Candy Crushed Grain Saga: Consumer Responses to Tax Notches in the Confections Market

Amanda McCullough

Abstract[1]

Defining the sales tax base requires tax jurisdictions to draw lines that specify, in a generalizable fashion, the tax rate applicable to all goods. When these lines are defined by the characteristics of goods, characteristic notches arise creating discontinuities in consumers' budget sets. Administratively feasible commodity taxation precludes assigning individual tax rates to all goods and necessarily assigns a common tax rate to characteristically similar products. The level of consumer understanding and responsiveness is an important component affecting the efficiency implications of characteristic notches.

Using Nielsen Scanner data and a characteristic notch in the tax treatment of chocolate candy in the United States, this paper estimates consumption changes following the introduction of a characteristic notch. States that tax candy differently from other food products differentiate the two alternatives on the characteristic of flour. When candy is taxed at the prevailing sales tax rate and grocery staples are taxed at a lower rate, some products typically regarded as candy are exempt from the higher rate if they contain flour. Thus, a characteristic notch is formed and consumers face budget sets with discontinuous tax liabilities on the basis of a product containing flour.

Exploiting variation in the implementation of this tax policy, a generalized difference-in-difference framework is estimated to assess the relative consumption of flour and non-flour candy before and after redefining the tax base. Current estimates indicate that the consumption of candy that contains flour increases 15-25% following the introduction of a flour-line relative to flour candy in control states and all non-flour candy. This suggests that consumers do understand and respond to characteristic notches even when the notch in question may seem arbitrary and relatively unknown.

Exploring the moderately large estimates found in the primary analysis, additional empirical specifications are conducted that could further support the primary result, or identify confounding trends responsible for misleading primary estimates. Disallowing product entry and repeating the primary analysis using a sub-sample of products that exist during the entire sample (2006-2015) almost entirely negates the previously estimated 15-25% increase and results in a precise, near zero, estimated effect of the policy change on preferentially taxed confections. The vastly different estimates obtained when allowing and disallowing product entry may be evidence of deliberate tax-preferred new-product introduction by manufacturers.

[1] "Calculated (or Derived) based on data from The Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business."

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1 Introduction

Consumption distortions introduced by the presence of taxes have long been a major area of research. In particular, the variety of tax instruments used by state and local governments in the United States have been broadly discussed in a variety of contexts. The income, sales, and property tax rates levied by state and local governments are important aspects when assessing the consumption decisions of citizens, as well as the revenue raising ability of governments. In addition to the prevailing tax rate, other elements of any given tax instrument influence the total distortion it creates. Two such elements of interest in this paper include the salience and base of state sales taxes.

The wealth of existing research and contemporary effort spent studying optimal commodity taxation are not surprising as sales tax is a major revenue generating tax instrument for state and local governments. State sales taxes generate, on average, almost one third of total tax revenue for the 45 US states that levy sales taxes. Within the United States, considerable variation exists in the rate, base, and local government authority to levy sales taxes, creating an ideal environment to study their effect on important economic outcomes. Sales taxes in the United States are important tax instruments that are levied with heterogeneity in rates, as well as heterogeneity in less apparent features such as base and delegation to local governments.

Unsurprisingly, given the economic importance of sales taxes, optimal commodity taxation has long been the subject of economic research. Standard theoretical results characterizing optimal policy regarding efficiency and incidence(Ramsey (1927) Harberger (1964) Wilson (1989)) enlighten policy decisions with the assumption that tax-payers will respond in a fashion consistent with utility maximizing behavior. More recent literature on commodity taxation has considered discrepancies that may arise between results predicted by classic optimal taxation theory and empirical evidence suggestive of non-optimizing consumer behavior.

Recently, a growing body of research (Chetty et. al. (2009), Finkelstein (2007), and Cabral and Hoxby (2012)) has empirically studied consumption decisions and prevailing tax rates in the context of their deviation from theoretically predicted outcomes. This emerging body of research suggests that consumers may not respond to taxes in a manner consistent with theory. An understanding of the administrative, compliance, and

consumer awareness factors that influence ultimate behavioral responses is an important aspect of assessing the efficiency and incidence of sales taxes.

Using state-level variation in the sales tax base dividing taxable 'candy' and non-taxable groceries this paper will empirically evaluate the consumption response and salience of changes in state sales tax bases. First, this paper uses Nielsen Scanner data to estimate the effect of changing the sales tax base on consumption of affected products providing evidence of the overall consumption distortion introduced by re-defining the sales tax base. Secondly, this paper will consider Nielsen Consumer Panel data and previous research to assess the probable knowledge consumers possess of the characteristic notch in question. Third, this paper will use Nielsen Scanner data to compare different sub-samples of confectionary products and ascertain the degree to which producers, through the introduction of new products, drive the results found in the initial analysis.

Salience

The salience of a tax to consumers affects behavioral responses through straightforward mechanisms. If consumers are unaware of a tax, or unaware of differential tax treatments between similar goods, they may not change their consumption habits. Similarly, the salience of the tax base could also result in minimal consumption changes if consumers are unaware, or find it too costly, to distinguish between goods included in the sales tax base and those excluded from taxation. Sales taxes in the United States vary from domestic excise taxes or European Value Added Taxes by being excluded from the posted price of an item. Accordingly, consumers may be unaware of tax-inclusive price differentials between similar products until they are ready to pay for the item. This feature of sales taxes in the United States has a particularly interesting relationship with defining the sales tax base. While consumers may experience cognitive costs arising from sales tax rate changes, sales tax base changes have the potential to be even more onerous as the entire set of taxable and tax exempt products must be accounted for. Optimal sales tax bases may be a function of both sales tax rates and citizen's salience of the tax base.

This paper follows the empirical framework of Chetty et. al. (2009) comparing the elasticity tax-inclusive and excise-tax exclusive prices. They test the effect of tax salience using experimental and naturally occurring settings that changed the posted price of items from tax-exclusive to tax-inclusive. Their empirical results and theoretical framework suggest that the sign and magnitude of estimates obtained in this study may differ

from predictions that rely solely on perfectly optimizing consumers. Firs,t the author's estimates of a natural experiment comparing alcohol expenditures following excise and sales tax increases suggest that individuals are not exceptionally responsive to unposted tax-inclusive price differentials. Though expenditures decreased following an excise tax (and therefore posted) increase, the decrease in expenditures following a sales tax increase was much smaller. In the theoretical portion of their paper the author's propose a framework to explain the difference in response magnitude between posted and un-posted tax-inclusive prices. When small cognitive costs of computing tax-inclusive prices are introduced, consumers are much less responsive to tax-inclusive price differentials. The authors note that estimates of behavioral responses that incorporate cognitive costs to consumers have the potential to more accurately estimate the incidence and efficiency of tax policy changes. In the context of this paper, the author's research may suggest that line drawing, especially nuanced non-salient line-drawing, has the potential to produce limited distortions. A key conceptual difference between this paper and Chetty et al is the sales tax parameter being manipulated. This paper considers changes in the tax base, rather than changes in the tax rate (sales or excise).

Other research on tax salience uses specific empirical settings to study the effect of tax salience on prices. Finkelstein (2009) examines the equilibrium toll after highways adopt electronic toll collection. Finkelstein finds that drivers are less aware of toll prices when they use electronic payment and subsequently, toll roads have a higher equilibrium toll rate after the introduction of electronic payment. In contrast to this study, Finkelstein focuses on the equilibrium price movement following a product entry rather than substitution towards close substitutes. Decreasing the salience of a tax is, again, found to mitigate consumer responses, lending further support for hypothesizing a small behavioral effect in the current study. Extending the recent literature on tax salience to other state and local tax instruments, Cabral and Hoxby (2015) find that increased use of escrow increases property tax rates. The use of escrow by homeowners reduces the salience of property taxes that would otherwise be due annually and is found to increase property tax rates. Cabral and Hoxby find results consistent with the tax salience literature, lower tax salience decreases behavioral responses and increases equilibrium rates.

Chetty et. al. use the term tax salience to imply cognitive disregard for fully understood sales tax rates and bases. Zheng et al.(2012) develop a theoretical model assessing the potential consumption responses arising from sales tax changes. A key insight if their model is an ability to separate the differential effect of tax salience and tax knowledge. They find

that the introduction of a sales tax on a previously untaxed market can fail to decrease demand as much as an equal price increase due to both salience and misinformation effects. The hypothesized result of expanding the tax base to previously untaxed goods is a central focus of this paper. The model introduced by Zheng et.al. (2012) suggests that the non-optimizing consumer behavior could be the result of consumer inattention or consumer misinformation, though this paper is not able to empirically separate these effects.

Notches and Tax Base

One factor that may influence the responsiveness of consumers to changing sales tax bases is the intricacy of the line defining included and excluded goods. Governments cannot achieve truly optimal sales tax bases as the administrative burden of individually assigning all goods a tax rate is not feasible. Feasible government implementation of sales taxes requires a generalizable definition of the sales tax base by grouping items into categories based upon item characteristics. This method of defining the base categorizes new products automatically and escapes the costly task of individually assessing new products. Subsequently, defining a sales tax base relies on drawing figurative lines defined by characteristics or sizes and thus uses an automated system to determine what side of the line a product is located. These lines create characteristic notches on either side of defined lines. The inescapable line drawing produced by defining a sales tax base may create tax differentials between close substitutes, thus creating a theoretically large incentive for consumers to alter consumption habits. The magnitude of this consumption distortion is influenced by consumer preferences over the proximity of potential substitute goods. The magnitude of consumption distortions is also influenced by the salience of the base-defining line drawn by governments.

Literature on tax notches suggests that creating non-linear tax schedules from the introduction of characteristic notches may be optimal in a realistic setting subject to administrative costs. Blinder and Rosen (1984) evaluate the efficiency of notches in a variety of contexts. Under certain assumptions of consumer utility and the distribution of consumer preferences, notches can outperform linear tax schedules while alternate assumptions about consumer preferences and utility yield the opposite result. Overall, they find that notches are not always sub-optimal and are, at times, preferable to linear tax and subsidy schedules. Slemrod (2013) notes that most notches are more distorting than a linear tax schedule but characteristic notches on commodities may be the best

administratively feasible option. It is also noted that a potential benefit of tax notches could be their confusing nature, eliciting behavior not in a consumer's best interest. The desirability of notches given salience and administrative cost considerations, is an area this paper explores by considering consumption distortions around a characteristic notch likely prone to low salience.

The existence of characteristic notches on commodities is a portion of a larger optimal commodity taxation consideration: determining the optimal tax base. Wilson (1989) constructs a model with increasing administrative costs from adding to the tax base. Ultimately, goods added to the tax base should be substitutes with goods already in the tax base to avoid reducing the demand for the previously taxed good even further.

Synthesizing the literature on tax salience, tax notches, and optimal tax bases the largest component of consumer response appears to stem from the salience of the tax differential. Accordingly, it is hypothesized that the behavioral response evaluated in this paper will be largely mitigated by the low baseline knowledge of a subtly defined characteristic notch. However, accounting for the similarities and probable substitution opportunities between taxed and untaxed confections, a small amount of salience may produce a large re-allocation by consumers.

2 Institutional Setting

This paper attempts to capture the magnitude of behavioral responses following tax base redefinition. Concretely, this paper will use state variation in the line defining taxable confectionary products to estimate consumers' purchasing habits of taxed and un-taxed confections. To examine the distortion around the characteristic notch of interest, this paper will use the Nielsen Consumer Panel. Studying confectionary products complements the use of Nielsen Data as the Nielsen Consumer Panel is largely composed of grocery items. During the panel years 2004-2015, food items, especially food items that are generally unhealthful, have considerable state sales tax variation. These items may be (1) taxed at the prevailing sales tax rate, (2) taxed at a lower sales tax rate applied to all grocery items, or (3) considered grocery items and completely exempt from sales tax. The specific item category of interest for this paper is chocolate candy, a category of goods that may be defined as a tax-exempt grocery item, or as a good subject to the prevailing sales tax. During the sample period, 18 states, following the definition of the Streamlined Sales Tax regulations, impose a strict definition of taxable confectionary products.

The Streamlined Sales Tax guidelines exclude candy as a grocery staple, thus subjecting candy to the prevailing sales tax rate. The formal line drawn to exclude candy from grocery staples is defined in Part II of the Streamlined Sales Tax library of definitions as "a preparation of sugar, honey, or other natural or artificial sweeteners in combination with chocolate, fruits, nuts or other ingredients or flavorings in the form of bars, drops, or pieces. "Candy" shall not include any preparation containing flour and shall require no refrigeration". This example of line drawing creates a notch that differentially taxes goods which seem to, intuitively, be close substitutes. Differentiating candy on the basis of containing flour would, for example, subject regular M&M's and Butterfinger Bars to the prevailing sales tax rate, while Pretzel M&M's and Kit Kat Bars would be taxed at the prevailing rate for groceries. Map 1 displays the tax status of confections during the sample.

The effect of the characteristic notch around the inclusion of flour in a confectionary product contains two competing mechanisms. First, the differential taxation of otherwise similar products would suggest that a large behavioral response is possible. Alternatively, the subtle definition of "candy" might decrease the salience of differential tax treatment between substitutes to a large extent, suggesting a very small behavioral response. The competing effects around low salience tax notches is an open empirical question. While characteristic notches certainly exist, the degree to which consumers respond to such notches, given the possibly large mental accounting costs of tracking them, has not been widely studied. The ability to minimize salience when line-drawing, knowing that any line will inevitably create a notch, could play an important role in minimizing distortions created by characteristic notches.

Public reaction to redefining candy using a "flour line" appears to range from well-informed to moderately amused. Writing in August 2009, *Chicago Tribune* reporters Ameet Sachdev and Bob Secter interviewed Illinois residents whose views spanned a broad spectrum. Summarizing the viewpoint of residents in favor of establishing a higher tax rate on candy, the authors note [prior to the policy change when candy and soda were subject to the prevailing grocery sales tax rate] "the state defined food in a way most dentists and moms never would". Reporting on concerns that the flour line was excessively arbitrary and costly to administer, the authors quote a tax law expert explaining one particularly arbitrary distinction imposed by the new legislation: "If you put yogurt on a piece of fruit, it becomes candy, but if you put it on a pretzel it's food". While the overall salience and consumer response to this definition of candy is the open-ended empirical

question addressed in this paper, it seems that the novelty of such comparisons attracted some media and consumer attention.

The confections market promotes high consumer engagement, resulting in large annual sales volume and market participation. The National Confectioners Association (NCA) reports that 97.2% of households participated in the confections market during 2017, including over 14 billion dollars of sales occurring in the chocolate confections sub-category[2]. Chocolate candy sales occur through most retail channel types and widely available. While defining candy on the basis of a product's flour content may seem unlikely to attract the attention of consumers, the size of aggregate chocolate expenditures and wide availability of these products suggests is a compelling reason to examine a characteristic notch in this market.

3 Data and Empirical Specification

3.1 Consumption Responses to the Flour Characteristic Notch

Empirical analysis will employ a generalized difference in difference framework. This design will be used to follow the evolution of expenditures on flour-containing confections after the introduction of a flour line policy. A triple difference model comparing treatment goods and treatment states in the pre and post reform time periods will also be estimated.

New products are allowed to enter the sample and the possibility of endogenous product entry with the introduction of flour-lines is possible. Gillitzer et. al.(2017) model tax driven product innovation as a producer response to characteristic notches in the tax code. They suggest that new products will intentionally fall on the tax preferred side of the line. As more states differentiate grocery staples and candy using flour, the incentive to create tax-favored products increases. In the context of the current study, producers may create new varieties of confections that contain flour and are subject to the preferred tax rate in all jurisdictions. To examine the possibility of such a situation, parallel specifications will compare estimates produced exclusively using products available during the sample against estimates allowing product entry. Contrasting results from these samples may suggest the formulation of new products is influenced by the tax policy.

[2]Reported in *Candy and Snack Today* May/June 2018

Data

To examine the effect of redrawing the line defining taxable and non-taxable confections, this paper uses the Nielsen Consumer Panel to aggregate panelist expenditures on these goods during 2004-2015. This paper aggregates the 70 most frequently purchased varieties of confectionary products to the state-product-quarter or household-product-quarter level. All products belong to one of the 3 major manufacturers of chocolate confections in the United States: Hershey, Mars, and Nestle. These manufacturers produce products that are almost always sold at the same retail price, widely available at a variety of retail types, and tend to be nationally marketed and available. Seasonal products are omitted due to significantly smaller quarter-state sample sizes than standard products. Various sizes and packages of the same product are aggregated together, thus, sample products do not correspond to UPCs.[3] The 70 tracked varieties are not constant over time. New products introduced in the middle of the sample are included.

The flour content of each sample product was obtained from manufacturer websites. The general sales tax, grocery product sales tax rate, and the unemployment rate are also included. The empirical estimates obtained do not include local sales taxes which could introduce measurement error on the exact sales tax rate applicable to each state-product-quarter combination.

A concern when using the Nielsen Consumer Panel to track the sale of candy, is the possible under-reporting of small, easily forgotten, items by panelists. Einav et. al. (2010) assess the reliability of the Nielsen Consumer Panel. They find that the most commonly unreported items are individual servings of snacks and drinks, likely consumed before panelists scan their purchases. To address this concern robustness checks using a sample of packages weighing 5 ounces or more are estimated. Limiting the sample to product quantities unlikely to be consumed before they have been recorded by panelists should reduce non-reporting error. However, this introduces the concern of over-restricting the available products consumers could substitute towards following the reform. If products that contain flour are more likely to be sold in smaller quantities or have systematically different non-linear pricing schemes the sample of large purchases may provide biased results.

To address these concerns about the Nielsen Consumer Panel, analogous estimates are

[3]For example, a 24oz bag of mini Candy X bars and an 8oz bar of Candy X are considered the same product, though they possess different UPCs

generated using Nielsen Scanner data. Nielsen Scanner Data tracks the weekly quantity and price of items sold at participating retailers. The state and three-digit zip code of the retailer are also observed in the Nielsen Scanner. As items are recorded at the time of sale, the Nielsen Scanner alleviates some of the potential concerns posed by the Nielsen Consumer Panel. Pertinent items at participating retailers are not subject to reporting errors by households.

As with the Consumer Panel, the final Scanner data sample contains the 70 most frequently purchased varieties. Nielsen Scanner data is available from 2006, corresponding to a sample period of 2006-2015. Products are aggregated to the state-product-quarter level of observation.

Descriptive statistics are provided in Tables 5 and 6. Table 5 compares all reported chocolate confections expenditures with those used in the analysis. Nielsen tracks over 2200 products in the chocolate candy category. The 70 products used in the analysis account for no less than 62% of sales by pre-tax expenditures. A large portion of the difference between all recorded spending and tracked spending is likely attributable to multi-product bundles. The tax status of these products varies by state and typically involves knowing the fraction of taxable products by value contained in the bundle. This information is unattainable, thus, these products are omitted.

Table 6 divides expenditures on tracked products by flour inclusion. Approximately 25% of sample products contain flour (17 of the 70 products). These products typically account for less than a quarter of expenditures. Accounting for only 10% of sales in 2008, a large upward trend begins in 2010, peaking at 15.2% of expenditures in 2012.

Generalized Difference in Difference Framework

To track the evolution of consumption changes around the adoption of a flour-line defined tax base, a generalized difference in difference framework is estimated using equation 1. The main specification includes the 48 contiguous states less Rhode Island and Washington. Five states implement the policy of interest, transitioning from taxing all candy at the same rate to taxing flour-less candy at the general sales tax rate and flour candy at the grocery tax rate. Eight states use flour to differentiate the tax status of products during the entire sample. Four states tax all candy at the same rate but define ''candy" using a non-flour based rule. Four sample states do not levy a sales tax and the remaining

25 states do not separate candy from other edible products. Washington is omitted as it experimented with a flour-line for less than 6 months during 2010. Omitting Washington allows evaluation for a longer pre and post period. Rhode Island is also omitted to expand the interpretable range of coefficients π_y and τ_y. In additional estimates the sample is further restricted to states the change policies and states that never differentiate candy from other groceries. Thus, states that tax groceries and states that implemented a flour-line before the beginning of the panel are omitted.

$$Y_{i,j,t} = \theta_i + \alpha_j + \gamma_t + X'_{i,t}\beta + \sum_{y=-36}^{-1} \pi_y D_{i,j} 1(t - T_i^* = y) + \sum_{y=1}^{36} \tau_y D_{i,j} 1(t - T_i^* = y) + \epsilon_{i,j,t} \quad (1)$$

The dependent variable, $Y_{i,j,t}$, is log real dollars spent in(by) state(household) i, on product j, during quarter t. State(household), product, and quarter fixed effects are denoted by θ_i, α_j, and γ_t while $X'_{i,t}$ represents a vector of time varying controls for households or states during quarter t. Alternatively, log ounces are used as the dependent variable in additional specifications.

To obtain coefficients for the π_y's and τ_y's, the dummy variable $D_{i,j}$ is interacted with an indicator variable for the quarters prior to, and quarters following, the first month a flour line was introduced. The indicator variable indexes event time, y, constructed such that y equals calender quarter, t, minus T_j^*, the calender quarter a flour line was first introduced. Thus when t equals T_i^*, y equals 0 and corresponds to the quarter a flour line was first introduced in state i. The dummy variable, $D_{i,j}$, equals 1 for products that contain flour in treatment states, and assumes the value of 0 for no-flour products everywhere and flour products in control states.

The π_y's describe the consumption of flour products in states that ever adopt a flour line prior to the tax policy change. The τ_y's capture expenditures for flour products in flour line states after the sales tax base is redefined. State, product, quarter, and, when applicable, household fixed effects are also included to control for unobserved differences between panelists in the treated states and those in the control states.

Figures 1 and 2 plot the coefficients estimated in equation 1. Figure 1 uses the Consumer Panel to aggregate spending per product to the state level, thus the unit of observation is the state-product-quarter. The pre-reform trend seems to be constant or slightly decreasing with a modest upward trend at the beginning of the reform which remains relatively constant post-reform. Figure 3 is analogous to Figures 1 but uses the Scanner data aggregated to the state-product-quarter observation level. Figure 3 shows a much stronger post-reform effect.

DDD Estimates

To obtain magnitudes and the joint significance of the generalized difference in difference framework above, a DDD specification is estimated from equation 2. The results from these estimates are presented in Table 1 and Table 4. The triple difference specification uses variation in sales tax bases across states, between flour content of products, and over time.

$$Y_{i,j,t} = \theta_i + \alpha_j + \gamma_t + \beta_1 X_{i,t} + \beta_2 FP_j Treat_i + \beta_3 Post_t Treat_i + \beta_4 Post_t FP_j + \beta_5 Post_t FP_j Treat_i + \epsilon_{i,j,t} \quad (2)$$

Real expenditures, log real expenditures, or log ounces are the dependent variables of interest, denoted $Y_{i,j,t}$. Own effects of the three sources of variation are included as θ_i, α_j, and γ_t. All pairwise interactions of these variables are included: $FP_j Treat_i$ is the interaction of indicator variables for treatment states and products that contain flour, $Post_t Treat_i$ is the interaction of indicator variables for treatment states and post-reform months, and $Post_t FP_j$ is the interaction of indicator variables for post-reform months and products that contain flour. Additional state and time-varying controls are included in $X_{i,t}$. These include the state sales tax rate and unemployment rate. The DDD estimates using the Consumer Panel are presented in Tables 1 while the DDD results using the Scanner data sample are presented in Tables 3.

Event Study and DDD Results

Figures 1 and 3 show estimates from the event-study framework and Tables 1 and 3 report estimates from the DDD specifications. As expected, Figure 1 and Figure 3 both show an increase in log expenditures on untaxed products in flour-line states, post-reform. Intuitively, close substitutes with different tax liabilities would seem to be at risk for large distortions in consumption. Figure 3, displaying the results of the Scanner data shows a larger increase than it's Consumer Panel counterpart in Figure 1. Assuming panelists misreport purchases of snack items often consumed before they return home, the results obtained from the Nielsen Scanner data are potentially more accurate. Therefore, the Scanner data results are preferred to the Consumer Panel.

Comparing the DDD results of the two datasets in Table 1 and Table 3, the Scanner data estimates in Table 3 show a much larger estimated impact of the policy reform than estimates using the Consumer Panel data. Expenditures on products that contain flour in states that implement a flour-based definition of candy that are thus exempt from a tax

increase are expected to increase 47% relative to non-flour products and flour products in control states. However, in the Consumer Panel, expenditures on relevant products are only expected to increase by approximately 15%.

The DDD and generalized difference in difference specifications show statistically significant increases in expenditures for flour products, in treated states, post-reform. This result holds in both the Scanner and Consumer Panel data. While the Scanner data is the preferred result given data reporting concerns, the increase in expenditures on relevant products is robust to both data sets.

3.2 Evidence on Producer Involvement

One possible explanation for the contradictory results found in sections 3.1 and 3.2 is producer intervention through the introduction of new products. As additional states adopt a flour line, the expected news coverage and consumer awareness increases (at least in the short term) and producers have an increasing incentive to introduce new products that contain flour and are not taxed in flour-line states. Further, producers face a growing incentive to produce flour-inclusive options to decrease the total price of their products, even if consumers only notice this price difference ex-post.

To assess the role product entry plays in the overall shift of consumption towards flour products and away from non-flour (taxed) products in states with a flour-line, equations 1 and 2 from section 3.1 are reproduced using a sub-sample of products manufactured during the entire sample period. These results are reported in Figure 2 (constant products within the Consumer Panel), Figure 4 (constant products with in the Scanner data) and Tables 2 and 4.

Comparing the Scanner data generalized difference-in-difference results using the full sample of products against the sub-sample of constant products (Figures 3 and 4) the difference is striking. Figure 3, allowing product entry, shows a large increase in flour-product expenditures, while Figure 4, using a sub-sample of constantly produced products, shows almost no increase in expenditures following redefined tax bases. The DDD results in Tables 3 and 4 mirror this result. The sample of constant choice products produces a statistically insignificant decrease in expenditures of approximately 2% in the main specification.

4 Conclusion

In section 3.1, large substitution patterns towards products subject to the lower tax rate were estimated. This result was obtained when allowing new products to enter during the sample period 2006-2015. This result provides an empirical estimate of the ambiguous effect a characteristic notch has on consumption. Relatively transparent characteristic notches may result in large responses while obscure notches may cause consumers to respond less than they would to comparative price changes.

Interestingly, the substitution towards tax-preferred goods was not found among the sample limited to products that are produced during every quarter of the sample. This result may suggest that producers are intentionally introducing new products with tax-preferred compositions. Producers may have an incentive to introduce new products in this manner if consumers are inattentive to the characteristic notch but producers wish to keep the tax-inclusive price of confections low. Considering the results of both samples, some combination of deliberate consumer substitution and endogenous new product introduction results in moderately large substitution towards tax-preferred chocolate candy post-reform.

Map 1: Tax Status of Confections

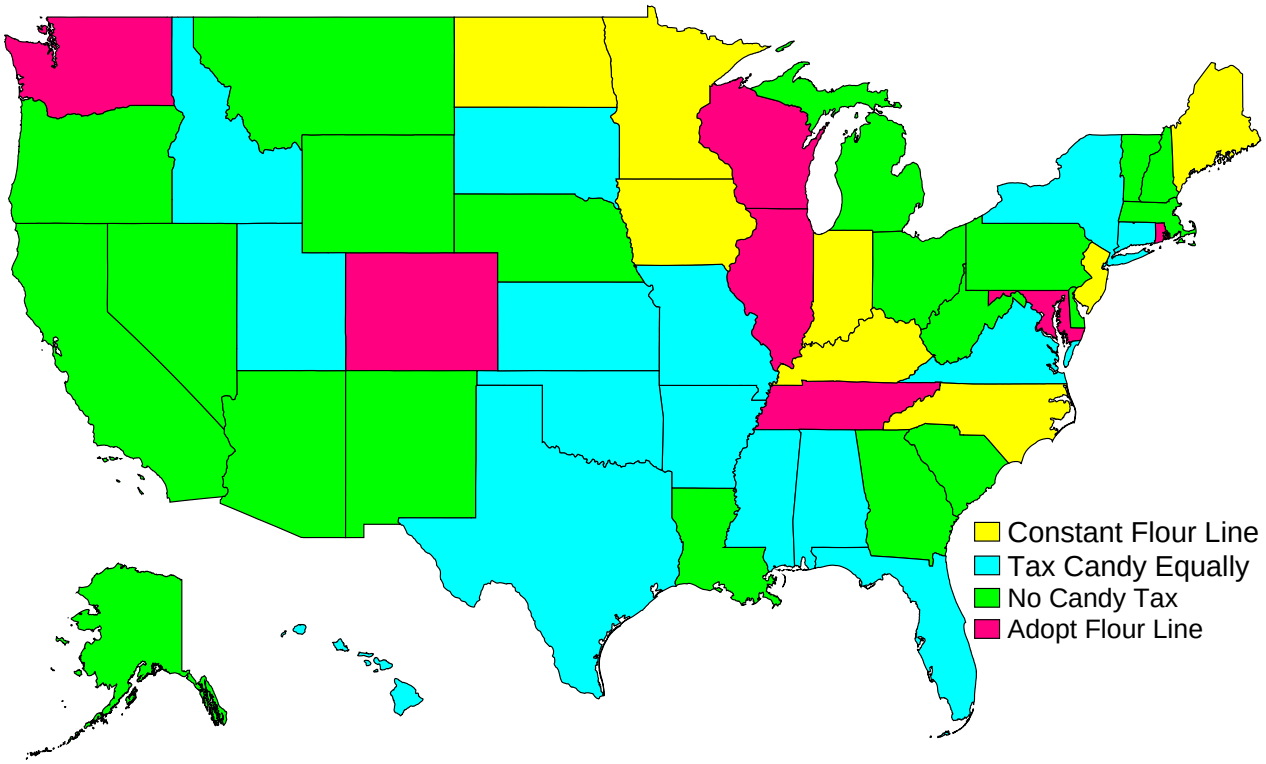

Figure 1

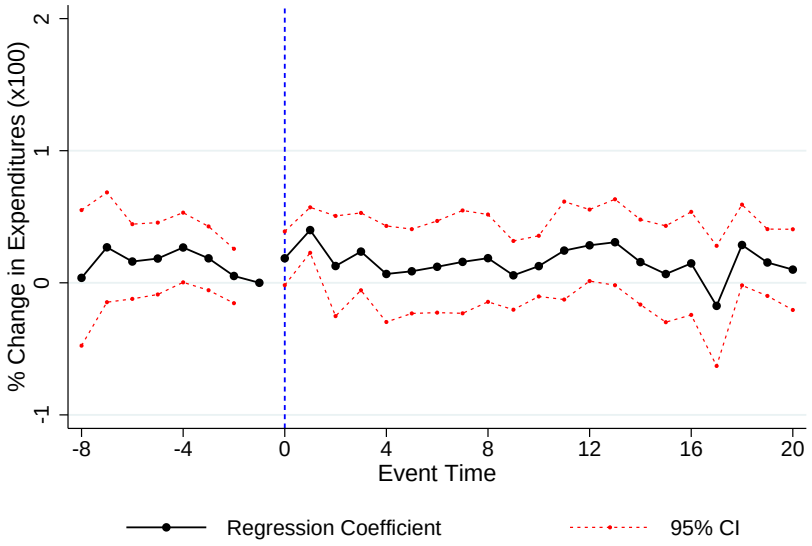

Figure 1 plots the coefficients from the Consumer Panel data state-product-quarter estimate. The first month of the reform, month 0, is the omitted category and the coefficient is normalized to 0.

Figure 2

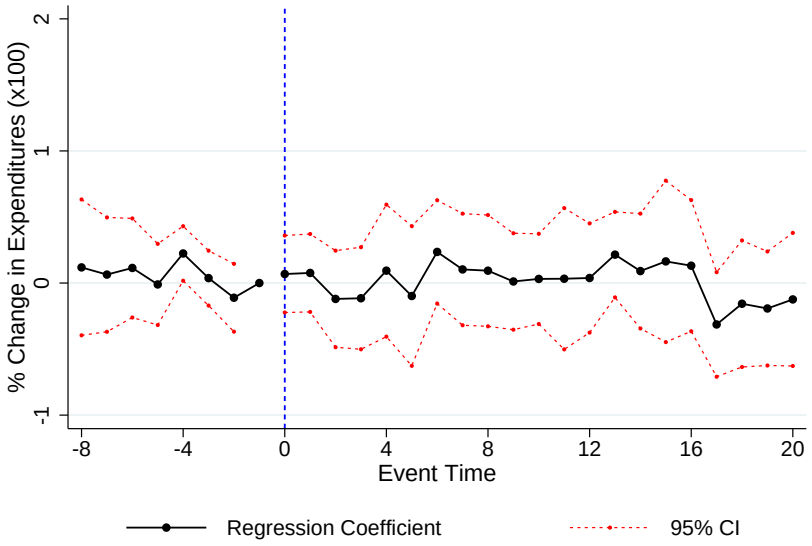

Figure 2 plots the coefficients from the Consumer Panel data, state-product-quarter estimate using constant products. The first month of the reform, month 0, is the omitted category and the coefficient is normalized to 0.

Figure 3

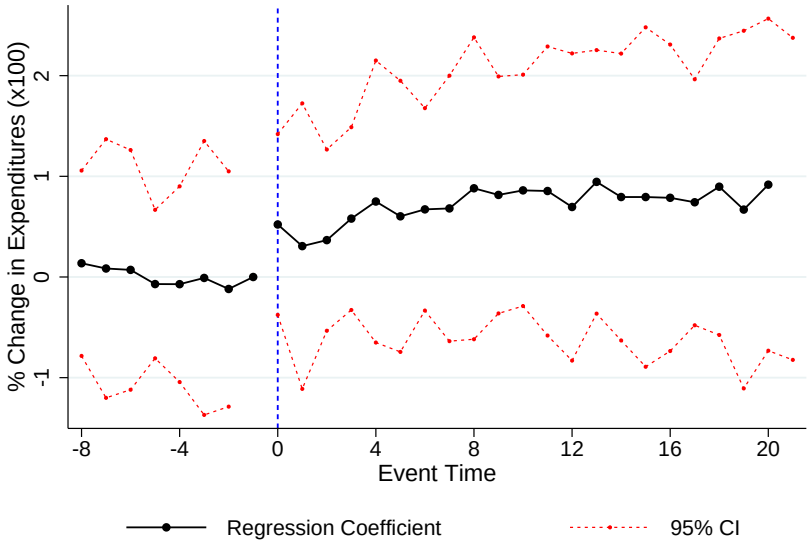

Figure 3 plots the coefficients from the Scanner data, state-product-quarter estimate. The first month of the reform, month 0, is the omitted category and the coefficient is normalized to 0.

Figure 4

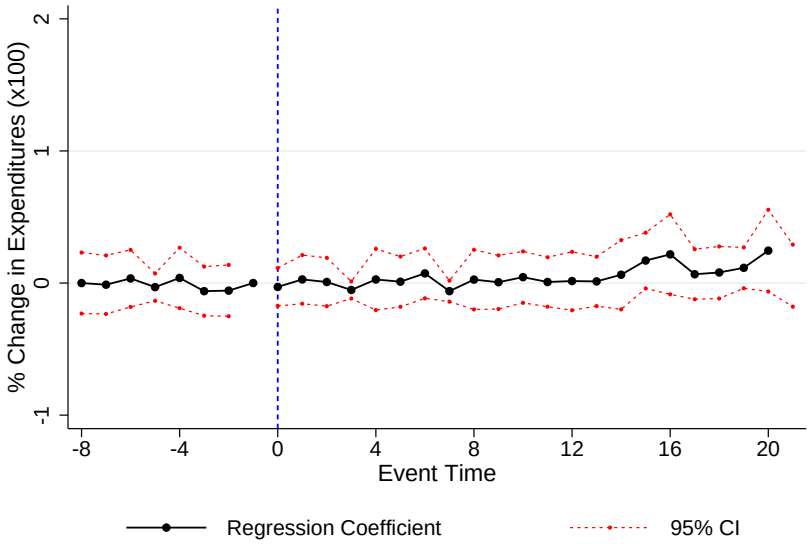

Figure 4 plots the coefficients from the Scanner data state-product-quarter estimate using constant products. The first month of the reform, month 0, is the omitted category and the coefficient is normalized to 0.

Table 1: Consumer Panel: Full Sample

	(1) Log Expenditures	(2) Log Expenditures	(3) Log Ounces
$Post * FlourProd * Treat$	0.155**	0.156**	0.0910
	(0.0580)	(0.0584)	(0.0589)
Sales Tax Rate	−1.001	−1.008	−1.196
	(0.766)	(0.767)	(0.779)
Unemployment Rate	0.0142	0.0143	0.0154
	(0.00996)	(0.00999)	(0.00928)
N	117814	117814	117814
Product FE	Yes	No	Yes
Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Product*Quarter FE	No	Yes	No

Standard errors clustered at the state-quarter level in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Consumer Panel: Constant Products

	(1) Log Expenditures	(2) Log Expenditures	(3) Log Ounces
$Post * FlourProd * Treat$	−0.0269	−0.0271	−0.0462
	(0.0539)	(0.0536)	(0.0545)
Sales Tax Rate	−0.994	−0.993	−1.077
	(0.949)	(0.948)	(0.911)
Unemployment Rate	0.0189	0.0189	0.0175
	(0.0110)	(0.0110)	(0.0109)
N	32814	32814	32814
Product FE	Yes	No	Yes
Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Product*Quarter FE	No	Yes	Yes

Standard errors clustered at the state-quarter level in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Scanner: Full Sample

	(1) Log Expenditures	(2) Log Expenditures	(3) Log Ounces
Unemployment Rate	0.0468***	0.0243***	0.0497***
	(0.00668)	(0.00389)	(0.00729)
Log Sales Tax Rate	3.205**	1.308***	3.999**
	(1.150)	(0.396)	(1.233)
$Post * FlourProd * Treat$	0.472***	0.224***	0.472***
	(0.123)	(0.0361)	(0.130)
N	126000	126000	126000
Product FE	Yes	No	Yes
Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Product*Quarter FE	No	Yes	No

Standard errors clustered at the state-quarter level in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Scanner: Constant Products

	(1) Log Expenditures	(2) Log Expenditures	(3) Log Ounces
Unemployment Rate	−0.00842**	−0.00842*	−0.0109**
	(0.00325)	(0.00329)	(0.00332)
Log Sales Tax Rate	−0.834**	−0.834**	−0.0562
	(0.306)	(0.295)	(0.307)
$Post * FlourProd * Treat$	−0.0216	−0.0542*	0.0333
	(0.0267)	(0.0247)	(0.0276)
N	27000	27000	27000
Product FE	Yes	No	Yes
Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Product*Quarter FE	No	Yes	No

Standard errors clustered at the state-quarter level in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Chocolate Confections Expenditures

	(1) Nielsen Reported Expenditures (Billions)	(2) Tracked Expenditures (Billions)	(3) Percent Tracked
2006	1.56	1.01	65.8
2007	1.68	1.09	65.7
2008	1.68	1.10	65.3
2009	1.66	1.10	66.0
2010	1.78	1.18	66.1
2011	1.85	1.23	66.4
2012	1.77	1.18	66.6
2013	1.89	1.24	65.5
2014	1.89	1.20	63.5
2015	1.83	1.13	62.0

Expenditures reported in constant 1994 dollars

Table 6: Flour and Non-Flour Confections Expenditures

	(1) Flour Expenditures (Billions)	(2) Non-Flour Expenditures (Billions)	(3) Percent Flour
2006	.11	.90	11.2
2007	.11	.98	10.3
2008	.11	.99	10.0
2009	.12	.98	10.6
2010	.15	1.02	13.1
2011	.18	1.04	15.0
2012	.18	1.00	15.2
2013	.18	1.04	14.7
2014	.16	1.04	13.6
2015	.16	.97	14.4

Expenditures reported in constant 1994 dollars

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