Stellenbosch 2023 Abstract Submission

Title
The value of potency in cannabis, wine, and spirits: A hedonic price approach

I want to submit an abstract for:
Conference Presentation

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Keywords
Hedonic, price, cannabis, wine, spirits, potency, distillation, retail prices, product characteristics, demand

Research Question
What is the role of potency in determining cannabis prices, and how does the price-THC potency relationship in cannabis compare to price-ABV potency relationships in wine and spirits?

Methods
We run hedonic regressions with a data set of 170 million cannabis flower and concentrate retail prices. Price is the dependent variable. Potency and other product characteristics are independent variables.

Results
For cannabis, flower, wine, and distilled spirits, potency (THC or ABV) has a significant positive effect on price. However, for cannabis concentrates, we find no positive effect of potency.
Abstract
The value of potency in cannabis, wine, and spirits: A hedonic price approach

Introduction
The U.S. legal cannabis market is expanding rapidly, but to date, no published research has examined the effects of cannabis potency and other product characteristics on prices, in part because of the unavailability of large-scale price data that include product characteristics. To fill this gap in the literature, we collected a large data set of about 170 million U.S. cannabis retail prices and product characteristics over a nine-month period. In this paper, we use the hedonic price method on these data to estimate implicit prices of cannabis characteristics such as potency, concentration method, and plant species. We observe considerable differences between cannabis flower and cannabis concentrates in the effect of THC potency on price.

Data
Over a 41-week time period from April 11, 2022, to January 16, 2023, we collected a data set of about 170 million cannabis retail prices at about 7,500 stores in 30 U.S. states that were listed on Weedmaps, the leading online retail listing and e-commerce website. A majority of legal cannabis retailers in many U.S. states maintain Weedmaps listings, and much of the existing literature on U.S. cannabis prices uses Weedmaps data (Goldstein et al., 2020).

We narrowed the 30 states from our initial data set to 23 states with at least 1,000 total price observations (including flower and concentrates) from at least 5 different stores in each state. The total data set for our hedonic price analysis was about 18.5 million price observations.

Retailers list prices for a variety of cannabis products, including standard flower packages, oil cartridges, and other products. Listings include a variety of product characteristics (including, for some, product and strain names, THC potency, and plant species), as well as retailer characteristics (including location and storefront vs. delivery-only).

Method
The hedonic price method, pioneered by Rosen (1974), aims to estimate implicit prices for the individual “utility-bearing attributes or characteristics” of products. Typically, implicit prices are estimated from a regression of price on a vector of objective characteristics, using data that include a variety of different combinations of characteristics that correspond to different prices.

The hedonic method has been used to estimate the value of wine characteristics (e.g. Gustafson et al., 2016; Nerlove et al., 1995), but has never been applied to cannabis data. We use the hedonic price method by regressing price on cannabis product characteristics to estimate implicit price values of each characteristic in a variety of retail products and package types.

We construct separate hedonic price models for flower, concentrates, and several sub-categories of concentrates. Prices and log prices are the dependent variables, and a vector of product characteristics are used as the right-hand-side variables.

We test several model specifications, including store- or state-level fixed effects to control for spatial variation, and weekly fixed effects or time trends of varying degrees to control for temporal variation. One of our primary variables of interest is THC content, roughly analogous to (but, as we find, also quite different from) alcohol content in wine, beer, and spirits. We include versions with THC and product characteristic interaction variables to examine heterogeneity in the THC-price relationship across distinct product segments. We run separate hedonic regressions on prices of cannabis flower and cannabis concentrates, and we compare the two.

Results
We report summary statistics and results with regression tables showing statistically significant coefficients for a variety of product characteristics, including state, package size, THC content, store type (delivery or storefront), and species (sativa, indica, or hybrid). We control for falling prices (negative time-lag almost monotonically decreasing over time) across all product categories over the 41-week data collection period.

Flower and concentrate product characteristics differ in important ways. Cannabis flower is sold in raw smokable
Form, processed only by trimming, curing, and packaging. Strains and plant species differ between flower products, but those differences can only be perceived through information on the label. Concentrates vary more in their physical characteristics. Common concentrate products include liquid oil in cartridges or disposable vape pens, and sugar-like resin and butter-like rosin that are consumed by dabbing. Some are nearly pure THC distillates, while others are “live,” “whole-plant,” or “full-spectrum” extracts that contain more terpenes and other cannabinoids in addition to THC.

For flower, we find that THC potency has the biggest effect on price of any characteristic. We find that for a one-eighth-ounce package (the most common flower format), an increase of 1% THC (about a 3.9% increase in potency, for an average product) increases price by about 78 cents (about a 2.2% increase). In concentrates, however, we find that higher THC potency is not associated with higher prices. Instead, specialty methods of extraction (“live,” “rosin,” and “resin”), are the main drivers of retail value in concentrates; and higher THC potencies are actually associated with slightly lower prices for concentrate products.

Discussion

The dissociation of the price-THC potency relationship between the two main forms of cannabis has not been observed in previous literature, and is unique in the context of other agricultural markets like wine and other alcoholic beverages, where farm products that are also marketed in raw forms (e.g. table grapes) are concentrated and distilled into products (wine, brandy, cha cha, etc.) with a wide range of potency. In the high-potency alcohol market, unlike in the high-potency cannabis market, consumers do pay more for even higher potency. A 750 ml bottle of 190 proof (95%) neutral grain alcohol (e.g. Everclear) typically sells at a 10-15% retail price premium over the 151 proof (75.5%) version. A similar relationship holds for non-ingestible rubbing alcohol prices.

Why does the price-potency relationship disappear or even invert in the cannabis concentrate category? We conclude by discussing some unique aspects of cannabis that could explain these phenomena, including consumer information gaps, regulatory and tax structures, and unusual allocation of labor and capital resources in production.

References


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