

# Online Appendix

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## 1 Measurement Details

Measures of the minimum UI tax rate from off-the-shelf datasets are not well suited to measuring the true minimum UI tax rate. We use an alternative dataset combined with a new method, to estimate a comprehensive measure of the minimum UI tax rate.

We calculate the minimum UI tax rate in each state using the Quarterly Census of Employment and Wages (QCEW) data from the Bureau of Labor Statistics (BLS). The QCEW data contains data for county by industry cells. The cells contain information on total taxable wages and total state UI tax contributions.

Our goal is to measure the minimum UI tax rate paid by firms within each state. In the QCEW, we can calculate the average UI tax paid by county-by-industry cells, averaging across firms within the cell. We calculate the minimum, within each state and year and across cells, of this average UI tax rate. We then use minimum average UI tax across cells in the state to approximate the minimum UI tax rate faced by firms in the state.

There is a simple test for whether our approximation is correct—we should observe a “spike” at the bottom of the distribution of cells’ average UI tax rates. The average UI tax rate of a cell is based on the “experience rating” of firms within the cell. If firms in the cell have collectively laid off few or no workers, then the cell will pay an average UI tax at minimum UI tax rate for firms in the state. In practice, many firms pay the minimum UI tax rate. Therefore many cells should have average UI tax rates equal to the minimum UI tax rate for firms in the state—leading to a spike at the bottom of the distribution of average UI tax rates. There is clear evidence of such spikes in the data, as we document in subsection 2.

In practice, we calculate the minimum tax rate for a state in a given year as follows. For each county by industry cell, we calculate the average payroll tax paid ( $\bar{\tau}$ ), as quarterly UI contributions divided by quarterly UI-taxable wages  $\times 100$ , and rounded to the nearest tenth. We let  $\tau' = \min(\bar{\tau})$  be the lowest

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rate any industry-cell pays. We then search for the value of  $\bar{\tau}$  with a spike in the distribution, near the minimum value  $\tau'$ . We define  $\tau_0$ , our estimate of the minimum UI tax rate, as the value of  $\bar{\tau}$  at the spike. We locate the spike at the mode of all values of  $\bar{\tau}$  such that  $\bar{\tau} < \tau' + .5$ .<sup>1,2</sup>

The QCEW data uses SIC industry codes for 1975-2000, and NAICS industry codes for 2001-2018. As we are interested in determining the lowest tax rate across industries (rather than which industries pay that rate), this discrepancy poses no problems for our estimation of  $\tau_0$ . All level of industry aggregation (SIC/NAICS codes ranging from 2 to 6 digits) were used in calculating the minimum rate. This does not affect our estimation of  $\tau_0$ , as a more aggregated county-industry cell cannot have a lower tax rate than those of its constituent industries. We include only private sector industries.

## 2 Advantages of the Method: Demonstration with a Case Study

We use a case study to explain our method, verify its accuracy, and confirm its advantages versus off the shelf measures of UI tax rates. The case study is the increase in minimum UI taxes from 2009 to 2010 in Alabama.

We start by confirming spikes at the minimum of the distribution of cells' UI tax rates, meaning our method correctly measures minimum UI tax rates in Alabama. Figure 1 plots histograms of the values of  $\bar{\tau}$  by industry-county cells, in the neighborhood of  $\tau' = \min(\bar{\tau})$ , for Alabama in 2009 and 2010. These histograms show a clear spike near the minimum of the distribution, consistent with our assumption that the minimum UI tax rate across cells measures the minimum UI tax rate across firms in the state.

Our method implies that the minimum UI tax rate rose from  $\approx .7\%$  to  $\approx 2.2\%$  between 2009 to 2010. We show that off-the-shelf datasets do not capture this tax increase. In particular, Figure 2 plots the minimum state UI tax rate measured from the *Significant Provisions of State Unemployment Insurance Laws* alongside our measure. Our measure clearly documents an increase, which the measure from the *Significant Provisions* omits.

Independent sources verify that Alabama did indeed increase UI taxes in 2010. However, the increase came from “social cost taxes” and “solvency taxes” (see ? for details). These forms of UI taxes are not measured in the *Significant Provisions* but are captured in our comprehensive measure of UI taxes from the QCEW. More generally, our measure of minimum tax rates is more volatile than the measure from the *Significant Provisions* and tends to increase by much more during recessions—due to increases in social cost and solvency

<sup>1</sup>We do not set our estimate of the minimum UI tax rate faced by firms,  $\tau_0$ , equal to the minimum value across cells,  $\tau'$ . Due to measurement error and time aggregation, there are typically a few small cells with average UI tax rates beneath the spike.

<sup>2</sup>For states operating under the reserve ratio system, a smaller number of firms are at the minimum rate. Spikes in  $\bar{\tau}$  are less common. For these states our estimate of  $\tau_0$  is the 0.5th percentile of all firm's tax rates.

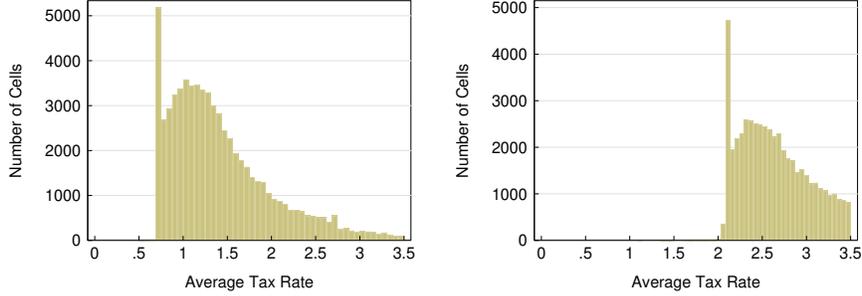


Figure 1: Average County by Industry Tax Rates Near  $\tau_0$  in Alabama, 2009 and 2010

The x-axis is the average UI tax in a county-by-industry cell and is truncated at  $x = 3.5$ . The y axis is the number of cells corresponding to each value of the UI tax. The UI tax is the ratio of quarterly UI contributions paid by firms in the cell, to the sum of quarterly UI-taxable wages in the cell, measured in percent. The sample is all industry by county cells, measured separately for each quarter of 2009 (left panel) or 2010 (right panel) in Alabama. Industry-by-county cells include industries at the NAICS 2 through 6 digit level.

taxes. Reassuringly, during periods without social cost or solvency taxes such as 1985-2000, our estimate is the same as the *Significant Provisions*.

### 3 Model Extension

In this Appendix we clarify the extent to which UI taxes are equivalent to a uniform payroll tax combined with a firing tax in the model outlined in Section ???. Assuming that the firm's revenue in the second period is a function of their employment,  $f(n')$ , profits in the second period are:

$$\pi = f(n') - w \left( 1 + \tau \left( \frac{B'}{wn} \right) \right) n' \quad (1)$$

For firms below the maximum UI tax rate, this is equal to:  $\pi = f(n') - w \left( 1 + \tau_0 + \tau_1(1 - f) \phi \frac{(n - n')}{n} \mathbf{1}(n' < n) \right) n'$   
 $= f(n') - (1 + \tau_0) wn' - \tau_1(1 - f) \phi w \frac{n'}{n} (n - n') \mathbf{1}(n' < n)$  Now, consider an alternate environment in which firms pay a uniform payroll tax  $\tilde{\tau}$  and a firing tax  $F$  per employee that they layoff. In this environment, profits in the second period are:

$$\tilde{\pi} = f(n') - (1 + \tilde{\tau}) wn' - F(n - n') \mathbf{1}(n' < n) \quad (2)$$

Thus, these two environments are exactly equivalent if  $\tilde{\tau} = \tau_0$  and  $F = \tau_1(1 - f) \phi w \frac{n'}{n}$  (and if there is no maximum UI tax rate). The “firing tax” is counter-cyclical, as it depends negatively on the job-finding rate: a laid-off worker will

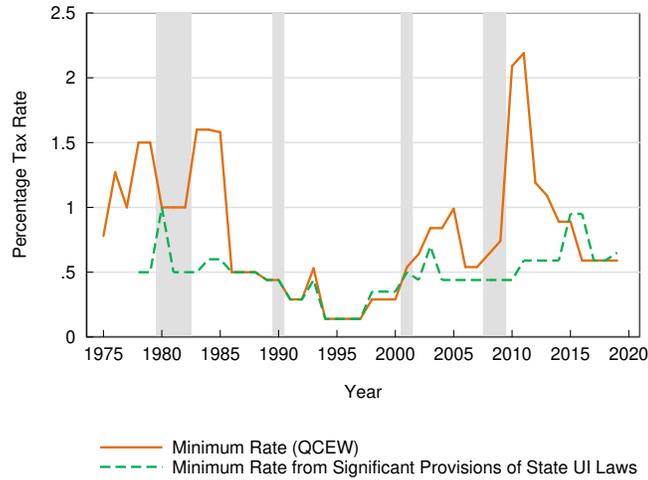


Figure 2: Minimum UI Tax Rates from Our Data vs. Other Datasets  
 The solid line plots estimates of Alabama’s minimum UI tax rate, from our method based on the QCEW. The dashed line plots estimates of Alabama’s minimum UI tax rate, from the *Significant Provisions*. The data are reported for each year between 1975 and 2019.

not collect unemployment insurance if they find a job, and thus the firm’s UI tax rate will not increase.

In practice, if there is a maximum UI tax rate, the experience-rated tax system is equivalent to an environment in which there is a payroll tax and a firing tax which only needs to be paid on any layoffs up to a fraction  $\frac{n-n}{n}$  of the firm’s workforce. Any layoffs in excess of this do not face a firing tax, as such a firm would already face the maximum UI tax rate.