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Bidding in Competition: Wholesale Alcohol Markups under Changing Liquor Laws

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Abstract

In this research, we examine a repeated pricing game that occurred for more than a decade between wholesale alcohol distributors in Oklahoma. In November of 2016, new liquor laws were voted on and adopted, but the new policies were not set to take effect for nearly two years. Using bi-monthly data from June 2007 to the enacting of new liquor laws in October of 2018, we show that firm behavior moved contrary to game theoretic expectations. Using this natural policy experiment setting, we show that wholesale markups steadily increased for both spirits and cordials following the passing of the new law until the final stage of the game, when the wholesale distribution system changed after the enacting of new laws.

1 Introduction

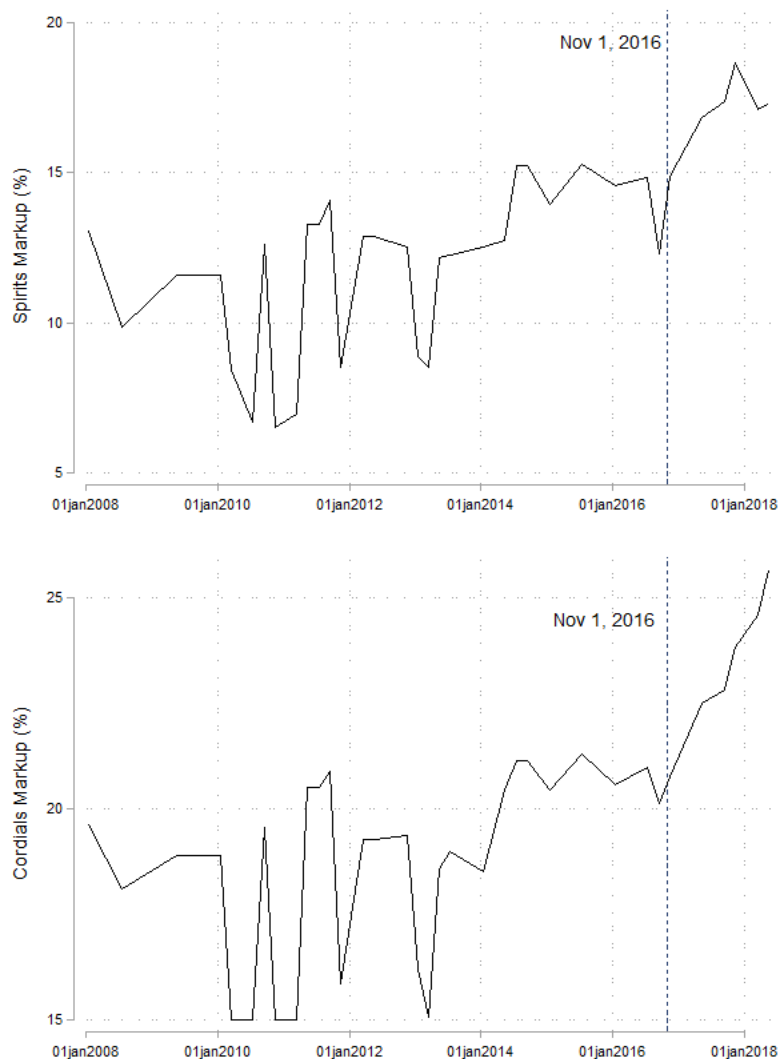
Firm behavior is difficult to entangle in many markets because firms compete in myriad venues with varied abilities to match their competitors actions in a short amount of time. This competitive behavior can range from closed bidding on government contracts, to day-to-day competition in which prices are posted simultaneously but must be held at the posted value for some period of time if menu costs are sufficiently high. These decisions become even more clouded, certainly from an econometric standpoint, when one considers that product quality and features often vary across firms as well. In this research, we examine a unique policy change that disturbed the typical bidding behavior of firms that are able to compete using markup-prices only. Here we show how the bidding behavior of wholesale alcohol distributors changed following a vote to amend state liquor laws - before the laws were even implemented.

The state of Oklahoma historically regulated markups in the distribution system using what are known as “post and hold” laws. Every other month, wholesalers would independently post a proposed markup for the next two months. After viewing the markup bids by other wholesalers, market participants were allowed to revise their markups if they chose to do so (e.g. match the lowest price) but were not allowed to bid below the prior lowest price. Throughout the majority of the sample all distributors would match the lowest price posted. Prior to the passage of new liquor laws in Oklahoma, the distribution system was regulated such that all alcohol had to be sold through licensed wholesale distributors. These distributors were required to sell to any licensed retail operator, for example restaurants or liquor stores, without discrimination (no exclusive dealing between upstream supplier and wholesaler). Moreover, all products sold through the alcohol wholesalers had to be made available to each wholesale market participant. Thus, the competing firms could

only use price signals to compete. Following the vote to amend liquor laws, bidding behavior did not follow what would be expected in a competitive pricing game with a newly known ‘finite’ ending. Instead, markups *increased*.

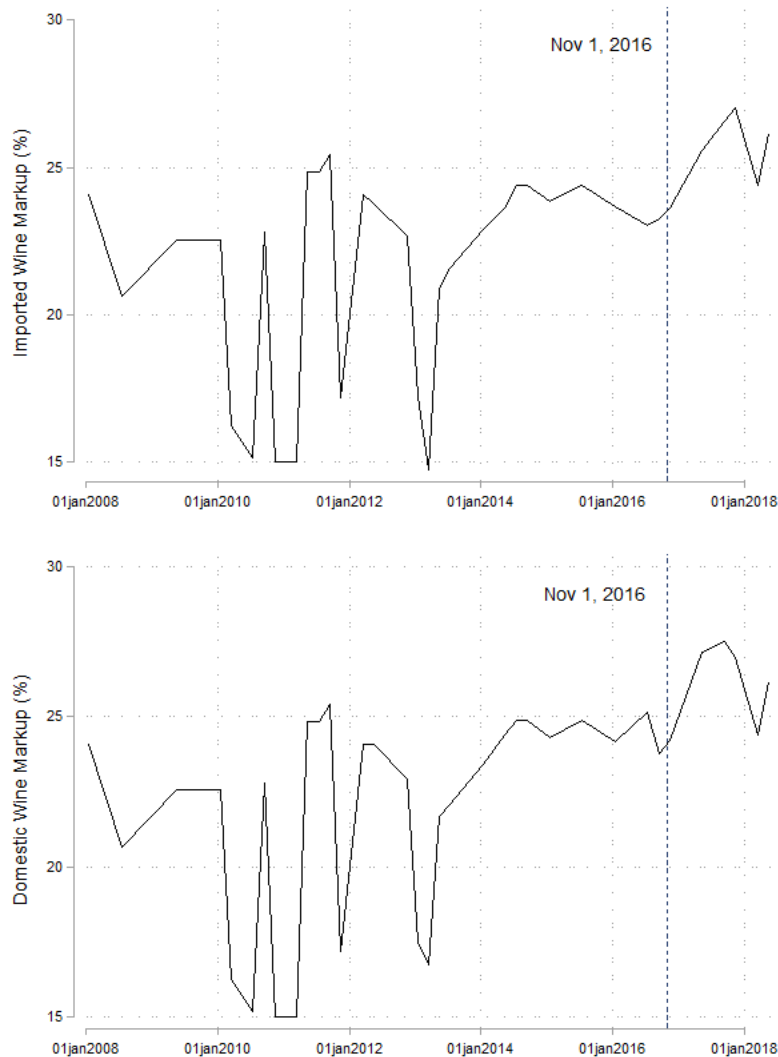
In this research, we study how the markup bids proposed by wholesalers changed following the vote which would amend liquor laws. We are able to examine markups for spirits, cordials, imported wine, and domestic wine. Figures 1 and 2 plot the average initial markup bid over time for each product group. These figures hint at a change in bidding behavior for spirits and cordials, but not for wines, that we confirm using panel data methods to control for unobserved heterogeneity, accounting for the amount of wholesalers in the market, and dynamic treatment effect models and structural break tests.

Figure 1: Spirits and Cordials



We find that markup percentages changed for cordials and spirits following the vote to implement new liquor laws. The change associated with the vote is approximately a two percentage point increase for both product categories – a 12% and 17% increase relative to the mean for cordials and spirits, respectively. The result that markups increased for these product categories is robust to the inclusion of various fixed effects, dynamic modeling of markups, and even structural break tests. The same cannot be said for imported or domestic wines, though. We consistently find across all model specifications that the markup on wine products did not change following the vote to amend liquor laws.

Figure 2: Imported and Domestic Wines



1.1 Background

Historically, Oklahoma's alcoholic beverage industry operated under a four-tier system, where manufacturers (i.e., wineries, distillers, and brewers) sold alcoholic beverages through licensed nonresident sellers. The nonresident sellers, serving as agents to the suppliers, would sell these alcoholic beverages to licensed wholesalers,¹ who were responsible for distributing the alcoholic beverages to licensed retailers (i.e., restaurants, bars, and liquor stores).² Manufacturers would post their manufacturer-to-wholesaler prices with the state regulatory agency on a monthly basis,³ while wholesalers would post their wholesaler-to-retailer mark-ups every other month (as set forth below). Wholesalers were required to sell alcoholic beverages to every licensed retailer based on the same price, terms, and conditions.⁴ Oklahoma's post-and-hold provisions were intended to assist the state's regulatory agency in enforcing this prohibition against price discrimination.

In November 2016, Oklahoma voters amended the state's alcoholic beverage laws, passing State Question

¹37 O.S.Supp.2017, §524(A), repealed by Laws 2016, SB 383, c. 366, §169, eff. October 1, 2018.

²37 O.S.Supp.2017, §521(F)(1), repealed by Laws 2016, SB 383, c. 366, §169, eff. October 1, 2018.

³OAC 45:30-3-3(a), amended at 35 Ok Reg 833, effective 10-1-18.

⁴37 O.S.Supp.2017, §536(a)(1), repealed by Laws 2016, SB 383, c. 366, §169, eff. October 1, 2018, and OAC 45:30-3-6(a), amended at 35 Ok Reg 833, effective 10-1-18.

792 by over 65% of the vote.⁵ Prior to passage of SQ 792, wineries and distillers wishing to sell their products in Oklahoma were compelled to sell those products to every licensed Oklahoma wholesaler in the state, and every wholesaler wanting to sell those products to retailers were required to comply with the state's post-and-hold provisions.⁶ Every wholesaler was obliged to post its proposed wholesaler-to-retailer mark-up on each wine or spirits category, and every wholesaler was forced to hold or maintain its adjusted mark-up for the next sixty (60) days.⁷

Prior to SQ 792, Oklahoma's post-and-hold provisions required each licensed wholesaler to post with the state's regulatory agency and competitors its proposed original mark-up on wine and spirits products (by category) on the 15th of every odd-numbered the month.⁸ For example, a wholesaler may propose to sell all domestic wine at a 15% mark-up over the supplier's price. After submitting an original markup, the wholesaler was provided a copy of the proposed original mark-ups submitted by competitors.⁹ No later than the 25th of the same month, each wholesaler must file its adjusted mark-up with the state regulator agency and its competitors.¹⁰

A wholesaler's adjusted mark-up could be identical to its original mark-up, or if that original mark-up was not the lowest mark-up submitted, the wholesaler could match the lowest mark-up submit by its competitors.¹¹ Provided, no adjusted mark-up may be lower than the lowest proposed original mark-up submitted by their competitors.¹² For example, if Wholesaler A's proposed original mark-up on domestic wines was 15%, and Wholesaler B's proposed mark-up was the lowest among all wholesalers at 12%, then Wholesaler A could submit an adjusted price posting between 12% and 15%.

SQ 792 modified Oklahoma alcoholic beverage distribution laws, permitting wineries and distillers to designate a single wholesaler to distribute their products or continue selling those products through all licensed wholesalers.¹³ Beginning October 1, 2018, products that were designated to be sold by a single wholesaler would no longer be required to follow the state's post-and-hold provisions. Instead, the designated wholesaler would post its wholesaler-to-retailer price with the state regulatory agency on a monthly line-item basis.¹⁴ If the winery or distiller chose not to designate a single wholesaler, then every wholesaler could continue selling those undesignated products through the traditional post-and-hold provisions.¹⁵

The momentum to change Oklahoma liquor laws at the ballot box were primarily driven by a demand for easier availability of 'strong' beer and wine.¹⁶ However, there is evidence that the push to change the distribution system had backing from distributors because distributors in many other states have pushed (and in some cases been successful) at removing the post and hold laws.¹⁷ Furthermore, retail businesses that would be impacted by the law change spent considerable time and money lobbying for the alcohol law change (The Oklahoman, 2018)

Oklahoma's stakeholders were provided nearly two years to implement SQ792. During that transition, wineries and distillers were permitted to create exclusive distribution agreements with Oklahoma wine and spirits wholesalers, to become effective October 1, 2018, but they were required to continue to sell their products to licensed wine and spirits wholesaler until that date. The Oklahoma Attorney General also opined that wine and spirits wholesalers would be allowed to sell previously purchased inventory following SQ792's implementation date.

In 2019, the Oklahoma Legislature passed a law attempting to reinstate the post-and-hold provisions

⁵State Question 792 was approved by Oklahoma voters by a margin of 939,848 to 492,422.

⁶Okla. Const. Art. 28, §3(A), repealed by Laws 2016, SJR 68, State Question No. 792, Legis. Ref. 370, adopted at election held November 8, 2016, effective October 1, 2018, 37 O.S. §533, repealed by Laws 2016, SB 383, c. 366, §169, eff. October 1, 2018, and OAC 45:30-3-7, amended at 35 Ok Reg 833, effective 10-1-18.

⁷OAC 45:30-3-7(l), amended at 35 Ok Reg 833, effective 10-1-18.

⁸OAC 45:30-3-7(a), amended at 35 Ok Reg 833, effective 10-1-18.

⁹OAC 45:30-3-7(e), amended at 35 Ok Reg 833, effective 10-1-18.

¹⁰OAC 45:30-3-7(f), amended at 35 Ok Reg 833, effective 10-1-18.

¹¹OAC 45:30-3-7(i), amended at 35 Ok Reg 833, effective 10-1-18.

¹²OAC 45:30-3-7(h), amended at 35 Ok Reg 833, effective 10-1-18.

¹³Okla. Const. Art. 28A, §2(A)(2).

¹⁴37A O.S.Supp.2018, §3-116.2.

¹⁵37A O.S.Supp.2018, §3-116.1.

¹⁶Prior to SQ 792, beer sold in commercial locations (grocery stores, gas stations, etc.) had to be lower than 3.2 alcohol by weight. Wine was not permitted in these same stores either

¹⁷Costco v. Hoen 2009 in Washington; and TFWS v. Schaefer et al., 2004, final appeal 2009 in Maryland

that were repealed by the implementation of SQ792 the previous year. Senate Bill 608 would have required manufacturers of the top 25 brands of wine or spirits sold in the state, as determined by wholesaler liter reports, to sell those particular brands to every licensed wine and spirits wholesaler in the state.¹⁸ The legislation's proponents asserted that elimination of the post-and-hold provisions had effectively created a concentration of market share among the state's two largest wine and spirits wholesalers.¹⁹

In reality, the number of Oklahoma licensed wine and spirits wholesalers more than doubled following the implementation of SQ792, from five wholesalers on September 25, 2018, to twelve wholesalers, less than one year after the October 1, 2018, implementation date. Unlike beer distributors, the Oklahoma Legislature does not provide wine and spirits wholesalers with franchise protections, so a winery or distiller is not required by statute to compensate its current wholesaler in the event a distribution agreement is terminated without cause. The Oklahoma Supreme Court declared Senate Bill 608 unconstitutional on January 22, 2020.

Changes in post and hold laws have received some attention in the economics literature. Saffer and Gehrsitz (2016) use the state-to-state variation in the timing of changing post and hold laws to show that there is no effect of post and hold laws on the consumption of either beer, wine, or spirits. They further find that there is no evidence that the laws increase the prices of these products. Their paper is a refinement on the earlier work of Cooper and Wright (2012) which also discusses post and hold laws. In our setting, there is anecdotal evidence that the change in regulatory structure has not changed prices. In a memorandum jointly prepared by wholesalers in Oklahoma, the change in price for the top 25 products (by sales volume before the implementation of the law) was calculated. The report found that price only increased for seven of the twenty-five products, and that the average price increase was only \$1.55.²⁰ Byrne and Nizovtsev (2017) discuss how strict liquor laws impact labor markets, and find that strict laws increase employment at liquor stores, but there is no effect on retail (grocer) employment. What constitutes a 'strict' liquor law is certainly debateable, and it is not clear whether or not post-and-hold laws would be considered as such. Regardless, we contextualize their findings to our setting by noting that beer was sold in grocery stores prior to the law change, but it was not 'full strength' beer. Thus, we may reasonably expect their null result, that liquor laws have no effect on employment, to be applicable in Oklahoma.

1.2 Competitive Pricing in Repeated Games

Here, we briefly discuss a simple game-theoretic model of price competition for both finite and indefinitely repeated games. We use this to provide a framework and discuss implications of our empirical findings below.

Consider two firms that compete by setting prices only. That is to say, firms cannot vary product quality or variety to induce more demand for their product. We assume that each firm can service the entire market if they are the low cost provider earning profit ($\pi = \alpha$), and that consumers will always purchase from the low-cost firm ($\pi = 0$ for the high-cost firm). If firms match on a low price, then we assume the market is split between the two firms ($\pi = \alpha/2$). If both firms match on a high price, then they split a higher profit than if they match with low prices ($\pi = \beta/2$ with $\beta > \alpha$). If this game were played only once, then we would expect both firms to select a low price because setting a low price is the best response to each potential choice by their rival firm. That is to say, assuming prices are (simultaneously) set once, then each firm has a strictly dominant strategy to set a low price. Such competitive behavior is what we see in the data on product markups that follows. Each period firms post an original markup, but then are able to adjust their markup after learning the markup set by others. In each period and across all product groups we see that firms match on the lowest proposed markup.

Cooperation in this game can occur if the game is repeated an indefinite amount of times. For instance, consider two firms that are able to update prices at a regular interval with the same payoff structures for each period as before. Assuming neither knows when such repeated interactions will finish, then a cooperative outcome of setting higher prices is an equilibrium strategy for both firms if the present-value discounted sum

¹⁸37A O.S.Supp.2019, §3-116.4, ruled unconstitutional by the Oklahoma Supreme Court, *The Institute for Responsible Alcohol Policy v. State of Okla. ex. rel. ABLE Commission*, 2020 OK 5 (2020).

¹⁹Amicus Curiae filed by State Senator Kim David and State Representative Chris Kannady, *The Institute for Responsible Alcohol Policy v. State of Okla. ex. rel. ABLE Commission*, Oklahoma Supreme Court, Case. No. 118209, October 4, 2019.

²⁰The memorandum was prepared, in part, to discuss erroneous reports that prices had increased following the implementation of the new laws.

of profits are such that:

$$\frac{\beta/2}{r} > \frac{\alpha/2}{r} + \alpha$$

In words, setting a high price is an equilibrium strategy when the discounted sum of profits from the cooperative high-price payoff is greater than the discounted sum of profits from the low-price payoff plus the one period payoff for ‘cheating’ on the agreement.²¹

Suppose now that there is a finite or ‘known’ end to this repeated pricing game. If that is the case, then ‘cooperation’ in setting high prices is not an equilibrium outcome. For example, consider the final stage of price setting: both firms know that there are no further chances for cooperation, so will return to their dominant strategy of setting a low price. By the same logic, in the penultimate round of price setting both firms will know that the final round results in low prices, so the second-to-last round will also result in low prices. Using backward induction, we can see that the same logic will be used in each stage of the game. Thus, each firm will rationally choose to set low prices for each stage of the repeated game because of the known (finite) ending.

2 Data Description

The data for this project were obtained through the Oklahoma Open Records Act, 51 O.S. §24A.1 et seq. The data includes information on the original submitted bids from each wholesale distributor, as well as the revised price 10 days after the initial bid. The data are available from January 2007 through October 2018 - the implementation of the new alcohol laws. Importantly, this time range includes observations prior to the introduction of the State Question that would ultimately amend liquor laws, observations through the period when discussion and advertising was taking place prior to the vote (both in opposition and support of the law), and observations after the vote took place but before the implementation of the law. We later make use of these timing overlaps to check the robustness of our estimates. Table 1 shows summary statistics for all markup data (including revised markups).

Table 1: Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Spirits Markup	695	12.301	4.883	6.25	30
Cordials Markup	694	19.320	3.807	15	30
Imported Wine Markup	694	21.610	6.276	13	35
Domestic Wine Markup	696	21.948	6.087	13	35

Notes: Markups are percentages (%)

3 Empirical Specification

We are interested in how markup behavior changed following the vote to amend state alcohol distribution laws, but prior to the implementation of those changes to the distribution system. Our primary estimating equation is shown in Equation 1:

$$Markup_{it} = \beta_0 + \beta_1 Vote_t + \beta_2 Wholesalers_{it} + \mu_i + \omega_t + \varepsilon_{it} \quad (1)$$

where the dependent variable, $Markup_{it}$, is the proposed (original) markup by wholesaler i in period t in percentage points. For now, we exclude revisions to this markup that occur in the follow-up period because all wholesalers match the lowest bid price. In extensions to the main model we measure how follow-up bidding

²¹Here we have assumed that there is a ‘trigger strategy’ such that after a ‘betrayal’ the rival firm will set low prices indefinitely. There are other trigger strategies that are supported in this repeated prisoner’s dilemma game.

changed over the same period and find that our main results hold. We control for the number of wholesalers that are active in the bidding process for each period, time period fixed effects for the month of the year (ω_t) which account for potential seasonal variation in pricing, and fixed effects by wholesaler (μ_i) which accounts for remaining unobserved heterogeneity between the wholesalers (for example, the location(s) of distribution warehouses). Our primary variable of interest is the estimate connected with “ $Vote_t$ ” which is a dummy variable that measures the change in proposed markups (in percentage points) due to the passing of the new liquor law, all else equal. Essentially, this estimate is a reduced form estimate of an interrupted time-series. In later robustness exercises we implement time-series structural break tests and difference-in-differences analyses to gauge the validity of our primary conclusions. All standard errors are robust and clustered by wholesaler.

4 Results

Tables 2 and 3 present our main results. Table 2 presents estimates for the effect of the vote on the markup percentage for spirits (first two columns) and cordials (latter two columns). Table 3 presents estimates for imported wine (first two columns) and domestic wines (latter two columns). In each table we toggle the inclusion of fixed effects for robustness. Clearly, models that control for wholesaler fixed effects and monthly fixed effects capture important unobserved heterogeneity. These models generally explain 50+% of the variation in markups relative to the models that do not include fixed effects (only 1-20% of the variation in markups). For this reason, we base our discussion solely on those models that include fixed effects.

Table 2: Spirits and Cordials

Variables	Spirits	Spirits	Cordials	Cordials
Wholesalers	-0.877** (0.330)	-0.677*** (0.190)	-0.571** (0.206)	-0.439*** (0.133)
Vote	3.486*** (0.814)	2.241*** (0.653)	3.220*** (0.619)	2.461*** (0.462)
Wholesaler Fixed Effects	N	Y	N	Y
Month Fixed Effects	N	Y	N	Y
R-Squared	0.182	0.539	0.185	0.542
Obs	474	474	473	473

Notes: Robust standard errors clustered by wholesaler; ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively.

In Table 2, we see that the vote is associated with a distinct increase in the average markup bid for both spirits (2.24%) and cordials (2.46%). Note, that markup units are in percentage points, so the percentage change in markups (relative to the mean) is better able to show the amount of change associated with the vote taking place. We find that markups increased by approximately 16.7% and 11.98% for spirits and cordials, respectively.²² In other words, the roughly two percentage point change associated with the vote is actually a rather large increase in markups for both spirits and cordials. These results are statistically significant at the 1% level, and are persistent across models that exclude fixed effects, though estimates are slightly attenuated when fixed effects are included. Additionally, we find that as the amount of wholesalers bidding in the market increases, the average markup falls. This result confirms prior expectations that more competition results in lower markups. We explore this assumption more fully in the appendix.²³

Table 3 offers different evidence on how wholesalers responded to the change in liquor laws. For both imported and domestic wines the point estimate is positive, but we cannot say with traditional statistical confidence that the vote changed markup bidding behavior. In our preferred (fixed effects included) models we see that the markup is associated with about a 1 percentage point increase in average markups. For

²²Using the mid-point method.

²³Throughout the post-vote period there are between five and seven wholesalers in the market with an average of 6 participants. This is similar to the pre-vote period in which there are 8 participants on average.

Table 3: Imported and Domestic Wines

Variables	Imp. Wine	Imp. Wine	Dom. Wine	Dom. Wine
Wholesalers	-0.829** (0.357)	-0.670** (0.304)	-0.969** (0.323)	-0.758** (0.147)
Vote	1.077 (1.336)	1.143 (0.722)	1.018 (1.257)	0.718 (0.699)
Wholesaler Fixed Effects	N	Y	N	Y
Month Fixed Effects	N	Y	N	Y
R-Squared	0.055	0.513	0.074	0.473
Obs	474	474	475	475

Notes: Robust standard errors clustered by wholesaler; ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively.

imported wines this coefficient estimate is just outside the traditional 10% bound of statistical significance. In percentage change terms, the vote is associated with a 5% and 3% increase in markups, relative to the mean, for imported and domestic wines, respectively. We do still find evidence that increases in the amount of wholesalers in the market reduces the average bid as expected.²⁴

4.1 Robustness

Here, we present variants of the primary model to discuss alternative hypotheses that may weaken our results. First, if the policy change was anticipated we may expect markup behavior to change prior to the vote. Recall, the vote to amend liquor laws ultimately passed by a wide margin with over 65% of the vote. To test this possibility, we include an additional indicator variable for the three month period prior to the vote ($Prevote = 1$ for the period August 1, 2016 through October 31, 2016).²⁵ These estimates are shown in Table 4 for all product categories with month and wholesaler fixed effects included.

Table 4: Robustness, Pre-Vote

Variables	Spirits	Coridials	Imp. Wine	Dom. Wine
Wholesalers	-0.690*** (0.197)	-0.432** (0.134)	-0.666** (0.303)	-0.754** (0.267)
Vote	2.175*** (0.647)	2.491*** (0.456)	1.162 (0.696)	0.740 (0.680)
Pre-Vote	-1.058 (1.356)	0.504 (0.468)	0.308 (1.043)	0.360 (0.939)
Wholesaler Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y
R-Squared	0.540	0.542	0.513	0.529
Obs	474	473	474	475

Notes: Robust standard errors clustered by wholesaler; ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Here we see that there is no meaningful impact associated with the “Pre-vote” variables for any of the product categories, but that there is still an increase in markups for spirits and cordials. We also see that the point estimate for the two wine categories is positive, though not statistically significant.²⁶ These results

²⁴ Again, this assumption is explored more fully in the appendix.

²⁵ Extending the time dimension of this variable to mark the six and nine months before the vote are no different from the shorter time period.

²⁶ Again, the coefficient estimate for the affect of the vote on markups for imported wine is just outside the traditional 10% level at 13.5%

are consistent in magnitude to our prior estimates which excluded the ‘Pre-vote’ indicator.

We next investigate whether the vote is associated with higher markups after the follow-up (rebidding) process has completed. It may be the case that starting markup bids increased following the vote, but that follow-up bids (adjusted markup) have not changed. If this were the case, there would not be any meaningful effect on the ultimate markup levels due to the passing of new laws. We find an increase in markup percentage points for spirits of 2.1 percentage points which is statistically significant at the 10% level. Further, we find that after voters approved SQ792, the adjusted mark-ups on cordials increased by 2.8 percentage points, which is statistically significant at the 1% level. Both imported and domestic wines remain unaffected by the vote, though again the coefficient estimate for the effect of the vote on markups just misses the traditional 10% significance level for imported wines.

Table 5: Robustness, Final Adjusted Markup

Variables	Spirits	Coridials	Imp. Wine	Dom. Wine
Wholesalers	0.110 (0.197)	0.109 (0.287)	1.053** (0.479)	0.878* (0.474)
Vote	2.121* (0.647)	2.795*** (0.845)	2.409 (1.562)	1.703 (1.441)
Wholesaler Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y
R-Squared	0.529	0.573	0.590	0.612
Obs	221	221	220	221

Notes: Robust standard errors clustered by wholesaler; ***, **, * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.2 Alternative Specifications

Our estimates so far indicate that there has been an uptick in the seasonally adjusted estimate of markups in the post-vote period relative to the pre-vote period for liquor and cordials, but not for either of the wine categories. A concern is that this estimated change in markups is not due to the vote and pending change in alcohol legislation but due to unobservable changes. Here, we present three additional specifications to test the validity that markups are in-fact higher for the post-vote period for spirits and cordials.

First, we estimate a model using the method of difference-in-differences. This method allows us to determine the ‘average treatment effect’ of the vote on product markups. The data at hand are not necessarily ideal for this setting because an adequate ‘treatment-free’ comparison group, wholesalers that are not exposed to the law change, do not exist. However, because there is a difference in the available market for wines following the vote (relative to liquor and cordials which are still exclusively sold in liquor stores), we are able to categorize imported and domestic wines as a treatment-free comparison group that is still subject to the same global factors that affect demand for all product groups. The ‘treatment effect’ of the vote, then, is defined as the difference in markups for liquor and cordials following the vote, relative to the difference in markups for wine following the vote. Our difference-in-differences version of the model is shown in Equation 2.²⁷

$$Markup_{it} = \beta_0 + \beta_1 Vote_t + \beta_2 Liquor_i + \beta_3 Vote_t * Liquor_i + \beta_4 Wholesalers_{it} + \mu_i + \omega_t + \varepsilon_{it} \quad (2)$$

where $Vote_t$ is defined as before, $Liquor_i = 1$ for spirits and cordials, and we still control for the amount of wholesalers in the market, wholesaler fixed effects, and time fixed effects. The coefficient of interest is the parameter estimate for β_3 as this is our estimate for the effect that the vote had on average markups for liquor products relative to wine products.

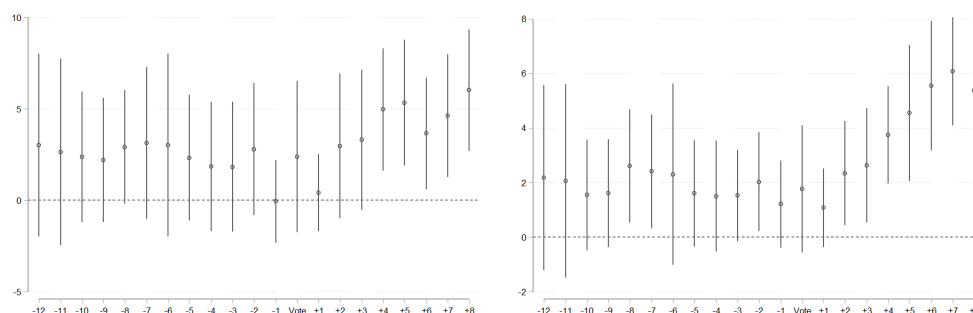
²⁷Using the wine product category as the ‘treated group’ instead of the control group yields the exact same estimates, but the sign of the coefficients for the dichotomous indicator variables are reversed.

The results are presented in Table 5. In this specification we come to nearly identical conclusions as before. We find that the vote is associated with a 2.08 percentage point increase in markups for liquor store products, all else equal.²⁸ That is to say, products in the liquor product category have increased following the vote relative to changes in the wine product category that are subject to the same ‘global’ factors that affect demand for both products.

Next, we use structural break test techniques derived from the time-series econometrics literature. This testing procedure is common in macroeconomic applications, though it has been used in interrupted time-series applications like ours in Evans et al. (2018). To perform these tests, we collapse the data on markups into an average markup over time for each product group.²⁹ We then use the familiar Chow test of a structural break with a known break date. In this test, we are able to determine if the coefficients do not vary over the subsamples defined by the specified (“known”) break date. Using November 1, 2016 as our known break date, we reject the null hypothesis of no structural break for the spirits and cordials categories, both at the 1% level.³⁰ We do not, however, find evidence of a structural break for the wine categories.³¹ These tests provide support for our prior conclusions. We also perform tests of an ‘unknown’ break date as a sort of validation exercise. Essentially, the unknown break date test collects multiple Wald tests of a structural break, and selects on the test statistic that is largest.³² We again find evidence of a structural break for spirits and cordials (a few periods after the vote), and find no evidence of a structural break for either of the wine categories.

Lastly, we estimate a fully saturated model with binary indicator variables included for each period beginning two years prior to the vote occurring and following through to the end of the sample. In essence, this model is an event-study style model in which we can gauge how markups have changed in each time period relative to the average markup prior to two years before the vote.³³ The benefit of this model is that we are able to see the dynamics of changing markups over time instead of a single average effect over the entire post-vote period.

Figure 3: Event Study - Spirits (left); Cordials (right)



Figures 3 and 4 plot the coefficient estimates for each time period dummy for individual periods two years prior to the vote, the month of the vote, and each period following the vote. Looking to Figure 3, we can see that markups increased following the vote for both spirits and cordials. Though the point estimate for the period that the vote took place is not statistically greater than zero, we can see that markups gradually increase in the follow-up periods through the implementation of the new laws. This supports our prior findings of an average treatment effect estimate over the entire period of approximately 2 percentage points. Figure 4 displays the same coefficients for the wine categories. Here, we do not find any consistent evidence that markups have increased following the vote. This, again, confirms our prior findings that markups are not markedly different following the vote for wine products.

²⁸Statistically significant at the 1% level. Omitting fixed effects, the estimate is 2.05 and is statistically significant at the 5% level. The R-squared in the model with fixed effects is 0.52, and 0.24 without.

²⁹These averages are displayed in Figures 1 and 2.

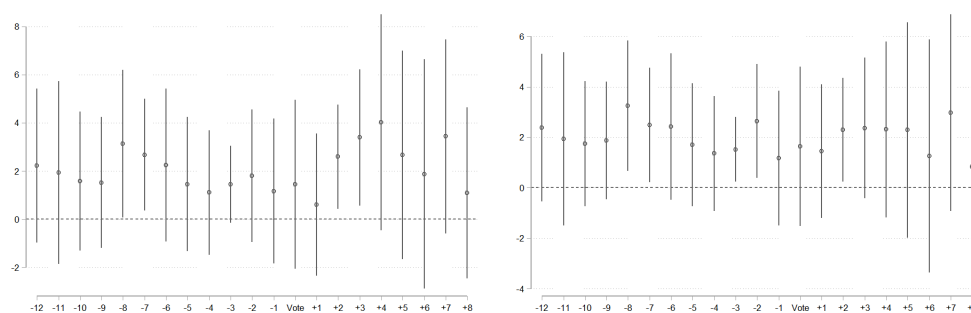
³⁰Chi-squared test statistic of 14.66 and 17.71 for spirits and cordials, respectively.

³¹Chi-squared test statistic of 1.53 and 1.05 for imported and domestic wines, respectively.

³²That is to say, this test concludes that a break occurs when the test statistic most strongly rejects the null hypothesis of no structural break.

³³Recall that bids are submitted bi-monthly, so 12 periods prior to the vote is really two years.

Figure 4: Event Study - Imported Wine (left); Dom. Wine (right)



5 Discussion and Conclusion

We find that the new liquor law vote caused competitive behavior between firms to change. Interestingly, this change occurred before the new laws even took effect. Specifically, we find that the vote is associated with an increase in wholesale markup bids of 2.46 percentage points for cordials and 2.24 percentage points for spirits. Relative to the mean markup for each product category, this is an increase of approximately 12% and 17% for each, respectively. Even though the same wholesalers participated in posting proposed markups for the wine categories, we do not find evidence that markups were significantly changed in this category following the vote.

There are many possible explanations for this difference in bidding behavior. While we remain agnostic to the causes of this behavior, we still believe it is useful to describe some of the potential mechanisms: i) The new law permitted the sale of wines in grocery and convenience stores, but spirits and cordials remained prohibited (from grocery and convenience stores). Because wholesale distributors do not have to compete for business from grocery stores or other retailers for market share in the cordials and spirits categories, they could thus increase their markups in this product category without negatively affecting demand from these sources.³⁴ Moreover, to the extent that new relationships between wholesaler and a new channel of retailers could be forged (grocery/convenience stores), there was no incentive to raise markups on wines given the competition from other wholesalers. ii) The distributors in the case of cordials and spirits are (still) playing an infinitely repeated game and choosing to cooperate with trigger strategies.³⁵ Thus, a sub-game perfect equilibrium exists in which players cooperate through the foreseeable future. iii) Because the new law would eventually allow for exclusive dealing between the product manufacturer and wholesaler, wholesalers could be offsetting future losses from losing a popular wine brand by increasing margins on the other product categories. This aspect of the new law (exclusive dealing) faced litigation, though. Ultimately, the Oklahoma Supreme Court invalidated Senate Bill 608 on January 22, 2020, effectively ending the legal challenge to a manufacturer's right to designate a wholesaler to distribute its products within the state.³⁶

We conclude by noting that although the experience in Oklahoma is in some ways idiosyncratic to the state's laws, the empirical example of cooperative coordination to raise markups until the 'final stage' of a repeated competition game is intriguing in that it casts doubt on the readily accepted (or expected) outcome - that when the final stage of a repeated prisoner's dilemma game is known the equilibrium strategy of low prices will emerge. Further inspection of this pricing phenomena in other markets may be warranted. For example, as the start-date for a generic alternative to a popular pill produced by both Pfizer Inc. and Eli Lilly & Co. loomed in the future, the companies gradually increased their prices as the date drew closer - despite what was otherwise stiff competition (Rockoff, 2016). This pricing behavior was noted in Wineinger et al. (2019), and the subsequent drop-off in prices when the generic alternative became available has been discussed in the news media (Rao, 2020).

³⁴This mechanism is consistent with the difference-in-differences estimate in the robustness section.

³⁵A trigger strategy essentially threatens other players with a "worse" action if they deviate from an implicitly agreed action profile.

³⁶IRAP v. State of Oklahoma, ex rel., Alcoholic Beverage Laws Enforcement Commission, 2020 OK 5.

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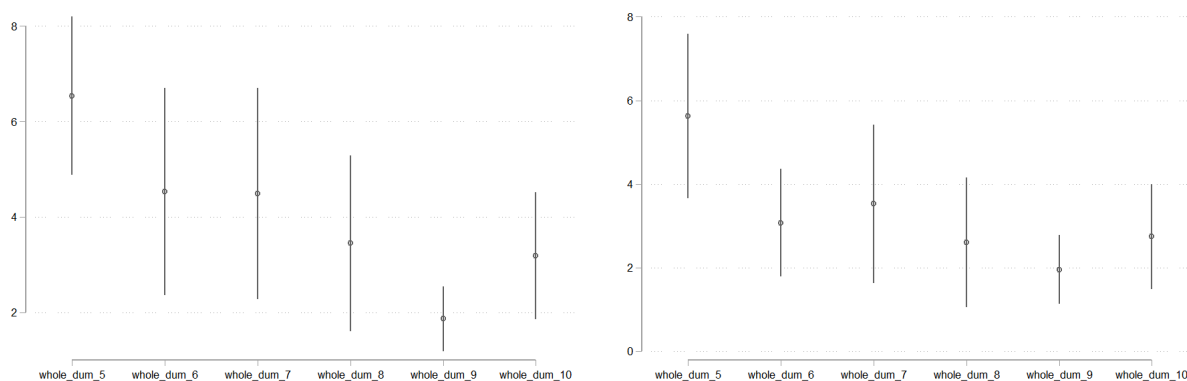
A1 Appendix

Here, we briefly discuss the competitive effects that the amount of wholesalers present in the market have on average markups. It is natural to expect that more firms participating in the market will result in lower average markups. We consistently find evidence that this in fact the case. However, there is a branch of the established literature that documents how these effects may be non-linear. In other words, that there may be threshold effects with the presence of additional competitors in the market. For example, Xiao and Orazem (2011) show how the presence of a fourth competitor effects competitive behavior. Here, we investigate if this is true for the firms involved in the wholesale alcohol distribution market in Oklahoma.

At the time of the vote there were 6 wholesalers participating in the market. Just a few periods later, there were 7 participants. In the post-vote period the lowest amount of participants is 5, though this only persisted for one period and immediately returned to 7 participants. Prior to the vote, the maximum amount of wholesalers present in the market was 11 and the lowest amount was 6.

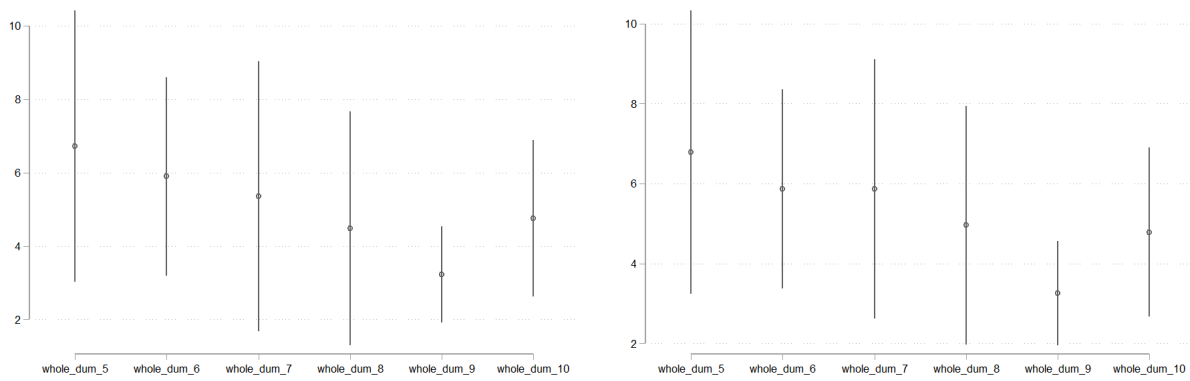
In this extension, we separately estimate the average markup by the amount of wholesalers in the market. To do this, we include a dummy variable that is equal to one when a certain amount of wholesalers are present in the market.³⁷ For example, the variable $Whole_dum_5 = 1$ when there are five wholesalers present.

Figure A1: Wholesaler Counts - Spirits (left); Cordials (right)



³⁷The variable *Wholesalers* is dropped from prior specifications and the dummy variables are included in its place.

Figure A2: Wholesaler Counts - Imported Wine (left); Dom. Wine (right)



Figures A1 and A2 show how the presence of additional wholesalers affects markups at the margin. For spirits and cordials, there appears to be nonlinear effects, though the difference between any two consecutive levels is not statistically significant (e.g. five wholesalers compared to six). For wines, this pattern continues - we can see that the incremental presence of new wholesalers does not dramatically alter markups, but that the point estimate gradually decreases as the amount of participants increases. Taken on the whole, it is easy to see that the presence of more wholesalers reduces markups.