Wholesale to Retail Margins in Cannabis Products

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Abstract

Cannabis is highly taxed and regulated, and as a result, cannabis sold through the licensed segment has higher prices than illegal cannabis. While more research on cannabis is being done than a few years ago, relatively little is known about the structure of the cannabis industry and the evolution of this structure under various sets of taxation and regulation scenarios which are present among the states where cannabis is legal. In this paper we examine wholesale to retail margins for legal cannabis products. We compare wholesale to retail margins of cannabis products by geographic location and evaluate the markups by price segment of cannabis products. To our knowledge, ours is the first analysis of the wholesale-to-retail markups for legal cannabis.

Introduction

Cannabis has become a major commodity in much of North America, and is one of the most highly taxed and regulated agricultural products. In places where cannabis has been legalized, some consumers are allowed to possess cannabis, but legal restrictions and licensing requirements, as well as taxes in several forms and several stages of the supply chain, are imposed on producers and distributors of cannabis products (Goldstein and Sumner 2022a). As a result, cannabis sold through the licensed segment has higher prices and is in places is less available than illegal cannabis, and the illegal segment still comprises a significant share of cannabis sold (Goldstein and Sumner 2022b, Hart et al. 2023). While more research on cannabis is being done than a few years ago, relatively little is known about the structure of the cannabis industry and the evolution of this structure under various sets of taxation and regulation scenarios which are present among the states where cannabis is legal.

In this paper we examine marketing margins for legal cannabis products. We compare marketing margins of cannabis products by geographic location and examine the marketing margins of dried flower products. To our knowledge, ours is the first analysis of the wholesale-to-retail markups for legal cannabis.

Wholesale and retail markups are assumed to be percentage margins applied to wholesale or retail prices. Marketing margins for agricultural commodities are typically modeled as a combination of percentage and absolute margin (Wohlgenant 2001). Marketing margins for cannabis have been modeled in percentage terms in previous work (Sumner et al. 2020). The results of our study will contribute to the discussion of how to appropriately model margins for cannabis products, which is essential to modeling the effects of policy on cannabis markets.

Data and Methodology

We use several high-resolution datasets from the California Metrc (track and trace) database. The database contains all transactions among licensed cannabis businesses in California, including records of harvest, shipments to and from manufacturers of cannabis products, shipments of cannabis products to retailers, testing records for cannabis products, and, finally, retail sales of cannabis products to consumers. Each transaction of cannabis products is identified by a unique package code and by using these codes we were able to assemble a dataset that included wholesale prices paid by retailers for a package of cannabis product and retail prices paid by consumers for the same package of cannabis product, as well as THC content for the same package of cannabis product from a licensed cannabis testing laboratory. Our data covers the period of January 2020 through December 2021, and we are able to identify individual retail stores (as well as delivery only retail operators) and their location. This unique high-resolution dataset allows us to directly calculate the margin between the price paid by the retailer and the price received by the retailer for the same package of cannabis product. We begin our analysis with transactions that include 1/8 ounce packages of dried flower (3.5grams). These types of packages, commonly called "eighths," are the most commonly purchased cannabis product by consumers. The dataset we use for analysis in this paper is a subset of the Metrc data on all retail transactions of cannabis products and includes a total of over 38 million transactions of retail sales of 1/8 ounce packages of flower to consumers in California. We use these data to directly estimate the wholesale to retail margins for each transaction.

Finally, we use detailed data on characteristics of cannabis licenses and taxes and regulations by state and in some cases down to local jurisdiction. Combining information on

licenses and regulations with the data on prices allows us to econometrically estimate the effect of selected taxes and regulations on price margins.

Wholesale Prices Paid and Retail Prices Received by Cannabis Retailers in California

In this paper we discuss wholesale to retail margins for the most common cannabis product sold to consumers: packages of 1/8 ounce of dried flower, commonly referred to as "eighths." We refer to the wholesale price paid by the retailer for a cannabis product as simply the "wholesale price," and to the retail price received by the retailer for the product as "retail price." Retail price is then exclusive of any taxes added at the retail stage. In contrast to the retail price discussed in this paper, price paid by the consumer for a retail product would also include state and local excise and sales taxes. We discuss these taxes in more detail later in this paper.

Figure 1 shows the average wholesale and retail prices in 2020 and 2021, the years covered by our data. The difference between the two prices is the wholesale to retail margin. The prices are shown over the dates of the retail sale, so the wholesale price does not reflect the average price paid by the retailer on those dates since product sold to the consumer may have been purchased by the retailer months ago. As is shown in the figure, the wholesale to retail margin in our data hovers around 100 percent for the 1/8 ounce packages of dried flower and we see a slight drop in average prices of cannabis over the time period covered by our data.

Figure 1: Wholesale Cannabis Prices Received by Licensed Growers in California and Wholesale to Retail Margin in 1/8 Ounce Packages of Dried Flower.

The price paid by the consumer for an 1/8 ounce package of flower, or any other cannabis product, will also include a number of taxes and will be higher than the retail price received by the retailer. Cannabis products in California as of May 2023 are taxed as follows: an excise tax of 15% is applied to the gross receipts from the sale of a cannabis product before all other taxes but after any local cannabis business tax. Sales tax is then applied to the total of gross receipts, local tax, and excise tax (CDTFA 2023 https://www.cdtfa.ca.gov/industry/cannabis.htm#Retailers). During the period covered by our data, 2020, and 2021, the procedure for calculating taxes was as follows: an excise tax of 15% was applied to the wholesale price paid by the retailer, multiplied by a state-mandated markup of 1.75. Then a local tax was applied to the retail price that included excise tax, and the sales tax was applied to the retail price that included both excise and local taxes. An example of tax calculation prior to January 1, 2023, and as of January 1, 2023, is presented in Table 2.

Table 1: Calculation of Prices and Taxes for a Typical 1/8 Ounce Package of Dried Flower at Retail.

Local taxes on cannabis businesses generally vary by county and municipality and can range from zero to over 10 percent of gross sales. Sales taxes include the California state and county sales tax and so also vary by location. As a result, prices paid by consumers also vary quite a bit by location. Figure 2 shows a sample calculation of average taxes assessed on a package of 1/8 ounce of dried flower in five counties in California. Taxes in Figure 2 are calculated using the pre-January 1, 2023 method. We use county-level local taxes on cannabis

businesses and do not include additional taxes that may be assessed on a municipal level, so the actual prices paid by consumers may be slightly higher than shown in the Figure.

Figure 2: Prices and Taxes Paid by Consumer for 1/8 Ounce Packages of Dried Cannabis Flower in Selected Counties

Figure 2 demonstrates how the effect of local taxes on the price paid by consumers may depend more on the local taxes than on the wholesale and retail prices of cannabis products. Alameda, Humboldt, and San Francisco counties at the time of this writing did not impose local excise taxes on cannabis businesses (in most municipalities). Wholesale and retail prices in San Francisco are similar to those in Los Angeles, but because of higher local taxes in Los Angeles, prices paid by consumers were several dollars higher per 1/8 ounce package of dried flower.

Wholesale to Retail Margins in Dried Flower Products

Next we examine the wholesale to retail margins applied to cannabis products based on wholesale price in order to determine whether margins differ by price category of cannabis product.

We use our data to estimate the following relationships:

$$R_{ij} = \beta_0 + \beta_1 W_{ij} + \beta_2 THC\%_i + \beta_3 MonthYear_j + \beta_4 RetailerID_j + \varepsilon_{ij} \quad (1)$$

In Equation 1, R_{ij} refers to the retail price of product i in retail transaction j, W_{ij} refers to the wholesale price of product i, $THC\%_i$ refers to the THC content of product i, $MonthYear_j$ is the month and year of retail transaction j, $RetailerID_j$ is the unique identifier of the retailer where retail transaction j took place, and ε_{ij} is the error term. We estimate this relationship both as a

linear regression and in logs to determine how retail price of product i depends on product characteristics such as THC content, as well as the wholesale price paid by the retailer for the product, and the date and location of the sale.

We also examine the determinants of wholesale to retail margin:

$$R_{ij} - W_{ij} = \beta_0 + \beta_1 W_{ij} + \beta_2 THC\%_i + \beta_3 MonthYear_j + \beta_4 RetailerID_j + \varepsilon_{ij} \quad (2)$$

And

$$\frac{R_{ij}}{W_{ij}} = \beta_0 + \beta_1 W_{ij} + \beta_2 THC\%_i + \beta_3 MonthYear_j + \beta_4 RetailerID_j + \varepsilon_{ij} \quad (3)$$

Equation 2 defines the wholesale to retail margin as a difference between the retail and wholesale price; and Equation 3 use the ratio of retail to wholesale price to estimate the relationship between the wholesale to retail margin and the characteristics of the retail transaction on the right-hand side.

We estimate each equation in linear and in log forms, and include quadratic values of explanatory variables where appropriate.

Table 2 shows the summary statistics for the key variables of interest in our data.

Table 2: Descriptive Statistics of the Sample Used for Statistical Analysis of Wholesale to Retail Margins in 1/8 Ounce Packages of Dried Flower

Our dataset includes over 13.5 million observations of retail transactions with packages of 1/8th flower sold to consumers in 2020, and over 24.9 million in 2021, for a total of over 38.4 million observations. Average retail price of a 1/8th in 2020 was $34.3, decreasing to $32.9 in 2021; at the same time, average wholesale price of a 1/8th sold by a retailer in 2020 was $17.2, decreasing

to $16.4 in 2021. It is important to note that our data includes dates a 1/8th was sold at retail to a consumer; not the dates the same 1/8th was purchased by the retailer. The average wholesale to retail margin defined as the difference between retail and wholesale prices, was $17.2 in 2020, and $16.5 in 2021. Defined as a ratio of retail to wholesale price, the average margin was 2.05 in 2020 and 2.08 in 2021, or, essentially, the retail price of a 1/8th received by the retailer was just slightly more than double the wholesale price that was paid for the same 1/8th by the retailer.

Results and Discussion

We estimate models in Equations (1), (2), and (3) in both linear and log forms and present the results in Table 3.

Table 3: Regression Analysis of Margins in 1/8 Ounce Packages of Dried Flower

As wholesale prices of cannabis increases, so does retail price. On average, each dollar increase in wholesale price increases the retail price by about $2, which translates to a markup of 100% (as shown in regressions (1) and (3)). In percentage terms, as wholesale price per 1/8th increases by 1%, retail prices increases by .66%, and markup increases by .52%. The coefficient on the squared wholesale price is significant and negative, which means that for packages of 1/8th that are more expensive at wholesale, the wholesale to retail margin decreases as the price increases.

We can observe how retail price and markup change as wholesale price changes from marginal effects shown in Figure 3. Panel (a) in Figure 3 shows marginal effects of wholesale price on retail prices from Regression (1) in Table 3. At lower values of the wholesale price, retail price is just over double the wholesale price; at the highest values of the wholesale price, retail price is

less than double the wholesale price. Panel (b) in Figure 3 shows marginal effects of wholesale price on the dollar margin per 1/8th (defined as the difference between retail and wholesale price). At lower values of the wholesale price, the dollar margin is almost double the wholesale price; at higher values of the wholesale price, the margin decreases to be below wholesale price. Finally, panel (c) in Figure 3 shows the marginal effects on the ratio of retail to wholesale price. At lower values of the wholesale price, the ratio of retail price to wholesale price is more than double; as the wholesale price approaches the mean value of about 16, the ratio of retail price to wholesale price is around 2, which translates to an average markup of 100%; and at the highest values of the wholesale price the ratio of retail to wholesale price bottoms out at around 1.85 and then starts increasing back towards 2. It is important to note that values of the wholesale price per 1/8th above $35 represent less than 1% of all observations.

Figure 3: Predictive Margins

Conclusion

In this paper we present a first analysis of wholesale to retail margins in cannabis products. The purpose of this analysis is to contribute to the discussion of how to appropriately model margins for cannabis products, which is essential to modeling the effects of policy on cannabis markets. The next steps would be extend this analysis to other types of cannabis products, specifically, manufactured products, and to econometrically evaluate the effect of tax changes on wholesale to retail margins.

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Figures and Tables

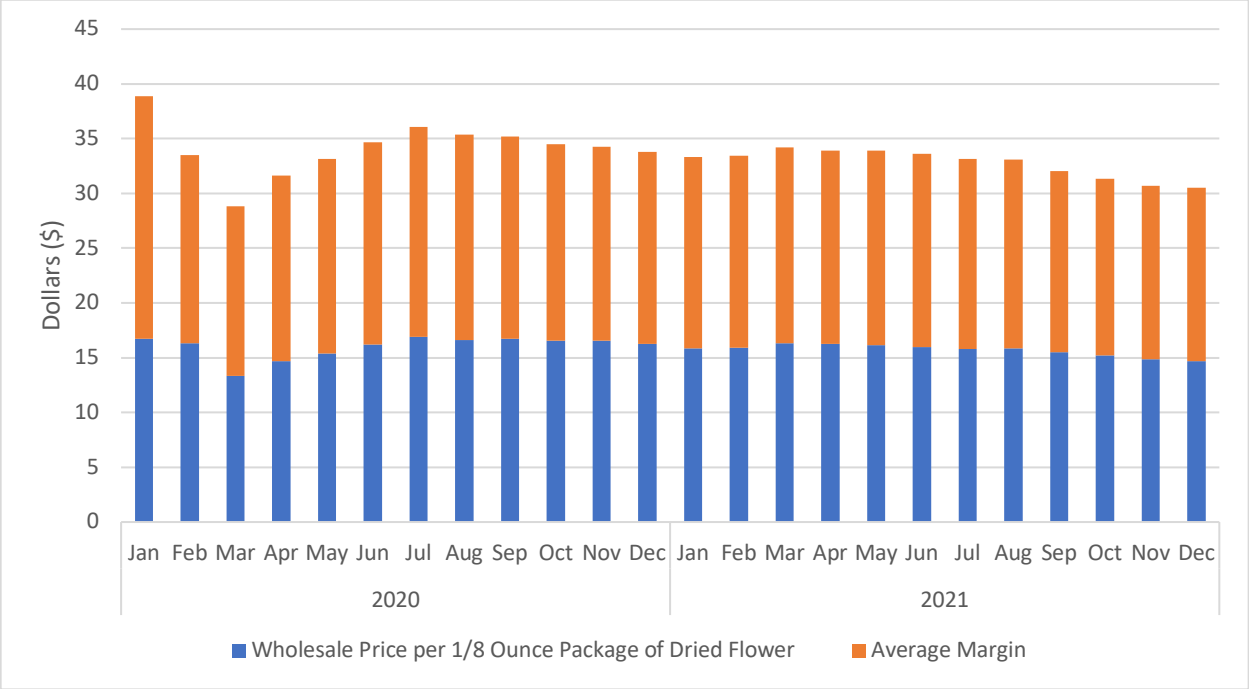


Figure 1. Wholesale Cannabis Prices Received by Licensed Growers in California and Wholesale to Retail Margin, Packages of 1/8 Ounce of Dried Flower.

Source: Author calculations based on data from Metrc.

Note: Dates are dates of retail sales of a package of 1/8 ounce of dried flower to the consumer. Wholesale prices are prices paid by the retailer for the same package and the date does not reflect the date of purchase of the package by the retailer.

Table 1: Example Calculation of Prices and Taxes for a Typical 1/8th Ounce Package of Dried Flower at Retail.

	Prior to January 1, 2023		As of January 1, 2023	
	$	*Calculation*	*$*	*Calculation*
Wholesale price	25		25	
Retail price (before all taxes)	50	Wholesale price plus retail markup	50	Wholesale price plus retail markup
Excise Tax	6.56	0.15 * 1.75 * wholesale price	8.25	0.15 * (retail price +local tax)
Local Tax	5	0.1 *retail price	5	0.1 *retail price
Sales Tax	5.08	0.0825 *retail price plus all other taxes	5.22	0.0825 *retail price plus all other taxes
Price consumers pay	66.64		68.47	

Source: CDTFA guide for calculating taxes for retailers.

https://www.cdtfa.ca.gov/industry/cannabis.htm#Retailers

Notes: Local tax is assumed to be 10% in this scenario. Actual local taxes vary by county and municipality. Sales tax includes state and county tax. County taxes also vary by county.

Wholesale to retail markup is assumed to be 100% in this scenario.

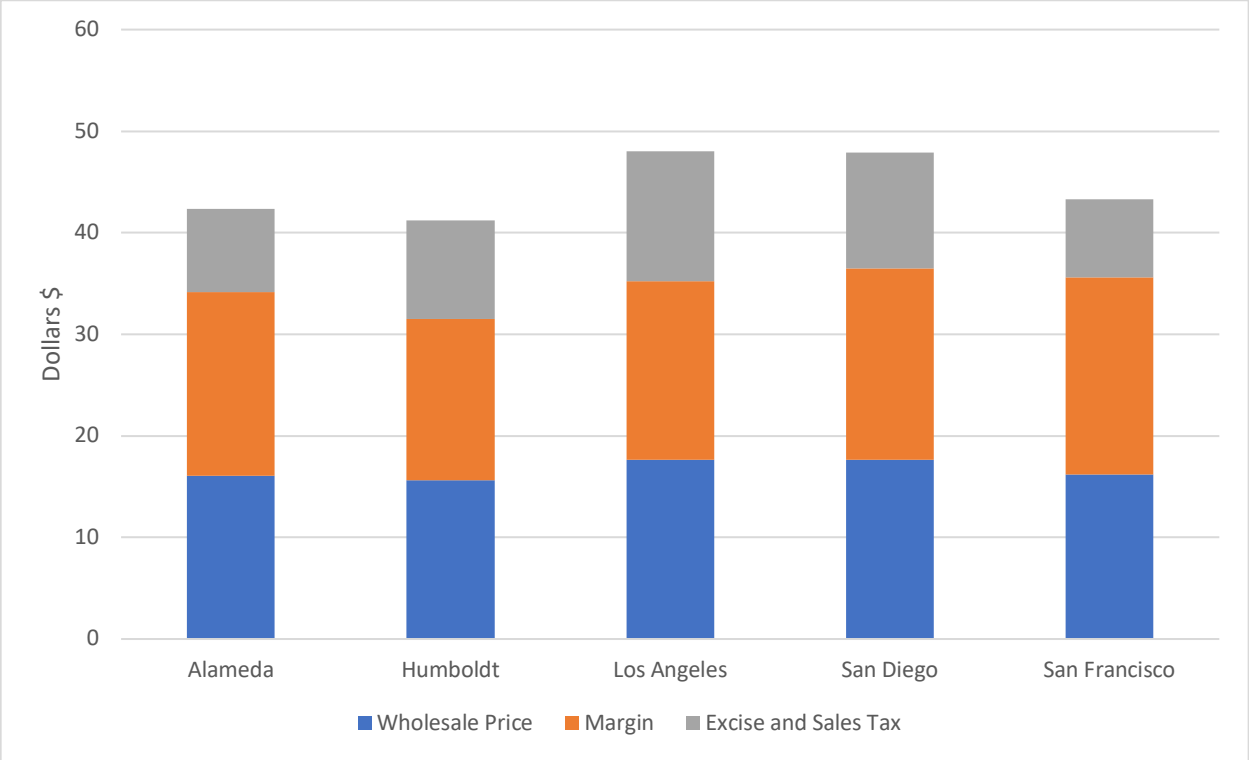


Figure 2: Average taxes paid by consumer for cannabis products by county

Source: author calculations based on Metrc data, CDTFA guidelines for cannabis businesses, and CDTFA data on sales taxes by county in 2021.

Notes: Additional taxes on cannabis businesses may be assessed by municipalities. We do not include those in our calculations and assume an average local tax by county.

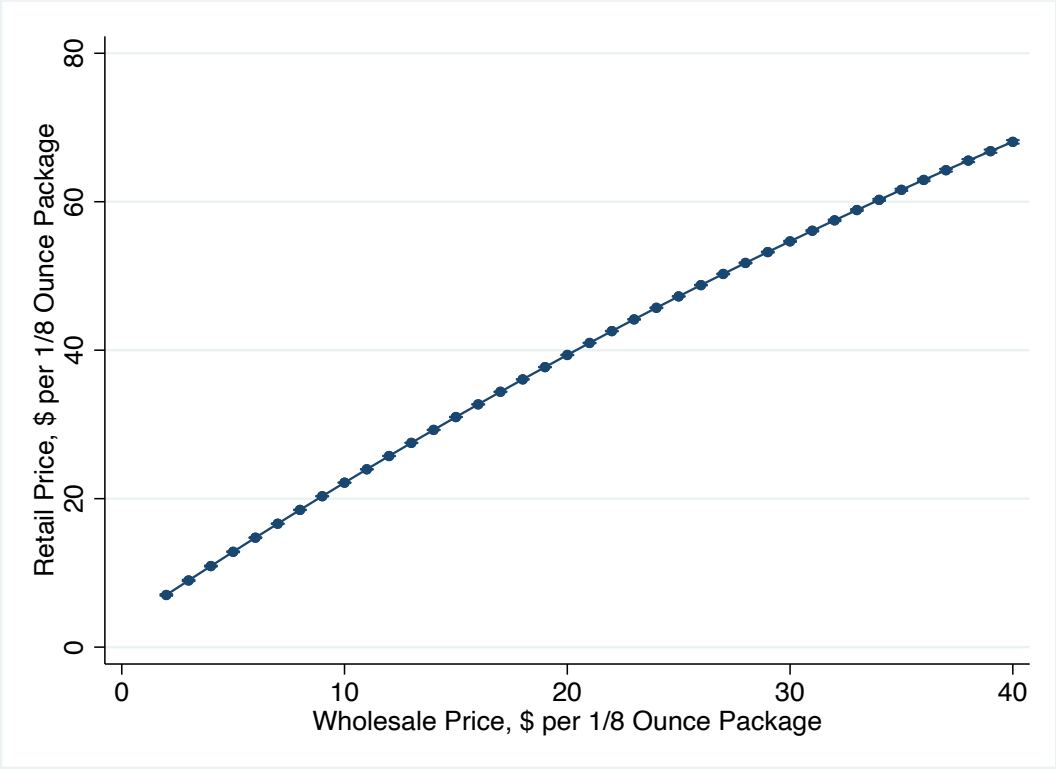
Table 2: Descriptive Statistics of the Sample Used for Statistical Analysis of Wholesale to Retail Margins in 1/8 Ounce Packages of Dried Flower

Variable	2020			2021			Total		
	N	mean	sd	N	mean	sd	N	mean	sd
		Dollars $			*Dollars $*				*Dollars $*
Retail Price	13.5 mln	34.36	13.58	24.9 mln	32.92	14.18	38.4 mln	33.43	13.9
Wholesale Price	13.5 mln	17.15	6.63	24.9 mln	16.41	7.32	38.4 mln	16.67	7.09
THC%	13.5 mln	23.85	5.99	24.9 mln	26.21	5.03	38.4 mln	16.76	8.91
Margin (Wholesale-Retail)	13.5 mln	17.21	8.93	24.9 mln	16.51	8.90	38.4 mln	16.76	8.91
Margin (Retail/Wholesale)	13.5 mln	2.05	0.48	24.9 mln	2.08	0.53	38.4 mln	2.07	0.52

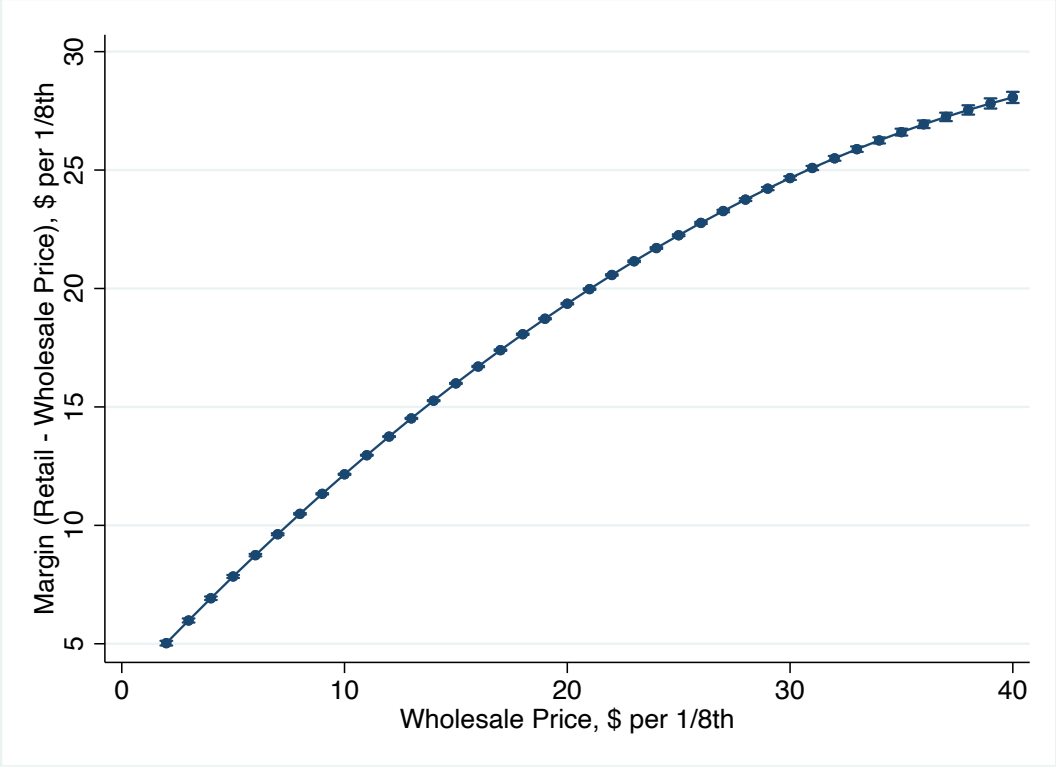
Source: calculated by the authors from Metrc data.

Table 3: Regression Analysis of Margins in 1/8 Ounce Packages of Dried Flower

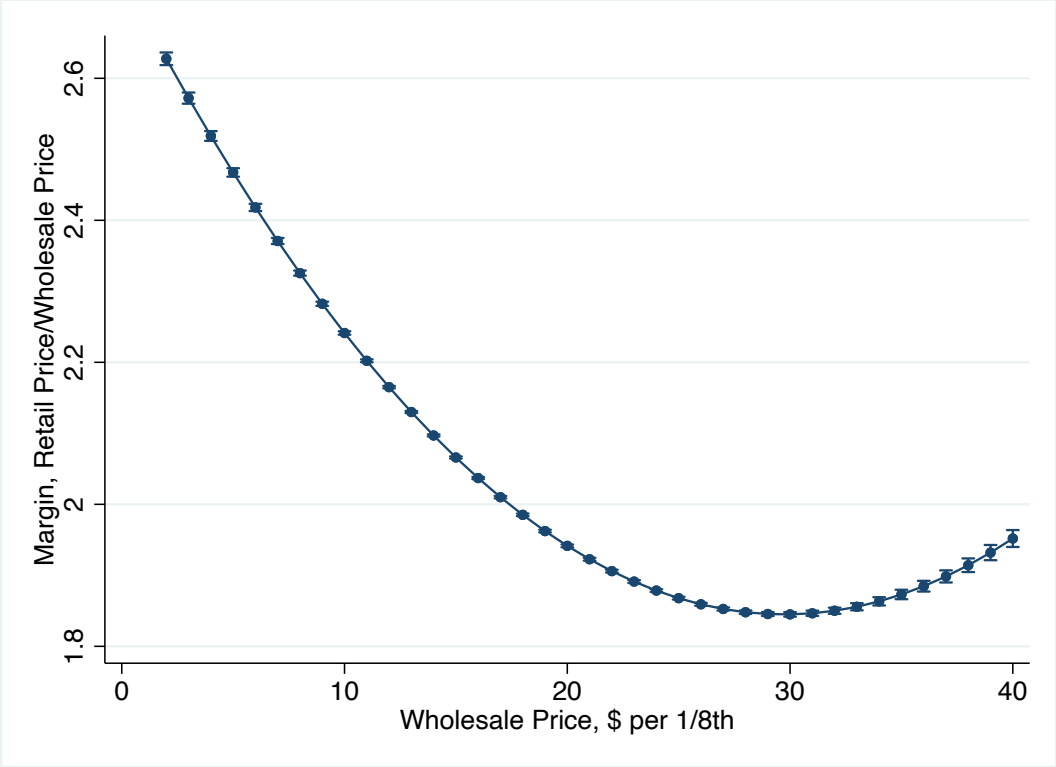
Variables	(1) Retail Price	(2) Log Retail Price	(3) Margin (R-W)	(4) Log (Margin R-W)	(5) Margin R/W	(6) Log Margin R/W
Wholesale Price	2.1056		1.1056		–0.0514	
s.e.	0.0009		0.0009		0.0001	
Wholesale Price Squared	–0.0122		(0.0122)		0.0008	
s.e.	0.0000		0.0000		0.0000	
Percent THC	0.1063	0.0035	0.1063	0.0085	0.0072	0.0035
s.e.	0.0002	0.0000	0.0002	0.0000	0.0000	0.0000
Log of Wholesale Price		0.6640		0.5157		–0.3360
s.e.		0.0009		0.0020		0.0009
Log of Wholesale Price Squared		0.0307		0.0186		0.0307
s.e.		0.0002		0.0004		0.0002
Constant	–1.3980	1.1767	(1.4002)	0.7472	2.1626	1.1767
s.e.	0.0895	0.0032	0.0898	0.0071	0.0074	0.0032
Month-Year FE	yes	yes	yes	yes	yes	yes
Retailer License FE	yes	yes	yes	yes	yes	yes
R-Squared	0.8395	0.8549	0.6045	0.5506	0.5084	0.5387
Number of Observations	38,250,971	38,250,971	38,250,971	38,250,971	38,250,971	38,250,971



a) Predictive margins with 95% CI from Regression (1) in Table 3



b) Predictive margins with 95% CI from Regression (3) in Table 3



c) Predictive margins with 95% CI from Regression (5) in Table 3

Figure 3: Predictive Margins