

## EFFECTS OF ADJUSTING DISTRIBUTION TABLES FOR FAMILY SIZE

Julie-Anne Cronin, Portia DeFilippes, and Emily Y. Lin

*This paper examines how adjusting for family size in distributional analysis affects the distribution of tax burdens. We find that average tax rates for low-income families fall and average tax rates for some high-income families rise when the measured ability to pay is adjusted for family size, and that there is less variation in average rates for middle-income families. We also find that the family size adjustment affects the distribution of certain tax expenditures. In a separate analysis, we measure the equivalence scale for families of four relative to single taxpayers implied by the individual tax code.*

*Keywords:* distributional analysis, tax burden, equivalence scale

*JEL Codes:* D31, H22, H24

### I. INTRODUCTION

According to the principle of vertical equity in taxation, individuals who have a higher ability to pay should contribute more in taxes than those who are less able to pay. The concept of vertical equity is often used to judge the “fairness” of a tax system. For example, President Barack Obama called the Buffett rule, which states that no household making over \$1 million should pay a smaller share of income in taxes than middle-class families pay, “a basic principle of tax fairness.”<sup>1</sup> To evaluate vertical equity, or “fairness,” of a tax system or reform options, researchers and policy analysts have studied the distribution of tax burdens across taxpayers with different abilities to pay.

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<sup>1</sup> The White House Blog, April 10, 2012, “White House Report—The Buffett Rule: A Basic Principle of Tax Fairness,” <http://www.whitehouse.gov/blog/2012/04/10/white-house-report-buffett-rule-basic-principal-tax-fairness>.

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Key to the distribution analyses is the method used to rank taxpayers according to their relative ability to pay. Cronin (1999) describes the ability-to-pay measure used by the Office of Tax Analysis (OTA), U.S. Department of the Treasury (Treasury) in its distribution model. While the exact elements included in the measure have changed over time, OTA's distribution model recognizes families as an economic and tax unit, and uses a broad-based measure of family income to rank taxpayers' ability to pay. It assumes that all members in a family pool resources and share expenses, and thus all members in a family have the same ability to pay. Because there is no variation in ability to pay across members within a family, the model places families, rather than individuals, into different ability-to-pay classes determined by family income. This measure of family income is not adjusted for family size. Hence, a family of four making \$50,000 is considered as having the same ability to pay as a single person family with the same income despite the apparent difference in consumption needs and economic well-being between the two families.<sup>2</sup>

This ability-to-pay measure results in a number of interesting policy implications for distributional analysis. First, in the absence of an adjustment for family size, low- and modest-income singles tend to be ranked at the bottom of the income distribution. However, policies that target low-income families often provide tax benefits to those who have significant consumption needs relative to income. With the targeted families not placed at the very low end of the income distribution, these policies may appear to be not delivering benefits to families with the least ability to pay. Second, in the absence of an adjustment for family size, family income roughly rises with family size. To the extent that certain tax expenditures vary with family expenses which depend on family size, the policies may be shown as providing more benefits to families with greater ability to pay. Finally, in the absence of an adjustment for family size, families across all levels of consumption needs may be placed in the same ability-to-pay class. With many provisions in the tax code affecting families differently based on family size, there may be a large dispersion of tax burdens across families with the same measured ability to pay, or lack of differentiation in tax burdens between families with different abilities to pay, consequently impacting the perceived fairness of the tax system.

In this paper, we investigate the empirical importance and policy relevance of these distributional issues. We estimate the distribution of tax burdens using two ability-to-pay measures to place families in different ability-to-pay classes: (1) family income as described above, and (2) family income adjusted for size. We adopt a commonly used size adjustment in the poverty and income inequality literature that accounts for economies of scale in family consumption. In a separate analysis, we show the disparate tax liabilities facing single-person and four-person families and measure the equivalence scale implied by the individual tax code following a methodology similar to Muellbauer and van de Ven (2004).

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<sup>2</sup> Many characteristics in addition to size affect a family's consumption needs and economic well-being. For example, cost-of-living and age composition of family members are among the contributing factors. While the effects of these factors can be quantified, they are beyond the scope of this paper.

The paper is organized as follows. Section II describes OTA's current measure of ability to pay and the distribution of families and individuals. Section III briefly reviews the equivalence scale literature and the use of such scales in distributional analysis. Section IV uses a common equivalence scale to illustrate the effect of family size adjustments on distributional analysis in general, as well as the distribution associated with the tax benefits of certain tax expenditures and extending various tax cuts enacted since 2001. Section V estimates the equivalence scale implied by the individual income tax code. Section VI concludes.

## II. CURRENT METHODOLOGY

Treasury uses a cash concept to measure ability to pay. Cash income consists of wages and salaries (net of employer and employee contribution to retirement accounts), employer contributions to health insurance, net income from a business or farm, taxable and tax-exempt interest, dividends, rental income, realized capital gains, cash transfers from the government (including food stamps), and retirement distributions. Employer contributions for payroll taxes and the federal corporate income tax are added to place cash on a pre-tax basis. Cash income is shown on a family basis.<sup>3</sup>

Table 1 shows the distribution of families, individuals and family size at 2013 income levels. Families are ranked by decile so there are an equal number of families per decile. The lowest decile excludes families with negative income but even with this adjustment, the lower deciles have the fewest individuals.<sup>4</sup> The average family size in the lowest decile is 1.3 which is less than half the average family size of the 9<sup>th</sup> and highest deciles.

Income increases with family size both because larger families have multiple sources of income (e.g., multiple wage earners as opposed to a single earner) and because the wage earners in larger families (parents of dependent children) are more likely to be at the peak of their lifecycle income as opposed to just starting a career or in retirement. About 45 percent of all families are single-person families. Yet, 77 percent of the lowest income decile is composed of single-person families compared to only 11 percent of the highest income decile. In contrast, 9 percent of all families are four-person families, but only 1 percent of the lowest income decile and 4 percent of the second lowest income decile is composed of four-person families compared to 21 percent of the highest income decile.

The cash income ranking in Table 1 does not adjust for the differing consumption needs of larger families. When these needs are accounted for, the ability to pay of some

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<sup>3</sup> Cash income is computed on Treasury's Individual Tax Model (ITM) and individual income and payroll tax changes are simulated directly in the ITM. The distribution of corporate tax is derived from the ITM's capital and labor income distributions, and the distribution of excise taxes is derived from the ITM's factor income and consumption distributions. Cronin (1999) provides a general description of Treasury's distribution methodology and Cronin et al. (2012) describe Treasury's updated methodology for distributing the corporate income tax.

<sup>4</sup> Families with negative income are included in the lowest decile for the purpose of determining decile breaks but are otherwise only included in the total.

**Table 1**  
**Distribution of Family Size and Type by Deciles of Cash Income under Current Methodology**

Cash Income Decile	Families (Millions)	People (Millions)	Average Family Size	Distribution within Decile of Families of Different Sizes (%)							Total		
				Family Size = 1			Family Size = 2		Family Size = 3			Family Size = 4	
				Family Size = 1	1 Taxpayer & 1 Dependent	2 Taxpayers	Family Size = 3	Family Size = 4	Family Size = 5+	Family Size = 4		Family Size = 5+	
Lowest	14.8	19.9	1.3	76.6	11.9	3.2	6.3	1.3	0.7	100.0			
2nd	15.4	24.2	1.6	66.5	13.8	4.2	9.6	4.2	1.7	100.0			
3rd	15.4	27.5	1.8	57.3	13.9	5.6	14.9	5.4	2.9	100.0			
4th	15.4	28.6	1.9	57.1	11.6	7.2	12.9	6.7	4.5	100.0			
5th	15.4	29.3	1.9	53.3	11.8	11.4	11.8	6.5	5.2	100.0			
6th	15.4	31.1	2.0	45.5	12.2	17.4	12.4	6.9	5.7	100.0			
7th	15.4	34.0	2.2	37.0	10.2	25.0	11.9	8.6	7.2	100.0			
8th	15.4	37.5	2.4	26.0	6.7	31.3	15.4	12.5	8.0	100.0			
9th	15.4	41.8	2.7	16.0	3.6	35.6	17.5	17.5	9.8	100.0			
Highest	15.4	44.4	2.9	11.2	2.0	36.3	17.9	21.3	11.2	100.0			
Total	154.3	319.5	2.1	44.5	9.8	17.8	13.1	9.1	5.7	100.0			

middle-income larger families in Table 1 will be shown to be more similar to those of some lower-income singles. Because our family size adjustment assumes some economies of scale (and because of lifecycle effects), larger families are still likely to be overrepresented in the upper income deciles, even after we adjust for income.

### III. EQUIVALENCE SCALES

To adjust a family's ability to pay for its size, a common approach is to divide family income by an equivalence scale to account for economies of scale in family consumption. A family exhibits no economies of scale if, to maintain the family's ability to pay, each additional family member requires the same amount of resources as the first family member does. In this case, the equivalence scale is equal to the family size so that a family of 5 making \$50,000 is considered as having the same ability to pay as a family of 1 making \$10,000. At the other extreme, a family exhibits perfect economies of scale if adding an additional member to the family does not require any additional resource for the family to maintain its ability to pay. In this case, the equivalence scale is 1, suggesting that a family of 5 making \$50,000 has the same ability to pay as a family of 1 making \$50,000. Perfect economies of scale are the implicit assumption in a distribution analysis that ranks families by income without adjusting for size.

The poverty and income inequality literature uses less extreme equivalence scales but the scales adopted vary widely across studies depending on the assumed economies of scale in family consumption. Buhmann et al. (1988) review over 30 equivalence scales developed in various income studies or transfer programs across countries. The authors summarize the different equivalence scales by an elasticity with respect to family size, following the equation  $\text{Equivalence Scale} = (\text{Family Size})^e$ , where  $e$  is the family size elasticity (FSE). The two extreme cases mentioned above — no economies of scale and perfect economies of scale — have an FSE of 1 and 0, respectively. Between these upper and lower bounds, the implicit elasticity of the 34 equivalence scales reviewed by the authors ranges from 0.12 to 0.84. For example, for the United States, the implicit elasticity is 0.38 based on 1972–1973 family expenditure data, 0.56 for the official poverty measure, and 0.72 based on family budgets developed by the Bureau of Labor Statistics. The authors find that choice of equivalence scale affects countries' rankings in poverty and income inequality.

Given the illustrative purposes of our paper, we choose an FSE of 0.5 to show the effects of size adjustment on distributional analysis. As noted in Nunns et al. (2008), the U.S. poverty thresholds show increasing returns to scale for smaller families and relatively constant returns to scale for larger families, and an elasticity of 0.5 represents a "smoothed" adjustment across families of all sizes. The authors adopt an elasticity of 0.41 to evaluate the distribution of tax burdens across individuals using a panel tax model. They explain that an elasticity of 0.41 is close to the average elasticity across all poverty thresholds when the population is weighted but a larger elasticity is necessary to approximate the official poverty thresholds for larger families.

Several researchers choose an FSE of 0.5 to demonstrate the effects of family size adjustment on distributions of tax incidence and trends in income inequality. For example, Williams, Weiner, and Sammartino (1998) consider five income adjustments,<sup>5</sup> including one with an FSE of 0.5, and find significant movements of families across income classes under different adjustments. However, the authors find that trends in the distributional effects of federal taxes, measured by effective tax rates and Gini coefficients, change little under the different adjustments. A recent paper by Burkhauser, Larrimore, and Simon (2012) uses an FSE of 0.5 and shows that moving from unadjusted to size-adjusted income results in very different distributional patterns in the relative benefits of health insurance tax exclusions.<sup>6</sup> Specifically, with the adjustment, the relative benefits for families in the bottom three income quintiles rise and the relative benefits for the top quintile fall significantly.

An FSE of 0.5 is also commonly used by other tax policy groups. The Congressional Budget Office uses an FSE of 0.5 in its historical analyses of effective federal tax rates (Congressional Budget Office, 2009). The Tax Policy Center (TPC) uses an FSE of 0.5 in some of the detail tables in which it adjusts for family size.<sup>7</sup> Finally, recent publications by the Organisation for Economic Co-operation and Development have adopted an FSE of 0.5 (Organisation for Economic Co-operation and Development, 2008).

#### IV. POLICY IMPLICATIONS

##### A. Re-ranking of Families

In this section, we consider the empirical and policy implications of choosing an equivalence scale that adjusts for family size. For illustrative purposes we have chosen to use an FSE of 0.5 and a scale that does not differentiate between children and adults. As discussed above, an FSE of 0.5 is commonly used and, although the exact form of the “best” scale may still be an open empirical question, an FSE of 0.5 clearly reflects differences in consumption needs better than not adjusting for family size at all (that is, assuming an FSE of 0). Our intention is to test whether a commonly used family size adjustment has a significant impact on the distribution of tax burdens.

Table 2 gives examples that show the magnitudes of the income adjustments that occur when we use an FSE of 0.5. With an FSE of 0.5, family income is divided by the square root of family size to arrive at a size adjusted or equivalent income. A single

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<sup>5</sup> In addition to family size, some adjustments considered by the authors account for the difference between adults and children in contribution to household consumption. Cutler and Katz (1992) discuss the various adjustments.

<sup>6</sup> The benefits include tax exclusions of the ex-ante insurance value of Medicare, Medicaid, and employer-provided health insurance.

<sup>7</sup> For example, see Tax Policy Center, “H.R. 3630: The Middle Class Tax Relief and Job Creation Act of 2012,” <http://www.taxpolicycenter.org/numbers/displayatab.cfm?Simid=429>.

**Table 2**  
Examples of Equivalent Families Under 0.5 Family Size Elasticity

Family size	Cash Income (\$)	Cash Income Decile	Cash Equivalent Income (\$)	Cash Equivalent Income Decile
1	10,000	2	10,000	2
2	14,142	2	10,000	2
3	17,321	3	10,000	2
4	20,000	3	10,000	2
1	25,000	3	25,000	4
2	35,355	4	25,000	4
3	43,301	5	25,000	4
4	50,000	6	25,000	4
1	50,000	6	50,000	7
2	70,711	7	50,000	7
3	86,603	8	50,000	7
4	100,000	8	50,000	7
1	75,000	7	75,000	9
2	106,066	9	75,000	9
3	129,904	9	75,000	9
4	150,000	9	75,000	9
1	125,000	9	125,000	10
2	176,777	10	125,000	10
3	216,506	10	125,000	10
4	250,000	10	125,000	10

person with cash income of \$25,000 is calculated to have the same ability to pay (and is ranked the same) as a family of 2 with \$35,355 of cash income, or a family of 3 with \$43,301 of cash income, or a family of 4 with \$50,000 of cash income. Using the cash equivalent income, we re-rank families into 10 ability-to-pay classes, with each decile containing the same number of families. The single person with \$25,000 of income moves up from the 3<sup>rd</sup> income decile in the cash income distribution to the 4<sup>th</sup> decile in the cash equivalent income distribution. The family of 4 with \$50,000 of income moves down from the 6<sup>th</sup> decile of the cash income distribution to the 4<sup>th</sup> decile of the cash equivalent income distribution.

Table 3 shows how families in each cash decile are re-ranked across cash equivalent deciles. The large majority (88.8 percent) of families in the lowest decile of the cash income distribution remain in the lowest decile of the cash equivalent income distribution. Likewise at the other extreme of the income distribution, the large majority (82.1 percent) of families in the top 1 percent of the cash income distribution remain in the top 1 percent of the cash equivalent income distribution. About 69 percent of families in the 95<sup>th</sup> to 99<sup>th</sup> percentiles, and 63 percent of families in the second decile, of the cash income distribution remain in the same class under cash equivalent income.

Outside of the tails of the distribution, however, there is considerable re-ranking. Less than half of the families in the middle income deciles of the cash income distribution remain in the same position — i.e., most families move up or down the distribution — after families are re-ranked by size-adjusted income. Less than 20 percent of families in the 5<sup>th</sup> and 6<sup>th</sup> deciles remain in the same income classes. For example, only 19.9 percent of all families in the 6<sup>th</sup> decile of the cash income distribution remain in the 6<sup>th</sup> decile of the cash equivalent income distribution. About 36 percent of the families originally in the 6<sup>th</sup> decile move up to the 7<sup>th</sup> decile; 9.2 percent move up to the 8<sup>th</sup> decile; 22.7 percent move down to the 5<sup>th</sup> decile; 11.1 percent move down to the 4<sup>th</sup> decile; and 0.8 percent move down to the 3<sup>rd</sup> decile.

Table 4 shows the distribution of families, individuals, and family size by cash equivalent income deciles. In contrast to Table 1, average family size is around 2 for all deciles except the lowest decile which is higher than it had been but still less than 2. With the adjustment for family size, one-person families become less represented in the lower half of the income distribution and more represented in the top half of the distribution. The share of one-person families in the bottom income decile declines from 76 to 65 percent (still above the overall average of 45 percent) and the share in the top income decile increases from 11 to 28 percent. The pattern is reversed for larger families as they become more represented in the lower end and less represented in the higher end. For example, the top equivalent income decile is composed of only 16 percent of families with 4 or more persons, including 11 percent of families of 4 members and 5 percent of families of 5 or more members. This percentage of large families is close to the overall average of 14.8 percent and represents a drop by 17 percentage points from 33 percent in the top income decile of the original cash distribution.

## B. Baseline Distribution

Changes in decile rank will not necessarily change the distribution of income and tax burdens. For example, to the extent that families that move lower in the distribution of cash equivalent income have the same average tax rates as those that move higher, the distribution of average tax rates across or within deciles may be unchanged. The next two figures address how changing family ranks changes the distribution of effective rates. Figure 1 shows the distribution of average effective tax rates for federal individual income taxes. The dashed line shows average rates for deciles of family cash income



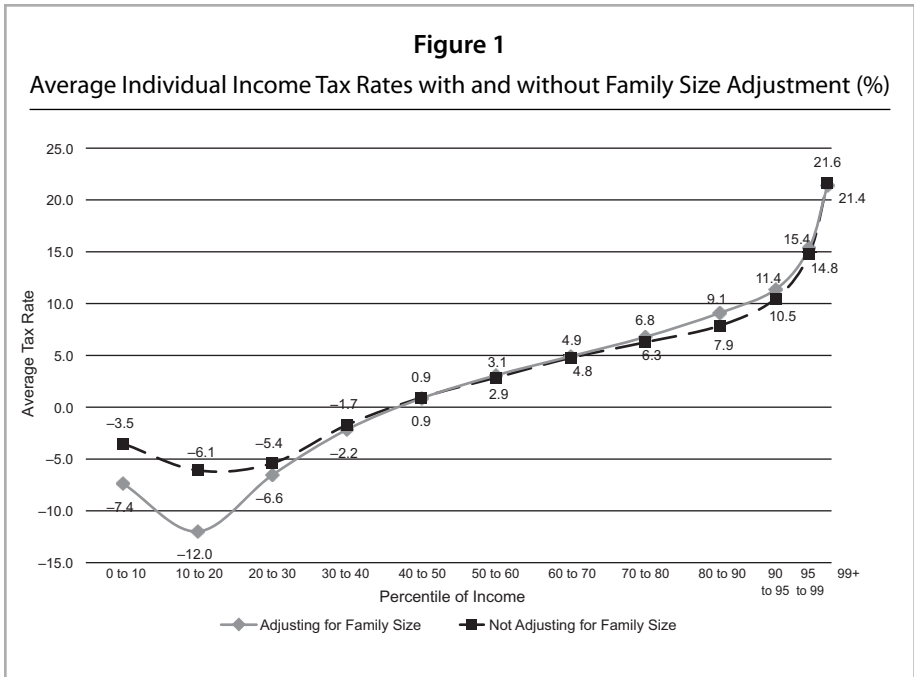
**Table 3**  
 Percentage of Families in Cash and Cash Equivalent Income Classes (%)

Cash Income Percentiles	Cash Equivalent Income Percentiles										Total	
	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100		
0 to 10	88.8	11.2										100.0
10 to 20	11.1	62.5	26.4									100.0
20 to 30		23.1	40.9	35.9								100.0
30 to 40		3.2	24.6	27.1	45.1							100.0
40 to 50			7.3	23.3	18.2	45.9	5.4					100.0
50 to 60			0.8	11.1	22.7	19.9	36.3	9.2				100.0
60 to 70				2.5	12.1	21.6	26.8	28.5	8.4			100.0
70 to 80				0.1	1.8	11.7	22.5	35.7	27.0	1.2		100.0
80 to 90					0.1	0.9	9.0	24.7	44.9	17.9	2.4	100.0
90 to 95							0.2	3.7	37.0	42.8	16.4	100.0
95 to 99									2.9	23.7	68.9	100.0
99 to 100										17.9	82.1	100.0

Notes: Cash deciles begin at: 2<sup>nd</sup> \$8,501; 3<sup>rd</sup> \$17,024; 4<sup>th</sup> \$25,748; 5<sup>th</sup> \$35,628; 6<sup>th</sup> \$46,630; 7<sup>th</sup> \$60,051; 8<sup>th</sup> \$78,139; 9<sup>th</sup> \$104,905; and 10<sup>th</sup> \$152,930. Cash equivalent deciles begin at: 2<sup>nd</sup> \$7,009; 3<sup>rd</sup> \$13,363; 4<sup>th</sup> \$19,998; 5<sup>th</sup> \$27,791; 6<sup>th</sup> \$36,015; 7<sup>th</sup> \$45,330; 8<sup>th</sup> \$56,778; 9<sup>th</sup> \$72,817; and 10<sup>th</sup> \$102,842.

**Table 4**  
 Distribution of Family Size and Type by Deciles of Cash Equivalent Income  
 (Family Size Elasticity of 0.5)

Cash Equivalent Income Decile	Distribution within Decile of Families of Different Sizes (%)									
	Families (Millions)	People (Millions)	Average Family Size	Family Size = 2					Total	
				Family Size = 1	1 Taxpayer & 1 Dependent	2 Taxpayers	Family Size = 3	Family Size = 4		Family Size = 5+
Lowest	14.8	23.8	1.6	65.0	14.6	3.7	10.2	4.3	2.2	100.0
2 <sup>nd</sup>	15.4	31.0	2.0	51.3	14.4	4.6	16.6	7.4	5.7	100.0
3 <sup>rd</sup>	15.4	32.8	2.1	47.8	13.7	6.4	16.1	8.7	7.3	100.0
4 <sup>th</sup>	15.4	33.3	2.2	47.8	12.6	8.6	14.4	8.5	8.1	100.0
5 <sup>th</sup>	15.4	31.6	2.0	47.2	12.3	13.6	12.5	7.9	6.5	100.0
6 <sup>th</sup>	15.4	31.6	2.0	45.9	10.7	17.7	10.5	9.1	6.2	100.0
7 <sup>th</sup>	15.4	32.5	2.1	41.7	8.1	22.4	11.6	10.3	5.9	100.0
8 <sup>th</sup>	15.4	33.5	2.2	37.8	5.6	26.5	13.0	11.6	5.6	100.0
9 <sup>th</sup>	15.4	33.8	2.2	33.3	3.6	33.4	13.4	11.8	4.6	100.0
Highest	15.4	34.4	2.2	28.4	2.4	40.4	12.7	11.5	4.7	100.0
Total	154.3	319.5	2.1	44.5	9.8	17.8	13.1	9.1	5.7	100.0



and the solid line shows average rates for deciles of family cash equivalent income.<sup>8</sup> Average tax rates are measured as individual income taxes under the Administration’s 2013 adjusted baseline divided by cash income (2013 income level).<sup>9</sup> This rate represents the share of pre-tax income paid in individual income taxes by all families within the same ability-to-pay class.

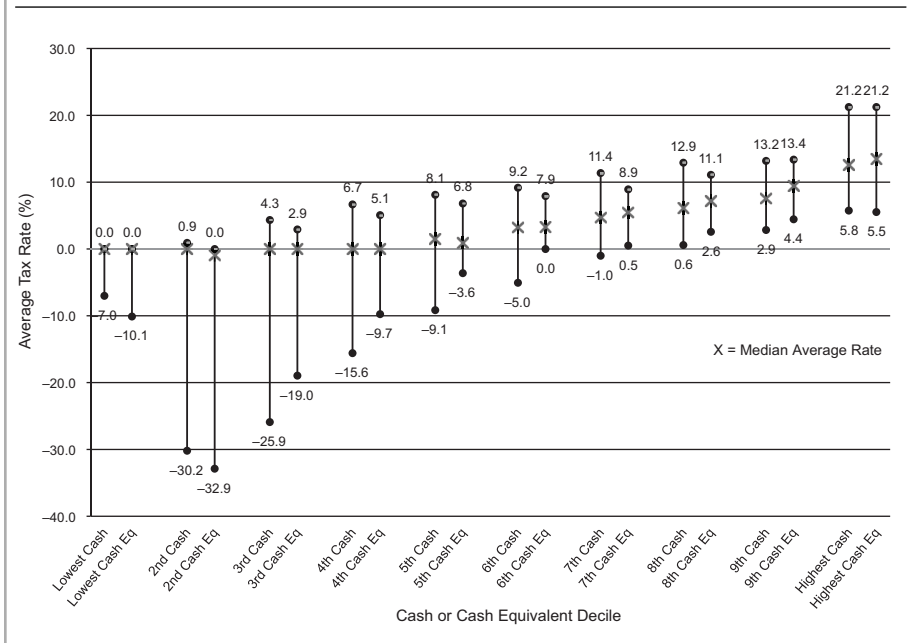
The effective tax rates decline at the bottom of the distribution when families are ranked by equivalent income. Low-income working families are eligible for the earned income tax credit (EITC). The EITC increases with family size. Likewise, the partially refundable child tax credit is based on the number of children in the family. Adjusting family income for family size places these larger families with relatively large EITCs and refundable child tax credits lower in the distribution, thereby reducing the effective rates at the bottom of the income distribution. Adjusting family income for family size also places higher-income singles higher in the distribution of income, consequently increasing average tax rates for upper middle income families.

<sup>8</sup> Calculations are for each decile and for the 90<sup>th</sup> to 95<sup>th</sup> percentiles, 95<sup>th</sup> to 99<sup>th</sup> percentiles, and top 1 percent. The point estimates are joined to create a smooth line but each point on the line has not been separately calculated.

<sup>9</sup> The 2013 adjusted baseline assumes permanence of the 2001 and 2003 tax cuts, extends the EITC marriage penalty relief and the expanded additional child tax credit enacted in the American Recovery and Reinvestment Act of 2009 (ARRA), and includes an AMT patch.

Figure 2 shows the distribution of average individual income tax rates for each unadjusted and adjusted income decile. We calculate the average tax rate for each family and measure the rate dispersion over all families within each decile. For each decile, the figure shows the range of rates from the lowest 10<sup>th</sup> percentile of average rates to the 90<sup>th</sup> percentile of average rates. The median rate is marked with an X. There is a marked reduction in variance in average rates in the 3<sup>rd</sup> through 9<sup>th</sup> deciles of income when income is adjusted for family size. Without the adjustment for family size, average rates for the 5<sup>th</sup> income decile range from -9.1 percent to +8.1 percent, a range of 17 percentage points. With the size adjustment, average rates range from -3.6 to percent to +6.8 percent, a range of 10.4 percentage points. Large families, because they are deemed to have a lower ability to pay, benefit from many provisions in the tax code. Without the adjustment for family size, these families appear to be relatively better off than they are and appear to be enjoying much lower rates than families in the same cash income class. Likewise, without the size adjustment, small families appear to be relatively worse off with higher rates than families in the same cash income class. When the ability to pay is better measured, the variance in effective rates within a size-adjusted income class is reduced.

**Figure 2**  
Distribution of 10th to 90th Percentile Average Individual Income Tax Rates Under Cash and Cash Equivalent Income



Interestingly, with the family size adjustment, the variation in rates increases slightly at the bottom of the income distribution and changes very little at the top of the distribution. The lower deciles of the cash income distribution are composed of families with relatively high shares of transfer income relative to labor or capital income. The family size adjustment shifts larger families with labor income into the lower deciles. While transfer income is lightly taxed (if at all), having earnings qualifies families for the EITC. When larger families with EITCs move to lower deciles, the variation in effective rates in these deciles rises because the lower deciles now include a greater mix of families with mostly (untaxed) transfer income and others with low earnings but relatively high refundable tax credits.

For the highest income families, there is considerable variation in average rates but the range of variation appears unrelated to family size. Although the median tax rate for the highest income decile increases when family income is adjusted for family size, the range of rates is unchanged by the family size adjustment. There are a number of sources of low rates for very high income taxpayers. First, some high income families have more tax-preferred sources of income (e.g., tax exempt interest and qualified capital gains and dividends) than other high income families that have mainly labor income. Second, the level of itemized deductions varies widely among high income families, and third some high income families are eligible for foreign tax credits. These sources of variation are largely unrelated to family size. Hence, although some smaller families with relatively high average tax rates move from the 9<sup>th</sup> decile into the highest decile and some larger high income families with lower than average rates move from the highest decile into the 9<sup>th</sup> decile, some high income families who remain in the highest income decile still enjoy relatively low average rates.

### C. Policy Proposals

To measure the distributional effects of family size adjustments on tax reform, we estimate the change in after-tax income associated with the benefits of certain tax expenditures. We find that the increases in after-tax income associated with the state and local tax deduction, the charitable giving deduction, and preferential rates for capital gains and dividends change very little with the adjustment for family size. For the home mortgage interest deduction, the value of the home mortgage interest deduction rises as a percentage of income<sup>10</sup> for upper middle income families and falls slightly for the highest income decile with the family size adjustment. The biggest change, as expected, however, is with the distribution of the EITC and the child credits. For these credits, Figure 3 shows larger tax benefits as a percentage of income for the lowest income classes and smaller benefits as a percentage of income for middle income families when the income ranking is adjusted for family size.

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<sup>10</sup> The change is small, about 0.1 or 0.2 percentage points.

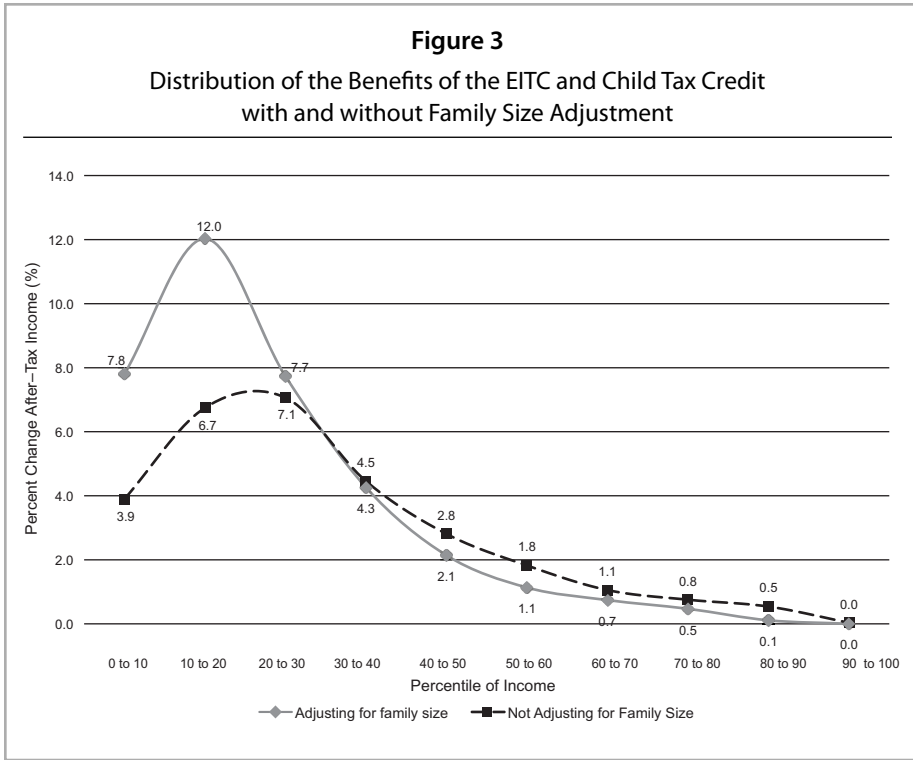
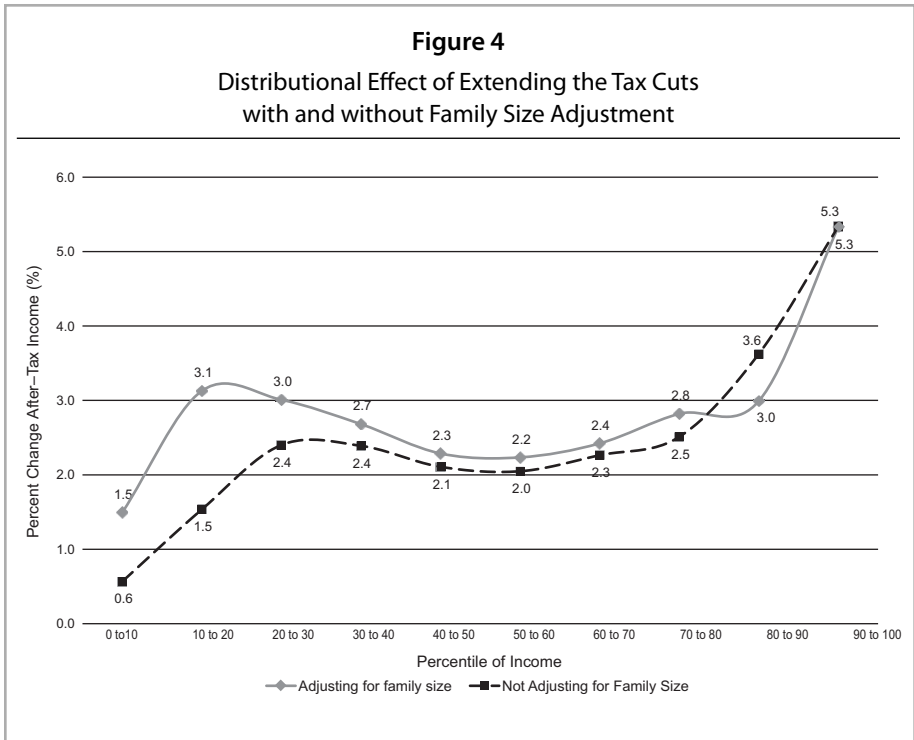


Figure 4 shows the change in after-tax income associated with extending the 2001 and 2003 tax cuts with and without the family size adjustment. Some of the major provisions of the 2001 and 2003 tax cuts include expanding the child credits, creating a 10 percent rate bracket, decreasing marriage penalties, and lowering the tax rate on capital gains and dividends. This figure also captures the effects of the AMT patch as well as the effects of the EITC marriage penalty relief and expanded additional child tax credit in the American Recovery and Reinvestment Act of 2009 (ARRA).

The dotted line in Figure 4 shows the change in after-tax income by income decile without adjusting for family size. The increase in after-tax income is less than 2 percent for the bottom two income deciles, 3.6 percent for the 9<sup>th</sup> income decile, and as high as 5.3 percent for the top income decile. For the other income deciles, the increase in after-tax income ranges from 2 to 2.5 percent. The adjustment for family size (solid line) results in higher increases in after-tax income for the lower income deciles, slightly higher increases in after-tax income for the middle income deciles, smaller increases in after-tax income for the 9<sup>th</sup> income decile, and unchanged increases in after-tax income for the highest income decile. Although the percentage change in after-tax income



increases for the bottom 80 percent of the income distribution after the adjustment for family size, the top decile still experiences the largest increase in after-tax income under the extension of the tax cuts.

**V. ESTIMATING EQUIVALENCE SCALE FOR THE INDIVIDUAL TAX CODE**

The previous section demonstrates that, as families are shifted across income deciles due to a family size adjustment, the distribution of tax burdens could change within an income class as well as across incomes classes. Implicit in this result are different tax burdens for families of different sizes. In this section, we quantify the difference in tax burdens between one-person and four-person families arising partly from the various provisions in the code that depend on family size. As Muellbauer and van de Ven (2004) point out, this difference provides a source of information for identifying the implicit value judgments made by policymakers regarding the needs of heterogeneous households. Using the tax difference between one-person and four-person families, we then estimate the equivalence scale implicit in the tax code. For illustrative purposes,

our analysis includes only these two types of families. The analysis can be extended to other family types and this type of analysis could be a valuable tool for comparing the effects of various proposals in achieving a target adjustment of tax liabilities for family size.

The tax code recognizes that a family's ability to pay depends on its needs and responsibilities and hence many provisions in the code affect liabilities differently based on family size and composition. The value of the standard deduction depends on filing status. Personal exemptions increase with the number of persons in the tax unit. The widths of rate brackets vary by filing status and are generally larger for joint and head of household filers than single filers. The benefits of the child tax credit depend on the number of qualifying children. The EITC increases with the number, up to three under current law, of EITC-qualifying children. The amount of expenses eligible for the child and dependent care tax credit for taxpayers with two or more dependents is twice the amount of eligible expenses for taxpayers with one dependent. In addition, larger families incur more expenses or have greater saving needs for education and health care expenses, for which the tax code provides various tax benefits. As a result of these income adjustments and tax subsidies, federal income tax liabilities at a given income level can vary widely across families of different sizes and compositions.

Figure 5 illustrates the resulting tax differences between single-person families, defined as single taxpayers without dependents, and four-person families, defined as joint-filing married couples with two children living at home. The figure shows average tax rates by income class for each of these two family types. We extract non-elderly families from OTA's Individual Tax Model (ITM) and, for each family type, calculate the average federal income tax rate for every \$500 interval of the modified adjusted gross income (MAGI) under the 2013 adjusted baseline law.<sup>11</sup> We then use a non-parametric estimation to fit the resulting average rates on a smoothed line for each family type and depict the smoothed lines in Figure 5.

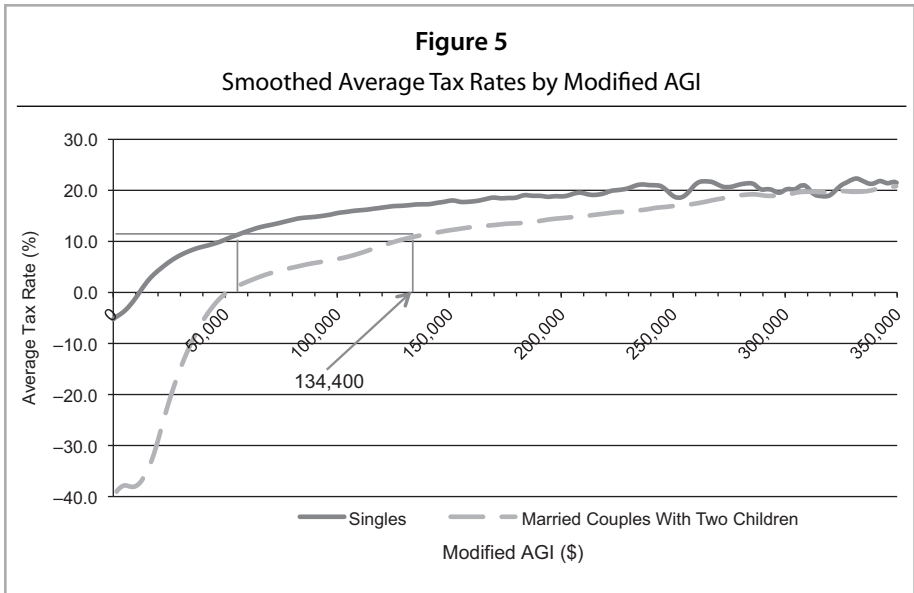
The figure shows that single-person families have a higher average tax rate than four-person families throughout the MAGI range up to about \$300,000. Above that income level, the two types of families have approximately equal tax liabilities.<sup>12</sup> Families have negative average tax rates because of refundable tax credits. The figure shows that the average individual income tax rate is zero at about \$12,000 of income for single-person families, and at about \$51,000 of income for four-person families. The average individual income tax rate is 11 percent at an income of about \$53,000 for single-person families, and at about \$134,400 for families of four (their weighted average income).

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<sup>11</sup> Tax exempt interest is added to adjusted gross income (AGI) to arrive at the modified AGI (MAGI). Tax rate is federal income tax liability divided by MAGI. Families with a negative MAGI are excluded from the calculation.

<sup>12</sup> The x-axis is truncated at \$350,000 to show details below this income level. The two lines roughly merge over the higher-income levels because four-person and single-person families have similar tax liabilities above an income of \$300,000.

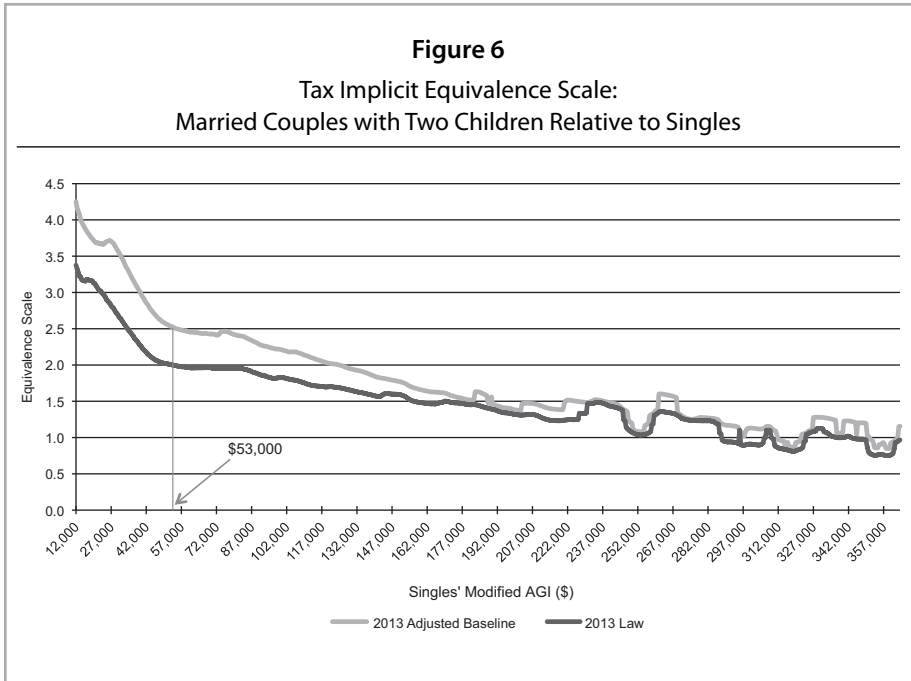




The lines converge at an average individual tax rate of about 20 percent and an income of about \$300,000.

We conduct the same analysis for 2013 law, under which the 2001 and 2003 tax cuts, the AMT patch, and the EITC marriage penalty relief and expanded refundable child tax credit in the ARRA expire. We use the results of tax-equivalent incomes to infer the equivalence scales implied by the two tax laws. Figure 6 depicts the implicit equivalence scale by singles' incomes between \$12,000 and \$350,000. For the adjusted baseline law, the implicit scale roughly declines from 4.3 (\$51,000/\$12,000) for an income of \$12,000 to 1 for \$300,000 and then fluctuates around 1 above that income level. The line for 2013 law generally lies below the adjusted baseline, implying a less generous treatment of larger families under the 2013 law. The implicit equivalence scale begins at 3.4 for an income of \$12,000, declines to 1 for an income of \$285,000, and then fluctuates around 1 above that income level. The higher equivalence scale associated with extending the tax cuts, particularly for low- and middle-income families, reflects the value judgment implied by the adjusted baseline law that there is a greater ability-to-pay differential between large and small families.

We then measure the equivalence scales implied by the two tax laws at a given income for single filers. As illustrated above, under the adjusted baseline law, an income of \$53,000 for singles is tax-equivalent to an income of \$134,400 for families of four where both families have an average tax rate of 11 percent. These incomes suggest an equivalence scale of 2.5 or a family size elasticity of 0.65. At \$53,000 of singles' income, the average tax rate is 12 percent and the tax-equivalent income for families of



four is \$106,000 under 2013 law. These incomes suggest an equivalence scale of 2.0 or a family size elasticity of 0.5 for 2013 law. Hence, a family of four earning \$106,000 is considered to have the same ability to pay as a single person earning \$53,000 under 2013 law, but it takes \$134,400 for a family of four to have the same ability to pay as the single person under the extension of the tax cuts.

**VI. CONCLUSION**

“Fairness” is a key element of good tax policy. It is generally believed by both policymakers and average citizens that the tax code should be vertically and horizontally equitable. Families that are more able to pay taxes should pay more and families equally able to pay taxes should pay at the same rate. The tax code reflects these general rules but many distributional analyses fail to account for variation in consumption needs when measuring ability to pay. As a result, some families that are less able to pay are misclassified as being more able to pay. This paper uses a family size adjustment to more accurately measure ability to pay. We find that effective individual income tax rates decline at the bottom of the income distribution when income is adjusted for family size. In addition, there is less variation in effective rates for middle income families when income is adjusted for family size. The family size adjustment also affects the

distribution of certain tax expenditures, including the home mortgage interest deduction, child credits, and the ETIC as well as the distribution of tax benefits associated with extending the various tax cuts enacted since 2001.

In a separate analysis, we show the effect of these tax cuts on reducing the tax burden for large families relative to small families by measuring the increase in the tax-equivalent income for four-person relative to one-person families as a result of the tax cuts. We find that the tax cuts enacted since 2001 are relatively more generous to larger families than single persons. Without the tax cuts, a family of four could have about twice the income of a single-person family earning \$53,000 and pay the same individual income tax rate. With the tax cuts, a family of four could have 2.5 times the income of the single-person family and have the same individual income tax rate.

## ACKNOWLEDGEMENTS AND DISCLAIMERS

We thank Janet McCubbin, Thomas Hungerford, David Kamin, Jim Nunns, and the participants at the 2012 National Tax Association Spring Symposium for helpful comments and discussion. Views and opinions expressed are those of the authors and do not necessarily represent official Treasury positions or policy.

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