

Diagnosing Foreclosure due to Exclusive Dealing

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Abstract

Exclusive dealing arrangements, in which a distributor contracts to work exclusively with a single manufacturer, can be efficiency enhancing or they can be an anticompetitive means to foreclose markets. This paper evaluates the effect of exclusive distribution arrangements on competition in the Chicago beer market in 1994. A diagnostic test is provided to judge whether exclusive arrangements between brewers and their distributors lead to foreclosure. To implement this test I estimate a model of consumer demand and firm behavior that incorporates industry details and allows for distribution through exclusive and shared channels. The test indicates that foreclosure effects are not present in this market, suggesting that the most likely effect of intervention would be to reduce social welfare.

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1 Introduction

This paper considers exclusive dealing arrangements between manufacturers and distributors. These arrangements stop the distributor selling the products of the manufacturer's rivals. Such arrangements raise antitrust concerns, since they may restrict the access of upstream rivals to distributors. Rivals may be foreclosed from the market altogether or, more commonly, forced to use higher cost, or less effective, methods to bring their products to market. In either case, competition can be reduced through either reducing the number of manufacturers serving the market or by artificially raising the costs of some manufacturers.

In contrast to these anti-competitive effects it is frequently argued that exclusive dealing arrangements help a firm organize their distribution more efficiently. In cases where these arrangements result in cost reduction or some other efficiency dividend, antitrust concerns may be unfounded.

This paper formulates and implements a test for foreclosure using non-proprietary data on prices and shares. Foreclosure is considered in both the sense of forcing competitors to use higher cost distribution channels, and also in the sense of forcing competitors to use distributors who are less effective at providing service through product support. The results suggest that in the Chicago beer market, during the period of study, concerns about foreclosure are unfounded. That is, the cost of distribution for brewers (other than Anheuser Busch and Miller) in markets in which a exclusive distributor (serving Miller) is being used, is the same as in non-exclusive markets (Anheuser Busch's distribution system is completely exclusive). Similarly, the estimates suggest that point of sale service is not diminished in exclusive markets, relative to to non-exclusive markets.

The American beer industry is dominated by a few large brewers. During 1994, the period of analysis, Anheuser Busch was the largest brewer nationally, followed by Miller, Coors, Stroh, Heileman and Pabst. Anheuser Busch produced 45% of the beer shipped in the USA, Miller produced 22%, Coors, 10%, Stroh 6%, Heileman 5% and Pabst 4%. Imported beers, treated together, accounted for about 5% of the market.²

In 1997, the US Department of Justice began an investigation into distribution practices in the industry.³ During this time Anheuser Busch was engaged in a campaign to increase their number of exclusive distributors. This campaign, dubbed "100% Share of Mind" by the company, offered distributors extended credit, increased marketing support and other incentives for going exclusive.⁴ This drive for more ex-

²Perhaps unsurprisingly, the beer industry has had a long history of involvement with antitrust authorities. See Trembaly and Tremblay (2005), Tremblay (1993) and Klein and Murphy (1988) for a discussion.

³This investigation was reported widely in the business press. See, for example, Canedy (1997) and Chicago Sun-Times (1997)

⁴See Lenderman (1997), Butler (1997) and Stokes (1997) for more details. Sherwood (2000) provides an interesting account of the industry at this time. The Anheuser Busch Annual Reports for 1998 and 1999 reveal that in 1997 40% of A-B beer was sold through exclusive distributors; by

clusive distributors raised antitrust concerns. Paraphrasing, Section 3 of the Clayton Act provides that an exclusive contract for the provision of goods that substantially lessens competition between upstream firms is in breach of the antitrust law.⁵

This paper asks whether the use of exclusive distributors lessens competition by foreclosing distribution channels that might otherwise be available to competing brewers.

The core data set used in this study is a detailed description of the Greater Chicago distribution networks of 12 beer brewers. This is merged with data on the sales of beer from a major Chicago supermarket chain (Domicks). These demand data include information about the price paid by the chain and the price paid by consumers for the units of beer sold. Combining these sources results in a rich data set that allows the sale of beer to be tracked through the vertical chain.

The analysis proceeds in several steps. First, demand estimates are obtained. Then an industry model is used along with the demand estimates to compute markups. These markups are combined with the retail price to back out the costs to the brewer and distributor. These estimated costs are then compared to see whether exclusivity arrangements lead to cost-based foreclosure. The demand estimates are used to examine the incidence of service-based foreclosure.

The bulk of the existing literature on exclusive dealing is theoretical. Theoretical work on exclusive dealing has investigated justifications for, and the consequences of, exclusionary contracts. The literature is best organised in terms of the offered justifications, which can be grouped into foreclosure, spillover and incentive stories. Salop and Scheffman (1983), Comanor and Frech (1985), Schwartz (1987), Mathewson and Winter (1987), Rasmusen et al (1991), Bernheim and Whinston (1998), Fumagalli and Motta (2006), Simpson and Wickelgren (2007) and Abito and Wright (2008) all investigate models that describe the incentives for a manufacturer to engage in exclusive dealing in order to foreclose rivals from the market.⁶ The essence of all these papers is that a firm can gain from an exclusive dealing contract by forcing competitors to use higher cost distributors or by completely foreclosing them from the market. Besanko and Perry (1993) and Segal and Whinston (2000) provide models where investment spillovers can encourage firms to engage in exclusive dealing. They show that exclusive dealing arrangements can provide an incentive for firms to invest more in their distributors. Marvel (1982) and Ornstein (1989) make similar, informal, arguments. Bernheim and Whinston also provide a model that shows that exclusive dealing can solve incentive problems between manufacturers and shared distributors. This gives a reason why we might expect to see exclusive distributors providing better service. Klein and Murphy (1988), Martimort (1996) and Prat and Rustichini (2003) provide related models.⁷

1999 this had risen to 60%.

⁵Section 1 of the Sherman Act and section 5 of the FTC Act have similar effect. See Areeda and Hovenkamp (2002) for an extensive analysis.

⁶Asker and Bar-Isaac (2014) provide a complementary exclusionary mechanism that does not rely on any contractual obligation.

⁷In the Klein and Murphy model incentives are provided by the threat of contractual termination rather than via incentive contracts. Asker and Bar-Isaac (2014) provide a related model through

A number of empirical papers exist that are related to this study.⁸ Sass (2002) uses a detailed survey of the cost structure of 391 beer distributors to present evidence that exclusive dealing increases the productivity of the sales and promotional effort of distributors. Sass argues that these productivity increases are most likely due to incentives put in place by brewers. Chipty (2001) examines foreclosure in the context of integration between programming and distribution in the cable television industry. She finds evidence in support of foreclosure, in the sense that integrated operators have less externally produced programming. The study here differs from Chipty's in that it focuses on product-service and cost side impacts of possible foreclosure effects.

Using a related approach to this paper, Brenkers and Verboven (2006) evaluate the welfare impacts of enhanced competition between car dealers due to the removal of exclusive territories and exclusive distribution arrangements in the European car market. They proceed by estimating demand and then running experiments based on different scenarios describing the price setting behavior of dealers and manufacturers. These experiments benefit from sanity checks afforded by limited data on average dealer markups at the country level. Due to much finer data on distribution arrangements, the study in this paper is able to delve deeper into the specific effects of particular vertical arrangements. A more recent paper by Nurski and Verboven (2013) examines the Belgian car market, utilizing similarly detailed distribution data. In contrast to this paper, they find that exclusive dealing does lead to foreclosure.

Closely related at a methodological level, Villas-Boas (2007) and Bonnet et al (2005, 2010) use inferred costs (derived using similar methods to those used here) to test different hypotheses about the interaction of supermarkets and manufacturers. Whereas in their markets the method of interaction is unknown, in this study information from interviewing beer distributors and the regulator is used to model this interaction. In this sense, this paper is different in that the mode of conduct in the vertical market is observed. A similar approach (to that employed in this paper) is also used by Hellerstein (2008) and Goldberg and Hellerstein (2013) to investigate exchange rate pass through for beer. Lastly, Miller and Weinberg (2015) use similar structural methods to investigate coordinated effects arising from the 2008 merger of Miller and Coors.⁹

A feature of the beer industry in many states, including Illinois, is the regulatory requirement that exclusive sales territories be assigned to distributors. This is used in this paper to track products up the vertical chain and determine the nature of interaction between distributors. Sass and Saurman (1996), Culbertson and Bradford (1991) and Jordan and Jaffe (1987), all examine the effects of exclusive territories on beer prices. They find that the use of territories have a positive effect on price, while Sass and Saurman also conclude that the territories enhance the provision of dealer

which retailers foreclose entry on behalf of incumbents.

⁸A small experimental literature also exists. See Landeo and Spier (2009) and Smith (2011).

⁹In the last decade, a series of papers have estimated models of vertical market structures in which prices are the result of bargaining. See Crawford and Yurukoglu (2012), and Crawford, Lee, Whinston and Yurukoglu (2015) for leading examples. For the industries where bilateral bargaining over prices is a central feature of vertical interaction, these papers provide a significant advance on the methods used in this paper.

services.

The rest of this paper is organized as follows: Section 2 describes the structure of the Chicago beer market. Section 3 provides an overview of the model used to provide structure to the data, then describes the empirical implementation of this model. Section 4 describes the data set. Section 5 discusses the empirical results, including the demand estimates and the testing of both the service quality and cost-side foreclosure hypotheses. Finally, Section 6 offers some concluding remarks.

2 The Chicago Beer Market

Two Illinois state statutes provide the basis for the regulatory structure which governs the sale of beer in Illinois.¹⁰ This legislation provides the basis for a three-tiered vertical market structure, with the tiers being brewer, distributor and retailer. A member of one tier is prohibited from operating in another tier. Under the legislation the brewer has to supply their beer to one or more distributors who are in turn responsible for distributing the beer to retailers.

A distributor must be given a distribution territory by the brewer. Within this territory the distributor has the exclusive distribution rights for the brands assigned to them. These territories must be registered with the Liquor Control Commission. The standard practice is that territories be contiguous geographic areas commonly bordered by major roads or county boundaries, although brewers are free to configure them as they wish.¹¹

Within this three-tier structure the market works as follows. Brewers produce the product and deliver it to the distributor. The distributor buys the beer at a flat rate from the brewer and then sells it on to retailers within their territory. Figure 1 shows a stylized example of the way the three-tier system works.

figure 1 around here

The brewer has varying degrees of input into the wholesale price charged by the distributor to retailer. When dealing with a large supermarket chain, a sales representative from the brewer will arrive at a wholesale price for the chain with the chain's buyer. Distributors are then expected to supply at that price.¹² Discussions

¹⁰The Liquor Control Act of 1934 (235 ILCS 5/.) and The Beer Industry Fair Trading Act (815 ILCS 720/.)

¹¹The distribution agreements between brewers and distributors, in some instances, last for decades. This can be seen from the dates at which agreements and territories are registered. While actual contracts are not required to be registered with the Liquor Control Commission, a very small number of filings did contain contracts or parts of contracts. There was no evidence in these extracts of contracts having a short length (less than two years), indeed the one complete contract that was read did not have a finite end date (although provisions addressing proper termination and notice did exist).

¹²While resale price maintenance is prohibited explicitly by the Beer Industry Fair Trading Act (sections 5(3) and 2(A)(i)), this practice does not appear to invite legal sanction.

with distributors indicated that they had little or no freedom to negotiate another price; as far as they were concerned they had to take the price as given. The demand and price data used in this study is taken from the Dominick's Finer Foods (DFF) supermarket chain. Since this is a large chain, this data allows us to test the claim that the price to retail is fixed by the brewer. This institutional structure is confirmed in the data - less than 2% of observations at the UPC level have the price to retail varying across distributors serving Dominick's Finer Foods.¹³

Distributors also have a significant role in providing product support (which this paper will refer to as 'service'). While brewers take care of national and regional advertising campaigns, distributors are responsible for point of sale (POS) promotion and advertising, particularly that which is ongoing and not linked to an specific promotional event. Distributors supply POS materials to retailers and coordinate other service activity at the retail outlet.¹⁴ This other service includes monitoring the retailers to make sure that shelving and in-store positioning is adequate, that labels are readily visible and that stocking is occurring at appropriate frequency. Distributors also appear to have an important role in transmitting information back to brewers so that when interacting with large retailers, like Dominicks, brewers are well informed about the quality of the retail experience.

The laws regulating the Illinois beer industry make it easy to identify the vertical structure of this market. Elsewhere, the vertical structure is an artifact of individual distribution contracts which are very hard to observe. Here, the registration of exclusive territories makes the vertical structure observable and the laws give a clear basis for the interpretation of the nature of competition at the distributor level. The territory records provide a way to map a beer sale in a particular store, to the distributor who provided the beer and then to the brewer. This feature of the regulatory environment enables much of the following analysis to proceed.

3 The Foreclosure Tests, the Industry Model and its Empirical Implementation

To investigate the potential impact of exclusive dealing arrangements on the beer industry in Chicago an industry model is proposed and then used to estimate demand and cost parameters. The model provides the environment in which the tests for foreclosure can be implemented. Rather than jumping straight into this model, the foreclosure tests are first described. The model is then described and used to take the analysis to the point where these foreclosure tests can be implemented.

Although the data are described fully in section 4, it will be useful to have in mind the following facts. The demand data contain UPC level observations for 73 beer

¹³Universal Product Codes (UPCs) are the bar codes found on most products.

¹⁴The provision of distributor service is seen as very important by all brewers; so important that Anheuser-Busch and Miller initiated legal proceedings against each other in 1998 over contractual clauses they alleged interfered with each others' products (see Stamborski 1998 and Bloomberg News 1998).

brands drawn from 71 Dominick’s Finer Foods (DFF) stores spread through Greater Chicago, in 24 weeks. Pricing by DFF is done at a chain-wide level. Moving up the vertical chain, 12 brewers use 42 distributors to serve DFF, averaging 6 distributors each. The price to the consumer and the price to retail for each product are observed.

3.1 The Foreclosure Tests

3.1.1 Concept

This paper examines foreclosure arising from competitors being unable to gain access to low cost distributors and also from competitors being unable to gain access to those distributors that provide better product services. In both cases there are concerns about distributors with desirable characteristics being foreclosed. In what follows this characteristic is assumed to be low cost distribution, however the logic remains the same when service quality is considered.

The test considers two types of market; those with a distributor to whom access is restricted by an exclusive arrangement with a brewer: and markets without a distributor restricted by an exclusive arrangement. Under the foreclosure hypothesis, if the distribution of potential distribution costs in these markets were the same then the presence of an exclusive arrangement would mean that this distribution of costs would be truncated from the left, for those brewers that never use exclusive distributors. That is, an exclusive arrangement would prohibit competitors from getting access to the distributors in the low cost tail of the distribution. Then, in expectation, distribution costs for the set of potentially foreclosed brewers should be higher in markets that have access to a distributor restricted by an exclusive arrangement.

Of course, if exclusivity arrangements are being used to protect investments then this pattern would not necessarily be expected. It is easy to imagine a setting in which the initial state of distributors is the same and exclusive distributors, via some investments, are made more cost effective. In this setting there would be no difference between the two types of markets in terms of the distribution costs for competitors.

The test is designed to pick up whether foreclosure effects are present. This is distinct from diagnosing whether they were intended. It may be that exclusivity arrangements are being used to protect spillovers and the distributors selected to be exclusive are also from the low cost tail of the distribution. An implication of this would likely be foreclosure, in the sense of competitors having higher costs in exclusive markets. In such instances the social benefit of exclusive practices would be ambiguous since the added incentive for investment may or may not compensate for the distortion in competitors costs.

figure 2 around here

The central problem of formulating a test for foreclosure is in the lack of understanding of the equilibrium structure of distribution chains with and without exclusive dealing. Because of this, the test offered here is not “necessary”. This is illustrated

in Figure 2. Figure 2 shows two markets in equilibrium. In both markets the brewer marked by the grey circle is matched to the low cost distributor (distributor 1). In market 2 this relationship is exclusive. The equilibrium allocation of brewers to distributors in market 1 results in the average cost of distribution being c^* for brewers other than the grey brewer. In market 2, the configuration of brewers and distributors changes so that all other brewers use distributor 2. In market 2, despite one brewer being foreclosed, the average distribution cost has decreased from c^* to c_2 . Despite foreclosure occurring in this market, the change in equilibrium configurations will result in this not being detected by the proposed test. Hence, the cases that will prove problematic for the test are where one brewer is excluded but equilibrium reallocations of distributors actually benefit other brewers substantially. In these cases it may even be that the social welfare effect is positive overall.¹⁵

Having laid out the basis for the test questions of implementation are now examined.

3.1.2 Implementation

Implementation of the the test is aided by the structure of the data. In the Chicago beer market all Anheuser Busch distributors are exclusive, half the Miller distributors are exclusive and all other brewers are using shared distributors. This means that the treatment effect of exclusivity of Anheuser Busch is constant across the region, while there is variation in Miller.

In running the test each store is taken to be a distinct market. The test compares the cost to brewers, other than Anheuser Busch and Miller, of serving a market with a Miller-exclusive to the cost of serving markets without a Miller-exclusive. If the cost of serving a market with a Miller-exclusive is higher then this can be taken to be indicative of either foreclosure or some other market specific effect correlated with the exclusivity of Miller distributors. To untangle these effects the Anheuser Busch distributors are used as a control group to pick up market specific effects. That is, the cost effect for Anheuser Busch of being in a market with a Miller-exclusive is measured and this is taken to be the market effect. This inferred market effect is then used to normalize the measured effect on the potentially foreclosed brewers.¹⁶

This implementation requires two important conditions: First, that the second and higher-order moments of the distribution of potential distribution costs are invariant across markets; And second, that the access of Anheuser Busch to distribution is not affected by the presence of a Miller-exclusive. This second condition is satisfied if Anheuser Busch were to get first pick of the distributors. If Anheuser Busch is affected by the presence of a Miller-exclusive this would mean that the market specific effect may have a positive bias, presuming that the more likely effect would be that the presence of a Miller-exclusive would make access harder. However, given Anheuser Busch always chooses to be exclusive it is hard to imagine how the exclusivity or

¹⁵This suggests that the cases where the test may falsely reject the hypothesis of foreclosure are likely to those that are less important from the perspective of policy.

¹⁶That is, the test has a diff-in-diff structure.

otherwise of another distributor would affect them.¹⁷

Implementation of this foreclosure test requires cost information. Cost information is highly sensitive commercial data and is unavailable here. To combat this issue the industry model, outlined below, is used to infer cost data from price and quantity data.

When foreclosure of high service quality distributors is examined the test is run in a similar way. Instead of comparing costs in different markets, the demand effect of facing a Miller-exclusive is the variable of interest. If facing a Miller-exclusive has a negative impact on the performance of products from potentially foreclosed brewers then we have some basis for being concerned about foreclosure.

To begin with, the test outlined above is implemented using the demand data. The effect of facing a Miller-exclusive on demand, is assessed using Anheuser Busch as a control group to manage any market specific effects.

An identification problem emerges when considering running the test in this way. There are at least three different reasons why product performance may be lower in markets with a Miller-exclusive: first, there may be some market specific effect, such as a strong dislike for beer in these markets; second, the Miller-exclusives may be better at providing service, causing people to substitute away from other brands; third, the service quality of other brewers distributors may be lower due to foreclosure effects. The third effect is of interest here. In the basic form of the test the Anheuser Busch control group is being relied on to control for the first two effects. Since cross-product substitution effects are likely to be different for different products this is especially unsatisfactory for dealing with the second effect. With this in mind a reformulated version of the test is also run.

Distributors who do business for the potentially foreclosed brewers are divided into three classes. The first class comprises those distributors who never serve a market with a Miller-exclusive. The second class comprises those distributors who serve some markets with a Miller exclusive and some markets without. The third class comprises those distributors who only serve a markets with a Miller-exclusive. In implementing the test I compare distributors in classes two and three in markets where Miller is exclusive. Distributors in class two are used in markets where Miller is not exclusive. This means that they are selected even when the market is not potentially foreclosed. Thus, under a foreclosure hypothesis, distributors in class two should be better at service provision than distributors in class 3. By comparing these two groups of distributors in markets with Miller-exclusives the first two reasons (outlined above) why product performance may be lower in markets with a Miller-exclusive are controlled and the third reason, that the service quality of other brewers distributors may be lower, can be evaluated.

One condition that is required for this implementation of the test is that class two distributors do not substitute service away from markets with a Miller-exclusive toward those markets without a Miller-exclusive. This would lead us to be biased toward rejecting foreclosure too often. A sense of the importance of this condition can

¹⁷One possible way it might affect Anheuser Busch is if it changed the "order" of who picked distributors when.

be gleaned from the data, and will be discussed with the results.

3.2 The Industry Model

The purpose of the industry model is to provide a framework for analysis of the data, so that the tests outlined above can be implemented. When examining cost-based foreclosure the cost data needs to be inferred from pricing decisions and shares (since cost data is unavailable). The model outlined below allows this inference to be made. The investigation of service-based foreclosure utilizes a demand system which is part of the empirical industry model.

The proposed model divides the industry into its three tiers: retailers, distributors and brewers. Products are taken to be horizontally differentiated, with consumers having different preferences for different products. The retailer (Dominick’s Finer Foods) sets the price paid by consumers, taking into account the cross-price elasticities with all the products they stock, the price they pay at wholesale and their other costs. Further, when they set a price for a product they set a chain-wide price. That is, for a given product, price across different stores does not vary. Nonetheless, in estimating demand each supermarket is assumed to operate in a distinct, stand-alone market.

The brewer sets the price paid by the retailer and the price paid by the distributor. In this sense, the brewers’ pricing decision is modeled in the same way as resale price maintenance is modeled in standard double marginalization models. When the brewer sets prices they take into account their costs, a participation constraint for the distributor, the cross-price elasticities with other products they produce and the impact of the price paid by the retailer on the ultimate price paid by the consumer. In this model the retailer is assumed to be a monopolist while the brewer is taken to be an oligopolist.¹⁸

figure 3 around here

The timing of the model is set out in Figure 3. Brewers move first, taking into account the impact of the prices they set on the prices subsequently set by the retailer. The retailer sets the price paid by consumers after the brewers have set wholesale prices. The model is a dynamic game of complete information, solved by application of the equilibrium concept of subgame perfection. As is standard in these games backward induction is used to find equilibria.

The retailer solves the following problem when choosing the retail price:

$$\max_{p_j^c} \sum_k \sum_j (p_j^c - p_j^r - c^r) [M_k s_{jk}(p^c, x|\theta)] \quad (1)$$

Where p_j^c (p_j^r) is the price to consumers (retailers) of product j at store k , c^r captures store level marginal costs, M_k is the market size for store k and $s_{jk}(p^c, x|\theta)$ is the share of product j at store k which is a function of consumer prices, other product

¹⁸Equivalently, the retailer optimizes against a residual demand curve.

characteristics and model parameters. Solving this problem gives the following first-order condition for each product l

$$\sum_k M_k \left(s_{lk}(p^c, x|\theta) + \sum_m \frac{\partial s_{mk}(p^c, x|\theta)}{\partial p_l^c} (p_m^c - p_m^r - c^r) \right) = 0 \quad \forall l \quad (2)$$

The brewer solves the following price setting problem:

$$\begin{aligned} \Pi^b &= \max_{p^r, p^d} \sum_{j \in B^b} \sum_k (p_{jd(k)}^d - c_j^b) M_k s_{jk} & (3) \\ \text{subject to } p_j^r - (c_{jd(k)}^d + r_{jd(k)}^d) - p_{jd(k)}^d &= 0 \quad \forall d(k) \end{aligned}$$

Where $p_{jd(k)}^d$ is the price paid by the distributor who serves store k for product j , B^b is the set of products made by the brewer and c_j^b represents the costs of production of the brewer. The term $(c_{jd(k)}^d + r_{jd(k)}^d)$ catches the per unit cost of distribution internalized by the brewer. A component of this is the cost of the physical distribution process, $c_{jd(k)}^d$, while the rest are any quasi-rents that may have to be transferred to the distributor per unit distributed, $r_{jd(k)}^d$. This $r_{jd(k)}^d$ may be a result of some bargaining process or transfers used to induce particular actions. In any case, $(c_{jd(k)}^d + r_{jd(k)}^d)$ summarizes the markup on $p_{jd(k)}^d$ received by the distributor, which is treated as a cost term when the brewer is setting the optimal level of p_j^r .

The first-order condition for expression (3) is

$$\frac{\partial \Pi^b}{\partial p_j} = \sum_k M_k s_{jk} + \sum_{l \in B^b} \sum_k (p_l^r - [c_{jd(k)}^d + r_{jd(k)}^d] - c_l^b) M_k \sum_m \frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r} = 0 \quad \forall j \in B^b \quad (4)$$

It is important to note the essentially passive role of the distributor in this model. While it seems reasonable to assume distributors choose a service level to direct toward each brand, taking as given the margin they earn on the brand, it is assumed that brewers do not use this margin to provide incentives for distributor service. This assumption still leaves room for the use of fixed payments as rewards for service.¹⁹ Additionally, it significantly eases the computational burden in estimation.²⁰

¹⁹Note that, when demand is estimated, the large size of the data set allows brand dummy variables to be interacted with distributor dummies. This incorporates the mean level of service provision by each distributor on each brand into the estimated product characteristics. When markups are calculated the precise level of service provision for each store and week is incorporated into the estimated utility of the consumer (in the ‘deltas’, or the non-interacted component of utility). Hence, the only substantive assumption is on the brewers’ pricing decision.

²⁰The assumption is on the derivative of effort w.r.t. distributors’ markup times the derivative of demand w.r.t. effort. Since both these effects are likely to be small at the margin, their product is likely to be very small. The extra layer of complexity required to relax this assumption would increase the computational complexity by several orders of magnitude, making estimation impractical.

3.3 Econometric Implementation

Estimation of the model proceeds in two steps. First, a demand system is estimated using the scanner data from Dominick’s Finer Foods (DFF). These demand estimates are then combined with the industry model to impute the markups at the retail and the wholesale levels (recall that we observe the price paid by the retailer). The second stage takes the observed prices paid by the retailer and backs out the costs using the estimated markups from the first stage. Then, the impact of various cost drivers are investigated. In what follows elements of each step are discussed.

3.3.1 Demand

Beer is a differentiated product. Hence, any demand model used must be able to handle product differentiation. Two demand models are estimated. The first, the logit model, is nested in the second, the random coefficients logit model as implemented by Berry, Levinsohn and Pakes (1995) (BLP hereafter). Nevo (2000b) and BLP provide a detailed overview of the mechanics of these models.

The convenience of the logit model for estimation is offset by the restrictions the specification places on the resulting demand function. The most unattractive aspect of the model is that cross-price effects become solely a function of product shares. The resulting substitution matrix is thus flawed, to the extent that consumers in the market substitute more readily between products that are ‘closer’ in the characteristic space. The random coefficients logit model (BLP) relaxes these restrictions.

The basic specification of the utility function giving rise to demand is given by

$$U_{ijkt} = x_j \beta_i - \alpha_i p_{jt}^c + \xi_{jkt} + \varepsilon_{ijkt}$$

where ε_{ij} ’s capture idiosyncratic tastes that are assumed to be distributed according to a gumbel (extreme value type 1 (maximum)) distribution. Following BLP and Nevo (2000b) the random coefficients, $[\alpha_i, \beta_i]$ are functions of demographic variables taken from census information (denoted D_i) and unknown consumer characteristics v_i . Thus $[\alpha_i, \beta_i]$ are given by

$$[\alpha_i, \beta_i] = [\alpha, \beta] + \Gamma D_i + \Upsilon v_i$$

D_i takes an empirical distribution implied by market level demographic data. v_i are assumed to be distributed $N(0, I)$. The matrices Γ and Υ contain the parameter values to be estimated. Γ contains the parameters on interactions between demographic variables and product characteristics. Υ contains a lower triangular matrix that represents a cholesky decomposition of the variance-covariance matrix of the v_i ’s.²¹

The model is completed by the inclusion of a good, denoted good zero, which captures all the outside goods. As is standard in the discrete choice demand literature

²¹If the $[\alpha_i, \beta_i]$ coefficients are not dependent on the individual factors (that is $[\alpha_i, \beta_i] = [\alpha, \beta]$) then the model is just the GMM implementation of the familiar logit model (McFadden (1974)).

it is assumed that consumers purchase only one unit during an observed week.²²

If $[\alpha_i, \beta_i] = [\alpha, \beta]$ then we have the familiar logit model, which can be transformed to give the following estimating equation

$$\ln s_j - \ln s_o = x_j \beta - \alpha p_j^c + \xi_j \quad (5)$$

where s_o is the share of the outside good. In the more general model a contraction mapping theorem is used to extract the unobserved terms, ξ_j allowing moments to be formed for estimation (see BLP for details).

In these data, price is likely to be correlated with unobservable characteristics known by consumers and price setters, but not the econometrician. As a first step to solve this problem distributor-brand dummies are included in the demand specification. These dummies pick up any time-invariant unobservable at the distributor-brand level. Together with variables for packaging, this takes care of time invariant unobservables at the product level. Variables that capture in-store promotional activity and seasonal effects will capture some time variant effects. However, in these data there is still concern about short run unobservables, like promotional activity at the national or regional level, changes in shelf placement, unobserved packaging changes, community events and so on. This means that a set of instruments in place of price is desirable for consistent parameter estimates. In this study lagged and lead mean prices for the brand are used as instruments for each product. The lag and lead is four and eight weeks. These instruments are similar in spirit to those used by Hausman et al (1994) and Nevo (2000a) & (2001), the difference here being that cost shocks are assumed to be shared across time rather than across geographic markets.²³ The instruments are valid to the extent that time variant demand unobservables at the retail level have a short duration of effect, while underlying cost changes are more persistent.

In the BLP (as opposed to logit) demand model, price needs to be interacted with demographic data (so as to form the α_{ik}). The demographic data used here are household income and age taken from the 1990 census. The characteristics were matched to the zip code of each store to create the appropriate set of demographics for each observation.²⁴

²²Throughout the paper, heteroskedasticity robust standard errors are reported. Clustering standard errors may make sense, depending on whether the appropriate sampling theory is at the store-week or store level (recalling that the demand approach also requires n to increase in products). Here, it is judged that the appropriate sampling theory would be at the store-week level. In any case, since clustering would most likely widen the confidence intervals, doing so would not be expected to change the conclusions of the paper.

²³Recall that, since products are priced on a chainwide basis, we have only one market (in the sense of Hausman et al, or Nevo) at any point in time.

²⁴Where a store stood on the boundary of a zip code it was assumed customers were drawn from each zip code with equal probability. To aid in sampling in the simulation estimator the income data were fitted to a lognormal distribution and the age data to a gamma distribution, following the methodology used in BLP.

3.3.2 Distributor and Brewer Costs

An objective of this paper is to measure any cost differences between markets that may be foreclosed and those that are not. To do this I take the markup, computed from earlier demand estimates, away from the price to retail, leaving costs, and then investigate the determinants of cost variation between different brewer-distributor combinations. The two econometric issues are to correctly instrument for an endogeneity problem that arises from the fact each brewer has to take into account the costs of several distributors in making each pricing decision and, secondly, to construct the standard errors of the second stage estimates, taking into account variance introduced from the use of first stage coefficient estimates.

The first-order condition in equation (4) summarizes the economic problem of the brewer. To use this first-order condition I need $\frac{\partial s_{lk}}{\partial p_m^c}$ which is available from the demand system. I also need $\frac{\partial p_m^c}{\partial p_j^r}$. This is derived from the retailer's first-order condition using the implicit function rule.

To set one price for the chain the brewer must take into account the different costs of servicing each store of the chain. Since each distributor is serving only a subset of stores in the DFF chain, when the brewer sets the price for the chain, the costs of several different distributors must be taken into account, according to the demand conditions in the individual markets they serve.

To recover costs as a linear function of the markup and price we need to invert the system of equations (4). A difficulty is introduced in this context by the introduction of distributor costs.²⁵ Since $(c_{jd(k)}^d + r_{jd(k)}^d)$ in equation (4) is a market specific variable we cannot "pop" it out cleanly in the same way as a chain wide variable can be recovered. This can be seen if we rewrite equation (4) as follows:

$$\sum_k M_k s_{jk} + \sum_{l \in B^b} (p_l^r - c_l^b) \left[\sum_k M_k \sum_m \frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r} \right] - \underbrace{\sum_{l \in B^b} \left[\sum_k (c_{ld(k)}^d + r_{ld(k)}^d) M_k \sum_m \frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r} \right]}_{\text{part 3}} = 0 \quad \forall j \in B^b$$

which, letting the ij^{th} element of $\mathbf{G}_k = \sum_m \frac{\partial s_{jk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_i^r}$, can be rendered in matrix notation as

$$\mathbf{B} + \left[\sum_k M_k (\mathbf{G}_k \bullet \Pi) \right] (\mathbf{p} - \mathbf{c}^b) - \underbrace{\sum_k [M_k (\mathbf{G}_k \bullet \Pi) [c_{d(k)}^d + \mathbf{r}_{d(k)}^d]]}_{\text{part 3}} = 0 \quad (6)$$

where $-\left[\left(\sum_k M_k \mathbf{G}_k\right) \bullet \Pi\right]^{-1} \mathbf{B}$ gives the markups on the prices to retail. The Π term is a J -by- J accounting matrix that makes sure that only the set $l \in B^b$ is considered

²⁵There is also a minor issue arising from the fact that the price in the demand equation is price per 12oz. I have to trivially adjust equation (4) to model the brewer as choosing a per 12oz price, if the demand estimates are to inform the estimation. Thus estimated costs etc are per 12oz.

in the first-order condition (\bullet is used to denote element-by-element multiplication of matrices).²⁶ The inclusion of the $\mathbf{c}_{ld(k)}^d + \mathbf{r}_{ld(k)}^d$ terms in the summation over k in part 3 of equation (6) is the problem. Were this $\mathbf{c}_{ld(k)}^d + \mathbf{r}_{ld(k)}^d$ term able to be factored out of the summation we would be able to include it in the $(\mathbf{p} - \mathbf{c})$ vector in the second part of the equation.

Rearranging equation (6) gives the estimating equation for a specific product j

$$p_j - \mu_j(x, \theta, \xi) = \alpha c_j^b + \beta \sum_k W_{kj}(x, \theta, \xi) [c_{ld(k)}^d + r_{ld(k)}^d] + \varepsilon_j \quad (7)$$

where

$$W_k(x, \theta, \xi) = \left[\sum_k M_k (\mathbf{G}_k \bullet \Pi) \right]^{-1} M_k (\mathbf{G}_k \bullet \Pi) \mathbf{1}_{[J \times 1]}$$

These weights capture the marginal importance to each product of the stores served by each distributor. $\mu_j(x, \theta, \xi)$ is the markup on the price to retail.

The concern is that the inclusion of the $\frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r}$ terms in the regressor, $\sum_k W_{kj}(x, \theta, \xi)(c_{jk}^d + r_{ld(k)}^d)$, will give rise to an endogeneity problem (prices should be correlated with cost unobservables and so functions of prices are likely to be as well). Since $\frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r}$ is only a function of demand level parameters²⁷, endogeneity is a concern if a cost unobservable is feeding through to the price to the consumer (as would be expected if firms are profit maximizing) or if the cost unobservable is correlated with the level of the utility derived from the product. An example would be the hypothetical ‘Green Beer’ which differs from ordinary beer only in its color (which is unobserved). If it costs more to produce green beer, but people like to drink it (say on special occasions like St. Patrick’s Day), then we would expect $\frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r}$ to be correlated with the cost unobservable associated with green beer..

Consider a scenario where the $\frac{\partial s_{lk}}{\partial p_m^c} \frac{\partial p_m^c}{\partial p_j^r}$ terms are such that those stores served by distributors with high $[c_{ld(k)}^d + r_{ld(k)}^d]$ terms are also ones measured as having higher marginal importance (higher weights) for the costly, but popular, ‘green beer’.²⁸ Then this story would lead to a positive bias in the estimates of β .^{29,30}

²⁶All vectors are column vectors, unless otherwise noted.

²⁷To see this note that $\frac{\partial s_{lk}}{\partial p_m^c}$ is already available from the work on retailer costs and $\frac{\partial p_m^c}{\partial p_j^r}$ is recoverable without using data on p^r .

²⁸Say the $[c_{ld(k)}^d + r_{ld(k)}^d]$ term was an exclusive dummy. This might occur due to exclusive distributors providing relatively better support for more expensive brands, or due to some territory specific component of peoples preferences.

²⁹This is distinct from the $[c_{ld(k)}^d + r_{ld(k)}^d]$ terms being correlated with unobserved costs. Consider a story where all products go through all the distributors. Unobserved product cost is uncorrelated with distributor characteristics, $[c_{ld(k)}^d + r_{ld(k)}^d]$, but the weights will still be correlated.

³⁰Exploration of this issue with simulated data found that it was easy to find parameter settings under which the bias was large enough to be economically significant.

This problem can be dealt with using appropriate instruments. In this instance, variables that should be included in the $\left[c_{d(k)}^d + r_{d(k)}^d \right]$ terms give us potential instrumental variables. Since if foreclosure were occurring facing a Miller-exclusive would increase distribution costs, the element of this expression that is of interest is a dummy for whether the market has a Miller-exclusive. This leads to the instrument being the proportion of stores at which a product is stocked that are served by a Miller-exclusive. A sufficient condition for the validity of the instrument is that the stocking decision be independent of whether the distributor is exclusive or not.

The last issue is making adjustments for the two step estimation procedure being adopted here. The empirical strategy requires preliminary estimates of demand as an input into the estimation of costs. The difficulty in implementing the cost estimator in this context is that it is the second step in a two step process. This has no impact on the consistency of results but will affect the standard error estimates. Thus the fact that estimated parameters are being used in this second step needs to be directly incorporated into the estimates of the variance-covariance matrix. The method for making this adjustment is discussed in Wooldridge (2002).

4 Data

The Chicago Distribution System The new data set introduced in this paper documents the exclusive sales territories of 12 brewers' distributors in Illinois in 1994. These 12 brewers comprises all of the major domestic brewers and most of the major imported brands. It also includes some smaller brewers. The selection of brewers provides a sample covering of over 90% of the beer sold through the Dominick's Finer Foods supermarket chain, the source of the demand data used in this study.

Data on exclusive sales territories is collected by the Illinois Liquor Control Commission. Brewers are required to keep an up-to-date register of the sales territories of their distributors with the Commission. These registration documents must specify the relevant brands, the precise geographic area covered by the territory and the time period of the distribution agreement.³¹

figure 4 around here

Figure 4 shows the result of the data collection process. For each brewer we can draw a map of their distributors' territories. The maps in Figure 4 are stylized for ease of illustration. Each square corresponds to a page in the Rand-McNally street

³¹The availability of these data was made possible by the generosity of the Commission in allowing access to their archives and their patience with questions about how the data were organized. The data exist in hard copy form in Illinois.

The data supplied by the brewers is often far more detailed than is required, at times even including the complete text of the distribution arrangements. To an economist, these contracts tend to be remarkably vague documents. However, it is interesting to note that where they are most precise is in describing the data collection and data sharing responsibilities of the distributor. Actual performance benchmarks and targets tend to be qualitative at best.

directory (3.5 x 4.5 miles). Shaded squares indicate the presence of at least one Dominick’s Finer Foods supermarket. Comparing the territories of the three brewers illustrates the variation in territory configuration across brewers (note that none of the distributors are shared between these brewers).

An examination of Figure 4 and the underlying data are quite informative. The following stylized facts quickly emerge:

- Different brewers do not divide Chicago into the same territories;
- The sales territories for a single distributor serving two brewers tend not to overlap perfectly;
- Different brewers use different numbers of distributors; and
- Territories tend to remain the same over the course of several years.

It is worth noting some caveats on the territory data. The files from which the data were drawn occasionally had missing documents. In most cases this was not a problem since, as territories are contiguous, the territory for a distributor will be defined by the boundaries of the neighboring distributors (recall territories may not overlap). This feature of the data, together with the complete lists of distributors serving a brewer contained in the files, meant that the territory of the problematic distributor could be described. However, in two instances the files had too many missing documents to enable the recovery of all the territories for a brewer’s brands. In these instances the brewer was dropped (this resulted in Heineken and Guinness, both major imported brands, being omitted from the sample).

Information on the presence of exclusive dealing arrangements was collected by talking to industry insiders and comparing various industry sources. It is accepted in the Chicago industry that there are three different distribution “systems” in the city: the Anheuser Busch system, which is completely exclusive; the Miller system, which is somewhat exclusive; and the “all others system” which is a catch-all for distributors who are not in the Anheuser Busch or Miller systems. Table 1 contains information on the relationships between the 42 distributors in the data (each indicated by a number from 1 to 42) and the 12 brewers. Table 1 shows which distributors deal for which brewers and also whether the relationship is exclusive (indicated by a shaded rectangle). The Barton and Heilman distributors who are indicated as being exclusive are marked this way as, according to the data, they are only serving one brewer. This is distinct from having an exclusive arrangement with the brewer. Since there is no corroborative evidence to suggest that there was an exclusive arrangement between these distributors and the brewers, they are not considered as being party to such an arrangement.³²

table 1 around here

³²Indeed, examination of the available data on distributor characteristics suggest that several of these distributors are highly likely to be lemons, in the sense of being very poor quality.

Demand Data from Dominick's

Demand data are drawn from the Dominick's Finer Foods data set collected by the Chicago GSB Marketing Department.³³ This is a data set that provides weekly scanner data on consumer purchases at stores in the Dominick's chain across a wide range of products. This study uses data on beer sales during 1994 drawn from this much larger, data set.

Dominick's Finer Foods is the second biggest supermarket chain in greater Chicago (Jewel being the biggest), having around a 20% market share depending on the year and source (Hoch et al (1994)).³⁴

For each beer, the data provide a considerable amount of information. The brand, store and week are recorded, together with the price at which the beer was sold to consumers. When promotional activity occurs this is also recorded (the promotional activity is usually a price decrease resulting in a sale, as distinct from the other forms of ongoing sales service that distributors provide (see section 2)).³⁵ Lastly, the data records the average prices paid by the retailer for their inventory of each beer.³⁶ Thus this acquisition price and the true economic cost may be slightly different.

In the data this average acquisition cost (or price to retail) varies across stores by less than 1¢ for 98% of UPCs. 76% of UPCs show no variation. The remaining 22% is accounted for by the way DFF computes the cost of inventory (Dominick's reports the average acquisition cost of inventory. Hence, where stores are running through inventory at slightly different rates we would expect slightly different average acquisition costs). Given the legal requirements that beer distributors sell only to stores in their territory, this pattern of wholesale price indicates that the brewer is coordinating the price to retail across distributors. As noted earlier this confirms the anecdotal evidence collected from distributors. This institutional feature is an important aspect of the model used in this study.

The same analysis on the price to consumers suggests that DFF sets prices centrally. That said, there is more variation in prices across stores at the UPC level as compared to the price to retail. Centralized price setting on the part of DFF is incorporated into the model.

The data on beer are provided at the UPC level, by store, by week. This results in a very large data set. Organizing the data requires drawing a balance between the size of the data set and the desire to use the actual transaction prices paid by consumers rather than resorting to some weighted average measure of price. To do this a product is defined as a set of observations where the brand, size (6-pack, 12-pack etc), price

³³This data set is available online at <http://gsbwww.uchicago.edu/research/mkt/Databases/DFF/DFF.html>

³⁴The importance of Dominick's to individual distributors varies. Using reported revenues from the 1994 Beverage Marketing Directory, the Dominicks stores make up around 3% of the business of the average distributor of Anheuser Busch or Miller products. This number varies however, the maximum is around 10% and the minimum less than 1%. Since revenue is self-reported and recorded in ranges the numbers are only indicative at best.

³⁵The documentation supporting the DFF data comment that this variable may fail to report some promotions. There is no way of telling whether this is a problem in the data used here.

³⁶Beer distributors visit major accounts like Dominicks several times per week, so it is likely that the impact of this averaging of the price paid by the retailer is minimal. In particular, contamination from acquisitions made in previous weeks should be small.

to consumer, week, store and promotional status are the same.

The price to retail is not required to be the same. Across stores, this can vary slightly due to stores going through inventory at slightly different rates (refer back to the earlier discussion). For each product the price to retail is a quantity weighted average. However, as the earlier discussion suggests, these averages are over prices that very similar.³⁷ Due to the cost of inventory issue, this averaging procedure will always be required, regardless of how the data are organized.

Table 2 provides some descriptive statistics of the demand data. The data contain 138213 observations, where an observation is the weekly purchases of a product (as defined above), in a store, in a week. The data are drawn from 71 stores spread across greater Chicago (see Figure 4 for some indication of the geographical distribution). 73 brands of beer are used, which together account for over 91% of the beer sold at Dominick's stores in 1994. Overall Dominick's sells in excess of 3 million gallons of beer each year. These 73 brands are drawn from 12 brewers, listed (together with their distributor allocations) in Table 1.

table 2 around here

Table 2 shows descriptive statistics of the price paid by the consumer for a 12oz serve of beer (equivalent to a bottle). The mean price is 60¢ with a large standard deviation (17¢). The minimum price per bottle in the data is 19.8¢ and the maximum price is \$2.97. Table 2 also shows corresponding statistics for the price paid by the retailer. Mean price to retail per 12oz is 50¢ with a standard deviation of 13.5¢. The minimum price to retail is 15.3¢ and the maximum is \$1.11. These statistics suggest an average retail markup (ignoring shelf costs) of 10¢ per bottle, a conclusion borne out by closer examination of the data. The mean difference between price to retail and the price paid by consumers per bottle is 9.7¢, with a maximum of \$2.49 and a minimum of -34¢, reflecting a sale. Promotional activity is quite common in this data set with just under $\frac{1}{3}$ of all observations being recorded as a sale item.

The data provides information on the total number of customers visiting the store for each week, in about $\frac{2}{3}$ of cases. This is used as the market size where available. Where this is not available the number of customers visiting the store is forecast from regressions done on those stores where these data are available. The regressions are run using an OLS specification, with population, median age, median household income and a constant as regressors. The demographic data are for the surrounding zip code taken from the 1990 census. These regressions are done for each week, so week specific fixed effects (due to holidays, for instance) are taken into account by the constant. The standard approach in demand estimation has been to make an *a priori* assumption about the geographical market size and then infer the population size using the assumption and census data.³⁸ Given the richness of the information

³⁷Differences, where they occur, are usually at the 3rd or 4th decimal place. That is, tenths or hundredths of a cent, when price is quoted as per 12oz.

³⁸See BLP (1996), Nevo (1997) and (2000), Mortimer (2003) and Villas Boas (2002), for a few examples of this approach.

in this data set, this paper departs from the traditional approach and lets the data guide the market size.³⁹

Once the size of the market has been set, shares can be calculated from the data on quantity. Here, an assumption is made; that consumers buy only one unit of beer, where a unit is defined as at the UPC level. That is, if a six pack of Bud sold then it is assumed that that was the only beer the consumer bought. This assumption allows shares for each product to be calculated as the number of units sold divided by the market size. To make everything add up to one, an outside option is introduced with collects all those consumers who chose not to buy any beer. Table 2 shows the average share of a product to be 0.05% with a standard deviation of 0.09%. The smallest share is 0.003% and the largest is 3.7%.

Data on beers' alcohol by volume (ABV) and calories per 12oz, was collected from industry publications from around the time of the study (Brewing Matters (1995) and (1996)) or by contacting brewers directly. Table 2 shows that the average ABV among the brands in this sample is 4.4%, while the average amount of calories per 12oz is 130.

5 Empirical Results

5.1 Demand

Several different demand specifications are considered in this study, all nested in the BLP framework considered above. These estimated demand systems are identified from variation in products' shares. In particular, this exploits variation in the composition of characteristics available across the different choice sets. In the simple logit specification (equation 5) the impact of a product's characteristics on its own and other products' shares is captured by the $\ln s_j - \ln s_o$ term. In the full BLP specification the relationship is algebraically more complex, but similar in flavor. As described in section 3.3, identification of the price coefficients is aided by the use of instruments and distributor brand dummies. The component of price variation used for identification here is within-brand and within-distributor-territory variation.

As a starting point, the logit specification without interactions was run. This specification has several attractions. First, it is simple. Second, it provides a useful comparison for the full model with interactions. The problem with the logit model is that it generates potentially unrealistic substitution patterns. Thus, running a full BLP style specification with interactions between individual characteristics and product characteristics is likely to be informative, if for no other reason than as a robustness check on the appropriateness of the logit specification.

table 3 around here

³⁹That said, there is still an implicit assumption that if the price of a brand goes down this will not cause people to go to the supermarket, who otherwise would not have. Chintagunta et al (2003), provide evidence in support of this assumption in the DFF data.

Table 3 contains the results from the logit demand models. In the OLS specification (specification A) the estimated price coefficient is -4.64, whereas when instruments are used for price (specification B) the estimated coefficient on price is -6.51. This estimate corresponds to a price elasticity for beer of around -3.4, depending on the beer, store and week. The results indicate that instrumenting for price has a significant impact on the coefficient estimate, correcting for the expected positive bias in the price coefficient. The effect of a promotion, independent of the price effect is found to be small in the instrumented logit case, being equivalent to a five cent drop in the price of a six pack of beer. The coefficients on serving size and serving size squared suggest that the smaller size units are preferred in the relevant region (six packs are preferred to cases).

Table 3 also provides demand estimates for BLP demand models. These models allow for consumer heterogeneity through random coefficients. The first specification, C, allows the coefficient on price and a constant (interpreted as the value of the outside option) to vary with the inverse of income. The inverse of income was used since as income gets larger we would expect the importance of price to decrease; this functional form seems a natural way to incorporate this. Thus the price coefficient is $\left(\alpha + \frac{\beta}{y_i}\right)$ where $\alpha = -6.59$, $\beta = 0.29$ and y_i is household income divided by 2500. For a consumer with annual household income of \$10,000 this corresponds to a price coefficient of -6.51 . As income increases, the coefficient converges to -6.59 . This implies that income does not change a consumer's sensitivity to price very much. At the same time the value of the outside option is decreasing with income, although the magnitude of this effect is very small. In a joint test, the null hypothesis that the coefficients on the interacted terms are zero is unable to be rejected at any reasonable significance level. This implies that the logit model cannot be rejected. This is also the case for specification D, which uses randomness generated from a normal distribution, capturing unknown sources of consumer heterogeneity.⁴⁰

Since specifications C and D are unable to reject the logit specification of demand, and the magnitude of the impact of consumer heterogeneity implied by these specifications is small, the logit model of demand with instruments for price (specification B) is used in the rest of this paper.

5.2 Testing for Foreclosure

5.2.1 Foreclosure in Service Quality

To begin to investigate the possibility of foreclosure in service quality the standard test was run, as described in Section 3.1. This test compares the demand effect of facing a Miller-exclusive to the demand effect of not facing a Miller-exclusive, using Anheuser Busch as a control group to manage any market specific effects. The results of this test are contained in specification A of Table 4. The basic demand specification used above is also used here, but instead of using brand-distributor dummies only

⁴⁰Chi-Squared statistics for the joint test of the null that the coefficients are zero are 0.0050715 for specification D and 1.9542 for specification C.

brand dummies are used. There are two variables of interest, ‘Potentially Foreclosed’, which is a dummy for when a potentially foreclosed (non-Anheuser-Busch) brewer’s distributor faces a Miller-exclusive, and ‘AB’ which is a dummy for an Anheuser Busch distributor in the same position (the control group). The estimates indicate that both Anheuser Busch and potential foreclosed brewers seem to get better product performance in markets where Miller is exclusive. Further, there appears to be no significant difference between the magnitudes of this effect. On this basis, there appears to be no evidence of foreclosure.⁴¹

As discussed in Section 3.1, an identification problem arises when running the test in this way. In the basic form of the test the Anheuser Busch control group is being relied on to control for the market specific demand shifters and the effect of a (potentially) more active Miller distributor. Since cross-product substitution effects are likely to be different for different products this may be unsatisfactory for dealing with this second effect. With this in mind, a reformulated version of the test is also run.

This reformulated test compares product performance when serviced by a distributor who is used in markets where Miller is exclusive and also where Miller is not exclusive (class two distributors) to product performance when serviced by a distributor who only services markets where Miller is exclusive (class three distributors). Performance is compared across the two types of distributors in markets where Miller is exclusive. This holds constant market specific effects that may be correlated with the Miller distributor being exclusive and the impact of a more active (exclusive) Miller distributor.

table 4 around here

Specification B in table 4 shows the results of this form of the test. The variable of interest is denoted ‘All Exclusive Markets’. This variable is a dummy for a product serviced by a class three distributor. If the coefficient on this dummy is negative then evidence consistent with foreclosure exists. In specification B, which is the test as described above, the coefficient on ‘All Exclusive Markets’ is strongly positive, rejecting the conclusion that foreclosure in service quality is present in this market. Indeed, the magnitude of the coefficient suggests that the class three distributors are providing extra service equivalent to a 3.5¢ price reduction on a bottle of beer.

A possible concern in this analysis is that class two distributors may be switching effort away from their exclusive markets toward their non-exclusive ones. To see

⁴¹This test evaluates foreclosure in service quality on the intensive margin. It is possible that there be foreclosure in this dimension on the extensive margin. For instance, the existence of an exclusive may make it harder for other brands to gain any access to shelf space, meaning that products would not be present in a store at all. It is clear in the data that not all the varieties of all brands are available in all stores in every week (the number of observations is too low for this to even close to true). To assess whether the pattern of omission is consistent with a foreclosure story a version on the test employed here would need to be implemented, albeit adjusted so that the presence of the products in a store be the object of interest. This would likely require a logit- or probit-based implementation.

whether this might be an issue specification C was run. Specification C includes all the markets that class two distributors service, not just those in which Miller is exclusive. If this substitution in effort were a problem it might be expected that the coefficient on ‘All Exclusive Markets’ would be smaller. Instead it gets larger, both in absolute size and in terms of the equivalent price reduction of the extra service benefit provided by the class three distributors. This result is interpreted as suggesting that a substitution effect is not likely to be distorting the conclusion.

5.2.2 Foreclosure in Costs

Before delving straight into the test for foreclosure in terms of distribution costs it is useful to examine data that might allow for an easier rejection of the hypothesis.

One way to cast doubt on the hypothesis is to compare the production technologies of exclusive and non-exclusive distributors. If the foreclosure hypothesis, or an investment type theory, were correct we would expect to be able to see differences in the production technologies used by each type of distributor. An investment story (e.g. Besanko and Perry 1993) would suggest that these differences were a function of better investment by brewers, while a foreclosure story would suggest that these differences are a function of innate distributor characteristics.

While ideal data is not available for a full econometric treatment of this issue, some data does exist which is informative about the characteristics of distributors in Greater Chicago. Figures 5 and 6 show the number of employees and the number of trucks that Anheuser Busch and Miller distributors have, compared to other distributors. The data are drawn from the 1994 Beverage Marketing Directory, which contains survey data collected in the middle and later part of 1993. These data are collected as ranges, with respondents asked to tick the bin into which they fall. Thus, these data contain a noisy view of the industry.⁴²

figures 5 and 6 around here

Despite this, the data paint an interesting picture. 50% of Anheuser Busch distributors have between 30 and 39 employees, this being the modal response for this group. Other distributors are less homogenous in terms of their numbers of employees. This same pattern, of greater homogeneity in Anheuser Busch distributors as compared to other distributors is also present in the trucks data. This pattern is maintained when the sample is extended to include all the distributors in the state of Illinois.

This relative homogeneity in the labor and capital used by Anheuser Busch (and to a lesser extent Miller) distributors seems consistent with both foreclosure and investment type theories of why lower cost distributors are more likely to be exclusive.

⁴²The distributor details collected from the ILCC registration documents were matched to distributors in the directory. For some distributors this was difficult due to the existence of different business names. It is also possible that missing distributors did not respond to the Beverage Marketing Directories survey. Unfortunately 5 of the 42 distributors were unmatched, 2 of which were Anheuser-Busch distributors.

Having examined these data, it remains to test for foreclosure in costs. To do this, the industry model and the demand system is used to infer costs, as described in section 3. Then these inferred costs are projected down onto cost drivers using equation (7). Recall that to implement the test, each store is defined as a market. If the store is served by an exclusive Miller distributor then it is classed as a market with an exclusive distributor. These markets are allocated a dummy which is applied to product observations from brewers other than Miller. These dummies form part of the $\left[c_{ld(k)}^d + r_{ld(k)}^d \right]$ terms in equation (7). In this specification costs (price to retail minus markup), are projected onto product and brewer characteristics and a dummy for when there is an exclusive distributor in the market.⁴³ This last variable is labelled ‘Potentially foreclosed’ in the table reporting results (for Anheuser-Busch products a separate variable ‘AB’ is reported). If the coefficient on this variable is negative then the costs of distributors who serve brewers who never use an exclusive distributor are lower in markets where there is an exclusive distributor. This rejects the foreclosure argument.

This specification is described formally by equation (7). The αc_j^b term in equation (7) is captured by the product and brewer characteristics and their estimated coefficients, while the β coefficient corresponds to the coefficient on ‘Potentially foreclosed’ (or ‘AB’ in the case of Anheuser-Busch products).

Identification of the coefficient on the dummies that comprise the $\left[c_{ld(k)}^d + r_{ld(k)}^d \right]$ terms is a challenge. The problem is that, when a brewer makes its pricing decision, it takes into account the costs of several different distributors. Some of these distributors are in exclusive markets, while others are in non-exclusive markets. There are two potential sources of identification of the impact of different distributor types. The first takes advantage of the fact that different brewers and brands have different exposure to exclusive and non-exclusive markets. This is due to variation in stocking decisions and also variation in the relative importance of the different types of markets due to, for example, consumer preferences. This type of variation relies heavily on the instrument on the $\sum_k W_{kj}(x, \theta, \xi) \left[c_{ld(k)}^d + r_{ld(k)}^d \right]$ term in equation (7) being orthogonal to any unobserved product characteristic. As described earlier, the instrument is the proportion of stores that a product is stocked at that are served by a Miller-exclusive. Thus, controlling for product characteristics is especially important.

The second source of identification comes from within-product variation across time in the importance of the two types of distributors (those in exclusive markets versus those in non-exclusive markets). This source of identification seeks to exploit demand shock hitting different parts of the distribution chain differentially. A simple example might be that if a football game is occurring in a region dominated by exclusive markets, we might expect to see the relative importance of distributors

⁴³This dummy is only applied to brewers that never use an exclusive distributor - the estimation is done on only those brewers who might be foreclosed (thus estimation is done within the set of ‘potentially foreclosed brewers’). The “dummies” are really sums of dummies, as required by the aggregation process discussed in section 3.3 and equation (7). The instrument used for the resulting weighted sum is the proportion of stores stocking the product with an exclusive Miller distributor. The same procedure is applied to Anheuser-Busch distributor when used for comparison.

servicing exclusive markets increase. This would mean that the costs of distribution through these distributors would be more strongly reflected in the pricing decisions of the brewer for that week.

Thus identification can be thought of as coming from some combination of across- and within-brand sources.

table 5 around here

The results in Table 5 show the estimates from projecting costs down onto various cost drivers. The coefficients on the “Foreclosed” Stores’ terms are of primary interest as they capture differences in distribution costs in the two types of markets. The rest of the specification captures product-specific cost drivers. The constant (per unit/SKU) term is controlling for differences in serving size (e.g. 6 packs vs 12 packs). Light, Ice, NA (for non-alcoholic) and Import are dummies for different types of beer. ABV (alcohol by volume) and Calories are two important beer characteristics that reflect different production processes and ingredient mixes. Lastly, specifications 1 and 2 include brewer dummies, while specifications 3 and 4 include brand dummies. These variables are intended to capture any returns to scale or other brewer (or brand) specific cost characteristics that might be present.

In specification 1 (with no instrumental variables) the estimated coefficient on the ‘Potentially foreclosed’ term is 0.011. This suggests that in markets with a Miller exclusive the potentially foreclosed brewers have distribution costs that are on average 1¢ higher than in markets where Miller is not exclusive. Specification 2 shows the impact of instrumental variables on the coefficient estimate on the ‘Potentially foreclosed’ term. The estimate changes to 0.0007, which is not significantly different from zero. To evaluate the effect of market specific cost variables, this is compared to the coefficient on ‘AB’ which captures the effect on Anheuser Busch’s costs of serving an exclusive market. The results do not indicate that there is evidence of foreclosure, instead it appears that the potentially foreclosed brewers have relatively lower costs in exclusive markets than their Anheuser Busch counterparts.

The results in specifications 1 and 2 use both the across- and within-brand sources of identification. This may be problematic as we might expect higher cost brands to be higher quality and better able to compete in markets where Miller is exclusive, hence more likely to be placed in these markets. If this were the case then the instrument used here may not be orthogonal to the unobserved cost terms, leading to a positive bias in the estimates. To control for these effects the specification was re-run replacing all the brand specific variables with a full set of brand dummies. Thus only the second, within-brand source of identification is exploited.

Specifications 3 and 4 shows the results. In specification 4 (with instruments) the ‘Potentially foreclosed’ coefficient changes to -0.009, while the coefficient for Anheuser Busch changes to -.006. Taking the difference between these two estimates and testing the hypothesis that this is not different from zero, suggests that, for the potentially foreclosed brewers, the cost advantage from serving markets with a Miller-exclusive is attributable to differences in market specific effects and not reflecting any underlying

cost difference at the distributor level. Thus, the hypothesis of foreclosure in costs remains rejected by the test.

6 Conclusion

This paper has provided evidence that the use of exclusive distributors in the beer industry should not lead to concerns about foreclosure, at least in metropolitan markets.

An issue left in the background by this paper is the influence of scale on the structure of distribution. It would be expected that distributors have considerable fixed costs to cover, in addition to their marginal costs. In discussions with distributors, rent of premises and insurance were stated as significant costs that might be considered fixed. If fixed costs are considerable, then attempting to make distributors exclusive would be more attractive to brewers that can provide a large market share.

Such a story has interesting implications. If any cost advantage from exclusivity is due to foreclosure effects, then fixed costs and accompanying returns to scale would help preserve foreclosure by discouraging new distributors from entering the market. New distributors (entrants) would have to cover potentially high fixed costs, and to do this may need to persuade several of the smaller brewers to break their existing distribution agreements and switch. Thus, entry by talented, low cost, distributors would be impeded.⁴⁴

In the more likely event that exclusive distributors attract higher investment levels, then scale is likely to be even more important in restricting access to any cost advantages. If a smaller brewer cannot provide the scale to support a distributor by themselves then they will be forced to share, removing incentives to invest in lowering the marginal costs of distribution.

Estimates of fixed costs, and obtaining better data on the contractual durations and obligations of distributors, appear crucial to understanding the organizational structure of distribution in this market.⁴⁵ This would be a first step to unpacking questions of how distributors and brewers match up. To properly understand the impact of specific interventions by a regulatory authority, modeling this matching process would be important.

Lastly, more work on the identification of different reasons for using exclusive distributors would be useful. This paper rejects foreclosure effects in a simple test. However it would be informative to confront the investment hypothesis with a similar test. This would likely require data with cross-market and -time variation in the structure of distribution. More detail on distributor inputs to production would also be helpful. It is also likely that some theoretical work would be required to nest different models within the same broad framework, so as to facilitate empirical evaluation. Developing identification strategies for the exact motivation for using exclusive

⁴⁴See Rasmusen et al (1991) for a related theoretical discussion.

⁴⁵The most promising approach to estimating fixed costs appears to be the moment inequality approach described in Pakes et al (2015) and employed in papers such as Ho (2009) and Crawford and Yurukoglu (2012).

distributors and studying the matching process behind the choice of distributor is left for future research.⁴⁶

⁴⁶Fong and Lee (2013) provides a promising framework for research in this direction.

References

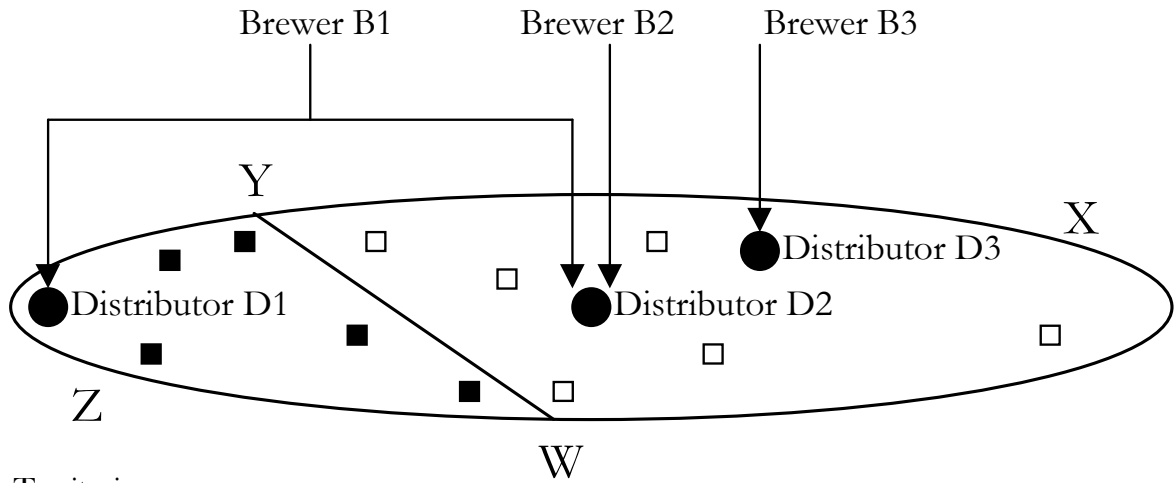
- [1] Abito, Jose Miguel and Julian Wright (2008), Exclusive Dealing with Imperfect Downstream Competition, *International Journal of Industrial Organization*, 26(1), 227-246.
- [2] Areeda, Phillip and Herbert Hovenkamp (2002), *Fundamentals of Antitrust Law Volume 2*, Aspen Law and Business, New York.
- [3] Asker, John and Heski Bar-Isaac (2014), Raising Retailers' Profits: On Vertical Practices and the Exclusion of Rivals, *American Economic Review*, 104(2), 672-686.
- [4] Ater, Itai (2015), Vertical Foreclosure using Exclusive Dealing: The Case of Hamburger Restaurants in Shopping Malls, *Journal of Economics and Management Strategy*, Forthcoming.
- [5] Bernheim, B. Douglas and Michael Whinston (1998), Exclusive Dealing, *Journal of Political Economy*, 106(1), 64-103.
- [6] Berry, Steve, James Levinsohn and Ariel Pakes (1995), Automobile Prices in Equilibrium, *Econometrica*, 63(4), 841-890.
- [7] Besanko, David and Martin Perry (1993), Equilibrium Incentives for exclusive dealing in a differentiated products oligopoly, *RAND Journal of Economics*, 24(4), 646-667
- [8] Bloomberg News (1998), Anheuser Busch, Miller Settle Lawsuits, printed in *Los Angeles Times*, May 20, Section D, p3.
- [9] Bonnet, Celine, Pierre Dubois and Michel Simioni (2005), Two-Part Tarrifs versus Linear Pricing between Manufacturers and Retailers: Empirical Tests on Differentiated Products Markets, IDEI Working Paper 370.
- [10] Bonnet, Cline and Pierre Dubois (2010), Inference on Vertical Contracts between Manufacturers and Retailers Allowing for Non Linear Pricing and Resale Price Maintenance, *Rand Journal of Economics*, 41(1), 139-164.
- [11] Brenkers, Randy and Frank Verboven (2006), Liberalizing A Distribution System: The European Car Market, *Journal of the European Economic Association*, 4(1), 216251.
- [12] Brewing Matters (1995), *1995 Great American Beer Festival Program*, Association of Brewers, Colorado.
- [13] Brewing Matters (1996), *1996 Great American Beer Festival Program*, Association of Brewers, Colorado.
- [14] Butler, Rachel (1999), Harness the Power, *Beverage World*, September 1999, p40.

- [15] Canedy, Dana (1997), Anheuser Busch Queried on Distribution Practices, *New York Times*, October 3, Section D, p17, column 1.
- [16] Chicago Sun-Times (1997), Antitrust Probe Targets Busch, *Chicago Sun-Times*, October 2, Financial p2.
- [17] Chintagunta, Pradeep, Jean-Pierre Dube and Vishal Singh (2003), Balancing Profitability and Consumer Value in a Supermarket Chain, *Quantitative Marketing and Economics*, 1(1), 111-147.
- [18] Chipty, Tasneem (2001), Vertical Integration, Market Foreclosure, and Consumer Welfare, *American Economic Review*, 91(3), 428-453
- [19] Comanor, W.S. and H.E. Frech (1985), The Competitive Effects of Vertical Agreements, *American Economic Review*, 75, 539-546.
- [20] Culbertson, W. Patton and David Bradford (1991), The Price of Beer: Some Evidence from Interstate Comparison, *International Journal of Industrial Organization*, 9(2), 275-289.
- [21] Crawford, Gregory, and Ali Yurukoglu (2012), The Welfare Effects of Bundling in Multichannel Television Markets, *American Economic Review*, 102(2), 643-685.
- [22] Crawford, Gregory, Robin Lee, Michael Whinston and Ali Yurukoglu (2015) The Welfare Effects of Vertical Integration in Multichannel Television Markets, mimeo.
- [23] Fong, Kyna and Robin Lee (2013), Markov-Perfect Network Formation: An Applied Framework for Bilateral Oligopoly and Bargaining in Buyer-Seller Networks, mimeo.
- [24] Fumagalli, Chiara and Massimo Motta (2006), Exclusive Dealing and Entry, when Buyers Compete, *American Economic Review*, 96(3), 785- 795.
- [25] Goldberg, Pinelopi and Rebecca Hellerstein (2013), A Structural Approach to Identifying the Source of Local-Currency Price Stability, *Review of Economic Studies*, 80(1), 175-210.
- [26] Hausman, Jerry, Gregory Leonard and J. Douglas Zona (1994), Competitive Analysis with Differentiated Products, *Annales D'Economie et Statistique*, 34, 159-180.
- [27] Hellerstein, Rebecca (2008), Who bears the Cost of a Change in the Exchange Rate? Pass-Through Accounting for the Case of Beer, *Journal of International Economics* 76,14-32.
- [28] Ho, Katherine (2009), Insurer-Provider Networks in the Medical Care Market, *American Economic Review*, 99(1), 393-430.

- [29] Jordan, John and Bruce Jaffe (1987), The Use of Exclusive Territories in the Distribution of Beer: Theoretical and Empirical Observations, *The Antitrust Bulletin*, 32(1), 137-164.
- [30] Klein, Benjamin and Kevin Murphy (1988), Vertical Restraints as Contract Enforcement Mechanisms, *Journal of Law and Economics*, 31(4), 265-297.
- [31] Lafontaine, Francine and Margaret Slade, Exclusive Contracts and Vertical Restraints: Empirical Evidence and Public Policy, in Paolo Buccirossi, ed., *Handbook of Antitrust Economics*, Cambridge: MIT Press, 2008, pp. 391-414.
- [32] Landeo, Claudia and Kathryn E. Spier (2009), Naked Exclusion: An Experimental Study of Contracts with Externalities, *American Economic Review*, 99(5), 1850-1877
- [33] Lenderman, Max (1997), All Stressed Out ... and Nowhere to Go, *Beverage World*, August 1997, p53.
- [34] Mathewson G.F. and R.A. Winter (1987), The Competitive Effects of Vertical Agreements: Comment, *American Economic Review*, 77, 1057-1062.
- [35] Miller, Nathan and Matthew Weinberg (2015), Mergers Facilitate Tacit Collusion: Empirical Evidence from the U.S. Brewing Industry, mimeo.
- [36] Mortimer, Julie (2002), The Effects of Revenue-Sharing Contracts on Welfare in Vertically-Separated Markets: Evidence from the Video Rental Industry, mimeo, Harvard University.
- [37] Nevo, Aviv (2000a), Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry, *RAND Journal of Economics*, 31(3), 395-421.
- [38] Nevo, Aviv (2000b), A Practitioner's Guide to Estimation of Random Coefficients Logit Models of Demand, *Journal of Economics and Management Strategy*, 9(4), 513-548.
- [39] Nevo, Aviv (2001), Measuring Market Power in the Ready-to-Eat Cereal Industry, *Econometrica*, 69(2), 307-342.
- [40] Nurski, Laura Frank Verboven (2013), Exclusive dealing as a barrier to entry? Evidence from automobiles, mimeo.
- [41] Ornstein, Stanley (1989), Exclusive Dealing and Antitrust, *The Antitrust Bulletin*, vol 34, 65-98
- [42] Pakes, Ariel and David Pollard (1989) Simulation and the Asymptotics of Optimization Estimators, *Econometrica*, 57(5), 1027-1057.
- [43] Ariel Pakes, Jack Porter, Katherine Ho and Joy Ishii (2015), Moment Inequalities and Their Application, *Econometrica*, 83(1), 315-334.

- [44] Prat, Andrea and Aldo Rustichini (2003), Games Played through Agents, *Econometrica*, 71(4), 989-1026.
- [45] Rasmusen, Eric, J. Mark Ramseyer and John Wiley Jr. (1991), Naked Exclusion, *American Economic Review*, 81(5), 1137-1145.
- [46] Salop, Steven and David Scheffman (1983), Rising Rivals Costs, *American Economic Review*, 73(2), 267-271.
- [47] Sass, Tim (2002), The Competitive Effects of Exclusive Dealing: Evidence from the US Beer Industry, Florida State University Working Paper.
- [48] Sass, Tim and David Saurman (1996), Efficiency Effects of Exclusive Territories: Evidence from the Indiana Beer Market, *Economic Inquiry*, 34(3), 597-615.
- [49] Segal, Ilya and Michael Whinston (2000), Exclusive Contracts and Protection of Investments, *RAND Journal of Economics*, 31(4), 603-633
- [50] Sherwood, Sonja (2000), A Full House, *Beverage World*, September 2000, p22.
- [51] Simpson, John and Abraham Wickelgren (2007), Naked Exclusion, Efficient Breach and Downstream Competition, *American Economic Review*, 97(4), 1305-1320.
- [52] Stokes, Patrick (1997), Anheuser Busch: Taking the Initiative, *Beverage World*, July 1997, p78.
- [53] Smith, Angela M (2011), An experimental study of exclusive contracts, *International Journal of Industrial Organization*, 29 (1), 4-13.
- [54] Schwartz, M. (1987), The Competitive Effects of Vertical Agreements: Comment, *American Economic Review*, 77, 1063-1068.
- [55] Stamborksi, Al (1998), A-B and Miller Settle Distribution Suits, *St Louis Post Dispatch*, May 20, p C1.
- [56] Tremblay, Victor (1993), Consistency Between the Law and Its Enforcement, *The Antitrust Bulletin*, 38(2), 327-348.
- [57] Tremblay, Victor and Carol Tremblay (2005), *The US Brewing Industry*, MIT Press, Cambridge.
- [58] Villas-Boas, Sofia (2007), Vertical Relationships Between Manufacturers and Retailers: Inference With Limited Data," *Review of Economic Studies*, 74(2), 625-652
- [59] Wooldridge, Jeffrey (2002) *Econometric Analysis of Cross Section and Time Series Data*, MIT Press, Cambridge.

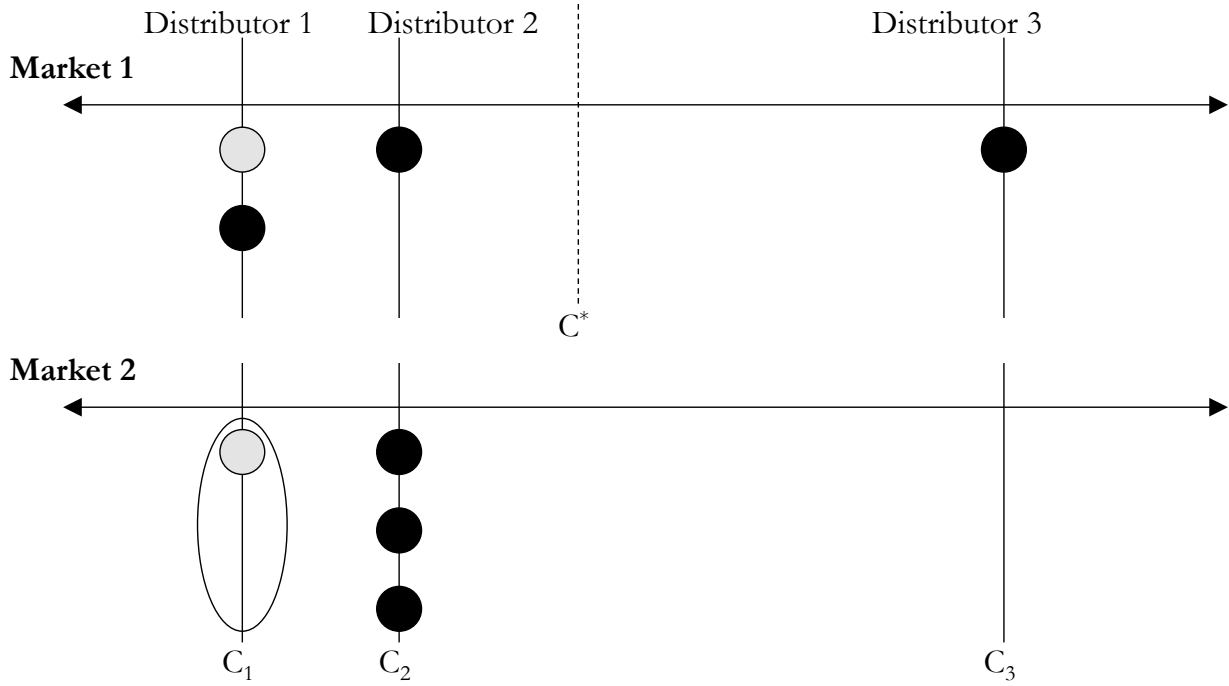
Figure 1: Exclusive territories and the three tier system



Territories:

- | | |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D1: YZW | D1 can distribute B1's products to retailers marked with a |
| D2: YXW | D2 can distribute B1's products to retailers marked with a |
| WXYZ | D2 can distribute B2's products to all retailers [&] |
| D3: WXYZ | D3 can distribute B3's products to all retailers [&] |

Figure 2: Equilibrium distribution networks in two markets



○ Brewer who is excluding others in Market 2 and not excluding in Market 1
 ● Other Brewers; $C_1 < C_2 < C^* < C_3$

Figure 3: Order of moves in the industry model

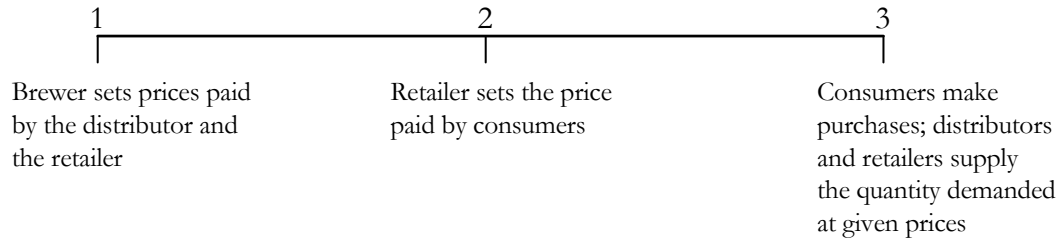
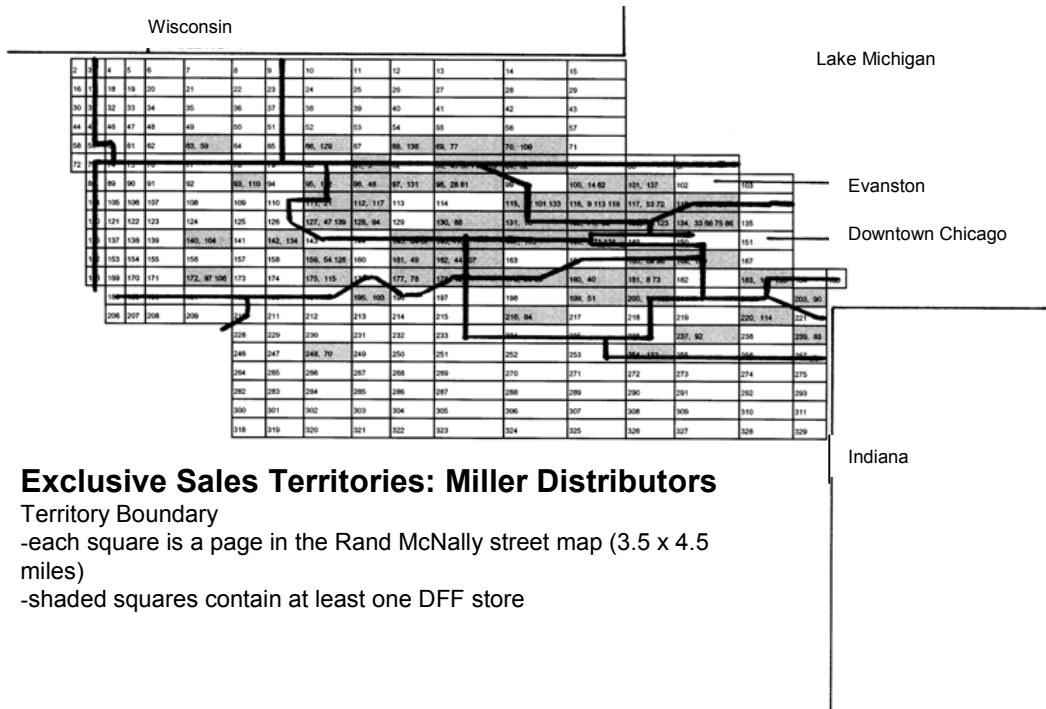


Figure 4: Exclusive sales territories for selected brewers

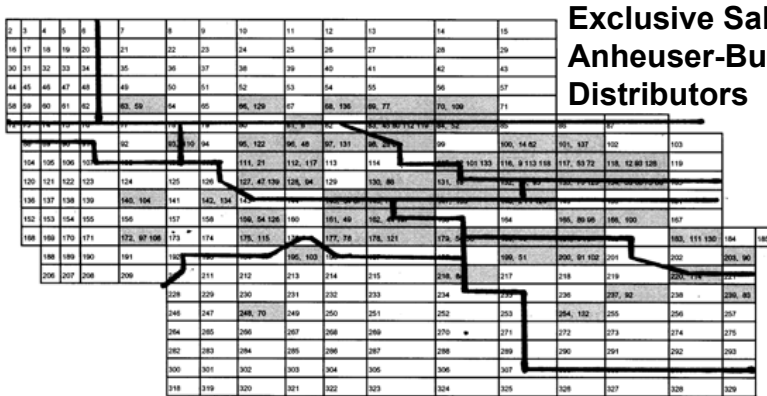


Exclusive Sales Territories: Miller Distributors

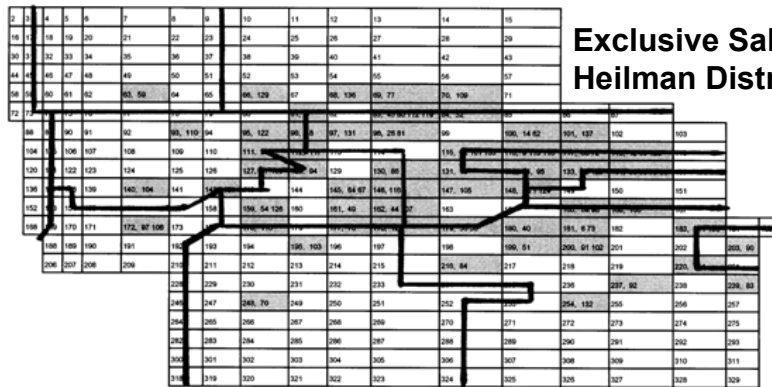
Territory Boundary

-each square is a page in the Rand McNally street map (3.5 x 4.5 miles)

-shaded squares contain at least one DFF store



Exclusive Sales Territories: Anheuser-Busch Distributors



Exclusive Sales Territories: Heilman Distributors

Figure 5: Distributors' employees by brewer

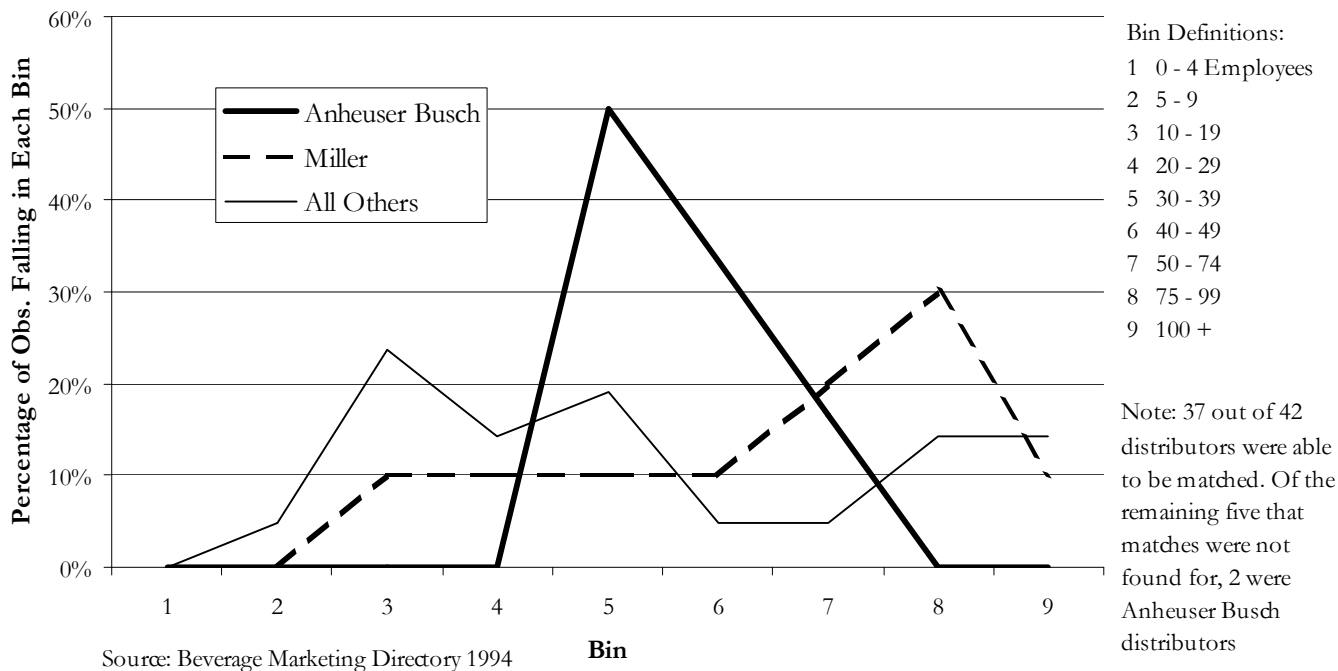


Figure 6: Distributors' trucks by brewer

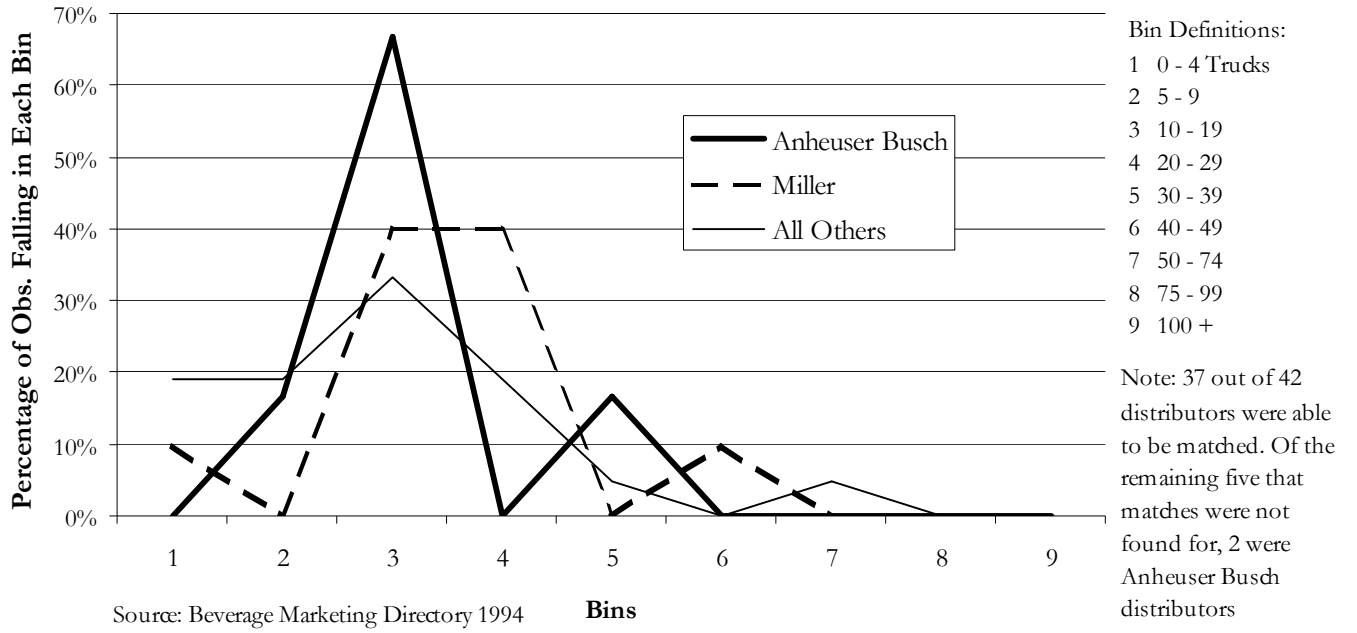


Table 1: Brewer-distributor matchings

Distributors used (shaded entries are exclusive)

Anheuser Busch	1	2	3	4	5	6	7	8		
Barton	10	15	18	21	22	23	24	25	26	31
Boston Beer	9									
Becks	10	11	12	13	14	15	16			
Petes*	9	32								
Sierra Nevada	32									
Sapporo	9									
Miller	21	23	24	33	34	35	36	37	38	39
Hielman	14	15	17	18	19	20	27	28	29	30
Pabst	12	13	26	27	29	37	40	41		
Stroh 1	11	12	13	38	40	41	42			
Stroh 2	10	11	12	13	16	40	42			
Coors	11	14	15	17	18	19	20			

Notes: Petes switches from distributor 9 to 32 in May 1994. Stroh has slightly different distribution for some of its brands, accounting for the ‘Stroh 1’ and ‘Stroh 2’ labels.

Table 2: Descriptive statistics drawn from the Domicks data

Number of obs				138213
Number of stores				71
Number of brands				73
Number of brewers/importers				12
<hr/>				
<i>Prices</i> (\$ per 12oz)	p^c	p^r	$p^c - p^r$	
mean	0.6001	0.5033	0.0968	
stdev	0.1777	0.1345	0.0906	
min	0.1983	0.1533	2.4866	
max	2.9683	1.1073	-0.3375	
<hr/>				
<i>Characteristics</i>	Mkt shares	Size	ABV	Calories
mean	0.054	132.0	4.41	130.8
stdev	0.094	88.8	1.02	25.0
min	0.003	21.0	0.25	58.0
max	3.710	661.0	6.94	200.0
<hr/>				
<i>Promotional Activity</i>				
% of Obs with promotional activity tagged				31.3
% of Obs with $p^c - p^r < 0$				17.6
% of Obs with $p^c - p^r < 0$ and promo. activity tagged				15.0
<hr/>				

Notes: p^c refers to the price to consumers; p^r refers to the price to retailers. “Mkt shares” (market shares) are expressed as a percentage, taking into account the share of the outside good. “Size” (package size) is expressed in oz. “ABV” is Alcohol By Volume expressed as a percent. Calories are per 12oz.

Table 3: Logit and random coefficient (BLP) demand models

Specification:	A		B		C		D	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
<i>Interacted with (1/Income)*2500</i>								
Constant					0.029	0.129		
Price (per 12oz)					0.293	0.283		
<i>Interacted with draws from $N(0,1)$</i>								
Constant							-0.177	3.134
Price (per 12oz)							0.063	3.093
<i>Not interacted</i>								
Price (per 12oz)	-4.648	0.106	-6.509	0.112	-6.590	1.341	-5.966	0.744
Promo	0.260	0.013	0.059	0.013	0.104	0.081	0.118	0.062
Size (div by 10)	-0.052	0.002	-0.071	0.002	-0.066	0.010	-0.064	0.009
Size ² (div by 10000)	0.097	0.005	0.119	0.005	0.011	0.001	0.011	0.001
Holiday2	0.364	0.006	0.360	0.006	0.364	0.009	0.361	0.016
Temperature ($^{\circ}\text{C}/10$)	0.084	0.002	0.083	0.002	0.085	0.003	0.085	0.008
Distrib.-Brand Dummies	Y		Y		Y		Y	
IV for price:	N		Y		Y		Y	
r^2	0.436		0.431		0.438		0.433	
SSR	98527		99501		105800		99031	
SER	0.846		0.850		0.877		0.848	
N	138213		138213		138213		138213	

Notes: The Holiday variable is a dummy for weeks in the fortnight leading up to Superbowl Sunday, the 4th of July, Labor Day and Christmas. Lagged and lead mean prices for the brand are used as instrumental variables for each product.

Table 4: Testing for foreclosure in service quality

Specification:	A		B		C	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Price (per 12oz)	-6.323	0.115	-7.130	0.246	-6.730	0.193
Promo	0.064	0.014	-0.069	0.030	-0.061	0.023
Size (div by 10)	-0.067	0.002	-0.048	0.005	-0.046	0.004
Size ² (div by 1000)	0.011	0.001	0.009	0.001	0.009	0.001
Holiday	0.359	0.006	0.337	0.013	0.335	0.010
Temperature	0.008	0.000	0.007	0.000	0.007	0.000
Potentially Foreclosed	0.129	0.010				
AB	0.117	0.008				
All Exclusive Markets			0.255	0.012	0.300	0.011
r^2	0.377		0.399		0.388	
SSR	108836		22678		35040	
SER	0.888		0.840		0.841	
N	138213		32174		49555	

Notes: The logit specification used here includes brand dummies (removing the need for a constant) and instrumental variables accounting for the endogeneity of prices. Lagged and lead mean prices for the brand are used as instrumental variables for each product. Specification A uses all observations. Specification B restricts attention to observations in markets in which Miller has an exclusive. The variable ‘All Exclusive Markets’ is a dummy for distributors that only serve markets served by a Miller-exclusive. Specification C expands the set of markets to include all those that are served by distributor that serves at least one market in which Miller has an exclusive.

Table 5: Testing for cost-based foreclosure

Specification:	1		2		3		4	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Constant	0.146	0.010	0.145	0.010	0.0958	0.008	0.095	0.008
Light	0.018	0.003	0.019	0.003				
Ice	0.043	0.006	0.044	0.006				
NA	-0.476	0.079	-0.476	0.079				
Import	0.276	0.006	0.276	0.006				
ABV	-0.179	0.041	-0.179	0.041				
ABV ²	0.013	0.005	0.013	0.005				
Calories	-0.009	0.001	-0.009	0.001				
Calories ² (div by 1000)	0.043	0.002	0.043	0.002				
Potentially Foreclosed	0.011	0.003	0.001	0.003	0.002	0.002	-0.009	0.002
AB	0.027	0.004	0.013	0.004	0.009	0.002	-0.006	0.002
A - B	-0.016	0.005	-0.013	0.005	-0.007	0.003	-0.004	0.003
Brand Dummies:					Y		Y	
Brewer Dummies:	Y		Y		-		-	
r^2	0.7883		0.7878		0.9480		0.9475	
SSR	43.49		43.59		10.68		10.78	
SER	0.0662		0.0663		0.0329		0.0331	
N	9935		9935		9935		9935	

Notes: The dependent variable is the price to retail minus the estimated markup. Specifications 2 and 4 employ an instrumental variable, being the proportion of stores at which a product is stocked that are served by a Miller-exclusive, to account for the potential endogeneity of the ‘Potentially Foreclosed’ and ‘AB’ terms. Specifications 1 and 3 do not employ the IV.