Cartel Pricing with Entry: the Experience of the Far West Marketing Order for Spearmint

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This paper documents the remarkable experience of the Far West mint producers in the operation of their marketing order. From 1993 to 2002, the marketing order witnessed a dramatic reduction its share of the Scotch spearmint market, as well as a reduction in both its price. We apply a model of a cartel facing a competitive fringe to describe the fall in the marketing order price as a logical consequence of increased world production of spearmint oil. We estimate an econometric model of the marketing order price and find that a 1-percent change in the marketing order's market share corresponds to a 0.8 percent change in the marketing order price.

Overview

Federal marketing orders allow a group of farm producers to vote on mandatory limits on

the production and sale of their product, in effect serving as a government-enforced cartel. A

total of 35 fruit and vegetable marketing orders are currently authorized under the 1937 law, of

which the most recent (for pistachios in California) was authorized in 2004. Of the 35

authorized marketing orders, only four currently have mandatory supply restrictions in effect.

These apply to citrus in Florida, hazelnuts in Oregon, raisins in California and spearmint oil in a

five-state region in the Far West (Lee et al. (1996)).

Marketing orders act as a government sanctioned cartel on the supply of a particular farm

product. This is particularly true for those orders with explicit selling restrictions, reserve pools,

and market allocations. The marketing orders raise the price for their members by restricting

supply through the marketing order regulations enforced by the government.

A cartel's marketing power depends on its ability to prevent cheating among its members,

and also to prevent or limit competition from non-members (Stigler (1974)). In the case of

agricultural marketing orders, government enforcement prevents cheating among members.

However, competition in the regulated market from nonmembers can also weaken a marketing

order's ability to generate rents. In fact, the creation of rents through supply control attracts

entry, which diminishes the marketing order's market share and reduces the price. That is, the

short-run success of a marketing order can lead to reduced market share and diminished capacity to affect market prices (Berck and Perloff).

This paper examines the role of competition from non-member producers in determining the price a marketing order can achieve through supply controls. We document the experience of the Far West mint producers in the operation of their marketing order. After enjoying a decade of success in raising the price of mint oil for its producers, growth in the quantity and quality of foreign—particularly particularly Asian—mint production beginning in the mid-1990s began to undermine the marketing order's ability to maintain a premium.

Previous analyses of other marketing orders have largely ignored the potential role of foreign entry in limiting the order's market power. With spearmint, the differences in location-specificity between Scotch and Native varieties offers a valuable matched pair of case studies. Foreign entry has been much faster for Scotch than for Native, reducing the marketing order's market power in the Scotch market faster than in the Native market. We conduct an econometric analysis of the marketing order focusing on the relationship between the order's market share and the price premium it commands.

An overview of mint markets

Peppermint and spearmint were imported into the United States from England during colonization. Originally grown in the New York state, its cultivation eventually moved west and settled into the muck soils of Indiana and Michigan. Due to the plants' large water requirement, the muck soils of northern Indiana and southern Michigan were ideally suited for mint production. The irrigation projects of the 1950s and 1960s allowed mint to be cultivated in the western states of Idaho, Washington, and Oregon.

The mint plant is cultivated and processed into a crude oil on the farm site. The mint oil is then sold by the farmers to processors for further refinement. There are three types of mint oil, each with particular taste and smell. Peppermint oil is the largest in terms of production and application. Spearmint is divided into native spearmint oil and scotch spearmint oil. All three oils are derived from different plants. The primary application for mint oils is in the confectionery (gum, candy) and dentifrice (toothpaste, mouthwash) industries.

Demand for mint oil is highly concentrated and consists mostly of large multinational companies. The largest two users of mint oil constitute roughly 50% of the total demand, with another 20-30% of demand going to the next four largest users. This implies that 70-80% of the world mint demand is controlled by six large multinational users.

The middle market for mint is serviced by between three and six processor firms. These firms collect the mint oil from the farmers, and proceed to blend and distill the oil to final customer specification. Perhaps the most important characteristic of these processing firms is their ability to act as both a facilitator in establishing the spot market price between buyers and sellers, and a crude forward market. It is the role of price facilitator that provides processor firms with market information on both supply and demand.

The Far West Marketing Order

Spearmint growers in 1980, citing low prices and farm income, appealed to the U.S. Government and were granted Marketing Order No. 985 for both native and scotch spearmint oils. The government allowed the creation of the marketing order, in part, because they successfully argued that the high level of concentration of mint purchasers provided these companies a heightened level of market power in relation to the farmers.

The Far West Marketing Order (FWMO) controls the sale of all spearmint oil production in the states of Washington, Oregon, and Idaho, representing a majority of U.S. spearmint oil production. The FWMO governs the quantities sold by 160 individual producers to 8 mint-oil processors. In 2005-06, these sales are estimated by the marketing order to account for 72 percent of Scotch spearmint and 90 percent of Native spearmint produced in the U.S. (All data from *70 Fed. Reg.* 2027-32, in a proposed rule issued 12 January 2005 by the USDA).

The FWMO includes provisions for the regulation of supply, through the use of selling limits, and reserve pools. At the inception of the marketing order, farmers in the member states were allotted a "Spearmint Base" which was calculated as a percentage of production from the previous three years prior to marketing order introduction. New base has periodically been added to the marketing order, and farmers are allowed to sell or transfer base.

Each year, an administrative meeting is held, where the middle processors provide estimates for the demand of the approaching year. The administrative committee then sets the percentage of the base that each producer may sell. Any spearmint oil produced in excess of the salable quantity is stored in a reserve pool. The process is funded by a small "check-off" on each pound of oil sold. The sale of all spearmint oil is reported, and the appropriate amount of check-off remittance is provided to the administrative committee. The committee also has the power to change the level of available spearmint oil throughout the year to react to changes in the marketplace.

When it was established in 1980, the FWMO was able to stabilize U.S. prices at nearly double their historical price level. However, in the mid-1980s, the market order premium for Scotch mint began to shrink. The reduction in the marketing order's ability to affect prices corresponded to rapid growth of Asian production of Scotch mint, and a reduction of the order's

market share of Scotch mint to half of its 1980 level. The order's market share of Native mint remains high, but the order's pricing power in that market has been eroded by technical change and substitution among types of mint.

Starting in 1993, the rise of production outside the United States became a factor in the world spearmint oil market. The increase in foreign spearmint production was the result of less governmental restrictions on cash-crop development, and closer trade ties between countries. These oils include Chinese and Canadian scotch spearmint production, and Indian native spearmint production.

When they first began to appear, foreign spearmint oils were of lower quality than U.S. spearmint oil, and the marketing order was able to command a premium over the price of foreign spearmint oil. Gradually, however, the quality of foreign spearmint oil began to approach that of U.S. spearmint oil.

A simple model of marketing order pricing

Previous authors have noted that the behavior of agricultural marketing orders resembles that of a cartel. "An agricultural cartel operates like a dominant firm facing a competitive fringe: the cartel can adjust the amount it ships to the fresh market to influence price, while growers outside the regions covered by the marketing order are price takers" (Filson et al., 2001, p. 466). Thus, we look to the textbook model of the dominant firm facing a competitive firm to shed insight on the pricing behavior of the Far West Mint Marketing Order.

Figure 1 depicts the standard model of a dominant firm facing a competitive fringe (see for example, Perloff and , p.). Total demand for mint oil is D, and marginal cost for the marketing order is MC_{MO}. A number of foreign producers and non-member U.S. producers

comprise a small portion of the market and are price takers. Marginal cost for this competitive fringe is MC_f. Demand facing the marketing order is $D_{MO} = D_{Total} - S_f$, and marginal revenue is MR_{MO}. The marketing order sets its sellable base equal to Q_{MO}, where $MR_{MO} = MC_{MO}$. The market price is P^*, at which total quantity demand is Q_T, and the quantity supplied by the competitive fringe is Q_f.[1]

Rents generated by the marketing order are $Q_{MO}(P^* - MC_{MO})$. However, by establishing a high price, the marketing order induces an increase in production by fringe firms, who enjoy an increase in producer surplus. Note that if the marketing order were to behave competitively, the market price would be equal to MC_{MO}, marketing order rents would be zero, and the marketing order share would be greater.

A shift in the fringe supply shifts the demand facing the marketing order, and thus affects the degree to which the marketing order could raise the price above marginal cost. An increase in the fringe supply effectively reduces the demand facing the marketing order. As a result, the profit-maximizing quantity sold by the marketing order is smaller, as is the premium that it receives over marginal cost.

Thus, we would expect to see a reduction in the marketing order's price as a result of the growth of Asian mint oil production through the 1990s and the corresponding reduction in the Far West Mint Marketing Order market share. In the remainder of this paper, we introduce data and a simple econometric framework for testing this relationship between market share and the marketing order price.

Data

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[1] Note that in figure 1, the products of the cartel and the fringe are perfect substitutes and fetch the same price. As discussed above, foreign mint oil was initially inferior in quality to U.S. mint oil, but has improved. Because of this quality difference, the foreign mint oil has been sold at a discount below the marketing order price.

Obtaining accurate mint market information is problematic. Demand is dominated by large companies that desire to purchase mint oil at the lowest possible price. These companies have a financial interest to somewhat conceal their true demand, and hopefully depress prices. Likewise, farmers tend not to be forthcoming about acreage or yield information. This activity is done in an effort to cloud production information and hopefully strengthen prices or negotiating power. These competing interests have resulted in an industry dominated by murky and often misleading information. The data used in this study was a combination of both public and proprietary information, and reflects the best possible efforts to ensure accuracy. The proprietary information was obtained from one of the middle market processor firms and represents internal decision making data.

The size of the mint oil market is very small when compared to other agricultural crops, such as grain, in both acreage and total sales dollars. Given the meager size, the industry has attracted little outside attention. No public data are compiled or maintained. For these reasons, little literature exists on the subject, outside of a few producer driven books on better cultivation techniques. Most of the published information is collected or catalogued by the Mint Industry Research Council, a trade association that promotes better cultivation techniques, and scientific research.

The study will rely on information and data gathered primarily from two sources. Information on mint oil markets, such as spearmint oil production and pricing, will come from processor records. Resources from the Far West Spearmint Marketing Order and elsewhere will also be utilized to the extent of its offering and applicability. U.S. spearmint oil data was collected yearly from 1984 to 2002. The data on foreign produced spearmint oil was collected from 1993 to 2002. Summary statistics are presented in Table 1.

Figure 2 charts production of Scotch spearmint oil from 1984 to 2002. Spearmint is a small crop as compared to other agricultural production, and farmers that engage in spearmint cultivation usually use it as a cash or rotation crop. Given these characteristics, spearmint oil production has the capacity to vary significantly over time, which is reflected in Figure 2. Foreign production of Scotch spearmint oil began in earnest after 1993 and grew to exceed marketing order production by 1998.

Figure 3 charts production of Native spearmint oil from 1984 to 2003. Like the Scotch spearmint oil market, foreign production of native spearmint oil began in the early 1990s. Unlike the Scotch market, the foreign market share of the Native spearmint has remained relatively small, due in part to the geographical limitations to Native spearmint production.

The FWMO market shares of the Scotch and Native spearmint oil markets have declined over time (Figure 4). The Scotch market share peaked in 1992 at 84%, and had fallen to 30% by 2002. The drop in the Native market share is less dramatic, from a peak of 95% in 1992 to 72% in 2002.

Figure 5 charts Scotch spearmint oil prices for FWMO, Midwest Spearmint, and the foreign spearmint oil. Prices for FWMO and Midwest spearmint have declined steadily over the last 13 years. FWMO spearmint oil prices peaked in 1990 at $16.90/lb, and had fallen 49% by 2002 to $8.65/lb. Prices for foreign spearmint oil have always been lower than domestic prices, averaging $8.77/lb between 1993 and 2002. It appears as though domestic prices tend to approach foreign prices over time, but it is not clear whether this is a continuation of a long-term decline in prices, or whether domestic prices are falling in response to increased supply of foreign oil.

Figure 6 charts Native spearmint oil prices. Compared to the sharp decline in the FWMO

price for Scotch spearmint oil, the FWMO price for native spearmint oil is flatter and less

variable. Like Scotch spearmint oil, prices for foreign oil are lower than domestic prices, and

FWMO price appears to approach the foreign price over time.

Preliminary econometric analysis of the marketing order price

We posit the following econometric model to begin to examine the relationship between

market share and the price that the marketing order obtains for its oil:

(1) $P_{it} = \beta_0 + \beta_s S_{it} + \varepsilon_{it}$

where i indexes the type of spearmint oil (Scotch or Native), t indexes time in years, P is the

natural logarithm of the FWMO price of spearmint oil, S is the natural log of the FWMO market

share, β_0 and β_s are parameters to be estimated, and ε is a random error. Since price and market

share variables are in natural logarithms, the parameter β_s is the elasticity of the FWMO

premium with respect to the FWMO market share.

We estimate three models based on equation (1), using Ordinary Least Squares (OLS) on

data from 1993 to 2002. The first model is equation (1) applied to the Scotch spearmint oil

market, the second is applied to the Native spearmint oil market, and the third combines the two

oil types, and includes a dummy variable equal to one for observations on the Native market.

Results are presented in Table 2. Noting that there may be some serial correlation in the market

share, and thus some serial correlation in the price, we estimate a fourth regression by

augmenting equation (1) with a lagged dependent variable.

For all four regressions, the estimated elasticity of the FWMO price with respect to

market share is positive, as expected. In the Scotch spearmint oil market (Table 2, column 1), a

1-percent decrease in the FWMO market share corresponded to a 0.8-percent decrease in the

FWMO price. The effect is much smaller for the Native spearmint market (Table 2, column 2); a 1-percent decrease in market share corresponded to a 0.2-percent decrease in the FWMO price. Combining data on the two types of spearmint oil, we find an elasticity of 0.72. When the lagged dependent variable is included in the Scotch equation (Table 2, column 4), the estimated elasticity is slightly smaller and estimated with less precision.

Discussion of results

The data supports the existence of a positive correlation between the market share controlled by a marketing order and the price that the marketing order can command. The elasticities of the marketing order price with respect to market share are estimated to be approximately 0.8 for Scotch spearmint, and 0.2 for Native spearmint. These results are consistent with the behavior of the dominant firm facing a competitive fringe. Increases in the supply from producers outside the cartel reduce the demand facing the cartel, and thus reduce the price it is able to achieve. Thus, increased supply of mint oil from Asia and other regions diminished the effectiveness of the FWMO's supply controls.

Over a period of 10 years, from 1993 to 2002, Scotch spearmint oil produced outside the FWMO increased by 25 percent. As a result, the marketing order's market power was reduced and the FWMO price fell dramatically. In contrast, in the Native spearmint oil market, production outside the marketing order had grew more slowly, and thus the FWMO price for Native spearmint oil fell only slightly.

The FWMO experience holds important lessons for other agricultural marketing orders. As U.S. commodity markets are exposed increasingly to trade, domestic marketing order programs that have traditionally enjoyed large domestic market shares may be faced with

diminished market power, and thus dimished usefulness for producer members. For example,

milk marketing orders, whose pricing discrimination scheme depends on a highly protected U.S.

market for dairy products, would arguably struggle to maintain normal price levels if faced with

liberalized trade in dairy products.

Directions for further research

This paper presents preliminary analysis and discussion of the experience of the FWMO

and the dramatic changes that have taken place in spearmint oil markets over the last two

decades. The analysis is being extended in several dimensions.

One issue that we discuss only briefly here is premium that the FWMO commanded for

its spearmint oil relative to the world price. This premium reflects, to a large extent, quality

differences between domestic and foreign oils. Over time, improvements in the foreign quality,

together with technological advances in processing, reduced the quality premium.   Further

research will investigate potential interaction between the quality differences and market share in

determining the FWMO price.

Another issue that we do not address in this paper is the supply control mechanism

managed by the marketing order. For lack of data, we use FWMO production, as opposed to the

salable quantity, to calculate market share. In ongoing work, we are collecting data on the

marketing order parameters (salable quantity, changes in the base, etc.) that will allow us to

better analyze the relationships between marketing order policy, market share, and price.

Table 1. Summary statistics

	Price	Premium	Production	Market Share
	($/lb.)	($/lb.)	(lbs.)	(ratio)
Marketing Order Scotch Spearmint				
Mean	13.33	3.00	833,573.79	0.53
Standard Deviation	2.43	1.67	389,710.16	0.15
Number of observations	19	10	19	19
Marketing Order Native Spearmint				
Mean	10.34	2.31	1,319,936.32	0.80
Standard Deviation	0.81	1.43	384,341.55	0.11
Number of observations	19	10	19	19
Midwest Scotch Spearmint				
Mean	14.15	4.24	317,899.11	
Standard Deviation	2.06	1.37	129,590.66	
Number of observations	19	10	19	
Midwest Native Spearmint				
Mean	12.72	3.87	190.034.00	
Standard Deviation	2.75	2.46	239,227.38	
Number of observations	19	10	19	
World (non-U.S.) Scotch Spearmint				
Mean	8.77		855,477.00	
Standard Deviation	0.78		237,163.57	
Number of observations	10		10	
World (non-U.S.) Native Spearmint				
Mean	8.20		284,030.00	
Standard Deviation	0.90		130,186.63	
Number of observations	10		10	

Table 2. Ordinary Least Squares Regressions of the FWMO Price on Market Share

Dependent variable: FWMO Price				
	(1)	(2)	(3)	(4)
Spearmint type	Scotch	Native	Combined	Scotch
Intercept	3.17*	2.411*	3.100*	2.644
	(0.23)	(0.119)	(0.181)	(1.761)
Market Share	0.800*	0.208	0.723*	0.729
	(0.255)	(0.392)	(0.196)	(0.557)
Native Dummy	-	-	-0.537*	-
			(0.130)	
Lagged Dependent Variable	-	-	-	0.189
				(0.528)
R-square	0.550	0.03	0.501	0.569

Note: * denotes statistical significance at the 1-percent level.

Figure 1. Marketing order as a dominant firm facing a competitive fringe.
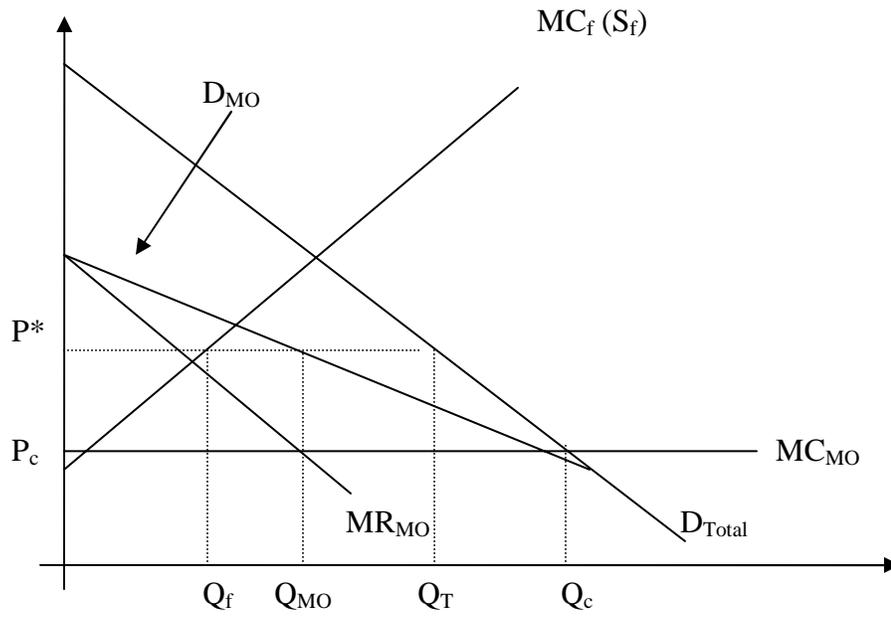
Figure 2. Scotch Spearmint Oil Production, 1984-2002.
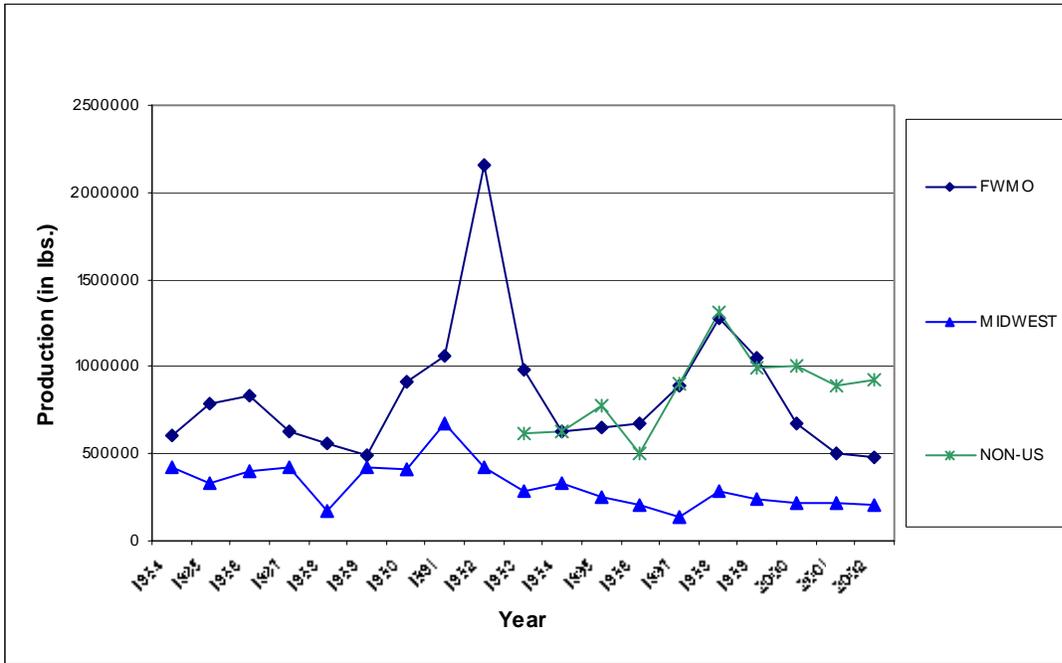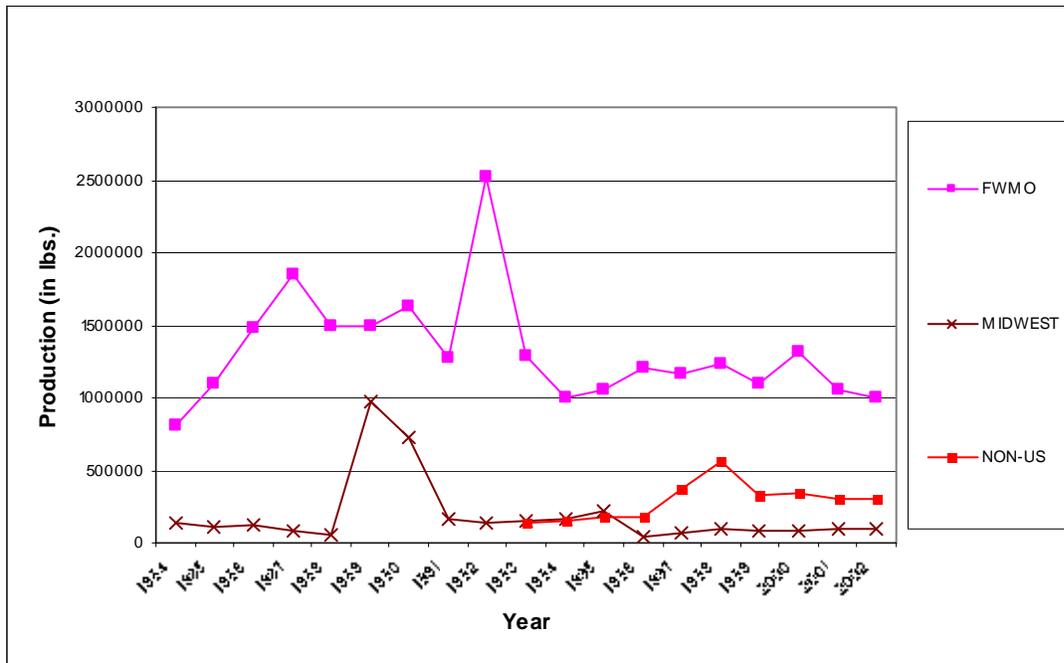
Figure 3. Native Spearmint Production , 1984-2002.

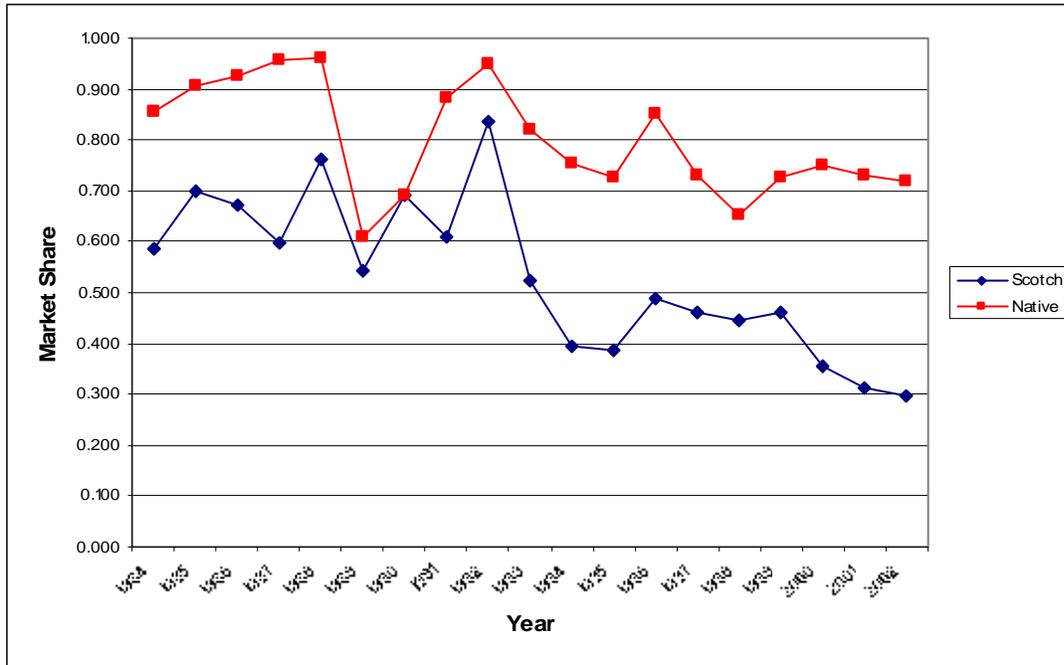Figure 4. FWMO market shares for Scotch and Native Spearmint Oils, 1984-2002.

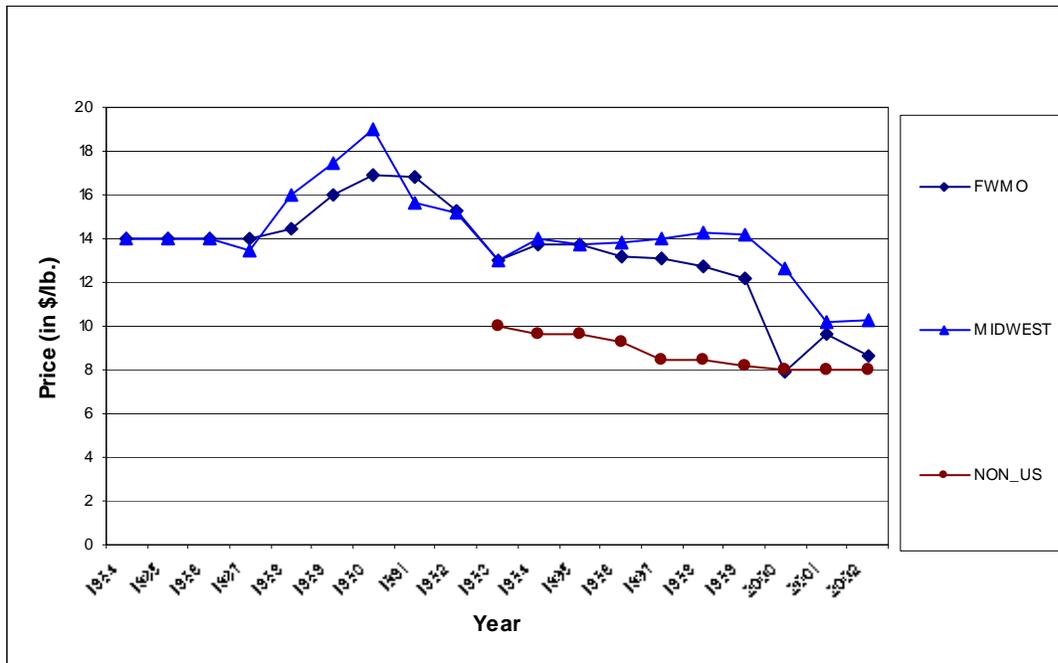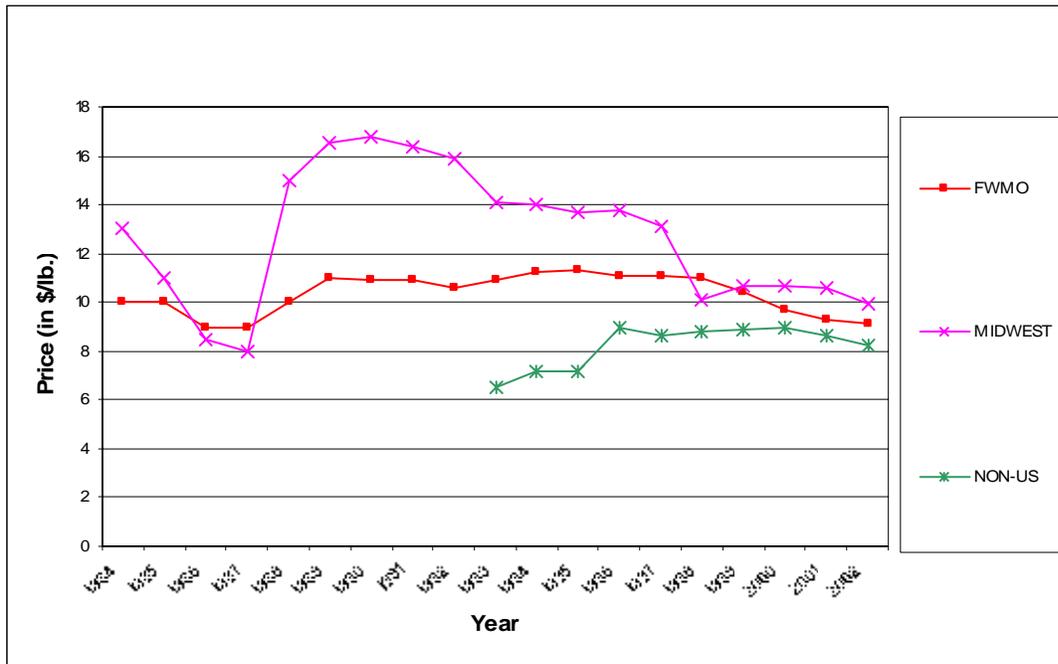Figure 5. Scotch Spearmint Oil Prices, 1984-2002

Figure 6. Native Spearmint Oil Prices, 1990-2002.

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