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The Effect of the Tipped Minimum Wage on Employees in the U.S. Restaurant Industry

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According to federal law in 2013, employers can take a credit of up to $5.12 for tips received by workers in satisfying the minimum-wage requirement of $7.25. This article uses interstate variation in laws regarding tip credits and minimum wages to identify the effects of reducing or eliminating the tip credit on employment, hours, and earnings in the U.S. restaurant industry. Using data from the Quarterly Census of Employment and Wages and the Current Population Survey, we find that a reduction in the tip credit increases weekly earnings but reduces employment in the full-service restaurant industry and for tipped workers. The results are robust to controls for spatial heterogeneity in employment trends and are supported by a series of falsification tests.

JEL Classification: J21, J23, J30, J31, J38

1. Introduction

In 2011, the U.S. restaurant industry employed nearly nine million workers and accounted for nearly one-half of all hourly workers in the United States that were paid at or below the federal minimum wage.[1] Because of the sheer size of the industry and the number of its workers that are affected by minimum-wage laws, many studies of the earnings and employment effects of minimum wages have focused on the restaurant industry. Most of this research, however, focuses on the limited-service restaurant industry because of a special provision in the federal law that full-service restaurants can take advantage of—the "tip credit." As of 2013, federal law requires a minimum wage of $7.25, but employers of tipped workers may take a credit of up to $5.12 per hour against the minimum-wage requirement. Put in other words, the law allows employers to pay a "tipped minimum wage" of $2.13 per hour only if tip income is sufficient to increase total hourly compensation to at least the minimum wage of $7.25.

While the federal tipped minimum wage has remained at $2.13 since April 1991, 31 states currently have a tipped minimum above $2.13, and 7 states set the tipped minimum equal to the minimum wage. There have been several legislative efforts in recent years to raise the federal tipped minimum wage. Most recently, the Fair Minimum Wage Act of 2013, introduced as

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[1] The employment estimate is from the Bureau of Labor Statistics' (BLS) Current Employment Statistics (http://www.bls.gov/ces). Estimates of the number of workers earning at or below the minimum wage by industry are available from the BLS at http://www.bls.gov/cps/minwage2011tbls.htm#5.

H.R. 1010, would gradually increase the federal tipped minimum wage to 70% of the federal minimum wage. This would more than double the tipped minimum and could have significant effects on earnings and employment in the restaurant industry.

This article uses data from two different sources—the Quarterly Census of Employment and Wages (QCEW) and the Current Population Survey (CPS)—to estimate the effects of changes in the tipped minimum wage on earnings and employment in the restaurant industry. The QCEW data provide information on employment and earnings by state and industry. Since workers at limited-service restaurants are rarely eligible for tips, we use the QCEW to estimate the effect of changes in tipped minimum wages in the full-service restaurant industry. The limited-service restaurant industry is used as a comparison group to assure that our results are not driven by unobserved factors that might drive employment or earnings in both parts of the restaurant industry. The CPS data provide information on a worker's industry of employment but do not separately identify full-service from limited-service restaurants. The CPS does, however, provide information on hours worked and occupation. This allows us to examine the effect of tipped minimum wages on employment and hours of restaurant-industry employees separately for tipped and nontipped workers.

Using QCEW data, we find fairly robust evidence that increasing the tipped minimum wage improves earnings of full-service restaurant workers but has no effect on limited-service restaurant workers. Estimation of employment and hours effects is more challenging. We implement several strategies to isolate the employment effects, test the robustness of results to sample periods and spatial heterogeneity, and provide falsification tests to be sure that our results are not spurious. Overall, the bulk of the evidence suggests that increasing the tipped minimum wage reduces the employment and hours of workers who are eligible for a tip credit. Moreover, we find fairly strong evidence that the results are not due to omitted variables that could cause a spurious relationship between a state's tipped minimum wage and employment levels.

2. Background

The vast majority of the existing research on the effects of the minimum wage on employment in the restaurant industry focuses on limited-service restaurants because of the complexities created by tip credits in the full-service restaurant industry.[2] While full-service restaurants are subject to the same minimum-wage requirements as other industries, federal law allows employers to meet some of the minimum-wage requirement by taking a credit for tips earned by their workers.

Between 1990 and 2013, federal law increased the minimum wage from $3.35 to $7.25 in seven steps. Over the same period, numerous states passed laws increasing their minimum wage above the federal level. The result was a substantial increase in the interstate variation in minimum wages. The standard deviation of minimum wages across states tripled between 1990

[2] Studies focusing on the effects of minimum wages on the limited-service restaurant industry include Card and Krueger (1994, 2000), Neumark and Wascher (2000, 2008), Aaronson and French (2007), and Aaronson and McDonald (2008). On the other hand, Dube, Lester, and Reich (2010) examine the effect of minimum-wage hikes on the entire restaurant industry.

and 2007, but has fallen since then as the $2.10 increase in the federal minimum between 2007 and 2009 reduced interstate variation.

Over the past two decades, interstate variation in the tipped minimum wage has increased steadily. While the federal tipped minimum has remained at $2.13 since 1991, there has been a steady increase in the number of states with a tipped minimum above the federal level.

The theoretical effects of a higher minimum wage on earnings and employment have been described in numerous studies. If the labor market is competitive, an increase in the minimum wage reduces employment of workers previously earning the minimum but can increase or decrease aggregate earnings of the affected workers depending upon the elasticity of labor demand. If, on the other hand, the labor market is monopsonistic, small increases in the minimum wage can increase both employment and earnings of affected workers, but sufficiently large increases in the minimum reduce employment.[3]

A simple extension of the competitive model suggests that an increase in the tipped minimum wage (i.e., a reduction in the tip credit) would reduce the employment of workers eligible for a tip credit and, depending on the elasticity of labor demand, could either increase or decrease total earnings in the industry. The standard competitive model, however, ignores several possible employer responses to an increase in the tipped minimum wage that could mitigate any effect. For example, suppose that an increase in the tipped minimum wage leads to rents (i.e., wages in excess of reservation wages) for tipped workers. Employers can offset the increased cost of a higher tipped minimum by requiring tip pooling, which would take some of the tips away from the tipped workers and redistribute them to other workers. Since the other workers now receive a share of the tips, the employer can reduce their wages and offset the costs of the higher tipped minimum. There are several limits to the tip-pooling strategy, however. For example, federal law requires that only "regularly tipped" workers be included in a mandatory tip pool.[4] "Back of the house" staff who do not regularly engage with customers, such as cooks, dishwashers, and janitors, do not qualify.[5] Over the years, there have been numerous lawsuits over tip-pooling requirements (Ahmed 2009). These include rulings that salad preparers and workers with managerial responsibilities cannot be included in the tip pool but bartenders can. Other lawsuits have addressed the validity of the tip-pooling formula at specific restaurants. Courts have also upheld the notion that a "service charge is not a tip, and thus employers can keep part or all of service charges."[6]

Another limit to the effectiveness of the tip-pooling strategy is that even if tips are shared with other workers, minimum-wage restrictions may limit the employer's ability to reduce their wages—particularly if the tipped minimum rises to the level of the minimum wage. If, for example, bussers are paid the minimum wage without tips and a mandatory tip pool is introduced, an employer can reduce a busser's wage below the minimum wage only if there is a tip credit allowed in the state.

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[3] For a discussion of minimum-wage effects in a monopsonistic labor market, see McConnell, Brue, and Macpherson (2013, pp. 397–405).

[4] Robinson (2011) provides a good review of federal law on tip pooling. If the tip pool is voluntary, there are no restrictions on whom the worker can share the tips with. The Department of Labor defines a "tipped employee" as someone that customarily and regularly receives at least $30 per month in tips. In practice, this has been interpreted to include waiters/waitresses, counter personnel who serve customers, server helpers (bussers), and service bartenders.

[5] An interesting exception to the rule that cooks cannot be included in the tip pool was made for sushi chefs, since they interact with customers (http://waiterpay.com/japanese-restaurants-hit-by-wave-of-overtime-and-tip-stealing-cases).

[6] If the restaurant does not make it clear to the customer that the added charge is a "service charge" (e.g., if it is listed as a gratuity), the employee may be entitled to the payments. See Ahmed (2009) for a discussion of this point.

If tip pooling is not a viable option for offsetting the effect of a higher tipped minimum wage, an employer could attempt to mitigate the effect on labor costs by requiring each server to perform more nontipped work. This is essentially the same as mandating tip pooling, except that the pooling occurs by requiring servers to hold "dual jobs" so that tips earned while performing the tipped job can be used to generate a tip credit for hours when they perform the nontipped job. Examples of such strategies would include the requirement that servers clean their own tables or prepare the salads for their customers, or that servers stay after the restaurant is closed to assist with cleaning. As with tip sharing across workers, this strategy becomes less effective when the tipped minimum wage approaches the minimum wage, unless some nontipped workers were initially being paid above the minimum wage. Also, federal law restricts an employer's ability to receive a tip credit for a worker with dual jobs.[7]

Whereas the predicted effects of a higher tipped wage are fairly straightforward in the competitive model, Wessels (1997) has suggested that while restaurants may hire workers in a competitive labor market, an increase in the number of workers in the restaurant industry, *ceteris paribus*, reduces tips per hour and must thus be offset by higher money wages to retain workers. Consequently, in the absence of a minimum wage, the restaurant faces an upward-sloping labor-supply curve and displays monopsonistic behavior in response to a minimum-wage hike. As a result, increases in the tipped minimum wage could lead to an increase in employment, though a sufficiently large increase would reduce employment.

In sum, the theoretical effects of a higher tipped minimum wage on earnings and employment depend critically on whether (i) the employer can use tip pooling or dual jobs to offset the effects, or (ii) restaurants act like monopsonists. If the restaurant industry is competitive and the employer is unable to mitigate the effects of higher tipped minimum wages through tip pooling or dual jobs, an increase in the tipped minimum wage drives up the cost of tipped workers and should have the same effect as an increase in the minimum wage—fewer hours of employment, an increase in *hourly* earnings, but an ambiguous effect on *aggregate* labor earnings in the industry. If tipping in the restaurant industry leads to monopsonistic behavior, a higher tipped minimum wage could lead to an increase in employment—but a sufficiently large increase in the tipped minimum wage would reduce employment. Given the wide range of possible outcomes, the effect of higher tipped minimum wages becomes an empirical question.

While numerous studies have examined the effect of minimum-wage increases on employment in the limited-service restaurant industry, few studies have examined the effect of higher tipped minimum wages in the full-service restaurant industry. Wessels (1993) performed a cross-sectional analysis of restaurant employment (full-service and limited-service combined) using data from the 1987 Census of Retail Trade and found that increases in either the minimum wage or tipped minimum wage reduce restaurant employment. The tipped-minimum-wage elasticity of employment is estimated to be -0.15, implying that a 10% increase in the tipped minimum wage reduces employment at restaurants by 1.5%. A potential concern with this study is that it is based on cross-sectional data. Consequently, if there are unobserved

[7] The Department of Labor limits an employer's ability to take a tip credit for the hours that a person does nontipped work. For example, if a server is required to spend a significant share of his or her time cleaning the restaurant before opening or after closing, the employer may be prohibited from taking a tip credit for the hours the worker is cleaning. It is more difficult, however, to restrict an employer's ability to require a server to perform dual tasks (such as serving and cleaning tables) where the line between tipped and nontipped work is less clear. See Robinson (2011) for a discussion of "dual jobs" versus "related duties."

differences across states that affect both their law on tipped minimum wages and restaurant-industry employment, the estimated effect of tipped minimum wages will be biased. Later, Wessels (1997) used panel data on restaurant employment (full-service and limited-service combined) from 1977, 1982, and 1987 to estimate the effect of higher tipped minimum wages. Consistent with the predictions of his monopsonistic model, he found that higher tipped minimum wages increase employment at full-service restaurants when the tipped minimum wage is low, but sufficiently large increases in the tipped minimum wage reduce employment.

The effect of tipped minimum wages on earnings in the restaurant industry is examined by two studies. Anderson and Bodvarsson (2005) used 1999 earnings data on state-specific measures of hourly compensation for waiters, waitresses, and bartenders and found that, controlling for economic conditions and worker characteristics, higher tipped minimum wages have no effect on hourly compensation (wages plus tips) for these tipped workers.

Using data from the 2008–2009 Current Population Survey, Allegretto and Filion (2011) found that servers living in states with a higher tipped minimum wage have higher hourly wages (including tips). While this conflicts with the results from Anderson and Bodvarsson (2005), the two studies use different data sources, and Allegretto and Filion do not control for other factors that might influence earnings and a state's tipped minimum wage. For example, if states with higher earnings levels (perhaps due to a higher cost of living) are more likely to have tipped minimum wages above the federal level, a spurious relationship would be found between tipped minimum wages and earnings.

Overall, there has been relatively little research on the effects of tipped minimum wages on earnings and employment. Our article adds to the existing literature by exploiting a data set spanning a larger time period than those used in the earlier studies and by using some of the recent methods that have been developed for identifying the true effect of minimum wages and testing whether the results are spurious. We also provide evidence corroborating some of the concerns expressed by Neumark, Salas, and Wascher (2012) regarding problems in empirically modeling spatial heterogeneity.

3. Data

The Quarterly Census of Employment and Wages (QCEW) is the first source of data for our analysis. This data set provides a quarterly count of employment and payroll reported by employers and covers 98% of U.S. jobs. The quarterly counts are available at the county, state, and national levels by industry.[8] The data provide a complete tabulation of employment and earnings for workers covered by either state or federal unemployment-insurance programs.

This article uses state-level QCEW data on private-sector employment from 1990 through 2011 to investigate how changes in the minimum and tipped minimum wage affect private-sector employment in the full-service restaurant industry (North American Industry Classification System [NAICS] code 7221). We expect that changes in the tipped minimum wage will have the largest effect on full-service restaurants, since a large share of their workers

[8] For more details on the QCEW, see http://www.bls.gov/cew/. The data we use here made a revision to the Ohio figures for employment in the full-service restaurant industry prior to 1992 when there was an apparent change in the classification of dinner theaters. We also revised earnings data for 1995:3 for Illinois, which is an apparent outlier. Using the uncorrected data has a negligible effect on any of the results reported here.

are eligible for tips. As a point of comparison, we also consider effects on limited-service restaurants (NAICS code 722211), where few workers are likely to receive tips and tipped minimum wages should have a minimal effect on labor cost.[9] As an illustration of the significant differential in the share of workers eligible for tips, the Occupational Employment Survey for May 2011 indicates that the percentage of employees in occupations generally eligible for tips is 55% at full-service restaurants but only 4% at limited-service restaurants.[10]

The primary advantage of the QCEW data is that they include all workers covered by state or federal unemployment insurance and thus provide a very accurate estimate of employment and payroll. While the QCEW censors state-specific data for confidentiality reasons when an industry's employment count is too small, both the limited-service and full-service restaurant industries are sufficiently large that there are no censored data for any state or quarter. A shortcoming of the data is that they do not provide any information about work hours or the characteristics of the workers in the industry.

Our second data source is the monthly Current Population Survey (CPS) from 1990 through 2011. An advantage of the CPS is that it provides work hours and occupation for each worker. There are, however, two shortcomings relative to the QCEW. First, the CPS represents a stratified random sample of approximately 60,000 U.S. households in every month. Consequently, sample weights must be used to estimate employment or hours, and the sample sizes for the restaurant industry for some states in a given month can be small. This may potentially lead to significant sampling error in the estimates of employment or hours. To address this issue, we pool our data and generate quarterly estimates of state employment and estimate regressions with weighting by state population to account for greater precision in the employment estimates for the larger states. Standard errors for the regression coefficients are calculated with corrections for clustering by state to allow for the possibility of heteroskedasticity or correlation of errors across time within a state. The second shortcoming of the CPS relative to the QCEW is that the industry codes do not distinguish between full- and limited-service restaurants. As a result, we use occupational classifications to sort workers according to whether they are likely to be eligible for a tip credit.

Our data on state tipped minimum wages are obtained from a variety of sources, including Wessels (1993, 1997), legislative updates published in the *Monthly Labor Review* for early years, research documents from the Employment Policies Institute, and the Department of Labor Web site.[11] To get a sense of the overall trend in the tipped minimum wage, Figure 1 plots the number of states (counting Washington D.C. as a state) that required a tipped minimum wage above the federal tipped minimum wage between 1990 and 2011. The number of states with tipped minimum wages above the federal level rose from 15 in January 1990 to 31 in December 2011. Figure 2 plots the average tipped minimum wage across the 50 states and Washington, D.C., and shows that the average tipped minimum wage rose from $2.25 to $4.04 since 1990.

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[9] According to the Census Bureau industry definitions, full-service restaurants are "primarily engaged in providing food services to patrons who order and are served while seated (i.e., waiter/waitress service) and pay after eating." Limited-service restaurants provide "food services … where patrons generally order or select items and pay before eating." See http://www.census.gov/econ/isp/index.php for a complete list of NAICS industry definitions.

[10] Occupations that we count as eligible for tips include waiters and waitresses, dining-room attendants, bartenders, bartender helpers, and hosts and hostesses. See http://www.bls.gov/oes/ for occupational employment statistics.

[11] The BLS provides minimum wages for tipped workers by state for 2009 through 2011 at http://www.dol.gov/whd/state/tipped.htm. A data set containing monthly data on the minimum and tipped minimum wage for every state between 1990 and 2011 is available from the authors upon request.

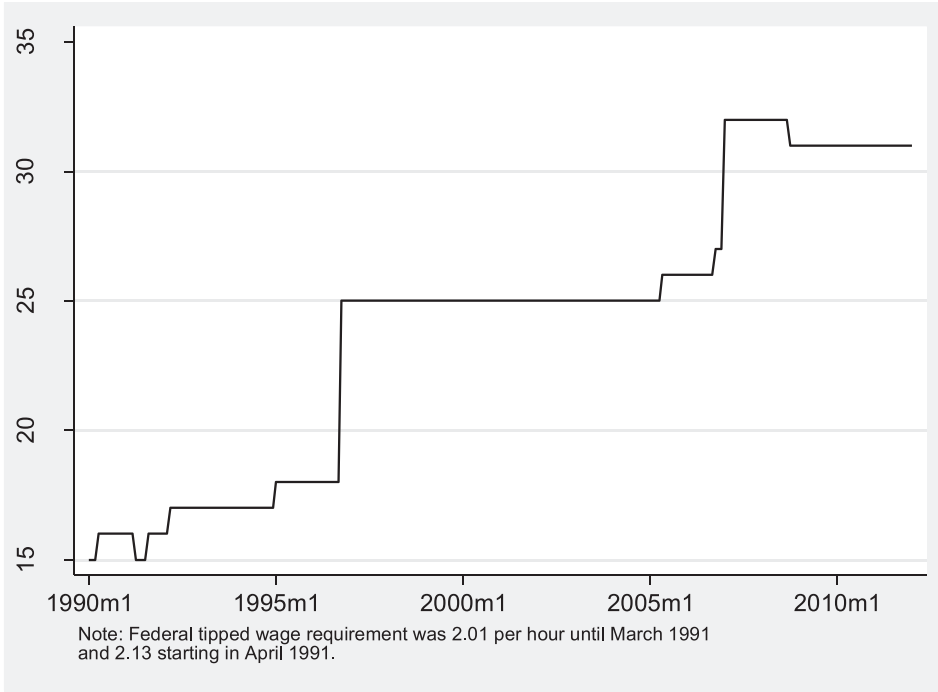

Figure 1. Number of States with Tipped Minimum Wage above Federal Requirement

There were particularly large increases in the average tipped minimum wage in October 1996, when seven states increased their tipped minimum wage above the federal level for the first time, and again in January 2007, when five additional states pushed above the federal level for the first time. In 20 states, the tipped minimum wage is now tied directly to the minimum wage so that the tipped minimum wage rises whenever the minimum wage rises.

4. Empirical Analysis

To examine the effect of higher tipped minimum wages on employment or earnings in the restaurant industry, we use a regression version of difference-in-difference estimation common in studies of the employment effects of minimum-wage increases.[12] The regression equation is as follows:

$$Y_{it} = \alpha_0 + MW_{it}\beta_1 + TW_{it}\beta_2 + X_{it}\gamma + \lambda_t + S_i + \varepsilon_{it},$$

where the subscripts i and t represent state and quarter, respectively; Y is the log of a measure of employment or earnings in a sector of the restaurant industry; MW is the log of the effective minimum wage (i.e., the greater of the federal or state minimum wage); TW is the log of the effective tipped minimum wage; X_{it} is a vector of control variables reflecting economic

[12] See, for example, Burkhauser, Couch, and Wittenburg (2000); Sabia (2009a, b); and Allegretto, Dube, and Reich (2011).

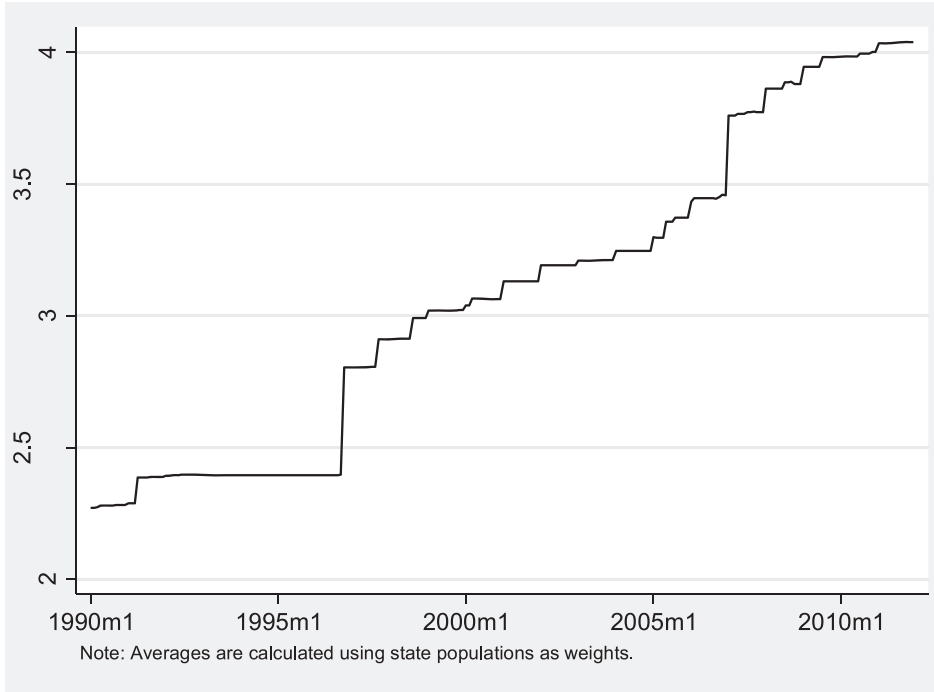

Figure 2. Average Tipped Minimum Wage: 1990–2011

conditions, state-specific quarter-of-year dummy variables to control for seasonality, and population demographics that would affect earnings or employment in the industry; λ_t represents time fixed effects for each quarter; S_i represents state fixed effects; and $\boldsymbol{\varepsilon_{it}}$ is an error term.

The elasticities of the relevant dependent variable with respect to the minimum and tipped minimum wage are β_1 and β_2. If, for example, the elasticity of employment with respect to the tipped minimum wage (β_2) is -0.2, a 10% increase in the minimum wage causes a 2% decrease in employment. To allow for the possibility that errors are heteroskedastic and correlated across time within a state, the standard errors for the estimated coefficients are adjusted for clustering by state.

A key concern with this empirical model is whether employment trends that are not accounted for by our controls differ systematically across states. State fixed effects will control for differences across states that are fixed over time, and quarterly fixed effects control for factors that impact employment equally across all states in a given quarter. Nevertheless, there is a possibility that unobserved differences influencing employment in the restaurant industry could bias our results if these effects are correlated with state-specific changes in the tipped minimum wage. If, for example, states with unobserved factors leading to unusually high growth in restaurant employment are simultaneously more likely to increase their tipped minimum wage, the estimated effect of tipped minimum wages on employment will be biased upward (i.e., any negative effect will be understated). We believe that the best strategy for eliminating the potential for such a bias is to include a wide range of controls for economic and demographic factors that affect employment growth in the restaurant industry. We also consider a few other approaches to improve confidence that our results are not spurious.

Our first approach to determine whether differences in unmeasured trends lead to a biased estimate of the effect of the tipped minimum wage on employment is to estimate models that include state-specific time trends. Second, we compare the earnings and employment effects of tipped minimum wages in two parts of the restaurant industry (full-service and limited-service) and for two different types of occupations within the restaurant industry (tipped and nontipped). Third, we estimate models of the difference in earnings or employment in the full-service and limited-service restaurant industries. Finally, we implement falsification tests to determine whether we find effects of the tipped minimum wage in occupations and industries where there should not be an effect.

The addition of state-specific time trends is designed to omit any bias that might emerge from spatial heterogeneity in employment trends that are correlated with state tipped-minimum-wage policies. Neumark, Salas, and Wascher (2012) point out several potential problems introduced by the inclusion of state-specific time trends in their study of minimum-wage effects on teen employment. The same issues are relevant in our study of the effect of higher tipped minimum wages. First, it is possible that state-specific trends may be capturing some of the earnings or employment variation that is induced by tip-credit laws. That is, higher tipped minimum wages could lead to a reduction in the trend rate of growth in the state after passage. Allowing for state-specific time trends may therefore capture some of the effect of higher tipped minimum wages on employment. Arguably, a preferable alternative to allowing for state-specific time trends would be the inclusion of a sufficiently rich set of control variables that would explain differences in the trend rate of growth across states.

A second problem with adding state-specific trends is that it increases collinearity in the data, reduces the precision of estimated coefficients, and makes the results more sensitive to inclusion or exclusion of observations. Finally, inclusion of state-specific trends can make results sensitive to the choice of the sample period. This is especially important when there are recessions at the very beginning and end of the sample period. Excluding these recessions can substantially alter the estimates of the state-specific trends and thereby alter the estimated effects of variables that also exhibit a trend.[13]

The second approach for determining whether the estimated effects of tipped minimum wages are spurious is to test whether tipped minimum wages have an effect in the limited-service restaurant industry. Since few workers in the limited-service restaurant industry receive tips, a higher tipped minimum wage should have a negligible effect on labor cost and, therefore, generate little or no employment loss. In fact, it is possible that a higher tipped minimum wage could increase employment at limited-service restaurants as customers and/or employers switch from full-service to limited-service restaurants in response to an increase in the relative cost at full-service restaurants.

The third approach we pursue is similar to the ''triple-difference'' approach described by Sabia, Burkhauser, and Hansen (2012) in their analysis of the effect of minimum-wage hikes. To the extent that the full-service and limited-service restaurant industries are affected by many of the same unobservables, taking the difference between employment in the two industries will difference out the effect of any such unobservables. This will eliminate any bias caused by state-specific trends in unobservables that are common to the two sectors of the restaurant industry.

[13] Neumark, Salas, and Wascher (2012) make this same point for studies of the employment effects of minimum-wage increases.

Finally, we explore falsification tests to determine whether our findings are spurious. In particular, we test whether higher tipped minimum wages have effects in industries or occupations that should be unaffected. A failure to find an effect in the other industries would be supportive evidence that our estimated effects in the full-service restaurant industry and for tipped workers are not spurious.

5. Empirical Results

QCEW

In this section, we examine the earnings and employment effects of minimum and tipped minimum wages using QCEW. As noted by Burkhauser, Couch, and Wittenberg (2000), an important issue in empirically estimating the earnings or employment effects of minimum wages (or, by extension, tipped minimum wages) is the high degree of collinearity between the minimum wage and the time and state fixed effects. If all states followed the federal law, the minimum and tipped minimum wage would be perfectly collinear with date fixed effects. Because there is interstate variation in the timing and size of the change in minimum and tipped minimum wages, there is some variation that can be used to identify earnings and employment effects. Despite the interstate variation in the minimum wage, the collinearity problem is still significant, for both the minimum wage and the tipped minimum wage. The collinearity problem is exacerbated with controls for state-specific time trends.[14] In our case, the collinearity problem is further amplified by the fact that our models include both the minimum and tipped minimum wage as control variables, and 20 states link the tipped minimum wage to the minimum wage.

As a gauge of the collinearity problem, we follow Burkhauser, Couch, and Wittenberg (2000) and calculate an "auxiliary R^2" from a regression of the (tipped) minimum wage on all the other control variables used in our analysis—economic conditions, state fixed effects, and national quarterly fixed effects. For the minimum wage, the auxiliary R^2 for the full sample period (1990:1 through 2011:4) is 0.95, and it rises slightly to 0.96 when state-specific time trends are added. For the tipped minimum wage, the corresponding figures are 0.87 and 0.96. The implication is that there is a high degree of collinearity in the data, and the addition of state-specific time trends significantly reduces the identifying variation in the tipped minimum wage.[15]

Earnings

Table 1 presents the results of the QCEW earnings regressions. The dependent variable is the log of average weekly earnings per worker. For each sector in the restaurant industry (full-service and limited-service), models are estimated with and without state-specific time trends.

[14] Allegretto, Dube, and Reich (2011) control for state-specific time trends and also allow census-region-specific effects that differ by quarter. As noted by Neumark, Salas, and Wascher (2012), this introduces a very high degree of collinearity, and the statistical significance of the estimated minimum-wage effects disappears. Moreover, there is little evidence that states in the same census region are any better than states outside the census region as a control group for estimating the effects of minimum-wage hikes.

[15] The bulk of the explanatory power in the auxiliary regressions is from the state fixed effects and national quarterly fixed effects. The addition of all the other control variables increase the auxiliary R^2 by less than 0.01 for both the minimum wage and the tipped minimum.

Table 1. The Determinants of Average Weekly Wages in the Full- and Limited-Service Restaurant Industries

	Full-Service Restaurants				Limited-Service Restaurants				Full-Service Minus Limited-Service			
Sample Period	1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3	
Log of Tipped	0.045	0.037	0.038	0.032	−0.010	−0.017	0.004	−0.0218	0.056	0.054	0.034	0.054
Minimum Wage	(4.00)	(2.75)	(3.21)	(2.80)	(−0.69)	(−0.85)	(0.23)	(−1.59)	(3.42)	(2.97)	(1.68)	(4.29)
Log of Minimum	0.152	0.152	0.156	0.125	0.222	0.202	0.161	0.154	−0.070	−0.050	−0.006	−0.029
Wage	(5.27)	(7.04)	(5.48)	(5.43)	(7.17)	(7.04)	(3.34)	(3.68)	(−2.25)	(−1.96)	(−0.11)	(−0.86)
Log of Population	0.001	0.176	−0.0136	0.169	−0.132	−0.127	−0.229	0.0105	0.133	0.303	0.215	0.159
	(0.01)	(1.71)	(−0.14)	(0.78)	(−0.63)	(−0.58)	(−1.95)	(0.03)	(0.64)	(1.73)	(1.49)	(0.76)
Log of Employment/	0.090	0.061	0.0578	0.167	0.127	0.309	0.099	0.249	−0.037	−0.248	−0.041	−0.082
Population	(1.26)	(1.11)	(0.79)	(2.28)	(0.67)	(2.33)	(0.92)	(2.11)	(−0.21)	(−2.02)	(−0.35)	(−0.75)
Log of Personal	0.326	0.321	0.313	0.266	0.432	0.347	0.500	0.417	−0.106	−0.026	−0.187	−0.151
Income	(4.36)	(4.76)	(3.61)	(3.84)	(2.19)	(2.25)	(4.74)	(3.31)	(−0.60)	(−0.21)	(−1.77)	(−1.41)
State-Specific Time											No	
Trends Included?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes		Yes
Observations	4488	4488	2805	2805	4488	4488	2805	2805	4488	4488	2805	2805
Within-Group R^2	0.986	0.991	0.980	0.987	0.958	0.971	0.960	0.974	0.394	0.597	0.384	0.609
Overall R^2	0.356	0.217	0.257	0.189	0.307	0.420	0.235	0.126	0.001	0.104	0.0226	0.047

The dependent variable is the log of average weekly wages (including any reported tip income) for workers in either the full-service or limited-service industry. It is quarterly state-level data drawn from the Quarterly Census of Employment and Wages. Each regression also includes controls for the percentage of the population over age 60, the percentage under age 18, the prime-age unemployment rate, average household size, and demographic controls describing the prime-age (25-to-60-year-old) population (female labor-force participation rate, percentage married, and percentage with college degrees). All of the *t*-statistics (provided in parentheses) are based on standard errors that are corrected for clustering at the state level.

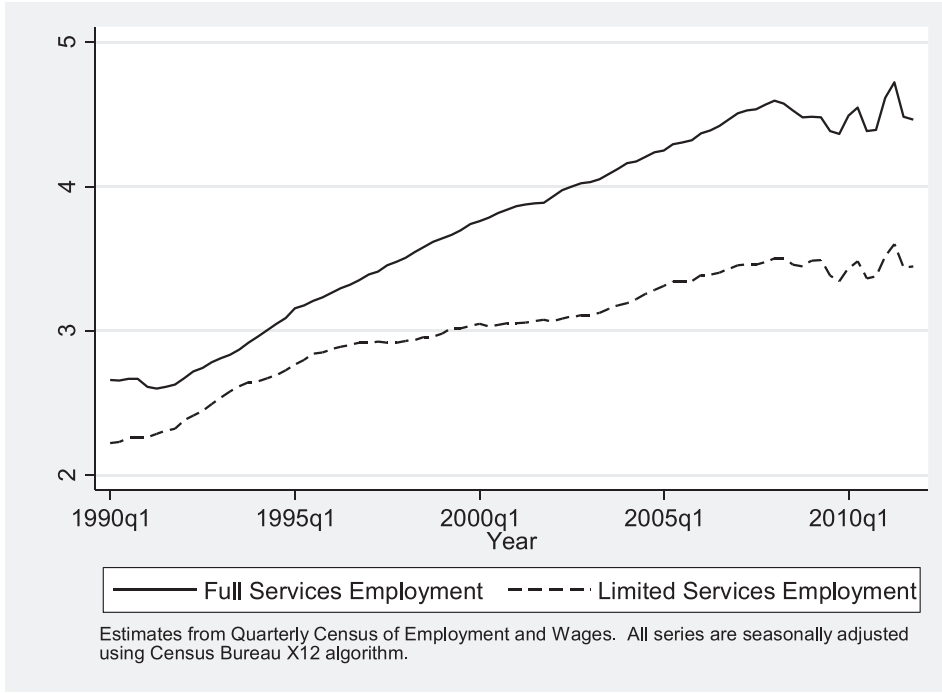

Figure 3. Restaurant-Industry Employment: 1990–2011

All the models include state and quarter fixed effects, along with controls for state-specific quarter-of-year effects and a rich set of controls for factors that could affect restaurant employment in a state. These include the log of the population, the log of the employment-population ratio, the log of the state's personal income, the unemployment rate for the prime-age population, the percentage of the state's population that is under age 18 and the percentage over age 60, demographic controls describing the 25-to-60-year-old population (female labor-force participation rate, percentage married, percentage with college degrees), and average household size. Quarterly fixed effects capture anything that influences restaurant employment nationally (e.g., business cycle, a changing propensity for families to dine out nationally).[16] Unfortunately, we do not have a measure of hours per week in the QCEW, so we cannot estimate the average hourly wage. We also estimate a model with the difference between full- and limited-service earnings as the dependent variable to difference out the effect of unobservables that are common to both sectors of the restaurant industry.

As illustrated in Figure 3, the full-service and limited-service restaurant industries experienced significant declines in both employment and payroll during the recessions at the very beginning and end of our original sample period. Inclusion of these recessionary periods could result in estimates of state-specific trends that are not an accurate reflection of long-term

[16] The source of state population data is http://www.census.gov/popest/. The annual data were converted into monthly data using a constant growth rate between each annual data point and the next. The state employment data ere obtained from the QCEW. The state personal-income data were obtained from http://www.bea.gov. The Current Population Survey provided the unemployment rate for the prime-age population, the percentage of the state's population that is under age 18 and the percentage over age 60, demographic controls describing the prime-age (25-to-60-year-old) population (female labor-force participation rate, percentage married, percentage with college degrees), and average household size.

trends. To determine whether this affects the estimated effects of minimum and tipped minimum wages, Table 2 provides estimates with a sample period of 1994:1 through 2007:3 to remove the beginning and ending recessions. The estimates of the effects of the minimum and tipped minimum wage on weekly earnings are fairly robust to the sample period.[17]

In all four specifications considered, a higher tipped minimum wages (i.e., a reduction in the tip credit) increases weekly earnings in the full-service restaurant industry but has no statistically significant effect (at the 0.10 level) in the limited-service restaurant industry. On the other hand, higher minimum wages have a positive effect on earnings in both the full-service and limited-service restaurant industries in all four specifications considered. In all specifications, the effect of higher minimum wages is greater at limited-service than full-service restaurants, but the effects in the two sectors are significantly different from each other in only two of the four specifications. A larger effect in the limited-service restaurant industry might be expected, since the industry pays lower average wages and a larger share of its workers might be affected by minimum-wage hikes.[18]

The effects of minimum wage and tipped minimum wage on weekly earnings in the restaurant industry appear small. If there is no adjustment in hours worked, a 10% increase in the minimum wage should lead to a 10% increase in weekly earnings for minimum-wage workers. It is important to keep in mind, however, that many workers in the restaurant industry are paid above the minimum wage and will be unaffected by minimum-wage hikes.[19] Also, for workers whose wages increase with the minimum wage, weekly earnings would increase by a smaller amount than the hourly wage if the employer cuts back on hours per worker.

Although the effect of an increase in the tipped minimum wage on weekly earnings in the full-service restaurant industry is statistically significant at the 0.05 level, it is less than one-third of the effect of a higher minimum wage in all four specifications considered. To put this in context, suppose that the tipped minimum wage is $2.13, the minimum wage is $7.25, and the typical server is earning $2.13 plus $10 per hour in tips. If the tipped minimum wage is increased by 10% to $2.24, this extra $0.21 per hour would be only 1.7% of the server's $12.13 earnings. On the other hand, if a dishwasher is paid $7.25 per hour and the minimum wage increases by 10%, this results in a full 10% increase in the dishwasher's hourly wage. Consequently, because higher tipped minimum wages affect only a portion of a tipped worker's wages, whereas the minimum wage affects all of a nontipped worker's wages, we expect a smaller weekly earnings elasticity for the tipped minimum wage.

The underreporting of tips is another reason that the estimated effect of tipped minimum wages on earnings could be small. Employers in the restaurant industry have difficulty monitoring tips and may be less concerned with underreporting so long as employees report enough tips to meet the minimum-wage requirement. If the tipped minimum wage is increased,

[17] The recession at the beginning of our sample ended in 1991:1, and the Great Recession at the end of our sample began in 2007:3. The ending date of 2007:3 was chosen to omit the Great Recession. The start date of 1994 was chosen because the model estimated for the entire period fits the data much better after 1994 than before. When the model without state-specific time trends is estimated for the full period, the root mean squared error is 0.077 for 1990:1 through 1993:4, 0.037 for 1994:1 through 2007:3, and 0.056 for 2007:4 through 2011:4. Moreover, the root mean squared error shows a sharp rate of decline up until 1994 and a sharp increase after the onset of the Great Recession.

[18] According to the May 2011 Occupational Employment Survey data, the average hourly wages (including tips) in the full- and limited-service restaurant industries were $10.92 and $9.71, respectively.

[19] According to the Bureau of Labor Statistics (http://www.bls.gov/cps/minwage2011tbls.htm#5), 22% of workers in the leisure and hospitality industry are paid at or below the federal minimum wage. Since many states require a minimum above the federal level, a larger fraction of workers in the industry are paid at or below the relevant state minimum wage. Unfortunately, there is not a separate breakdown for limited-service and full-service restaurants.

Table 2. The Determinants of Employment in the Full- and Limited-Service Restaurant Industries

	Full-Service Restaurants				Limited-Service Restaurants				Full-Service Minus Limited-Service			
Sample Period	1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3	
Log of Tipped Minimum Wage	−0.102	0.004	−0.078	−0.029	−0.023	0.079	−0.015	0.009	−0.079	−0.076	−0.063	−0.038
	(3.45)	(0.16)	(3.13)	(2.32)	(0.76)	(2.73)	(0.56)	(0.39)	(2.34)	(2.38)	(1.64)	(1.75)
Log of Minimum Wage	−0.052	−0.046	−0.015	0.053	−0.191	−0.157	−0.095	0.000	0.138	0.111	0.080	0.053
	(1.24)	(1.70)	(0.34)	(1.56)	(2.85)	(2.93)	(1.52)	(0.01)	(2.12)	(1.72)	(1.04)	(0.81)
Log of Population	0.858	0.926	0.970	1.039	0.920	1.648	0.961	1.458	−0.064	−0.724	0.009	−0.418
	(2.59)	(3.73)	(3.91)	(3.68)	(2.98)	(5.97)	(3.47)	(3.56)	(0.30)	(3.03)	(0.048)	(1.00)
Log of Employment/ Population	0.054	0.816	0.080	0.388	0.168	0.752	0.062	0.353	−0.115	0.062	0.017	0.035
	(0.28)	(6.27)	(0.44)	(2.55)	(0.70)	(3.91)	(0.25)	(2.07)	(0.56)	(0.27)	(0.087)	(0.21)
Log of Personal Income	0.035	−0.102	−0.128	−0.024	0.055	−0.208	−0.127	−0.056	−0.019	0.108	−0.001	0.032
	(0.16)	(0.81)	(0.78)	(0.17)	(0.21)	(0.87)	(0.55)	(0.21)	(0.11)	(0.50)	(0.004)	(0.12)
State-Specific Time Trends Included?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	4488	4488	2805	2805	4488	4488	2805	2805	4488	4488	2805	2805
Within-Group R^2	0.935	0.978	0.934	0.974	0.847	0.934	0.776	0.903	0.532	0.751	0.574	0.782
Overall R^2	0.931	0.972	0.962	0.970	0.954	0.952	0.959	0.951	0.008	0.044	0.02	0.034

The dependent variable is the log of state employment for workers in either the full-service or limited-service industry. It is quarterly state-level data drawn from the Quarterly Census of Employment and Wages. Each regression also includes the same list of controls as in Table 1. The absolute value of the *t*-statistics (in parentheses) is based on standard errors that are corrected for clustering at the state level.

the employer might not object if reported tips decline so long as there are sufficient tips reported to meet the minimum-wage requirement. As a result, higher tipped minimum wages could cause actual earnings to increase more than reported earnings. Like the Internal Revenue Service (IRS), we have difficulty assessing the extent of this problem.[20]

Employment

Estimates of employment effects in the QCEW are provided in Table 2. The models include the same controls used in the earnings regressions presented in Table 1. Tipped minimum wages have a significant negative effect (0.05 level) in the full-service restaurant industry but not in the limited-service restaurant industry in three of the four specifications considered. The one exception is the model for the full sample period with state-specific time trends. In this one case, the tipped minimum wage has a small positive but statistically insignificant effect ($t = 0.16$) in the full-service restaurant industry and a statistically significant positive effect in the limited-service restaurant industry ($t = 2.74$).

As noted by Neumark, Salas, and Wascher (2012), estimates of minimum-wage effects can be sensitive to the choice of sample period when state-specific trends are included—particularly when there are recessions at the beginning or end of the sample. To remove the effects of the beginning and ending recessions on the long-term state-specific trends, we also estimated models that remove the influence of the recessions on the state-specific trends for the bulk of the sample period. This is accomplished by including spline functions allowing each state's trend line to change slope at the end of the first recession (1994:1) and at the beginning of the last recession (2007:3).[21] In these models, the estimated effect of the tipped minimum wage is virtually identical to the estimate for the shorter time period with state-specific trends (-0.031, with t-statistic = 1.78). Thus when the effects of the beginning and ending recessions on the long-term state-specific trends are eliminated, the results are robust to choice of sample period.

Further evidence on the robustness of results is provided by differencing employment in the full-service and limited-service restaurant industries, to eliminate any bias-associated unobservables that might be correlated with a state's tipped minimum wage and have a common effect on employment in the two sectors of the restaurant industry. For example, suppose states with booming tourism are more likely to increase the tipped minimum wage. If the tourist boom increases employment in both the limited-service and full-service restaurant industries, the difference equation would eliminate any bias associated with the lack of control for tourism. The difference results are presented in the rightmost columns of Table 2. In all four specifications considered, tipped minimum wages reduce employment in the full-service restaurant industry relative to the limited-service restaurant industry. In each specification, the coefficients are statistically significant at the 0.10 level or lower. The one anomaly found in the earlier regressions (the full sample period with state-specific time trends) disappears in the difference equations.

We also considered alternative specifications to test for the robustness of results in the full-service restaurant industry. First, since economic conditions are potentially endogenous in the employment regressions, we re-estimated models that exclude state employment,

[20] The IRS estimates that only between 20% and 25% of servers fully report tip income (Thomas 1994), and IRS data reveal that in 1988, tipped workers only reported about one-third of their tip income (Erard and Ho 2003).

[21] The spline functions require the trend lines to connect at the points where the slopes change.

unemployment rate, and personal income and found only modest changes in the estimated effects of the minimum and tipped minimum wage on employment. Following Wessels (1997), we also estimated models that test for monopsonistic behavior by estimating models that include the tipped minimum wage and its square along with the log of the minimum wage. If there is monopsonistic behavior, the employment effect of increases in the tipped minimum wage should switch from positive to negative as the tipped minimum rises.[22] In the four specifications we consider (two sample periods with and without state-specific time trends), there is no value of the tipped minimum wage in our sample for which we find a positive effect that rose to statistical significance at the 0.20 level. We repeat the same exercise for the minimum wage and find a statistically significant positive effect (at the 0.10 level) in only one of the four specifications for approximately the bottom one-third of the range of minimum wages. Given the lack of robustness of this result across the four specifications, we are reluctant to draw strong conclusions about monopsonistic behavior with respect to the minimum wage.

Overall, the bulk of the evidence suggests that an increase in the tipped minimum wage has a relatively small effect on average weekly earnings. A 10% increase in the tipped minimum wage would increase average weekly wages by less than 1% in the full-service restaurant industry, though the small increase in the average wages may mask larger increases for the subset of workers that receive tips. Similarly, higher tipped minimum wages reduce employment in the full-service restaurant industry by a small amount. In the three models that we place greatest faith in (i.e., excluding the model with the beginning and ending recession and state-specific time trends), a 10% increase in the tipped minimum wage reduces employment by less than 1%. In the difference equations, a 10% increase in the tipped minimum wage reduces employment in the full-service restaurant industry by less than 1% relative to the limited-service restaurant industry.

While the estimated effects on earnings and employment may seem small, it is important to keep in mind that the bulk of the earnings and employment effects will be absorbed almost entirely by the group of tipped workers. Consequently, if tipped workers represent one-half of the workers in the full-service restaurant industry, the earnings and employment effects for this subgroup would be twice the size of those for the industry.

CPS Data

While the QCEW provides a very accurate measure of employment in the two sectors of the restaurant industry, it has two major shortcomings. First, it does not provide any information about hours worked. Ignoring the possibility of monopsonistic responses, an increase in the tipped minimum wage should lead to a reduction in total work hours. At the same time, it is possible that a firm could accomplish this by adjusting both the number of workers and hours per worker. There is no consensus in the empirical literature on how an increase in the minimum wage affects average hours among workers.[23] The optimal response will depend on a variety of factors, including quasi-fixed labor costs associated with hiring, training, and fringe benefits as well as the relationship between worker productivity and hours per worker.

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[22] This pattern emerges if the coefficient on the tipped minimum is positive and that on its square is negative.

[23] As an illustration of the diversity of findings, Katz and Krueger (1992) found that increased minimum wages increase average hours per worker at fast-food restaurants. Neumark and Wascher (2000) found the opposite. Sabia (2009a) found no effect of minimum-wage increases on average hours per worker among teenagers in retail trade. Couch and Wittenburg (2012) found that minimum-wage increases reduce average hours per worker among teenagers.

A second shortcoming of the QCEW is that it does not provide any information on occupation. This makes it impossible to focus on the group most likely to be affected by an increase in the tipped minimum wage—tipped workers.

While the CPS does not distinguish between full-service and limited-service restaurants, it does provide information on the occupations of individual workers. Thus, within the restaurant industry, we can identify workers who are the most likely to be at full-service restaurants and be eligible for tips. We use two different measures to gauge the fraction of each occupation that is tipped within the restaurant industry. The CPS provides two measures of hourly earnings: (i) hourly earnings excluding tips, overtime, and commissions; and (ii) hourly earnings including tips, overtime, and commissions. To eliminate overtime as a potential source of differences between the two measures, for our analysis of tip frequency we restrict the sample to people who report usual work hours of 40 hours or less, so that the difference between the two measures of earnings should reflect tips. Since earnings in the CPS are based on self-reports and workers probably underreport tips in the CPS, our estimates of the fraction of workers receiving tips is likely an understatement.

Another way to examine the frequency of tips is to compute the percentage of workers earning less than the minimum wage, excluding tips. An employee could earn less than the minimum wage because he or she is eligible for a tip credit or is not covered by minimum-wage law, or because the earnings are misreported.[24]

Table 3 presents these two different measures of tipping for the most common occupations in the restaurant industry. The three occupations with the highest tip rate are front-of-the-house jobs: waiters/waitresses, bartenders, and attendants (more commonly referred to as bussers or waiter assistants). For these occupations, the percentage of employees that are tipped ranges from a low of 33% (attendants) to a high of 68% (bartenders). On the other hand, back-of-the-house employees (i.e., those in the kitchen) all have substantially lower tip rates. For example, only 10% of cooks and 7% of dishwashers report tips. While one might not expect any of these back-of-the-house employees to receive tips, given the rules on mandatory tip sharing, coworkers might voluntarily share tips, or workers could have dual job duties and receive some tips (e.g., a cook might serve food on occasion to customers).

The ranking of occupation by the percentage paid less than the minimum is similar to the tip-rate rankings. The front-of-the-house employees are more likely to be paid below the minimum than the back of the house. Consequently, we expect increases in the tipped minimum wage to have a larger effect on workers in one of the three tipped occupations—waiters/waitresses, bartenders, and attendants.

To examine the effect of tipped minimum wages on employment and hours with CPS data, we aggregate the data by state to obtain an estimate of total tipped and nontipped employment and hours in the restaurant industry by quarter. Unlike the analysis of tip frequency in Table 3, we include workers regardless of whether they report working overtime. We do not perform an analysis of earnings with CPS data, since earnings information is only available for the outgoing rotation groups in the CPS, the sample sizes are one-fourth of what is available for usual hours worked, and eliminating imputed earnings reduces sample sizes even further.

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[24] Federal law exempts businesses with less than $500,000 in annual sales from the minimum wage. Also, federal law allows employers to pay a subminimum wage to workers under age 20 during the first 90 days of employment. See http://www.dol.gov/compliance/guide/minwage.htm#who for a description of which jobs are covered by federal minimum-wage laws.

Table 3. Percentage of Workers Reporting Tips for Restaurant by Occupation: 2006–2011

	Share of Workers	Percentage Tipped	Percentage Hourly Wage Less than Minimum Wage
All Workers in Restaurant Industry	100%	27%	20%
Tipped Occupations			
Waitstaff	26%	61%	44%
Bartender	3%	68%	37%
Attendants	3%	33%	25%
All	32%	59%	42%
Nontipped Occupations			
Cashier	9%	8%	11%
Cook	31%	10%	10%
Dishwasher	3%	7%	14%
Food-Service Manager	10%	15%	4%
Counter Attendant	4%	10%	18%
All Other Nontipped	13%	21%	14%
All	69%	12%	10%

Estimates are based upon Current Population Survey data from January 2006 through December 2011. Workers reporting any overtime, tips, or commissions are defined as tipped. The sample is restricted to workers reporting 40 or fewer hours per week, to avoid counting workers receiving overtime as tipped workers. The percentage of workers with an hourly wage below the state's minimum wage is based upon the hourly wage that excludes tips, overtime, and commissions.

Estimates of log-employment and log-hours regressions with CPS data are presented in Table 4. The four specifications estimated with QCEW are repeated here for the log of employment and for the hours of tipped workers, the hours of nontipped workers, and the difference between the two. We control for the same list of control variables used in the QCEW.

In all four specifications, tipped minimum wages have negative employment effects on tipped workers, but the effects are never statistically significant at the 0.10 level. In the bottom panel of Table 4, estimates are presented for aggregate hours in the restaurant industry. In the case of the full-service restaurant industry, in all four specifications the hours effects of the tipped minimum wage are more negative than the employment effects. This suggests that an increase in the tipped minimum wage leads to reductions in both the number of employees and the number of hours per worker.

The estimated hours elasticities for the tipped minimum wage range from -0.12 to $-.021$ across the four specifications and are statistically significant at the 0.10 level in three of the four models. The model where statistical significance drops below 0.10 (t-statistic $= -1.51$) has the largest point estimate for the elasticity (-0.21) but also the largest standard error. The imprecision of the estimated effect here relative to the other specifications probably reflects a combination of a shorter sample period, the inclusion of state-specific time trends, and the highest degree of collinearity between the tipped minimum wage and the other control variables.

While the statistical significance of the employment and hours effects of the tipped minimum wage are lower in the CPS than in the QCEW, the point estimates of the effects of the tipped minimum wage are much higher in the CPS. The fact that the estimates in the CPS are less precise (i.e., have higher standard errors) is not surprising, given the smaller sample sizes for estimating quarterly employment by state. Measurement error in the employment variable will contribute to higher standard errors for the coefficient estimates. The fact that the point

Table 4. Determinants of Total Hours Employed and Employment for Tipped and Nontipped Workers in the Restaurant Industry

	Tipped Workers				Nontipped Workers				Tipped Minus Nontipped			
Sample Period	1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3		1990:1 to 2011:4		1994:1 to 2007:3	
Employment												
Log of Tipped Minimum Wage	−0.118	−0.074	−0.153	−0.171	−0.030	−0.056	0.002	0.002	−0.089	−0.018	−0.155	−0.174
	(1.60)	(0.91)	(1.34)	(1.18)	(0.78)	(1.01)	(0.038)	(0.044)	(1.32)	(0.21)	(1.21)	(1.10)
Log of Minimum Wage	−0.258	−0.207	−0.158	−0.156	−0.054	−0.047	−0.089	−0.065	−0.204	−0.160	−0.069	−0.091
	(1.51)	(1.28)	(0.82)	(0.78)	(0.52)	(0.50)	(0.93)	(0.68)	(1.27)	(0.92)	(0.35)	(0.40)
Log of Population	−0.583	−0.673	−0.996	−1.037	−0.375	−0.277	−0.313	−0.319	−0.208	−0.396	−0.684	−0.718
	(1.97)	(2.23)	(2.44)	(2.25)	(2.28)	(1.44)	(1.51)	(1.13)	(0.73)	(1.10)	(1.64)	(1.17)
Log of Employment/ Population	−0.200	−0.244	−0.290	−0.301	0.436	0.419	0.126	0.918	−0.636	−0.663	−0.416	−1.220
	(0.24)	(0.34)	(0.27)	(0.29)	(0.62)	(0.67)	(0.14)	(1.08)	(0.77)	(0.74)	(0.30)	(0.93)
Log of Personal Income	1.570	0.814	1.904	0.950	1.075	0.767	1.037	0.302	0.495	0.0470	0.867	0.648
	(4.05)	(1.25)	(3.20)	(0.72)	(4.90)	(1.71)	(3.45)	(0.35)	(1.31)	(0.064)	(1.33)	(0.41)
Total Hours												
Log of Tipped Minimum Wage	−0.172	−0.121	−0.183	−0.213	−0.044	−0.058	0.018	−0.008	−0.128	−0.063	−0.201	−0.205
	(2.17)	(1.70)	(1.72)	(1.51)	(1.02)	(1.04)	(−0.33)	(0.14)	(1.78)	(0.82)	(1.64)	(1.32)
Log of Minimum Wage	−0.226	−0.161	−0.132	−0.128	−0.057	−0.034	−0.103	−0.097	−0.169	−0.127	−0.029	−0.032
	(1.21)	(0.94)	(0.67)	(0.61)	(0.55)	(0.33)	(1.08)	(0.90)	(1.03)	(0.68)	(0.15)	(0.14)
Log of Population	1.439	1.047	1.781	1.291	1.054	0.48	0.939	−0.125	0.384	0.567	0.841	1.415
	(−3.41)	(−1.51)	(−3.09)	(−1.04)	(−4.04)	(−0.93)	(−2.63)	(0.11)	(−0.92)	(−0.68)	(−1.32)	(−0.92)
Log of Employment/ Population	0.799	1.32	1.044	1.398	0.961	0.882	0.612	0.822	−0.162	0.439	0.432	0.577
	(−1.95)	(−3.08)	(−2.91)	(−3.85)	(−4.15)	(−2.95)	(−1.89)		(0.34)	(−0.89)	(−0.92)	(−1.16)
Log of Personal Income	−0.462	−0.603	−0.944	−1.041	−0.264	−0.032	−0.23	−0.099	−0.198	−0.571	−0.713	−0.942
	(1.48)	(1.71)	(2.26)	(2.07)	(1.43)	(0.14)	(1.03)	(0.31)	(0.64)	(1.36)	(1.78)	(1.48)
State-Specific Time Trends Included?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	4488	4488	2805	2805	4488	4488	2805	2805	4488	4488	2805	2805
Employment R^2	0.95	0.96	0.95	0.96	0.98	0.98	0.98	0.98	0.27	0.30	0.30	0.34
Hours R^2	0.94	0.95	0.95	0.95	0.98	0.98	0.98	0.98	0.19	0.22	0.27	0.31

The dependent variable is the log of state employment (top panel) or aggregate hours (bottom panel) for the specified group of workers in the restaurant industry. The estimates are based upon aggregation of monthly CPS data to quarterly state-level data. Tipped workers include servers, attendants, and bartenders in the restaurant industry. Nontipped workers include all other workers in the restaurant industry. The regressions also include the same list of controls as in Table 1. Unlike in Table 3, the sample here includes workers regardless of whether they report overtime hours. The absolute value of the *t*-statistics (in parentheses) is based on standard errors that are corrected for clustering at the state level.

estimates of the employment effects are larger in the CPS should be expected, since the CPS allows us to focus on the group most likely to be affected (tipped workers), whereas the QCEW estimates are for all workers in the full-service restaurant industry.

As a check on whether the estimates for tipped workers are spurious, we estimate the same models for nontipped workers. In all four specifications considered, tipped minimum wages have no statistically significant effect (at the 0.10 level) on employment or aggregate hours of nontipped workers. This is suggestive evidence that unmeasured trends affecting employment in the restaurant industry are not the source of a spurious relationship between tipped minimum wages and employment of tipped workers.

The difference equations for tipped minimum wages are not precisely estimated, particularly when state-specific time trends are included. The difference equations for all four specifications indicate that an increase in the tipped minimum wage reduces employment and aggregate hours of tipped workers relative to nontipped workers, but the estimated effects are statistically significant (0.10 level) only in the two specifications for aggregate hours that exclude state-specific time trends.

Overall, the CPS data indicate that higher tipped minimum wages reduce the employment and aggregate hours of tipped workers but have a negligible effect on nontipped workers. The point estimates are less precise when state-specific time trends are included, probably because of the greater degree of collinearity. Relative to the QCEW data, the estimated effects are larger in the CPS data, arguably because the CPS data are able to separate tipped from nontipped workers and capture the effects of adjustments in both employees and hours per employee.

Falsification tests

Thus far, the bulk of the evidence suggests that higher tipped minimum wages reduce employment at full-service restaurants and reduce the aggregate hours of tipped workers. The one nagging concern, however, is that allowing for unmeasured spatial heterogeneity in employment trends makes these results more fragile. This fragility might reflect the high degree of collinearity in the data that state-specific trends add, or it could be that the state-specific trends are controlling for unmeasured trends that are correlated with state-specific growth in tipped minimum wages.

To provide additional evidence on whether the estimated effects of tipped minimum wage are spurious and capturing unmeasured trends, we re-estimate the model for other industries (QCEW) and occupations (CPS) where the tipped minimum wage should not matter. If we find that tipped minimum wages have a significant negative effect on employment in many industries (or occupations) where workers are not eligible for a tip credit, this will be strong evidence that our results for the full-service restaurant industry and tipped occupations are spurious.

For the QCEW, we choose the 81 other two-digit industries available in the data. We estimate each of the earlier specifications with the same controls, the two sample periods, and with and without state-specific time trends. For each industry, we record the coefficient on the tipped-minimum-wage variable and the *t*-statistic. The results, presented in the top panel of Table 5, show that it is unusual to find an industry where the estimated effect of the tipped minimum wage is statistically significant and negative. Across the four specifications, the percentage of industries with a *t*-statistic less than -1.96 ranges from 3.7% to 11.1%. In all three specifications where the tipped minimum wage has a statistically significant negative

Table 5. Falsification Tests

	1990:1 to 2011:4		1994:1 to 2007:3	
	No State-Specific Time Trends	State-Specific Time Trends Included	No State-Specific Time Trends	State-Specific Time Trends Included
QCEW				
Coefficient on Tipped Minimum Wage for Full-Service Restaurants	−0.10	0.004	−0.08	−0.03
t-Statistic for Full-Service Restaurants	−3.45	0.16	−3.13	−2.32
Median Coefficient for 81 Other Industries	−0.03	0.01	−0.02	−0.001
Median *t*-Statistic for 81 Other Industries	−0.50	0.18	−0.39	−0.06
Percentage of Industries with *t*-Statistic				
< *t*-Statistic for Full-Service Restaurants	1.2%	48.1%	2.5%	4.9%
< −1.96	11.1%	3.7%	9.9%	6.2%
CPS Employment				
Coefficient on Tipped Minimum Wage for Tipped Workers	−0.12	−0.07	−0.15	−0.17
t-Statistic for Tipped Workers	−1.60	−0.91	−1.34	−1.18
Median Coefficient for 81 Other Occupations	−0.03	0.003	−0.02	−0.03
Median *t*-Statistic for 81 Other Occupations	−0.40	0.02	−0.21	−0.18
Percentage of Occupations with *t*-Statistic				
< *t*-Statistic for Tipped Workers	18.5%	23.5%	16.0%	16.0%
< −1.96	12.3%	3.7%	4.9%	6.2%
CPS Aggregate Hours				
Coefficient on Tipped Minimum Wage for Tipped Workers	−0.17	−0.12	−0.18	−0.21
t-Statistic for Tipped Workers	−2.17	−1.70	−1.72	−1.51
Median Coefficient for 81 Other Occupations	−0.03	−0.04	−0.02	−0.02
Median *t*-Statistic for 81 Other Occupations	−0.23	−0.33	−0.10	−0.08
Percentage of Occupations with *t*-Statistic				
< *t*-Statistic for Tipped Workers	2.5%	7.4%	2.5%	16.0%
< −1.96	3.7%	3.7%	1.2%	7.4%

Results represent the estimated effect of tipped minimum wage on the log of employment (QCEW and CPS) and log of hours (CPS). The QCEW regressions are identical to those in Table 2 for the full-service restaurants, except that the log-employment measure is for 81 nonrestaurant industries. Regressions for the CPS are identical to those in Table 4 for tipped and nontipped workers, except that aggregate hours or employment (excluding those in the restaurant industry) is for 81 occupations not in the tipped or nontipped category for restaurant workers. All of the *t*-statistics in the falsification tests are based on standard errors corrected for clustering at the state level.

effect in the full-service restaurant industry, less than 5% of the *t*-statistics for the other industries are more negative than the *t*-statistic found for the full-service restaurant industry.

For the CPS, we identify 81 two-digit occupations and estimate employment and hours regressions. We exclude all employees in the restaurant industry from our calculation of occupation-specific employment and hours. We estimate the same four employment and hours specifications as in Table 4. The results for the other occupations, summarized in the bottom two panels of Table 5, show that is unusual to find an occupation where the effect of the tipped minimum wage is statistically significant and negative. In all but one specification, the percentage of occupations with a *t*-statistic less than −1.96 is below 8%. In the case of the hours regressions, for all four specifications, less than 8% of the occupations have a *t*-statistic below −1.96.

Overall, the falsification tests reveal that it is unusual to find a statistically significant negative effect of the tipped minimum wage on employment or hours in occupations or industries where the tip credit is unlikely to be important. This adds further evidence that the results we find for the restaurant industry and for tipped occupations are not likely to be spurious.

6. Summary and Conclusions

There is significant momentum among states to increase the tipped-minimum-wage requirement for tipped workers, and legislation has been proposed to increase the federal tipped minimum wage. This study provides evidence on the effects of such policies and should help provide policy makers with useful information when considering the wisdom of such changes. Using data from the QCEW, we estimate that higher tipped minimum wages increase earnings for workers at full-service restaurants but reduce employment. Allowing for spatial heterogeneity of employment trends in the regression analysis makes the employment results more fragile, but we provide several pieces of evidence suggesting that the estimated effects of the tipped minimum wage are not spurious. For example, we show that higher tipped minimum wages do not affect employment in the limited-service restaurant industry, and placebo tests for other two-digit industries show little effect.

The CPS data allow us to focus on workers most likely to be affected by higher tipped minimum wages—tipped workers. For this group, we find that higher tipped minimum wages reduce aggregate employment and hours for tipped workers in the restaurant industry, though the precision of these estimates is less than desirable. Evidence that these results are not spurious includes the fact that nontipped workers are not affected by higher tipped minimum wages, and falsification tests for other occupations also suggest no effect.

We believe the empirical analysis provides convincing evidence that higher tipped minimum wages increase earnings but reduce employment. Like much of the minimum-wage research, however, this study is confronted with the difficulties of separately identifying the true effect from a spurious relationship. A potential concern with the analysis is the sensitivity of the results to the inclusion of state-specific time trends when the recessions at the beginning and end of our sample period are included. Future research is needed to improve the degree of confidence in the statement that higher tipped minimum wages reduce employment. In particular, there is room for additional research that would focus on examples of tipped-minimum-wage increases in specific states using difference-in-difference methods similar to those employed by other researchers to examine the effects of minimum-wage hikes. Another fruitful area for research would address the question of how tip-credit laws affect the

composition of pay for restaurant workers. For example, do firms respond by mandating more tip pooling? Do customers respond to the higher wages of tipped workers by cutting back on tips?

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