INCOME DISTRIBUTION EFFECTS OF GOVERNMENT TRANSFERS: SENSITIVITY TO CLOSURE RULES IN INPUT-OUTPUT AND COMPUTABLE GENERAL EQUILIBRIUM APPROACHES

by

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I. INTRODUCTION

It has long been acknowledged that the distributional impacts of public policies extend beyond those directly affected. However, it has not been until the last two decades that operational models have been available to perform analyses of indirect or general equilibrium effects. Moreover, these models have been subject to much criticism.

One straightforward approach to capturing economic interdependencies associated with income distribution impacts is the category of extended input-output models (see, e.g., Golladay and Haveman, 1977; Ghosh and Sengupta, 1984; Rose et al., 1988; Batey and Rose, 1990). Even more facile are the several types of Miyazawa income distribution multipliers (see, e.g., Miyazawa, 1976; Rose and Beaumont, 1988; Bernat and Johnson, 1991; Rose and Li, 1998). However, critics are quick to point out the inherent limitations of these two related techniques, including linearity, absence of constraints, and omission of factor and product pricing considerations.

Another approach is to use computable general equilibrium models with special distributional features (see, e.g., Ballard et al., 1985; Wiese et al., 1995; Hanson and Rose, 1997). CGE models are able to overcome the limitations of I-O, but the determinants of results are not readily transparent and are thus often criticized for their "black box" impression. One general advantage of the CGE approach is the explicit inclusion of constraints, the most pertinent to this paper being "closure rules" for government spending (in this case fiscal balances of government itself or including some interaction with the rest of the economy). The problem is that results may be highly sensitive to the type of closure rule used.

The purpose of this paper is to examine the relative merits of these two approaches to distributional impact analysis, specifically with reference to closure rules. Utilizing an extended I-O model and a CGE model, both containing a set of detailed, income disaggregated household accounts, we simulate the distributional impacts of government transfers under four sets of closure rules. To our knowledge, this is the first time such closure rules have been utilized in I-O analysis, the first evaluation of the sensitivity of distributional impacts to government closure rules in CGE analysis, and the first comparison of closure rules in these two modeling approaches.[1]

II. CLOSURE RULES

The conventional approach to I-O impact analysis of government expenditures, or most other types of spending changes, is to multiply the vector of changes by the Leontief inverse or a set of multipliers. If the initial perturbation is positive, so too will be the indirect (and induced) impacts. There is typically no consideration of the fact that the increased spending will either require a tax increase or raise the deficit, both having typically negative ramifications for the rest of the economy.[2]

Borrowing some terminology from CGE analysis, we can consider this to be a matter of a *closure rule*, which refers to a balancing of major accounts.[3] In an I-O context, such constraints are not required, and hence a pure expansionary outcome is possible, and in fact predestined by conventional applications. However, we wish to consider possibilities where realistic constraints are binding, and thus will utilize the closure rules presented in Table 1 to perform our simulations. Closure Rule 1 (CR-1) is merely a base case (or reference point), and is not applicable for CGE simulations, which do require accounts to balance.

Our model closure calls for government transfer payments to households being financed by a reduction of the funds available for some other activity in the economy, rather than being an autonomous creation of income and new economic activity. Alternative sources of income to finance the government transfers distinguish the alternative model closures (see again Table 1). One closure rule (CR-2) reduces government expenditures on goods and services such that the government deficit remains fixed (we assume the spending cutback is representative of the existing government spending mix). Another closure rule increases taxes to pay for the government transfers (CR-3), leaving the government deficit unchanged (we assume the tax increase is at the same level of progressivity across income brackets as the existing personal income tax). A final closure rule increases the government

Table 1

deficit (CR-4), which crowds out savings available for fixed private investment (we assume the investment reduction follows the current investment mix, or proportions).

III. THE EFFECT OF GOVERNMENT TRANSFERS ON INCOME INEQUALITY

In recent years several researchers have analyzed the constancy of the U.S. size distribution of personal income both before (gross) and after (net) government tax and transfers. The Gini coefficient measure of inequality for gross income distribution in 1977 was .419 as compared to .418 in 1947, with little fluctuation in between (U.S. Bureau of the Census, 1984).[4] Even net income distribution showed little trend (Rivlin, 1975). Since that time Gini coefficients for both measures improved in the late 1970s and then worsened throughout most of the 1980s (Levy and Murnane, 1992; Gottschalk and Smeeding, 1997).

This general constancy of the income distribution is at first surprising in light of the many changes that have taken place in the U.S. economy over the past half century. In fact, Blinder (1980) characterized the situation as one in which "The more things change, the more they stay the same." He points out that although the aggregate level of income and the average standard of living rose dramatically in the U.S. during the post-war period, it was difficult to detect any marked improvement in income distribution as measured in conventional terms. Reynolds and Smolensky (1978) detailed the growing size of government additions and subtractions to personal income and reached similar conclusions on a net basis, despite the fact that government revenue gathering and expenditures, at least at the federal level, are intended to be progressive.

There is some agreement over that what has taken place has been a confluence or offsetting of determinants of the overall distribution. Generally, demographic factors (e.g., the maturing of the age distribution of the population, and increase in unrelated individuals establishing household) have nudged the distribution in the direction of great inequality. Government sector involvement, at least on the surface, (primarily cash transfers and, to a lesser extent, income taxation) has pushed the distribution in the direction of equality.

Especially troubling to some has been the ineffectiveness of government in improving the distribution of income in the longer run. Rivlin (1975) and others have pointed to one of the major difficulties being that government transfers simply smooth out the life cycle of income, but have little positive impact on earning capacity. In other words, they may simply treat the symptom but not the underlying cause of the problem (see, e.g., Danziger, 1991). Reynolds and Smolensky (1978) point to the diminishing returns in government's ability to affect the distribution due to the tendency to extend transfers into the middle income brackets and also point more generally to greater competition among interest groups as the stakes get higher.

Several attempts have been made to quantify the distributional impacts of federal transfer payments. A survey by Danziger et al. (1981) indicates that the effect of cash transfers, for example, on the immediate Gini coefficient measure of inequality ranges from a 9.8 percent reduction to a 20.0 percent reduction depending on the year and data source cited. Still, nearly all of the studies thus far have examined the issue in a partial equilibrium context, and have thus failed to determine whether general equilibrium considerations undercut progress toward equality.

IV. I-O ANALYSIS OF GOVERNMENT TRANSFER

Previous analyses of the impacts of transfers are, upon reflection, incomplete because of their partial equilibrium nature. The studies cited first present the baseline distribution of income and its corresponding Gini coefficient. Then they typically assign transfers to income groups and calculate the Gini coefficient for the combination of baseline income plus transfer, thus taking the effect of transfers as simply additive. A moment's reflection and one quickly realizes this approach violates a first principle of I-O analysis -- transfers have their own multiplier effects. In fact, baseline income and transfers used in these studies are not independent; the baseline income actually includes some of these multiplier effects![5] The situation is analogous for CGE analyses.

A proper analysis would begin by calculating the second-order effects of transfers, subtracting them from the baseline, and recalculating the initial Gini. The effects of transfers could then be ascertained in terms of their pure direct effects and multiplier or general equilibrium effects separately or together. The effects would be measured in relation to the revised baseline Gini. Miyazawa *interrelational multipliers* (see, e.g., Miyazawa, 1976; Rose and Li, 1998) give us a clue as to the outcome -- they indicate that second-order effects of income changes, in general, and transfers to low income groups, in particular, are skewed toward upper income groups and hence undercut the equalizing effect of the transfers.[6]

An extended I-O model was used to calculate the distributional impact of government transfers in the U.S. economy in 1987 (see Rose et al., 1994). Results for CR-1, the pure government expansion case (see Table 1) are presented in Table 2. The first column of the table presents the typical baseline distribution of pre-tax/transfer income for the U.S. in 1987 in terms of Adjusted Gross Income (AGI). The sum of federal cash transfers is distributed across income groups in column 2.[7] The indirect and induced effects of the transfers, calculated by multiplying the entries in column 2 by the Leontief inverse, is presented in column 3. Total transfer effects are presented in column 4. Column 3 is then subtracted from column 1 to arrive at an adjusted pre-transfer baseline, which is entered in column 5. Total income plus direct transfers is presented in column 6.

Some of our a priori expectations are borne out. Indirect effects of federal cash transfers amount to $419.2 billion, and are almost as large as direct effects (see column 3a of Table 2). Moreover, these second-order impacts are much less evenly distributed than the direct impacts (compare Gini coefficients of .513 and .025, respectively).[8] The total benefits of transfers to upper income groups are very large (column 4). For the highest bracket, they are over four times the direct cash payments ($108.5 billion vs. $24.5 billion). This is nearly three times as great as the direct payments to the lowest bracket and more than twice as great as the total impact! The comparison is even more phenomenal on a per household basis. Also worthy of note, is the fact that the groups benefiting the most from federal cash disbursements, in terms of both indirect and total transfer effects (see columns 3a and 4a), are the middle-income groups ($20,000 to $39,000) and the wealthy ($90,000+).

Of course, the second-order stimulus to the middle- and upper-income groups is not a pure net gain since, had we considered alternative closures, i.e., had the federal government chosen to spend these funds in another manner or had the expenditures not been made and instead had taxes been decreased by this amount thereby allowing more private consumption, some level of multiplier

Table 2

effects would still have been forthcoming. Dynamic adjustments, of a not as yet definitely determined type, would have also taken place, and we acknowledge several of the limitations of a static I-O approach. However, *a priori,* there is no reason to suspect that other model forms would yield significantly different results.

None of this detracts from the point that all members of the economy receive income benefits from social welfare expenditures, either directly or indirectly, and that higher income groups fare especially well. This means that these groups may suffer some surprising fallout from welfare reform, and that the constituency base for government spending of this type may thereby grow in the future as the widespread gains from transfers become apparent. We acknowledge that not all types of welfare spending are equally effective in remedying short-run and long-run social problems, and we are not saying that the system should not fine-tuned or overhauled. Nor are we taking sides in the debate of whether the economy is best stimulated by public sector or private sector spending. The analysis does, however, indicate that transfers may have a "trickle-up" effect.[9]

The results further help explain the constancy of the U.S. income distribution despite the presence of cash transfers to low income groups. The second-order effects of the transfers are sizable and are not skewed progressively. Thus, analagously to Blinder's characterizations, our results indicate the process of income equalization through government transfers may be one of "two steps forward and one step back."

Next we perform I-O income distribution simulations under Closure Rules 2, 3, and 4, each incorporating offsets to pure welfare spending expansion. The results are presented in Tables 3, 4, and 5, respectively, and represent a significant contrast to the results for CR-1 presented in Table 2. In each of the three new cases, offset effects are sizable. They are largest for CR-3 because the spending offset directly affects income through a tax increase rather than the more circuitous route of government spending or investment decreases coming first with income decreases then being derived from them.[10] For the case of CR-3, the total offset effect exceeds the indirect effects by a sizable amount ($816 billion versus $370 billion). The net transfer stimulus is still positive, but only $134 billion ($521-$397 billion), or less than 15% as great as the stimulus under the pure expansion case of CR-1.

Table 3

Table 4

Table 5

From a distributional standpoint, the results for CR-2 and CR-4 are analogous to CR-1, i.e., the indirect effects have an adverse effect on income distribution. This is not the case for CR-3 (Table 4), owing to the assumption that a tax increase would be progressive. Thus, the Gini coefficient for column 3c of .131 is lower than the Gini coefficient for column 7c of .436 (this is not the case in Tables 3 and 5). Hence, this closure rule, which can also be thought of as a policy variable, affects the ability to improve the distribution of income along with the welfare payments themselves.

V. CGE MODEL SIMULATIONS

Features of a CGE model that distinguish it from an I-O model are the endogeneity of prices, non-linearities, assumptions about factor markets, and closure rules (though this paper closes the gap on the latter). The supply of factors for production in the I-O model are unconstrained, whereas in the CGE model total factor supplies are either fixed at base levels, or there is an inelastic supply of labor and a fixed supply of capital. The simulations in this paper were performed with the USDA/ERS CGE Model (see Robinson et al., 1990; and Hanson and Rose, 1997), which assumes fixed factor supplies.

Tables 6-8 summarize the partial and general equilibrium impact of government transfer payments to households in a CGE modeling framework. The first column of data in each table contains the adjusted gross income (AGI), which is net of government transfers. The second column contains the government transfer payments to households. The last column of data are the adjusted gross income plus government transfers (combines the first and second columns of data), which is equivalent to total personal income. The Gini coefficient for total personal income (last column of data) is lower than that for adjusted gross income (second column) illustrating the distributional impact of government transfers. For all scenarios of model closure, the values in the first column and the last column of data are the same, representing the base data used by the CGE model.

The third, fourth, and fifth columns of data capture the indirect (general equilibrium minus partial equilibrium) impacts from government transfers. These differ among experiments as a result of the different closure rules. The third column of data is the indirect impact of government transfers on household income. We derive the values of this column by simulating the change in household

Table 6

Table 7

Table 8

income from adding government transfers, but, given model closure, subtract the direct government transfers from the change in household income. For all closure rules the indirect impacts are negative, reflecting that government transfers also result in income offsets that households give up for redistribution, i.e., government transfers are income households would have received through some other channel depending on model closure. In a sense, the indirect impacts are a cost of redistribution through government transfer programs.

The indirect impact of the government transfers are largest for closure rule CR-4, which expands the government deficit (see Table 8). This is a result of redistribution that shifts demand from capital goods for fixed private investment to consumer goods, with wages tending to be higher in capital goods industries. This shift in demand with wage differentials reduces value-added generated by the same total supply of factors. The distributional impact from the indirect impact is skewed towards the higher income classes.

The comparison of the indirect impact under the deficit expansion closure rule is comparable with the indirect impact under CR-3, the tax increase closure rule (see Table 7). The aggregate negative impact is slightly smaller, and the distributional impact is ore evenly distributed. The second-order effects of CR-2, which reduces government expenditures on goods and services (Table 6), is much smaller and more evenly distributed (note the lower Gini coefficient). The explanation for the lower impact is that a large share of government expenditures is for labor.

The fourth column of data combines the direct and indirect impacts from government transfers on household income. For CR-3 and CR-4 (Tables 7 and 8), the aggregate impact is negative, reflecting a net reduction in household income from using government transfers to redistribute income. Still, for these two closure rules, low income households gain income while high income households lose income.[11]

The fifth column of data contains the adjusted gross income net of the indirect impacts from the government transfer program. Recall that, AGI and, hence this column of data, is net of direct government transfers as well. AGI less the direct impact from government transfers reflects what household income would have been without the government transfer program, accounting for both the direct and indirect impacts of the program, and accounting for how the income would be distributed (through the closure rule) if the transfer program did not exist.

Table 9

Table 10

Comparing AGI less the indirect impact of the transfer program (fifth column) with AGI plus the direct impact of the program (last column) is a means of comparing the impact of the transfer program, fully accounting for the direct and indirect impacts. Under CR-3 and CR-4, aggregate household income without the government transfer program would be higher, but the distribution would be less equitable (higher Gini coefficient). This result reflects the trade-off between equity and efficiency.

VI. SUMMARY

The results of the I-O and CGE simulations are contrasted in Tables 9 and 10. The net effects on total personal income of increased welfare payments are positive in all four I-O simulations, but negative for two of the three CGE simulations. For CR-2 using the CGE model, the results are close to those yielded by CR-2 and CR-4 of the I-O model. For CR-3 of the I-O model, the results are close to CR-3 and CR-4 using the CGE model, though of the opposite sign. Viewed another way, the results for CR-2 and CR-3 differ moderately between the two models (i.e., by less than $200 billion). The greatest divergence is for CR-4, where the results differ by more than $700 billion. Clearly the CGE model is capturing more direct and indirect effects of private investment decreases than the I-O model, though it may also be overstating the case.

From a distributional standpoint, two cases stands out. First is CR-3 using the I-O model, due primarily to the assumed progressivity of the tax increase (the three other closure rules do not necessarily have progressive offsets). Of course, the progressivity assumption also pertains to the direct effects of CR-3 using the CGE model, but apparently it is overwhelmingly offset by general equilibrium effects. Second is CR-4 using the CGE model, due to the fact that investment decreases have a disproportionately adverse effect on higher income households.

Finally, we note that even with the imposition of government budget closure rules, I-O models yield more positive total impacts of government transfers than do CGE models with the same closure rules. Part of the reason is that CGE models contain still other closure rules, which inhibit expansionary effects (and in two cases lead to contractionary outcomes). Still further work on model decomposition is needed to further ascertain the differences in the two modeling approaches.

ENDNOTES

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[1] This analysis is part of a larger project to compare I-O and CGE methodologies with an emphasis on the decomposition of the results (see Rose et al. 1997). This involves calculating multipliers for both methodologies, as well as the incremental results of CGE vs. I-O models, which reveals how adding pricing considerations and relaxing linearity assumptions affects the results.

[2]These do not require perfect balancing at the regional level as they do at the national, but still involve explicit constraints.

[3] Closure rules ensure the equality of endogenous variables and equations, and hence are also related to the general category of identification problems. Also, while the emphasis in this paper is on government balances and the savings-investment balance, closure rules also apply to factor supplies.

[4]We are aware of the several shortcomings of the Gini coefficient (see Atkinson, 1983), but in the absence of a clear cut dominant measure of income distribution, we have resorted to using the one likely to be most familiar to the reader. The coefficients calculated below are based on a standard algorithm for calculating a Lorenz curve on the basis of grouped data.

[5] Another source of interdependency, the "disincentive effect" of transfers, may also be significant (see, e.g. Danziger et al., 1981) in terms of aggregate and distributional levels, but its estimation is beyond the scope of an I-O model.

[6] Rose and Beaumont (1989) and Rose and Li (1998) computed Miyazawa interrelational multipliers for the U.S. for 1982 and 1987, respectively. (These multipliers measure the total income payments to one income bracket from successive rounds of the income formation process as a result of a direct income increase to another bracket). They found that higher income households: (1) benefit most from the income generation process, and (2) benefit more from an equivalent income increase to a lower income group than to a higher income group (in fact, about twice as much for the extreme case). of course, the first result stems in part from the inability of I-O models to capture positive gains from savings, since they are viewed as leakages from the spending stream. This is overcome somewhat by social accounting matrices (and even more so by CGE models, which are typically based on SAMs), because they incorporate the complete flow of funds and not just goods and income flows. The first of these implications is not surprising, while the second bears further examination.

The reason a rich person benefits more from the income gain of a poor person than from that of another rich person stems from a combination of consumer behavior, tax policy, and production technology. Comparing sectoral Gini coefficients with consumption shares, we note that low income groups purchase a much higher proportion of goods whose production results in income disbursements skewed toward higher income households, e.g., Agricultural Products, Utilities, and Finance/Insurance. Also, high income groups make relatively higher allocations of income to goods with low Gini's, e.g., Apparel, Trade, and Lodging/Personal Services. Moreover, the relative ability to impact the overall distribution is greater for low income groups out of an equivalent dollar of income generated because of their higher propensity to consume and lower tax rates.

[7]NIPA data were used for the government transfer total and IRS data for the distribution across income brackets. The latter is based mainly on data for unemployment compensation and social security, two of the major sources, and thus column 2 is not a perfectly accurate reflection of the distribution of government transfers. Note also that not all transfers are geared just to the poor (e.g., social security and medicare).

[8]We have emphasized that it is the difference between Table 2 columns 5 and 6 (equivalent to column 4) that is most meaningful, not the typically analyzed difference between columns 1 and 6. Again, we see the "homogenizing" nature of second-order effects, which closely resemble the initial overall income distribution of the economy.

[9]In earlier work, the empirical results were used to debunk "trickle-down" theory of the Reagan administration (Rose and Beaumont, 1989). For a 1982 base, a $1 billion increase in the income of the highest income bracket results in a direct and indirect $723 increase per household for this group, but less than $1 for the $0 to $5,000 bracket! This is the extent of the gains to the lowest bracket despite the increased production and job creation. The term "trickle" was intended to describe a <u>process</u> by which gains at the top flow to the bottom, though it appears best to describe the <u>result</u>.

[10] Note that direct offset effects are $521.3 billion in each case, but adjustments to translate them into income terms reduces them. For CR-2 (Table 3), the offset is a $521.3 reduction in government spending on goods and services, which translates into only $264.2 billion in income. Similarly, for CR-4 (Table 5), the $521.3 billion decrease in investment translates into only $153.3 billion of income. In the case of CR-3 (Table 4), the personal savings leakage reduces the offset only slightly to $500 billion.

[11]The Gini coefficients are difficult to calculate in this setting where the sign of income changes switches.

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