Eat at Home or Away from Home? The Role of Grocery and Restaurant Food Sales Taxes

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This work was funded by the USDA Economic Research Service through a cooperative agreement under federal grant number 58-5000-5-0096. The findings and conclusions in this article are those of the authors and do not represent the views of USDA.

Abstract: Sales taxes on both grocery food and restaurant food exist in almost every county in the United States. By combining county level sales tax data with USDA's recent national household food acquisition and purchase survey, we examine how a food sales tax affects consumers' expenditures on grocery and restaurant food. We find that a grocery tax reduces consumers' grocery food expenditures and increases restaurant food expenditure, which has further public health implication because the latter is generally considered to be less healthy. A restaurant food sales tax increases consumers' grocery food expenditures. Such result provide insight into the potential impact of "fat" taxes on fast food restaurants. In addition, we find no differential impacts from food sales taxes based on consumers' income, participation status in Supplemental Nutrition Assistance Program, or sharing borders with lower taxed counties. Finally, our results provide evidence that many consumers are attentive to food sales taxes even though the taxes are added at the register and are not salient.

Keywords: grocery food sales tax, restaurant food sales tax, tax salience

JEL: H71, D12, Q18

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1. Introduction

The majority of states and counties in the United States exempt grocery food, but not restaurant food from the general sales tax. For example, in Fayette County of Kentucky where there is no county sales tax, groceries are exempt from the 6% state sales tax, but restaurant food is not exempt. As a result, consumers living in Fayette County face a 6% tax differential between eating at home vs. away from home for a similar meal. On the other hand, in Lee County of Alabama, groceries are subject to the same 4% state and 4% county sales taxes that are levied on restaurant food, providing no tax incentive to consumers to eat at home. Such myriad and often conflicting sales tax codes across and even within states can have direct public health implications by changing the relative prices of eating at home versus dining out since the latter is generally considered to be less healthy.[1]

The aim of this research is to provide the first empirical examination of consumers' dietary behaviors in response to both types of *food sales taxes*, defined as *grocery taxes* (sales taxes imposed on foods at retail outlets such as grocery stores, convenience stores, etc.) and *restaurant taxes* (sales taxes imposed on restaurant food). We address two important policy questions faced by local, state, and federal governments: 1) do food sales taxes affect consumers' expenditures on grocery food and restaurant food, and 2) are food expenditures of government food assistance program participants less sensitive to food sales taxes?

The first policy question is important for at least two reasons in addition to the aforementioned public health implications. First, food sales taxes (grocery and restaurant) exist

[1] Many studies have associated dining out with a poor diet quality in terms of high caloric intake (e.g., Taveras et al., 2005; Beydoun et al. 2009).

in almost every county in the United States. In Figure 1, we provide two maps showing the rates of grocery taxes and restaurant taxes, respectively, for each U.S. county in 2014. These are the state and county combined tax rates. Note that our restaurant tax data reflect the fact that some counties impose an additional sales tax on top of the general sale tax on restaurant food.[2] Grocery taxes exist in 18 states, with the highest being 9% (4% state plus 5% county) in Tuscaloosa County, Alabama in 2014. The average combined grocery tax rate for counties that tax groceries is 4.3%. Most of the counties that have a grocery tax are located in the South such as Alabama, Mississippi, and Arkansas. Restaurant taxes exist in all states except Delaware, New Hampshire, Montana, and Oregon, with the highest being 10% (4% state plus 6% county) in Catahoula Parish County, Louisiana. Overall, one-third of U.S. counties are affected by grocery taxes and most U.S. counties are affected by restaurant taxes.

Second, many state and local governments have imposed or raised food sales taxes, particularly grocery taxes as a means to raise additional governmental revenues. Table 1 presents an overview of 16 possible combinations of grocery tax policies, each of which depends on whether a state and a county tax grocery food at the full rate, tax grocery food at a reduced rate, exempt grocery food from sales tax, or have no sales tax. A grocery food tax is simply a result of a state and/or county taxing groceries at the full or reduced rate, e.g., South Dakota (full state tax), Georgia (full county tax), and Tennessee (reduced state tax coupled with full county tax). In addition, many public health supporters advocate taxing fast food restaurants to curb the obesity epidemic. It is critical for policy makers as well as restaurants to gain insight into how food sales tax policies affect consumers' dietary behaviors. If consumers allocate more of their budgets to

[2] Sources: tax-rates.org, www.sale-tax.com, and state and various county departments of revenue. Our data are at the county level and do not reflect that some cities may impose additional restaurant taxes (not available to us).

eating away from home in response to a higher grocery tax rate, such a tax is beneficial to the local restaurant industry at the cost of grocery retailers.

The second policy question addresses how federal food assistance policies may interact with local tax policies. According to federal laws and U.S. Department of Agriculture (USDA) regulations, food purchases made with federal government food assistance benefits, namely the Supplemental Nutrition Assistance Program (SNAP), are exempt from both state and local sales taxes. Therefore, SNAP recipients might be less sensitive to grocery taxes because the program benefits are shielded from the taxes.

In this paper, we empirically examine the impacts of county-level grocery and restaurant taxes on consumers' Food-At-Home (FAH) and Food-Away-From-Home (FAFH) expenditures by using the new USDA's National Household Food Acquisition and Purchase Survey (FoodAPS). FoodAPS is the first nationally representative survey of American households to collect unique and comprehensive data about household food purchases and acquisitions. Detailed information was collected about foods purchased or otherwise acquired for FAH and FAFH consumption. We combine the FoodAPS data with newly collected food sales tax data at the county level. We find that a one percentage point increase in the grocery tax leads to a $1.86 decrease in household weekly (cash) FAH spending, and a $1.58 increase in weekly FAFH spending. This result provides evidence that consumers respond to grocery taxes even though taxes are added at the register and therefore not reflected in the shelf price, a finding that contributes to the growing literature on tax salience. We also find that a one percentage point increase in the restaurant tax leads to a $3.00 increase in household weekly FAH spending, but does not affect FAFH spending. We also examine how SNAP participation may interact with food taxes, by controlling for the endogeneity of SNAP participation using an instrumental

variable approach. The results indicate that SNAP participation reduces consumers' cash FAH and FAFH spending, which is consistent with findings in the literature. Unexpectedly, the results do not support the hypothesis that SNAP mitigates the impact of a grocery tax. We offer several explanations for this result. The overall findings of this study suggest that policy makers should consider consumers' food consumption responses when crafting or changing food tax policies.

2. Relevant Literature

Our study is closely related to a large literature on the impacts of food and beverage taxes (and subsidies) on consumption and health outcomes. Most studies emphasize the importance of the price elasticity of demand for food, while assuming that a tax is perfectly passed on to consumers (e.g., Zheng and Kaiser 2008; Zhen et al. 2011). A few studies analyze the impact of state food sales taxes on grocery sales for consumers living close to state borders by using tax-inclusive prices (e.g., Walsh and Jones 1988; Tosun and Skidmore 2007). Several researchers use a reduced form approach to directly examine the impact of a tax on food and beverage consumption (e.g., Sturm et al. 2010) and health outcomes such as the body mass index (e.g., Fletcher et al. 2008). Andreyeva et al. (2010) and Powell et al. (2013) conduct two subsequent, comprehensive reviews (published studies for 1938–2007 and 2007–2013 respectively) of hundreds of studies in the literature and conclude with clear evidence of negative consumption responses to food and beverage taxes. However, Powell et al. (2013) show that the evidence for the effect of taxes on weight outcomes is mixed. Because the tax studies primarily used state level sales taxes, Powell et al. (2013) attribute this mixed evidence to the small magnitude of state level taxes. Following some of the previous studies, we adopt the reduced-form approach, but use sales tax data with a much finer level of disaggregation. As displayed in Table 1,

numerous counties have their own grocery taxes. Using county level sales tax data therefore better captures reality and provides greater variation.

Complicating the results from the above literature is the small, but burgeoning research on tax salience. In their seminal work, Chetty et al. (2009) show that consumers underreact to taxes that are not salient by using a store experiment. These authors also show that consumers ignore state sales tax imposed on beer, but not the excise tax imposed on manufacturers. Zheng et al. (2013) further find that consumers' imperfect tax knowledge can attenuate or strengthen the degree of consumer under reaction to a sales tax. Their survey finds that about one-third of New York State consumers have the wrong knowledge of tax status of some foods. Similarly, Chen et al. (2015), using an economic experiment of 131 adults, non-student subjects, find that an inclusive tax (included in the menu price) has a significantly stronger effect on reducing the consumption of total calories, calories from fat, and the intake of carbohydrates, cholesterol, sugar and sodium compared with an exclusive tax (added at register). Goldin and Homonoff (2013) investigate income differences in attentiveness to cigarette sales taxes and find that only low-income consumers respond to the taxes. In contrast, Berck et al. (2016) show that a bottled-water sales tax in Washington decreased sales, and such effect is more pronounced in the lowest and highest quintile income areas. Our analysis relates to this literature because it provides a test of whether consumers ignore food sales taxes, which are generally added at the register. We also examine income differences in attentiveness to food sales taxes, providing some insights on whether food taxes place a higher burden on lower income population.

Three studies have analyzed the determinants of FAH and FAFH spending using longitudinal survey data. They share a common objective of identifying consumption responses to the SNAP program and all ignored food sales taxes. Wilde et al. (2009) analyzes this issue by

splitting samples into SNAP participants and nonparticipants. Hoynes and Schanzenbach (2009) utilize the original introduction of the program across counties as the source of variation while Beatty and Tuttle (2014) utilize the large increases in SNAP benefits in 2009. The latter two studies adopt a difference-in-difference design. Because the FoodAPS data cover only one week in duration, it prevents us from using either of the techniques used by the latter two related studies to get around the endogeneity of SNAP participation. Instead, we use instrumental variables to address this well-known issue following a broader literature of examining SNAP impacts on food security (e.g., Ratcliffe et al. 2011). Because historical county food sales tax is unavailable, our source of variation comes from the vast tax differences among U.S. counties (Figure 1). This is a reasonable approach considering food sales taxes generally do not change over a short period of time. We also make use of the detailed and unique consumer characteristics the FoodAPS data provide (e.g., traveling time to primary food store, shopping behavior, food access, nutrition knowledge) to compensate for the limitation that we cannot model consumer fixed effects.

Overall, this research makes three main contributions. First, we examine both the own and cross effects of grocery and restaurant taxes and learn about the potential tax policy interactions between state/local and federal levels. The estimates presented here are directly relevant to policies such as a fat tax on fast food restaurants. Second, our conceptual framework illustrates how the sales tax affects market equilibrium in the presence of tax inattentiveness and various degrees of tax pass-through. Our empirical model provides a test of tax attentiveness, contributing to the growing tax salience literature. Third, the use of county-level food sales tax data is an improvement over previous tax studies. The rich household information in FoodAPS

also allows measurement of how consumers' shopping behavior, nutritional knowledge, and food access affect food consumptions.

3. Conceptual and Empirical Frameworks

Conceptual Framework

Our conceptual framework builds on the framework of Fletcher et al. (2008), and incorporates the salience component developed by Chetty et al. (2009). We conceptualize the food consumption quantity (*Q*, which can be FAH or FAFH consumption) of individual *i* living in county *c* as a function of the tax-exclusive food price (*P*) and food sales tax rate (*T*) in county *c*, as well as other variables such as demographics and income. Suppressing the other variables for exposition purpose leads to a general functional form

(1) $Q_{ic} = f[P_c, (1 + T_c)]$.

Total differentiation of equation (1) yields:

(2) $dQ_{ic} = \frac{\partial Q_{ic}}{\partial P_c} dP_c + \frac{\partial Q_{ic}}{\partial (1+T_c)} d(1 + T_c)$.

Dividing equation (2) by $d(1 + T_c)$ and expressing it in logarithm, we have:

(3) $\frac{dlnQ_{ic}}{dln(1+T_c)} = \frac{\partial lnQ_{ic}}{\partial lnP_c} \frac{dlnP_c}{dln(1+T_c)} + \frac{\partial lnQ_{ic}}{\partial ln(1+T_c)}$.

where $\frac{\partial lnQ_{ic}}{\partial lnP_c}$ is the price elasticity of demand, $\frac{dlnP_c}{dln(1+T_c)}$ is the degree of tax pass-through, and $\frac{\partial lnQ_{ic}}{\partial ln(1+T_c)}$ is the tax elasticity of demand. Equation (3) can be expressed equivalently as:

(4) $\frac{dlnQ_{ic}}{dln(1+T_c)} = \underbrace{\frac{\partial lnQ_{ic}}{\partial lnP_c}}_{\text{price elasticity}} \left[\underbrace{\frac{dlnP_c}{dln(1+T_c)}}_{\text{tax pass-through}} + \underbrace{\theta}_{\text{tax attentiveness}} \right]$.

The θ term, defined as $\theta = \frac{\partial lnQ_{ic}}{\partial ln(1+T_c)} / \frac{\partial lnQ_{ic}}{\partial lnP_c}$, measures the ratio of tax elasticity to price elasticity of demand and bears further discussion. If $\theta = 0$, the consumer completely ignores the sales tax when shopping; if $\theta = 1$, then the consumer is fully attentive of sales taxes when shopping; and $0 < \theta < 1$ is the case between the two extreme ones where the consumer partially responds to the sales tax.

Therefore, the effect of the tax on equilibrium food consumption depends on three factors: (1) price elasticity of demand, (2) degree of tax pass-through to consumers, and (3) degree of tax attentiveness. The conventional thought is that retail price rises by approximate the amount of a sales tax in a standard competitive market (i.e., full pass-through, $\frac{dlnPrice_c}{d\ln(1+Tax_c)} = 0$ because the price here excludes tax). On the other hand, the tax can over shift in a non-competitive market (i.e., $\frac{dlnPrice_c}{d\ln(1+Tax_c)} > 0$). Empirical studies estimating tax pass-through for food sales taxes are very limited. The most relevant study we found is Besley and Rosen (1999), who reported full tax pass-through for Big Mac, Crisco, eggs and over-shifting for bananas, bread, milk, and soda. Therefore, our reduced form estimates of tax impact nest the net effect of tax pass-through and tax attentiveness, assuming a negative price elasticity of demand.

Our conceptual framework for the differential impact of grocery tax on SNAP recipients is illustrated in Figure 2, where the kinked budget constraint (BC_1) is the standard textbook treatment of SNAP recipients (i.e., Hoynes and Schanzenbach 2009, and Beatty and Tuttle 2014). Imagine another consumer who attains the same consumption bundle of FAH and the other good, but does not participate in the SNAP. The budget constraint for this consumer is the straight line BC_0. When the grocery tax increases, the budget constraint for the non-participant rotates clockwise around the Y-axis intercept and becomes BC_2. However, the budget constraint

for the SNAP participant rotates clockwise around the kink and becomes BC_3 (proof available upon request). As a result, the reduction of FAH consumption becomes more pronounced for the non-recipient (the black dot versus the gray dot). The fundamental cause for this difference is the exemption of SNAP benefits from the tax, providing SNAP benefits a higher purchasing power than cash in the presence of a tax.

Empirical Model

Our empirical model consists of a separate equation for household-weekly FAH and FAFH expenditures. We hypothesize that the out-of-pocket or cash FAH expenditures of household *i* living in county *c* is a function of the following core variables—grocery tax rate (*Grtax*) and restaurant food tax rate (*Resttax*) in county *c*, household SNAP participation status (dummy variable), basket food price index constructed from retail scanner data for the county to control for price effect, household size, income—and additional control variables

$$(5)\ FAH_{ic} = \beta_0 + \beta_1 Grtax_c + \beta_2 Resttax_c + \beta_3 SNAP_i + \beta_4 Basketprice_c + \beta_5 Size_i + \beta_6 Income_i + \boldsymbol{\beta_7 Demog_i} + \boldsymbol{\beta_8 Access_i} + \boldsymbol{\beta_9 Shopping_i} + \boldsymbol{\beta_{10} Nutrition_i} + \varepsilon_i.$$

In (5), we use expenditures instead of quantities as in (1) for FAH and FAFH since that information is better recorded in FoodAPS than is information on physical quantities and easy to aggregate from all food consumptions. With the rich information provided by the FoodAPS data, we add four additional sets of control variables. Demographic variables (*Demog*) include the primary survey respondent's age, education level, marital status, and race. Food access variables (*Access*) include one-way travel time to the household primary food stores measured in minutes, numbers of SNAP-authorized retailers, fast food restaurants, and non-fast food restaurants all within 5 miles of the household. Shopping behaviors (*Shopping*) include three dummy variables

indicating whether in the past thirty days the household shopped for food at a convenience store, or at a discount (big box) store, or wholesale club, respectively. The vector for nutrition (*Nutrition*) includes how often the household uses nutrition facts panel, whether any household member is on any kind of food diet and other miscellaneous variables including whether the household receives USDA foods from local program or distribution site, receives meals at home from community program, or receives meals at a community center in past month, respectively. Finally, the FAFH equation is similarly specified as

$$(6)\ FAFH_{ic} = \gamma_0 + \gamma_1 Grtax_c + \gamma_2 Resttax_c + \gamma_3 SNAP_i + \gamma_4 Basketprice_c + \gamma_5 Size_i + \gamma_6 Income_i + \boldsymbol{\gamma_7 Demog_i} + \boldsymbol{\gamma_8 Access_i} + \boldsymbol{\gamma_9 Shopping_i} + \boldsymbol{\gamma_{10} Nutrition_i} + \mu_i$$

where in both equations $\beta's$ and $\gamma's$ are parameters to be estimated, and ε_i and μ_i are the error terms.

4. The National Household Food Acquisition and Purchase Survey (FoodAPS)

USDA's new FoodAPS offers unique data on the food choices of American households, including SNAP participants. For FoodAPS, 4,826 households living in various locations throughout the continental United States recorded all the foods they acquired for both at home consumption and away from home consumption over seven consecutive days between April 2012 and mid-January 2013. Each household's primary respondent participated in two in-person interviews and up to three telephone interviews. Collected data include information on food and beverage items purchased or otherwise acquired, including location, price, brand, package size, flavor, and payment method (e.g., whether it was purchased with SNAP benefits). Collected data also include detailed factors that are expected to affect food acquisition decisions, such as household size, demographic characteristics, income, participation in federal food assistance

programs, and food access information (also known as the food environment) etc. The basket prices were constructed by the University of Illinois and matched to the survey respondents' locations. These basket prices, based on weekly IRI store level sales at the universal product code (UPC) level, reflect the food basket of the Thrifty Food Plan for Feeding America's the Meal Gap Project (Gundersen et al. 2015). Detailed survey information, including variable list and code books, are available on USDA's website.[3]

Our unit of analysis is at the household level. We aggregated all the members' FAH and FAFH expenditures over the week for each household. The FAH and FAFH expenditures include sales taxes paid. Since the amount of the expenditure paid using SNAP Electronic Benefit Transfer (EBT) card is exempt from grocery sale taxes, we subtracted this amount from total FAH expenditures and use the net amount as the dependent variable in equation (5). That is, we use the cash FAH expenditures (similar to Hoynes and Schanzenbach 2009), including sales taxes paid, to better estimate the tax impact. About 60% of the SNAP recipients in the data reported a positive EBT transaction amount for the week. Similarly, we use household members' total FAFH expenditures over the week including taxes and tips paid, as the dependent variable for equation (6). We restrict our study samples to households who had positive FAH expenditures and households who had positive FAFH expenditures during the week, resulting in sample sizes of 3,995 and 3,596, respectively, for the two equations. Finally, our tax data came from several sources. We augment sales tax data available from tax-rates.org and www.sale-tax.com with a comprehensive search on state and county departments of revenue. Because we started collecting the tax data at the end of 2014 and the sources only provide county tax data for the current year, our tax data are for the year of 2014 and therefore do not align perfectly with

[3] http://www.ers.usda.gov/data-products/foodaps-national-household-food-acquisition-and-purchase-survey.aspx

the FoodAPS data. However, the historical grocery tax rates at the state level reported by Bridge the Gap show that only Kansas changed the rate (from 6.3% to 6.15%) from 2013 to 2014. Our data adjusted for this change accordingly but results should be interpreted with the caveat that county level taxes may change during this period.

Table 2 shows the summary statistics for FAH expenditure, taxes, and other control variables based on households who had a positive FAH expenditure. The FAFH expenditure is based on households who had a positive FAFH expenditure. On average, households spent $98.36 for FAH net of SNAP benefits and $60.31 for FAFH in the week. When broken down by SNAP participation status, SNAP recipients spent $63.51 cash for FAH, $93.81 SNAP benefits, and $45.6 for FAFH, while nonparticipants spent $112.64 in cash for FAH and $66.72 for FAFH. Such numbers fit squarely into the textbook illustration of the SNAP effect on recipients: an increase of total FAH expenditure and a decrease in cash FAH expenditure. Table 2 shows that 29% of the households received SNAP benefits, which is higher than the national participation rate of 19%.[4] This reflects the fact that the FoodAPS oversampled low-income households, because of special interest in the food acquisition patterns of households participating in government food assistance programs.

Table 3 presents a breakdown of average FAH and FAFH expenditures by food sales tax rate. Overall, counties that exempt groceries have the highest average FAH expenditure. It is striking to observe that FAH expenditures are lowest for the counties with positive, but less than 2% grocery tax rate, not the areas with the highest tax rate. On the other hand, it seems areas

[4] USDA reports that 23 million households participated in SNAP in 2013 (USDA, SNAP Participation and Costs, 1969-2015). According to U.S. Census Bureau, there were 122 million households in that year (Households by Type and Tenure of Householder for Selected Characteristics: 2013).

with higher restaurant taxes have higher average FAFH expenditures. It is this ambiguity that necessitates a multivariate statistical analysis.

The FoodAPS data are a far better source than other large datasets such as the Current Population Survey Food Security Supplement (CPS-FSS) to study the impact of food sales tax for several reasons. First, while SNAP enrollment is self-reported in the CPS-FSS and most large datasets, the FoodAPS data verifies enrollment through administrative records, which eliminates bias arising from measurement error. Second, the FAH and FAFH expenditures are measured with better precision because households were asked to scan barcodes on packaged foods and calculate FAFH expenditures based on saved receipts from restaurants. Third, the FoodAPS data allows for better control of the local food environment, by including variables that measure food access, ease of SNAP benefit use, type of grocery stores available, etc.

5. Estimation and Results

Strategy to Address Endogeneity Issue

The primary econometric issue for the empirical model is the well-known endogeneity issue with SNAP participation. People may self-select into SNAP for reasons such as a stronger taste for food consumption (Hoynes and Schanzenbach 2009). In our case, the error term of the model subsumes such unobservable taste factor and is potentially correlated with SNAP participation. A secondary concern is the potential endogeneity with the food sales tax. For example, one might argue that lack of exempting groceries from the tax coupled with large number of fast-food restaurants reflect a relative lack of concern about residents' diets (or nutrition status, of food security) relative to other priorities. In addition, if households in a county have low FAH expenditure in cash (because they rely more on SNAP benefits), then local governments might

be able to impose a higher grocery tax. However, in the aforementioned literature, tax is generally treated as an exogenous factor to individual's consumption behavior or health outcome (e.g., Fletcher 2008) because it is a policy variable. Therefore, our empirical strategy is to use instruments to control for SNAP endogeneity, and only do this for food taxes for robustness checks.[5]

Following the study by Ratcliffe et al. (2011) on how SNAP participation affects food security, we use three instrument variables for SNAP participation. These are three state-level dummy variables that capture variation in SNAP eligibility requirements and administrative options, including the use of biometric technology (fingerprint scan) for identity verification, adoption of simplified reporting, and SNAP outreach spending (federal, state and grant combined). Biometric testing is negatively correlated with SNAP participation because it imposes a transaction cost on the application and reduces the probability of cheating the system. Simplified reporting eliminates the requirement that participants must report any changes in income and living conditions regularly, and outreach spending measures the amount of dollars spent spreading awareness about the program. Both of these policies encourage participation and are therefore positively correlated with SNAP participation. In addition, they satisfy the exclusion restriction assumption because while they affect participation, they do not impact FAH or FAFH expenditure. These variables are obtained from the USDA's SNAP Policy Database and are for the year of 2010, which is the latest year of data available. Since these policy changes do not vary much over time, we do not expect it to be an issue combining it with the more recent FoodAPS data.

[5] A tertiary concern is possible endogeneity with income, which again is generally treated as exogenous in the literature (e.g., Hoynes and Schanzenbach, 2009). Our results are robust when we dropped household income.

Table 4 (column 1) presents a battery of tests on the instrument validity, based on our primary equation, the FAH equation. While these tests are also run for the FAFH equation, the results are suppressed here since they are almost identical to those for the FAH equation. The *F*-test in the first stage regression on the excluded three instruments yields a test statistic of 16.02, which exceeds the critical value of the Stock–Yogo test statistic (13.91 for 5% maximal relative bias), suggesting the instruments are not weak. The Kleibergen–Paap test on under-identification rejects the null hypothesis of under-identification while the Hansen J statistic shows that the over-identification restrictions are valid. We further conducted Hall–Peixe redundancy tests on the three instruments and rejected the null hypothesis that any instrument is redundant at the 10% significance or better. Finally, a Durbin–Wu–Hausman endogeneity test on SNAP participation does not strongly suggest endogeneity. We focus our discussion on the results using instruments to err on the side of caution while presenting the results using the ordinary least squares (OLS) as well.

FAH Equation

Table 5 presents the estimated results for the FAH equation. We use robust standard errors for all specifications in this paper.[6] Column (1) presents the OLS (non-instrumented) results, where all the core variables have the expected signs and are statistically significant at the 10% level or better. Column (2) shows the OLS results for the model with full control variables. Column (3) shows the two-stage-least-square (2SLS) estimates for both stages. Because program participation is a dummy variable, the last column (4) differs from column (3) in that the first stage is estimated using the logit model following the method suggested by Wooldridge (2010, p.

[6] We tried a specification with state dummies but almost all the dummies were not statistically significant.

622) for treating a dummy endogenous variable. Therefore, column (4) becomes our preferred specification. In the first stage, all the instruments have the correct signs and are statistically significant at the 5% level or better.

Focusing on the preferred specification in column (4), we find that a one percentage point increase (e.g., the tax rate changes from 5% to 6%) in grocery tax leads to a $1.86 decrease in household weekly (cash) FAH spending (a 1.9% decrease) and a one percentage point change in the restaurant tax leads to a $3.00 increase in weekly FAH spending (a 5% increase). Such numbers, though small at first glance, can easily aggregate to around $40 a month for a 5% tax imposition (i.e., $1.86 x 5 x 4). Note that the restaurant tax impact is much larger than that of the own grocery tax. One reason for this finding is that SNAP shield… SNAP participation reduces FAH cash spending by $61.73, which is consistent with the summary statistics we presented earlier in Table 2. The basket food price has a negative effect (significant at the 10% level), which is consistent with Gregory and Coleman's (2013) finding that food prices reduced food security. Both household size and income positively affect FAH expenditures.

Regarding demographic effects, we find that older age, higher education, and being married lead to higher FAH expenditure, while African Americans and Asians have lower FAH expenditures compared with Caucasians. As to food access, longer travel time to the primary food store increases FAH spending, possibly because shoppers with a longer distance shop less frequently and spend more for each trip to economize travel cost. The number of SNAP retailers and fast-food restaurants both decrease cash FAH expenditure, while the opposite is found for the number of non-fast food restaurant. The coefficients on the first two variables are exactly what we would expect. Households that live in proximity of a large number of SNAP retailers will be able to rely more on their SNAP benefits for FAH consumption and would therefore have

lower cash expenditures on FAH. Similarly, the availability of fast food restaurants might induce household to allocate a smaller proportion of their food budget on FAH. The positive coefficient on the number of non-fast food restaurants might suggest that the household resides in a more suburban neighborhood has better access to FAH options. For shopping behavior, we find that consumers who shopped for food at a wholesale club recently have higher FAH expenditures. Finally, more frequent use of nutrition facts panel (note a higher value means less familiarity) is associated with higher FAH spending.

FAFH Equation

Table 6 displays results for the FAFH equation. The first-stage results and results for the non-core variables are suppressed to conserve space. The preferred specification in column (4) shows that a one percentage point increase in the grocery tax leads to a $1.58 increase in weekly FAH (cash) spending, but the restaurant tax does not have a statistically significant effect on FAFH spending (though the latter coefficient has the correct negative sign). SNAP participation is found to reduce FAFH expenditures, which is consistent with Wilde et al.'s (2009) finding. Though not presented in Table 6, other noteworthy findings include: African Americans and Asians have lower FAFH expenditures compared with Caucasians; the number of non-fast food restaurants increased FAFH expenditure; and, surprisingly, a household member on any kind of food diet leads to higher FAH and FAFH expenditures. This may be due to healthier food often costing more than less healthy food.

Additional Specifications

A few additional specifications are described in this subsection to see whether taxes have differential impacts with income, SNAP participation, and others, and how robust the results are when taxes are treated as endogenous. Results are reported in Table 7. The first specification stems from the consideration that food sales taxes could be regressive by affecting disproportionately the lower income population. Columns (1) and (6) show the results with an interaction term between the grocery tax and income, based on the preferred specifications in the last two tables. The interaction effect is not statistically significant.

Second, previous studies show some evidence that consumers might cross a state border to shop for food (e.g., Walsh and Jones 1988; Tosun and Skidmore 2007) and cigarettes (Harding et al. 2012) when there is sizeable tax difference. We therefore created a dummy variable, *Border*, to indicate counties that tax groceries (positive combined state and county tax rate) and share borders with counties that exempt groceries. The interaction of grocery taxes and the border effect again is not significant (column 2), possibly because only 148 households fit into this category.

Third, based on the conceptual framework, we test whether grocery taxes have a less pronounced effect on SNAP recipients, by adding an interaction between SNAP participation and grocery taxes. We find an insignificant interaction effect (columns 3 and 7). A few reasons could explain this finding. First, the tax impact depends on where a consumer is located on the initial budget constraint (different locations of the white dot in Figure 2). The tax impact will be larger for consumers with a higher preference for food consumed at home. Second, each consumer's degree of substitution between FAH and the other good could be different (i.e., different gray or different black dots in the figure). Third, current tax rates might be too small to

make a discernable difference (i.e., difference between the black and gray dots may be too small). To explore the first two reasons further, we reduce consumer heterogeneity by restricting the analysis to only households that are eligible to receive SNAP benefits using the 185% poverty rate as the threshold. Results (columns 4 and 8) still show an insignificant grocery tax effect, providing more support for the last reason.

Finally, we present in columns (5) and (9) the results obtained from treating both SNAP and food sales taxes as endogenous. We selected two instruments for food taxes, county level household poverty rate (from American Community Survey, 2008–2012) and a dummy variable indicating existence of state-level law that specifies portion sizes for a la carte snacks in elementary schools (National Cancer Institute School Nutrition Environment State Policy Classification System, 2012). Poverty rate and state law provisions addressing school nutrition standard should reflect local governments' financial need to impose food sales taxes and priority of their resident health. The two instruments both have the correct sign in the unreported first stage results for food sales taxes (positive for poverty and negative for law). As column (2) in Table 4 indicates, they all pass the various tests for instrument validity. When instrumented, we found that both tax impacts on FAH remain very robust but increase in the magnitude, especially for the grocery tax. For the FAFH equation, surprisingly we found that grocery tax impact becomes insignificant while the own restaurant tax effect is negative and statistically significant at the 10% level. Our final conclusion is based on the results that treat taxes as exogenous, partly because the endogeneity test in Table 4 suggests so.

6. Conclusions

This study provides the first empirical examination of consumers' dietary behaviors in response to grocery and restaurant taxes. The focus of the research is on two important policy questions, namely: 1) do food sales taxes affect consumers' expenditures on grocery food and restaurant food, and 2) are food expenditures of government food assistance program participants less sensitive to food sales taxes? The analysis is based on food sales tax data at the county level combined with USDA's new National Household Food Acquisition and Purchase Survey (FoodAPS). FoodAPS is the first nationally representative survey of American households on food purchases and acquisitions, which provides a rich dataset on consumer behavior.

The results indicate that a one percentage point increase in grocery tax leads to a $1.86 decrease in weekly (cash) FAH spending and a $1.58 increase in weekly FAFH spending. This suggests that consumers respond to grocery taxes even though this tax is added at the register and therefore not reflected in the shelf price. We also find that a one percentage point increase in restaurant tax leads to a $3.00 increase in weekly FAH spending, but does not affect FAFH spending.

Several findings may have important policy implications. First, the grocery tax changes consumers' allocation of food dollars between FAH and FAFH because it changes the relative prices of the two. Considering many state and local governments use grocery taxes as a means to generate revenue, our finding raises an unintended consequence of the grocery tax. This consequence might further have health implications because FAFH generally is considered to be less healthy than FAH. Furthermore, we find that a restaurant tax increases consumers' FAH spending, suggesting that a tax on fast food might be effective in encouraging consumers to eat more at home.

Second, we do not find any differential impacts of food sales taxes by consumers' income or SNAP participation status. These two results suggest that overall food sales taxes are not regressive. Nevertheless, this result should be interpreted with the caveat in mind that FoodAPS oversampled low-income households. Third, we do not find evidence that consumers might cross a state border to shop for food when there is sizeable food tax difference. However, this result may be due to the fact that only 148 households in the survey fit into this category.

The findings that consumers respond to food sales taxes also contributes to the growing literature of tax salience. Although both grocery tax and restaurant taxes are generally not posted on the shelf or on menus and are only added after checking out, our results show that many consumers are still attentive to food sales taxes (under the conventional assumption of one to one tax pass-through). This result is consistent with other sales tax studies on a specific product such as bottled water (Berck et al. 2016).

Finally, these results should be interpreted with some caution since only one-year of data was used due to the unavailability of historical food sales tax data at the county level. Powell et al. (2013) points out that cross-sectional studies tend to overestimate the association between fast-food prices and weight outcomes by about 25% compared with longitudinal estimates. In this respect, our results likely should be properly interpreted as an upper bound on food sales tax impacts.

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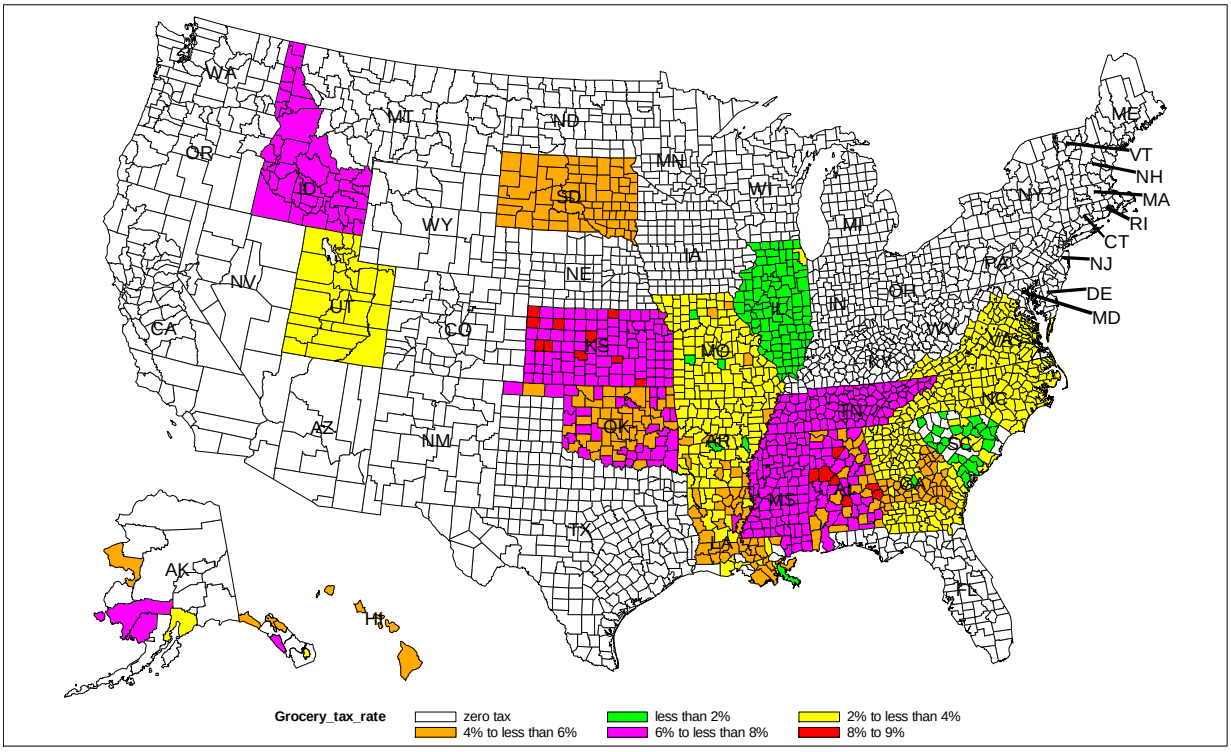
Figure 1. U.S. Food Sales Taxes, State and County Combined, 2014

(1a) Grocery Food Sales Taxes



(1b) Restaurant Food Sales Taxes

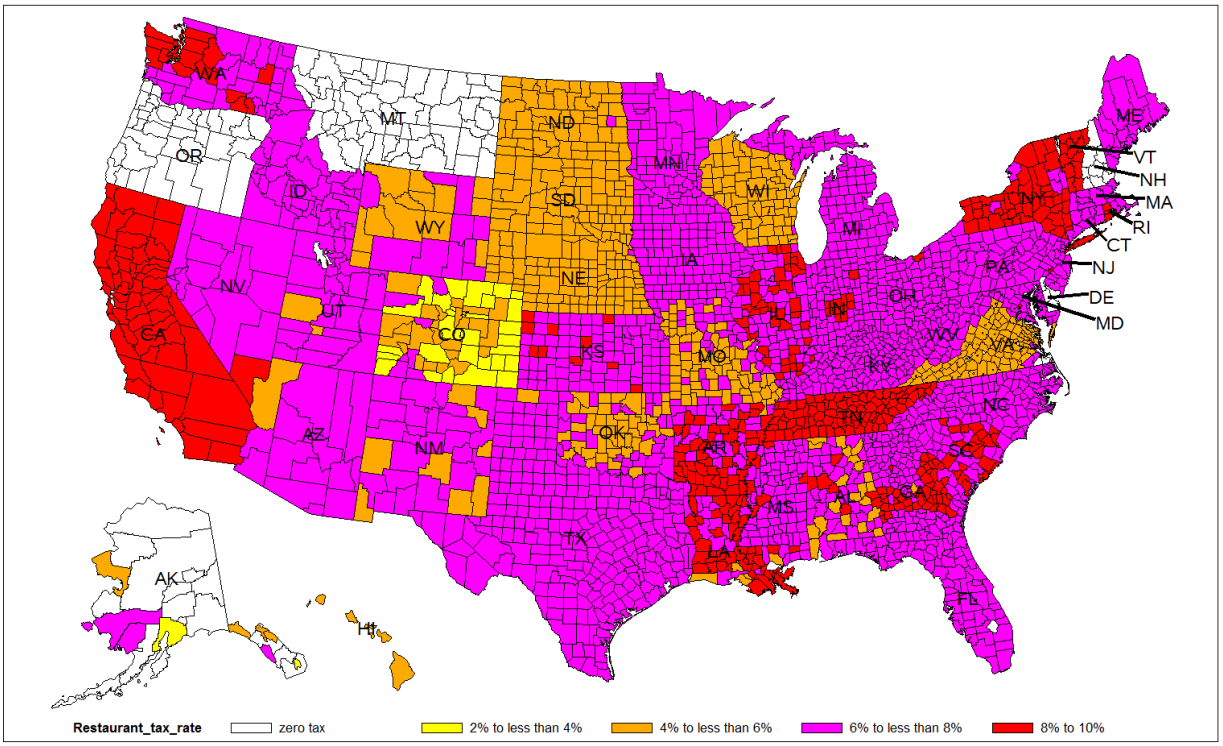


Figure 2. Illustration of Grocery Tax on Food-at-Home Consumption

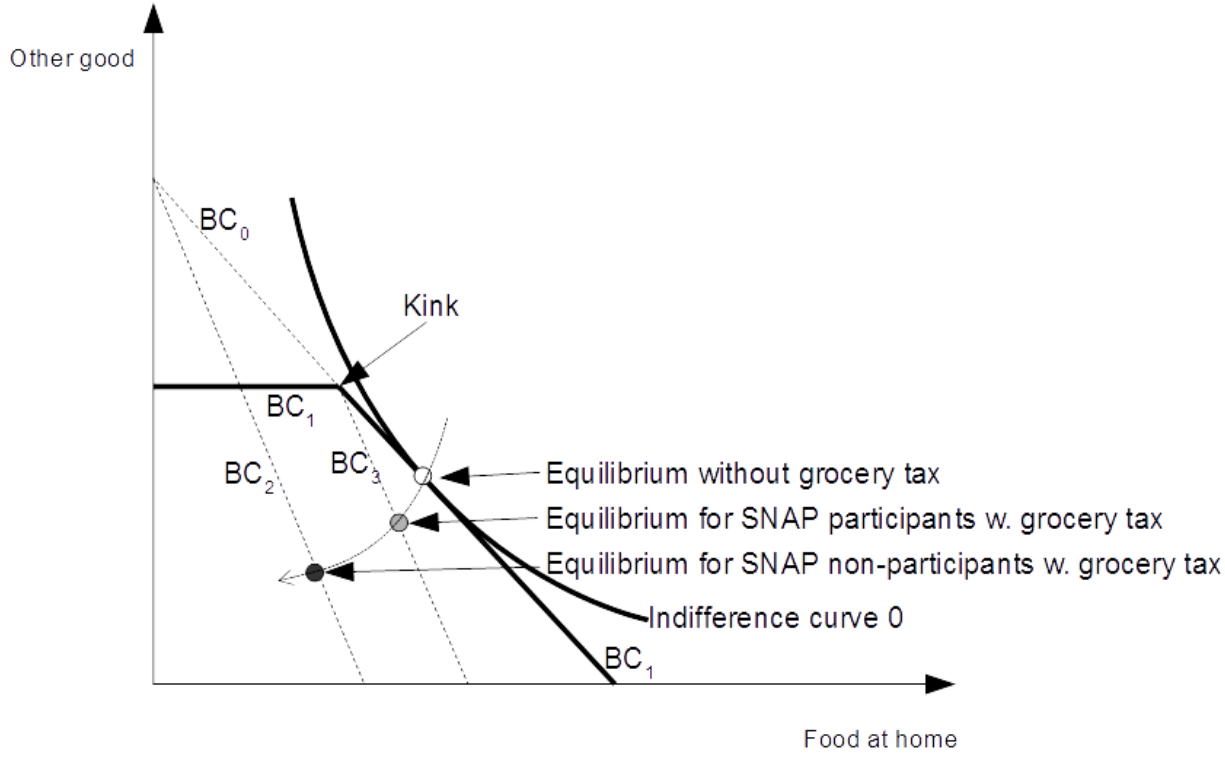


Table 1. Overview of U.S. State and County Grocery Food Sales Taxes, 2014

State Grocery Tax	County Grocery Tax	States (No. of Counties If Not All Counties Fall into This Category)
State taxes grocery at full rate	**Counties tax full rate**	AL (67), KS (90), OK (76)
	Counties tax reduced rate	
	Counties exempt grocery	
	Counties have no sales tax	AL (1), HI, ID, KS (15), MS+, OK (1), SD
State taxes grocery at reduced rate	**Counties tax full rate**	AR (73), IL (4)+, MO (114), TN, VA
	Counties tax reduced rate	IL (4)+, MO (1)
	Counties exempt grocery	IL (55)+
	Counties have no sales tax	AR (2), IL (39)+
State exempts grocery from sales tax	**Counties tax full rate**	GA, LA (56), NC, SC (20), UT (18)+
	Counties tax reduced rate	LA (4), SC (11), UT (11)+
	Counties exempt grocery	AZ, CA+, CO (52), DC, FL (56), IA (92), MN (17), NE (1), NV (12), NM, NY, ND (6), OH, PA (2), SC (7), TX (123), WA, WI (65)+, WY (20)
	Counties have no sales tax	CO (12), CT, FL (11), IN+, IA (7), KY, LA (4), ME+, MD, MA+, MI, MN (70), NE (92), NV (5), NJ, ND (47), PA (65), RI+, SC (8), TX (131), VT+, WV, WI (7)+, WY (3)
State has no sales tax	**Counties tax full rate**	AK (13)
	Counties tax reduced rate	
	Counties exempt grocery	
	Counties have no sales tax	AK (15), DE, MT, NH, OR

Note: Bold denotes the existence of a grocery tax. Superscript + denotes some counties impose an additional sales tax on top of the general sale tax on restaurant food. Sources: tax-rates.org, www.sale-tax.com, and state and county departments of revenue.

Table 2. Summary Statistics of the FoodAPS and Tax Data

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
FAH	Total cash food-at-home expenditures during the week	3,995	$98.36	$97.41	$0.03	$1,847.50
FAH for SNAP=1	Total FAH expenditures during the week for SNAP recipients	1,161	$63.51	$74.02	$0.03	$567.19
FAH for SNAP=0	Total FAH expenditures during the week for SNAP nonrecipients	2,834	$112.64	$102.14	$0.99	$1,847.50
FAFH	Total food-away-from-home expenditures during the week	3,596	$60.31	$73.35	$0.35	$1,816.97
FAFH for SNAP=1	Total FAFH expenditures during the week for SNAP recipients	1,091	$45.60	$56.42	$0.89	$1,073,36
FAFH for SNAP=0	Total FAFH expenditures during the week for SNAP nonrecipients	2,505	$66.72	$78.77	$0.35	$1,816.97
Grocery tax	Grocery food sales tax rate, county and state combined	3,995	0.04[a]	0.02	0.01	0.08
Restaurant tax	Restaurant food sales tax rate, county and state combined	3,995	0.07	0.01	0.04	0.10
SNAP participation	Equals 1 if household reports SNAP current participation	3,995	0.29	0.45	0.00	1.00
SNAP EBT	SNAP EBT payment	3,995	$93.81[a]	$95.48	$0.50	$856.72
Basket price	Basket food price index constructed from IRI scanner data	3,995	347.41	56.33	235.80	518.24
Household size	number of people at residence, excluding guests	3,995	2.99	1.73	1.00	–[b]
Household income	household average monthly income, in $1,000	3,995	$3.58	$4.04	$0.00	$66.20
Age	Individual's age in years (for the primary respondent)	3,995	46.29	16.36	16.00	96.00
Education	Highest level of school completed	3,995	20.21	2.80	11.00	24.00
Married	Equals 1 if married	3,995	0.45	0.50	0.00	1.00
Black	Equals 1 if race is Black or African American	3,995	0.14	0.35	0.00	1.00
Native American	Equals 1 if race is American Indian or Alaska Native	3,995	0.02	0.14	0.00	1.00
Asian	Equals 1 if race is Asian	3,995	0.05	0.21	0.00	1.00
Hispanic	Equals 1 if individual is Spanish, Hispanic, or Latino	3,995	0.01	0.07	0.00	1.00
Travel Time	One-way travel time to primary food store, in minutes	3,995	10.50	8.22	1.00	90.00
No. SNAP retailers	No. of SNAP-authorized retailers within 5 miles of household	3,995	184.14	423.69	0.00	3812.00
No. fast food rest.	No. of fast food restaurants within 5 miles of household	3,995	73.81	79.00	0.00	429.00
No. non-fast food rest.	No. of non-fast food restaurants within 5 miles of household	3,995	337.90	547.17	0.00	3639.00
Shop convenience	Equals 1 if household shopped for food at a convenience store during past 30 days	3,995	0.34	0.47	0.00	1.00
Shop big box	Equals 1 if household shopped for food at a discount or big box store during past 30 days	3,995	0.42	0.49	0.00	1.00

Shop clubs	Equals 1 if household shopped for food at a wholesale club during past 30 days	3,995	0.22	0.42	0.00	1.00
Nutrition facts	How often use nutrition facts panel (1 = alwasys, 6 = never seen)	3,995	3.01	1.34	1.00	6.00
Any dieting	Equals 1 if any household member is on any kind of food diet	3,995	0.32	0.47	0.00	1.00
Food pantry	Equals 1 if household went to a food bank or food pantry in past 30 days for groceries	3,995	0.06	0.24	0.00	1.00
USDA foods	Equals 1 if anyone receiving USDA foods from local program or distribution site	3,995	0.04	0.19	0.00	1.00
Meal delivery	Equals 1 if anyone receiving meals at home from community programs	3,995	0.01	0.10	0.00	1.00
Meal facility	Equals 1 if anyone received meals at a community center in past month	3,995	0.02	0.15	0.00	1.00
Finger print	Equals 1 if SNAP requires fingerprinting of applicants	3,995	0.33	0.47	0.00	1.00
Report simple	Equals 1 if SNAP uses simplified reporting option for households with earnings	3,995	0.87	0.33	0.00	1.00
Outreach	Outreach spending (federal, state, and grant), in $1,000	3,995	$150.19	$166.63	$0.00	$452.80

Note: a. summary statistics for the observations that are not zero. The grand mean for grocery tax rate is 0.0076. b. maximum household size is suppressed per USDA requirement.

Table 3. Average FAH and FAFH Expenditures by Food Sales Tax Rates

	Sort by Grocery Tax		Sort by Restaurant Tax
	Cash FAH Expenditures	Total FAH Expenditures	FAFH Expenditures
0	**$100.28**	**$117.02**	
	(99.95)	(107.06)	
	N = 3,307		
Positive but less than 2%	**$72.30**	**$86.34**	
	(67.82)	(73.75)	
	N = 53		
2% to less than 4%	**$93.05**	**$107.16**	
	(97.10)	(103.16)	
	N= 232		
4% to less than 6%	**$89.81**	**$102.57**	**$57.22**
	(80.17)	(82.02)	(60.03)
	N = 174		N = 405
6% to less than 8%	**$88.55**	**$103.01**	**$58.34**
	(74.24)	(86.13)	(65.20)
	N = 229		N = 2,135
8% to less than 10%			**$65.50**
			(91.21)
			N = 1,056

Note: Numbers in parentheses are standard deviations.

Table 4. Tests on Instrument Validity

	Null Hypothesis	(1) SNAP Endogenous	(2) SNAP and Taxes Endogenous
F-test of excluded instruments (Cragg-Donald F statistic)	Parameters for excluded instruments are zero	16.02 ($p < 0.01$)	12.06 ($p < 0.01$)
Stock-Yogo weak identification test c.v.	Excluded instruments are weak	c.v. = 13.91	c.v. = 9.53
Kleibergen-Paap rk LM statistic	Underidentification	44.76 ($p < 0.01$)	53.09 ($p < 0.01$)
Hansen J statistic	Instruments are valid	4.41 ($p = 0.11$)	2.57 ($p = 0.28$)
Hall - Peixe redundancy test on			
Finger print	Instrument is redundant	9.21 ($p < 0.01$)	382.27 ($p < 0.01$)
Report simple	Instrument is redundant	27.48 ($p < 0.01$)	1,073.16 ($p < 0.01$)
Outreach	Instrument is redundant	3.34 ($p = 0.07$)	804.66 ($p < 0.01$)
Poverty rate	Instrument is redundant		465.35 ($p < 0.01$)
State laws related to school nutrition	Instrument is redundant		235.09 ($p < 0.01$)
Durbin-Wu-Hausman endogeneity test on			
SNAP participation	SNAP participation is endogenous	2.42 ($p = 0.12$)	
Grocery tax	Grocery tax is endogenous		2.30 ($p = 0.13$)
Restaurant tax	Restaurant tax is endogenous		0.004 ($p = 0.95$)

Note: C.v. stands for critical value.

Table 5. Impacts of Food Sales Taxes on FAH Expenditures

			(3) 2SLS, First Stage Linear		(4) 2SLS, First Stage Logit	
	(1) OLS Core	(2) OLS Full	Second Stage	First Stage	Second Stage	First Stage
Grocery tax	-187.68***	-166.97**	-204.43***	-0.87**	-186.38***	-6.11**
	(67.91)	(68.08)	(76.58)	(0.39)	(69.38)	(2.59)
Restaurant tax	214.42*	307.58**	293.00**	1.77**	300.02**	11.35**
	(123.08)	(124.89)	(125.06)	(0.82)	(125.27)	(5.26)
SNAP participation	-48.71***	-36.98***	-84.73**		-61.73***	
	(3.07)	(3.00)	(34.10)		(12.61)	
Basket price	-0.06**	-0.06*	-0.07*	-0.0002*	-0.06*	-0.002*
	(0.03)	(0.03)	(0.04)	(0.00)	(0.03)	(0.00)
Household size	13.72***	13.46***	16.53***	0.07***	15.05***	0.46***
	(1.01)	(1.18)	(2.52)	(0.00)	(1.48)	(0.03)
Household income	4.50***	3.24***	2.29***	-0.02***	2.75***	-0.37***
	(0.62)	(0.60)	(0.81)	(0.00)	(0.63)	(0.02)
(Head) Age		0.28***	0.21**	-0.001***	0.25***	-0.01***
		(0.09)	(0.10)	(0.00)	(0.09)	(0.00)
Education		2.44***	1.61**	-0.02***	2.01***	-0.09***
		(0.52)	(0.79)	(0.00)	(0.55)	(0.02)
Married		19.69***	10.97	-0.18***	15.17***	-1.05***
		(3.19)	(6.74)	(0.01)	(4.00)	(0.10)
Black		-27.66***	-22.89***	0.09***	-25.19***	0.38***
		(3.26)	(4.77)	(0.02)	(3.51)	(0.11)
Native American		-5.63	-0.24	0.11**	-2.84	0.52**
		(6.50)	(7.63)	(0.05)	(6.60)	(0.27)
Asian		-23.77***	-28.35***	-0.08***	-26.14***	-1.14***
		(6.70)	(7.72)	(0.03)	(6.84)	(0.30)
Hispanic		-13.42	-13.62	0.010	-13.52	0.160
		(17.41)	(16.57)	(0.08)	(16.85)	(0.56)
Travel Time		0.54***	0.65***	0.002***	0.60***	0.01***
		(0.17)	(0.18)	(0.00)	(0.17)	(0.00)
No. SNAP retailers		-0.01*	-0.01	-0.00002	-0.01*	-0.0001
		(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
No. fast food rest.		-0.12***	-0.13***	0.0003	-0.13***	0.003**
		(0.04)	(0.04)	(0.00)	(0.04)	(0.00)
No. non-fast food rest.		0.02***	0.02***	-0.00001	0.02***	-0.0002
		(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
Shop convenience		1.50	1.20	-0.010	1.34	-0.020
		(3.35)	(3.38)	(0.01)	(3.35)	(0.09)
Shop big box		0.36	-0.14	-0.010	0.10	-0.020
		(2.96)	(3.09)	(0.01)	(2.97)	(0.09)
Shop clubs		13.97***	12.73***	-0.020	13.32***	-0.130

		(4.00)	(4.19)	(0.02)	(4.03)	(0.11)
Nutrition facts		-2.62***	-1.72	0.02***	-2.15**	0.11***
		(1.01)	(1.20)	(0.01)	(1.05)	(0.03)
Any dieting		6.81**	8.37**	0.03**	7.62**	0.27***
		(3.13)	(3.29)	(0.01)	(3.19)	(0.09)
Food pantry		-4.09	4.99	0.19***	0.62	0.79***
		(5.66)	(8.80)	(0.03)	(6.24)	(0.17)
USDA foods		-5.56	1.66	0.14***	-1.82	0.69***
		(6.71)	(8.96)	(0.04)	(7.09)	(0.23)
Meal delivery		-13.38	-11.45	0.040	-12.38	0.150
		(8.49)	(9.64)	(0.07)	(8.88)	(0.35)
Meal facility		-19.49***	-20.59***	-0.020	-20.06***	-0.130
		(6.88)	(7.33)	(0.04)	(7.01)	(0.27)
Finger print				-0.08***		-0.56***
				(0.03)		(0.15)
Report simple				0.16***		1.23***
				(0.03)		(0.22)
Outreach				0.0002*		0.001**
				(0.00)		(0.00)
N	3,995	3,995	3,995	3,995	3,995	3,995
R^2	0.16	0.21	0.17	0.23	0.20	0.25

Notes: * p<0.1, ** p<0.05, and *** p<0.01. Standard errors are in parentheses.

Table 6. Impacts of Food Sales Taxes on FAFH Expenditures

	(1) OLS Core	(2) OLS Full	(3) Second Stage of 2SLS (First Stage Linear)	(4) Second Stage of 2SLS (First Stage Logit)
Grocery tax	102.37	174.44**	133.63*	157.60**
	(70.59)	(74.34)	(79.29)	(75.81)
Restaurant tax	133.78	-66.70	-81.98	-73.01
	(101.08)	(99.87)	(102.52)	(100.09)
SNAP participation	-16.34***	-12.12***	-52.79**	-28.90**
	(2.72)	(2.51)	(25.70)	(12.26)
Basket price	0.03	0.03	0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Household size	5.93***	5.86***	8.56***	6.97***
	(0.80)	(0.91)	(1.97)	(1.36)
Household income	3.66***	3.21***	2.38***	2.87***
	(0.55)	(0.56)	(0.75)	(0.67)
N	3,596	3,596	3,596	3,596
R^2	0.09	0.11	0.06	0.10

Notes: * p<0.1, ** p<0.05, and *** p<0.01. Standard errors are in parentheses. Effects of demographics, etc. are suppressed.

Table 7. Additional Specifications

	FAH					FAFH			
	(1) Interaction w. Income	(2) Interaction w. Border	(3) Interaction w. SNAP	(4) SNAP Eligible	(5) Endogenous taxes	(6) Interaction w. Income	(7) Interaction w. SNAP	(8) SNAP Eligible	(9) Endogenous taxes
Grocery tax	-112.56	-177.51**	-241.67**	-184.77	-452.26**	181.40*	61.74	-29.71	-147.35
	(89.84)	(70.41)	(107.19)	(184.17)	(195.59)	(103.45)	(90.21)	(156.12)	(161.51)
Restaurant tax	295.64**	308.76**	294.38**	243.29*	361.87**	-74.53	-82.37	-26.60	-228.21*
	(124.83)	(127.92)	(125.28)	(134.25)	(157.26)	(100.75)	(101.88)	(116.53)	(118.35)
SNAP participation	-61.80***	-61.29***	-63.03***	-53.71**	-61.86***	-28.85**	-30.81**	-33.38**	-31.58***
	(12.65)	(12.51)	(12.97)	(21.61)	(12.27)	(12.30)	(12.50)	(14.99)	(12.06)
Basket price	-0.06*	-0.06*	-0.06*	-0.06*	-0.08**	0.02	0.02	-0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
Household size	15.06***	15.01***	15.04***	13.36***	15.03***	6.97***	6.93***	6.54***	7.22***
	(1.48)	(1.48)	(1.48)	(2.01)	(1.47)	(1.37)	(1.36)	(1.35)	(1.36)
Household income	2.87***	2.75***	2.75***	-3.06	2.71***	2.91***	2.87***	-1.86	2.81***
	(0.67)	(0.63)	(0.63)	(2.59)	(0.63)	(0.72)	(0.68)	(1.72)	(0.67)
Grocery tax*income	-20.95					-6.38			
	(21.35)					(18.53)			
Grocery tax*border		-106.68							
		(184.24)							
Grocery tax*SNAP			205.33	67.76			352.9	401.22	
			(264.90)	(368.27)			(300.45)	(348.92)	
N	3,995	3,995	3,995	2,257	3,995	3,596	3,596	1,997	3,596
R^2	0.20	0.20	0.20	0.19	0.20	0.10	0.10	0.03	0.09

Notes: * p<0.1, ** p<0.05, and *** p<0.01. Standard errors are in parentheses. Effects of demographics, etc. are suppressed.