Private Labels and Bargaining in the Supply Chain: The Case of Wine

(Incomplete and Preliminary Draft)

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Abstract

I estimate the role of private label products on vertical (manufacturer-retailer) relationships and welfare. In particular, I study to what extent retailers use private label products to improve their bargaining position with manufacturers. I propose a new model of bargaining in the vertical channel where players negotiate bilaterally over both wholesale and retail prices. I estimate this model using data on domestic wine sales in the US in 2015 and supplementary data on prices from alcohol control states. I show that wholesale prices and bargaining parameters can be identified with these two datasets. On average, I find that bargaining power and the resulting split of channel profits are roughly even between retailers and manufacturers. I find that offering a PL improves retailer bargaining position, increasing profit earned on national brands by 10.83% compared to a no-private label scenario. I compare the conclusions from my model to those of other prominent models of the vertical channel, showing that my model produces more realistic results. JEL Codes: L1, L81, M31

Keywords: private labels, bargaining, vertical relationships

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Introduction

Private labels (PLs), or store brands, have become more popular with consumers in recent years. Usually associated with providing good value, private label products are also becoming associated with higher quality than in the past. Major retailers, including Walmart (Great Value brand) and Amazon (Amazon Basics brand), offer a wide range of private label products across multiple categories. As a result, researchers note that retailers might be using private labels in a strategic manner when dealing with national brand (NB) manufacturers (Meza & Sudhir, 2010; Ailawadi & Harlam, 2004; Draganska, Klapper & Villas-Boas, 2010). At the same time, competition authorities have pointed out potential efficiency issues with private labels, particularly that they might grant too much power to retailers in negotiations with manufacturers (Doyle & Murgatroyd, 2011). These observations lead to the following questions: does having a PL increase bargaining power of retailers vis-à-vis manufacturers, and if so by how much? And how do PLs affect overall welfare and its distribution among consumers, retailers and manufacturers?

I answer these questions in this paper. In particular, I study to what extent retailers use private labels to improve their bargaining outcomes with national brand manufacturers in the specific case of the US domestic wine market. Although wine might not be the first market that one considers when thinking about private labels, a few major retailers have begun to offer private label wines in recent years. I study the US domestic wine market because there are only a few major domestic wineries, which makes the bargaining game tractable. In addition, by studying wine I am able to leverage data from alcohol control states when estimating the bargaining model. These estimates will allow me to answer the research questions posed above, which will show whether there is a role for public policy in this market. Specifically, in the current environment of retail consolidation (Amazon and Whole Foods, e.g.), it is important for antitrust authorities to understand how a private label can increase a retailer's bargaining position when judging potential mergers.

In terms of methodology, I develop a theoretical model of bargaining between retailers and manufacturers. Each retailer and manufacturer negotiates over the wholesale price and retail price of that manufacturer's products. Previous retail bargaining work assumes that the parties can only negotiate over the wholesale price, but this assumption is lacking. In particular, the wholesale-only bargaining model assumes that upstream and downstream firms cannot contract over downstream prices, yet it also assumes that retailers cannot adjust prices if there is breakdown in bargaining, a seeming contradiction. I show that both sides can achieve higher profits in partial equilibrium by coordinating over retail and wholesale prices rather than only wholesale prices, so it stands to reason that if there are no legal barriers to this arrangement, then the two-price contract is superior to the one-price contract. As it turns out, these vertical contracts are not illegal *per se* in the US as outlined in the Supreme Court ruling *Leegin Creative Leather Products* (2007), and retailers and manufacturers often agree upon retail prices via a suggested retail price, or MSRP. While not legally binding à la resale price maintenance, it still represents a form of retail price coordination within the vertical channel. From the econometrician's perspective, I show that the cost of allowing for retail and wholesale price bargaining is that one needs to observe either wholesale prices or marginal costs to identify the parameters of the model, whereas wholesale price bargaining does not require this data for identification.

The profits earned by retailers and manufacturers in this model depend primarily on two aspects: bargaining power, which captures some notion of negotiating skill, and bargaining position, which is defined as the outside option that each side has if negotiations break down. PLs affect the outside option: a profitable PL makes the retailer less dependent on the NB, and thus the retailer improves its bargaining position.

I use data on product sales and retail prices to estimate the model. I do not observe wholesale prices in the retail scanner data, so as part of my identification strategy, I use wholesale price data from alcohol control states for the same set of products in order to estimate marginal costs of production. With these marginal cost estimates, I show that I am able to estimate the negotiated wholesale prices between retailers and manufacturers in non-alcohol control states and the bargaining power parameters. I am unaware of other work which uses data on a common set of products whose prices are negotiated by a different entity in estimation. On average, I find that both bargaining power and the share of profit going to each side is roughly evenly split between retailers and manufacturers. However, smaller manufacturers tend to receive a smaller share of channel profit.

I use the estimates to evaluate profits and welfare in two counterfactual scenarios. First, I treat PLs as NBs in order to isolate the effect of PLs on pricing, profits and consumer welfare. I find that the retailer which offers the private label earns on average 10.83% higher profit on its NB sales than in the no-PL scenario and consumer surplus is on average 4.5% higher compared to the no-PL scenario. The increase in consumer surplus is due to lower average prices on NBs. However, competing retailers and manufacturers are harmed by the PL to varying degrees. CALCULATE TOTAL CHANGE IN WELFARE TO MAKE FINAL CONCLUSION. In a second counterfactual, I show how PLs affect merger analysis. Finally, I compare estimated market outcomes from my model to models that ignore the vertical channel (Nevo, 2000), linear pricing upstream and downstream (classic double marginalization), and wholesale-bargaining only (Draganska, Klapper & Villas-Boas, 2010). I show that conclusions differ significantly based on the chosen supply-side model, and that my model better fits some anecdotal evidence from the industry.

The paper proceeds as follows: chapter 1 is the literature review, chapter 2 is a description of the mass-market wine industry, chapter 3 outlines the theoretical model, chapter 4 outlines the empirical model, chapter 5 discusses identification, chapter 6 outlines data, chapter 7 contains estimation results chapter 8 contains counterfactual results and chatper 9 covers comparisons to other supply-side models.

Literature Review

There is a growing literature in economics which uses Nash bargaining to model negotiations within the vertical supply chain. Crawford and Yurukoglu (2012) study welfare effects of bundling versus a la carte pricing in the cable television market, where content producers and distributors bargain over input costs. Grennan (2013) studies price discrimination in the market for coronary stents, where hospitals and stent producers baragin over the price of stents. Finally, Ho and Lee (2017) study the effects of insurer competition on premiums, welfare and negotiated medical prices by modeling bargaining between both employers and insurers *and* insurers and hospitals. These papers have shown that Nash bargaining can be used in empirical work to model complicated vertical structures.

However, most studies on how private labels affect vertical relationships come from the marketing literature. Meza and Sudhir (2010) use a linear pricing model to show that a monopolist retailer obtains lower wholesale prices after PL introduction. They claim that this reduction is due to increased retailer bargaining power, but do not model bargaining explicitly. Draganska, Klapper, and Villas-Boas (2010) estimate a model of bargaining over wholesale prices. Retailers and manufacturers choose wholesale prices to solve the Nash bargaining problem, and there is Nash-Bertrand competition among retailers. They find that retailer bargaining power is positively correlated with higher quality PL offerings (measured by the ratio of the price of the PL good to an average of NB goods in the category). Ellickson, Kong, and Lovett (WP) use the previous model but apply it to a setting with exogenous private label introduction to identify the effects of private label entry on market outcomes. Their setting is the introduction of private label K-cups, which entered the disposable cup coffee market after Keurig's patent expired. They find that offering a PL increases retailer profits, and that the net benefits from bargaining (increased margins on NB goods minus cannibalization of NB sales) account for 20% of the increase in retail profits due to PL introduction. However, these studies allow for a low degree of coordination in the vertical channel (and in the case of Meza and Sudhir (2010), no coordination).

On the contrary, there is empirical evidence supporting the use of complex contracts, and thus channel coordination, in the grocery industry. Villas-Boas (2007) compares various vertical pricing models using yogurt sales data. Using a non-nested model test, she finds little evidence of linear pricing (and thus double marginalization) in the vertical channel. In a similar vein, Bonnet and Dubois (2010) use French bottled water sales data to test different vertical supply models. They find that two-part tariffs with resale price maintenance contracts best fit the data. These results show that there is large degree of channel coordination in the grocery industry. However, they can only conclude that two-part tariff models best fit their data compared to the other tested models. The institutional reality is that firms do not use two-part tariffs in the grocery industry, so these studies are likely picking up on a degree of channel coordination but attributing it to the wrong form of contract. The contracts in my model fit the reality of the industry better than the two-part tariffs proposed in these papers.

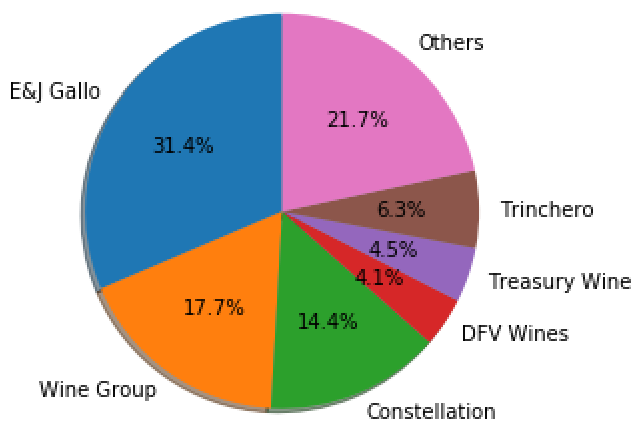
There is also a growing literature studying liquor pricing in alcohol control states. Miravete, Siem and Thurk (WP) investigate the welfare implications of fixed markup rules in Pennsylvania distilled liquor pricing. Before 2017, Pennsylvania law required its state alcohol commission to charge fixed retail markups over wholesale price. They therefore estimate a model of Nash-Bertrand wholesale pricing among alcohol manufacturers, treating the state as a passive entity. In their counterfactuals, they allow Pennsylvania to choose different markups across products after manufacturers choose wholesale prices, making it a sequential pricing game without bargaining. At least before 2016, all alcohol control states allowed manufacturers to quote prices and the state could only approve or disapprove, which validates using Nash-Bertrand pricing. I extend their work to the wine market.

Industry Description

Manufacturers

US wine sales totaled over $13 billion in 2015, with domestic wine sales totaling about $9.5 billion (Wine Business Monthly, 2015). However, most of these sales are made on value bottles (less than $15) produced by large wineries: although there were 9,654 US wineries in 2018, the top 50 wineries by volume sales account for over 90% of those sales (Wine Business Monthly, 2018). Figure 1 shows the global market share of the top ten California producers [1]. In some cases, these wineries own large, diverse portfolios of wine labels which have only grown in recent years due to acquisitions (Wine Business Monthly, 2018).

Figure 1: Top CA Wine Producers by Global Market Share, 2017



Source: Wine Business Monthly

[1] California is by far the largest wine producer in the US, supplying around 90% of gallons produced (http://wineamerica.org). However, there are wines in my data produced in Washington and Oregon as well.

These large wineries' top-selling products are often value labels, which are mass-produced and sell for reasonable prices. These wines are differentiated from more expensive wines for two key reasons: inputs and economies of scale. The key inputs to winemaking are grapes and barrels for aging. Value wines often do not have a specific appellation, or vineyard location, apart from general terms such as California, while expensive wines often have region-specific appellations (Napa Valley, e.g.) or even estate-specific. In many cases, value wines will source grapes from multiple large vineyards in cheaper growing regions, such as Lodi in California. The second key input is barrels, which are used for aging the wine. Value wines are now often aged in stainless steel tanks rather than oak barrels, which are significantly cheaper. Large winemakers can infuse wood chips and oxygen into the wine when aging in steel tanks to impart organic flavor. Finally, large winemakers benefit from economies of scale in production compared to expensive boutique vineyards (Sellers & Alampi-Sottini, 2016).

As for profit figures, an industry survey performed by Moss Adams, LLP revealed that US wineries had an average gross profit margin (percentage markup over cost) of 51% (Moss Adams, 2013). I use this figure as a benchmark when assessing model estimates.

Retailers

Wine is sold through supermarkets and mass-market retailers in 35 states. According to Nielsen, there are almost 30,000 grocery stores which sell wine as of December 2014, and these stores accounted for about 42% of total off-premise wine sales that year (Nielsen, 2015). While in the past large retailers might have only offered a few value labels, retailers are now rapidly expanding their wine offerings to cater to many price points: Nielsen says that the average supermarket sells around 360 different wine products in a week (Nielsen, 2015). Retailers are keen to offer well-stocked wine aisles due to its complementarity with purchases in other departments: on average, consumers spend an

Figure 2: Notable Private Label Wines

Retailer	**PL Brands**
Costco	Kirkland
Target	Wine Cube, California Roots
Trader Joe's	Charles Shaw
Whole Foods	Animist, Criterion, Wine Farmer, Songbird Cellar
Kroger	Acronym, Parker's Estate
Sam's Club	Member's Mark
Aldi	Broken Clouds, 30 Miles

Source: IBWSS

extra $13 on other groceries when purchasing a bottle of wine (Nielsen, 2015).

Another recent trend in grocery retail is the growth of private label wine. Private label wines began appearing on store shelves around 2003 with the launches of Costco's Kirkland label, Target's Wine Cube and Trader Joe's Charles Shaw (Wallace, 2017). Now, many retailers offer private label wines which are either "linked" to the retailer's name, such as Kirkland at Costco, or "de-linked" from the retailer's name, such as Acronym at Kroger or Animist at Whole Foods (Wallace, 2017). Figure 2 contains a list of major retailers and their associated private label wines.

Complexities

There are two complexities in the wine market which I do not address in this study: distributors and PL producers. The majority of wine sold in the US passes through the "three-tier" distribution system, in which dedicated distributors act as the middleman between wineries and retailers. This is a holdover from post-Prohibition Era when states decided that this system would make it easier to regulate and tax alcohol. Currently, distributors are either private companies or state monopolies in every state except Washington, which ended its *de jure* three-tier system in 2011. While recognizing this layer exists in the supply chain, I ignore this layer in the vertical channel. This simplification is justified because I focus only on large retailers and wineries in this study, which both likely have high degrees of bargaining power with distributors.

The second complexity I do not address in this study is the identity of the PL wineries. Many PL wines are either produced by other NB wineries or dedicated PL wineries. However, in this study I treat PL wines as being directly owned by the associated retailer (that is, retailers are vertically integrated with their PL wineries). First, in many cases it is difficult to determine the winery that produces the PL. Second, this assumption allows me to estimate the bargaining game without having marginal cost data for the PL. I show in the Estimation section how I need marginal cost data to estimate the model for NBs, but assuming the retailer owns the PL means that wholesale price is equal to marginal cost. Finally, there is no reason why retailers must source their PL from a particular manufacturer, so it stands to reason that retailers have higher bargaining power when negotiating prices for PL products.

Model

I outline a general model of the bargaining game between any number of retailers and national brand manufacturers. Let i index a product, where each product belongs to a manufacturer-retailer pair. Let R be the set of retailers and M be the set of manufacturers. Let G_r be the set of all products offered by retailer r and H_m be the set of products produced by manufacturer m. Denote the retail price of product i as p_i, wholesale price w_i, and unit cost c_i. I assume the retailer is vertically integrated with its private label producer, and the rest of the network is exogenous. On the supply side, the retailer solves the Nash bargaining game with each manufacturer independently for each product offered by that manufacturer, choosing a wholesale and retail price for the particular product. Demand for products is then realized in both cases.

Demand

Consumers pick the product in the market that gives them the greatest utility, where the indirect utility for consumer n from purchasing product j is denoted $V_{jn}(\epsilon_{jn})$, where ϵ_{jn} is a heterogeneous, unobserved match value distributed $F(\epsilon)$. Consumers also have the outside option of no purchase, in which case they receive utility $V_{0n} = \epsilon_{0n}$.

Expected demand for product j is then $D_j = \int_\epsilon Pr(V_{jn} > V_{kn} \forall k \neq j) dF(\epsilon_n)$. In the empirical application, I will assume ϵ is distributed Type 1 Extreme Value, thus leading to a closed-form expression for D_j. I also need to define demand in case negotiations break down over product i. I assume that in this counterfactual case, product i is removed from the retailer and no other changes take place. Then, demand for product j is $D_j^{(-i)} = \int_\epsilon Pr(V_{jn} > V_{kn} \forall k \neq \{j, i\}) dF(\epsilon_n)$. As a result of this demand specification, $D_j^{(-i)} \geq D_j$, that is, expected demand for product j cannot decrease when product i is removed from the network. Note that $D_i^{(-i)} = 0$ since i is removed in case of disagreement.

Retail and Wholesale Price Bargaining with the Private Retailer

In the supply-side game, retailers negotiate independently and bilaterally with each manufacturer over the wholesale price w_i and retail price p_i for product $i \in G_r \cap H_m$ given prices for all other products. I model the negotiation process using Nash bargaining, which maximizes the weighted joint surplus of the two parties. Retailer surplus is the difference in retailer profits when offering all goods versus removing product i. Let $\Pi_r = \sum_{j \in G_r} D_j(p_j - w_j)$ be retailer r's profits when all products are offered. If there is a disagreement in negotiations over product i, then the retailer's profit is $\Pi_r^{(-i)} = \sum_{j \in G_r} D_j^{(-i)}(p_j - w_j)$. I interpret $\Pi_R^{(-i)}$ as the retailer's outside option. Retail and wholesale prices are fixed in the disagreement case because I assume that prices for all other goods are fixed during negotiations with manufacturer m (called the passive beliefs assumption in the bargaining literature) [1]. Therefore, the retailer's surplus from offering product i is $\Pi_R - \Pi_R^{(-i)}$. In a similar manner, define manufacturer m's profit from selling its products as $\pi_m = \sum_{j \in H_m} D_j(w_j - c_j)$, and define the disagreement profit as $\pi_m^{(-i)} = \sum_{j \in H_m} D_j^{(-i)}(w_j - c_j)$. Therefore, manufacturer m's surplus from selling product i is $\pi_m - \pi_m^{(-i)}$

Given the surplus expressions defined above, retailer r and manufacturer m jointly pick w_i and p_i to solve the following problem:

$$\max_{p_i, w_i} \left[\Pi_r - \Pi_r^{(-i)}\right]^{\lambda_{rm}} \left[\pi_m - \pi_m^{(-i)}\right]^{1-\lambda_{rm}}. \tag{1}$$

λ_{rm} is the retailer r's exogenous relative bargaining power with manufacturer m and is common across all negotiations between the two parties. Bargaining power captures all unmodeled aspects of bargaining [2]. λ can take values between 0 and 1. When $\lambda_S = 0.5$, the parties have equal bargaining power. If the retailer has advantages over the manufacturer for reasons outside my model, then $\lambda_{rm} > 0.5$. The assumption that the retailer is vertically integrated with its PL is equivalent to setting $\lambda = 1$.

The first order conditions of the Nash bargaining game with respect to p_i and w_i are the following:

$$\sum_{j \in G_r \cap H_m} (p_j - c_j)\frac{\partial D_j}{\partial p_i} + \sum_{j \in G_r - H_m} (p_j - w_j)\frac{\partial D_j}{\partial p_i} + \sum_{j \in H_m - G_r} (w_j - c_j)\frac{\partial D_j}{\partial p_i} + D_i = 0 \tag{2}$$

$$(1 - \lambda_{rm})(\Pi_r - \Pi_r^{(-i)}) - \lambda_{rm}(\pi_m - \pi_m^{(-i)}) = 0. \tag{3}$$

[1] This assumption is logically consistent in a model of retail price and wholesale price bargaining because all other prices are specified by their contracts and cannot be adjusted unilaterally. This is in contrast to the wholesale-only bargaining model, which assumes passive beliefs but also assumes that retailers have the ability to change prices unilaterally.

[2] λ is capturing all aspects which affect the bargaining outcome apart from the outside option. This could include negotiation skill, patience, etc.

The retailer plays this game simultaneously with all other manufacturers and products[3]. For a private label product L, Equation 3 (FOC with respect to w) says that $w_L = c_L$ because $\lambda_{rL} = 1$ by assumption. This means that the retailer sets the integrated retail price for the private label. In equilibrium, p_i^* and w_i^* solve the first order conditions given that all other retail and wholesale prices are at their equilibrium values. This is the Nash-in-Nash equilibrium, which is a Nash equilibrium over simultaneous Nash bargaining games (refer to Ho and Lee (2017) for more information on the Nash-in-Nash equilibrium). To understand the properties of this problem better, note that the retail pricing first order condition is identical to the retail pricing first order condition when retailer r and manufacturer m are vertically integrated:

$$\max_{p_i} \sum_{j \in G_r \cap H_m} (p_j - c_j) D_j + \sum_{j \in G_r - H_m} (p_j - w_j) D_j + \sum_{j \in H_m - G_r} (w_j - c_j) D_j. \tag{4}$$

This game is not equivalent to one in which industry profit is maximized (i.e., the multiproduct monopolist problem) because there are externalities imposed on channel i from non-commonly owned products. However, holding all other contracts fixed, both parties would prefer to bargain over both retail price and wholesale price rather than just wholesale price (refer to the Appendix for the proof). Retailer r cares about its margins on products not produced by m, and m cares about its margins on products not sold by r. This makes the pricing game similar to a model of partial ownership. However, neither bargaining power nor bargaining position between the two sides explicitly enters the retail pricing first order conditions for product i. These variables only affect the split of channel profit and not the size of the pie in partial equilibrium. In general equilibrium, the bargaining powers related to products in the sets $G_r - H_m$ and $H_m - G_r$ affect retail pricing for product i since those wholesale prices enter the FOC.

To see precisely how wholesale price and bargaining power affect retail pricing, exam-

[3] I assume that the two sides can only negotiate over one product at a time, rather than negotiating a deal for all of manufacturer m's products simultaneously. I leave multiproduct negotiations for future work.

ine the retail pricing FOC in Equation 4 (I relabel this equation as F_p in the following analysis). The effect of increasing w_j on p_i depends on which set j belongs to. If $j \in G_r \cap H_m$, then there is no effect because the retailer and manufacturer act like the integrated monopolist for products in $G_r \cap H_m$. If $j \in G_r - H_m$, $\frac{\partial F_p}{\partial w_j} = -\frac{\partial D_j}{\partial p_i} < 0$ and p_i decreases. Intuitively, if retailer r is less profitable in channel j, then it wants to divert demand away from j by decreasing the retail price of product i. The reverse logic holds if $j \in H_m - G_r$; p_i increases because manufacturer m wants to divert demand towards productl j.

With regards to the effects of bargaining power on partial equilibrium outcomes, focus on the wholesale pricing FOC in Equation 3 (I relabel this equation as F_w in the following analysis). Again, the results depend on which set product i and j belong to. First. suppose $i, j \in G_r \cap H_m$. $\frac{\partial F_w}{\partial \lambda_{rm}} = -(\Pi_r - \Pi_r^{(-i)}) - (\pi_m - \pi_m^{(-i)}) < 0$ because surplus terms must be positive. Therefore, w_j decreases. However, changes in w_j do not affect p_i because both products belong to $G_r \cap H_m$. Therefore, λ only determines the split of channel profit in this case. Now, suppose λ_{rn} increases, where $n \neq m$. For product j produced by n, w_j decreases for same logic as above. From pricing statics results, since $j \in G_r - H_m$, p_i increases. Intuitively, if retailer r is able to drive a harder bargain with manufacturer n, then it is more profitable for r to divert demand to n's products at the expense of other manufacturers' products. Thus, r wants to set a higher retail price for product i produced by m. The reverse logic holds if λ_{qm} increases: if retailer q is able to drive a harder bargain with manufacturer m, then it is more profitable for m to divert demand to all other retailers at the expense of retailer q. Thus, m wants to set a lower retail price for product i sold at retailer r.

Finally, how does increasing other wholesale prices affect w_i? First, solve for w_i from

Equation 4:

$$w_i = \frac{1}{D_i}\Big[(1-\lambda_{rm})\big[\sum_{j\in G_r-\{i\}}(p_j-w_j)(D_j-D_j^{(-i)})\big]-\lambda_{rm}\big[\sum_{j\in H_m-\{i\}}(w_j-c_j)(D_j-D_j^{(-i)})\big]\Big]$$
$$+\lambda_{rm}c_i+(1-\lambda_{rm})p_i$$
$$= \frac{1}{D_i}\Big[(1-\lambda_{rm})A_r^{(-i)}-\lambda_{rm}B_m^{(-i)}\Big]+\lambda_{rm}c_i+(1-\lambda_{rm})p_i. \quad (5)$$

Consider $\frac{\partial w_i}{\partial w_j}$ for $j \in G_r \cap H_m$. Term A increases because $p_j - w_j > 0$ decreases and $D_j - D_j^{(-ir)} < 0$. Term B decreases because $w_j - c_j > 0$ increases and $D_j - D_j^{(-ir)} < 0$. Therefore, w_i increases. In fact, w_i is increasing in w_j when $j \in G_r - H_m$ or $j \in H_m - G_r$ by similar logic. Therefore, any increase in relevant wholesale prices (that is, any wholesale price that matters to either party) causes all negotiated wholesale prices to increase. Intuitively, a higher wholesale price either improves the manufacturer's outside option, hurts the retailer's outside option, or both.

Empirical Model and Estimation

I now adapt the general theoretical model to an empirical setting. I do not observe wholesale prices nor unit costs, one of which is necessary to estimating bargaining power parameters in this model. Instead, I use data from alcohol control states to obtain estimates of the marginal cost of production, c_j, since I observe the same set of products in both settings. I then show how I can estimate bargaining power parameters between manufacturers and retailers without observing wholesale prices but "observing" marginal production costs.

Marginal Cost Estimation using Alcohol Control State Data

Alcohol control states have little control over the retail pricing of wine due to fixed markup laws, so I model this market as Nash-Bertrand competition between wine vendors. First, I outline the demand model, which borrows heavily from Nevo (2001).

Consumer n has an indirect utility from purchasing product j in market t as follows:

$$V_{njt} = \beta X_j - \alpha p_{jt} + \xi_j + \xi_t + \Delta\xi_{jt} + \epsilon_{njt}. \quad (6)$$

X_j includes a constant and the wine rating and p_{jt} is the price. Following Nevo, I split the valuation of unobserved characteristics into two components: the product-specific compenent ξ_j, the market-specific component ξ_t and the market-level deviation from these mean valuations, $\Delta\xi_{jt}$. I control for ξ_j and ξ_t by including product and market fixed effects. However, $\Delta\xi_{jt}$ is endogenous to price assuming firms observe this value when pricing. I discuss how I address this endogeneity issue in the identification section. Finally, ϵ_{njt} is an idiosyncratic match value which I assume is distributed Type 1 Extreme Value. For now, the marginal utility of price α is constant across consumers, meaning the demand model is multinomial logit [4]. Berry (1994) shows that this model becomes a straightforward linear estimation problem:

$$\ln D_j - \ln D_0 = \beta X_j - \alpha p_{jt} + \xi_j + \xi_t + \Delta\xi_{jt}. \quad (7)$$

After estimating demand, I solve for equilibrium price-cost markups from the first order conditions of the wholesale pricing game. In alcohol control states, manufacturers submit their wholesale price offers to the state liquor boards, and if the state accepts the offer, the retail price is set by fixed markup laws. Specifically, manufacturer m in market t solves the following problem:

$$\max_{\bar{w}_{mt}} \sum_{j \in H_{mt}} (w_{jt} - c_{jt}) D_{jt}(p_{jt}). \quad (8)$$

Define an ownership matrix Ω such that $\Omega_{ij} = 1$ if products i and j are produced by the same manufacturer, and define the matrix of share-price derivatives as Δ. Finally, define the fixed retail markup over wholesale price in market t as ρ_t. Writing the FOCs in matrix form, I obtain:

$$w_t - c_t = (\rho_t(\Omega \circ \Delta_t))^{-1} D_t(p). \quad (9)$$

[4] I plan to estimate a richer demand model in the future.

I use the demand estimates to construct Δ, while Ω, w, s and ρ are observed. Therefore, I can solve for the estimated marginal costs, $\hat{c}_t$. I take the average over all markets to obtain a single marginal cost estimate, $\hat{c}$, to use in the bargaining game.

Estimation of Bargaining Game

I now proceed to the main estimation exercise of the study: the bargaining game between private retailers and manufacturers. First, I need to re-estimate demand because private retailers serve different consumers than the alcohol control states. However, I use exactly the same demand model as in the previous model except for adding weeks featured and weeks displayed to X_{jt}. With these estimates, I can evaluate disagreement demand $D_j^{(-i)}$ and demand-price derivatives $\frac{\partial D_j}{\partial p_i}$.

On the supply side, I allow for unobserved heterogeneity in marginal cost for product i across markets:

$$c_{it} = \hat{c}_i + \eta_{it}, \;\; \eta_{it} \sim N(0, 1). \tag{10}$$

The mean marginal cost for product i is the estimated marginal cost from the state data, and I assume the unobserved portion of cost is standard normally distributed [5]. This heterogeneity is capturing unobserved market-specific differences, including transportation costs and taxes.

I obtain estimating equations for the bargaining game by rewriting the FOCs in Equations 2 and 3 as moment conditions (market subscript t is suppressed):

$$\begin{pmatrix} \mathbb{E}\big[\sum_{j \in G_r \cap H_m}(p_j - c_j)\frac{\partial D_j}{\partial p_i} + \sum_{j \in G_r - H_m}(p_j - w_j)\frac{\partial D_j}{\partial p_i} + \sum_{j \in H_m - G_r}(w_j - c_j)\frac{\partial D_j}{\partial p_i} + D_i\big] \\ \mathbb{E}\big[(1 - \lambda_{rm})(\Pi_r - \Pi_r^{(-i)}) - \lambda_{rm}(\pi_m - \pi_m^{(-i)})\big] \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}. \tag{11}$$

These moment conditions define the Nash-in-Nash equilibrium and must hold simultaneously for every product i in market t. The parameters of interest are λ relative

[5] I am currently studying whether I can relax this assumption, such as making the variance a parameter to be estimated.

bargaining powers and w wholesale prices. These equations only hold within market; λ is not constrained to be constant for retailer-manufacturer pairs across markets [6].

Note that each moment has multiple errors contained within it (η unobserved marginal costs), so I cannot use GMM to estimate this model because I cannot solve for one η as a function of parameters and data. I therefore use Simulated Method of Moments (SMM) instead. For each moment condition, I make draws from the distribution of η and take the average of the moment condition across all draws. Specifically, let M_t be the set of moment conditions for market t. The estimation algorithm solves the following problem:

$$\min_{\Theta} \; M_t(\Theta)' M_t(\Theta). \tag{12}$$

.

Identification

On the demand side, the key problem is identifying the price parameter, α. Obtaining an unbiased estimate is pivotal to constructing the demand derivative matrix Δ and the disagreement payoffs. Recalling the indirect utility function in Equation 6, prices are endogenous due to ξ_{jt}, the mean unobserved utility from buying product j in market t. Following Nevo (2001), I specify the error term as $\xi_{jt} = \xi_j + \xi_t + \Delta\xi_{jt}$. I include product and market fixed effects to control for ξ_j and ξ_t respectively, meaning the only unobservable that I cannot control for is $\Delta\xi_{jt}$, the market-specific deviation in average unobserved product valuation. Therefore, I need instruments which are correlated with p_{jt} but not $\Delta\xi_{jt}$. I leverage the panel data and use the average price of product j in all other markets as instruments for $\Delta\xi_{jt}$. The identifying assumption is that prices for the same product in other markets are correlated via common marginal costs but

[6] I am currently working on estimating a model which constrains λ to be constant across markets for a retailer-manufacturer pair. This procedure would be necessary in order to estimate other parameters which do not vary by market, such as variance of the marginal cost shock η.

that demand shocks across markets for product j are uncorrelated. These instruments are commonly referred to as Hausman instruments. This assumption is violated in the case of a national ad campaign which shifts demand in a correlated fashion in all markets, for example. However, wineries only spent \$91 million on media advertising in 2014 comapred to \$1.3 billion spent on beer ads (Nielsen, 2015), so these concerns are limited.

On the supply side, the parameters of interest are retail bargaining power λ and wholesale prices w. There is a unique set of parameters which solve the first order conditions of the bargaining game if there are as many equations as there are parameters. Let N be the number of unique manufacturer-retailer paris and n be the number of total products in a particular market. Therefore, λ is an $N \times 1$ vector and w is an $n \times 1$ vector. However, there are $2n$ FOCs in each market (retail price and wholesale price FOCs for each product). Since $2n > n + N$ if at least one manufacturer produces multiple products, the system is overdetermined. Therefore, I only include one pricing FOC per manufacturer in estimation but inlcude all NB wholesale pricing FOCs (the PL wholesale pricing FOC is trivial because $w = c$). This means the system is exactly determined and has a unique solution.

Intuitively, the retail pricing first order conditions identify wholesale prices, while bargaining power is identified given wholesale prices and disagreement demands in the wholesale price first order conditions. However, this argument relies on observing some measure of marginal production costs. If costs were not observed, then there would be $2n + M$ parameters but only $2n$ first order conditions and therefore no unique solution. Given the full channel margin $(p - c)$ and disagreement demands, the equilibrium conditions of the model exactly determine the wholesale prices and bargaining power parameters.

Data

I estimate my model using four primary types of data: retail scanner data, alcohol control state data, product characteristic data, and demographic data.

Retail Scanner Data

I need retail price and sales data in order to estimate demand and calculate outside options in the bargaining game. I use Nielsen's Retail Scanner Dataset to obtain sales and retail price data for domestic wines at a set of large US retailers in 2015 [7]. I cannot publically identify the retailers due to Nielsen's user agreement. For a selection of these retailers' stores, I observe the retail price, units sold, and advertising (in-store display and weekly circular ads) at the store-week-UPC level. These retailers consist of large supermarket chains or mass-market retailers, and only one retailer (coded as 13) sells PL wine products during this time period. I exclude independent liquor stores from the analysis in order to focus on large downstream firms.

There are 13 unique retailers and 8 unique manufacturers (excluding the PL) in the dataset, although only a subset of them compete in a given market, which I define as a county-quarter. I aggregate sales across all stores owned by the same retailer in a given market. In total, I use data from 58 US counties and include 82 unique products in my sample. I define a product as a brand-color (Barefoot red, e.g.). I aggregate products at such a high level in order to limit the number of products over which the retailer and manufacturers must negotiate. One potential issue with this aggregation is that a brand-color can come in multiple sizes (750 mL, 1.5 L, 3 L, etc.). To correct for this, I use

[7] Researcher(s) own analyses calculated (or derived) based in part on data from The Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the Nielsen data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

liters sold and price per liter as market share and price variables, respectively. I obtain the price per liter by taking the average price across all sizes weighted by the liters sold. Therefore, if 3L is the most commonly sold product size at a retailer, then the aggregated price per liter will reflect that. The Feature and Display variables are interpreted as the number of weeks in a quarter in which any subproduct is advertised. Since my definition of product can inlcude many subproducts (different sizes and varieties, e.g.), this number can be much larger than the number of weeks in a quarter. In order to limit the number of products in estimation, I only include products with greater than a 0.1% market share.

I define the market size as total liters sold in a county-quarter in the Nielsen data. Because I exclude small retailers and products with small market share at the included retailers, the average market share of the outside good is 48.8%. While this is high, the average share of the outside good at a given retailer is 24%. That is, I am capturing most of the sales made by the included retailers.

Table 1 in the Appendix contains sample averages for retailers. The first 10 retailers are supermarkets and the final three are mass-market retailers. Not surprisingly, the mass-market retailers (MMs) have a wider geographic spread, offer fewer products, and charge lower prices than most supermarkets on average. However, the average market share in a given market is lower at the MMs. This might be because consumers do not normally shop for wine at these types of stores. However, Retailer 13 has a greater average market share than the other MMs, which might be due to the PL presence. Finally, supermarkets tend to advertise wines more often than MMs (apart from Retailer 11). This also makes sense as dedicated supermarkets tend to be higher-service, higher-cost options than MMs.

Table 2 contains sample averages for manufacturers. These manufacturers compete across all counties in my sample, but the number of products offered varies widely. The largest manufacturers, Constellation and EJ Gallo, offer many products at a range of prices. Another tier of manufacturers (Francis Coppola, Jackson Family and Ste

Michelle) offer only a few pricier products. Finally, Trinchero, Wine Group and the PL supply the cheapest products on the market, on average. In this table, Market Share is defined as the average sum of market share for all products produced by the manufacturer in a given market. Therefore, one can divide Market Share by the number of products to get some sense of average product market share. In particular, this figure for PL products is about 0.05%, making them one of the more popular products in the sample. This points to the PL playing an important role in the bargaining game.

Table 3 contains summary statistics for PL products versus NB products at the retailer who offers the PL. All variables are averages at the product-market level. PL products are cheaper and bought more often than NB products, which is partially a result of the PL being sold in large containers (3L, e.g.). In addition, PL products are advertised more frequently than NB products. This fact highlights the retailer's interest in promoting its own products.

Control State Price and Sales Data

As explained in the identification section, I either need to observe wholesale prices or marginal cost in the private retailer data to identify bargaining power parameters. However, proprietary wholesale price data is difficult to obtain and thus I do not observe the associated wholesale prices negotiated by the retailer. To circumvent this issue, I use wine sales data from Pennsylvania and Montgomery County, Maryland in 2015 in order to estimate marginal costs for a common set of products. The data was compiled by NABCA, an organization which collects data for alcohol control states. These jurisdictions nearly control all distribution and sales of wine. In each of these states, I observe the retail price, 9-liter cases sold and "freight-on-board" price at the month-UPC level. Freight-on-board price is the amount the state is charged by the manufacturer for a case of that product, where transportation costs from the manufacturer to the state are borne by the manufacturer. Table 4 contains sample averages by manufacturer for

Montgomery County, MD.

One peculiarity with these alcohol control jurisdictions is that they must set a fixed markup by law. For example, before 2017 Montgomery County's Department of Liquor Control was forced to charge a markup of 72.8% (pre-sale) over manufacturer costs by law (Montgomery County DLC, 2015), and Pennsylvania was forced to charge a 30% markup over wholesale price before 2016 (Miravete, Seim & Thurk, WP). In the data, this markup rule predicts the retail price quite closely. I report the average retail markup as a percentage above wholesale price in Table 4. This percentage is fairly constant across manufacturers, hovering somewhere between 55% and 65%. There is some variation in markup due to heterogeneous sales, which are pre-negotiated between the manufacturers and the state. Apart from these sales, states have no real ability to price their products, and instead manufacturers are setting prices indirectly through their choices of wholesale price. For this reason, I model the state pricing game as Nash-Bertrand competition in wholesale prices between wine vendors.

Product Characteristic Data

I collect data on product characteristics for use in demand estimation. An important vertical differentiation characteristic of wine is a score on the 100-point scale. Although these scores are subjective, I obtain one set of scores from Wine Enthusiast, a major wine reviewer. In my data, the scores vary between 79 and 91. Most scores lie in the 80s, which Wine Enthusiast describes qualitatively as "Acceptable" to "Very Good". This is consistent with the selection of mass-market wines in this study. I also collect data on input prices for each product to use as demand instruments. I obtain grape prices in 2014 for the regions included in my data (California, Oregon and Washington). For California, these prices vary by wine growing districts. The variation in grape prices across products comes from both the geographic source of the grapes and the grape blend of a particular wine. For example, a Merlot must only contain at least 75% Merlot grapes to be labeled as a Merlot in California. I obtain barrel prices from a manufacturer of oak barrels, and the variation in barrel prices across products comes from the type of barrel used (American oak, French oak, European oak, or stainless steel) and how much new barrel aging a wine receives. For example, a wine which is aged in 50% new oak will have higher barrel expenses than a wine aged in 25% new oak. For each of the wines in my dataset, I collected tasting notes which describe the grape source, grape blend, and barrel aging technique.

Demographic Data

I obtain the mean and variance of household income at the county level using the American Community Survey 5-year estimates from 2015. In estimation, I assume a lognormal income distribution and take individual draws from the distribution associated with a particular county. I do not include any other demographic variables in estimation.

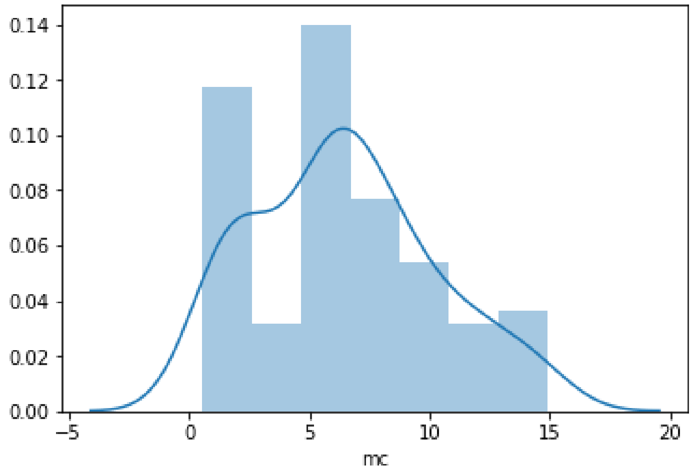
Results

Alcohol Control State Estimates

I report demand estimates for the multinomial logit model using the alcohol control state data in Table 5 in the Appendix. I am currenty working on estimating the random coefficients model. The price coefficient estimate is of the expected sign, but the coefficient on wine rating is negative and significant at the 10% level. This might be due to the lack of variation in wine ratings (most vary between 80 and 90 in this dataset), but consumers of mass-market wines might not value quality as much as serious oenophiles. The marginal costs are estimated by evaluating Equation 9 in each market, and I take the mean cost estimate across Pennsylvania and Montgomery County, MD as $\hat{c}$ when estimating the bargaining game. I cannot obtain marginal cost estimates for the PL products because they are only offered by the private retailer by definition.

Figure 3 shows the density of marginal per-liter cost estimates. The mass towards \$0 is composed of brands which are primarily boxed wines, which are sold in large sizes. Therefore, the price per liter and estimated cost per liter are quite low. The mean and median per-liter cost estimate is about \$6.

Figure 3: Distribution of Marginal Cost Estimates



Private Retailer Demand Estimates

I report demand estimates from the multinomial logit model using the private retailer data in Table 6 in the Appendix. I am curenty working on estimating the random coefficients model. The price coefficient estimate is of the expected sign and similar to that of the state data. The coefficient on rating is not significantly different from zero, which is likely due to the same reasons listed in the previous section. The coefficients on the advertising variables (feature and display) are positive and significant at the 5% level. The majority of the own-price elasticities implied by these estimates fall between -1 and -5, and one would expect products to be price elastic in a market with this many products.

[INSERT FIGURE HERE WITH DISTRO OF ELASTICITIES]

Bargaining Model Estimates and Analysis

I report estimates of the bargaining power parameters in Table 7 in the Appendix. The reported parameters are averaged across markets, and since the parameters were estimated market-by-market, the standard deviations reported in the table capture variance in the estimated coefficients across markets. I am currently obtaining bootstrapped standard errors.

Only a few of the bargaining power estimates across markets are significantly different from 0.5, indicating that manufacturers and retailers have roughly equal negotiating skill and that bargaining position is the key determinant of the split of channel profit. The average bargaining power of retailers does not vary much from 0.5, but there is more variation across manufacturers. For example, retailer bargaining power tends to be higher when dealing with smaller manufacturers (such as Bogle) than with larger manfacturers (such as Wine Group). Table 8 reports total profit estimates across all markets for each firm, and Table 9 reports the estimated percentage of channel profit going to the retailer ($\frac{p-w}{p-c}$). Similar to the bargaining power estimates, the average split of channel profits is close to 50% for all retailers and manufacturers. The figures are slightly different because the equilibrium channel split is determined by both bargaining power and bargaining position (i.e. disagreement profit). One key result is that when including PL sales, Retailer13 has an average channel profit percentage of 53.9%, which is the largest of any retailer. This is in part due to the PL's larger percentage margins over cost than NB wines (average gross margins of 64% for PLs versus 27% for NBs). However, part of this increase in channel profit share is due to the PL's ability to improve bargaining position. I calculate this effect in the next section.

For manufacturers, the same patterns apply to channel profit split as bargaining power. Smaller manufacturers, notably Bogle, receive a lower share of channel profit (38.6%) than larger manufacturers such as Constellation (53.6%). This makes intuitive sense because smaller manufacturers have a worse bargaining position compared to larger manufacturers. One other comparison I make concerns matching the average gross margin for manufacturers ($\frac{w-c}{w}$) reproted by Moss Adams, LLP in their 2013 survey of wineries. They report that the average gross margin in their sample is 51%, while the mean in my sample is 57%. These figures are fairly close, so my estimates do not appear to be far off from industry averages as reported directly by manufacturers.

Counterfactuals

With estimates in hand, I can determine how the presence of the PL affects retailer and manufacturer profits. In a similar study, Ellickson, Kong and Lovett (WP) decompose the profit effects of offering a private label into three: the direct effect of PL sales, the substitution of sales from NBs, and the effect of the PL on improving bargaining position with NB manufacturers. To capture these effects, I treat PL products as if they are NBs, granting the PL producer a retailer bargaining power of $\lambda = 0.5$. I then use the estimated parameters to re-solve the bargaining problem with the counterfactual bargaining power. Changes in sales can be measured by comparing market shares in the two scenarios, and the change in NB margins captures the bargaining effect. These estimates should be of interest to both retailers and manufacturers in order to assess the profitability of PLs.

Effect of PL on Profit, Prices and Consumer Surplus

I first compute change in total profits to retailers. Let G_{PL} be the set of PL products and let tilde denote values in the counterfactual no-PL scenario. Focusing on the PL retailer (13), the total change in profit is:

$$\Pi_{13} - \widetilde{\Pi}_{13} = \sum_{j \in G_{13}} (p_j - w_j) D_j - \sum_{j \in G_{13} - G_{PL}} (\tilde{p}_j - \tilde{w}_j) \widetilde{D}_j.$$

The first component of the total change is the change in retailer margins on PL sales:

$$\sum_{j \in G_{PL}} \big((p_j - w_j) - (\tilde{p}_j - \tilde{w}_j)\big)\widetilde{D}_j.$$

The second component is the change in demand for NBs when the PLs are no longer owned by the retailer (I will call this the substitution effect from here on):

$$\sum_{j \in G_{13} - G_{PL}} (p_j - w_j)(D_j - \widetilde{D}_j).$$

The last component is the change in retailer margins on NBs:

$$\sum_{j \in G_{13} - G_{PL}} \big((p_j - w_j) - (\tilde{p}_j - \tilde{w}_j)\big)\widetilde{D}_j.$$

Table 10 contains these values as a percentage of counterfactual profit across all retailers and markets. Positive values indicate that profit is higher when Retailer 13 owns the PL (actual scenario). Retailer 13's profit increases by an estimated 21.18% when it owns its PL, but this is the net effect. The retailer earns 22.37% more profit on PL sales by owning its PL but loses 12.03% of profit on substitution away from NB products. This is because in equilibrium, Retailer 13 negotiates higher prices on NB products to divert demand to the PL. However, Retailer 13 also earns 10.83% higher profit due to increased margins on NB products. Retailer 13 obtains higher margins on NB products when it owns the PL because it has greater bargaining position with NB manufacturers.

I also draw conclusions about how competing retailers are affected by PL ownership. Since the other retailers do not offer a PL, then their total change in profits is the sum of the substitution and bargaining effects. Nearly all other retailers are worse off when the PL is offered, with losses ranging between 0.75% to 9.06% of profit in the no-PL case. For most retailers, this decrease is due to negative bargaining effects. which means that other retailers obtain lower margins when Retailer13 owns the PL. It appears that while the PL is certainly profitable for Retailer 13, it imposes negative bargaining externalities on competing retailers. To understand why, I perform this same exercise for manufacturers.

I can isolate the effect of Retailer 13 owning its PL products on the profits of manufacturers. The total change in profits for manufacturer m is:

$$\pi_m - \widetilde{\pi}_m = \sum_{j \in H_m} (w_j - c_j)D_j - (\tilde{w}_j - c_j)\widetilde{D}_j.$$

The first component of the total change is the substitution effect:

$$\sum_{j \in H_m} (w_j - c_j)(D_j - \widetilde{D}_j).$$

The second component is the change in manufacturer margins due to changes in bargaining position:

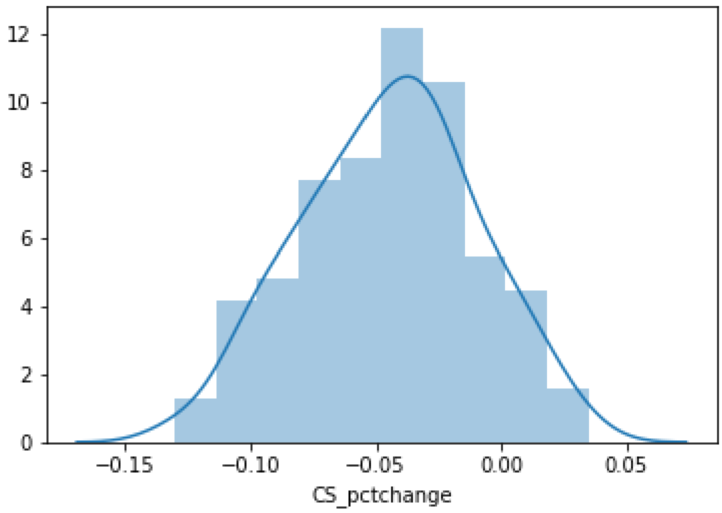
$$\sum_{j \in H_m} \big((w_j - c_j) - (\tilde{w}_j - c_j)\big)\widetilde{D}_j.$$

Table 11 contains these values for all manufacturers across all markets. Negative values indicate that profit decreases when Retailer 13 offers the PL. Profits are lower for all manufacturers when Retailer 13 offers the PL, but the cause for this drop varies by manufacturer. Smaller manufacturers such as Francis Coppola and Jackson Family have large negative substitution effects and large positive bargaining effects. These effect sizes are large because each of those manufacturers produce a small number of products, so a small change in outisde option for those players has a large effect on negotiated prices. In addition, the model predicts that in the no-PL scenario, the negotiated retail price of some products offered by these manufacturers would be so high as to essentially remove those products from the shelf. However, the net effect for all manufacturers is negative, but not as negative as non-PL retailers. Thus, suppliers' bargaining position improves relative to the non-PL retailers and explains why nearly all non-PL retailers have a negative bargaining effect.

In terms of consumer surplus, removing the PL leads to an average decrease in consumer surplus of 4.5% across markets. There is a decrease in consumer surplus in

168 out of the 189 markets included in the counterfactual. Figure 4 plots the distribution of the percentage change in consumer surplus between the actual and no-PL scenarios. Consumers are partially better off when Retailer 13 owns its PL due to lower prices paid at other retailers; retail prices fall on average by 2.3% when Retailer 13 owns the PL, although there is much heterogeneity at the product level.

Figure 4: % Change in Consumer Surplus when no PLs Allowed



Merger Analysis

I plan to use the estimates to evaluate merger counterfactuals. Because I model the vertical channel, I can model the effects on market outcomes of both vertical mergers (retailer merging with manufacturer) and horizontal mergers (two manufacturers merging). Note that a vertical merger in this model is equivalent to converting a product from NB to PL. In both cases, I can estimate how consumer surplus and firm profits change. [TO BE COMPLETED]

Comparison to Other Supply-Side Models

Given the demand estimates in the private retailer setting, I estimate a selection of vertical supply models and compare key results with those of my model. The alternative models I consider are the following: ignoring the vertical channels, linear sequential wholesale pricing (classic double marginalization), and wholesale-only bargaining with Nash-Bertrand downstream competition (Draganska, Klapper & Villas-Boas, 2010). The key outcomes I compare across models are marginal costs, wholesale prices and firm profits [8].

Manufacturer Nash-Bertrand

The first comparison model is one which ignores the vertical channel, such as Nash-Bertrand competition among manufacturers. Specifically, each manufacturer solves the following problem simultaneously:

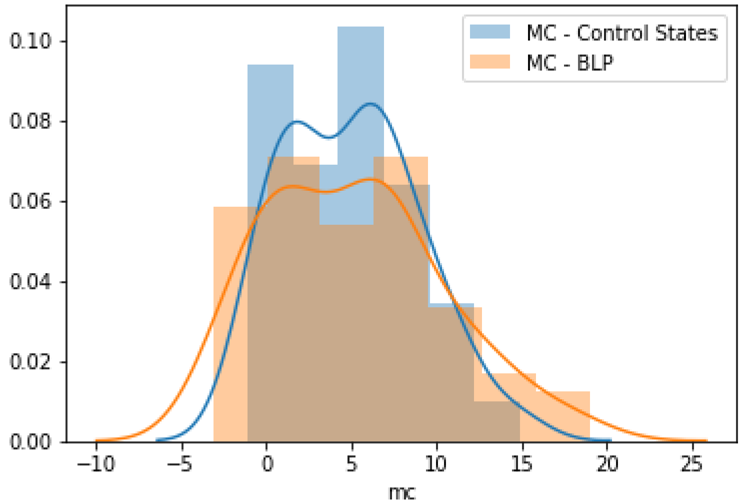
$$\max_{p \in H_m} \sum_{j \in H_m} (p_j - c_j) D_j. \tag{13}$$

The FOCs of this problem in matrix form are written as $p - c = (\Omega \circ \Delta))^{-1} D(p)$, where Ω is the manufacturer ownership matrix and Δ is the demand-price derivative matrix. Thus, marginal costs are solved directly from this equation. Clearly, this model ignores the vertical model and has no wholesale prices, so the only comparison to make here is between marginal cost estiamtes. Figure 5 shows how the distribution of estimated marginal costs from this model compares with those from the state price setting model, which are used as mean cost estimates in the bargaining model. The estimated marginal costs have higher variance in this model than in the state price setting model. There are also a good deal of negative marginal cost estimates when using this model. These differences in marginal cost lead to differences in estimated channel margins $(p - c)$, which affect channel profit calculations. Therefore, it is important to obtain marginal

[8] Consumer surplus is identical since the demand model is held constant.

cost estimates from a setting in which we know the game being played by firms, which is exactly the case in control state pricing.

Figure 5: Density of Marginal Cost Estimates: BLP vs. State Pricing



Linear Sequential Pricing

The second comparison model is the linear sequential pricing model, which is the classic double marginalization model. In this game, manufacturers set wholesale prices first and retailers set retail prices given the wholesale prices. This model captures addresses the vertical channel but allows for no coordination between upstream and downstream firms. In the second stage, retailer r maximizes its profit function over retail prices all products in G_r given wholesale prices $\bar{w}$:

$$\max_{p} \sum_{j \in G_r} (p_j - \bar{w}_j) D_j. \tag{14}$$

In the first stage, manufacturer m maximizes its profit function over all wholesale prices in H_m anticipating optimal downstream pricing:

$$\max_{w} \sum_{j \in H_m} (w_j - c_j) D_j\big(p(w)\big). \tag{15}$$

The solution to this problem can be found in Meza and Sudhir (2010). For PL products, I assume that the retailer solves the pricing problem facing the margin $p-c$ as in the first model. This model has distinct predictions for marginal cost, so I first compare those to the marginal cost estimates from the state bargaining game. Figure 6 shows how the distribution of estimated marginal costs from this model compare to the ones I use in the bargaining game. The linear model marginal cost estimates are tightly packed between \$0 and \$5 per liter, which seems quite low for such a wide variety of wines. Indeed, the average gross supplier margin is 72%, which is much higher than the 51% reported by Moss Adams, LLP. The distribution of channel profit between the two models is quite different too; Figure 7 shows the distribution across all products in both models. The mean percentage of channel profit going to retailers in the linear model is 26.4% versus 50.7% in the bargaining model. This is due to the manufacturer receiving a first-mover advantage in the sequential pricing game. Finally, estimated channel profit is about 43% larger in the linear model because of the lower marginal cost estimates.

Figure 6: Density of Marginal Cost Estimates: Linear vs. State Pricing

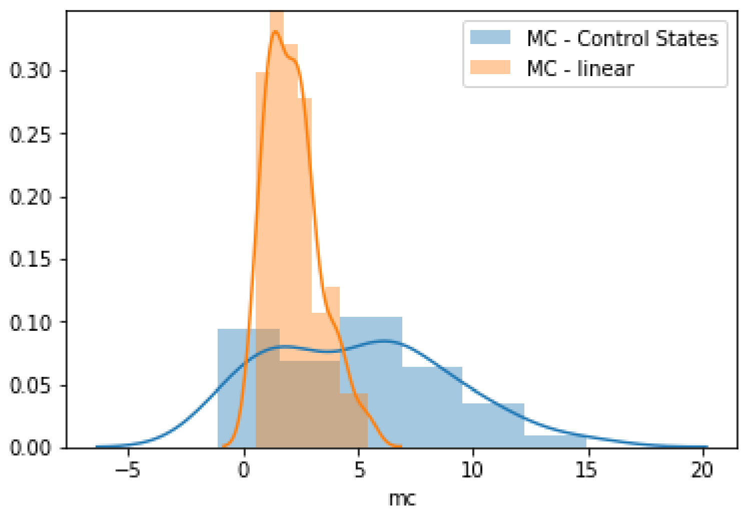
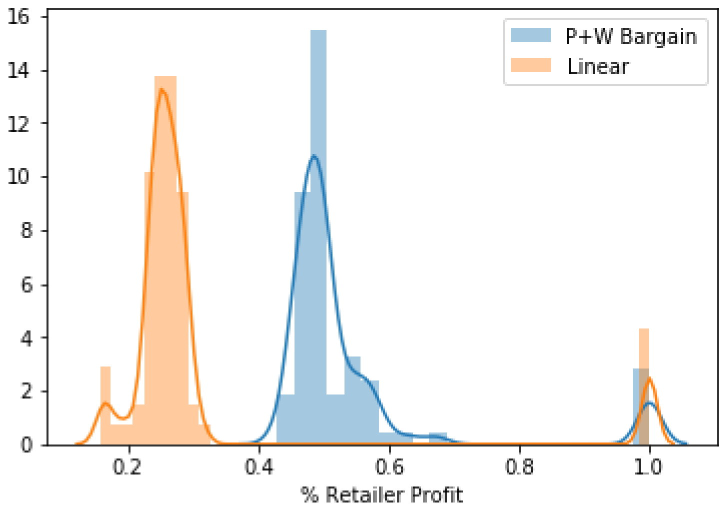


Figure 7: Density of % Retail Profit: Linear vs. P+W Bargaining



Wholesale-Only Bargaining

The third comparison model is the wholesale price-only bargaining model as outlined by Draganska, Klapper and Villas-Boas (2010). Retailers compete in Nash-Bertrand competition. Specifically, retailer r chooses retail prices to maximize profit:

$$\max_{p} \sum_{j \in G_r} (p_j - w_j) D_j. \tag{16}$$

Simultaneously, retailers and suppliers bargain bilaterally over wholesale prices only. Using the notation from the earlier bargaining model, retailer r and manufacturer m solve the following probem for product i:

$$\max_{w_i} \left[\Pi_r - \Pi_r^{(-i)}\right]^{\lambda_{rm}} \left[\pi_m - \pi_m^{(-i)}\right]^{1-\lambda_{rm}}. \tag{17}$$

The detailed solution to this problem can be found in Draganska, Klapper and Villas-Boas (2010). They use a Nash-in-Nash equilibrium concept as in the model presented in this paper. Briefly, solving for the equilibrium yields the following estimation equation:

$$p - m_r = \gamma \tilde{m}_w + \theta Z + \eta. \tag{18}$$

In the above equation, m_r and $\tilde{m}_w$ are the retailer and manufacturer margins derived from the model, Z is a matrix of cost shifters, and η is the unknown portion of marginal cost. $\gamma = \frac{1-\lambda}{\lambda}$ is a transformation of the retailer bargaining power parameters. This equation is linear and thus can be estimated using OLS. To allow λ to vary across retailer-manufacturer pairs, I interact $\tilde{m}_w$ with retailer-supplier indicators.

[Results go here]

Conclusion

I introduce and estimate a new model of vertical bargaining between upstream and downstream firms in order to determine the effects of private label products on market outcomes. In particular, firms negotiate over both wholesale and retail prices, which better reflects anecdotal evidence of channel coordination in many retail industries. Theoretically, I show that this form of bargaining is superior (in partial equilibrium) for both upstream and downstream firms than wholesale-only bargaining.

I estimate the bargaining model using data on domestic wine sales at a set of major US retailers. In order to identify the supply-side parameters, I use marginal cost estimates for the same set of products sold in alcohol control states. I find that the estimated retailer bargaining power parameters are close to 0.5 (indicating even bargaining power) and the percentage of channel profits going to manufacturers and manufacturers are roughly equal as well. I find that the presence of the private label leads to 10.83% higher profits for the PL retailer due to increased bargaining position with national brand suppliers, while most other retailers and manufacturers are harmed by the PL. Consumer surplus is on average 4.5% higher due to the presence of the PL.

I compare the estimates from my bargaining model to three other models: Nash-Bertrand competition among manufacturers (i.e. ignoring the vertical channel), linear sequential pricing and wholesale price-only bargaining. I find that marginal cost estimates from the Nash-Bertrand model differ significantly from those I obtain from the control state pricing game, which justifies the use of control state data in estimating the bargaining model. The linear sequential pricing model leads to low cost estimates and inflated channel profit estimates, and predicts that retailers earn only a quarter of channel profits compared to half in my model.

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Appendix

Theorem 1. *Suppose retailer r and manufacturer m are negotiating over product i. Assuming that all other contracts (p_{-i}, w_{-i}) are fixed, both r and m earn higher profits by bargaining over both p_i and w_i than only bargaining over w_i and letting r choose p_i independently.*

Proof. According to Equation 3, the first order condition with respect to w_i is:

$$\frac{\Pi_r - \Pi_r^{(-i)}}{\pi_m - \pi_m^{(-i)}} = \frac{\lambda_{rm}}{1-\lambda_{rm}}.$$

This is identical to the first order condition with respect to w_i in the wholesale price-only bargaining game (refer to Draganska, Klapper and Villas-Boas (2010), equation 13). Thus, the ratio of gains from contracting are equal in both models assuming that λ_{rm} is the same. Equation 4 shows that the retail pricing FOC in the two-price bargaining game is equivalent to the retail pricing FOC where r and m act as an integrated monopolist over products in $G_r \cap H_m$. The following is also true:

$$\hat{p_i} = \arg\max_{p_i} \ \Pi_r + \pi_m = \arg\max_{p_i} \ (\Pi_r - \Pi_r^{(-i)}) + (\pi_m + \pi_m^{(-i)}).$$

That is, choosing p_i to maximize joint profits is identical to choosing p_i to maximize joint gains from contracting. This holds because $\frac{\partial \Pi_R^{(-i)}}{\partial p_i} = \frac{\partial \pi_m^{(-i)}}{\partial p_i} = 0$. Thus, two-price bargaining leads the firms to choose p_i such that joint gains from contracting are maximized.

In the wholesale price-only bargaining game, p_i is set only by the retailer:

$$\tilde{p_i} = \arg\max_{p_i} \ \Pi_r.$$

This necessarily means that $\hat{p_i} \neq \tilde{p_i}$. Because $\hat{p_i}$ is chosen to maximize total gains from contracting, then $\tilde{p_i}$ cannot also maximize total gains from contracting. Thus, total gains from contracting are larger under two-price bargaining. Since the gains from contracting are split the same way in both models, and the gains from contracting are larger in two-price bargaining, then both r and m earn higher profits using two-price bargaining. $\square$

Table 1: Nielsen Retailer Sample Averages

Retailer	**Type**	**# Counties**	**# Prod**	**$/L**	**Share**	**% Sales Modeled**	**Feature**	**Display**
1	S	4	55.3	10.53	0.395	83.2	21.67	25.24
2	S	16	30.3	8.47	0.069	75.6	16.19	15.98
3	S	12	53.2	9.88	0.275	70.0	19.39	15.41
4	S	5	30.5	8.75	0.125	80.1	6.49	9.72
5	S	3	47.8	11.50	0.178	74.5	1.57	13.49
6	S	15	54.7	10.37	0.323	67.6	6.03	7.89
7	S	4	44.2	9.38	0.197	72.1	14.16	21.41
8	S	5	56.9	9.48	0.155	71.6	24.41	19.66
9	S	7	50.3	8.96	0.175	68.8	22.89	21.27
10	S	10	40.6	9.73	0.283	79.1	9.60	7.70
11	MM	25	15.5	6.00	0.043	79.1	14.21	9.33
12	MM	53	14.7	8.22	0.059	83.0	2.21	4.95
13 (PL)	MM	53	23.7	10.25	0.063	83.1	1.09	6.78

Table 2: Nielsen Manufacturer Sample Averages

Manufacturer	# Counties	# Prod	$/L	Share	Feature	Display
Bogle	53	4.19	12.44	0.011	15.24	9.53
Constellation	53	37.31	10.42	0.119	11.09	11.53
Francis Coppola	53	3.53	18.27	0.006	5.32	11.60
EJ Gallo	53	38.60	8.18	0.184	7.83	13.83
Jackson Family	53	4.65	16.80	0.015	22.53	13.80
Ste Michelle	53	12.70	13.34	0.034	11.84	13.69
Trinchero	53	6.90	6.88	0.043	8.09	9.25
Wine Group	53	16.95	6.54	0.081	7.04	5.20
PL	53	2.89	7.73	0.017	4.51	12.08

Table 3: Sample Averges for Products by PL, NB at Retailer 13

		Sample Averages			
Type	**# Prod**	**$/L**	**L Sold**	**Featured**	**Displayed**
NB	45	10.97	1248.33	0.616	6.59
PL	6	8.07	3158.40	4.24	11.86

Table 4: Manufacturer Sample Averages in Montgomery County, MD

		Sample Averages		
Vendor	**#Brands**	**Retail Price**	**Wholesale Price**	**Avg. Markup (%)**
Bogle	1	14.28	8.72	63.8
Constellation	24	12.70	8.05	57.8
Francis Coppola	3	13.43	8.64	55.4
Delicato	9	14.23	9.15	55.5
Deutsch	1	13.33	8.09	64.8
EJ Gallo	28	12.37	7.82	58.2
Jackson	14	18.16	11.53	57.5
One True Vine	1	13.91	8.18	70.0
Philps Michael David	3	23.88	14.94	59.8
Ste. Michelle	8	13.22	8.28	59.7
Trinchero	6	10.62	6.79	56.4
Treasury	13	13.30	8.35	59.2
Vintage	3	10.62	7.16	48.3
Wine Group	11	12.55	7.72	62.6

Table 5: Alcohol Control State Demand Estimates

Variable	β
Price	-0.271 (0.024)
Rating	-0.090 (0.051)

$N = 944$. Regression includes state, quarter and product FEs.

Table 6: Private Retailer Demand Estimates

Variable	β
Price	-0.223 (0.005)
Rating	-0.003 (0.005)
Feature	0.004 (0.0003)
Display	0.004 (0.0006)

$N = 27,209$. Regression includes county, quarter, retailer and product FEs.

Table 7: Mean Retail Bargaining Power Estimates by Retailer-Manufacturer Pair

	Bogle	**Const**	**FFC**	**Gallo**	**Jcksn**	**StMich**	**Trinch**	**WineGp**	**Mean**
1	0.687* (0.095)	0.428* (0.031)	0.623 (0.109)	0.457 (0.058)	0.577 (0.093)	0.488 (0.058)	0.490 (0.016)	0.360* (0.049)	0.460
2	0.504 (0.136)	0.442 (0.062)	0.476 (0.099)	0.509 (0.049)	0.496 (0.082)	0.469 (0.087)	0.492 (0.075)	0.483 (0.070)	0.485
3	0.582 (0.088)	0.433 (0.063)	0.559 (0.094)	0.435 (0.078)	0.522 (0.065)	0.483 (0.068)	0.513 (0.045)	0.369* (0.066)	0.449
4	0.450 (0.232)	0.484 (0.076)	*n/a* (*n/a*)	0.511 (0.049)	0.582 (0.182)	0.421 (0.164)	0.482 (0.084)	0.429 (0.053)	0.500
5	0.580 (0.121)	0.438 (0.066)	0.586 (0.157)	0.460 (0.051)	0.549 (0.149)	0.460 (0.069)	0.531 (0.079)	0.434 (0.048)	0.460
6	0.597 (0.124)	0.400 (0.052)	0.650 (0.160)	0.470 (0.055)	0.567 (0.085)	0.488 (0.065)	0.493 (0.065)	0.368* (0.054)	0.452
7	0.658 (0.123)	0.463 (0.034)	0.511 (0.077)	0.468 (0.033)	0.532 (0.064)	0.470 (0.023)	0.543 (0.047)	0.444 (0.058)	0.475
8	0.536 (0.102)	0.444 (0.050)	0.513 (0.061)	0.497 (0.029)	0.506 (0.035)	0.488 (0.050)	0.521 (0.061)	0.471 (0.049)	0.481
9	0.544 (0.076)	0.440 (0.049)	0.510 (0.077)	0.480 (0.039)	0.523 (0.091)	0.493 (0.078)	0.507 (0.041)	0.444 (0.053)	0.471
10	0.651 (0.176)	0.448 (0.045)	0.662 (0.180)	0.456 (0.045)	0.613 (0.132)	0.553 (0.149)	0.515 (0.037)	0.404 (0.057)	0.472
11	0.483 (0.148)	0.468 (0.117)	0.718 (*n/a*)	0.549 (0.058)	0.468 (0.181)	0.441 (0.118)	0.502 (0.110)	0.502 (0.074)	0.520
12	0.491 (0.184)	0.443 (0.092)	0.523 (0.150)	0.495 (0.069)	0.580 (0.176)	0.518 (0.155)	0.511 (0.100)	0.462 (0.101)	0.490
13	0.534 (0.174)	0.411 (0.125)	0.494 (0.159)	0.472 (0.093)	0.525 (0.165)	0.441 (0.148)	0.521 (0.101)	0.507 (0.128)	0.475
Mean	0.571	0.429	0.546	0.477	0.550	0.484	0.512	0.424	

Standard deviation of estimates across markets in parentheses. $*$ indicates estimate is significantly different from 0.5 at the 5% level.

Table 8: Estimated Aggregate Profits, by Firm ($ million)

Retailer	**Profit**	**Manufacturer**	**Profit**
1	11.62	Bogle	2.59
2	9.29	Constellation	37.89
3	25.56	Francis Coppola	3.15
4	3.26	EJ Gallo	53.47
5	4.88	Jackson Family	5.88
6	25.30	Ste Michelle	12.62
7	5.89	Trinchero	9.96
8	15.29	Wine Group	21.07
9	12.49		
10	6.71		
11	6.56		
12	12.21		
13 (PL)	17.82		

Table 9: Mean Retailer's % of Channel Profit Across Markets

	Bogle	**Const**	**FFC**	**Gallo**	**Jcksn**	**StMich**	**Trinch**	**WineGp**	**Mean**
1	0.736* (0.088)	0.514 (0.049)	0.689 (0.096)	0.516 (0.063)	0.639 (0.078)	0.584 (0.073)	0.612* (0.034)	0.484 (0.069)	0.539
2	0.520 (0.160)	0.438 (0.073)	0.484 (0.108)	0.491 (0.057)	0.504 (0.092)	0.478 (0.099)	0.504 (0.083)	0.491 (0.070)	0.476
3	0.641 (0.094)	0.500 (0.073)	0.600 (0.087)	0.506 (0.075)	0.569 (0.066)	0.542 (0.082)	0.586 (0.062)	0.464 (0.061)	0.515
4	0.489 (0.213)	0.484 (0.070)	n/a (n/a)	0.500 (0.061)	0.610 (0.189)	0.452 (0.166)	0.506 (0.095)	0.458 (0.052)	0.499
5	0.609 (0.130)	0.458 (0.083)	0.627 (0.158)	0.482 (0.056)	0.563 (0.142)	0.486 (0.077)	0.535 (0.080)	0.472 (0.053)	0.479
6	0.659 (0.109)	0.481 (0.045)	0.680 (0.143)	0.522 (0.054)	0.621 (0.088)	0.554 (0.078)	0.588 (0.075)	0.483 (0.056)	0.521
7	0.695 (0.142)	0.486 (0.048)	0.531 (0.075)	0.494 (0.051)	0.555 (0.064)	0.490 (0.037)	0.562 (0.047)	0.478 (0.047)	0.500
8	0.577 (0.120)	0.460 (0.062)	0.529 (0.068)	0.494 (0.040)	0.528 (0.055)	0.516 (0.074)	0.547 (0.073)	0.501 (0.051)	0.494
9	0.581 (0.094)	0.462 (0.066)	0.525 (0.082)	0.481 (0.062)	0.551 (0.101)	0.525 (0.101)	0.548 (0.054)	0.483 (0.053)	0.489
10	0.694 (0.167)	0.493 (0.060)	0.683 (0.173)	0.495 (0.082)	0.652 (0.136)	0.590 (0.142)	0.581 (0.065)	0.468 (0.069)	0.516
11	0.494 (0.156)	0.452 (0.117)	0.733 (n/a)	0.511 (0.070)	0.465 (0.173)	0.434 (0.125)	0.505 (0.109)	0.498 (0.058)	0.497
12	0.533 (0.173)	0.449 (0.140)	0.549 (0.150)	0.479 (0.096)	0.588 (0.181)	0.520 (0.156)	0.515 (0.112)	0.472 (0.070)	0.480
13	0.556 (0.182)	0.427 (0.106)	0.506 (0.157)	0.470 (0.091)	0.531 (0.185)	0.450 (0.163)	0.529 (0.120)	0.517 (0.115)	0.491
Mean	0.614	0.464	0.570	0.495	0.579	0.521	0.537	0.481	

Standard deviation of estimates across markets in parentheses. ∗ indicates estimate is significantly different from 0.5 at the 5% level.

Table 10: Retailer Profit Change: Private Labels as National Brands

		Partial Effects		
Retailer	%$\Delta\Pi$	PL Sales	Substitution Effect	Bargaining Effect
1	-4.28%	n/a	4.06%	-8.35%
2	-5.01%	n/a	-6.65%	1.64%
3	-4.75%	n/a	2.94%	-7.68%
4	-0.75%	n/a	0.40%	-1.16%
5	0.89%	n/a	-0.71%	1.60%
6	-1.93%	n/a	1.93%	-3.86%
7	-4.50%	n/a	3.74%	-8.24%
8	-6.10%	n/a	-1.86%	-4.24%
9	-7.05%	n/a	4.36%	-11.41%
10	-2.98%	n/a	6.98%	-9.96%
11	-9.06%	n/a	0.09%	-9.15%
12	-4.07%	n/a	-8.71%	4.64%
13	21.18%	22.37%	-12.03%	10.83%

Change in profits are aggregated across all markets. In counterfactual scenario, $\lambda = 0.5$ for the PL producer. Changes are computed as the difference between estimated values when $\lambda = 0$ and $\lambda = 0.5$ for PLs. Total market size is assumed to be the same in both scenarios.

Table 11: Manufacturer Profit Change: Private Labels as National Brands

		Partial Effects	
Retailer	$\%\Delta\Pi$	Substitution Effect	Bargaining Effect
Bogle	-2.19%	3.02%	-5.22%
Constellation	-0.42%	-1.43%	1.00%
Francis Coppola	-3.51%	-50.10%	46.60%
E&J Gallo	-0.86%	6.11%	-6.97%
Jackson Family	-1.84%	-24.43%	22.59%
Ste Michelle	-1.01%	-20.65%	19.64%
Trinchero	-3.65%	4.80%	-8.44%
Wine Group	-1.97%	0.73%	-2.70%

Change in profits are aggregated across all markets. In counterfactual scenario, $\lambda = 0.5$ for the PL producer. Changes are computed as the difference between estimated values when $\lambda = 0$ and $\lambda = 0.5$ for PLs. Total market size is assumed to be the same in both scenarios