An Empirical Test of the Free Rider and Market Power Hypotheses

by

Willard F. Mueller and
Frederick E. Geithman

WP-97 February 1991

Willard F. Mueller is William F. Vilas Research Professor of Agricultural Economics, Professor of Economics, and Professor in the Law School, University of Wisconsin-Madison.

Frederick E. Geithman is Research Scientist, Department of Agricultural Economics, University of Wisconsin-Madison.
An Empirical Test of the Free Rider and Market Power Hypotheses

Willard F. Mueller and Frederick E. Geithman

I. INTRODUCTION

A growing theoretical literature has examined the significance of distribution restraints on intrabrand competition and consumer welfare. There are two main theories explaining such restraints: the avoidance of free riding and the creation of cartels among manufacturers or distributors. While it is widely acknowledged that both explanations are theoretically possible, identifying the correct explanation is an empirical rather than a theoretical matter. The empirical analysis reported here was made possible when an unusually rich body of data became public in litigation involving the Sealy licensing system.

II. THE SEALY RESTRAINTS

Sealy, Inc., the owner of the Sealy trademark, licensed independently owned manufacturers to make and sell mattresses under the Sealy brand. This arrangement differed from the typical licensor-licensee agreement in that, beginning in 1926, nearly all of Sealy, Inc.'s common stock was held by its licensee-manufacturers. From 1926 until 1967, Sealy, Inc. licensing agreements required licensees to engage in resale price maintenance (RPM) and to sell only in specific geographic territories. In 1967, the Supreme Court declared the RPM and exclusive territory agreements per se unlawful. In 1968 Sealy, Inc. adopted a new licensing agreement designating each licensee's former exclusive sales territory an "area of primary responsibility" (APR) in which the licensee was expected to achieve certain
levels of sales performance. When a licensee sold outside its APR it was required to pay the owner of the invaded APR a "passover payment" (POP) and "warranty repair charge" (WRC). The POP rate was based on the invaded licensee's local advertising and promotion outlays in the prior year expressed as a percentage of sales. The WRC was 1 percent of out-of-APR sales, allegedly designed to cover product service repairs made by the invaded licensees. The POP and WRCs created such high barriers that licensees made few sales outside their APRs (Mueller 1989).

These and other provisions of the 1968 license agreement were challenged in a private antitrust action and in 1975 were found to restrain competition among Sealy licensees. After the Court of Appeals for the Seventh Circuit sustained the jury verdict, the district court ordered the elimination of the POP and WRCs. Commencing in 1981, Sealy licensees began selling, in varying degrees, in one another's APRs. In 1986 the nature and effects of the Sealy restraints were subject to extensive examination in yet another private antitrust case.

III. EMPIRICAL ANALYSIS

A. The Competing Hypotheses

The modern debate over distribution restraints on intrabrand competition stems from Telser's seminal article in 1960. He theorized that a manufacturer will only use such restraints to guarantee its distributors supra competitive prices if nonprice competition among the distributors results in the appropriate mix of services to their customers. The manufacturer and consumers benefit if more of the product is sold at a higher price with services than at a lower price without them. Without restraints on intrabrand competition, a free rider problem arises: Sales will be
diverted from the distributor that provides special services at a higher price to the distributor that does not provide any services but sells at a lower price. Whereas Telser’s free rider theory was originally designed to explain the imposition of vertical restraints, as early as 1966 it was extended to explain horizontal distribution restraints, including Sealy’s territorial restraints (Bork, 1966).

Prior to 1960, economists viewed such restraints as being motivated by market power considerations and as having the effect of increasing prices and restricting output. This traditionalist view is still shared by many economists, although they acknowledge that free rider considerations may at times be important (Comanor 1985; Scherer 1983; Gould and Yamey 1967).

Determining which hypothesis explains the Sealy restraints depends, in part, on whether a cartel could exercise control over price. Three leading proponents of the free rider explanation of the Sealy restraints contend that Sealy’s market share was too small to permit a cartel of licensee-manufacturers to raise prices (Bork, 1966, 1973; Posner, 1976; Posner and Easterbrook, 1981). This inference is based on the belief that product differentiation does not confer significant market power. Mainstream industrial organization economists have long disagreed. Just as high market shares are sometimes compatible with competition, low market shares are sometimes compatible with market power. The latter occurs when a brand is highly differentiated (Chamberlain, 1933; Comanor 1985; Scherer 1983; Porter 1976; Mueller, 1976).

The free rider hypothesis states that intrabrand competition injures consumer welfare because it lowers output. Applied to the Sealy system, if one licensee were permitted to sell in another licensee’s exclusive territory, total Sealy brand sales in the invaded licensee’s territory would
decrease, as the latter decreased demand enhancing promotion. Alternatively, the market power hypothesis predicts that intrabrand competition enhances consumer welfare by lowering prices and increasing output. Hence, the free rider (market power) hypothesis can be tested by determining if output is decreased (increased) by intrabrand competition.

Prior to the removal of the territorial restraints, each Sealy licensee priced above marginal cost and constrained output. Following the removal of the restraints the demand curve facing most licensees became more elastic as intrabrand competition became possible. If free riding was not a significant problem, output should have increased and prices fallen.4/

Data limitations prevent modeling the dynamics of the post-restraint behavior. It is possible, however, to make a straightforward test of the competing free rider-market power hypotheses. The inability to model the dynamics force us to assume that sufficient time has passed following the removal of the restraints to arrive at or near a new equilibrium. Also, the underlying dynamics and available data forced us to test for endogeneity between domestically supplied mattresses and imported mattresses. If the domestic firm sets price based on past sales and expected imports, domestic prices can be modeled as predetermined and imported quantities can be modeled as exogenous to domestic quantities. That is:

\[ P_t = f(Q_{t-i}^D, Q_{t-i}^I) \]

\[ Q_t^D = g(P_t, D_t) \]

\[ Q_t^I = h(D_t, I_t) \]

\( P_t \) and \( Q_t^D \) are the price set by the domestic licensee and the quantity demanded from the domestic licensee. \( Q_t^I \) is the quantity imported. If the domestic firm adjusts price frequently, APR price and domestic quantities may
be endogenous and quantities should be estimated within a simultaneous system.\textsuperscript{5/}

Sales of an invaded Sealy licensee are called domestic sales (D) and the sales of the invading licensee import sales (I). Imports into an APR represent the measure of entry. We hypothesize that the degree of entry has a direct relationship to price and the total quantity of Sealy mattresses demanded.

B. \textit{Sealy's Post-1980 Growth in Sales}

Before turning to the model specification and regression analysis, it is insightful to examine post-1980 developments as reflected in total U.S. Sealy brand sales before and after removal of the restraints. During 1972-1980, the Sealy brand mattress sales share of U.S. mattress sales displayed no perceptible trend, averaging 17.7 percent when measured in dollars and 14.0 percent when measured in the number of mattresses (Table 1). Between 1980 and the end of 1985, the share of all mattresses sold under Sealy's premium brand, Sealy Posturepedic, grew by 160 percent, whereas the share sold under other Sealy brands grew by 20 percent. Thus, not only were more Sealy brand mattresses sold during the period, but the quality mix of the mattresses sold improved as well. If the free rider hypothesis were applicable here, increased imports should have caused a decline in Sealy's share of total mattress sales. The data in Table 1 show the contrary.

C. \textit{Regression Analysis of the Effects on Output}

Sealy brand mattresses represent a homogenous product among licensees. In order for a domestic licensee to maintain its accounts it must meet import competition prices to retailers that could be served by an invading licensee. The actual volume of sales made by an invader would likely depend on how quickly the domestic licensee responded to entry, the strategy chosen, and
the supply elasticity of the domestic and importing licensee(s). We hypothesize that as the volume of imports increased the price of the domestic licensee decreased, resulting in an increase in the total quantity of Sealy brand mattresses demanded.

This hypothesis is tested by using a regression model that examines the impact of intrabrand competition, as measured by I, on the level of the domestic licensees' sales, as measured by D. The basic regression model explaining variations in licensee sales is:

$$ D = \beta_0 + \beta_1 I + \beta_1 Z_1 + \epsilon, $$

(1)

where $Z_1$ is a vector of control variables. The model assumes that the underlying demand and supply (production) structures are identical across Sealy licensees and variations in domestic sales can be explained by exogenous factors.

**Domestic Sales (D).** The dependent variable measures the 1985 Sealy brand mattress sales of a licensee within its area of primary responsibility (APR). Although data were also available for trading areas (TAs) within APRs, the APR data are superior for testing the free rider hypothesis.\(^6\) To permit direct comparisons among APRs, actual sales were normalized by dividing the sales by the potential demand for Sealy mattresses in each APR. Potential demand was proxied using a buying power index (BPI) for each APR constructed annually by *Sales and Marketing Management* for Sealy, Inc.\(^7\)

Domestic sales were measured in dollars and in mattress units. Mattress unit volume was calculated by dividing the domestic licensee's total Sealy brand dollar sales in its APR by the average price at which it sold its mattresses.\(^8\)

**Imports (I).** Imports are the normalized Sealy brand sales in an APR originating with Sealy licensees located outside the APR. Units of I were
calculated using the average APR price of the invaded licensee. I is a proxy for the intensity of intrabrond competition in an invaded licensee's APR. A coefficient greater than or equal to a negative 1.0 on I indicates that intrabrond competition either increased or did not change total Sealy brand sales. Because a negative effect of I on domestic sales performance may not be observed until some critical level of I is reached, an \( I^2 \) variable is included. We hypothesize that the coefficient on I will be greater than or equal to a negative 1.0, and that the combined effects of I and \( I^2 \) results in greater total Sealy brand sales within the range of observed values of I.

**Size (S)** Size of an APR, measured by its BPI, is included as a control variable. Larger APRs with correspondingly larger plants may be able to realize some economies in manufacturing and distribution. If such economies exist, the coefficient on S should be positive.

**Distance (M)** Distance is the number of highway miles between a licensee's plant and the trading areas (TAs) it served. M is measured as the weighted average miles over all TAs within an APR, with miles weighted by the BPIs of TAs. Because travel and service costs rise with distance, making it more difficult to serve distant TAs, the coefficient on M was expected to have a negative sign.

**Regression Results**

Equations 2a-2c in Table 2 report the OLS regression results using the number of mattresses sold in an APR. The signs for each of the coefficients are as expected. Most importantly, the coefficients on normalized I are always significantly greater than a minus 1.0. Indeed, the coefficients have a positive value, indicating that Sealy brand sales of the invaded licensee increased as import competition increased.
The complete quadratic model, equation 2c, yielded the best statistical fit of the data. At the mean value of equation 2c, an increase in imports of 1,000 units above the mean import level of 7,000 units resulted in an increase in an invaded licensee's sales of about 700 units, causing total Sealy brand sales within the APR to increase by 1700 units. The nonlinear relationship between D and I indicates that an invaded licensees' sales increased at a decreasing rate as imports increased. However, even at the maximum observed volume of imports into an APR, 18,500 units, the invaded licensees' unit sales increased by about 3,200 units. In this instance, intrabrand competition increased total Sealy brand sales in the APR by 21,700 units.

In equations 2d-2f, the dollar value of Sealy brand sales, an inferior measure of output, rather than unit sales is used to measure the quantity of sales. The coefficient on I is significantly greater than minus 1. In equation 1f, the quadratic form of imports, I and \( I^2 \), shows positive effects on domestic sales over the entire range of observed import values. In equation 1e, the coefficient on I is \( .111 \), which implies that for every $1,000 of imported Sealy brand mattresses, the invaded licensee's sales increased by $111. Thus, total Sealy brand sales in the invaded APR increased by $1,111.

The above analysis envisioned a system were domestic sales and imports were not simultaneously determined. The domestic licensee's price was based on past imports and import sales was based on the current price of the domestic licensee. A reviewer suggested that we test for simultaneity.\(^9\)

The following equations were specified to explain imports (not normalized).\(^{10}\)

\[
I = \beta_0 + \beta_1 S + \beta_2 M + \beta_3 CM + \epsilon, \quad \text{and} \tag{2}
\]
\[ I = \beta_0 + \beta_1 S + \beta_2 M + \beta_3 CM + \beta_4 I_{t-1} + \beta_5 P_{t-1} + \epsilon. \] (3)

Market size (S) and distance (M) are as defined earlier. The average
distance from the closest competitor licensee (CM) was included as a proxy
for distributional costs of importing (i.e., a unique cost that an exporter
must bear in order to sell in another licensee's APR). 11/ Equation 3 also
includes lagged imports (I_{t-1}) to account for business commitment (habit)
and lagged APR prices (P_{t-1}) as an instrument for actual import prices.

These two equations were estimated in order to complete a 2SLS
regression analysis. The results are shown in Table 3. Equation 2 was used
in estimating equation 3a and equation 3 was used to estimate equation 3c.
Equation 3b was estimated using a full quadratic of equation 2. Kelejian
(1971) demonstrated the necessity of using a second degree polynomial in
estimating equation 3b. Our analyses supports Kelejian's proof. The 2SLS
results, after comparing equations 2c and 3b and 3c, corroborate our OLS
analysis.12/

Table 4 includes the results of a seemingly unrelated regression (SUR)
analyses of domestic sales and import sales. We estimated the coefficients
jointly using equations 2b and 3, and equations 2c and 3. These results
confirm the results using OLS and support the assumption that the errors in
the import equation are largely a result of factors external to the importing
APR.13/

The APR analysis implies that invaded licensees increased their sales
substantially in response to the import competition. This finding is
consistent with the data in Table 1. Between 1980 and 1985, domestic
licensee shares increased more than import shares (Columns 1 and 2).

In sum, a consistent overall pattern emerges from the analyses using
alternative units of measurement, different samples, and different estimating
techniques. No regression result supports the free rider hypothesis that intrabrand competition reduced total Sealy brand sales in an APR. Rather, the findings support the market power hypothesis that the removal of the territorial restraints increased output, thereby enhancing consumer welfare. The results using dollar sales explain why the removal of the restraints increased substantially the royalties of the licensor, Sealy, Inc., which were assessed as a percentage of the dollar sales of licensees (Mueller, 1989).

D. Regression Analysis of Effects on Prices

Beginning in 1981, Sealy brand mattress prices declined appreciably in APRs with intrabrand competition. For example, there was no intrabrand competition in the sale of Sealy mattresses in Northern California, Oregon, Washington, and Idaho because of the geographic isolation of these areas. In 1980, the average Sealy Posturepedic mattress brand price in these areas was about the same as the average price of Sealy Posturepedic brands sold elsewhere in the U.S.; by 1984, the average Sealy Posturepedic brand price elsewhere was about 14 percent below the average price in the four areas with no intrabrand competition (Mueller, 1989).

As the first step in quantifying the overall effect of intrabrand competition on Sealy brand prices, we estimated a price equation for Sealy brand mattresses. The average price in 1984 of Sealy brand sales in each APR, \( P \), was regressed on the following independent variables:

- \( D \), the 1983 normalized unit sales within the APR;
- \( S \), market size measured by 1983 BPI;
- \( G \), growth in demand in an APR measured by the percentage change in BPI between 1980 and 1984;
- \( DB \), the product mix of the domestic licensee in 1984 measured by the percent that Posturepedic sales were of total sales;
IB, the product mix of imports in 1984, measured as in DB;

X, 1984 export sales as a percentage of the total sales of the
within APR plant.

The expected signs of coefficients on these variables are: D < 0; S ≠
0; G > 0; DB > 0; IB < 0; X < 0. DB, IB, and X were included to control for
variations in the weighted average price for all Sealy brand products due to
product mix and exports.

Regressing the dependent variable P on the independent variables yielded
the following equation:

\[ P = 87.44 - 0.326D + 1.120S + 0.079G + 0.274DB - 0.109IB - 0.127X, \]
\[ R^2 = 66.1, F = 7.14, n = 29. \]  

The numbers in parentheses are the estimated standard errors. The estimated
signs for each coefficient were as expected and all the coefficients were
statistically significant at the 5 percent level, except that for growth.14/

E. Consumer Savings

Consumers benefitted substantially from intrabränd competition during
the period of its existence, 1981-1986.15/ Using price equation 4 and
equation 2c in Table 2, the actual price and unit sales in 1984 can be
compared with the estimated price and unit sales had there been no intrabränd
competition in 1984. Based on equation 2c, had there been no intrabränd
competition in 1984 2,035,000 Sealy brand mattresses would have been sold,
rather than the 3,573,000 that were actually sold. Solving the price
equation while using estimated sales without intrabränd competition from
equation 2c yields an estimated average price of $100.67, or 13.8 percent
greater than the actual average price of $88.50. Given these values, without
intrabränd competition it would have cost retailers $43.5 million more to
purchase 3,573,000 Sealy mattresses in 1984 than they actually paid. This
estimate reflects only savings at the wholesale level. The savings at retail were substantially greater than this. Competition among Sealy licensee manufacturers also increased competition among mattress retailers, as more retailers, especially discounters, gained access to Sealy brand mattresses. If we assume, conservatively, that retailers reduced their traditional pre-competition markups of about 100 percent to 80 percent on Sealy brands, the above actual and estimated prices translate into the following Sealy mattress prices at retail: $159.30 per unit with the 1984 level of intrabrand competition and $201.34 with no intrabrand competition. With intrabrand competition, consumers paid $569 million for the 3,573,000 on Sealy mattresses they purchased in 1984. This is $150 million less than they would have paid for these mattresses with no intrabrand competition. Consumers also benefitted in the other years during 1981-1986 from lower Sealy and non-Sealy brand prices.

F. Conclusion

Sealy's national market share increased by over 60 percent between 1980 and 1985. Our analysis supports the hypothesis that the increase in share occurred because intrabrand competition decreased the price and increased the sales of Sealy brand mattresses. The evidence rejects the free rider hypothesis explanation of the Sealy territorial restraints. The greatest potential source of free riding was the national advertising of Sealy brands. Sealy solved this problem by tying licensee royalty payments to licensee sales, requiring lower royalties for invaded licensees if they lost sales and greater royalties from invading licensees that gained sales (Mueller, 1989).

The findings support the market power hypothesis that by eliminating competition among Sealy licensees the territorial restraints reduced output and increased prices. Some devotees of the free rider hypothesis may not be
<table>
<thead>
<tr>
<th>Year</th>
<th>Sealy Brand Dollar Sales to Retailers</th>
<th>Sealy Unit Sales to Retailers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Originating Within APR</td>
<td>Originating Outside APR</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>1972</td>
<td>17.6</td>
<td>0.1</td>
</tr>
<tr>
<td>1973</td>
<td>16.4</td>
<td>0.2</td>
</tr>
<tr>
<td>1974</td>
<td>17.3</td>
<td>0.2</td>
</tr>
<tr>
<td>1975</td>
<td>16.5</td>
<td>0.3</td>
</tr>
<tr>
<td>1976</td>
<td>16.5</td>
<td>0.4</td>
</tr>
<tr>
<td>1977</td>
<td>18.4</td>
<td>0.6</td>
</tr>
<tr>
<td>1978</td>
<td>18.7</td>
<td>0.7</td>
</tr>
<tr>
<td>1979</td>
<td>17.1</td>
<td>0.7</td>
</tr>
<tr>
<td>1980</td>
<td>16.6</td>
<td>0.6</td>
</tr>
<tr>
<td>1981</td>
<td>15.9</td>
<td>0.9</td>
</tr>
<tr>
<td>1982</td>
<td>18.1</td>
<td>1.7</td>
</tr>
<tr>
<td>1983</td>
<td>21.2</td>
<td>2.7</td>
</tr>
<tr>
<td>1984</td>
<td>22.1</td>
<td>4.0</td>
</tr>
<tr>
<td>1985</td>
<td>23.2</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Source: Derived from Sealy, Inc. Sales Performance and Trading Area reports, Ohio II, DSX 302A-N.

Note: Sales are expressed as a percentage to total United States mattress sales included in SIC 2515 (innerspring mattresses) other than crib size and SIC 25153 (foundations) as reported by U.S. Department of Commerce. Percentages may not add due to rounding.

\(\text{a/}\) Includes Sealy brands contract sales to hotels etc. of 1.8%; miscellaneous Sealy brand sales of 0.1%; and private brand sales of 1.1%. 
Table 2. OLS Regressions of the Within AFR Licensee's Sales on the Sales Made to the AFR by Out-of-AFR Licensees in 1985, 29 AFRs

<table>
<thead>
<tr>
<th>Dependent Variable (D)</th>
<th>Equation</th>
<th>Intercept</th>
<th>Imports in 1985 (1)</th>
<th>(1)</th>
<th>(2)</th>
<th>Market Size (S)</th>
<th>(3)</th>
<th>Miles Shipped (H)</th>
<th>(4)</th>
<th>R²</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Licensee's Domestic AFR Sales in 1985</td>
<td>2a</td>
<td>29.68⁷</td>
<td>(3.302)</td>
<td>(.339)</td>
<td>6.4</td>
<td>1.843</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2b</td>
<td>32.74⁷</td>
<td>(5.812)</td>
<td>(.397)</td>
<td>(1.104)</td>
<td>.199</td>
<td>(.035)</td>
<td>11.6</td>
<td>1.094</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2c</td>
<td>27.28⁷</td>
<td>(5.912)</td>
<td>(.158)</td>
<td>(.008)</td>
<td>.043</td>
<td>(.044)</td>
<td>27.0</td>
<td>2.217³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of Sealy Mattresses Sold</td>
<td>2d</td>
<td>2781.41⁷</td>
<td>(269.48)</td>
<td>(.387)</td>
<td>.03</td>
<td>0.769</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2e</td>
<td>2994.08⁷</td>
<td>(465.11)</td>
<td>(.380)</td>
<td>(89.126)</td>
<td>(2.334)</td>
<td>.79</td>
<td>0.716</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2f</td>
<td>2863.58⁷</td>
<td>(465.94)</td>
<td>(.114)</td>
<td>(.008)</td>
<td>.083</td>
<td>(2.219)</td>
<td>17.7</td>
<td>1.240</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: See notes to Table 4.

Table 3. 2SLS Regressions of the Within AFR Licensee’s Trading Area Sales on the Sales Made to the AFR by Out-of-AFR Licensees in 1985, 29 AFRs.

<table>
<thead>
<tr>
<th>Dependent Variable (D)</th>
<th>Equation</th>
<th>Intercept</th>
<th>Imports in 1985 (I)</th>
<th>(1)</th>
<th>(2)</th>
<th>Market Size (S)</th>
<th>(3)</th>
<th>Miles Shipped (H)</th>
<th>(4)</th>
<th>R²</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Licensee’s Domestic TA Sales in 1985</td>
<td>3a</td>
<td>34.69⁷</td>
<td>(7.964)</td>
<td>(0.684)</td>
<td>0.154</td>
<td>-0.026</td>
<td>6.2</td>
<td>0.548</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3b</td>
<td>24.77⁷</td>
<td>(8.443)</td>
<td>(2.291)</td>
<td>(0.205)</td>
<td>0.614</td>
<td>-0.046³</td>
<td>16.9</td>
<td>1.298</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3c</td>
<td>23.31⁷</td>
<td>(6.813)</td>
<td>(1.280)</td>
<td>(0.813)</td>
<td>0.261</td>
<td>-0.045³</td>
<td>20.1</td>
<td>1.510</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: See notes to Table 4.

Table 4. Seemingly-Unrelated Regressions of the Within AFR Licensee’s Sales and Import Sales.

<table>
<thead>
<tr>
<th>Dependent Variable (D)</th>
<th>Equation</th>
<th>Intercept</th>
<th>Imports in 1985 (I)</th>
<th>(1)</th>
<th>(2)</th>
<th>Market Size (S)</th>
<th>(3)</th>
<th>Miles Shipped (H)</th>
<th>(4)</th>
<th>R²</th>
<th>F-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Licensee’s Domestic TA Sales in 1985</td>
<td>4a</td>
<td>33.31⁷</td>
<td>(5.809)</td>
<td>(0.307)</td>
<td>0.167</td>
<td>-0.036</td>
<td>0.1</td>
<td>0.010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4b</td>
<td>27.62⁷</td>
<td>(5.911)</td>
<td>(1.157)</td>
<td>(0.087)</td>
<td>0.033</td>
<td>-0.044³</td>
<td>0.5</td>
<td>0.027</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Standard errors are shown in parentheses. ⁷Significant at the 1% level. ³Significant at the 5% level. ⁷Significant at the 10% level.

1/ H₀: β₁ < -1.0.
2/ R² and F values are reported but provide no clear meaning given the primary hypothesis tested, i.e., the coefficient on I is hypothesized to be equal to or greater than -1.0.
convinced by the evidence reported here. They may believe the results merely reflect a temporary free ride on the powerful Sealy brand that eventually would have been destroyed as less was spent for local and national promotion and advertising. In this regard, it seems significant that total local and national advertising and promotion outlays of both Sealy, Inc. and the licensees increased absolutely and relatively after 1980; moreover, market studies of Sealy, Inc. found that consumer preferences for Sealy brands were at all-time high in 1984 (Mueller, 1989). It was this highly differentiated nature of the Sealy brand that enabled the licensees to use territorial restraints to decrease output and increase price even though the pre-1980 Sealy market share was under 20 percent.
References


ENDNOTES

1/ University of Wisconsin. We are indebted to William Comanor, Rueben C. Buse, Matthew T. Holt.


4/ An invading licensee did not enjoy significant free rider opportunities because the invader had to incur the same local advertising and promotion expenses as the invaded licensee (Mueller 1989).

5/ See Pindyck and Rubenfeld (1976). Simultaneity is often modeled as a result of an assumed equilibrium being attained. The Sealy system seemed near to such an equilibrium by 1985, the last year for which data are available (Table 1).

6/ Sealy, Inc. divided the country into over 600 population centers, trading areas (TAs), located within 29 APRs. While the TA data has the virtue of many observations, it is seriously flawed. First, many of the TA observations are not entirely independent of one another, i.e., they are not in separate economic markets; APRs, which are aggregations of TAs, more closely approximate economic markets. Second, the TA sales data often had serious errors. All sales of large department, furniture and discount stores that operate in more than one TA within an APR were frequently reported as going to a single TA. This is illustrated by the
Victoria, Texas, TA. All sales to a department store chain operating in five Texas TAs were reported as going to the Victoria TA. Consequently, the reported normalized Sealy brand sales going to this TA was 12 times the average of all TAs. Such errors in TA data do not result in errors in APR sales since the TAs involved typically are within the same APR. We have tested our model using TA data and in no instance did the results support the free rider hypothesis.

7/ The BPI used by Sealy, Inc. was a weighted index that converted population, effective buying income and retail sales into a measure of each APR’s potential demand for mattresses expressed as a percentage of total U.S. potential demand. For example, if the BPI of an APR were 5 percent of the total U.S. buying power for mattresses, the APR would have had a BPI of .05. Thus, actual Sealy sales in the APR were divided by .05 to calculate normalized sales.

8/ In these and other calculations of mattress quantities, the dollar sales of a licensee’s Sealy Posturepedic brand mattresses were divided by its average Posturepedic brand price and dollar sales of "Other Sealy" brands were divided by its average "Other Sealy" brand price. It was not possible to calculate separate prices for domestic sales and export sales. It was necessary to use 1984 prices because 1985 prices were not available.

9/ In an earlier draft of this paper we presented the results of an endogeneity test on imports. Following Geroski (1982) and Hausman (1978) we did not find statistical evidence supporting endogeneity. The t-statistics on the residual terms, from estimating equations (2) and (3), when included in equation 2b were 0.086 and 0.559. The 2SLS
results are presented because the endogeneity test relied on a single identifying variable, CM.

10/ We also completed the analysis using normalized imports. There was little difference in the results.

11/ A reviewer suggested this approach.

12/ We also completed a 2SLS analysis using the dollar value of Sealy mattresses sold. The analyses supported the OLS results. Since our primary interest is with the quantity of mattresses sold we do not report the dollar value results here.

13/ The SUR estimation was completed using the SAS-Syslin procedure. The R²'s and F-values demonstrate the negligible gain in using SUR estimation to estimate the parameters of our domestic sales model.

14/ We tested price and quantity for endogeneity by regressing P on M, CM, and S. The residuals (R) were captured and included in a quantity dependent equation with P, S, and R on the right-hand side. The calculated t-value on R was 1.09. We concluded that price could be modeled as predetermined, hence we estimated price using lagged quantities.

15/ During 1986-1987, Sealy, Inc. and all but one Sealy licensee were acquired by the Ohio Mattress Company, thereby eliminating virtually all intrabrand competition in the sale of Sealy mattresses (Mueller 1989).

16/ For example, one of the largest discounters marked up Sealy mattresses by 10 percent to 30 percent during 1981-86. See Mueller 1989 for other evidence in the Sealy record on this point.
We have not attempted to use our findings to calculate the welfare losses for the entire mattress industry. Masson and Shannon (1984) demonstrate that the findings for an individual firm cannot be extrapolated to an entire industry. If all firms sell at MC it is possible to calculate accurately total industry welfare losses. This condition was not met here.