The Effect of the ACA on Marginal Tax Rates and Labor Supply*

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Abstract

The Affordable Care Act (ACA) represented the largest expansion of public health care coverage since the introduction of Medicaid and Medicare in 1965. In this paper, I estimate the extent to which major ACA provisions changed the financial return of working and affected the labor supply of Americans. I account for heterogeneous effects of the ACA by precisely identifying the impacted populations and looking at the labor supply responses of these groups. Importantly, my novel methodology based on the Policy Rules Database (Ilin and Terry 2021b) allows me to analyze the effects of all ACA provisions accounting for interactions with existing means-tested social safety net programs. First, I identify three natural experiments where the ACA changed work incentives. I find that depending on the experiment and affected population, the ACA changed hours worked by between -3 and +2 hours per week. Next, I estimate the overall elasticity of labor supply by exploiting the exogenous variation in the effective marginal tax rate (EMTR) – a single measure that captures all potential effects on work incentives. I find the elasticity of taxable income to be 0.1. Using this elasticity, I estimate the aggregate effect of the ACA on work effort. I find that on average, the ACA did not have a significant effect on the work effort of the population at large. However, for some groups the effect was economically and statistically significant. For example, those with annual taxable income of 50-99 percent of the federal poverty level in non-expansion states increased their income on average by 19.5 percent or $2,187.

JEL Codes: H21, H23, H24, H31, H53, J21, J22

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1 Introduction

The Affordable Care Act (ACA) was signed into law by President Obama on March 23, 2010 and resulted in the largest expansion of public health care coverage since the introduction of Medicaid and Medicare in 1965. In this paper, I estimate the extent to which major ACA provisions changed the financial return of working and affected the labor supply of Americans. In contrast to the previous literature, I account for heterogeneous effects of the ACA by precisely identifying the impacted populations and looking at the labor supply responses of these groups. Importantly, my novel methodology based on the Policy Rules Database (Ilin and Terry 2021b) allows me to analyze the effects of all ACA provisions accounting for interactions with existing means-tested social safety net programs. I find that on average, the ACA did not have a significant effect on the work effort of the population at large. However, for certain groups the effect was significant and large.

Three key provisions of the ACA were effective January 1, 2014. First, the law triggered the expansion of Medicaid to adults with incomes below 138 percent of the Federal Poverty Level (FPL). Second, the ACA established the Health Insurance Marketplace – an online platform where consumers can buy affordable private insurance plans. Third, households with income between 100 percent and 400 percent of the FPL became eligible for subsidies that significantly reduce their health insurance premiums for plans purchased through the ACA marketplace.

The central goal of the ACA was to expand coverage and decrease the number of uninsured people. This goal has unambiguously been achieved; the uninsured rate of nonelderly individuals has dropped from 44.3 percent in 2013 to 30 percent in 2020 (Finegold et al. 2021). An outstanding question is whether the ACA created disincentives to work, a key concern among critics of the law.[1] New income-based eligibility requirements, the phase-out

[1]See Matsudaira and Blank (2014) and Yelowitz (1995) for theoretical models that generate causal effects of Medicaid on labor supply. A report by the Congressional Budget Office (Harris and Mok 2015) intuitively describes these mechanisms. Additionally, see Moffitt (2015) and Mulligan (2013, 2015) for a detailed description of the ACA labor supply incentives and potential behavioral responses.

of ACA premium subsidies with income gains, and the implementation of Medicaid expansion introduced a shock to effective marginal tax rates (EMTRs) – a share of additional income that is effectively lost (or 'taxed away') because of an increase in tax liability or decline in means-tested public assistance and tax credits. Thus, the law changed the financial return of working for some, potentially altering work incentives for those affected.

Shortly after the law went into effect, the Congressional Budget Office produced a report (Harris and Mok 2015) estimating the effect on labor supply. The report predicted that the ACA would reduce total hours worked by 1.7 percent, which is equivalent to 2 million fewer full-time workers. Since this report, several studies attempted to empirically estimate the actual effects of the ACA on labor supply (Kaestner et al. 2017; Buchmueller et al. 2019; Kucko et al. 2018; Gooptu et al. 2016; Leung and Mas 2016). However, the studies so far have been inconclusive and evidence on the labor supply effects of the ACA have been mixed.

In this paper, I argue that the lack of consistent evidence found in prior studies stem from two missing considerations. First, specific segments of the population were differentially affected by the law. For example, the timing and status of the Medicaid expansion varies by states, and some states still have not implemented the expansion. Additionally, the value of the ACA marketplace subsidy varies by person's age, state of residency, and other characteristics such as availability of affordable health insurance through the employer. Therefore, in order to capture the effect of the law, one must account for these heterogeneous effects. Prior studies have failed to include this heterogeneity in their analysis and therefore analyzed the effect of the law on largely unaffected populations. Second, the ACA law exists alongside many other social safety net programs whose value varies with income. Thus, the magnitude and the direction of any individual's ACA-induced change in effective marginal tax rates depends on what other public support they are receiving. My methodology involves precisely estimating the effect of all ACA provisions in the context of their interaction with the entire U.S. social safety net. To my knowledge, my paper is the first to do this.

In the first part of the paper, I exploit highly heterogeneous effects of the ACA on work

incentives and identify three natural experiments that provide initial evidence on how the ACA changed the labor supply. I analyze each experiment using difference-in-differences (DiD) applied to the 2014 Survey of Income and Program Participation (SIPP). The first experiment examines the change in incentives of uninsured workers who were below the poverty line before the ACA and lived in states that did not expand Medicaid. In theory, this group would have an incentive to increase their work effort after the ACA was passed to gain eligibility for the premium subsidy which is only available to those above the poverty line. In the second experiment, I look at the change in work effort among those with income just above state Medicaid eligibility threshold who live in Medicaid expansion states. In theory, this group has an incentive to reduce their income in order to gain Medicaid eligibility and obtain premium-free insurance. Finally, the third experiment explores whether households who received Medicaid prior to the ACA increased their work effort after income eligibility thresholds for Medicaid were increased. The increase in the eligibility threshold for Medicaid theoretically removed a financial barrier for households that were intentionally keeping their income below this threshold in order to keep free health insurance. In all three experiments, I find statistically significant evidence that support each of my hypotheses. Notably, the ACA appears to change work incentives. The law had a positive effect on the work effort of some populations and a negative effect on the work effort of others.

In the second part of the paper, I analyze labor supply responses to the ACA taking into account the entire social safety net and the full spectrum of heterogeneous effects on work incentives. I exploit the exogenous shock to effective marginal tax rates created by the ACA to estimate the elasticity of taxable income for each household in the 2014 SIPP. Using the novel Policy Rules Database Ilin and Terry (2021b) I estimate the effective marginal tax rate (EMTR) on a $1,000 annual earnings increase. I estimate this EMTR before and after the ACA to isolate the change in EMTR induced by the ACA law. I then use an instrumental variable regression framework similar to Gruber and Saez (2002) to estimate the overall elasticity of taxable income. I find this elasticity to be 0.1; a 1 percent increase

in EMTR results in 0.1 percent decrease in taxable income.

I then apply the estimated elasticity of taxable income to the 2013 American Community Survey (ACS) to estimate the aggregate labor supply effects of the ACA. For each worker in the 2013 ACS, I estimate the same set of EMTRs and corresponding exogenous change in EMTRs due to the ACA law. my analysis shows that on average the ACA did not change the effective marginal tax rates faced by the U.S. workers. This lack of average effects, however, masks important heterogeneity. For example, workers in non-expansion states with income between 50 and 99 percent of the FPL had their EMTRs reduced by 78 percentage points. For this group, the ACA created an incentive to increase earnings by an average of $2,187. By contrast, workers in expansion states with income between 200 and 399 percent of the FPL experienced an increase in EMTRs by 6 percentage points. For this group, the ACA created an incentive to reduce earnings by an average of $675.

1.1 Related Evidence – A□ordable Care Act, Medicaid Expansion, and Labor Supply

The 2014 report by the Congressional Budget Office (Harris and Mok 2015) estimated that the ACA would reduce total hours worked by 1.7 percent, which is equivalent to 2 million fewer full-time workers. To get these estimates, the authors calculated the effects of each major provision of the ACA on marginal and average tax rates and then applied a labor supply elasticity obtained by the previous literature. These labor supply elasticities come from the synthesis of evidence from a set of important case studies. Dague et al. (2017) examine an expansion of Medicaid to childless adults in Wisconsin in 2009. Their regression discontinuity research design exploited the enrollment cap that left some eligible people unable to enroll in Medicaid. Results show that Medicaid enrollment was associated with a statistically significant 2 to 18 percent decrease in employment. Third, Garthwaite et al. (2014) use a difference-in-differences (DiD) research design to examine the reduction of Medicaid eligibility in Tennessee in 2005. Their paper finds that among low-educated, childless adults,

the change in Medicaid policy was associated with a 25 percent increase in employment, but there was no effect for other educational groups.

After the Affordable Care Act became law and expanded Medicaid, researchers used the expansion as an opportunity to study how altered work incentives affected labor supply. Kaestner et al. (2017) find little evidence that the Medicaid expansions decreased earnings and employment. They look separately at a sample of low-educated workers (high school or less) and those with income below 300 percent of the FPL. Their study did not find significant effects for either population. Buchmueller et al. (2019) find no effects on average for the population but does find positive effects on labor force attachment for parents and the short-term unemployed. Kucko et al. (2018) exploit the fact that those who fall in the Medicaid coverage gap face a strong incentive to increase their earnings above 100 percent of the FPL to obtain the premium tax credit.[2] Analyzing the universe of tax returns, they document bunching in the income distribution surrounding the notch. They find that bunching occurs only among filers with self-employment income and is most pronounced among filers without children. However, when they link the tax data to the ACS, they find that labor supply measures (full-time and part-time employment, monthly and weekly work hours) are unchanged. Thus, their conclusion is that this bunching likely reflects a change in reported income rather than a change in true labor supply. Thus, they find no evidence that wage and salary workers adjust their labor supply in response to increased availability of subsidized Marketplace health insurance. Gooptu et al. (2016) use a sample of adults with income below 138 percent of the FPL drawn from the monthly CPS between January 2005 and March 2015 to examine the effect of Medicaid expansions on transitions from employed to unemployed, transitions from full-time to part-time employment, and job switches. The results from the authors' DiD research design are that the ACA Medicaid expansions had no significant effect on the frequency of switches. Leung and Mas (2016) also use a DiD design to study the effect of the ACA Medicaid expansions on employment, hours of work,

[2]In non-expansion states, a Medicaid coverage gap occurs at income levels at which workers are not eligible for Medicaid, but also not yet eligible for the ACA subsidy.

and wages of childless adults. They find no significant effect of ACA Medicaid expansion on any of these outcomes.

To summarize, previous studies of the effect of the ACA on labor supply have not found significant effects when examining the U.S. population as a whole. I too do not find significant effects on aggregate labor supply. However, once accounting for the heterogeneity of the effects, I do find that the ACA significantly affected the labor supply of populations most impacted by the law. Thus, my paper contributes to the literature by precisely identifying the affected populations and looking at the labor supply responses of these groups. Moreover, prior studies considered the introduction of the ACA provisions in isolation from the existing social safety net programs. In reality, low-income families receive a variety of public assistance, each with its own set of complex and obscure means-tested requirements. I contribute to the literature by using a novel methodology based on the Policy Rules Database that allows me to analyze the effects of all ACA provisions accounting for interactions with existing means-tested public assistance programs and tax credits. my identification strategy exploits the exogenous variation in the effective marginal tax rate – a single measure that captures all potential effects on the work incentives. This approach differs from the previous research that concentrated on specific aspects of the ACA and therefore was not able to capture the aggregate effect of the policy change.

2 The E□ects of the ACA on Labor Supply – Two Channels

2.1 The Medicaid Expansion and Its Timing

The ACA gave states the option to expand Medicaid eligibility starting from January 1, 2014. For those states that chose to expand, the federal government paid 100 percent of Medicaid costs of those newly eligible from 2014 to 2016. The federal share gradually phased down to

90 percent in 2020 and is set to remain at that level thereafter. A decision by the Supreme Court (National Federation of Independent Business et al. vs. Sebelius, Secretary of Health and Human Services, 2012) allowed states to opt out of the ACA Medicaid expansions. As a result, only twenty five states and the District of Columbia expanded Medicaid immediately in January 2014. Moreover, among those that did expand, fmy states – Delaware, Massachusetts, New York, and Vermont – already had prior and comprehensive expanded Medicaid in place, qualitatively similar to the Medicaid expansion called for under the ACA. Therefore, these states did not experience a change in Medicaid eligibility. Finally, twelve states expanded Medicaid after 2015. Table 1 summarizes the status and timing of Medicaid expansion for each state as of 2021.

Table 1: Timing of State Medicaid Expansion Decisions

'Pre-expanded' Medicaid
Delaware, Massachusetts, New York, Vermont
Expanded in January 2014
Arizona, Arkansas, California, Colorado, Connecticut, District of Columbia, Hawaii, Illinois, Iowa, Kentucky, Maryland, Minnesota, Nevada, New Jersey, New Mexico, North Dakota, Ohio, Oregon, Rhode Island, Washington, West Virginia
Expanded after January 2014
Michigan (4/1/2014), New Hampshire (8/15/2014), Pennsylvania (1/1/2015), Indiana (2/1/2015), Alaska (9/1/2015), Montana (1/1/2016), Louisiana (7/1/2016), Virginia (1/1/2019), Maine (1/10/2019), Idaho (1/1/2020), Utah (1/1/2020), Nebraska (10/1/2020)
Not Expanded
Alabama, Florida, Georgia, Kansas, Mississippi, Missouri (planned for 7/1/2021), North Carolina, Oklahoma (planned for 7/1/2021), South Dakota, Tennessee, Texas, Wisconsin, Wyoming

Source: Kaiser Family Foundation's "Status of State Action on the Medicaid Expansion Decision" report

Eligibility for Medicaid is based on household income relative to the FPL. These income-eligibility thresholds vary by state, depend on whether adults have dependents, and vary

with the size of the household. In most states that have expanded Medicaid to date, adults with and without dependents are eligible for free coverage as long as the income of their households is below 138 percent of the FPL. Three states so far have expanded eligibility beyond this point and allowed households to keep eligibility for up to 200 percent of the FPL.

In most states that have not yet expanded Medicaid, adults without dependents are ineligible for Medicaid coverage. However, many non-expansion states utilize section 1931 of the Social Security Act to allow low-income individuals with children to qualify for Medicaid. The income eligibility threshold for this population in non-expansion states varies by state – the average across non expansion states is 53 percent of the FPL. Figure 1 shows a map of income eligibility thresholds across all U.S. states for adults with and without dependents as of 2021.

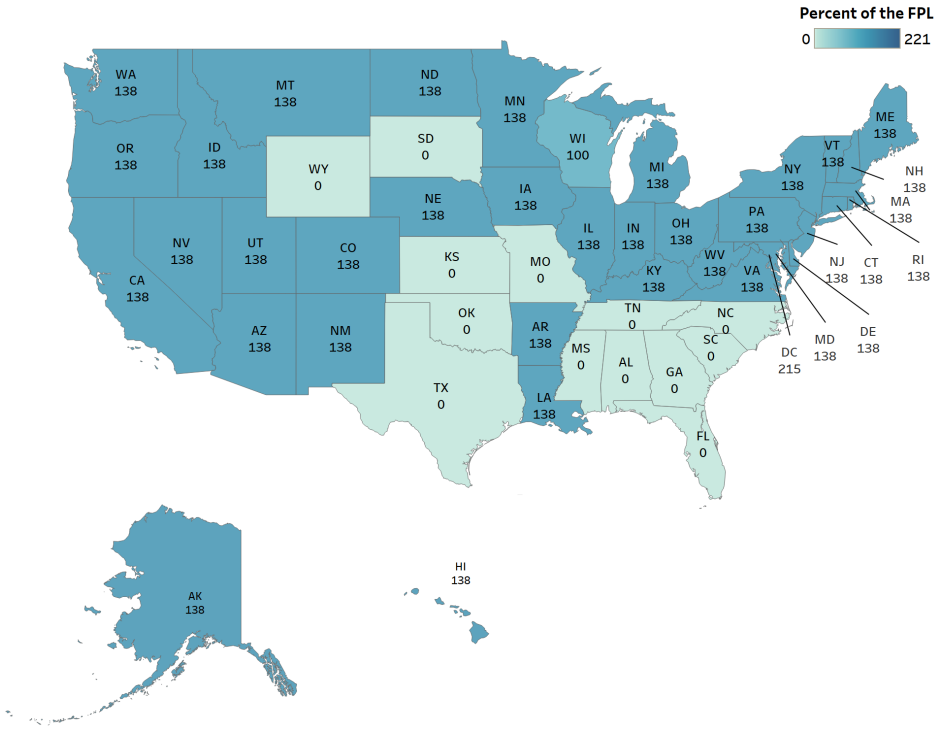
The Medicaid expansion may have influenced work effort through three main channels. First, after the expansion, some people may find themselves right above the expanded income eligibility threshold. Thus, they will have an incentive to reduce their work effort to lower their income and gain Medicaid eligibility. Second, some people that already received Medicaid before the expansion may choose to increase work effort because they can work and earn more and still remain eligible for Medicaid due to the higher Medicaid income limits. Finally, Medicaid eliminates all out-of-pocket health insurance premium contributions. It allows a person to work less and keep the same amount of consumption. Because of this income effect some people may reduce work effort. Crucial for my identification strategy, the location of these different inflection points will vary by state and whether the household has children or not.

2.2 Introduction of the Health Insurance Marketplace

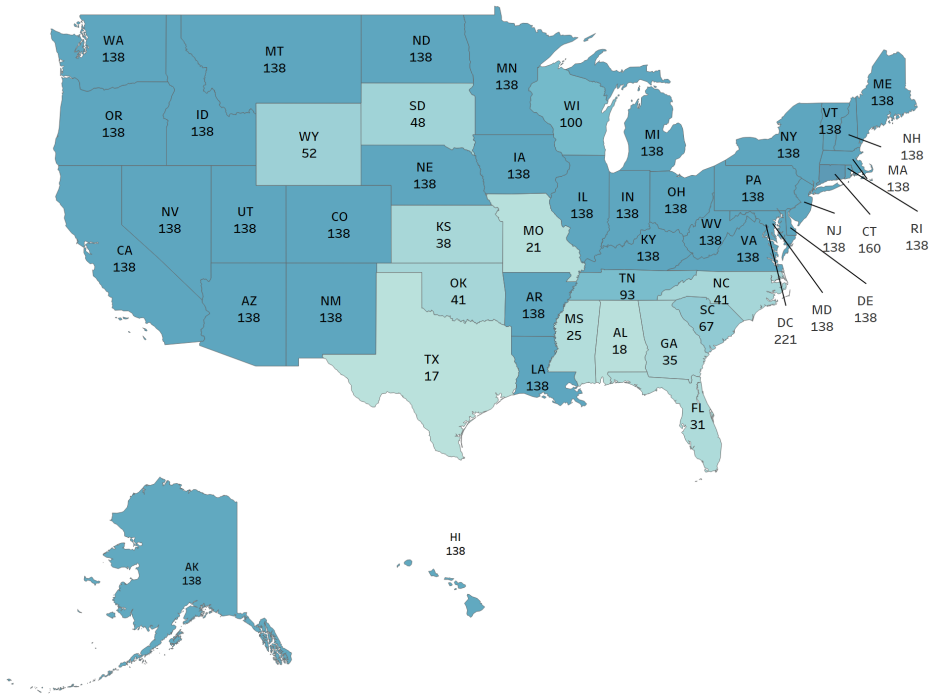
In 2014, all states launched Health Insurance Marketplaces (also known as Health Insurance Exchanges) – regulated, online marketplaces, administered by governments, that offer af-

Figure 1: Income Eligibility for Medicaid by State as a Percent of the FPL

(a) Childless Adults



(b) Adults with Dependents



Source: The Policy Rules Database (Ilin and Terry 2021b)

fordable private insurance plans to individuals and businesses. Some households are eligible for subsidies that significantly reduce their out-of-pocket health insurance premiums. To be eligible for a subsidy, the household must have an income between 100 and 400 percent of the FPL. Individuals' contributions increase with income. For example, households with income at 100 percent of the FPL pay 2.06 percent of their adjusted gross income towards health insurance premium and the rest is covered by the government. Households with income at 400 percent of the FPL pay more than four times this share – 9.78 percent of their income. In addition, the estimated cost of health insurance on the exchange varies with the age and state of residency. Each state has an 'age curve' which insurance providers must adhere to when price discriminating based on age.

The introduction of the Health Insurance Marketplaces may have altered work incentives in two major ways. First, households in non-expansion states with income right below the poverty line are ineligible for Medicaid, and thus would have a strong incentive to increase their work effort and become eligible for the ACA premium subsidies. Second, households with income between 100 and 400 percent of the FPL were uninsured before the expansion. After the expansion, they became eligible for the ACA premium subsidies which reduced their out-of-pocket costs, creating a positive income effect. This in theory could reduce the average work effort among the group. Moreover, these households experienced a positive shock to their effective marginal tax rates due to the phase-out of a subsidy. This too would theoretically disincentivize work effort. Finally, for some households the loss of a subsidy at 400 percent of the FPL can result in significant financial stress and thus can potentially induce some households to keep their earnings low. The size of this loss will vary significantly by the cost of the subsidy for individuals. Those that face large health insurance costs on the market (usually older adults) face larger health insurance costs and thus larger subsidies.

3 Part I: Three Natural Experiments

To test whether the ACA affected work effort I exploit three natural experiments created by the new policies. I limit the samples of all three experiments to the states that immediately adopted Medicaid expansion in 2014 and those states that did not expand Medicaid between 2015-2016. I intentionally exclude states that expanded Medicaid between 2015 and 2016 to simplify the analysis and not introduce bias into my results (Callaway and Sant'Anna 2020; Goodman-Bacon 2021). A description of each experiment is provided in Table 2 and includes the samples being used, allocation into treatment and control groups, and expected effects. All experiments utilize a canonical difference-in-differences technique. I use this technique to isolate the labor supply effects of the ACA, ignoring other factors (e.g. changes in wages and employment in the economy at large) that might also affect the behavior of both groups during the same time period as the ACA changes.

Table 2: Description of Three Natural Experiments

Sample	Treatment	Comparison	Expected E□ect
Experiment 1			
1. 2013 income is $< 100\%$ FPL 2. No employer health insurance in 2013 3. Not on Medicaid in 2013	Non-expansion states	Expansion states	*Increase* in work effort of treatment group
Experiment 2			
1. 2013 income is b/w 138% and 150% FPL 2. Employer health insurance in 2013	Expansion states	Non-expansion states	*Decrease* in work effort of treatment group
Experiment 3			
1. At least one adult in the household is on Medicaid in 2013	Expansion states	Non-expansion states	*Increase* in work effort of treatment group

In the first experiment I test whether the introduction of the Health Insurance Marketplace increased the work effort of affected households. I look at the sample of households with 2013 income below the poverty line, without access to employer health insurance, and without Medicaid coverage as of 2013. In non-expansion states these households were 'treated'

with the introduction of the Health Insurance Marketplace and premium subsidies. Thus, they had an incentive to increase their work effort to gain access to the premium subsidy that significantly reduced their out-of-pocket costs. In contrast, households in expansion states without access to employer health insurance and without Medicaid coverage would gain access to Medicaid, and thus I would not expect any significantly positive effects on their work effort as a result of the ACA.

In the second experiment, I look at whether some households decrease their work effort to get access to expanded Medicaid. The sample for this experiment are households with income right above the eligibility threshold of 138 percent of the FPL and whose employers offer affordable health insurance. The last restriction makes these households ineligible for the ACA premium subsidy. In expansion states, these households found themselves right above the income eligibility threshold for Medicaid and therefore had an incentive to decrease their work effort and income to become eligible for Medicaid. In non-expansion states, Medicaid was still not an option, and I do not expect Medicaid expansion to have any effect on work effort for this group.

In the third experiment, I analyze the potential positive effect of the Medicaid expansion on work effort. Before the expansion, households that were on Medicaid had to keep their earnings below the income eligibility threshold to keep the subsidy. After the expansion, these households were able to work more and still be eligible for the subsidy. In non-expansion states however, I do not expect any change in work effort among this group as a result of the ACA.

Formally, for each of the experiments described above, I estimate the following regression. For each individual i in state s in time period t I estimate:

$$y_{ist} = \alpha + \beta_i + \lambda(T_i \times S_t) + \mu_s + \delta_t + \epsilon_{ist} \tag{1}$$

Where y is an labor supply variable of interest; β is an individual fixed effect; T is an

indicator of whether the individual i is in the treatment group of the experiment group; S is a dummy indicator for the ACA shock. It is equal to 0 in 2013 and 1 in 2014, 2015, and 2016; μ is a state fixed effect and δ is a year-month fixed effect.

3.1 Data

I estimate equation 1 using the 2014 SIPP – a panel dataset that provides detailed information on short-term income dynamics and participation in public health insurance (Medicaid, Children Health Insurance Program (CHIP), and ACA premium subsidies). The 2014 SIPP panel covers reference years 2013 to 2016.

I restrict the sample to 18-64 years-old adults that were employed at the beginning of the survey in January 2013. To create a balanced panel, I remove any observations that are missing a response for any of the January observations. Table 3 provides descriptive statistics for my sample.

3.2 Results

I estimate equation 1 using OLS for all three experiments specified in Table 2. I use six labor supply variables as outcome variables – three of these variables are related to weekly hours of work and three of these variables are related to monthly labor earnings. The results for each of the three experiments are summarized in Table 4.

In the first experiment I find statistically significant positive effects of the introduction of the ACA Health Insurance Marketplace on total hours, hours of the main job, and hours of the second job, and main job earnings. On average, the ACA increased average weekly hours at the main job by 1.15, at the second job by 0.82, and total hours of work by 1.97. I find the ACA increased monthly earnings from the main job by an average of $192.96.

The results from the second experiment show that, as expected, Medicaid expansion had a negative effect on the work effort and earnings of treated households in the sample. I find that Medicaid expansion, on average, decreased total weekly hours by 3.20. Most of this

Table 3: 2014 SIPP Descriptive Statistics

Age	41.51
	(10.77)
Total Income	52,386
	(36,936)
Usual Hours Worked	40.49
	(11.23)
Number of Children	0.75
	(1.02)
Male	0.52
Married	0.56
Renters	0.31
High School Degree or Less	0.29
Some College or Associate	0.28
College Degree	0.43
White, non-Hispanic	0.69
Black, non-Hispanic	0.10
Hispanic	0.14
Other Race	0.07
Number of Observations	6,342

Note: Standard errors are in parentheses. Total income is defined as individuals earned and unearned income from all sources. Sample is limited to non-elderly working adults (age 18-64).

decline stems from a decline in hours worked at second jobs, where households have more flexibility. On average, Medicaid expansion decreased hours worked at second jobs by 3.97. Looking at earnings, I find that Medicaid expansion had a negative statistically significant effect on monthly earnings from all jobs. This change stems from both the earnings of the first and second jobs, where I also find negative significant effects as a result of the ACA.

Finally, the results from the third experiment indicate that Medicaid expansion had a positive effect on hours worked at the first job. On average, Medicaid expansion increased weekly working hours by 0.72. Total earned income increased by $77.03 on average; earnings from the main job increased by an average of $51.04 while second job earnings were not significantly changed by the ACA.

Table 4: Results of the Difference-in-Differences Analysis

	Total Weekly Hours Worked	Main Job Weekly Hours Worked	Second Job Weekly Hours Worked	Total Monthly Earned Income	Monthly Income from Main Job	Monthly Income from Second Job
Experiment 1: Positive Effect of ACA Premium Subsidies						
Baseline*	32.46	29.55	6.34	1,194.76	1,129.14	235.92
$T_i \times S_t$	1.97***	1.15**	0.82**	-0.76	192.96***	-15.83
	(0.62)	(0.63)	(0.45)	(87.23)	(82.23)	(31.38)
N	8,064	8,064	8,064	8,064	8,064	8,064
Experiment 2: Negative Effect of Medicaid Expansion						
Baseline*	37.27	28.32	15.97	1,798.93	1,395.12	719.35
$T_i \times S_t$	-3.20***	0.75	-3.97***	-489.89***	-275.78***	-252.94***
	(1.39)	(1.29)	(1.10)	(117.68)	(90.15)	(84.03)
N	1,968	1,968	1,968	1,968	1,968	1,968
Experiment 3: Positive Effect of Medicaid Expansion						
Baseline*	37.03	33.02	8.59	2,269.66	2,005.43	497.52
$T_i \times S_t$	0.42**	0.72***	-0.18	77.03***	51.04***	62.82
	(0.23)	(0.26)	(0.21)	(33.06)	(31.87)	(16.46)
N	46,624	46,624	46,624	46,624	46,624	46,624

* Average value as of December 2013

Note: Standard errors are in parenthesis

***,**,* indicate significance levels at 0.1%, 1%, and 5% respectively

3.3 Falsification Test

To confirm that the effects estimated in Table 4 represent true causal effects of ACA on labor supply, I conduct a series of falsification tests. Specifically, I perform an additional difference-in-differences estimation using 'fake' experiments. I estimate equation 1 using the 2008 SIPP panel that covers reference years 2008 to 2012. S is now a dummy indicator for the 'fake' ACA shock. I set it equal to 0 in 2008 and 2009 and 1 in 2010, 2011, and 2012. I allocate states into treatment and control groups in exactly the same way as specified in Table 2. Thus, 'fake' ACA shock should have no effect on individuals' labor supply decisions. Table 5 summarizes the results of the placebo test. In all experiments, I find no significant effect of the 'fake' ACA shock on the various measures of labor supply, supporting the validity

of the results obtained in Table 4.

Table 5: Results of the Falsification Test (ACA 'Shock' Set to Years 2010, 2011, and 2012)

	Total Weekly Hours Worked	Main Job Weekly Hours Worked	Second Job Weekly Hours Worked	Total Monthly Earned Income	Monthly Income from Main Job	Monthly Income from Second Job
Experiment 1: Positive Effect of ACA Premium Subsidies						
$T_i \times S_t$	8.48	7.27	1.21	-201.39	404.46	-228.91
	(5.28)	(6.20)	(1.70)	(452.40)	(337.71)	(228.06)
N	624	624	624	624	624	624
Experiment 2: Negative Effect of Medicaid Expansion						
$T_i \times S_t$	-3.93	-3.02	-3.21	258.74	-320.48	-196.65
	(2.49)	(5.53)	(3.51)	(196.50)	(566.17)	(124.03)
N	672	672	672	672	672	672
Experiment 3: Positive Effect of Medicaid Expansion						
$T_i \times S_t$	-1.62	-9.59	-2.43	-56.37	-588.95	-285.08
	(3.82)	(8.71)	(2.40)	(651.82)	(365.97)	(239.83)
N	1,444	1,444	1,444	1,444	1,444	1,444

Note: Standard errors are in parenthesis

***,**,* indicate significance levels at 0.1%, 1%, and 5% respectively

4 Estimating the Aggregate Effect of the ACA on Marginal Tax Rates and Labor Supply

The results from the previous section show the importance of precisely identifying the impacted populations for estimating the labor supply responses to the ACA. However, difference-in-differences estimates capture the effects only for selected groups; the estimates can not be extrapolated to the population at large.

In this section I develop a method of precisely measuring a worker's effective marginal tax rates (EMTR), using not only public health insurance laws, but the entire social safety net. The EMTR thus is a single measure that captures all potential effects of the social safety

net on work incentives. I then use an instrumental variable technique to causally identify how the ACA changed the incentives to work.

I start by describing my method for calculating workers' effective marginal tax rates using the novel Policy Rules Database – a repository that contains rules for all major public assistance programs and tax policies. Next, I separate the exogenous change in workers' EMTRs that were caused by the introduction of the ACA provision from the endogenous change in workers' EMTR that occurred because of income changes between two periods. I use the exogenous component of the EMTR change as an instrument for the change in EMTR to estimate the causal effect of the ACA on the labor supply of workers in the 2014 SIPP. my estimate of the effect of a change in EMTR on the change in labor supply gives me the elasticity on taxable income. Finally, to obtain population estimates of the aggregate labor supply responses to the ACA, I apply this estimated labor supply elasticity to workers in the 2013 American Community Survey, the largest nationally representative survey of U.S. households.

4.1 E□ective Marginal Tax Rates (EMTRs) – Definitions and Calculations

I define the EMTR as a share of income that is effectively lost (or 'taxed away') because of an increase in tax liability or decline in means-tested public assistance and tax credits. Thus, in contrast to the DiD research design in Section I, which relies on natural experiments created by the ACA law, the EMTR variable captures the combined effects of all ACA provisions on work incentives and other social safety net programs and tax credits.

To estimate EMTRs I first construct 'net resources' which summarizes the after-tax-and-transfer financial resources of the household. Net resources also account for household expenses, which will change if the source of health insurance changes. Source of health insurance can change because eligibility for public health insurance programs changes with

income.[3] The net resources (NR) of each household i at time t using the following formula:

$$NR_{it} = y_{it} + PA(y_{it}) - Tax(y_{it}) - Exp(y_{it}) \tag{2}$$

Where y is the household's total earnings; PA is the estimated value of household's total public assistance which is a non-linear decreasing function of earnings;[4] Tax is a total tax liability which is a non-linear increasing function of earnings; Exp is the household expenses and is calculated using the Cost-of-Living Database (Ilin and Terry 2021a). Exp is a function of earnings because the cost of health insurance depends on what type of health insurance is the lowest cost option, which will vary based on the household's eligibility for public health insurance.

As total earnings increase, a family's net resources increase by a smaller amount than an increase in earnings, because part of this decrease is effectively lost due to an increase in taxes or decline in public assistance and tax credits. I define effective marginal tax rate as a share of a $1,000 income increase which is effectively taxed away. For each household i in the time period t I use the following formula to measure EMTR:

$$emtr(y_{it}) = 1 - \frac{\Delta NR_i t + 1}{\Delta y_{it+1}} \tag{3}$$

where Δy_{it+1} is $1,000 for all i and t.

4.2 The Policy Rules Database

To estimate the NR and $emtr$ for each worker in my sample, I use state-specific tax rules and transfer-payment eligibility rules as collected in the Policy Rules Database (Ilin and Terry 2021b). The Policy Rules Database contains all of the major federal and state assistance

[3] Health insurance costs vary by the source of health insurance. For example, the unsubsidized cost of medicaid differs greatly from the unsubsidized cost of employer sponsored health insurance. See Ilin and Terry (2021a) for details.

[4] Except EITC which increases with earned income up to a certain point and CTC whose non-refundable portion increases with income.

programs, tax rules, and tax credits available to working adults and their dependents. Table 6 provides the full list of programs included in the Policy Rules Database.

Table 6: List of Taxes and Public Assistance Programs Included in the Policy Rules Database

Taxes and Tax Credits	
Personal Income Tax	Federal, State
Sales Tax	State
Federal Insurance Contribution Act (FICA) Tax	Federal
Earned Income Tax Credit (EITC)	Federal, State
Child Tax Credit (CTC)	Federal, State
Child and Dependent Care Tax Credit (CDCTC)	Federal, State
Public Assistance Programs	
School Breakfast Program (SBP) and National School Lunch Programs (NSLP)	Federal
Supplemental Nutrition Assistance Program (SNAP)	Federal, State
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)	Federal
(In Progress) Temporary Assistance for Needy Families (TANF)	State
Medicaid	Federal, State
Children's Health Insurance Program (CHIP)	Federal, State
Health Insurance Marketplace Subsidies	Federal
Employer Sponsored Health Insurance	State
The Housing Choice Voucher Program (Section 8)	State, County
(In Progress) Low Income Home Energy Assistance Program (LIHEAP)	State
School Voluntary Pre-K	State
Head Start/Early Head Start	Federal
Child Care and Development Fund (CCDF) Subsidies	State, County

Source: The Policy Rules Database (Ilin and Terry 2021b).

The Policy Rules Database is available at
https://www.atlantafed.org/economic-mobility-and-resilience/advancing-careers-for-low-income-households/policy-rules-database.aspx

4.2.1 Decomposing the Change in E□ective Marginal Tax Rates

I develop an instrumental variable for the change in a households' EMTR by pulling out the part of the change in EMTR that is due only to changes in social safety net programs and tax credits. This variable, $emtr^{M}_{it+1}$, is the 'mechanical' effective marginal tax rate that an individual would face in year $t+1$ if his real income did not change from period t to the period $t+1$. Thus $\ln(1-\frac{emtr^{M}_{it+1}}{emtr_{it+1}})$ represents the exogenous change in the effective marginal

tax rates only due to a change in policy rules.

For example, consider the ACA shock. The variable $emtr(y_{2013})$ in equation 3 is the actual EMTR that household i faces in 2013 – before the ACA – based on 2013 earnings. The variable $emtr(y_{2014})$ is the actual EMTR household i face in 2014 – after the ACA – based on 2014 earnings. The mechanical change in the two EMTRs between 2014 and 2013 is $emtr^M(y_{2013})$ – the exogenous component of the change in EMTR due to the introduction of the ACA.

4.3 Estimating Elasticities of Taxable Income

To estimate the elasticity of labor supply with respect to the EMTRs I use an instrumental variable approach similar to Gruber and Saez (2002). Namely, I regress the change in taxable income between two periods (my proxy for labor supply) on the change in the share of the \$1,000 in additional income not effectively taxed away $(1 - emtr)$ and the change in the share of total income not effectively taxed away $(1 - atr)$. Formally, I estimate the following equation:

$$\ln(\frac{y_{it+1}}{y_{it}}) = \gamma \ln(\frac{1 - emtr_{it+1}}{1 - emtr_{it}}) + \beta \ln(\frac{1 - atr_{it+1}}{1 - atr_{it}}) + \alpha \ln(y_{it}) + \mu_i + \delta_t + \epsilon_{it} \tag{4}$$

Where, y is an annual taxable income; $emtr$ is the effective marginal tax rate; atr is the average tax rate; μ_i is the individual fixed effect; δ_t is the year-month fixed effect. Standard errors are clustered at the individual level.

Parameter γ estimates the compensated elasticity of taxable income and β captures the income effect. Additionally, I include the log of current income $ln(y_{it})$ to avoid potential bias in the OLS estimates because individuals at different points of the income distribution might have different income growth rates. For example, those with high income in one period tend to be more likely to have lower income (resulting in lower or even negative income growth rates) in a later period – a phenomenon known as mean reversion.

The OLS estimation of equation 4 could still lead to a biased estimate of the behavioral elasticity . Let's suppose that there is a positive shock to income, then due to the progressivity of the U.S. tax system, the effective marginal tax rate increases mechanically, biasing estimates. To overcome this issue, I need use an instrumental variable for $emtr_{t+1}$.

Specifically, I use the $emtr^{M}_{it+1}$, the 'mechanical' marginal tax rate described above as an instrument for $\ln(\frac{1-emtr_{it+1}}{1-emtr_{it}})$. Important for ensuring my instrumental variable is valid, the variable $emtr^{M}_{it+1}(y_{it})$ is correlated with $emtr_{it+1}(y_{it})$ but uncorrelated with y_{it+1}.

4.4 Regression Results

After constructing the series of mechanical effective marginal tax rates for each individual in my 2014 SIPP sample, I estimate equation 4 by 2SLS using $\ln(\frac{1-emtr^{M}_{it+1}}{1-emtr_{it}})$ as an instrument for $\ln(\frac{1-emtr_{it+1}}{1-emtr_{it}})$. Likewise, I use $\ln(\frac{1-atr^{M}_{it+1}}{1-atr_{it}})$ as an instrument for $\ln(\frac{1-atr_{it+1}}{1-atr_{it}})$. Table 7 summarizes the regression results for three specifications each featuring a different set of control variables.

Table 7: Estimated Elasticities of Taxable Income

	Change in Annual Taxable Income $\ln(\frac{y_{it+1}}{y_{it}})$		
	Specification 1	Specification 2	Specification 3
$1-emtr$	0.01	0.15***	0.10***
	(0.04)	(0.05)	(0.02)
$1-atr$		0.86***	-0.13***
		(0.17)	(0.02)
$\ln(\frac{1-atr_{t+1}}{1-atr_t})$	No	Yes	Yes
$\ln(y_t)$	No	No	Yes
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	18,773	18,712	18,712

***, ** and * indicate significance levels at 0.1%, 1% and 5% respectively

Standard errors are reported in the parenthesis

Specification 1 estimates equation 4 without the income effect, $\ln(\frac{1-atr_{t+1}}{1-atr_t})$ or the log of

current income $\ln(y_t)$. An estimate of compensated elasticity obtained from this specification is insignificant. The second specification includes the income effect, but does not include the current income to control for possible mean reversion. The results from Specification 2 are significant; however, the estimated income effect coefficient has an unexpected positive sign. Economic theory would predict the income effect to be negative; that is, a positive increase in the share of income not taxed away would effectively reduce the amount of pre-tax earnings you need to make to obtain the same standard of living. Finally, Specification 3 includes the income effect and controls for mean reversion effects. The third estimate suggests the compensated elasticity of taxable income is 0.1 and statistically significant. That is, a one percent change in the effective marginal tax rate results in 0.1 percent decline in work effort as measured by taxable income.

4.5 The E□ect of the ACA Policy Shock on E□ective Marginal Tax Rates – 2013 American Community Survey

Figure 2 illustrates how the ACA changed EMTRs faced by U.S. workers. To construct these estimates I apply the Policy Rules Database to the 2013 American Community Survey to calculate the actual pre-ACA effective marginal tax rates (emtr2014) and mechanical post-ACA effective marginal tax rates ($emtr^{M}_{2014}$) for the sample of me workers that are 18-64 years old and are working (employed or self-employed).

Though the Policy Rules Database contains the specifics on the eligibility rules for the programs listed in Table 6, simply applying those rules to eligible households is not appropriate for calculating household net resources. In general, program take-up rates (share of eligible households that participate in the program) are less than 100 percent (and sometimes much less than 100 percent). Although the ACS asks survey participants about some public assistance receipts, the program coverage is too narrow and the underreporting rates too high to obtain reliable estimates of participation and take-up.

To correct for missing program participation data in the ACS I employ a four-step pro-

cedure.

1. I use the Policy Rules Database to determine the universe of eligible households within the ACS for each of the transfer programs and tax credits in Table 3.

2. Using the Annual Social and Economic Supplement of the Current Population Survey (ASEC), which contains household-level data for all of relevant programs in Table 3, I estimate a predictive participation model based on a set of observable household characteristics.[5]

3. I apply the prediction model to program-eligible observations in the ACS to predict the probability of participation in a given program.

4. I use the predicted probability of program participation obtained in (3) to assign a participation indicator to any observations missing information about program participation. I ensure that my participation estimates match national statistics of take-up rates for each public assistance program.

More details about my program participation model can be found in Appendix A.

Figure 2 shows that the ACA provisions had heterogeneous effects on the effective marginal tax rates of U.S. workers depending on their income level and state of residency. EMTRs of households in non-expansion states decreased to negative territory, because for them an increase in income would result in a gain in Health Insurance Marketplace subsidies. Households in non-expansion states with income above 100 percent of the FPL experienced an increase in EMTRs due to the phase-out of the premium subsidy.

In the expansion states, EMTRs declined for some low income households that were receiving Medicaid before the expansion. Expansion moved the eligibility threshold to a higher level, allowing these households to increase earnings without losing access to the

[5]Program participation in the ASEC is underreported in that the implied overall participation rates are below the aggregate statistics I can observe from administrative data. I deal with this by randomly assigning participation among eligible non-reporting households until the sample population matches aggregate participation rates for each program. my prediction model is based on this scaled-up data.

subsidy. However, the income eligibility for Medicaid was not eliminated, but rather moved up. Thus, some households in expansion states with income below 138 percent of the FPL faced higher EMTRs due to a potential loss of Medicaid. Finally, similar to households in non-expansion states, some households with income between 100 and 400 percent of the FPL experienced an increase in EMTRs due to the phase-out of ACA premium subsidies.

Figure 2: Exogenous Change in the EMTRs Due to the ACA

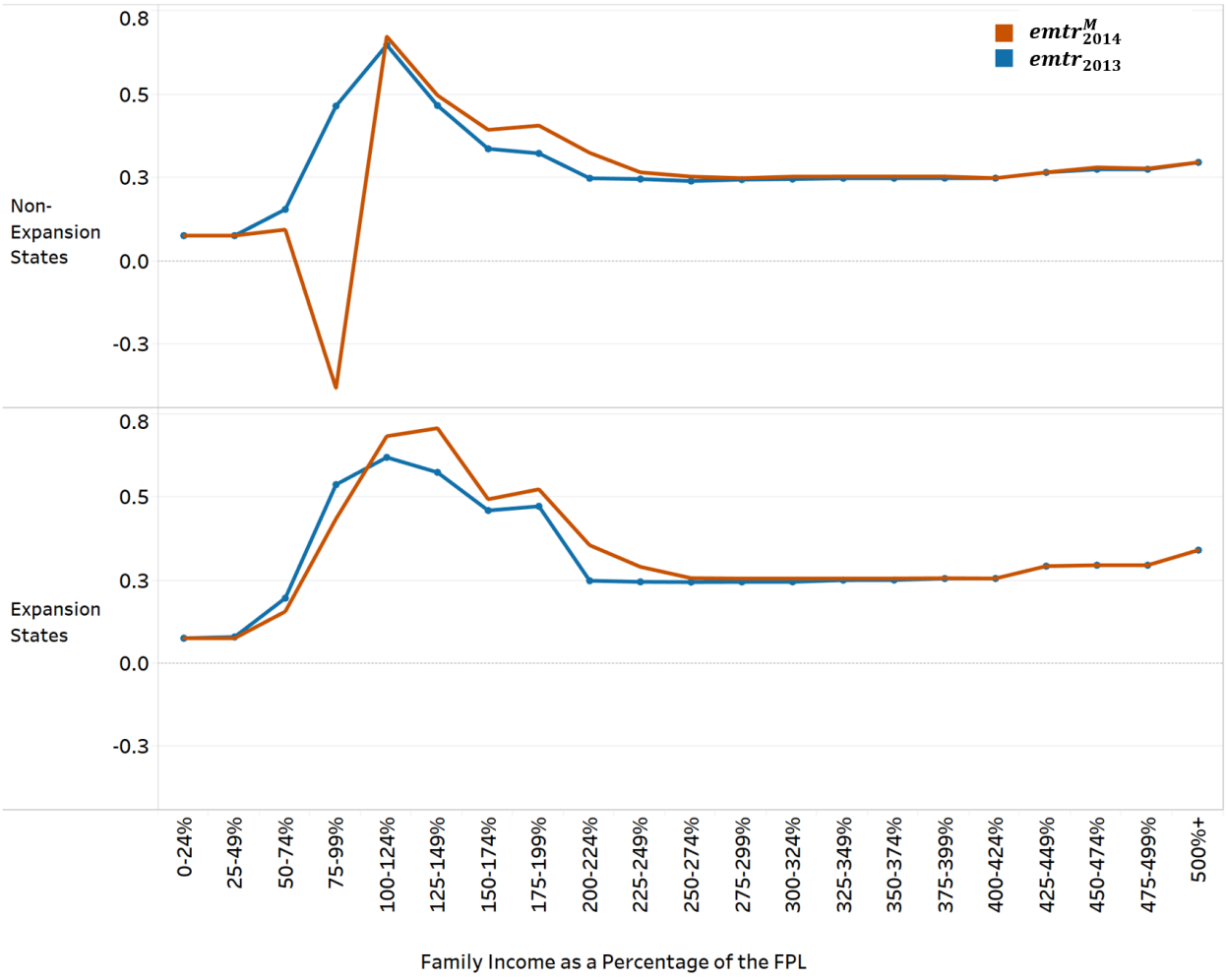


Table 9 provides average changes in EMTRs in expansion and non-expansion states by FPL groups.

Overall, across all states average EMTRs decreased only by 1 percentage point. Households in non-expansion states did not experience changes in average EMTRs and in expansion states the average EMTR declined by 2 percentage points. However, lack of economically

Table 8: Average Change in EMTR by FPL Group

	FPL Group	Average EMTR (pre-ACA)	Average EMTR (post-ACA)	Average EMTR Change
Non-Expansion States	1-49% FPL	0.24	0.21	-0.03
	50-99% FPL	0.40	-0.38	-0.78
	100-199% FPL	0.64	0.62	-0.02
	200-399% FPL	0.26	0.33	0.07
	400%+ FPL	0.29	0.29	0.00
	All	0.38	0.38	0.00
Expansion States	1-49% FPL	0.05	0.01	-0.04
	50-99% FPL	0.67	0.33	-0.33
	100-199% FPL	0.74	0.74	0.00
	200-399% FPL	0.30	0.36	0.06
	400%+ FPL	0.34	0.34	0.00
	All	0.34	0.32	-0.02
All	All	0.35	0.35	-0.01

Source: The Policy Rules Database (Ilin and Terry 2021b) and 2013 American Community Survey. Authors' calculations.

significant average effects masks highly heterogeneous effects by the FPL groups. For example, workers in non-expansion states with income between 50 and 99 percent of the FPL experienced 78 percentage points decline in the EMTRs. Workers in expansion states with income between 200 and 399 percent of the FPL had their EMTRs increased by 6 percentage points.

4.6 Estimating Labor Supply Responses to the ACA

Next, I apply the elasticity of taxable income parameters from Table 7 to predict the average effects of the ACA on labor supply. As Table 8 shows, the expected responses differ by FPL group and state of residency. Table 9 summarizes the predicted effects of the ACA-induced change in EMTRs on taxable income.

Table 9 provides average changes in EMTRs in expansion and non-expansion states by FPL groups.

My findings indicate that, on average, the effect of the ACA on taxable income is economically insignificant. However, workers in some FPL groups do adjust their labor supply.

Table 9: Average Change in EMTR by FPL Group

	FPL Group	Average Taxable Income	Average EMTR Change	Average %-EMTR Change	Predicted Average %-Change in Taxable Income	Predicted Average Change in Taxable Income
Non-Expansion States	1-49% FPL	$4,548	-0.03	-12.50%	1.25%	$56.85
	50-99% FPL	$11,214	-0.78	-195.00%	19.50%	$2,187
	100-199% FPL	$19,680	-0.02	-3.00%	0.30%	$59.04
	200-399% FPL	$33,073	0.07	27.00%	-2.70%	-$892.97
	400%+ FPL	$72,738	0.00	0.00%	0.00%	$0.00
	All	$52,034	0.00	0.00%	0.00%	$0.00
Expansion States	1-49% FPL	$4,524	-0.04	-80%	0.80%	$36.19
	50-99% FPL	$11,051	-0.33	-49.00%	4.90%	$541.50
	100-199% FPL	$19,727	-0.02	0.00%	0.00%	$0.00
	200-399% FPL	$33,753	0.06	20%	-2.00%	-$675.06
	400%+ FPL	$75,219	0.00	0.0%	0.00%	$0.00
	All	$47,399	-0.02	-5.90%	-0.59%	-$279.65
All	All	$49,855	-0.01	-2.9%	-0.29%	-$144.58

Source: The Policy Rules Database (Ilin and Terry 2021b) and 2013 American Community Survey. Authors' calculations.

For example, I estimate that those with annual taxable income of 50-99 percent of the FPL in non-expansion states increased on average by 19.5 percent or $2,187. Those with annual taxable income of 200-399 percent of the FPL in non-expansion and expansion states decreased their income by 2.7 percent ($892) and 2 percent ($675) respectively.

5 Conclusion

The Affordable Care Act (ACA) was signed into law by President Obama on March 23, 2010 and triggered the largest expansion of public health care coverage since the introduction of Medicaid and Medicare in 1965. The law arguably affected the labor supply of Americans by changing the returns to work. Key provisions of the ACA triggered the expansion of Medicaid to adults with incomes below 138 percent of the Federal Poverty Level (FPL) and introduced health exchange premium subsidies which phase-out with income gains. In this paper, I estimate the extent to which major ACA provisions changed the financial return of

working and affected the labor supply of Americans' workers.

Prior studies of the labor supply effects of the ACA law arrived at inconclusive results (Kaestner et al. 2017; Buchmueller et al. 2019; Kucko et al. 2018; Gooptu et al. 2016; Leung and Mas 2016). I argue that this lack of evidence is due to two missing considerations – significant heterogeneity in the ACA effects and interaction of the ACA law with existing social safety net programs. First, specific groups of the U.S. workers were differentially affected by the law. For example, the timing and status of the Medicaid expansion varies by states, and some states still have not implemented the expansion. Additionally, the value of the ACA marketplace subsidy varies by person's age, state of residency, and other characteristics such as availability of affordable health insurance through the employer. Therefore, in order to capture the effect of the law, one must account for these heterogeneous effects. Prior studies have failed to include this heterogeneity in their analysis and therefore analyzed the effect of the law on largely unaffected populations. Second, the ACA law exists alongside many other social safety net programs whose value varies with income. Thus, the magnitude and the direction of any individual's ACA-induced change in effective marginal tax rates depends on what other public support they are receiving. My methodology involves precisely estimating the effect of all ACA provisions in the context of their interaction with the entire U.S. social safety net. To my knowledge, my paper is the first one to do this. The paper features two parts. In the first part I identify three natural experiments where the ACA changed work incentives. I find that depending on the experiment and affected population, the ACA changed hours worked per week by between -3 and +2 hours per week.

In the first experiment I examine whether the introduction of the Health Insurance Marketplace increased the work effort of households with 2013 income below the poverty line, without access to employer health insurance, and without Medicaid coverage as of 2013. In non-expansion states these households were 'treated' with the introduction of the Health Insurance Marketplace and premium subsidies. Thus, they had an incentive to increase their work effort to gain access to the premium subsidy that significantly reduced their out-of-

pocket costs. In contrast, households in expansion states without access to employer health insurance and without Medicaid coverage would gain access to Medicaid, and thus I would not expect any significantly positive effects on their work effort as a result of the ACA. I find statistically significant positive effects of the introduction of the ACA Health Insurance Marketplace on total hours, hours of the main job, and hours of the second job, and main job earnings. On average, the ACA increased average weekly hours at the main job hours by 1.15, at the second job by 0.82, and total hours by 1.97. I find the ACA increased monthly earnings from the main job by an average of $192.96.

In the second experiment, I look at whether households with income right above the eligibility threshold of 138 percent of the FPL and whose employers offer affordable health insurance decreased their work effort. In expansion states, these households found themselves right above the income eligibility threshold for Medicaid and therefore had an incentive to decrease their work effort and income to become eligible for Medicaid. In non-expansion states, Medicaid was still not an option, and I do not expect Medicaid expansion to have any effect on work effort for this group. The results show that Medicaid expansion had a negative effect on work effort and earnings of treated households. I find that Medicaid expansion, on average, decreased total weekly hours by 3.20. Most of this decline stems from a decline in hours worked at second jobs, where households have more flexibility. On average, Medicaid expansion decreased hours worked at second jobs by 3.97. Looking at earnings, I find that Medicaid expansion had a negative statistically significant effect on monthly earnings from all jobs. This change stems from both the earnings of the first and second jobs, where I also find negative significant effects as a result of the ACA.

In the third experiment, I analyze the potential positive effect of Medicaid expansion on work effort. Before the expansion, households that were on Medicaid had to keep their earnings below the income eligibility threshold to keep the subsidy. After the expansion, these households were able to work more and still be eligible for the subsidy. In non-expansion states however, I do not expect any change in work effort among this group as a result of

the ACA. The results from the third experiment indicate that Medicaid expansion had a positive effect on hours worked at the first job. On average, Medicaid expansion increased weekly working hours by 0.72. Total earned income increased by $77.03 on average; earnings from the main job increased by an average of $51.04 while second job earnings were not significantly changed by the ACA.

In the second part of the paper I implement the analysis of labor supply responses to the ACA that takes into account the entire social safety net and the full spectrum of heterogeneous effects on work incentives. The ACA introduced a shock to effective marginal tax rates (EMTRs) faced by low- and moderate-income households. The shock differed by family size, state, income, age, by the type of health insurance held prior to the ACA, as well as enrollment in other government assistance programs. I exploit this exogenous shock to estimate the elasticity of taxable income for each household in 2014 SIPP. Using the novel Policy Rules Database (Ilin and Terry 2021b) (Ilin and Terry 2021) I estimate the effective marginal tax rate (EMTR) on a $1,000 annual earnings increase. I estimate this EMTR before and after the ACA to isolate the change in EMTR induced by the ACA law. I then use an instrumental variable regression framework similar to Gruber and Saez (2002) to estimate the overall elasticity of taxable income. I find this elasticity to be 0.1; a 1 percent increase in EMTR results in 0.1 percent decrease in taxable income.

Prior research that aimed to estimate the elasticity of taxable income concentrated mainly on the marginal tax rates embedded into the income tax system. In contrast, my measure takes into account all major public assistance programs, taxes, and tax credits. Thus, my estimated elasticity of taxable income with respect to effective marginal tax rates is an important parameter that can be used by researchers that study the effects of the U.S. tax and transfer system on individual's earnings and labor supply.

I then apply estimated elasticity of taxable income to the 2013 American Community Survey (ACS) to estimate the aggregate labor supply effects of the ACA. For each worker in the 2013 ACS I estimate the same set of EMTRs and corresponding exogenous change in

EMTRs due to the ACA law. my analysis shows that on average the ACA did not change the effective marginal tax rates faced by the U.S. workers. This lack of average effects, however, masks important heterogeneity. For example, workers in non-expansion states with income between 50 and 99 percent of the FPL had their EMTRs reduced by 78 percentage points. For this group, the ACA created an incentive to increase earnings by an average of $2,187. By contrast, workers in expansion states with income between 200 and 399 percent of the FPL experienced an increase in EMTRs by 6 percentage points. For this group, the ACA created an incentive to reduce earnings by an average of $675.

This heterogeneity of the labor supply responses is important for understanding the aggregate effects of the ACA law. my results indicate that an increase in Medicaid income eligibility threshold due to Medicaid expansion, would induce some workers to increase their work effort in response. On the contrary, the structure of the ACA premium tax credits that phase-out with income, increase effective marginal tax rates of certain workers and can potentially negatively affect the incentives to increase earnings.

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A Appendices

A.1 Assigning Take-up of Public Assistance Programs

Not all households that are eligible for public assistance programs choose to take the benefits. Therefore, simply applying rules of public assistance programs to eligible households is not enough to determine the population distribution of total transfer payments. Although the ACS asks survey participants about some public assistance receipts, the program coverage is too narrow and the underreporting rates too high to obtain reliable estimates of participation and take-up. In this paper I develop a procedure that adjusts estimates for the empirically observed program participation.

I start by estimating the program participation model using the Annual Social and Economic Supplement of the Current Population Survey (ASEC). ASEC contains household-level data on participation in all major public assistance programs. Program participation in the ASEC is underreported in that the implied overall participation rates are below the aggregate statistics I can observe from administrative data. I deal with this by randomly assigning participation among eligible non-reporting households until the sample population matches aggregate participation rates for each program. Table A1 shows national aggregate take-up rates for major public assistance programs and tax credits that I are using to scale-up the ASEC participation rates.

Next, using adjusted program participation data from the ASEC, for each program and eligible households i I estimate the following model:

$$p_i = \gamma_0 + \gamma_1 Y_i + \gamma_2 Y_i^2 + \beta^T X_i + \mu_s + \epsilon_i \tag{5}$$

Where p is a binary indicator of (adjusted) participation in a given program, Y is households total income, X is a set of demographic variables (number of adults, number of children, race, education, age, sex, marital status, and metropolitan status), and μ_s is a state fixed

Table A1: Estimated Participation and Take Up of Public Assistance Programs

	Number of Participating Units ('000)	Number of Eligible Units ('000)	Year	Take Up Rate (%)
TANF	1,213 families	4,869 families	2016	24.9
SNAP	40,776 persons	60,334 persons	2018	67.6
CCDF Childcare Subsidy	2,099 children	8,417 children	2015	24.9
Section 8 Housing Voucher	2,200 families	19,517 families	2016	11.2
Marketplace Subsidy	9,600 persons	112,942 persons	2020	8.5
Medicaid (Adults)	39,042 persons	48,863 persons	2016	79.9
Medicaid/CHIP (Children)	35,953 persons	38,370 persons	2016	93.7
EITC	26,500 taxpayers	33,974 taxpayers	2018	78.0
CTC	48,000 taxpayers	56,946 taxpayers	2020	84.3

Sources: Data on the number of participating and eligible units for TANF is taken from Giannarelli (2019). Data on the number of participating and eligible units for CCDF is taken from Chien (2019). The number of participating and eligible units for Medicaid is taken from the Kaiser Family Foundation (https://www.kff.org/). The number of expected Child Tax Credit claims is from the Joint Committee on Taxation (https://www.jct.gov). Participation and eligibility data on EITC is from the Internal Revenue Service (IRS) statistics for tax returns (https://www.eitc.irs.gov/eitc-central/participation-rate/eitc-participation-rate-by-states). The number of participating units for SNAP is taken from the USDA website (https://www.fns.usda.gov). The number of participating units for the Section 8 Housing Voucher is provided by the Housing and Urban Development Department's (HUD) Office of Policy Development and Research (https://www.huduser.gov). The number of eligible units for SNAP, Section 8 Housing Voucher, Health Insurance Marketplace Subsidy, and Child Tax Credit are estimated by applying Policy Rules Database (Ilin and Terry 2021b) to the Annual Social and Economic Supplement of the Current Population Survey.

effect.

Using estimates from this equation, for each income-eligible ACS household I predict out-of-sample the probability of program take-up. Finally, I use predicted probability to assign participation indicator to each program-eligible observation in the ACS that does not report participation. I assign participation to match the national statistics on the take-up of each public assistance program reported in Table A1.