Redistributive Effect of U.S. Taxes and Public Transfers, 1994-2004

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Abstract

In this study we derive measures of the redistributive effect of taxes and welfare expenditures for the U.S. using CPS data for the years 1994, 1999 and 2004. We find that whilst income inequality increased, the redistributive effect of taxes and public transfers together reduced market income inequality by approximately 30 percent. In 2004, 88 percent of the net redistributive effect resulted from public transfers and 12 percent from taxes. The total redistributive effect would have improved by 35 percent in 2004 if, all else equal, horizontal inequities in taxes and public transfers could have been eliminated.

1. Introduction

Taxation and government expenditure on welfare are the two major redistributive policy instruments to reduce inequality and ensure a more equitable distribution of income and other resources. In the assessment of redistributive policies, two fundamental principles are often discussed: *equity* and *efficiency*. Equity relates to the fair distribution of resources, while efficiency is concerned about losses due to distortion in economic behaviors in the process of redistribution of the resources, and can be considered as a secondary objective or a means to achieve equity as a primary goal (Le Grand, 1991).[2] Equity in measuring distributional justice of redistributive policies has two dimensions: *vertical* and *horizontal* equity. For vertical equity, redistributive policies should levy appropriately more taxes from the richer and provide appropriately more benefits to the poorer. For horizontal equity, redistributive policy should "levy identical taxes or provide identical transfers to all units with the same level of well-being" (Plotnick, 1985).

In this study of the redistributive effects of U.S. taxes and public transfers and their horizontal and vertical components, we use measurement theory developed by Urban and Lambert (2005). This methodology extends earlier work of Kakwani (1977,

[1] We thank Neil Bania and Jean Stockard for encouragement, and Ivica Urban and Felice Russo for helpful advice on methodology.

[2] In the 1970s, the dominant view in economics was that there was a trade-off between equity and efficiency. As it is well known, Okun (1975) described redistribution to be carrying money from the rich to the poor in a "leaky bucket". However, many literature from the late 1990s have argued that the trade-off does not exist (e.g. Kakwani & Pernia, 2000).

1984) and Aronson *et al.* (1994), by relaxing the requirement of these earlier studies that the recipients of pre-tax and pre-transfer income be partitioned into *exact equals groups* for the purposes of measuring horizontal fiscal effects; we use *close equals groups*. Additionally, an approach due to Lambert (1985) is adapted, whereby the net redistributive effect of the tax and benefit system can be decomposed into the contributions of taxes and benefits separately. We use U.S. Current Population Survey data over three periods: the 1995, 2000, and 2005 survey years.

Our results show that inequality in market income distribution has increased during the last ten years in the U.S., while the redistributive effect of taxes and public transfers slightly decreased. Approximately 88 percent of total redistributive effect resulted from public transfers including public assistance and social insurance programs. However, the role of public assistance was quite small. Total redistributive effect could be increased 35 percent if horizontal inequities in taxes and public transfers would be eliminated.

The structure of the paper is as follows. In Section 2, we review U.S. taxes and benefits, and describe their salient features in terms of reducing income inequality. In Section 3, the relevant measurement theory is briefly summarized. In Section 4, implementation issues are considered. In Section 5, we present our main results. Section 6 contains sensitivity analysis, to determine the extent to which our results may be conditioned by the particular normative and empirical choices we made. In the final Section 7, we summarize our findings, discuss their implications and draw conclusions.

2. Redistributive policy and income inequality in the U.S.

According to Kakwani (1986), government redistributive policies can be classified into two categories. The first category includes “the policies that have direct impact on the working of markets generating incomes. . . These policies change the distribution of factor incomes by altering the prices and supply of goods and factors”. Examples in this category include minimum wage legislation, subsidized interest rates for home buyers and wage indexation. The second category includes “fiscal policies that redistribute factor incomes received by individuals through market operations”. Direct and indirect taxes and various income support welfare programs belong to this category.

These "fiscal policies have relatively little direct effect on the process of price and income formation" (*ibid*, p.1).

In this study, we focus on redistributive policies belonging to Kakwani's second category, those which redistribute by means of taxation and public transfers, the latter comprising both cash and non-cash social welfare benefits.[3] Social welfare policies in the U.S. are various and complex, and can be classified into public assistance, social insurance, and social service program categories.

Public assistance goes to people who are poor according to legal standards, with funds coming from general tax revenues. Major *cash* public assistance programs include Temporary Aid for Needy Families (TANF) and Supplemental Security Income (SSI). TANF was established in 1996, as the Personal Responsibility and Work Opportunity Reconciliation Act (PRWOR), and was consolidated with Aid to Families with Dependent Children (AFDC), Job Opportunities and Basic Skills Training (JOBS) and Emergency Assistance. A poor family can receive TANF "only if it includes a minor child or pregnant person" (United States House of Representatives. Committee on Ways and Means., 2004). SSI provides cash benefits for low income people who are elderly, blind, or disabled. Along with the above, there are several *in-kind* public assistance programs to the poor such as Food Stamps, Medicaid, Public Housing and nutritional programs.[4]

Social insurance programs protect people against the risk of income loss due to old age, disability, unemployment, death of a breadwinner, work-related injury and sickness (Blau & Abramovitz, 2004). They are characterized by compulsory contribution and the absence of a means test. The major social insurance programs in the U.S. include Old Age, Survivors, and Disability Insurance (OASDI), Medicare, Unemployment Insurance (UI), and Worker's Compensation.

Social service programs provide care, training, and assistance to the poor as well as the elderly, children, the sick, and disabled. Child care and development, family services, community service, care for the elderly, job training, legal services, mental

[3] Payroll taxes and social welfare benefits may redistribute over lifetimes and between generations as well between income groups in a given year, but we neglect intertemporal aspects here.

[4] TANF is jointly funded by the federal government and the individual states. SSI is a federal program. General Assistance (GA) programs are state and local level cash and in-kind public assistance, which are designed to meet the needs of low income people who are ineligible for federally funded programs like TANF and SSI. As of 1998, 35 states had state GA programs (Karger & Stoesz, 2005).

health, public health, and vocational rehabilitation are included in the scope of social services (DiNitto & Dye, 1987).

Among all of these social welfare programs, public assistance is the primary one to redistribute to low income groups from the higher income groups. According to the Green book (United States House of Representatives. Committee on Ways and Means., 2004), there are some 85 means-tested benefit programs in the United States, as of 2002. Besides the above programs, the Earned Income Tax Credit (EITC), which subsidizes labor supply for low-income families, is the other major redistributive public transfer program, though usually it is regarded as a tax policy rather than a public assistance program (Gruber, 2005).

Tax policy is fundamental to the structure of social welfare, because it generates revenues for public expenditures. According to Gruber (2005), there are five types of taxation, distinguished from each other as follows. Payroll taxes are levied on the earnings of workers, and are the primary means of financing social insurance programs. Individual income tax is paid by individuals or families on broader sources of income accrued during the year as well as on earnings. Corporate income tax is levied on the earnings of corporations. Wealth taxes are paid on the value of assets held by persons. They include property taxes (based on the value of land and built structures) and estate taxes (based on inheritances). Finally, consumption tax is paid on individual or household consumption of goods and services. The most common type of consumption tax is the sales tax, paid by consumers to vendors at the point of sale. On the other hand, excise tax is levied on the sales of particular goods, such as cigarettes or gasoline.

As shown in Table 1, most revenues for the U.S. as a whole are raised by income taxation, followed by payroll taxes, consumption taxes, wealth taxes, and corporate taxes. Across all levels of government, the U.S. receives about two-thirds of its revenues from individual income and payroll taxes. On average in the OECD, consumption taxes occupy a greater portion of national government revenue than in the U.S, and public social expenditure and taxation ratios to GDP are typically higher.[5]

[5] On the other hand, private social spending plays a much more substantial role in the U.S. than in the OECD generally. See Adema and Ladaique (2005) for more on these international aspects.

Table 1. Tax Revenues by Types of Tax, 2001

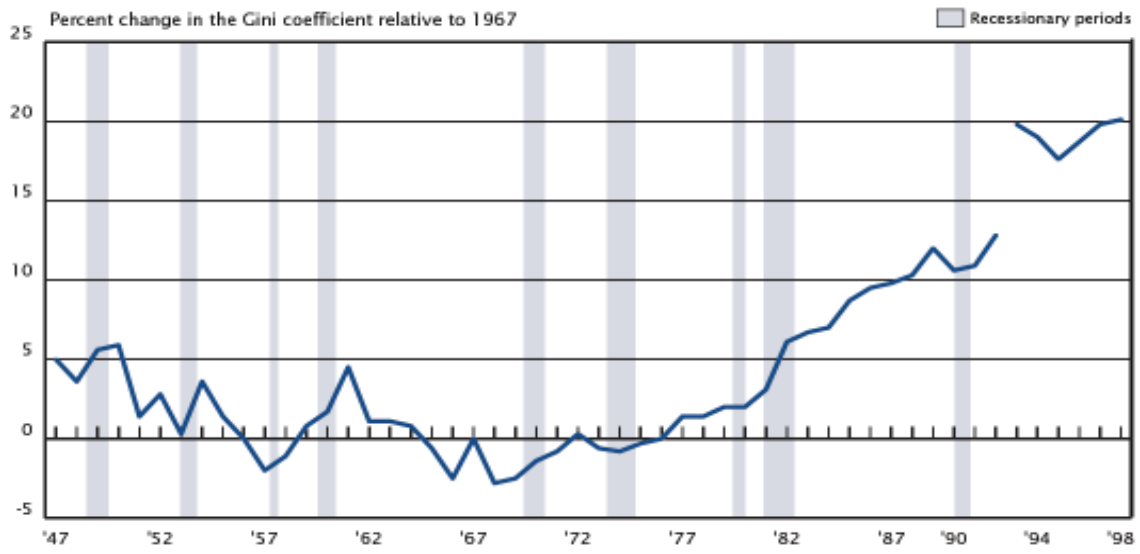
(% of total tax revenue)

	Payroll Tax	Individual Income Tax	Corporate Income Tax	Wealth Tax	Consumption Tax
U.S.	24.6%	42.3%	6.5%	10.6%	16.1%
Federal	35.9%	51.4%	7.8%	1.4%	3.4%
State and local	-	26.0%	4.4%	31.6%	38.0%
OECD average	26.7%	26.0%	9.3%	5.5%	32.6%

Source: Gruber (2005)

The concepts of inequality, poverty and welfare are closely related as well as distinct (Litchfield, 1999). Inequality has shown a secular increase in the United States, particularly from the mid-1970s to the early 1990s, whilst the poverty rate has risen and social mobility has shown little change (Gottschalk 1997, Nielsen and Alderson 1997, Harrison and Bluestone 1988). According to Förster and d'Ercole (2005), overall income inequality in the U.S. showed moderate increase during the mid 1970s to mid 1990s, and no change from the mid 1990s to 2000. See Graph 1, which uses Census data.[6]

Graph 1. Change in Income Inequality for Families: 1947-1998



Source: Jones & Weinberg (2000), based on Current Population Survey data
Note: Change in data collection methodology suggests that the pre-1993 and post-1992 estimates are not comparable.

[6] The U.S. exhibits greater income inequality than many other developed countries. In 2000, for example, the U.S. income distribution was fourth most unequal among 25 OECD countries, exceeded only by Poland, Turkey, and Mexico: see OECD (2005).

The Census Bureau's own research using CPS data indicates that government transfers and taxes in 2003 reduced income inequality by 0.104 Gini points (20 percent) compared to the pre-tax and pre-transfer income distribution (Cleveland, 2005), a greater reduction than that occasioned by the tax system. See Table 2: in 2003, for example, subtracting taxes lowers the Gini coefficient for income by 4.6 percent (from 0.498 to 0.475), while including transfers lowers it by 17 percent (from 0.475 to 0.394). Our study will amplify upon and inform these overall, broad-brush indicators.

Table 2. Gini coefficient and Redistributive Effect of Taxes and Transfers: 1979-2003

		1979	1980	1985	1990	1995	2000	2001	2002	2003
Gini index	Income (1): pre-tax and pre-transfers	0.460	0.462	0.486	0.487	0.509	0.509	0.510	0.498	0.498
	Income (2): (1) - Taxes	0.429	0.430	0.460	0.466	0.481	0.488	0.491	0.474	0.475
	Income(3): (2)+ Public transfers	0.359	0.354	0.392	0.382	0.394	0.412	0.412	0.394	0.394
% reducing inequality	Tax	6.7%	6.9%	5.3%	4.3%	5.5%	4.1%	3.7%	4.8%	4.6%
	Public Transfers	16.3%	17.7%	14.8%	18.0%	18.1%	15.6%	16.1%	16.9%	17.1%

Source: Adapted from U.S. Bureau of the Census (2006), Historical Income Tables – Experimental Measures (table RDI-5), Accessed at http://www.census.gov/hhes/www/income/histinc/rdi5.html

3. Measurement theory

Since the days of Musgrave and Thin (1948), redistributive effects have commonly been measured by comparing the Gini coefficients G_X and G_{X-T} for original (pre-tax and pre-transfer) and final (post-tax and post-transfer) income respectively:

(1) $RE = G_X - G_{X-T}$,

RE may then be decomposed across taxes and benefits, and into vertical and horizontal components. A brief sketch of the appropriate measurement theory is as follows.

For a tax function $T(x)$ such that both tax payments and post-tax incomes $x - T(x)$ increase with pre-tax income, Kakwani (1977) defined progressivity as disproportionality in taxes:

(2) $P_T^K = G_T - G_X$,

where G_T is the Gini coefficient for taxes, and he linked this measure with redistributive effect as follows:

(3) $$RE = \frac{t}{1-t} \cdot P_T^K ,$$

where *t* is the overall average tax rate.

If the tax system is such that the rank orderings of individuals by their incomes before and after taxes are different, Kakwani's model does not apply. Kakwani (1984) showed that, in such a case, redistributive effect can be decomposed into vertical equity, through his disproprtionality measure, along with a term to capture the extent of reranking:

(4) $$RE = G_X - G_{X-T} = \frac{t}{1-t}.P^K - [G_{X-T} - C_{X-T}] = V^K - R^K ,$$

in which C_T and C_{X-T} are the concentration indexes for taxes and post-tax incomes, $P^K = C_T - G_X$ and $V^K = G_X - C_{X-T}$, which differs from *RE* precisely when the tax system induces rerankings, which are captured by $R^K \geq 0$.

Aronson *et al.* (1994) refined this decomposition. For a population partitioned into pre-tax equals groups, there are in fact three contributions to redistributive effect:

(5) $$RE = G_X - G_{X-T} = \frac{t}{1-t}.P_T^K - \sum \alpha_x \cdot G_{E(x)} - R = V_T^K - H^A - R^A .$$

The vertical term V_T^K measures the inequality reduction that would have obtained if each member of each equals group *E(x)* had paid the same tax, the mean of the actual taxes paid by the group. In the middle term H^A, which measures classical (pure) horizontal inequity, the weighted sum is of post-tax Gini coefficients across pre-tax equals groups (where α_x is the product of the population share and post-tax income share of the members of *E(x)*), and reranking is $R^A = G_{X-T} - C_{X-T}$, which is as before except that for the new situation C_{X-T} is defined with respect to the lexicographic ordering of income units, first by pre-tax income and then, among pre-tax equals, by post-tax income.[7]

Urban and Lambert (2005), to which we refer henceforth as UL, adjusted this methodology to allow for the fact that it is by necessity *close equals* rather than *exact*

[7] The model of Aronson *et al.* has been widely applied. For example, Wagstaff *et al.* (1999) use it to compare the income tax systems of twelve OECD countries, Hyun and Lim (2005) applied it to Korea's income tax system, and van Doorslaer *et al.* (1999) use it to present the income redistribution consequences of health care finance in twelve OECD countries.

equals which must be used to define the *H* term (since there are typically few or no exact equals in real-world data sets). In this setting, rerankings may occur within close equals groups as well as between them (i.e. rerankings of entire groups). New measures capture these effects among close equals,[8] and in combination with the term R^A in the Aronson *et al.* decomposition, they define the reranking measure invoked in Kakwani (1984). The decomposition of redistributive effect advocated by UL and used in this paper takes the form:

(6) $$RE = V - H - R^K,$$

in which the vertical and horizontal components H and V differ slightly from those in (5), due to the close equals environment, but they sum to Kakwani's V^K as in (4).

The UL model extends readily from taxes to benefits and to the net fiscal system. In Lambert (1985), net redistributive effect $\left(V_N^L\right)$ is decomposed into separate contributions for taxes and benefits, involving Kakwani indices for each as well as average rates of each:

(7) $$V_N^L = G_X - C_{X-T+B} = \frac{t \cdot P_T^K + b \cdot P_B^K}{1-t+b} = \frac{(1-t)V_T^K + (1+b)V_B^K}{1-t+b},$$

Here t denotes average tax rate as before, b denotes the average benefit rate, P_T^K and P_B^K are Kakwani indices for taxes and benefits and $V_T^K = \frac{t}{1-t} P_T^K$ and $V_B^K = \frac{b}{1+b} P_B^K$ are the respective measures of redistributive effect.[9]

4. Implementation issues

We shall measure inequality and redistributive effects of taxes and welfare transfer programs in the U.S. using Current Population Survey data. Household incomes will be transformed into living standard using a needs-based equivalence scale, and the income unit will be the equivalent adult (Ebert, 1997) for which we need to modify the

[8] See the Appendix, which defines all component measaures invoked by UL, in particular the measures R^{WG} and R^{EG} referred to here.

[9] Lambert (1985) demonstrated the unsuitability of the Kakwani index for measuring net progressivity: "..since total net benefits may be positive, zero or negative, and certainly net benefits will be negative at some income levels, there are considerable problems in defining a concentration curve for net benefits, or otherwise measuring their 'deviation from proportionality'"(*ibid*, p.44). All of the measures featuring in (6) are further described in Lambert (2001, chapter 11). See Jenkins (1988) and also Ankrom (1993) for the introduction of reranking contributions (of taxes and benefits) into the Lambert (1985) model.

CPS sample weights. Sensitivity analysis will explore the variations of the results when the scope of taxes and public transfers, the equivalence scale and the close equals groups are varied. Our major results will then be compared with those of previous studies.

We use the Annual Social and Economic (ASEC) Supplement to the Current Population Survey (CPS) data of the U.S. Census Bureau for the survey years 1995, 2000, and 2005. The CPS is primarily a labor force survey, used to compute the federal government's official monthly unemployment statistics, along with other estimates of labor force characteristics. In addition to its core content, a different supplement is fielded each month. One of these, the ASEC Supplement, formerly known as the March Annual Demographic Supplement, is currently the official source of estimates on income and poverty in the United States.[10] The CPS collects data for the prior calendar year for about 35 cash and in-kind sources. Non-cash benefit and tax values are calculated by using the corresponding sources, and are added to the survey data set. The sample sizes and observation units we use are presented in Table 3.

Table 3. The CPS ASEC Sample Size and Analyzed Household Size

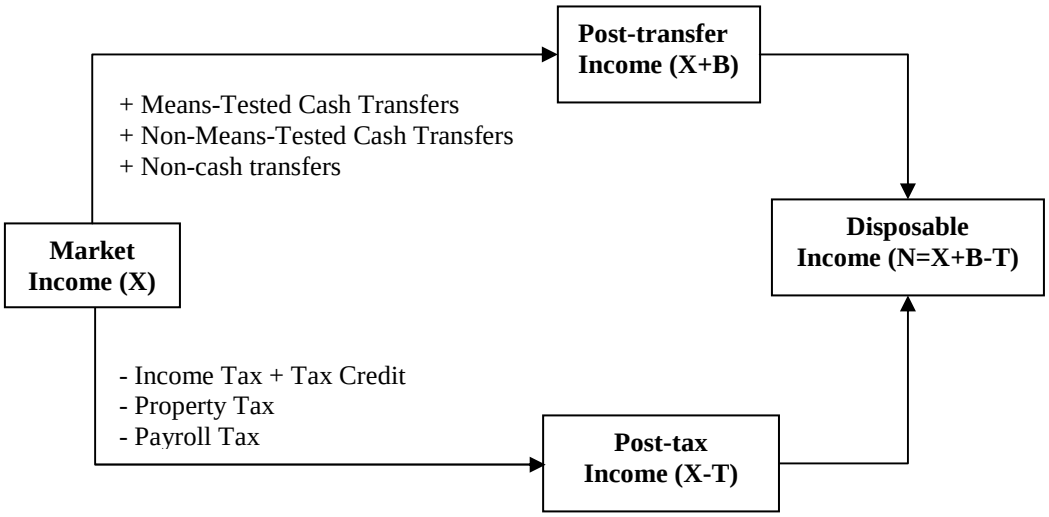
	Sample Size			**Excluded households(B)**		**Analyzed households (A-B)**
	Person	Family	Household(A)	Non-interviewed	group quarter	
1995	149,642	63,756	72,152	15,211	68	56,873
2000	133,710	58,093	64,994	13,978	38	50,978
2005	210,648	87,149	98,664	22,217	60	76,387

Source: each year's CPS dataset from http://www.bls.census.gov/cps/suppmain.htm

The CPS records income data at the individual, family, and household levels. Although the ultimate unit of welfare is the individual, this is not the appropriate income unit for distributional analysis (Atkinson *et al.*, 1995). We use the equivalent adult as the income unit. The time unit is the year: income statistics for the 1995, 2000, and 2005 survey years refer to receipts during the preceding calendar years, 1994, 1999, and 2004.

[10] While the other representative income data source, the Survey of Income and Program Participation (SIPP) collects income data every four months through a panel, the CPS income supplements interviews once a year. Unlike SIPP, CPS is designed to be representative within the states (U.S Census Bureau 2001 and 2005a).

Figure 1. Basic Definitions of Income



We frame everything in terms of income and not consumption, wealth or any other welfare indicator. The following income concepts are used: *i)* market income, *ii)* post-tax income, *iii)* post-transfer income, *iv)* disposable income. See Figure 1 and Atkinson *et al.* (1995). The formal definitions, which accord with the U.S. Census Bureau's documentation (U.S. Census Bureau, 2005a, 2005b), are as follows:

i) *Market Income* = money income[11] + capital gains and losses + return on home equity – work expenses – public cash transfers

ii) *Post-tax Income* = market income – payroll tax – property tax – income tax + tax credit

iii) *Post-transfer Income* = market income + public cash transfers (means-tested and non-means-tested)[12] + public non-cash transfers

iv) *Disposable Income* = market income + public transfers (cash and non-cash) – tax (payroll tax, property tax and income tax including tax credit)[13]

[11] According to the U.S. Census Bureau (2005a), money income data of individuals who are 15 years or over includes the following sources: (1) money wages or salary; (2) net income from non-farm self-employment; (3) net income from farm self-employment; (4) Social Security or railroad retirement; (5) Supplemental Security Income; (6) public assistance or welfare payments; (7) interest (on savings or bonds); (8) dividends, income from estates or trusts, or net rental income; (9) veterans' payment or unemployment and workmen's compensation; (10) private pensions or government employee pensions; (11) alimony or child support, regular contributions from persons not living in the household, and other periodic income.

[12] Means-tested cash transfers include payments from public assistance, including TANF, SSI and some Veterans' Payments. Non-means-tested cash transfers include Unemployment Compensation, State Workers' Compensation, Social Security, some Veterans' Payments, government survivor, disability, and pension payments, and educational assistance. Non-cash transfers include food stamps, housing subsidies, free or reduced-price school lunches, Medicaid and Medicare. See U.S. Census Bureau (2005b).

[13] Estimates of taxes and the value of non-cash benefits are not included in the CPS data but are added from information provided by other agencies, such as the Internal Revenue Service (IRS), the Centers for Medicare and Medicaid (CMS), the U.S. Bureau of Labor Statistics, the U.S. Department of Agriculture, and the U.S. Office of Personnel Management (OPM) (Cleveland, 2005).

In a broad sense, means-tested transfers refer to public assistance benefits and non-means-tested transfers to social insurance benefits. Four types of taxes are included: federal individual income tax, state individual income taxes, payroll tax and property tax on owner-occupied housing. The Earned Income Tax Credit is added to each level of income taxes.

Household incomes [14] are converted into a common base measuring living standard, or equivalent income, by deflating by factors which reflect differences in household needs attributable to size and composition. A range of possible judgments about the needs of households with different sizes and composition are accommodated by parametric equivalence scales such as those of Buhman *et al.* (1988) and Cutler and Katz (1992). Let economic well-being W be measured as the adjusted income of a household. Buhman *et al.* write $W = Y/S^e$ where S is household size and the elasticity e, indicating economies of scale, varies between 0 and 1. Cutler and Katz (1992) use the form

(8) $W = Y/z, \quad z = (n_A + \varphi n_C)^\theta, \; 0 \le \theta \le 1, \; 0 \le \varphi \le 1$

in which n_A and n_C are the number of adults and children in the household and φ and θ are parameter values between 0 and 1 which signify the relative importance of children and economies of scale respectively. Setting $\varphi = 1$ in Cutler and Catz's specification yields Buhman et al's scale. We set both φ and θ equal to 0.5 here, following the practice of Aronson *et al.* (1994) and also of Wagstaff *et al.*(1999).

The Gini coefficient is used to measure inequality in each income distribution. There are many ways to calculate Gini coefficient from micro data. See Lerman and Yitzhaki (1984) and Förster (2000). For sampling weights w and equivalence scale deflators z, the Gini coefficient across equivalent adults is calculated as:

$$(9) \qquad Gini = \frac{2\,\mathrm{cov}\left(W_k, \dfrac{\sum_{i=1}^{k} w_i z_i}{N}\right)}{\mu} = \frac{\dfrac{2}{N}\sum_{k=1}^{n} w_k z_k (W_k - \mu) \cdot \left(\dfrac{\sum_{i=1}^{k} w_i z_i}{N} - \dfrac{1}{N^2} \cdot \sum_{k=1}^{n}\sum_{i=1}^{k} w_i z_i\right)}{\mu},$$

[14] The U.S. Census Bureau (2005a) defines the household of the CPS data as follows: "A household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live and eat with any other persons in the structure and there is direct access from the outside or through a common hall.… The count of households excludes group quarters". For example, unmarried couples in a housing unit are treated as two single person families, but as one household.

where W_k is the equivalent income per equivalent adult in household k (k = 1, 2, ...n), n denotes the total number of sample observations, N is the total number of equivalent adults, $N = \sum_{k=1}^{n} w_k z_k$ and μ is mean income overall.

In calculating redistributive effects using Urban and Lambert's (2005) close equals model, we take account of van de Ven *et al.*'s (2001) warning that "an arbitrary specification of close equals groups can lead to misleading results" (p.381). They suggest setting the bandwidth for close equals groups to maximize the vertical component of redistributive effect. We follow this idea here, and identify optimal intervals for close equals groups by experimenting with a number of different income bandwidths along the pre-tax income scale, ranging from \$100 to \$3,000 (annually). A bandwidth of \$500 for 2004 maximizes the level of vertical effect V , adjusted to \$352 (1994) and \$438 (1999) by using median income variation rates for each year.[15]

5. Results

The main results, for all taxes and public transfers, are reported in Table 4. Here, as in all subsequent tables, original income is market income as previously defined.

Table 4. Redistributive Effect of Taxes and Public Transfers

	Year	**1994**		**1999**		**2004**	
	bandwidth	\$352		\$438		\$500	
	# of groups	1,058		1,068		1,537	
Taxes (T)	G_X	0.47150		0.48989		0.50081	
	G_{X-T}	0.43839		0.45497		0.47126	
	RE	0.03312	(7.02%)	0.03492	(7.13%)	0.02954	(5.90%)
	t	0.24314		0.24838		0.22828	
	P_T^K	0.12331		0.11640		0.11235	
	V_T^K	0.03961		0.03847		0.03323	
	V	0.03962	(119.64%)	0.03847	(110.17%)	0.03326	(112.57%)
	H	0.00001	(0.02%)	0.00001	(0.02%)	0.00002	(0.08%)
	R^K	0.00650	(19.62%)	0.00354	(10.15%)	0.00369	(12.49%)
Public Transfers	G_X	0.47150		0.48989		0.50081	
	G_{X+B}	0.36512		0.39622		0.38774	

[15] Aronson *et al.*(1994) used a £5 per week bandwidth to analyze 1990-91 U.K income data and the same real value for earlier years. Given the exchange rate for the British pound to the U.S. dollar in 1990-91 and the Consumer Price Index in the U.S. from 1990 to 2004, £5 per week in 1990-1991 in the U.K. converts into approximately \$665 per year in 2004 in the U.S.

(B)	*RE*	0.10638	(22.56%)	0.09367	(19.12%)	0.11307	(22.58%)
	b	0.20234		0.16788		0.20970	
	P_B^K	0.83636		0.86160		0.88549	
	V_B^K	0.14075		0.12385		0.15350	
	V	0.13990	(131.51%)	0.12342	(131.76%)	0.15276	(135.10%)
	H	-0.00085	(-0.80%)	-0.00043	(-0.46%)	-0.00074	(-0.66%)
	R^K	0.03437	(32.31%)	0.03018	(32.22%)	0.04043	(35.76%)
Net Taxes (T-B)	G_X	0.47150		0.48989		0.50081	
	G_N	0.31706		0.34523		0.34196	
	RE	0.15445	(32.76%)	0.14467	(29.53%)	0.15885	(31.72%)
	g	0.04080		0.08050		0.01858	
	V_N^L	0.20769		0.18875		0.21535	
	%T	0.03126	(15.05%)	0.03144	(16.66%)	0.02613	(12.13%)
	%B	0.17643	(84.95%)	0.15731	(83.34%)	0.18920	(87.86%)
	V	0.20662	(133.78%)	0.18821	(130.10%)	0.21444	(135.00%)
	H	-0.00107	(-0.69%)	-0.00054	(-0.38%)	-0.00091	(-0.57%)
	R^K	0.05324	(34.47%)	0.04409	(30.48%)	0.05650	(35.57%)

As can be seen, inequality of market income worsened over the period. On the other hand, final income became slightly less unequal. The total redistributive effect of taxes and benefits became sharply worse between 1994 and 1999, but fully recovered by 2004. As of 2004, equivalent adults pay an average 22.8 percent of their market income as taxes and receive 21 percent as benefits.

Between 1994 and 1999, the redistributive effect of the combined tax and transfer system, as expressed by *RE* as well as V_N^L, was diminished. The welfare reform of 1996 presumably led to reduced effectiveness of public transfers; there was a reduced average benefit level and a slight increase in benefit regressivity. Between 1999 and 2004, the role of public transfers in reducing inequality recovered, and the average benefit level increased again. Taxes became less redistributive between 1999 and 2004, and the burden and progressivity both lessened. In 2004, 88 percent of the net redistributive effect resulted from public transfers and 12 percent from taxes; 5.5 percent of the total tax burden was shifted from low incomes to high incomes by the presence of progression in taxes, whilst 44.5 percent of total benefit expenditures was shifted from high incomes to low incomes by the presence of regression in the benefits. Public transfers reduced the level of income inequality about seven times more than taxes.

The impact of differential tax and benefit treatments is seen through the values of horizontal inequity H and reranking R^K, and their sum.[16] The combined tax-transfer system in 2004 would have been 35 percent more redistributive in the absence of differential treatments. Reranking caused by benefits was about three times larger than that by taxes. Potential redistribution would have been much higher if the inequity caused by reranking in the process of benefit delivery could have been eliminated.

The income tax and public assistance

If we limit our attention to the personal income tax (federal and state, after EITC), and to public assistance programs (means-tested cash transfers such as TANF/AFDC and SSI, and non-cash transfers such as food stamps, housing subsidies, free or reduces-price school lunches and Medicaid), do we see that these programs are "doing most of the work"? It is generally supposed that the income tax is the most progressive component of the system, and that public assistance is the most regressive. If Table 4 is redone for income tax, public assistance, and net taxes defined as income taxes minus public assistance, we see that, indeed, the progressivity of income tax and the regressivity of public assistance are significantly larger than for all taxes and all transfers (approximately 1.3 to 2 times as large).[17] Though public assistance is strongly regressive, its proportion within the total public transfer system is fairly small, and as a result its inequality-reducing effect is roughly comparable only to that coming from the income tax. The non-income taxes – property tax and payroll tax – increase inequality rather than reduce it, that is, they are regressive. See Table 5.

Table 5. Redistributive Effect of Income tax, Property Tax and Payroll Tax, 2004

	Income tax		**Property Tax**		**Payroll tax**	
G_X	0.50081		0.50081		0.50081	
G_{X-T}	0.46681		0.50677		0.50304	
RE	0.03399	(6.79%)	-0.00596	(-1.19%)	-0.00223	(-0.45%)
t	0.14845		0.01984		0.06355	
P_T^K	0.20565		-0.24276		-0.03131	
V_T^K	0.03585		-0.00491		-0.00213	

[16] Wagstaff *et al.* (1999) point out that, in the Aronson *et al.* decomposition, the relative values of H^A and R^A depend on the interval chosen for close equals, and they advise focusing on $H^A + R^A$ to measure the gap between actual and potential redistributive effect. The value of R^K in our study, which is the sum of R^A, entire group reranking and within group reranking, is constant regardless of the bandwidth.
[17] Details are available from the authors on request.

V	0.03587	(105.51%)	-0.00491	(82.38%)	-0.00212	(95.23%)
H	0.00002	(0.05%)	0.000002	(-0.04%)	0.000001	(-0.07%)
R^K	0.00186	(5.46%)	0.00105	(-17.58%)	0.00010	(-4.70%)

The discrepancies between actual redistributive effect (*RE*) and potential redistributive effect (*V*) are smaller for income tax and public assistance than for all taxes and transfers. For example, if differences in income tax treatment could have been eliminated in 2004, the redistributive effect of the income tax would have been increased by around 5.5 percent. The reranking effect in public assistance is approximately five times as large as that of income tax.

Some figures for means-tested cash transfers are shown in Table 6. Their regressivity is higher than that of all public assistance because the level of benefits is more directly determined by income than in non-cash programs. The redistributive effect has fallen through time, resulting from the decreasing average benefit rate and regressivity. There has been relatively little differential treatment in the means-tested cash transfer system, though the extent of it did increase sharply between 1999 and 2004.

Table 6. Redistributive Effect of Means-tested Cash Transfers

	1994		**1999**		**2004**	
G_X	0.47150		0.48989		0.50081	
G_{X+B}	0.46148		0.48427		0.49535	
RE	0.01002	(2.13%)	0.00562	(1.15%)	0.00546	(1.09%)
b	0.00944		0.00529		0.00538	
P_B^K	1.17229		1.15337		1.12983	
V_B^K	0.01097		0.00607		0.00605	
V	0.01083	(108.03%)	0.00603	(107.31%)	0.00600	(109.85%)
H	-0.00014	(-1.39%)	-0.00004	(-0.70%)	-0.00005	(-0.96%)
R^K	0.00094	(9.42%)	0.00045	(8.01%)	0.00059	(10.81%)

The Earned Income Tax Credit

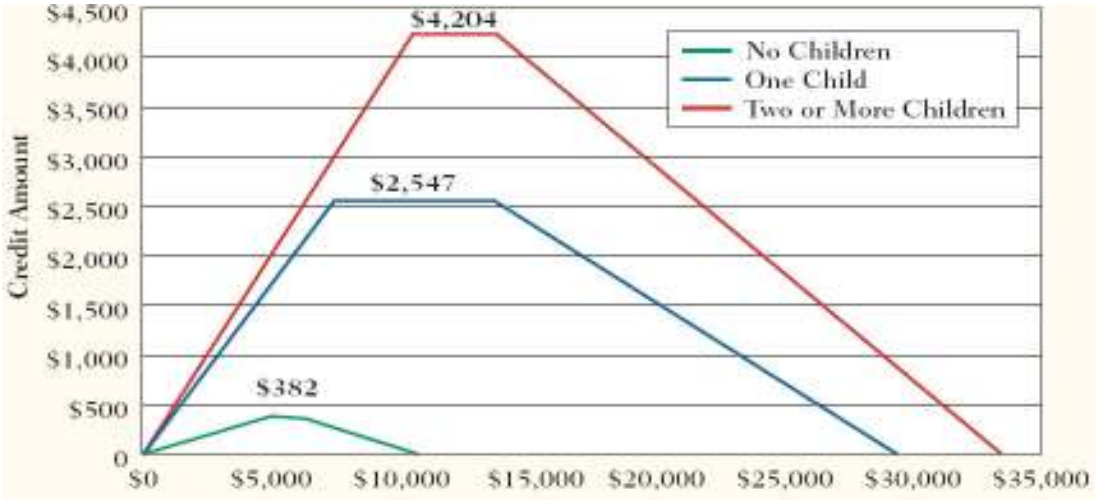
The EITC is a refundable credit for low-income working families. Its purpose is to reduce poverty and provide work incentives. EITC is basically a tax policy, but is frequently considered as public assistance. It has become one of the largest-scale programs to support low-income people in the U.S. Table 7 presents figures for the EITC.

Table 7. Redistributive Effect of EITC

	1994		1999		2004	
G_X	0.47150		0.48989		0.50081	
G_{X+B}	0.46804		0.48608		0.49716	
RE	0.00346	(0.73%)	0.00382	(0.78%)	0.00365	(0.73%)
b	0.00399		0.00410		0.00407	
P_B^K	0.88532		0.95181		0.91731	
V_B^K	0.00352		0.00389		0.00371	
V	0.00352	(101.67%)	0.00389	(101.81%)	0.00371	(101.84%)
H	-0.0000001	(0.00%)	-0.00000002	(0.00%)	0.0000002	(0.01%)
R^K	0.00006	(1.67%)	0.00007	(1.81%)	0.00007	(1.84%)

EITC has a progressive phase-in range, proportional range and regressive phase-out range (see Graph 2) and is inequality-reducing, with an average rate that is slightly less than that of means-tested cash transfers. The discrepancies between its redistributive and vertical effects are quite small (approximately 2%), which results from a relatively low level of reranking compared to other types of benefits and taxes.

Graph 2. Benefit Structure of Earned Income Tax Credit, in TY 2003



Source: Internal Revenue Service, Recited from Berube, A. & Tiffany, T. (2004)

Federal and state income taxes

Table 8. Redistributive Effect of Federal and State Income Tax, 2004

	Federal income tax after credit(T_F)		**State income tax after credit(T_S)**		**Total income tax[18] after credit ($T=T_F+T_S$)**	
G_X	0.50081		0.50081		0.50081	
G_N	0.47048		0.49641		0.46482	
RE	0.03033	(6.06%)	0.00440	(0.88%)	0.03599	(7.19%)
g	0.11418		0.03071		0.14489	
P_T^K	0.24583		0.14278		0.22398	
V_T^K	0.03169		0.00452		0.03795	
V	0.03170	(104.52%)	0.00453	(102.84%)	0.03797	(105.51%)
H	0.00001	(0.04%)	0.000002	(0.05%)	0.00002	(0.05%)
R^K	0.00136	(4.47%)	0.00012	(2.79%)	0.00196	(5.46%)

Note: state income tax structures vary from state to state.

Table 8 compares the redistributive effects of federal and state income taxes. The federal income tax is more progressive than the state income taxes in the U.S., which is in accord with Wagstaff *et al.*'s (1999) finding in some other OECD countries.[19] Wagstaff *et al.* also observed that the vertical and horizontal/reranking effects, as percentages of the redistributive effect, were lower at the central government level than at the local level. We find the opposite: the vertical effect and sum of horizontal inequity and reranking are higher for the federal income tax than at the state level. The average rate of federal income tax was three to four times higher than that of the state income taxes. This, in combination with high progressivity, results in a larger vertical effect than for the states.

6. Sensitivity Analysis

Using definitions of unadjusted income, taxes and public transfers all as for Table 4, we show in Table 9 the effect on our results for 2004 of varying the equivalence scale parameters θ and φ. As shown, the proportion of *V* in *RE* (equivalently, the sum of *H* and *R*) falls in the case of taxes, and rises in the case of benefits and net taxes, as θ increases and as φ decreases.[20]

[18] The results except for G_X are slightly different from those for the income tax plus EITC due to the different scope of this tax credit
[19] Denmark, Sweden, Finland, and Switzerland
[20] Aronson *et al.* (1994) chose the parameters $\theta = \varphi = 0.5$ because they minimized *H* in the case of the U.K.'s personal income tax system. According to Burkhauser *et al.* (1996), the reasonable values of θ range between approximately 0.4 and 0.8.

Table 9. Redistributive Effect by Equivalence Scale, 2004

θ		0	0.2	0.2	0.5	0.5	0.8	0.8
ϕ		-	0.5	1	0.5	1	0.5	1
# of equals groups (bandwidth=$500)		2,252	1,892	1,892	1,537	1,537	1,454	1,454
Taxes (T)	G_X	0.53286	0.51671	0.51590	0.50081	0.50262	0.49550	0.50424
	G_{X-T}	0.50944	0.49048	0.48899	0.47126	0.47191	0.46416	0.47193
	RE	0.02342	0.02623	0.02691	0.02954	0.03071	0.03135	0.03231
	t	0.22828	0.22828	0.22828	0.22828	0.22828	0.22828	0.22828
	P_T^K	0.09269	0.10177	0.10387	0.11235	0.11587	0.11821	0.12110
	V_T^K	0.02742	0.03011	0.03073	0.03323	0.03428	0.03497	0.03582
	V	0.02744	0.03013	0.03075	0.03326	0.03429	0.03499	0.03584
	(%)	117.18%	114.88%	114.26%	112.57%	111.68%	111.61%	110.95%
	H	0.00002	0.00003	0.00003	0.00002	0.00002	0.00002	0.00002
	(%)	0.08%	0.10%	0.09%	0.08%	0.06%	0.06%	0.06%
	R^K	0.00400	0.00388	0.00381	0.00369	0.00357	0.00362	0.00352
	(%)	17.10%	14.78%	14.17%	12.49%	11.63%	11.55%	10.89%
Benefits (B)	G_X	0.53286	0.51671	0.51590	0.50081	0.50262	0.49550	0.50424
	G_{X+B}	0.41902	0.40202	0.40254	0.38774	0.39437	0.38808	0.40665
	RE	0.11384	0.11469	0.11336	0.11307	0.10825	0.10742	0.09759
	b	0.20970	0.20970	0.20970	0.20970	0.20970	0.20970	0.20970
	P_B^K	0.86873	0.87776	0.87510	0.88549	0.87576	0.88491	0.86333
	V_B^K	0.15059	0.15216	0.15170	0.15350	0.15181	0.15340	0.14966
	V	0.14982	0.15137	0.15091	0.15276	0.15109	0.15265	0.14891
	(%)	131.61%	131.98%	133.12%	135.10%	139.58%	142.10%	152.59%
	H	-0.00077	-0.00079	-0.00079	-0.00074	-0.00072	-0.00075	-0.00075
	(%)	-0.68%	-0.69%	-0.69%	-0.66%	-0.66%	-0.69%	-0.76%
	R^K	0.03676	0.03747	0.03834	0.04043	0.04356	0.04597	0.05207
	(%)	32.29%	32.67%	33.82%	35.76%	40.25%	42.80%	53.36%
Net taxes (N= T-B)	G_X	0.53286	0.516706	0.51590	0.50081	0.50262	0.49550	0.50424
	G_N	0.37794	0.35834	0.35867	0.34196	0.34921	0.34304	0.36406
	RE	0.15491	0.15837	0.15724	0.15885	0.15341	0.15246	0.14018
	g	0.01858	0.01858	0.01858	0.01858	0.01858	0.01858	0.01858
	V_N^L	0.20720	0.21124	0.21116	0.21535	0.21409	0.216583	0.21265
	%T	10.41%	11.21%	11.44%	12.14%	12.59%	12.70%	13.25%
	%B	89.59%	88.79%	88.55%	87.86%	87.41%	87.30%	86.75%
	V	0.20625	0.21027	0.21020	0.21444	0.21320	0.21567	0.21174
	(%)	133.14%	132.77%	133.68%	135.00%	138.97%	141.46%	151.04%
	H	-0.00095	-0.00096	-0.00096	-0.00091	-0.00088	-0.00091	-0.00091
	(%)	-0.61%	-0.61%	-0.61%	-0.57%	-0.58%	-0.60%	-0.65%
	R^K	0.05228	0.05287	0.05392	0.05650	0.06067	0.06412	0.07247
	(%)	33.75%	33.38%	34.29%	35.57%	39.55%	42.06%	51.69%

In Table 10 we show corresponding results when the household is taken as the income unit, both with and without sample weighting. All variables are affected by

changing the unit of analysis and weighting method.[21] For most of the variables, the result using equivalent adults gives the median of the values for the three methods.[22]

Table 10. Redistributive Effect by Unit of Analysis and Weighting Method, 2004

		Household, unweighted[23]		**Household, weighted**		**Equivalent adult, weighted**	
bandwidth (groups)		500	(1,537)	500	(1,537)	500	(1,537)
total # of units		76,387		113,146,422		163,622,962	
Taxes (T)	G_X	0.50113		0.51720		0.50081	
	G_{X-T}	0.47108		0.49074		0.47126	
	RE_T	0.03005	(6.00%)	0.02646	(5.12%)	0.02954	(5.90%)
	t	0.22632		0.23203		0.22828	
	P_T^K	0.11455		0.10044		0.11235	
	V_T^K	0.03351		0.03035		0.03323	
	V	0.03354	(111.59%)	0.03038	(114.81%)	0.03326	(112.57%)
	H	0.00003	(0.09%)	0.00003	(0.13%)	0.00002	(0.08%)
	R^K	0.00346	(11.50%)	0.00388	(14.68%)	0.00369	(12.49%)
Benefits (B)	G_X	0.50113		0.51720		0.50081	
	G_{X+B}	0.38585		0.39127		0.38774	
	RE_B	0.11528	(23.00%)	0.12593	(24.35%)	0.11307	(22.58%)
	b	0.20756		0.23309		0.20970	
	P_B^K	0.90147		0.89999		0.88549	
	V_B^K	0.15495		0.17013		0.15350	
	V	0.15393	(133.52%)	0.16901	(134.21%)	0.15276	(135.10%)
	H	-0.00102	(-0.88%)	-0.00112	(-0.89%)	-0.00074	(-0.66%)
	R^K	0.03967	(34.41%)	0.04420	(35.10%)	0.04043	(35.76%)
Net taxes (N=T-B)	G_X	0.50113		0.51720		0.50081	
	G_N	0.33932		0.34613		0.34196	
	RE_N	0.16181	(32.29%)	0.17108	(33.08%)	0.15885	(31.72%)
	g	0.01875		-0.00106		0.01858	
	(P_N^K)	(11.36100)		(-219.5798)		(11.37218)	
	V_N^L	0.21712		0.23285		0.21535	
	$\%T$	0.02642	(12.17%)	0.02328	(10.00%)	0.02613	(12.14%)
	$\%B$	0.19069	(87.83%)	0.20956	(90.00%)	0.18920	(87.86%)
	V	0.21588	(133.41%)	0.23148	(135.31%)	0.21444	(135.00%)
	H	-0.00124	(-0.77%)	-0.00137	(-0.80%)	-0.00091	(-0.57%)
	R^K	0.05531	(34.18%)	0.06178	(36.11%)	0.05650	(35.57%)

[21] Note the instability in the value and sign of g, the net tax rate, and the abnormal levels of net progressivity P_N^K, especially for weighted households. As Lambert (1985) warned, the Kakwani index can be unsuitable for measuring net progressivity in such circumstances.

[22] Decoster and Ooghe (2003) discuss and compare the three methods using graphic examples, and go on to analyze a proposed Belgian personal income tax reform using each. Interestingly, they claim "quite fanciful results with respect to the choice of equivalence scales" (page 189).

[23] The MATLAB procedures developed by Ivica Urban (and adopted in UL) were used for the unweighted household calculations in this table. We acknowledge Ivica's support.

As the bandwidth defining close equals groups in original income changes, the values of *V* and *H* also shift. However, not all variables depend on the bandwidth.[24] Table 11 shows the variations in those vertical, horizontal and reranking measures which are affected when the bandwidth for close equals is changed.[25] Generally, as the bandwidth is increased, vertical effects reduce and horizontal effects rise (as also noted in Aronson *et al.*). *V* is maximized when bandwidth is set at \$500, but V^A is maximized when the bandwidth is \$1,000. We chose \$500 as the bandwidth in 2005.

Table 11. Redistributive Effect by Close Equals Groups Bandwidth

bandwidth	V	V_K^T	H	H^A	R^A
\$100	0.04822711	0.04814720	0.00000001	0.00003295	0.00153035
\$200	0.04822659	0.04818290	-0.00000051	0.00006472	0.00153427
\$300	0.04822688	0.04820173	-0.00000022	0.00009551	0.00152231
\$400	0.04822611	0.04820866	-0.00000099	0.00012518	0.00149958
\$500	0.04822715	0.04821430	0.00000005	0.00015413	0.00147627
\$600	0.04822491	0.04821496	-0.00000220	0.00018177	0.00144928
\$700	0.04822477	0.04821558	-0.00000233	0.00020833	0.00142334
\$800	0.04822316	0.04821604	-0.00000395	0.00023424	0.00139789
\$900	0.04821825	0.04821187	-0.00000885	0.00025884	0.00136912
\$1,000	0.04822450	0.04821858	-0.00000260	0.00028396	0.00135071
\$1,100	0.04821598	0.04821087	-0.00001112	0.00030583	0.00132113
\$1,200	0.04822084	0.04821615	-0.00000626	0.00032973	0.00130251
\$1,500	0.04821244	0.04820894	-0.00001466	0.00039195	0.00123308
\$1,700	0.04821117	0.04820815	-0.00001593	0.00042918	0.00119506
\$2,000	0.04820314	0.04820069	-0.00002396	0.00048040	0.00113639
\$2,500	0.04819108	0.04818898	-0.00003603	0.00055252	0.00105255
\$3,000	0.04817126	0.04816975	-0.00005584	0.00061005	0.00097579

Wagstaff *et al.* (1999) and Hyun and Lim (2005) both use the Aronson *et al.* methodology, the former for 12 OECD countries including the U.S. (1987) and the latter for the Korean income tax system. Table 12 compares results. For better comparability, in this table we have also used the Aronson *et al.* methodology with our U.S. data and have

[24] The Gini indices G_X, G_{X-T}, G_{X-B}, and G_N, the redistributive effect *RE*, the average rates of taxes, benefits, and net taxes (*t*, *b* and *g*), Kakwani's progressivity/regressivity indices (P_T^K and P_B^K), the vertical contributions (V_T^K , V_B^K and V_N^L) , and the reranking effect R^K all stay the same.

[25] Within the unvarying R^K, not surprisingly within-groups reranking increases, and entire group reranking declines as the bandwidth is raised.

chosen the same unit of analysis (the household), and the same sampling weights, equivalence scale, income definition, and bandwidths of equals groups (in real terms).[26]

Table 12. Comparison with Other Studies

	G_x	G_{X-T}	RE	t	P_T^K	V_T^K (%)	H^A (%)	R^A (%)
Wagstaff *et al.*(1999)								
Denmark (1987)	0.3023	0.2703	0.0320	0.2966	0.0938	123.8%	1.9%	21.9%
Finland (1990)	0.2685	0.2253	0.0432	0.2188	0.1644	106.7%	1.0%	5.7%
France (1989)	0.3219	0.3065	0.0154	0.0620	0.2717	116.6%	1.9%	14.8%
Germany (1988)	0.2591	0.2312	0.0279	0.1108	0.2433	108.5%	1.3%	7.3%
Ireland (1987)	0.3870	0.3418	0.0452	0.1540	0.2685	108.2%	1.0%	7.3%
Italy (1991)	0.3248	0.3009	0.0239	0.1354	0.1554	102.0%	0.4%	1.6%
Netherlands (1992)	0.2846	0.2517	0.0329	0.1487	0.1977	104.9%	0.7%	4.2%
Spain (1990)	0.4083	0.3694	0.0389	0.1397	0.2545	106.1%	0.4%	5.7%
Sweden (1990)	0.3004	0.2608	0.0396	0.3270	0.0891	109.3%	1.5%	7.8%
Switzerland (1992)	0.2716	0.2541	0.0174	0.1210	0.1528	120.7%	1.7%	19.0%
U.K. (1993)	0.4121	0.3768	0.0352	0.1421	0.2278	107.1%	0.9%	6.3%
U.S. (1987)	0.4049	0.3673	0.0376	0.1370	0.2371	102.6%	0.4%	1.9%
OECD12 Average	0.3288	0.2963	0.0324	0.1661	0.1963	109.7%	1.1%	8.6%
Hyun & Lim (2005)								
Korea (1991)	0.3472	0.3246	0.0226	0.0652	0.4116	126.8	23.1%	3.7%
Korea (1996)	0.3368	0.3188	0.0180	0.0660	0.4016	157.4	49.5%	7.9%
Korea (2000)	0.4008	0.3790	0.0218	0.0691	0.4264	128.7	25.2%	3.5%
This article								
U.S. (1994)	0.3707	0.3251	0.0456	0.1344	0.3164	107.3%	0.4%	6.9%
U.S. (1999)	0.4028	0.3514	0.0514	0.1490	0.3016	102.7%	0.3%	2.3%
U.S. (2004)	0.3933	0.3482	0.0451	0.1224	0.3340	103.2%	0.4%	2.8%

For most of the OECD personal income taxes which Wagstaff *et al.* (1999) cover, differential tax treatment effects are far less important than progressivity.[27] The U.S. income tax in 1987 was fairly progressive by international standards. From our own findings, tax progressivity in the U.S. in 1994, 1999 and 2004 was higher than in all other countries except Korea. Compared to the OECD average, the U.S. income tax system was more progressive, and showed low *H* and *R* values, but had a relatively low tax burden. Korea's income tax has a relatively low redistributive effect because, as Hyun and Lim explain, of a low average rate despite high progressivity. Horizontal inequity is very high in Korea compared to the U.S. and also to other OECD countries. If horizontal inequity in the Korean income tax could be eliminated, redistributive effect would improve between 27 percent (1991) and 57 percent (1996).

[26] A major difference, however, is that Wagstaff *et al.* use National Medical Expenditure Survey data for the U.S., whereas we use CPS data.

[27] Wagstaff *et al.* conducted regression analysis, the results of which indicate that countries with income tax systems which rely heavily on tax credits and making extensive use of non-standard deductions are the most likely to exhibit high discrepancies between actual and potential redistributive effect.

7. Summary, implications and conclusions

We summarize here our main findings in respect of the U.S. tax and benefit system, in a series of bullet points and graphs. These show the richness of the conclusions which the Lambert (1985) and Urban and Lambert (2005) analysis is capable of:

- Inequality in market income has increased during the last ten years, and inequality in final income was higher in 2004 than in 1994. The redistributive effect of taxes and public transfers, as a proportion of market income inequality, slightly decreased overall.

- Public transfers alone reduced inequality in 2004 by 22.6 percent, and income tax with EITC reduced inequality by 6.8 percent. Public assistance including both cash and non-cash benefits, and means-tested cash transfer programs such as TANF and SSI, had lesser roles. Both property tax and payroll tax increased inequality because of their regressivity.

- Progressivity in all taxes taken together, and in the income tax alone, has gradually decreased, reducing the redistributive effect. On the other hand, the regressivity of overall benefits has strengthened. However, if only public assistance programs and means-tested cash transfers are considered, regressivity has gradually declined.

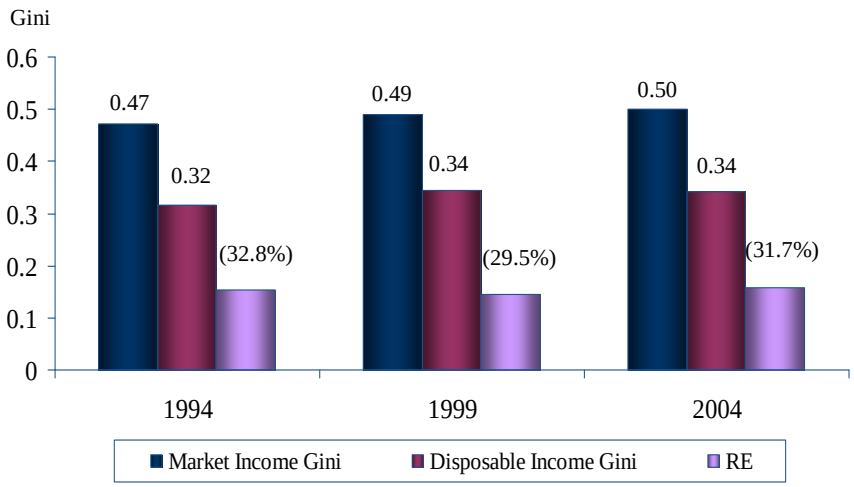
- Benefits contribute seven times more than taxes to reduce income inequality, and the role of benefits has increased since 1994. The impact of differential treatment in taxes and benefits has increased since 1999. Total redistributive effect could be increased 35 percent if horizontal inequity and, much more importantly, reranking in taxes and public transfers could have been eliminated in 2004.

- For taxes, redistributive effect is maximal in the case of income tax plus EITC. In the case of benefits, redistributive effect is maximal for public transfers. On the other hand, the income tax plus EITC is the most progressive among tax concepts, but has the lowest rate, whilst public transfers have the highest benefit rate and less regressivity than public assistance. Means-tested cash transfers have the highest regressivity, but they have little impact on inequality because of their relatively low rate.

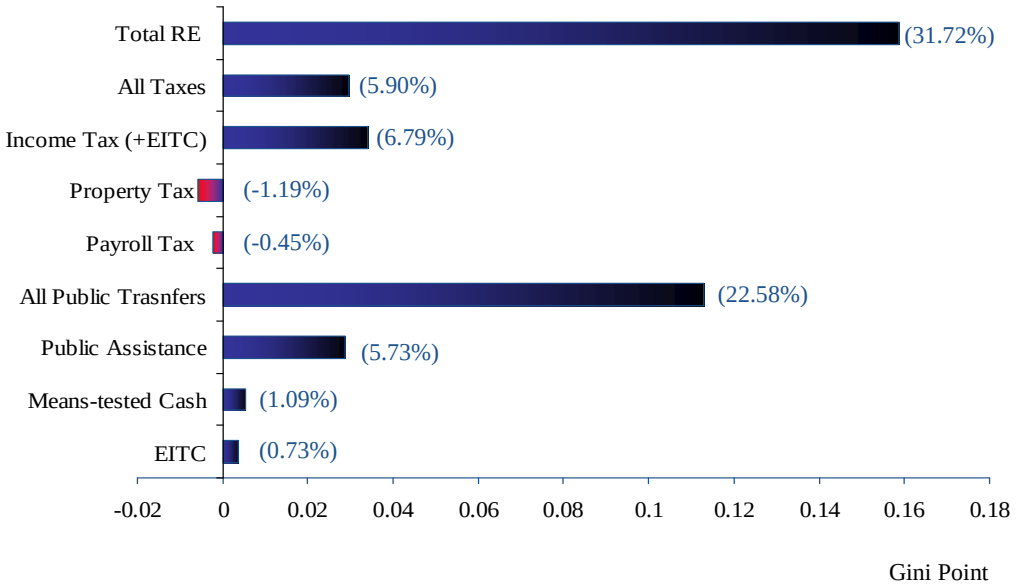
- The U.S. income tax system is more redistributive than the average of the OECD countries. It has more progressivity, but a lower average rate. Differential tax treatments

are low in the U.S. compared to other OECD countries. Korea's income tax system has twice the progressivity as the OECD average, but it has a lower redistributive effect due to seriously high horizontal inequity.

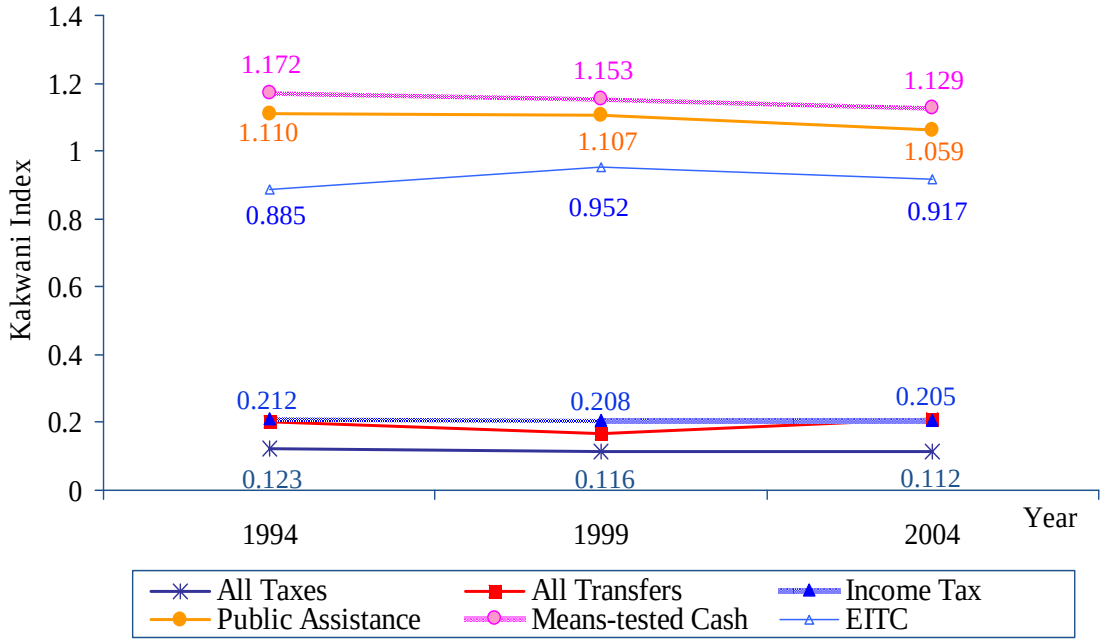
Graph 3. Trends in Income Inequality and Redistributive Effect



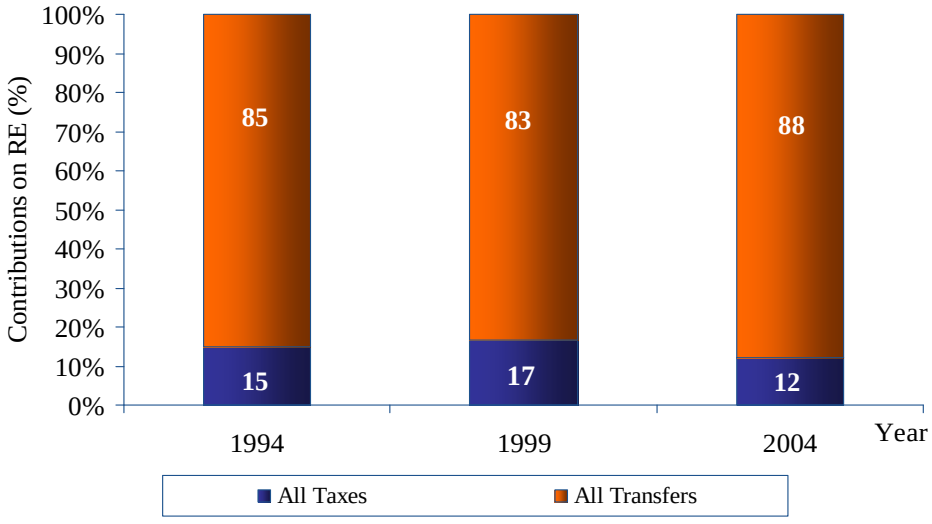
Graph 4. Redistributive Effect as a Proportion of Market Income Inequality, 2004



Graph 5. Trends in Progressivity and Regressivity



Graph 6. Contributions of Taxes and Transfers on Total Net Redistributive Effect



Graph 7. Discrepancies (%) between *V* and *RE* (equivalently, between $H + R^K$ and *RE*)

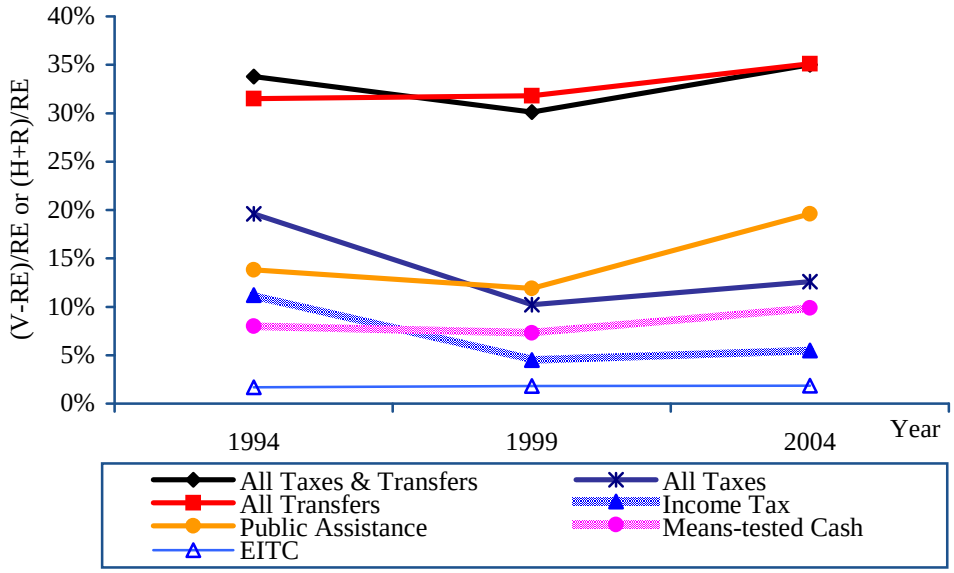


Table 13. Redistributive Effect of Different Parts of the Tax and Transfer System, 2004

	RE (%)	t or b (%)	P^K	$(H+R^K)(\%)$	Pro-Poor	Pro-Rich
All Taxes	5.9%	22.8%	0.11	12.6%	O	
Income Tax	6.8%	14.8%	0.21	5.5%	O	
Federal Income Tax	6.1%	11.4%	0.25	4.5%	O	
State Income Tax	0.9%	3.1%	0.14	2.8%	O	
Payroll Tax	-0.5%	6.4	-0.03	-5.2%		O
Property Tax	-1.2%	2.0%	-0.24	-17.6%		O
All Public Transfers	22.6%	21.0%	0.89	35.1%	O	
Public Assistance	5.7%	3.4%	1.06	19.6%	O	
Means-tested Cash	1.1%	0.5%	1.13	10.8%	O	
EITC	0.7%	0.4%	0.92	1.8%	O	

If policy-makers sought to improve redistributive effect to the exclusion of all other objectives, what could we advise as a result of this study? To improve the vertical stance of the U.S. tax system, the tax burden on the rich should be raised along with the average rate (i.e. total revenue). Horizontally, deductions and exemptions should be minimized and omitted sources should be taxed. Public transfers to support low income people directly will increase distributive justice as well as the quality of life. Of course, with non-income factors such as age, sex, and disability rather than income level determining eligibility for transfer programs, perceived horizontal inequity will remain.

The regressivities of payroll and property taxes evidently need to be reduced, and expanding the proportion of progressive direct taxes rather than indirect taxes will be desirable. Public assistance programs have decreased in both scale and redistributive effectiveness during the last ten years. There is a need to expand the proportion of public assistance in total welfare expenditures, and enhanced regressivity will also increase the redistributive effect.

Differential treatments reduce the actual redistributive effect of taxes and transfers a great deal, and are more significant in the public transfer system than in taxes. Tax incentives including allowances, deductions, and exemptions should be more systematized. If deductions and exemptions are designed to be interlocked according to income level or economic needs, rather than according to non-income factors, redistributive effect could also be improved.

However, these are complex issues and of course policy-makers have other objectives as well as equity. Some kinds of non-income-based eligibility criteria are necessary to achieve the benefit programs' other objectives.

There are some limitations related to the data used in this study. Indirect taxes are excluded,[28] and non-cash transfers that cannot be converted into market value directly, along with some other expenditures, are not available in the CPS data. In addition, the method of setting the appropriate bandwidth for close equals groups is not fully resolved theoretically, and the influence of outliers - extreme values of income, taxes or benefits – certainly influence results.[29]

Finally, wide agreement exists generally in public opinion that income inequality has increased in the U.S. during the last three decades, and our results conform with this view. Inequality has shown a secular increase, particularly from the 1970s to the early 1990s. Inequality, the redistributive effects of taxes and welfare expenditures and their vertical and horizontal characteristics, are important concerns for policy-makers. Quantitative information on these, such as we have achieved in this paper, are necessary inputs for the achievement of distributional equity.

28 According to Gruber (2005) taxes on consumptions, that is, consumption tax, sales tax and excise tax, occupy 38% of the State and local government tax revenues.

29 For this study we converted negative earnings and market incomes to zero. We used real values for the amounts of tax and benefits.

APPENDIX

In the table below, we define all of the component measures invoked by Urban and Lambert (2005) in their study of redistributive effect in the presence of close equals groups. The notation is that of UL, with links made in column 3 to the notation of this paper.

Redistributive Effect Index Measures according to the UL Methodology

Vector	Values and Ordering	Concentration coefficient	Measures
Pre-tax income: X	Order by pre-tax income (among exact pre-tax equals, by post-tax income)	$\mathbf{G_X}$: pre-tax Gini index	
Post-tax income : N_1	N_1-value is the actual post-tax income of a unit with pre-tax income given by X-value at same position (not necessarily increasing order)	$\mathbf{D_1}$: post-tax concentration index 1 (denoted $C_{X\text{-}T}$ in (4))	Kakwani's vertical effect: $\mathbf{V^K = G_X - D_1}$
N_2	Post-tax income vector ordered by by post-tax income. N_2-values do not correspond to the X-values at same positions.	$\mathbf{G_N}$: post-tax Gini index (denoted $G_{X\text{-}T}$ in (4))	Redistributive effect: $RE = G_X - G_N$ Kakwani-reranking : $\mathbf{R^K = G_N - D_1}$
N_3	Having defined close equals groups, order post-tax incomes by post-tax income within each group, and order the groups by pre-tax means	$\mathbf{D_3}$: post-tax concentration index 3	UL's within-group reranking: $R^{WG} = D_3 - D_1$
N_4	As for N_3 within groups, but order the groups themselves by post-tax means	$\mathbf{D_4}$: post-tax concentration index 4	UL's entire group reranking: $R^{EG} = D_4 - D_3$ Aronson et al 's reranking: $R^A = G_N - D_4$
$N_5 = X(1-t)$ $t = \frac{\sum T_i}{\sum X_i}$	Pre-tax income X reduced by the fraction t (mean tax of the group to which the unit belongs). No changes in order given in X	$\mathbf{D_5}$: post-tax concentration index 5	UL's vertical effect: $\mathbf{V = G_X - D_5}$ UL's horizontal effect : $\mathbf{H = D_1 - D_5}$
$N_6 = X(1-t)$	As for N_5 within groups, but order the groups themselves by post-tax means.	$\mathbf{D_6}$: post-tax concentration index 6	Aronson et al's vertical and horizontal effects: $V^A = G_X - D_6$, $H^A = D_4 - D_6 = D_3 - D_5$
N_T	Given by vector X – vector N_1	$\mathbf{D_T}$: post-tax concentration index of tax (denoted C_T in (4))	Kakwani index of progressivity : $\mathbf{P^K = D_T - G_X}$

Source: Adapted from Urban & Lambert (2005)

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