Non-Linear Budget Set Estimation: Virtual Incomes

Source: Hausman (Hbk 1985)
elasticity $e$ would no longer be a pure compensated elasticity, but a mix of the compensated elasticity and the uncompensated elasticity. Four points should be noted.

First, the larger the behavioral elasticity, the more bunching we should expect. Unsurprisingly, if there are no behavioral responses to marginal tax rates, there

**Figure 1. Bunching Theory**

*Notes:* Panel A displays the effect on earnings choices of introducing a (small) kink in the budget set by increasing the tax rate $t$ by $dt$ above income level $z^*$. Individual $L$ who chooses $z^*$ before the reform stays at $z^*$ after the reform. Individual $H$ chooses $z^*$ after the reform and was choosing $z^* + dz^*$ before the reform. Panel B depicts the effects of introducing the kink on the earnings density distribution. The pre-reform density is smooth around $z^*$. After the reform, all individuals with income between $z^*$ and $z^* + dz^*$ before the reform, bunch at $z^*$, creating a spike in the density distribution. The density above $z^* + dz^*$ shifts to $z^*$ (so that the resulting density and is no longer smooth at $z^*$).
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Figure 1. Bunching Theory

Source: Saez (2010), p. 184

Notes: Panel A displays the effect on earnings choices of introducing a (small) kink in the budget set by increasing the tax rate \( t \) by \( dt \) above income level \( z^* \). Individual \( L \) who chooses \( z^* \) before the reform stays at \( z^* \) after the reform. Individual \( H \) chooses \( z^* \) after the reform and was choosing \( z^* + dz^* \) before the reform. Panel B depicts the effects of introducing the kink on the earnings density distribution. The pre-reform density is smooth around \( z^* \). After the reform, all individuals with income between \( z^* \) and \( z^* + dz^* \) before the reform, bunch at \( z^* \), creating a spike in the density distribution. The density above \( z^* + dz^* \) shifts to \( z^* \) (so that the resulting density and is no longer smooth at \( z^* \)).
indexes earnings to 2008 using the IRS inflation parameters, so that the EITC kinks are perfectly aligned for all years.

Two elements are worth noting in Figure 3. First, there is a clear clustering of tax filers around the first kink point of the EITC. In both panels, the density is maximum exactly at the first kink point. The fact that the location of the first kink point differs between EITC recipients with one child, versus those with two or more children, constitutes strong evidence that the clustering is driven by behavioral responses to the EITC as predicted by the standard model. Second, however, we cannot discern any
indexes earnings to 2008 using the IRS inflation parameters, so that the EITC kinks are perfectly aligned for all years.

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systematic clustering around the second kink point of the EITC. Similarly, we cannot
discern any gap in the distribution of earnings around the concave kink point where the
EITC is completely phased-out. This differential response to the first kink point, versus
the other kink points, is surprising in light of the standard model predicting that any
convex (concave) kink should produce bunching (gap) in the distribution of earnings.

In Figure 4, we break down the sample of earners into those with nonzero self-
employment income versus those zero self-employment income (and hence whose

**Figure 4. Earnings Density and the EITC: Wage Earners versus Self-Employed**

*Notes:* The figure displays the kernel density of earnings for wage earners (those with no self-employment earnings) and for the self-employed (those with nonzero self employment earnings). Panel A reports the density for tax fil-
ers with one dependent child and panel B for tax filers with two or more dependent children. The charts include all years 1995–2004. The bandwidth is $400 in all kernel density estimations. The fraction self-employed in 16.1 per-
cent and 20.5 percent in the population depicted on panels A and B (in the data sample, the unweighted fraction
self-employed is 32 percent and 40 percent). We display in dotted vertical lines around the first kink point the three
bands used for the elasticity estimation with $\delta = $1,500.

Source: Saez (2010), p. 192
systematic clustering around the second kink point of the EITC. Similarly, we cannot discern any gap in the distribution of earnings around the concave kink point where the EITC is completely phased-out. This differential response to the first kink point, versus the other kink points, is surprising in light of the standard model predicting that any convex (concave) kink should produce bunching (gap) in the distribution of earnings.

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Source: Saez (2010), p. 192
income threshold so that most filers with low wage income and negative taxable income file to obtain a tax refund. Figure 7 casts further light on the mechanism behind the bunching uncovered on Figure 6 by plotting the kernel density of taxable income (as in Figure 6) along with the density of taxable income computed using the standard deduction, i.e., defined as...
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Figure 7 casts further light on the mechanism behind the bunching uncovered on Figure 6 by plotting the kernel density of taxable income (as in Figure 6) along with the density of taxable income computed using the standard deduction, i.e., defined as

\[
\text{Marginal tax rate = 0.2} \quad \text{for 1960 to 1963, 0.16 in 1964, and 0.14 in 1965–1969 (see Table 3, panel A for complete details).}
\]
However, the econometric application of the piecewise linear budget constraint method has been called into question by researchers who impose the condition that the estimated coefficients yield a positive compensated substitution effect. When this condition was not satisfied, researchers imposed it by constraining the income coefficient to be negative. MaCurdy (1968) argued that this approach is not warranted. The compensated effect may be estimated to be positive without the researcher imposing it, and MaCurdy (1968) recommended an alternative approach.

Note: In 1983 the earnings test was eliminated for 70–71 year olds (71–72 year olds in the following March CPS) but was not changed for 62–69 year olds. See Figure 2 note.
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\[\text{Figure 3-A.—Earnings Distribution, 1980–81}\]

\[\text{Figure 3-B.—Earnings Distribution, 1980–81}\]

\[\text{Figure 3-C.—Earnings Distribution, 1984–86}\]

\[\text{Figure 3-D.—Earnings Distribution, 1984–86}\]

Note: In 1983 the earnings test was eliminated for 70–71 year olds (71–72 year olds in the following March CPS) but was not changed for 62–69 year olds. See Figure 2 note.

Source: Friedberg (2000), p. 56
Cost of Bunching at Bracket Cutoff Points in Tax Schedule

Source: Chetty et al. (2009)
Marginal Tax Rates in Denmark in 1995

\[ \Delta \log(\text{NTR}) = -9\% \]
\[ \Delta \log(\text{NTR}) = -6\% \]
\[ \Delta \log(\text{NTR}) = -29\% \]

Note: $1 \approx 6\text{ DKr}$

Source: Chetty et al. (2009)
Income Distribution for Wage Earners Around Top Kink (1994-2001)

Source: Chetty et al. (2009)
In the graph, the income distribution for wage earners around the top kink (1994-2001) is shown. The x-axis represents income relative to the top bracket cutoff, and the y-axis represents frequency. The diagram highlights an excess mass, denoted as $B(\Delta\tau)$, which captures the concentration of individuals near the top bracket cutoff. The source of this data is Chetty et al. (2009).
Income Distribution for Wage Earners Around Top Kink (1994-2001)

Excess mass = 5.97%
Standard error = 0.38%

Source: Chetty et al. (2009)
Married Women

Excess mass = 14.1%
Standard error = 0.90%

Source: Chetty et al. (2009)
Single Men

Excess mass = 1.83%
Standard error = 0.34%

Source: Chetty et al. (2009)
Married Female Professionals with Above Median Experience

Excess mass = 41.5%
Standard error = 1.94%

Chetty et al. 2009

Taxable Income Relative to Top Bracket Cutoff (1000s DKr)
Military

Excess mass = 1.25%
Standard error = 0.61%
Married Women, 1994

Excess mass = 15.9%
Standard error = 1.41%

Source: Chetty et al. (2009)
Married Women, 1995

Excess mass = 14.0%
Standard error = 1.50%

Source: Chetty et al. (2009)
Married Women, 1996

Excess mass = 14.1%
Standard error = 1.34%

Source: Chetty et al. (2009)
Married Women, 1997

Excess mass = 11.2%
Standard error = 1.38%

Source: Chetty et al. (2009)
Married Women, 1998

Excess mass = 14.0%
Standard error = 1.39%

Source: Chetty et al. (2009)
Married Women, 1999

Excess mass = 15.6%
Standard error = 1.63%

Source: Chetty et al. (2009)
Married Women, 2000

Excess mass = 19.5%
Standard error = 1.69%

Source: Chetty et al. (2009)
Married Women, 2001

Excess mass = 12.1%
Standard error = 1.75%

Source: Chetty et al. (2009)
Married Women at the Middle Tax: 10% Tax Kink

Excess mass = 2.24%
Standard error = 0.46%

Source: Chetty et al. (2009)

Taxable Income Relative to Top Bracket Cutoff (1000s DKr)
Married Women at the Middle Tax: 10% Tax Kink

Excess mass = 2.24%
Standard error = 0.46%

Source: Chetty et al. (2009)
Married Women at the Middle Tax: 6% Tax Kink

Excess mass = 0.98%
Standard error = 0.90%

Source: Chetty et al. (2009)
Observed Elasticity vs. Size of Tax Change
Married Female Wage Earners

Chetty et al. 2009
Distribution of Individuals’ Deductions in 1995

Chetty et al. 2009
Teachers Wage Earnings: 1995

Chetty et al. 2009
Teachers Wage Earnings: 1998

Chetty et al. 2009
Teachers Wage Earnings: 2001

Wage Income (1000s DKr)

Frequency

Chetty et al. 2009
Wage Earnings: Teachers with Deductions > DKr 20,000

This group starts paying top tax here

Chetty et al. 2009
Self Employed: Top Kink

Excess mass = 150.0%
Standard error = 1.4%

Chetty et al. 2009

Taxable Income Relative to Top Bracket Cutoff (1000s DKr)
Self-Employed: Middle Kink

Excess mass = 11.2%
Standard error = 0.72%

Taxable Income Relative to Middle Bracket Cutoff (1000s DKr)

Chetty et al. 2009
All Female Wage Earners

Excess mass = 10.5%
Standard error = 0.64%

Chetty et al. 2009

Taxable Income Relative to Top Bracket Cutoff (1000s DKr)
All Male Wage Earners

Excess mass = 3.26%
Standard error = 0.29%

Chetty et al. 2009

Taxable Income Relative to Top Bracket Cutoff (1000s DKr)
**Table 1**
Parameters of the 11 Negative Income Tax Programs

<table>
<thead>
<tr>
<th>Program Number</th>
<th>$G$ ($)</th>
<th>$\tau$</th>
<th>Declining Tax Rate</th>
<th>Break-even Income ($)</th>
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Source: Ashenfelter and Plant (1990), p. 403

*Source: Ashenfelter and Plant (1990)*
<table>
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<th>( \tau )</th>
<th>Declining Tax Rate</th>
<th>Preexperimental Payment ($)</th>
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<th>Postexperimental Payment ($)</th>
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Note.—Terms are explained in text.

* Denotes mean is more than twice its standard error.
Table 4
Experimental Payment minus Predicted Control Payment for 5-Year Dual-headed Experimental Families, Attrition Familíés Excluded (Standard Errors in Parentheses)

<table>
<thead>
<tr>
<th>G ($)</th>
<th>τ</th>
<th>Declining Tax Rate</th>
<th>Preexperimental Payment ($)</th>
<th>Payment for Year of Experiment ($)</th>
<th>Postexperimenta Payment ($)</th>
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Note.—Terms are explained in text.
* Denotes mean is more than twice its standard error.

Source: Ashenfelter and Plant (1990), p. 407
Figure 2. Proportion with Positive Earnings for Nonwinners, Winners, and Big Winners

Note: Solid line = nonwinners; dashed line = winners; dotted line = big winners.
On average the individuals in our basic sample won yearly prizes of $26,000 (averaged over the $55,000 for winners and zero for nonwinners). Typically they won 10 years prior to completing our survey in 1996, implying they are on average halfway through their 20 years of lottery payments when they responded in 1996. We asked all individuals how many tickets they bought in a typical week in the year they won the lottery. As expected, the number of tickets bought is considerably higher for winners than for nonwinners. On average, the individuals in our basic sample are 50 years old at the time of winning, which, for the average person was in 1986; 35 percent of the sample was over 55 and 15 percent was over 65 years old at the time of winning; 63 percent of the sample was male. The average number of years of schooling, calculated as years of high school plus years of college plus 8, is equal to 13.7; 64 percent claimed at least one year of college.

We observe, for each individual in the basic sample, Social Security earnings for six years preceding the time of winning the lottery, for the year they won (year zero), and for six years following winning. Average earnings, in terms of 1986 dollars, rise over the pre-winning period from $13,930 to $16,330, and then decline back to $13,290 over the post-winning period. For those with positive Social Security earnings, average earnings rise over the entire 13-year period from $20,180 to $24,300. Participation rates, as measured by positive Social Security earnings, gradually decline over the 13 years, starting at around 70 percent before going down to 56 percent. Figures 1 and 2 present graphs for average earnings and the proportion of individuals with positive earnings for the three groups, nonwinners, winners, and big winners. One can see a modest decline in earnings and proportion of individuals with positive earnings for the full winner sample compared to the nonwinners after winning the lottery, and a sharp and much larger decline for big winners at the time of winning. A simple difference-in-differences type estimate of the marginal propensity to earn out of unearned income (mpe) can be based on the ratio of the difference in the average change in earnings before and after winning the lottery for two groups and the difference in the average prize for the same two groups. For the winners, the difference in average earnings over the six post-lottery years and the six pre-lottery years is -$1,877 and for the nonwinners the average change is $448. Given a difference in average prize of $55,000 for the winner/nonwinners comparison, the estimated mpe is $(-1,877 - 448)/(55,000 - 0) = -0.042 (SE 0.016). For the big-winners/small-winners comparison, this estimate is -0.059 (SE 0.018). In Section IV we report estimates for this quantity using more sophisticated analyses.

On average the value of all cars was $18,200. For housing the average value was $166,300, with an average mortgage of $44,200.12 We aggregated the responses to financial wealth into two categories. The first concerns retirement

Note: Solid line = nonwinners; dashed line = winners; dotted line = big winners.

Source: Imbens et al. (2001), p. 783
Figure II

Source: Federal Govt
<table>
<thead>
<tr>
<th>Group</th>
<th>Before TRA86</th>
<th>After TRA86</th>
<th>Change</th>
<th>Relative Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>.521 (.002)</td>
<td>.382 (.001)</td>
<td>-.139 (.002)</td>
<td></td>
</tr>
<tr>
<td>75th Percentile</td>
<td>.365 (.001)</td>
<td>.324 (.001)</td>
<td>-.041 (.001)</td>
<td>-.098 (.002)</td>
</tr>
<tr>
<td>90th Percentile</td>
<td>.430 (.001)</td>
<td>.360 (.001)</td>
<td>-.07 (.001)</td>
<td>-.069 (.002)</td>
</tr>
</tbody>
</table>

The marginal tax rate is calculated using family wage and salary, self-employment, interest, dividend, farm and social-security income. I assume all couples file jointly, and that all itemize their deductions. Itemized deductions and capital gains are imputed using Statistics of Income data. These figures include the secondary earner deduction, as well as social security taxes. Standard errors are in parentheses. Before TRA86 is tax years 1983-1985; After TRA86 is tax years 1989-1991.

Source: Eissa 1995
Table III
Differences-in-Differences Estimates
CPS Married Women Before and After TRA86

A: Labor Force Participation

<table>
<thead>
<tr>
<th>Group</th>
<th>Before TRA86</th>
<th>After TRA86</th>
<th>Change</th>
<th>Difference-in-Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>0.464 (.018)</td>
<td>0.554 (.018)</td>
<td>0.090 (.025)</td>
<td>0.037 (.028)</td>
</tr>
<tr>
<td></td>
<td>[756]</td>
<td>[718]</td>
<td>{19.5%}</td>
<td>{12.3%}</td>
</tr>
<tr>
<td>75th Percentile</td>
<td>0.687 (.010)</td>
<td>0.740 (.010)</td>
<td>0.053 (.010)</td>
<td>0.045 (.028)</td>
</tr>
<tr>
<td></td>
<td>[3799]</td>
<td>[3613]</td>
<td>{7.2%}</td>
<td>{13%}</td>
</tr>
<tr>
<td>90th Percentile</td>
<td>0.611 (.010)</td>
<td>0.656 (.010)</td>
<td>0.045 (.010)</td>
<td>0.045 (.028)</td>
</tr>
<tr>
<td></td>
<td>[3765]</td>
<td>[3584]</td>
<td>{6.5%}</td>
<td>{13%}</td>
</tr>
</tbody>
</table>

Source: Eissa 1995
### B: Hours Conditional on Employment

<table>
<thead>
<tr>
<th>Group</th>
<th>Before TRA86</th>
<th>After TRA86</th>
<th>Change</th>
<th>Difference-in-Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1283.0 (46.3)</td>
<td>1446.3 (41.1)</td>
<td>163.3 (61.5)</td>
<td>{12.7%}</td>
</tr>
<tr>
<td></td>
<td>[351]</td>
<td>[398]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75^{th} Percentile</td>
<td>1504.1 (14.3)</td>
<td>1558.9 (13.9)</td>
<td>54.8 (20.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2610]</td>
<td>[2676]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90^{th} Percentile</td>
<td>1434.1 (16.4)</td>
<td>1530.1 (15.9)</td>
<td>96.0 (22.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2303]</td>
<td>[2348]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each cell contains the mean for that group, along with standard errors in (), number of observations in [], and % increase in {}. Means are unweighted.

Source: Eissa 1995
Figure 10
Fraction of Married Women with Positive Annual Earnings by Income Group in March CPS

Notes: Groups are based on other household income (husband’s earnings plus asset income) as described in Eissa (1995). Group 1 <= 75th percentile. Group 75 is > 75th percentile and <= 80th percentile. Group 80 is > 80th and <= 90th. Group 90 is > 90th and <= 95th. Group 95 is > 95th and <= 99th. Group 99 is > 99th.

Source: Liebman and Saez (2006)


Fig. 1. Average monthly AFDC/TANF caseloads (1963–2000) (in millions).

Source: Meyer and Sullivan 2004
EITC Amount as a Function of Earnings

Source: Federal Govt
Figure IV
1986 and 1988 Earned Income Tax Credit

### TABLE II

**Labor Force Participation Rates of Unmarried Women**

<table>
<thead>
<tr>
<th></th>
<th>Pre-TRA86 (1)</th>
<th>Post-TRA86 (2)</th>
<th>Difference (3)</th>
<th>Difference-in-differences (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Treatment group:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With children</td>
<td>0.729 (0.004)</td>
<td>0.753 (0.004)</td>
<td>0.024 (0.006)</td>
<td></td>
</tr>
<tr>
<td>[20,810]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control group:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without children</td>
<td>0.952 (0.001)</td>
<td>0.952 (0.001)</td>
<td>0.000 (0.002)</td>
<td>0.024 (0.006)</td>
</tr>
<tr>
<td>[46,287]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. Treatment group:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school, with children</td>
<td>0.479 (0.010)</td>
<td>0.497 (0.010)</td>
<td>0.018 (0.014)</td>
<td></td>
</tr>
<tr>
<td>[5396]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control group 1:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school, without children</td>
<td>0.784 (0.010)</td>
<td>0.761 (0.009)</td>
<td>-0.023 (0.013)</td>
<td>0.041 (0.019)</td>
</tr>
<tr>
<td>[3958]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control group 2:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beyond high school, with children</td>
<td>0.911 (0.005)</td>
<td>0.920 (0.005)</td>
<td>0.009 (0.007)</td>
<td>0.009 (0.015)</td>
</tr>
<tr>
<td>[5712]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C. Treatment group:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school, with children</td>
<td>0.764 (0.006)</td>
<td>0.787 (0.006)</td>
<td>0.023 (0.008)</td>
<td></td>
</tr>
<tr>
<td>[9702]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control group 1:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school, without children</td>
<td>0.945 (0.002)</td>
<td>0.943 (0.003)</td>
<td>-0.002 (0.004)</td>
<td>0.025 (0.009)</td>
</tr>
<tr>
<td>[16,527]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control group 2:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beyond high school, with children</td>
<td>0.911 (0.005)</td>
<td>0.920 (0.005)</td>
<td>0.009 (0.007)</td>
<td>0.014 (0.011)</td>
</tr>
<tr>
<td>[5712]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


All Unmarried Females

FIGURE II
Figure 1. EITC Schedule, 1992 and 1996 by number of children

Source: Rothstein 2005
Employment Rates for Single Women with and without Children

Source: Meyer and Rosenbaum 2001
Figure 4

Labor Force Participation Rates for Women by Marital Status and Children (Ages 20-65)

Source: Tabulations of March Current Population Survey Data
Total Consumption: Single Mothers 1984-2000

Fig. 2. Total consumption: single mothers, 1984–2000.


Source: Meyer and Sullivan 2004
Fig. 3. Relative total consumption: single mothers vs. single women without children, 1984–2000. 

Source: Meyer and Sullivan 2004
Relative Consumption: married vs. single mothers

Fig. 4. Relative total consumption: single mothers vs. married mothers, 1984–2000.

Explaining EIC: 4 steps

1. Fill in earnings, EIC amount

Source: Chetty and Saez (2009)

2. Explain and dot graph

3. Table

4. Take-home Message

You are in the **increasing** range of the EIC. Think about it like this:

- (increasing) Suppose you earn $10 an hour, then you are really making $14.00 an hour.
- (peak) Your earnings are maxing-out the EIC amount
- (decreasing) If you earn $10 more, your EIC is reduced by $2.10

<table>
<thead>
<tr>
<th>EIC Range</th>
<th>If you earn between</th>
<th>EIC refund will be</th>
<th>If you earn $10 more, the EIC...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing</td>
<td>$0-$11,790</td>
<td>$0 up to $4,716</td>
<td>Increases by $4</td>
</tr>
<tr>
<td>Peak</td>
<td>$11,790-$15,390</td>
<td>$4,716</td>
<td>Stays the same</td>
</tr>
<tr>
<td>Decreasing</td>
<td>$15,390-$37,780</td>
<td>$4,716 down to $0</td>
<td>Decreases by $2.10</td>
</tr>
</tbody>
</table>

Source: Chetty and Saez (2009)
Year 2 Earnings Distributions: 1 Dep., Clients of Complying Tax Preparers

Source: Chetty and Saez (2009)
Year 2 Earnings Distributions: 2+ Deps., Complying Tax Preparers

Source: Chetty and Saez (2009)
Self-Employed Clients of Complying Tax Professionals: 1 Dependent

Post-Treatment (Year 2) Earnings ($)

Control Treatment EITC Amount

Earnings Density

0 5000 10000 15000 20000 25000 30000 35000 40000

EITC Amount ($)

2000 4000 6000 1000 3000 5000

Source: Chetty and Saez (2009)
Self-Employed Clients of Complying Tax Professionals: 2+ Dependents

Source: Chetty and Saez (2009)
Evolutionary shift: movements along a wage profile

Parametric shift: movements from one wage profile to another

Source: MaCurdy (1981), p. 1070

Source: MaCurdy 1981
<table>
<thead>
<tr>
<th></th>
<th>Wage</th>
<th>Compensated Wage</th>
<th>Other Income</th>
<th>Group Means:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Children</td>
<td>0.140</td>
<td>0.140</td>
<td>0.000</td>
<td>32 2.97 88.63</td>
</tr>
<tr>
<td></td>
<td>(0.075)</td>
<td>(0.088)</td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td>Youngest Child 0–2</td>
<td>0.205</td>
<td>0.301</td>
<td>-0.185</td>
<td>20 3.36 129.69</td>
</tr>
<tr>
<td></td>
<td>(0.128)</td>
<td>(0.144)</td>
<td>(0.104)</td>
<td></td>
</tr>
<tr>
<td>Youngest Child 3–4</td>
<td>0.371</td>
<td>0.439</td>
<td>-0.173</td>
<td>18 3.10 143.64</td>
</tr>
<tr>
<td></td>
<td>(0.150)</td>
<td>(0.159)</td>
<td>(0.139)</td>
<td></td>
</tr>
<tr>
<td>Youngest Child 5–10</td>
<td>0.132</td>
<td>0.173</td>
<td>-0.102</td>
<td>21 2.86 151.13</td>
</tr>
<tr>
<td></td>
<td>(0.117)</td>
<td>(0.127)</td>
<td>(0.109)</td>
<td></td>
</tr>
<tr>
<td>Youngest Child 11 +</td>
<td>0.130</td>
<td>0.160</td>
<td>-0.063</td>
<td>25 2.83 147.31</td>
</tr>
<tr>
<td></td>
<td>(0.107)</td>
<td>(0.117)</td>
<td>(0.084)</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Asymptotic standard errors in parentheses.*

Source: Blundell et al. (1998), p. 846

Source: Blundell, Duncan, and Meghir 1998
FIGURE I
Hours-Wage Relationships

Source: Camerer et al. (1997), p. 418

Source: Camerer et al. 1997
<table>
<thead>
<tr>
<th>Sample</th>
<th>TRIP</th>
<th>TLC1</th>
<th>TLC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log hourly wage</td>
<td>-0.411</td>
<td>-0.186</td>
<td>-0.501</td>
</tr>
<tr>
<td></td>
<td>(0.169)</td>
<td>(0.129)</td>
<td>(0.063)</td>
</tr>
<tr>
<td>High temperature</td>
<td>0.000</td>
<td>-0.000</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Shift during week</td>
<td>-0.057</td>
<td>-0.047</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.033)</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Rain</td>
<td>0.002</td>
<td>0.015</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.035)</td>
<td></td>
</tr>
<tr>
<td>Night shift dummy</td>
<td>0.048</td>
<td>-0.049</td>
<td>-0.127</td>
</tr>
<tr>
<td></td>
<td>(0.053)</td>
<td>(0.049)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Day shift dummy</td>
<td>—</td>
<td>—</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.028)</td>
</tr>
<tr>
<td>Fixed effects</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.243</td>
<td>0.484</td>
<td>0.175</td>
</tr>
<tr>
<td>Sample size</td>
<td>70</td>
<td>65</td>
<td>1044</td>
</tr>
<tr>
<td>Number of drivers</td>
<td>13</td>
<td>8</td>
<td>484</td>
</tr>
</tbody>
</table>

Dependent variable is the log of hours worked. Standard errors are in parentheses and are corrected for the nonfixed effects estimates in columns 1 and 3 to account for the panel structure of the data. Explanatory variables are described in Appendix 1.

Source: Camerer et al. (1997), p. 419

Source: Camerer et al. 1997
## Table 2

**Actual and Predicted Labor Supply**

In Selected Countries in 1993–96 and 1970–74

<table>
<thead>
<tr>
<th>Period</th>
<th>Country</th>
<th>Labor Supply*</th>
<th>Differences (Predicted Less Actual)</th>
<th>Prediction Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Actual</td>
<td>Predicted</td>
<td></td>
</tr>
<tr>
<td>1993–96</td>
<td>Germany</td>
<td>19.3</td>
<td>19.5</td>
<td>.2</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>17.5</td>
<td>19.5</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>16.5</td>
<td>18.8</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>22.9</td>
<td>21.3</td>
<td>−1.6</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>22.8</td>
<td>22.8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>27.0</td>
<td>29.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>25.9</td>
<td>24.6</td>
<td>−1.3</td>
</tr>
<tr>
<td>1970–74</td>
<td>Germany</td>
<td>24.6</td>
<td>24.6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>24.4</td>
<td>25.4</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>19.2</td>
<td>28.3</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>22.2</td>
<td>25.6</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>25.9</td>
<td>24.0</td>
<td>−1.9</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>29.8</td>
<td>35.8</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>23.5</td>
<td>26.4</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*Labor supply is measured in hours worked per person aged 15–64 per week.

Sources: See Appendix.

Figure 1: Tax Rates and Annual Work Hours Per Adult
Sample D: 14 Countries in 1995

Hours = 1655 - 9.5*(Sum of Tax Rates)
(2.4)

Source: Davis and Henrekson 2005
Figure 2: Tax Rates and Annual Hours Per Employed Person

Source: Davis and Henrekson 2005
There are certain key margins where tax rates impinge on earnings decisions. For many male workers this is at the beginning and at the end of their working lives. These are the schooling-work margins and the early retirement margins. Indeed much of the difference in male employment across OECD countries occurs at these points in the life-cycle.

Source: Blundell (2009), Mirrlees Review

**Male employment by age – US, FR and UK 2005**
Male Hours by age – US, FR and UK 2005

Source Blundell (2009), Mirrlees Review
Male employment by age – US, FR and UK 1975

Source: Blundell (2009), Mirrlees Review
Female Employment by age – US, FR and UK 2005

Source Blundell (2009), Mirrlees Review
For women earnings are influenced by taxes and benefits not only at these margins but also when there are young children in the family. For women with younger children it is not usually just an employment decision that is important it is also whether to work part-time or full-time.

Often the employment margin is referred to as the extensive margin of work and the part-time or hours of work decisions more generally as the intensive margin.

Source: Blundell (2009), Mirrles Review
Female Hours by age – US, FR and UK 2005

Source Blundell (2009), Mirrlees Review
Figure 1a: 1987 Tax Holiday in Iceland

Employment Rate

Year

75%
80%
85%
90%
95%

1982
1984
1986
1988
1990
1992

Empirical (Bianchi et al. 2001)
and control groups. Unfortunately, these data have some critical limitations relative to the administratively based Income Assistance data. Most importantly, they are only available for 52 months after random assignment. Since some program group members were still receiving subsidy payments as late as month 52, this time window is too short to assess the long-run effects of the program. Indeed, looking at Figure 1a, there is still an impact on IA participation in month 52 that does not fully dissipate until month 69. Second, because of nonresponses and refusals, labor market information is only available for 85% of the experimental sample (4,757 people). Third, there appear to be relatively large recall errors and seam biases in the earnings and wage data.

Nevertheless, the labor market outcomes provide a valuable complement to the administratively based welfare participation data.

Figure 3 shows the average monthly employment rates of the program and control groups, along with the associated experimental impacts. After random assignment the employment rate of the control group shows a steady

![Figure 3](https://example.com/figure3.png)

**FIGURE 3**—Monthly employment rates.

Source: Card and Hyslop, 2005, p. 1734

---

18 The distribution of response patterns to the 18-, 36-, and 54-month surveys is fairly similar for the program and control groups (chi-squared statistic = 11.4 with 7 degrees of freedom, p-value = 0.12). However, a slightly larger fraction of the program group have complete labor market data for 52 months—85.4% versus 84.0% for the controls. Moreover, the difference in mean IA participation between the treatment and control groups in month 52 is a little different in the overall sample (2.5%) than in the subset with complete labor market histories (3.3%).

19 Each of the three post-random-assignment surveys asked people about their labor market outcomes in the 18 months since the previous survey. Many people report constant earnings over the recall period, leading to a pattern of measured pay increases that are concentrated at the seams, rather than occurring more smoothly over the recall period.
Figure 2. Average Weekly Hours Worked per Person, by Age Group

Source: Authors' estimates, based on information from Kendrick (1961, 1973), the census, and the CPS.
Fraction of Tax Filers Who Report SE Income that Maximizes EITC Refund in 1996

Source: Chetty, Friedman, and Saez, NBER'12
Fraction of Tax Filers Who Report SE Income that Maximizes EITC Refund in 1999

Source: Chetty, Friedman, and Saez NBER'12
Fraction of Tax Filers Who Report SE Income that Maximizes EITC Refund in 2002

Source: Chetty, Friedman, and Saez NBER'12
Fraction of Tax Filers Who Report SE Income that Maximizes EITC Refund in 2005

Source: Chetty, Friedman, and Saez NBER'12
Fraction of Tax Filers Who Report SE Income that Maximizes EITC Refund in 2008

Source: Chetty, Friedman, and Saez NBER'12
Earnings Distributions in Lowest and Highest Bunching Deciles

Source: Chetty, Friedman, and Saez NBER'12
Income Distribution For Single Wage Earners with One Child

Is the EITC having an effect on this distribution?

Source: Chetty, Friedman, and Saez NBER'12
Income Distribution For Single Wage Earners with One Child
High vs. Low Bunching Areas

Source: Chetty, Friedman, and Saez NBER'12
Earnings Distribution in the Year Before First Child Birth for Wage Earners

Source: Chetty, Friedman, and Saez NBER'12
Simulated EITC Credit Amount for Wage Earners Around First Child Birth

$1900
$1850
$1800
$1750

Age of Child

Lowest Sharp Bunching Decile
Middle Sharp Bunching Decile
Highest Sharp Bunching Decile

Source: Chetty, Friedman, and Saez NBER'12

\( \beta = 85.4 \) (7.2)
Trends in Caseload Characteristics:
FY1988 to FY2013

The increases in the cash assistance caseload from 1989 to 1994, and its decline thereafter, were also associated with changes in the character of the caseload. Table 1 provides an overview of the characteristics of the family cash assistance caseload for selected years: FY1988, FY1994, FY2001, FY2006, and FY2013. The most dramatic change in caseload characteristics is the growth in the share of families with no adult recipients. In FY2013, 38.1% of TANF assistance families had no adult recipient; in contrast, in FY1988 only 9.8% of all cash assistance families had no adult recipient. These are families with ineligible adults (sometimes parents, sometimes other relatives) but whose children are eligible and receive benefits.

Caseload characteristic data in this report are based on information states are required to report to HHS under their AFDC and TANF programs. Efforts were made to make the data comparable across the years, but some changes in reporting as well as other program requirements affect the comparability of the data. The major difference is that for FY2013, TANF families “with an adult recipient” include those families where the adult has been time-limited or sanctioned but the family continues to receive a reduced benefit. These are technically “child-only” cases, because the adult does not receive a benefit. However, since FY2007 such families have been subject to TANF work participation standards and thus the policy affecting them is more comparable to that of a family with an adult recipient than a “child-only” family. For years before FY2007, these families were not subject to work participation standards and are classified together with other “child-only” families. The data to identify them separately prior to FY2007 are not comparable to data for FY2007 and subsequent years.
Annual Employment Rates for Women
By Marital Status and Presence of Children, 1980-2009

The landscape providing assistance to poor families with children has changed substantially.
judge allowance rate in the other cases a judge has handled. We note the judge leniency measure is calculated from all cases the judge has ever handled, not just the cases in our estimation sample. On average, each judge has handled a total of 380 cases. The mean of the leniency variable is .15 with a standard deviation of .06. The histogram reveals a wide spread in judge leniency, with approximately 22% of cases allowed by a judge at the 90th percentile compared to approximately 9% at the 10th percentile.

Figure 3: Effect of Judge Leniency on Parents (First Stage) and Children (Reduced Form).

Notes: Baseline sample, consisting of parents who appeal an initially denied DI claim during the period 1989-2005 (see Section 3 for further details). There are 14,893 individual observations and 79 different judges. Panel (A): Solid line is a local linear regression of parental DI allowance on judge leniency. Panel (B): Solid line is a local linear regression of child DI receipt on their parent’s judge leniency measure. All regressions include fully interacted year and department dummies. The histogram of judge leniency is shown in the background of both figures (top and bottom 0.5% excluded from the graph).

Source: Dahl, Kostol, Mogstad (2013)

Panel A shows the effect of judge leniency on a parent’s allowance rate. The graph is a flexible analog to the first stage equation (4), where we plot a local linear regression of actual parental allowance against judge leniency. The parental allowance rate is monotonically increasing in our leniency measure, and is close to linear. A one percentage point increase in the judge’s allowance rate in other cases is associated with an almost one percentage point increase in the probability the parent’s case is allowed. Panel B plots the reduced form effect of a parent’s judge leniency measure against their child’s DI participation, again using a local linear regression. The child’s DI rate is monotonically increasing in the leniency measure as well. Approximately two and a half percent of children whose parents had a relatively strict judge (leniency measure = .09, the 10th percentile) are predicted to participate in DI five years later. This can be contrasted with roughly three percent of children whose parents had a relatively lenient judge (leniency measure = .22, the 90th percentile).
Figure 1: Earned Income Tax Credit by Number of Children and Filing Status, 2013

FIGURE 1
Effect of Notch on Taxpayer Behavior

Panel A: Bunching at the Notch

Panel B: Comparing the Notch to a Hypothetical Kink

Source: Kleven and Waseem '11
FIGURE 2
Effect of Notch on Density Distribution

Panel A: Theoretical Density Distributions

Panel B: Empirical Density Distribution and Bunching Estimation

Source: Kleven and Waseem '11
FIGURE 3
Personal Income Tax Schedules in Pakistan

Notes: the figure shows the statutory (average) tax rate as a function of annual taxable income in the personal income tax schedules for wage earners (red dashed line) and self-employed individuals and unincorporated firms (blue solid line), respectively. Taxable income is shown in thousands of Pakistani Rupees (PKR), and the PKR-USD exchange rate is around 85 as of April 2011. The schedule for the self-employed applies to the full period of this study (2006-08), while the schedule for wage earners applies only to 2006-07 and was changed by a tax reform in 2008. The tax system classifies individuals as either wage earners or self-employed based on whether income from wages or self-employment constitutes the larger share of total income, and then taxes total income according to the assigned schedule. The tax schedule for self-employed individuals and firms consists of 14 brackets, while the tax schedule for wage earners consists of 21 brackets (the first 14 of which are shown in the figure). Each bracket cutoff is associated with a notch, and the cutoff itself belong to the tax-favored side of the notch.

Source: Kleven and Waseem '11
FIGURE 5
Density Distribution around Middle Notches:
Self-Employed Individuals and Firms (Sophisticated Filers)

Panel A: Notch at 300k

Panel B: Notch at 400k

Panel C: Notch at 500k

Panel D: Notch at 600k

Source: Kleven and Waseem ‘11

Notes: the figure shows the density distribution of taxable income for male self-employed individuals and unincorporated firms in 2006-08 around the four middle notches in the schedule applying to those taxpayers (shown in Figure 3). The densities include only “sophisticated filers” defined as those who do not report income in even thousands. Each dot represents the upper bound of a 2000 Rupee bin and thus shows the number of taxpayers located within a 2000 Rupee range below the dot. Notch points are shown by red vertical lines, and each notch point is itself part of the tax-favored side of the notch. The average tax rate jumps by 2.5%-points at all the middle notches.
Figure 2. Maximum credit over time, constant 2013 dollars, by number of children

Source: Nichols and Rothstein (2015)
Marshallian Labor Supply

\[ l(w, R) \]

\[ c = wl + R \]

Indifference Curve

Labor Supply Theory

Consumption

\[ c = \text{consumption} \]

slope = \( w \)
Labor Supply Theory

\[ c = \text{consumption} \]

utility \( u \)

tangent line with slope \( w \)

Hicksian Labor Supply \( l^c(w, u) \)

0

labor supply \( l \)
Labor Supply Income Effect

\[ \eta = w \frac{\partial l}{\partial R} \leq 0 \]
Labor Supply Substitution Effect

\[ l^c(w, u) \]

\[ l^c(w + \Delta w, u) \]

\[ \varepsilon^c = \frac{w}{l} \frac{\partial l^c}{\partial w} > 0 \]
Uncompensated Labor Supply Effect

\[ \varepsilon^u = \varepsilon^c + \eta \]

- **Substitution effect:** \( \varepsilon^c > 0 \)
- **Income effect:** \( \eta \leq 0 \)

Diagram:
- Points and lines illustrating labor supply changes with respect to wage and income effects.
- Labels for compensated and uncompensated labor supply effects.
- Arrows indicating the direction of changes due to income and substitution effects.
Table 1. Distribution of Prizes

<table>
<thead>
<tr>
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<th>Pooled Sample</th>
<th>Individual Lottery Samples</th>
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<tr>
<td></td>
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<td>Share</td>
<td>Count</td>
<td>Share</td>
<td>Count</td>
<td>Share</td>
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<tr>
<td>0 to 1K SEK</td>
<td>25,172</td>
<td>10.0%</td>
<td>0</td>
<td>0.0%</td>
<td>25,172</td>
<td>99.0%</td>
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<tr>
<td>1K to 10K SEK</td>
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<td>81.3%</td>
<td>204,626</td>
<td>92.0%</td>
<td>0</td>
<td>0.0%</td>
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<td>10K to 100K SEK</td>
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<td>6.5%</td>
<td>15,520</td>
<td>7.0%</td>
<td>0</td>
<td>0.0%</td>
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<tr>
<td>100K to 500K SEK</td>
<td>3,685</td>
<td>1.5%</td>
<td>1,654</td>
<td>0.7%</td>
<td>0</td>
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<tr>
<td>500K to 1M SEK</td>
<td>355</td>
<td>0.1%</td>
<td>195</td>
<td>0.1%</td>
<td>0</td>
<td>0.0%</td>
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<tr>
<td>≥1M SEK</td>
<td>1,481</td>
<td>0.6%</td>
<td>481</td>
<td>0.2%</td>
<td>263</td>
<td>1.0%</td>
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<tr>
<td>TOTAL</td>
<td>251,748</td>
<td>100.0%</td>
<td>222,476</td>
<td>100.0%</td>
<td>25,435</td>
<td>100.0%</td>
</tr>
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</table>

Notes: This table reports the distribution of lottery prizes for the pooled sample and the four lottery subsamples.

Cesarini, Lindqvist, Notowidigdo, Östling NBER WP 2015

Table 2. Effect of Wealth on Individual Gross Labor Earnings

<table>
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<tr>
<th></th>
<th>$t = 1$</th>
<th>$t = 2$</th>
<th>3-year total</th>
<th>5-year total</th>
<th>10-year total</th>
<th>Event study estimate $t = 1-5$</th>
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<tr>
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<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
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<tr>
<td>Prize Amount (SEK/100)</td>
<td>-1.152</td>
<td>-1.177</td>
<td>-3.219</td>
<td>-4.681</td>
<td>-8.033</td>
<td>-1.068</td>
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<tr>
<td>SE</td>
<td>(0.153)</td>
<td>(0.191)</td>
<td>(0.517)</td>
<td>(0.917)</td>
<td>(1.961)</td>
<td>(0.149)</td>
</tr>
<tr>
<td>$p$</td>
<td>[&lt;0.001]</td>
<td>[&lt;0.001]</td>
<td>[&lt;0.001]</td>
<td>[&lt;0.001]</td>
<td>[&lt;0.001]</td>
<td>[&lt;0.001]</td>
</tr>
<tr>
<td>$N$</td>
<td>199,168</td>
<td>211,555</td>
<td>193,312</td>
<td>186,819</td>
<td>173,129</td>
<td>249,278</td>
</tr>
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</table>

Notes: This table reports results of estimating equation (2) in the pooled lottery sample with gross labor earnings as the dependent variable. The prize amount is scaled so that a coefficient of 1.00 implies a 1 SEK increase in earnings per 100 SEK won.
Figure 1: Effect of Wealth on Individual Gross Labor Earnings

Notes: This figure reports estimates obtained from equation (2) estimated in the pooled lottery sample with gross labor earnings as the dependent variable. A coefficient of 1.00 corresponds to an increase in annual labor earnings of 1 SEK for each 100 SEK won. Each year corresponds to a separate regression and the dashed lines show 95% confidence intervals.

Cesarini, Lindqvist, Notowidigdo, Östling NBER WP 2015
Figure 4: Comparing Model-Based Estimates to Empirical Results

Notes: This figure compares the estimates obtained from equation (2) estimated in the pooled lottery sample with after-tax earnings as the dependent variable to the model-based estimates using the best-fit parameters reported in Table 5. Year 0 correspond to the year the lottery prize is awarded, and in the simulation, the prize is assumed to be awarded at end of the year, so dy/dL for that year is 0 by assumption.

Figure 5: Effect of Wealth on Gross Labor Earnings of Winners and Spouses

Notes: This figure reports estimates obtained from equation (2) estimated separately for winners, their spouses, and the household. The dependent variable is gross labor earnings. Each year corresponds to a separate regression.

Cesarini, Lindqvist, Notowidigdo, Östling NBER WP 2015
Notes: These figures depict the personal wealth tax schedule for Colombia. Panel (a) plots wealth tax liability by reported wealth $W_r$ in FY 2010. Each bracket of $W_r$ is associated with a fixed average tax rate on taxable net wealth. As a result, wealth tax liability $T(W_r)$ jumps discretely at the notch points. That year, the wealth tax brackets affected the top 0.12%, top 0.04%, top 0.02%, and top 0.01%, respectively. Panel (b) plots the statutory wealth tax rate FY 2000–2018. Wealth tax eligibility is determined using (taxable and non-taxable) net worth in all years but 2001, when it is determined using gross wealth. For 2007–2009, eligibility is established in 2006. In 2015–2018, eligibility is established in 2014. Tax brackets are expressed in current values for all years except 2004 and 2005 (2003 pesos). The tax schedule refers to average tax rates for all brackets in FY 2001–2010. In FY 2014–2018, only the first bracket is an average tax rate; the rest are marginal rates. Source: Table A.1.
Notes: This figure overlays the distribution of tax filers by reported net wealth before and after a reform introduced two wealth tax notches at 1 and 2 billion pesos (red vertical lines), as depicted in Figure 1. These notches imply that wealth tax liability jumps discontinuously, as illustrated in Figure 1. The figure shows that the distribution of individuals is smooth in the absence of wealth tax notches (2009). The two notches result in the immediate emergence of excess mass below the notch points, and corresponding missing mass just above them (2010). This observed bunching of taxpayers below the notch points is a direct behavioral response to wealth taxation. Bin width is 2010 10,000,000 pesos (2010 USD 5,208.30 in 12/31/2010). Source: Authors’ calculations using administrative data from DIAN.
Figures and Tables

Figure 1: The Personal Wealth Tax Schedule in Colombia

(a) Wealth Tax Liability as a Function of Reported Net Wealth (FY 2010)

Wealth tax \( T(W_r) \) (million COP)

\[
\begin{array}{c|c|c|c|c|c}
\text{Reported wealth } W_r & 0 & 1 & 2 & 3 & 5 \\
\text{(billion COP)} & \text{[0.5]} & \text{[1.0]} & \text{[1.6]} & \text{[2.6]} & \text{[5.0]} \\
\text{wealth percentile} & 0\% & 1\% & 1.4\% & 3\% & 6\% \\
\text{Wealth tax } T(W_r) & 28 & 90 & 150 & 300 \\
\text{(million USD)} & 0.5 & 1.0 & 1.6 & 2.6 & P99.99 \\
\end{array}
\]

(b) Evolution of Statutory Annual Wealth Tax Rates by Bracket Cutoff

Tax rate \( \tau \)

Source: Table A.1

Notes: These figures depict the personal wealth tax schedule for Colombia. Panel (a) plots wealth tax liability by reported wealth \( W_r \) in FY 2010. Each bracket of \( W_r \) is associated with a fixed average tax rate on taxable net wealth. As a result, wealth tax liability \( T(W_r) \) jumps discretely at the notch points. That year, the wealth tax brackets affected the top 0.12%, top 0.04%, top 0.02%, and top 0.01%, respectively. Panel (b) plots the statutory wealth tax rate FY 2000–2018. Wealth tax eligibility is determined using (taxable and non-taxable) net worth in all years but 2001, when it is determined using gross wealth. For 2007–2009, eligibility is established in 2006. In 2015–2018, eligibility is established in 2014. Tax brackets are expressed in current values for all years except 2004 and 2005 (2003 pesos). The tax schedule refers to average tax rates for all brackets in FY 2001–2010. In FY 2014–2018, only the first bracket is an average tax rate; the rest are marginal rates. Source: Table A.1
Figure 1: Costa Rica’s Corporate Tax Schedule

Figure 1 shows the design of the corporate income tax in Costa Rica, as discussed in section 2.1. Firms face increasing average tax rates on their profits (revenue minus cost) as a function of their revenue. When revenue exceeds the first threshold, the average tax rate jumps from 10% to 20% and from 20% to 30% past the second threshold. Thresholds are adjusted yearly for inflation.

Figure 2: Bunching with a Notched Schedule Based on Revenue

Figure 2 displays the theoretical density distributions, discussed in section 2.3. The counterfactual firm density is drawn under the assumption of a flat 10% tax rate. The notch induces some firms with counterfactual revenue above the threshold to reduce their revenue and bunch just below the threshold. The decision to bunch depends on firms’ revenue distance to the threshold and on their costs, such that for each revenue bin past the threshold, only firms with sufficiently low costs bunch. This implies that the observed density distribution should match the counterfactual density up to the threshold, exhibit excess mass at the threshold corresponding to missing mass above it. However there is no interval with zero density as firms with sufficiently large costs never have an incentive to bunch. Note that the observed density is permanently lower than the counterfactual past the threshold due to intensive margin responses which lower reported revenue.

Source: Bachas and Soto (2018)
Figure 3: Firm Density and Average Profit Margin

Panel A: Firm Density

Panel B: Profit Margin


Figure 3 presents the key patterns of the corporate tax data, discussed in Section 3.1. The figure pulls together data from years 2008 to 2014. Panel A shows the density of firms by revenue. Panel B displays the average profit margin by revenue. Profit margin is defined as profits over revenue. The size of the revenue bins is 575,000 CRC.
Figure 3 presents the key patterns of the corporate tax data, discussed in Section 3.1. The figure pulls together data from years 2008 to 2014. Panel A shows the density of firms by revenue. Panel B displays the average profit margin by revenue. Profit margin is defined as profits over revenue. The size of the revenue bins is 575,000 CRC.

EITC Schedule in 2017

- **0 children**
- **1 child**
- **2 children**
- **3+ children**

<table>
<thead>
<tr>
<th>Earnings (USD)</th>
<th>Annual Credit (USD)</th>
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<tr>
<td>0</td>
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</tr>
<tr>
<td>2000</td>
<td>10000</td>
</tr>
<tr>
<td>4000</td>
<td>20000</td>
</tr>
<tr>
<td>6000</td>
<td>30000</td>
</tr>
<tr>
<td>8000</td>
<td>40000</td>
</tr>
<tr>
<td>10000</td>
<td>50000</td>
</tr>
<tr>
<td>12000</td>
<td>60000</td>
</tr>
</tbody>
</table>
EITC Maximum Credit Over Time

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

50 years of relative stability, apart from these 5 years

Unemployment Rate

Labor Force Participation (%)

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

50 years of relative stability, apart from these 5 years

Unemployment Rate

68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10 12 14 16 18

Year

With Children
Without Children

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

Tax Reduction Act of 1975 TRA86 OBRA90 OBRA93 PRWORA State Welfare Waivers

Source: Kleven (2018)
Labor Force Participation of Single Women
With and Without Children

Source: Kleven (2018)
Labor Force Participation of Single Women
By Number of Children

Tax Reduction Act of 1975 TRA86 OBRA90 OBRA93 ARRA

68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10 12 14 16 18

Year

Source: Kleven (2018)
Labor Force Participation of Single Women
By Number of Children

Tax Reduction Act of 1975 TRA86 OBRA90 OBRA93 ARRA
Much larger increase by those with 3+ kids

Source: Kleven (2018)
Labor Force Participation of Single Women
By Number of Children

Source: Kleven (2018)
implemented with larger sample size.10 As we shall see, in some cases, the elasticity estimate is sensitive to the choice of $\delta$. The simplest method to select $\delta$ is graphical to ensure that the full excess bunching is included in the band $(z^* - \delta, z^* + \delta)$ as in Figure 2.

Empirically, $h(z^*_\cdot)$ can be estimated as the fraction of individuals in the lower surrounding band $(z^* - 2\delta, z^* - \delta)$ divided by $\delta$. Similarly, $h(z^*_+)$ can be estimated as the fraction of individuals in the upper surrounding band $(z^* + \delta, z^* + 2\delta)$ divided by $\delta$. We estimate the number of individuals in each of the three bands, which we denote by $\hat{H}_-, \hat{H}_+, \hat{H}_+$, by regressing (simultaneously) a dummy variable for belonging to each band on a constant in the sample of individuals belonging to any of those three bands. We can then compute $\hat{h}(z^*_\cdot) = \hat{H}_-/\delta, \hat{h}(z^*_+) = \hat{H}_+/\delta$ and $\hat{B} = \hat{H}^* - (\hat{H}_+^* + \hat{H}_-^*)$ to estimate $\hat{\delta}$.

Notes: The figure illustrates the excess bunching estimation method using empirical densities. We assume that, under a constant linear tax with rate $t_0$, the density of income $h_0(z)$ is smooth. A higher tax rate $t_i$ is introduced above $z^*$, creating a convex kink at $z^*$. The reform will induce tax filers to cluster at $z^*$, creating a spike in the post-reform density distribution $h(z)$. As illustrated on the figure, bunching might not be perfectly concentrated at $z^*$ because of inability of tax filers to control or forecast their incomes perfectly or imperfect information about the exact kink location. For estimation purposes, we define three bands of income around the kink point $z^*$ using the bandwidth parameter $\delta$. The lower band is the segment $(z^* - 2\delta, z^* - \delta)$, it has average density $h(z^*_\cdot)$ and hence includes $H^*_\cdot$ tax filers (dashed left area). The upper band is the segment $(z^* + \delta, z^* + 2\delta)$, it has average density $h(z^*_+)$ and hence includes $H^*_+ = \delta h(z^*_+)$ tax filers (dashed right area). The middle band is the segment $(z^* - \delta, z^* + \delta)$ and includes $H^*$ tax filers. Excess bunching is defined as $B = H^* - (H^*_+ + H^*_\cdot)$ and is the upper dashed area on the figure. If clustering of tax filers around $z^*$ is tight, excess bunching will be estimated without bias with a small $\delta$. If clustering is not tight around $z^*$, a small $\delta$ will underestimate the amount of excess bunching (as the lower and upper bands will include tax filers clustering around $z^*$). However, a large $\delta$ will lead to overestimate (underestimate) excess bunching if the before reform density $h_0(z)$ is convex (concave) around $z^*$.

Figure 2. Estimating Excess Bunching Using Empirical Densities

10Chetty et al. (2009) use much larger samples in Denmark and take into account such curvature by estimating the density nonparametrically outside the bunching segment $[z^* - \delta, z^* + \delta]$. 
1990s Income Tax Reform in Switzerland

Transition from retrospective taxation to annual pay-as-you-earn

- Reasons: modernizing, simplifying and harmonizing
- Side effect: incomes earned during the two years prior to the change remained **untaxed** (blank years, tax holiday)

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</table>

- Cantons chose different years to change: 1999, 2001, and 2003
Timing of the Reform

Blank Years in Each Canton

- 1997/98, federal and cantonal
- 1997/98 federal, 1998 cantonal
- 1999/00, federal and cantonal
- 1999/00 federal, 2000 cantonal
- 1999/00, federal tax only
- 2001/02, federal and cantonal
- No blank years

Legend:
- 1997/98
- 1999/00
- 2001/02

Map showing various regions with different color coding for the years of the reform.
Average Income Tax Rates over Time

Total federal, cantonal and municipal tax, single taxpayer; weighted by municipality population.
Marginal Income Tax Rates over Time

Marginal tax rate in % at a gross income of 100K CHF (real value 2010)

1997-98 1998 1999-00 2000 2001-02

Tax Holiday in...

Total federal, cantonal and municipal tax, single taxpayer; weighted by municipality population.
Employment Rate: Men (age 20-60)

[Graph showing trends in employment rate from 1990 to 2010 with data points for specific years and shaded areas indicating tax holiday periods.]

Data source: AHV-STATPOP
Average Wage Earnings: High-income Employees

High income: avg. real wage earnings in 1994-1996 > 100k CHF/year
Mean Self-employment Earnings (excluding zeros)

Data source: AHV-STATPOP
Empirical first stage

**Marginal Tax Rates**

single workers without children  

Note: Computed using own tax calculator (similar to the TAXSIM in the U.S.).
Earnings growth w.r.t. 2013

Note: average growth of (real) annual earnings w.r.t. 2013 within equally spaced bins of AR$ 500.
Earnings growth w.r.t. 2013

Note: average growth of (real) annual earnings w.r.t. 2013 within equally spaced bins of AR$ 500. Sample: private sector wage earners. Growth winsorized at p99. Inflation: 19%, 39%, 27% and 36%.
Earnings growth w.r.t. 2013

Note: average growth of (real) annual earnings w.r.t. 2013 within equally spaced bins of AR$ 500.
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Earnings growth w.r.t. 2013

Note: average growth of (real) annual earnings w.r.t. 2013 within equally spaced bins of AR$ 500.
Evolution of RD estimates, 2011-2017

Note: with $e = 0.3$ (thought experiment), excess earnings growth would be 7.5%.
Figure 4: Secondary Job Holding Rates by Secondary Earnings Level

Source: Tazhibdinova (2019)

(a) same axis

(b) different axis

Notes: This figure shows the share of individuals with secondary jobs paying less than €400 per month, paying between €400 and €1000, or more than €1000 per month. The vertical red line identifies the 2003 tax reform. Source: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.
Figure 4: Secondary Job Holding Rates by Secondary Earnings Level

(a) same axis

Notes: This figure shows the share of individuals with secondary jobs paying less than €400 per month, paying between €400 and €1000, or more than €1000 per month. The vertical red line identifies the 2003 tax reform. Source: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.
Employment Rates of Men by Age, 2019

Source: Saez AEA-PP'21

Source: OECD database online. Employment to population ratios.
Employment Rates of Women by Age, 2019

Source: OECD database online. Employment to population ratios.
Employment Rates of Men and Women, aged 25-54
Source: Saez AEA-PP’21

Source: OECD database online.
Employment Rates of Men and Women, aged 25-54

Source: Saez AEA-PP'21

Source: OECD database online.
US female labor force participation, age 16-64

Source: Saez AEA-PP’21

25% increase in 1943-1945 during WW2 planned economy

Average Annual Hours of Work of Employees

Source: Saez AEA-PP'21

US has 40 hour/week and no mandatory paid vacation

1968: 4th week of paid vacation

1982: 5th week + 39 hours/week

2000-2: 35 hours/week

Source: OECD database online. Includes all ages, genders, and part-time, full-time, overtime.
Starting from a Means-Tested Program

Disposable income 
\[ c = z - T(z) \]

Pre-tax earnings \( z \)

Graph with the equation \( c = z - T(z) \) and point G.
FIGURE 16: HOW MUCH CAN BE EXPLAINED BY WELFARE WAIVERS?
ALL SINGLE WOMEN, WEEKLY EMPLOYMENT

Notes: This figure shows DiD event studies of the 1993 reform for waiver states (black series) and non-waiver states (blue series). Specifically, the series show estimates of the DiD coefficient $\gamma_t$ from specification (2), implemented separately on states that ever approved statewide waiver legislation and those that did not. Both series include controls for demographics and unemployment. From Table A.3 in the appendix, there were 13 states without any statewide waiver legislation: Alabama, Alaska, District of Columbia, Kansas, Kentucky, Louisiana, Nevada, New Mexico, New York, Oklahoma, Pennsylvania, Rhode Island, and Wyoming. The extensive margin outcome is weekly employment. The sample includes single women aged 20-50 using the March and monthly CPS files combined. The 95% confidence intervals are based on robust standard errors clustered at the individual level.
Stacked Event Studies: All Reforms
Weekly Employment, All Single Women

Difference-in-Differences:
Treated vs Control States (With Kids)

Triple-Differences:
Treated vs Control States (With vs Without Kids)