = \frac{R_p - ty}{Y_p^{post-fisc}} \text{ and } BFI_p^{r=0} = \frac{R_p - ty}{Y_p^{post-fisc}}. \quad (28)$$

In this case, welfare and budgetary incidence for the parent are equivalent. Indeed, when the parent receives a lump-sum transfer equal to his tax payment, both the welfare and budgetary incidence for the parent will be zero.

The results in this section suggest that when the family is non-cooperative, budgetary incidence is a sensible proxy for welfare incidence only in the unusual cases where there are no behavioural adjustments and interdependence of utilities is not involved. [19]

4.2 Shifting analysis

Before turning to explore the case of the cooperative family, we analyze shifting. To begin, we consider the short run versus long run behavioural adjustment of the synthetic parent and the child on which the definition of shifting depends, with the short run defined as outlined in section three above. These adjustments are illustrated by the simulations reported in Figure 4 and Figure 5. The difference between the two curves at the lowest level of altruism is an indication of the direction of the long run adjustment on each relevant margin.

We see that in the short run, the child provides both formal and informal care to the parent. However, when the child takes the subsidy to the parent fully into account, he or she reduces working hours (compared to the short run situation) and contributes less formal care. Indeed, as we saw previously, no formal care at all is provided by the child in the long run. On the other hand, in response to the subsidy and to the lack of formal help from the child, the parent buys more formal care in the long run. On both accounts, the long run tax rate required to finance the subsidy has to rise relative to the short run rate, and this induces some substitution by the child from work to informal care. Informal care by the child stays about the same as in the short run if altruism is low, and rises in the long run relative to the short run with the degree of altruism.

[19] Of course if public goods are involved, budgetary incidence cannot be a proxy for welfare incidence either. See Aaron and McGuire (1970), Maital (1973), and Martinez-Vazquez (1982). Here we do not have a public good, just a price-subsidy for personal consumption.

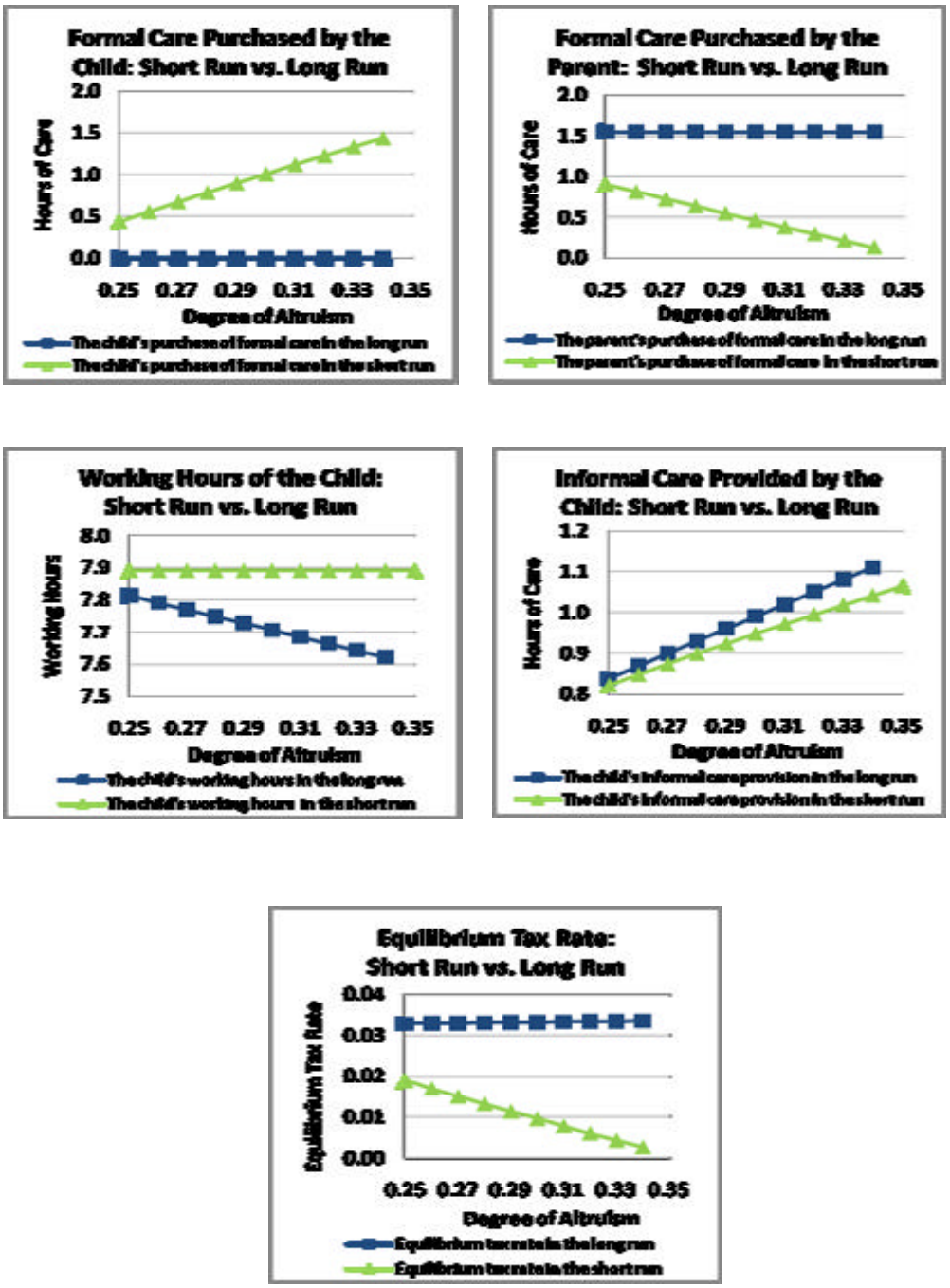

Figure 4: Behavioural Adjustments and the Tax Rate in the Short and Long Runs

The resulting shifting of net benefits in terms of budgetary measures is shown in Figure 5, where shifting is effectively measured by the vertical difference between short and long run incidence curves for a given degree of altruism.

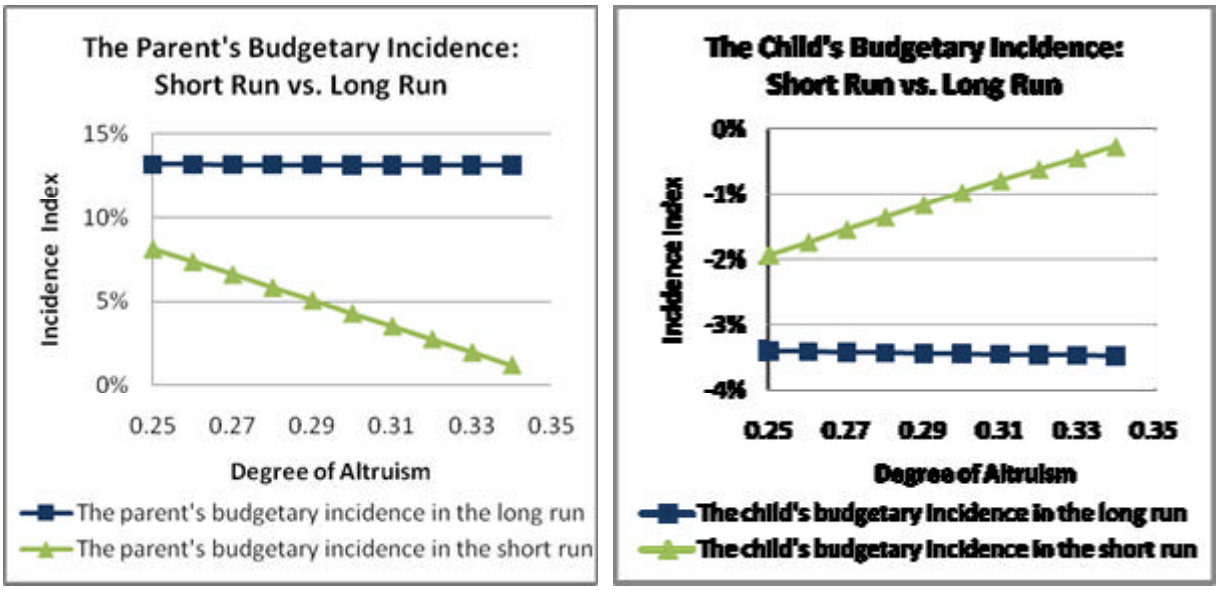

Figure 5: Shifting of Program Benefits Based on the Use of Budgetary Indexes

In the short run, we see a clear decreasing trend for the budgetary incidence of the parent and an increasing trend for that of the child's as degree of altruism increases. This is because, as degree of altruism increases, the child purchases more formal care, gradually substituting for the purchase of formal care by the parent (see Figure 4). Meanwhile, the child's working hours remain at a stable level. As a result, the parent receives less subsidy and the tax rate required to fund the subsidy drops, so that the overall fiscal situation of the child improves, and that of the parent's gradually worsens.

In the long run, the parent receives a larger subsidy as his purchase of formal care increases relative to the short run, and the parent's income, being fixed, is not negatively affected by the higher tax rate to the same extent as the child's. In contrast, the child works less than in the short run, and pays tax at a higher rate to finance the subsidy. The parent thus faces a better fiscal situation in the longer run than in the short run, and the child faces an opposite situation.

Therefore, in budgetary terms we clearly observe a shifting of benefits *from* the child *to* the parent (contrary to the ad hoc sharing rule discussed previously), in the sense that one party gains while the other loses.

Shifting using the welfare incidence indexes is quite different. We do not observe a shifting of benefits from the parent to the child in terms of welfare in Figure 6 where the short run and long run welfare indexes are shown. We see that *both* the generations are worse off in the longer run compared with the short run. This is the outcome of the behavioural adjustments in the family illustrated earlier and the fact that in welfare terms, a policy may make all parties worse off in the long run when compared to the short run, even though the policy is welfare improving relative to the counterfactual, no policy state (see the positive WFIs in the long run on Figure 6).

To be more specific, the subsidy for formal care increases the parent's consumption of formal care, but the tax used to finance the subsidy exerts a more profound effect on the time use decision of the

child (see the reducing working hours and increasing informal care hours in Figure 4). Even when the parent and child are able to adjust to the subsidy in long run, they fail to take the required tax rate fully into account because it is an ex-post outcome of non-cooperative behavioural adjustments.

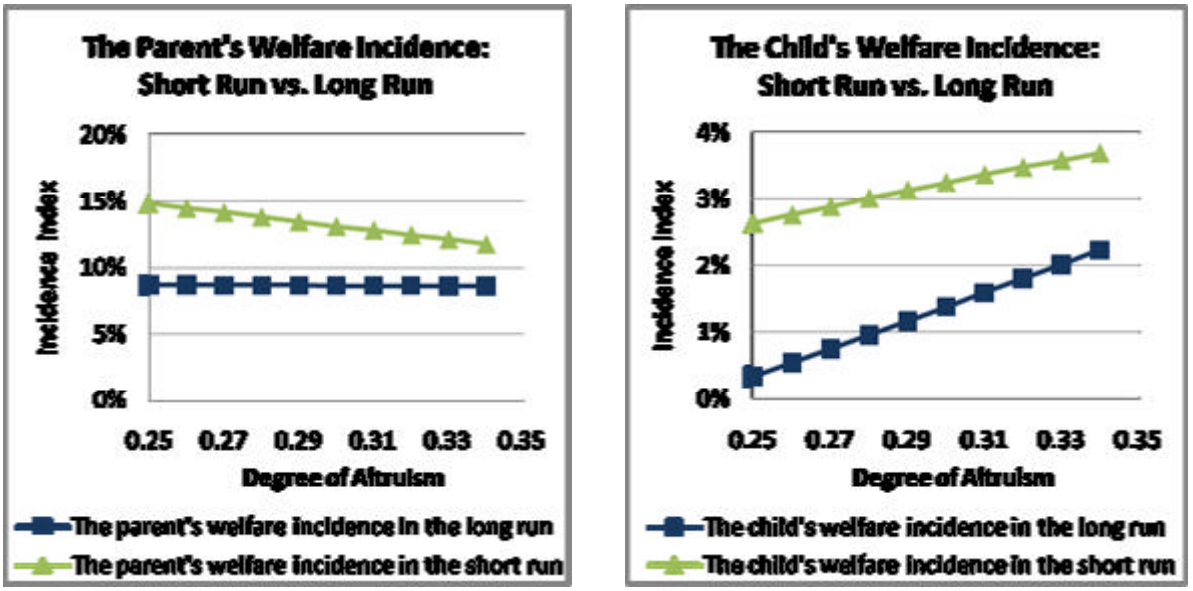

Figure 6: Shifting of Program Benefits based on the use of Welfare Indexes

The above simulation results depend on the data we use. In this sample family, the parent is relatively poor with an income of $12082 a year or about $33 per day. This may be due to the fact that the Medicaid subsidy covers only people with relatively low income. As a sensitivity test, we maintain the child's hourly wage rate at $19.56 per hour but set the parent's income equal to the average income of all the seniors included in the MEPS survey ($77.22 per day), and the average income of the richer group of seniors who are not eligible for Medicaid ($82.65 per day). Interested readers may check Figures A1 and A2 in the Appendix for the long run fiscal incidence in these two situations, where it is shown that the simulated pattern of incidence is not sensitive to the variation in income of the parent.

It may be that the hourly wage rate of the child relative to the price of formal care affects the type of care that the child will provide. In the above simulations, the wage rate of the child, $19.56 per hour, is higher than the price of formal care, $10.03 per hour. To check this matter, we vary the wage rate of the child from a low equal to the 10th percentile of the wage rates of the labor force to a high equal to the 90th percentile. The 10^{th} percentile wage rate of the work force in 2007 was $7.72 per hour, lower than the price of formal care. The 90^{th} percentile wage rate was $36.49 per hour, far above the price of formal care. Figures A3, A4, and A5 in the Appendix explore these two cases.

Comparing Figure A4 and A5 to Figure 3 illustrates the importance of higher wages for the child. In this case, substantially increasing the wage of the child does affect the simulation results, since at a high wage, the child purchases some formal care for the parent instead of providing no formal care. But budgetary and welfare indexes still diverge.

5. A cooperative family, and comparison of incidence indexes for both family types

Under different behavioural assumptions, the distribution of the benefits from an expenditure policy will also be different, just as alternative assumptions about model structure lead to alternative conclusions about the final burden of taxation. Assume, for example, that the family in question is cooperative instead of non–cooperative, so that the parent and the child jointly make a decision which benefits the family as an entity. How does this change in structure affect fiscal incidence indexes?

We can use a "collective model" to approximate the outcome of cooperative bargaining (Browning and Chiappori, 1998), and apply a generalized household welfare function based on Samuelson's idea that households can be modeled as if they maximized a social welfare function (Apps and Rees, 2007). Here we suppose that weights B and $(1-B)$, $0<B<1$, are put on the parent and the child respectively in the maximization of household welfare. Then the problem faced by the parent and the child when they act cooperatively is:

$$\underset{(x_p,\, x_c,\, m,\, h)}{Max}\ [BU_p+(1-B)U_c] = B\,[a\log(x_p) + b\log(m+s)+c\log(h)] +(1-B)\,[(1-d)\log(x_c) + d\log(l)]$$

subject to the joint budget constraint $y(1-t)+w(T-h-l)(1-t)= q(1-t_s)(m+s)+x_p+x_c$. (29)

As indicated by the joint budget constraint, the family pools their resources and jointly purchases formal care at the subsidized rate. Because the parent's purchase of formal care is cheaper than that of the child, the family will not let the child purchase any formal care, s.

When the family collectively makes choices, the family members adjust to the subsidy program simultaneously. Thus there is no meaningful difference between short and longer horizons based on the child's ability to incorporate the subsidy into their decision making, and thus there is no cross-generational shifting when the family acts as a unit. Thus the choice of family structure profoundly affects the analysis of shifting.

However, we can still calculate the budgetary and welfare incidence indexes for a cooperative family, assuming that calculation of separate benefits for each generation still makes sense in this context. [20] The difference between the indexes in a non-cooperative and in a collective family are complex because of the difference in the equilibrium tax rates, and it proves revealing to again explore these differences in simulations.

In the simulations, the parent's weight B and the child's weight $(1-B)$ in the family welfare function are defined as the ratio of the coefficient of his own utility to the total of the family, so that effectively $B = (1+r)/(2+r)$, and $1-B = 1/(2+r)$. [21] We do this because we want to study the role of the degree of altruism in a way that allows comparison to the indexes in the other non-cooperative situations. [22]

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[20] See the Appendix for detailed calculations.

[21] When $r = 0$, B is effectively 1/2. B is always equal to or higher than a half because of the presence of the child's altruism.

[22] The weights of individual utility in Browning and Chiaporri 's (1998) collective model depend on individual wage rates and total household income. Pollak (2007) suggests that bargaining power in a family depends on three components: exogenous non-labour income, wage rates or earnings, and productivity in household production. Here,

Figure 7 shows that with these weights and as the degree of altruism increases, budgetary and welfare fiscal incidences show a similar trend for both the generations in a cooperative family. In section 4.1 we illustrated the role of altruism in the divergence between welfare and budgetary incidence indexes in a non-cooperative family. Here, because of the cooperative nature of the family, the budgetary account for a cooperative family reflects the behavioural adjustments of *all* family members more fully than in the non-cooperative case and especially for the child (compared with Figure 3). Nevertheless, welfare and budgetary incidences are still different due to the nature of the two metrics in treating adjustments in consumption patterns.

It should be noted that the large positive index for the parent stems from the fact that incidence for the parent is expressed relative to income of the parent even though family resources are pooled in the cooperative case.

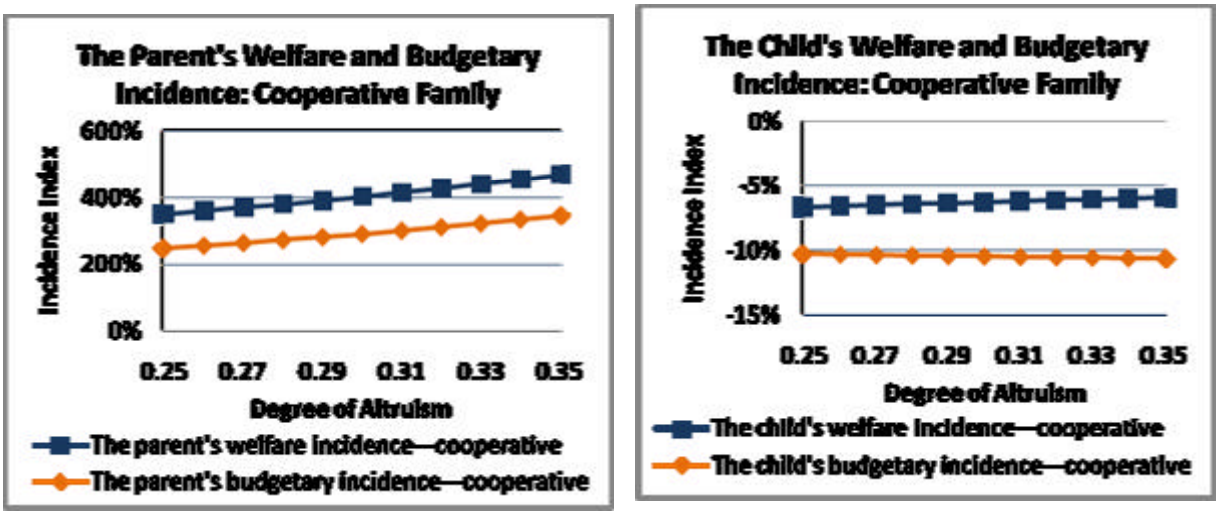

Figure 7: Welfare and Budgetary Fiscal Incidence in a Cooperative Family

Finally, we directly compare the effects of family structure on the welfare based incidence indexes. The simulations here reflect the conflict of interest between the parent and the child on the issue of living arrangements for the elderly under alternative views of the family. Figure 8 illustrates.

We see that the parent is better off when the family is cooperative rather than non-cooperative and, in contrast, the child is worse off. The reason is that a higher weight of the parent in a cooperative family, $(1+r)/(2+r)$ versus $r/(1+r)$ in the non-cooperative family, induces a greater provision of both informal care and formal care for the parent and less leisure time for the child. This result is consistent with observation on co-habiting intergenerational families where the parent usually receives more care while the child often suffers from stress or burn-out (George and Gwyther 1986, Hoyert and Seltzer 1992, Campbell and Martin-Matthews 2000, and Pezzin et al. 2007).

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we assume the weights depend on only altruism, in order to focus on the issue of intergenerational distribution of benefits.

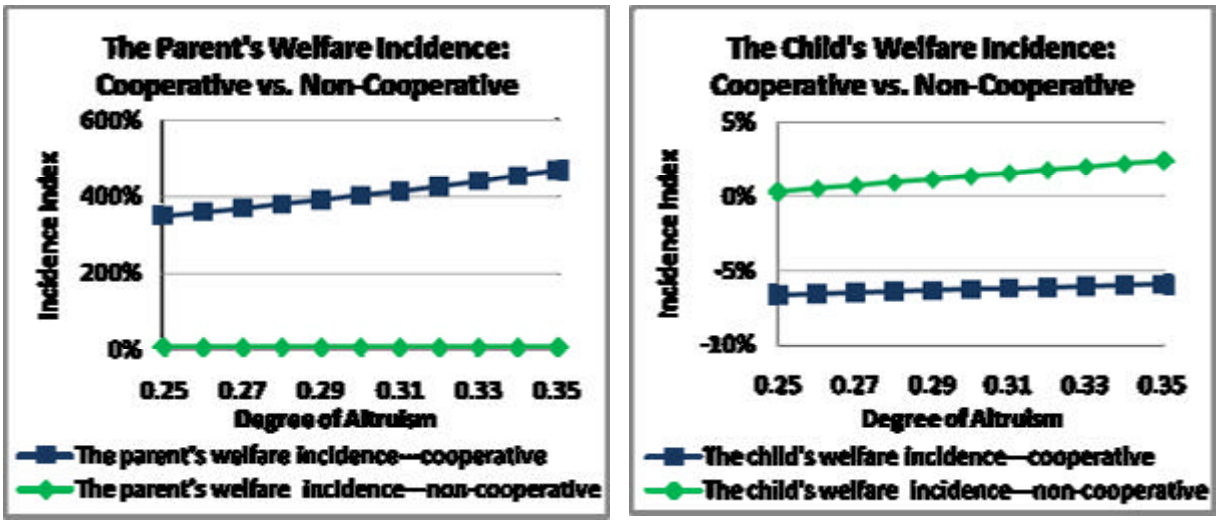

Figure 8: Welfare Fiscal Incidence and Family Structure

6. Concluding remarks

How should we construct incidence indexes for children and parents in the case of public subsidies for home-care of the elderly? What is the nature of a fiscal incidence index on a budgetary basis versus a theoretically more satisfactory index that is welfare-based? Can we find budgetary based measures that will serve as a proxy for incidence in welfare terms? Does the structure of the family including the altruism of children affect incidence indexes? How should shifting of the subsidy for home care paid to the parents be defined, in budgetary or in welfare terms, and what does simulation tell us about the likely long run distribution of benefits between the generations?

We have addressed these questions in this paper. We have constructed both budgetary and welfare–based incidence indexes appropriate for measuring the incidence, on children and parents, of a price-subsidy to the parents for the purchase of home-care, and we have investigated the roles of altruism and family structure in this context both analytically and with simulation in a manner analogous to studies that explore the role of assumptions about economic structure in determining tax-shifting. We began with a behavioral model of a non-cooperative family in which the child is altruistic towards his or her parent, and then explicitly followed our summary of the key analytical steps required of any incidence study. The existing literature is enormously diverse, and we hope that this procedure will be useful in aiding those who wish to pursue analytical or empirical incidence work.

We have shown that the nature of incidence indexes of either type depends crucially on whether the family is non-cooperative or cooperative. Shifting of benefits between the generations, for example, makes sense only if the family is non-cooperative - that is, in the case considered here, when parents and children do not always agree on the amount of time that the children will personally devote to home-care. And in that case, the simulations with budgetary incidence indexes we have conducted show that shifting in the long run tends to benefit the parents, not the children.

In general, and except for very special circumstances that apply to only the children, or only the parents, budgetary incidence is not an accurate measure of the level of incidence based on measuring

equivalent variations in welfare. Budgetary and welfare fiscal incidences are different because of the welfare consequences of the consumption responses by the parents and children, and because of interaction stemming from altruism by family members.

We can say that both the basic nature of the family and the degree of altruism of children have been shown to be key factors underlying the incidence of a program in which family structure is critical. More definitive analysis of the family-oriented policy we consider depends on the development of a theoretical consensus on how to treat these basic issues, as well as about key values of parameters used in simulations. In the absence of progress on these matters, incidence analysis based on budgetary amounts should be regarded as a poor predictor of the distribution of benefits from a program that works through family structure.

The analysis in this paper also conveys a more general message for the study of net fiscal incidence: to incorporate the expenditure side of the budget into incidence calculations, a separate analysis for each major type of public service will have to be developed. Such work will parallel the development of tax incidence theory, which has been built up over time on the basis of study of each of the major types of taxes. This paper is an initial contribution to this body of work for the class of public expenditure programs that depend importantly on family structure. Much remains to be done before net incidence analysis of expenditure programs attains the status achieved by the incidence analysis of taxation.

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Appendix

1. The post-fisc solutions to the non-cooperative family game in the long run

The parent's problem is:

Max $U(x_p, m, h) = a\ log(x_p) + b\ log(m) + clog(h)$, Subject to $y(1-t) = x_p + q(1-t_s)m$.
(m)

The child's problem is:

Max $U(x_c, l, x_p, m, h, s) = [(1-d)\ log(x_c) + d\ log(l)] + rU_p(x_p, m, s, h)$, Subject to $w(T-h-l)(1-t) = x_c + qm$.
(l, h, s)

The post-fisc solutions to the non-cooperative family, in the long run when the child fully incorporates the receipt of a subsidy by his parent include:

$$m^{LR} = \frac{y(1-t^{LR})}{q(1-t_s)} - \frac{ra[wT + \frac{y}{(1-t_s)}](1-t^{LR})}{(1+r)q}$$

$$s^{LR} = \frac{r(a+b)[wT + \frac{y}{(1-t_s)}](1-t^{LR})}{(1+r)q} - \frac{y(1-t^{LR})}{q(1-t_s)}$$

$$H^{LR} = \frac{rb[wT + \frac{y}{(1-t_s)}](1-t^{LR})}{(1+r)q}$$

$$l^{LR} = \frac{d[wT + \frac{y}{(1-t_s)}]}{(1+r)w},\ h^{LR} = \frac{rc[wT + \frac{y}{(1-t_s)}]}{(1+r)w},\ L^{LR} = T - h - l = T - \frac{(d+rc)[wT + \frac{y}{(1-t_s)}]}{(1+r)w},$$

$$x_c^{LR} = \frac{(1-d)[wT + \frac{y}{(1-t_s)}](1-t^{LR})}{(1+r)},$$

$$x_p^{LR} = \frac{ra[wT + \frac{y}{(1-t_s)}](1-t^{LR})(1-t_s)}{(1+r)}$$

The equilibrium tax rate in the long run for the non-cooperative family is solved using $t(Y_p + Y_c^{pre}) = t_s qm$, so that

$$t^{LR} = \frac{\frac{y}{(1-t_s)} - \frac{ra}{(1+r)}[wT + \frac{y}{(1-t_s)}]}{\frac{y}{(1-t_s)} - \frac{ra[wT + y/(1-t_s)]}{(1+r)} + \frac{(1+r-d-rc)(y+wT)}{t_s(1+r)}}.$$

2. Budgetary and welfare based incidence indexes for the non-cooperative family in the short run

In the short run, the child's choice of *s*, *h*, *l*, and *L* are fixed at the level as if $t_s=0$. Either the child does not know that the subsidy exists, or cannot adjust to its presence in the short run.

The parent's problem is:

Max $U(x_p, m, h) = a\ log(x_p) + b\ log(m+s) + clog(h)$, Subject to $y(1-t) = x_p+q(1-t_s)m$.
(m)

The child's problem is:

Max $U(x_c, l, x_p, m, h, s) = [(1-d)\ log(x_c) + d\ log(l)] + rU_p(x_p, m, s, h)$, Subject to $w(T- h-l)(1-t)=x_c+qs$.
(l, h, s)

First, the child's choice of *l*, *h*, and *s* are as if $t_s=0$ and $t=0$:

$$s^{SR} = \frac{r(1-c)[wT+y]-(1+r)y}{(1+r)q}$$

$$h^{SR} = \frac{rc(wT+y)}{(1+r)w}, \quad l^{SR} = \frac{d(wT+y)}{(1+r)w}$$

$$L^{SR} = T - h^{SR} - l^{SR} = \frac{(1+r)wT-(d+rc)(wT+y)}{(1+r)w}.$$

The child's income and private consumption are subject to the income tax determined later in the equilibrium:

$$Y_c = \frac{(1+r)wT-(d+rc)(wT+y)}{(1+r)}$$

$$Y_c^{post} = \frac{(1+r)wT(1-t^{SR})-(d+rc)(wT+y)(1-t^{SR})}{(1+r)}$$

$$x_c = Y_c^{post} - qs = \frac{(1+r)[wT(1-t^{SR})+y]-(d+rc)(wT+y)(1-t^{SR})-r(1-c)(wT+y)}{(1+r)}.$$

Second, given the child's choice of *s* and *h*, and the policy parameters t_s and *t*, the parent chooses *m*. The total formal care *H*, and the private consumption of the parent, x_p, are also solved:

$$m^{SR} = \frac{\frac{by(1-t^{SR})}{(1-t_s)} - ra(1-c)wT + a(1+rc)y}{(1+r)(1-c)q}$$

$$H^{SR} = m^{SR} + s^{SR} = \frac{\frac{by(1-t^{SR})}{(1-t_s)} + rb(1-c)wT - b(1+rc)y}{(1+r)(1-c)q}$$

$$x_p^{SR} = \frac{[a+r(1-c)]y(1-t^{SR}) + ra(1-c)wT(1-t_s) - a(1+rc)y(1-t_s)}{(1+r)(1-c)}.$$

The tax required to finance the subsidy is determined by government budget $t\,(Y_p + Y_c) = t_s qm$:

$$t^{SR} = \frac{\frac{byt_s}{(1-t_s)} - ra(1-c)wTt_s + a(1+rc)yt_s}{\frac{byt_s}{(1-t_s)} + (1+r-d-rc)(1-c)(wT+y)}.$$

The indirect utilities of the parent and the child in the presence of the subsidy in the short run, where the subsidy is actually in place and not fully adjusted to, V_p and V_c, are:

$$V_p = a\log[\frac{(a+r-rc)(1-t^{SR})y + ra(1-c)wT(1-t_s) - a(1+rc)(1-t_s)y}{(1+r)(1-c)}] + b\log[\frac{\frac{by(1-t^{SR})}{(1-t_s)} + rb(1-c)wT - b(1+rc)y}{(1+r)(1-c)q}] + c\log[\frac{rc(wT+y)}{(1+r)w}]$$

and

$$V_c = (1-d)\log\{\frac{[(1+r-d-rc)(1-t^{SR}) - r(1-c)]wT + [1+rc-(d+rc)(1-t)]y}{(1+r)}\} + d\log[\frac{d(wT+y)}{(1+r)w}] + rV_p.$$

The EV for the parent can be solved using $V_p^0[q(1-t_s),\ Y_p(1-t) - EV_p] = V_p^1[q,\ Y_p(1-t) + R_p]$. And similarly, the child's' EV from the subsidy is solved using $V_c^0[q(1-t_s),\ Y_c(1-t) - EV_c] = V_c^1[q,\ Y_c(1-t) + R_c]$.

The budgetary fiscal incidences for the family in the short run are therefore:

$$BFI_p^{SR} = \frac{NB_p}{Y_p^{post-fisc}} = \frac{t_s qm^{SR} - t^{SR} y}{Y_p^{post-fisc}},$$

where $Y_p^{post\text{-}fisc} = y_p\,(1-t^{SR}) + t_s qm^{SR}$, and

$$BFI_c^{SR} = \frac{NB_c}{Y_c^{post-fisc}} = \frac{-t^{SR} Y_c}{Y_c^{post-fisc}}.$$

The welfare incidence index in the short run is:

$$WFI_p^{SR} = \frac{EV_p}{Y_p^{post-fisc}}$$

and

$$WFI_c^{SR} = \frac{EV_c}{Y_c^{post-fisc}}.$$

The incidence in the short and longer run show that shifting depends importantly on the income of the parent, y, the potential and actual gross income of the child, wT and Y_c, the degree of altruism, r, the parent's taste coefficients, and the policy parameters, t^{LR}, t^{SR} and t_s.

An alternative scenario (not implemented in the paper)

An alternative short-run scenario is one in which the child does not take the subsidy into account, but does respond to the consumption pattern of the parent. The post-fisc solutions to the non-cooperative family, in the short run, when the child cannot fully incorporate the receipt of a subsidy by his parent include:

$$s^{SR} = \frac{wT(1-t^{SR})}{q} - \frac{(1+rc)(wT+y)(1-t^{SR})}{(1+r)q}$$

$$m^{SR} = \frac{by(1-t^{SR})}{(a+b)q(1-t_s)} - \frac{\text{as}^{\text{SR}}}{(\text{a}+\text{b})} = \frac{by(1-t^{SR})}{(a+b)q(1-t_s)} - \frac{a}{(a+b)}\frac{wT(1-t^{SR})}{q} + \frac{a}{(a+b)}\frac{(1+rc)(wT+y)(1-t^{SR})}{(1+r)q}$$

$$H^{SR} = m^{LR} + s^{LR} = \frac{b[wT + \frac{y}{(1-t_s)}](1-t^{SR})}{(1-c)q} - \frac{b(1+rc)(wT+y)(1-t^{SR})}{(1+r)(1-c)q}$$

$$h^{SR} = \frac{rc(wT+y)}{(1+r)w},\ l^{SR} = \frac{d(wT+y)}{(1+r)w},\ L^{SR} = T^{SR} - h^{SR} - l^{SR} = T - \frac{(d+rc)(wT+y)}{(1+r)w}.$$

The equilibrium tax rate for the non-cooperative family in the short run is solved using the government budget $t(Y_p + Y_c^{pre}) = t_s qm$:

$$\text{t}^{\text{SR}} = \frac{\frac{b(1+r)y}{(1-c)}\frac{\text{t}_\text{s}}{(1-t_s)} - \frac{a}{(1-c)}(1+r)wTt_s + \frac{a}{(1-c)}(1+rc)(wT+y)t_s}{(1+\text{r}-\text{d}-\text{rc})(\text{wT}+\text{y}) + [\frac{b(1+r)y}{(1-c)}\frac{\text{t}_\text{s}}{(1-t_s)} - \frac{a}{(1-c)}(1+r)wTt_s + \frac{a}{(1-c)}(1+rc)(wT+y)t_s]}.$$

The budgetary fiscal incidences for the family in the short run are therefore:

$$BFI_p^{SR} = \frac{NB_p}{Y_p} = \frac{t_s qm^{SR} - t^{\text{SR}} y}{Y_p^{post-fisc}},$$

where, $Y_p^{post\text{-}fisc} = y_p(1\text{-}t^{\boldsymbol{SR}}) + t_s qm^{\boldsymbol{SR}}$, and

$$BFI_c^{SR} = \frac{NB_c}{Y_c} = \frac{-t^{SR} Y_c}{Y_c^{post-fisc}},$$

where $Y_c = wT - (rc+d)(wT+y)/(1+r)$, and $Y_c^{post\text{-}fisc} = wT(1\text{-}t^{SR}) - (1\text{-}t^{SR})(rc+d)(wT+y)/(1+r)$.

The welfare incidence index in the short run scenario B is:

$$WFI_p^{SR} = \frac{[y(1-t^{SR}) + q(1-t_s)s^{SR}] - (1-t_s)^{b/(a+b)}[y + qs^{SR}]}{Y_p^{post-fisc}}$$

and

$$WFI_c^{SR} = \frac{(wT+y)(1-t^{SR}) - (1-t_s)^{rb} \times \{\frac{[y(1-t^{SR}) + qs^{SR}]}{[y(1-t^{SR}) + q(1-t_s)s^{SR}]}\}^{r(a+b)} \times [(wT+y)(1-t^{SR}) + t^{SR}Y_c]}{Y_c^{post-fisc}}.$$

3. Differences between BFI and WFI over long and short horizons for a non-cooperative family

The differences between BFI and WFI in the long run for a non-cooperative family are:

$$BFI_p^{LR} - WFI_p^{LR} = \frac{t_s qm^{LR} \times m^{LR}/(m^{LR}+s^{LR}) - t^{LR} y - [wT(1-t^{LR})(1-t_s) + y(1-t^{LR})] + (1-t_s)^{(b+c)}[wT(1-t^{LR}) + y(1-t^{LR}) + t^{LR} y]}{Y_p^{post-fisc}}$$

and

$$BFI_c^{LR} - WFI_c^{LR} = \frac{t_s qm^{LR} \times s^{LR}/(m^{LR}+s^{LR}) - t^{LR} Y_c - [wT(1-t^{LR}) + y(1-t^{LR})/(1-t_s)] + (1-t_s)^{[-ra/(1+r)]}[wT(1-t^{LR}) + tY_c + y(1-t^{LR})]}{Y_c^{post-fisc}}$$

The differences between WFI and BFI in the short run for a non-cooperative family using scenario A are too complicated and are explored using simulation only.

4. Fiscal incidence in a cooperative family

The problem faced by the cooperative family is:

Max $[BU_p + (1-B)U_c] = B[a\log(x_p) + b\log(m+s) + c\log(h)] + (1-B)[(1-d)\log(x_c) + d\log(l)]$
(m, s, h, l)

subject to the joint budget constraint $y(1-t) + w(T-h-l)(1-t) = q(1-t_s)(m+s) + x_p + x_c$.

The solutions to the cooperative game (C) include:

$$H^C = m^C + s^C = \frac{Bb(wT+y)(1-t^C)}{q(1-t_s)}$$

$$h^C = \frac{Bc(wT+y)}{w},\ l^C = \frac{(1-B)d(wT+y)}{w},\ L^C = T - h - l = T - \frac{[Bc+(1-B)d](wT+y)}{w},$$

$$x_c^C = (1-B)(1-d)(wT+y)(1-t^C),$$

$$x_p^C = Ba(wT+y)(1-t^C).$$

The equilibrium tax rate in the long run for the cooperative family is defined by the government budget,
$t(Y_p + Y_c^{pre}) = t_s qm$:

$$t^{LR} = \frac{\frac{Bbt_s}{(1-t_s)}}{\frac{Bbt_s}{(1-t_s)} + 1 - Bc - (1-B)d}$$

Following the steps outlined in the text, we then have the following budgetary incidence indexes for a cooperative family, assuming that calculation of separate benefits for each generation still makes sense in this context. The BFI over both horizons are[23]:

$$BFI_p^C = \frac{t_s qH^C - t^C y}{Y_p^{post-fisc}},$$

$$BFI_c^C = \frac{-t^C Y_c^C}{Y_c^{post-fisc}}.$$

In contrast, using welfare as a metric we have:

$$WFI_p^C = \frac{[wT(1-t^C) + y(1-t^C)] - (1-t_s)^b [wT(1-t^C) + y(1-t^C) + t^C y]}{Y_p^{post-fisc}},$$

and

$$WFI_c^C = \frac{[wT(1-t^C) + y(1-t^C)] - (1-t_s)^{[rb/(1+r)]} [wT(1-t^C) + +t^C Y_c^C + y(1-t^C)]}{Y_c^{post-fisc}},$$

where

$Y_p^{post\text{-}fisc} = y\,(1\text{-}t^C) + t_s q m^C$,
$Y_c^C = wT\text{-}[Bc+(1\text{-}B)d](wT+y)$, *and*
$Y_c^{post\text{-}fisc} = Y_c^C(1\text{-}t^C)$.

5. Sensitivity tests underlying simulations

5.1 Simulation results when the income of the parent varies

Figures A1 and A2 below are to be compared with Figure 3 in the text. They imply that the fiscal incidence indexes are not sensitive to the income of the parent. Further simulations show that the incidence in the short and longer run are the same in these two cases because over both horizons, the child does not purchase any formal care and there is no direct interaction between the parent and the child. There is thus no shifting in budgetary or welfare terms when the parent's income is assumed to be much higher than is reported in the text.

[23] Altruism and shifting do not matter in a cooperative family.

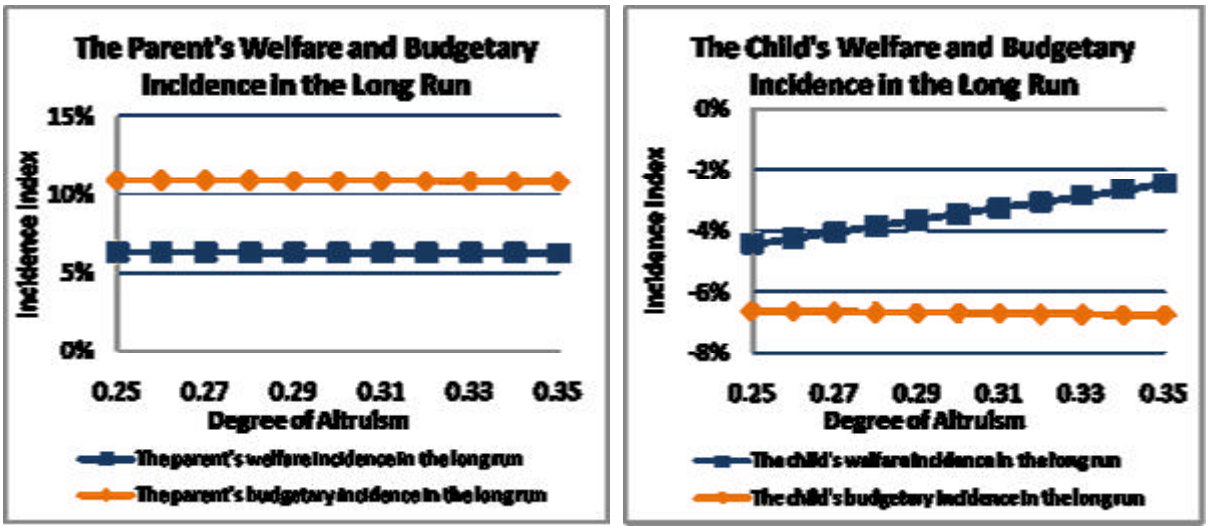


Figure A1: Welfare vs. Budgetary Fiscal Incidence in the Long Run and Short Run When the Parent's Income y = \$77.22 per day (versus \$33.10 in the text)

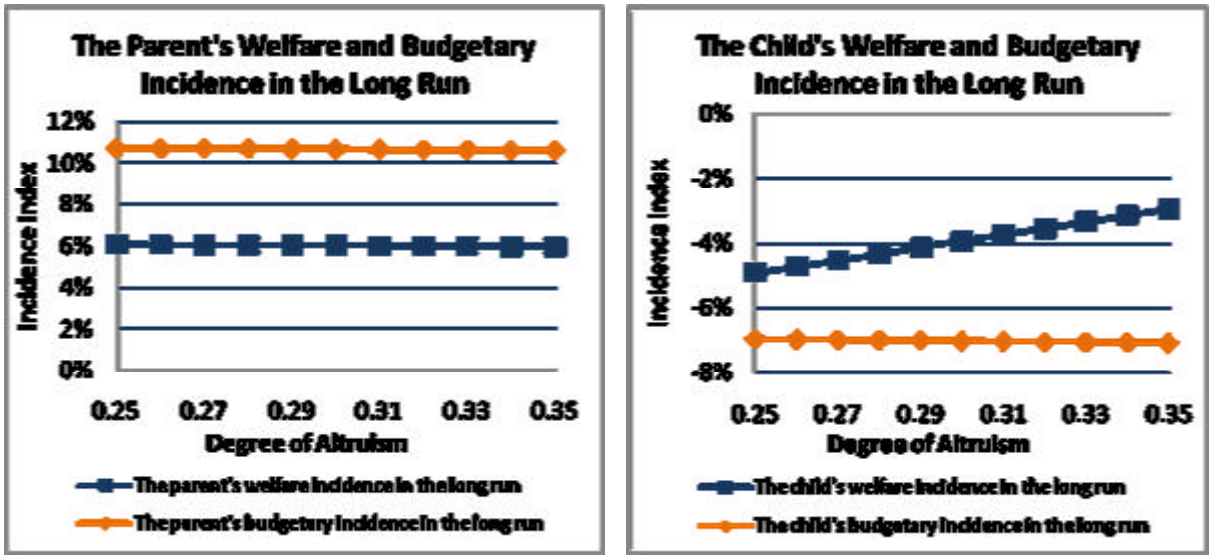


Figure A2: Welfare vs. Budgetary Fiscal Incidence in the Long Run and Short Run When y = \$82.65 per day (versus \$33.10 in the text)

5.2 The simulation results when the wage rate of the child varies

Figure A3 below shows that when the child earns \$7.72 per hour, the incidence indexes are similar with those when the child makes \$19.56 an hour. In this case, the hourly wage rate of the child is lower than the price of formal care. As a result, the child provides informal care to the parent, but does not purchase any formal care in the short and longer runs. There then is no direct substitution between the formal care purchased by the child and by the parent, and there is no shifting between short and longer run.

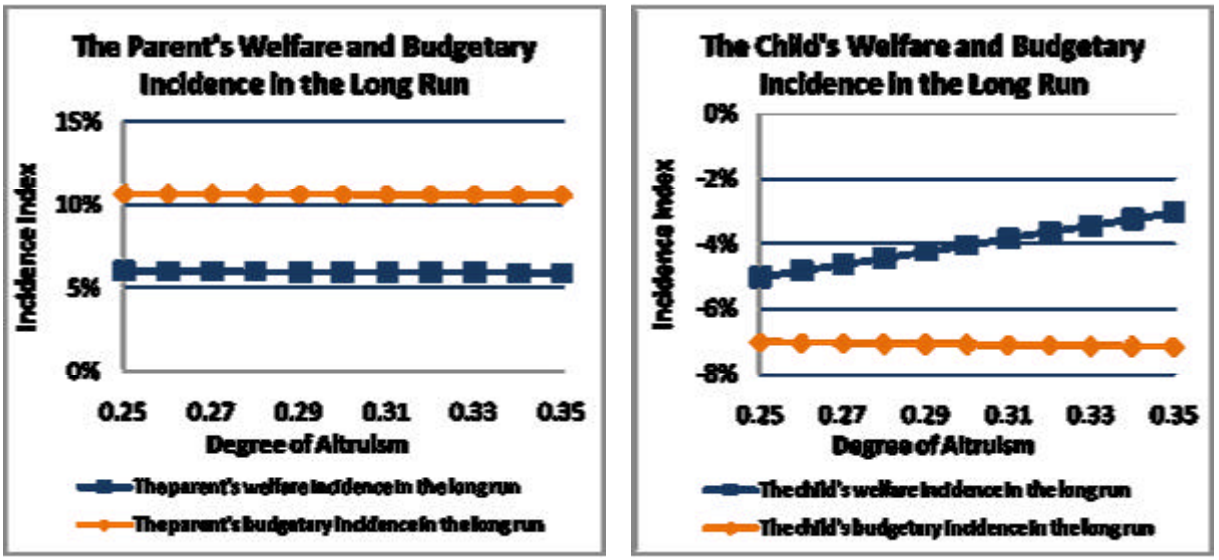


Figure A3: Welfare vs. Budgetary Fiscal Incidence in the Long Run and Short Run When the Child's Wage *w* = $7.72 (versus $19.56 in the text)

When the child's income is much higher at $36.49 per hour, he purchases formal care in addition to providing informal care. Figure A4 shows that the distribution between welfare and budgetary incidence is different from that in Figure 3 when the child's income is at the average level.[24] The child's budgetary incidence is now higher than his welfare incidence, partly due to the fact that the child substitutes his own private purchase of formal care for the formal care purchased by the parent, so the tax rate gradually falls and the child's public budgetary situation improves.

[24] The simulation ends when degree of altruism reaches 0.28, instead of 0.35 as in previous simulations, because when degree of altruism is higher than 0.28, the purchase of formal care by the parent becomes negative.

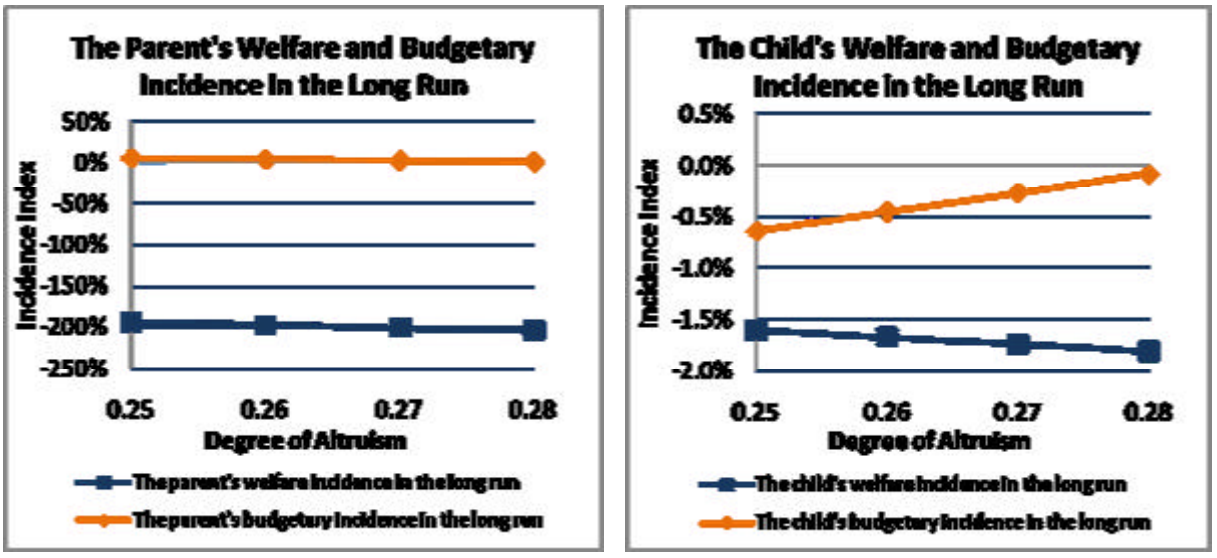


Figure A4: Welfare vs. Budgetary Fiscal Incidence in the Long Run When *w* = $36.49 (versus $19.56 in the text)

Figure A5, corresponding to the simulations reported in Figure A4, shows a similar pattern of shifting as that depicted in Figure 6 and Figure 7. Shifting from the child to the parent in budgetary terms occurs. But no shifting of this sort in welfare terms occurs, since both the parent and the child are again worse off in the longer run relative to in the short run.

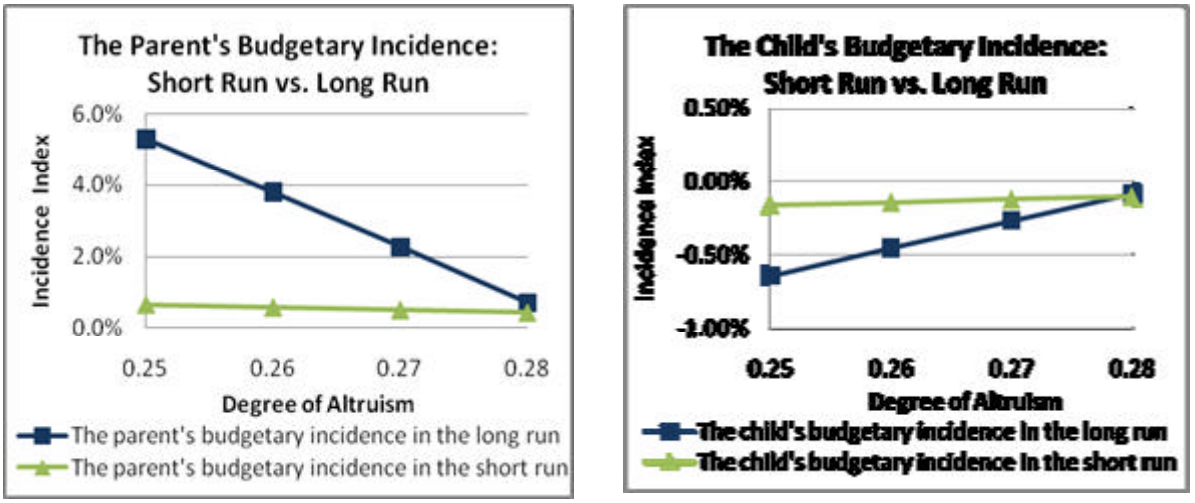
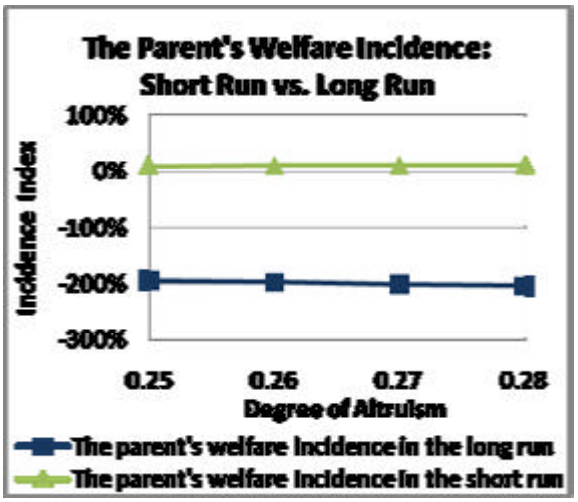


Figure A5: Fiscal Incidence and Shifting in the Short and Long Run When *w* = $36.49



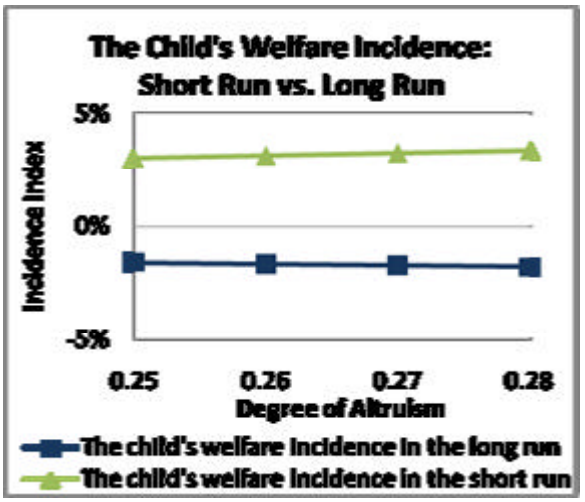


Figure A5, comtinued.