

# Spectrum Auctions Do Not Raise the Price of Wireless Services: Theory and Evidence

Evan Kwerel<sup>1</sup>  
Office of Plans and Policy  
Federal Communications Commission  
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A widely held misconception about auctions for spectrum licenses is that they will raise the price of wireless communications services.<sup>2</sup> If licensees pay for their licenses instead of getting them for free, it is argued that they would have higher costs and that these costs would be passed on to their customers in the form of higher prices. This conventional wisdom is, however, contradicted by both economic theory and empirical evidence.

## Theory

Standard economic theory predicts that *sunk* costs are irrelevant to the pricing and output decisions of firms.<sup>3</sup> A sunk cost is one that is not escapable. It does not vary with output or even if the firm goes out of business, and thus should have no effect on any business decision.<sup>4</sup> The amount paid for a spectrum license in an auction is such a sunk cost. Once it is paid, the payment cannot be recovered from the government and it does not vary with output. Therefore, the historical cost of winning bids at auctions should have no effect on the price or availability of spectrum-based communications services for customers.

While prices do not depend on sunk costs they do depend on *opportunity* or avoidable cost, and the opportunity cost of spectrum is independent of the assignment technique. The opportunity cost of a license is the amount that a firm forgoes by using it. This is what someone else would pay for its use. This market-clearing price of spectrum will be a function of current supply and demand conditions, not the historical cost at which firms acquired their spectrum. Moreover, to the extent that auctions assign licenses to the most efficient producers, facilitate efficient aggregation of spectrum, and move spectrum into the production of services consumers value the most, they will tend to expand the supply and reduce the prices of the wireless services most valued by consumers.

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<sup>1</sup> The opinions and conclusions expressed in this paper are my own and do not necessarily represent the views of the Federal Communications Commission or any of its Commissioners, or other staff.

<sup>2</sup> The issue of whether auctions will increase prices was raised in hearings on spectrum auctions held in 1986 before the U.S. House of Representatives (U.S. House 1986, p. 43). More recently, Spectrum Consultancy argued in a presentation to Hong Kong's Office of the Telecommunications Authority that a merit-based selection system could result in prices 30% below the level with auctions (Spectrum 2000).

<sup>3</sup> Nicholson 1978, p. 223.

<sup>4</sup> The profit maximizing level of output for a firm is determined by equating marginal cost and marginal revenue. Marginal cost and marginal revenue are independent of sunk costs since it does not vary with output. The decision to operate or shut down depends on whether total revenue exceeds variable cost, which also is independent of sunk costs.

Although charging for spectrum licenses will not increase the prices consumers pay for wireless services, it will affect the profits of licensees. Giving away licenses for free may create a large windfall for the lucky recipients. Imposing post-licensing obligations that the licensee would not have voluntarily chosen can reduce such a windfall. But these obligations would also be payments for the license, in the form of in-kind obligations instead of cash. And if it were true that cash payments for spectrum raise the prices of wireless services it would also be true that post-licensing obligations raise prices.

Theory predicts that when bidding for a spectrum license in an auction, a firm would never knowingly bid more than the discounted value of the expected profits from acquiring the license. Indeed, auctions typically provide positive profits to the winner, since in order to win, the bidder who values the items the most must generally pay only slightly more than the amount the second highest bidder is willing to pay. Nevertheless, bidders may sometimes overestimate the value of a license and find that they cannot cover their fixed debt payments. This could result in one-time losses for the investors and a change in ownership. But because the amount of the fixed payments is a sunk cost, such losses should not affect pricing or output decisions, including whether to exit the market.

### **Empirical Findings**

Observations are consistent with the theory that sunk costs do not affect prices. This is true regardless of market structure. For example, in competitive rental markets rents do not depend on the historical costs of acquiring a property. Those who paid high prices for their property are not able to charge higher rents. Nor do owners who acquired their properties cheaply or even for free charge less, absent government price controls. The same is true in less competitive markets such as sport stadiums. Owners who inherited their stadiums are not likely to set ticket prices any lower than those who obtained them through competitive bidding.

Our preliminary analysis of the U.S. cellular telephone market supports the conclusion that paying for a spectrum license does not increase the prices of wireless services. For this analysis we used data on cellular prices and ownership from 1985 to 1998.<sup>5</sup> The pricing data show the lowest price for 160 minutes of use for each of the two cellular carriers in the largest thirty markets.<sup>6</sup> The ownership data provide the date of the first sale of each license.<sup>7</sup> Prior to the first sale all cellular licenses were acquired for free.<sup>8</sup> The attached charts present this data graphically.

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<sup>5</sup> The price data were obtained from Professor Jerry Hausman of M.I.T. The Wireless Telecommunications Bureau of the FCC provided the data on cellular license transfers.

<sup>6</sup> We are missing price data for market 22.

<sup>7</sup> We defined a sale as a non-pro forma transfer. That is a transfer of at least 51% ownership.

<sup>8</sup> In cases of a single qualified applicant the license was awarded to that applicant. This was generally the case for B block licenses that were limited to wireline carriers serving the license area. When more than one carrier serviced the same area, carriers often settled and submitted a single application. (For the top 30 markets there were 52 applications by wireline carriers.). Where there was more than one qualified applicant, the FCC used comparative hearings to select among them. The A block license was initially limited to non-wireline carriers and there were more comparative hearings than for the B block licenses. (For the top 30 markets there were 141 applications by non-wireline carriers.)

An examination of the charts suggests three points that support our hypothesis that paying for a license does not lead to higher prices for consumers. First, within a given market, the prices charged by cellular operators who purchased their licenses in the after-market are not generally higher than those of firms that acquired their licenses for free. For example, in New York and Los Angeles the A block licenses sold in 1990 yet from 1991 to 1994 the price charged by the new A block licensee was the same or less than that of the B licensee that acquired its license for free.

Second, within each market, a comparison of prices before the sale date and after the sale date indicates no increase after the sale. The change in prices before and after a license sale is summarized in the first row in the attached table. We found that on average the price one year after a sale was 5 percent lower than the price one year before the sale, and the average of prices over the three years after the sale was 12 percent less than the average of the prices over the three years before the sale.<sup>9</sup>

Finally, we examined whether prices were falling by even larger percentages in markets with no license sales during the same period. For each year, we calculated the average price changes in those markets without a license sale three years before and three years after that year. This allows a comparison of the change in price before and after a sale relative to the change in price in markets without any sales in the same time period. The comparison for each license in each market with a license sale is shown in the attached table. The following table provides a summary of the comparisons.

	<b>Change in Price</b> 3 year average price before and after sale	<b>Change in Price</b> 1 year before and 1 year after sale
<b>Markets with Sales</b>	-12%	-5%
<b>Markets without Sales</b> <sup>10</sup>	-10%	-8%

Comparing the rows in the first column of the table shows that the average percentage reduction in the three-year average price before and after a sale was slightly greater for markets with sales, 12 percent versus 10 percent. Comparing the rows in second column indicates that the one-year reduction in price was slightly less for markets with sales, 5 percent versus 8 percent. A reasonable conclusion from this is that paying for a license (the first sale of a license that was acquired free of charge) had no effect on prices, or even may have reduced prices as the new licensee gained full control of the business.

<sup>9</sup> In cases where only two years of data were available before or after a sale we used the two available observations to calculate the “3 year average.” For example, since our data set began in 1985 the three-year average price before a sale in 1987 was the average of 1985 and 1986, while the three-year average after the sale was based on 1988, 1989 and 1990.

<sup>10</sup> For each year after 1987 we considered only those markets with no first sales during the seven years starting three years before and ending three years after that year. For 1987 we included markets with no first sales in 1985 to 1990, since our data set starts in 1985.

## **Acknowledgements**

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## **References**

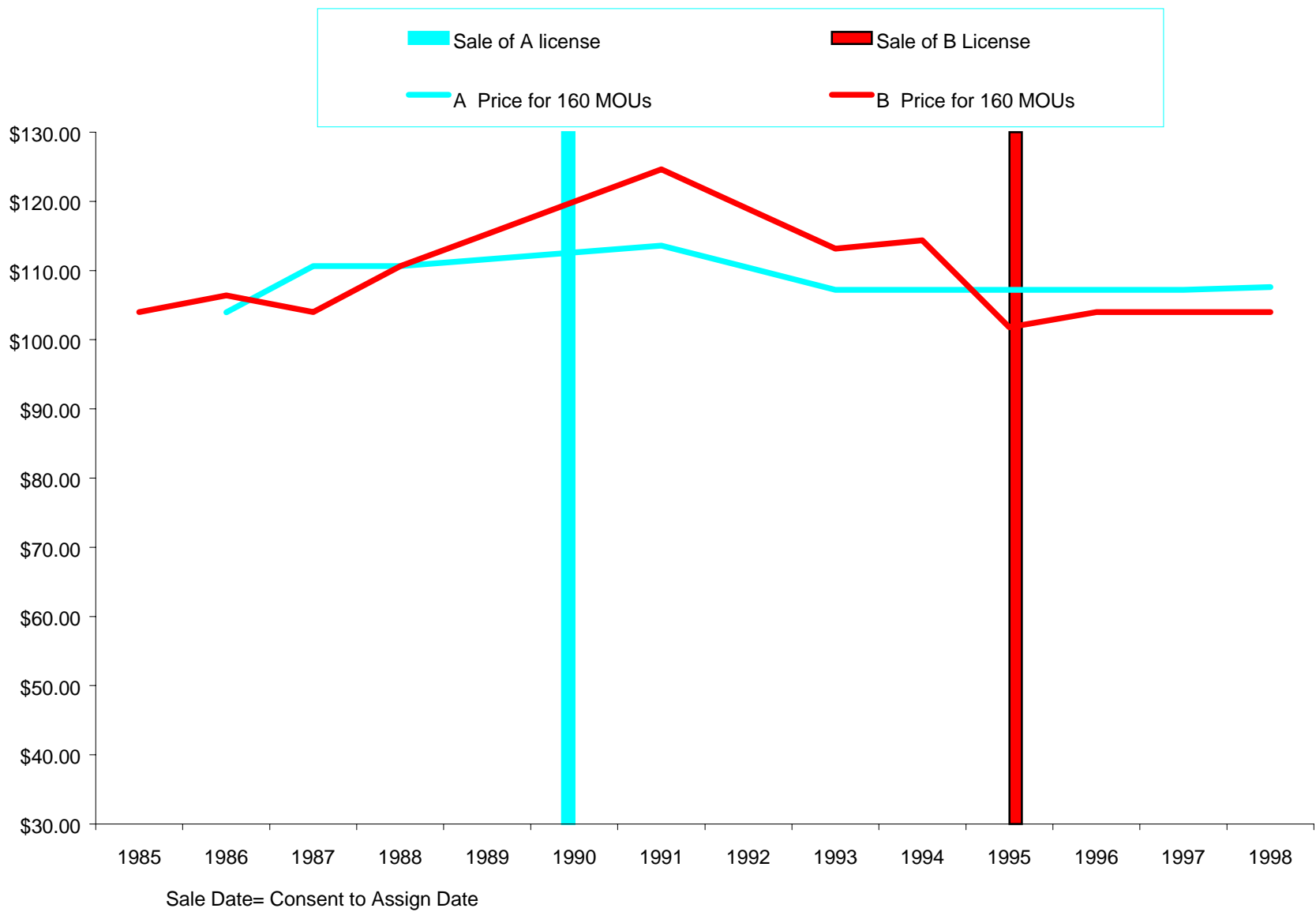
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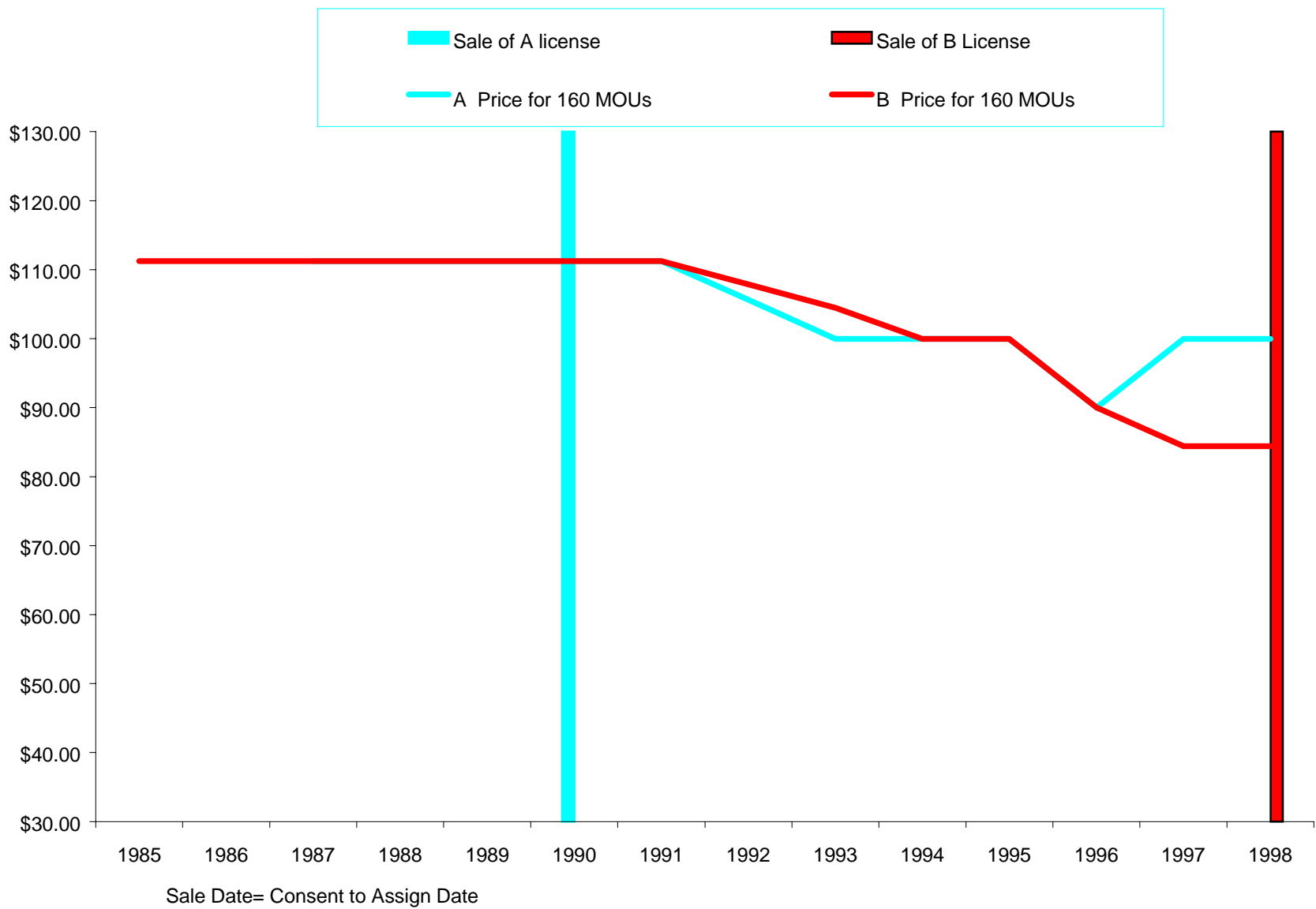
U.S. House. 1986. Subcommittee on Telecommunications, Consumer Protection, and Finance of the Committee on Energy and Commerce. *Spectrum Auctions: FCC Proposals for the Airwaves: Hearing before the Subcommittee on Telecommunications*, 99<sup>th</sup> Cong., 1st sess. 1 October.

**PRICING ANALYSIS - COMPARISON**

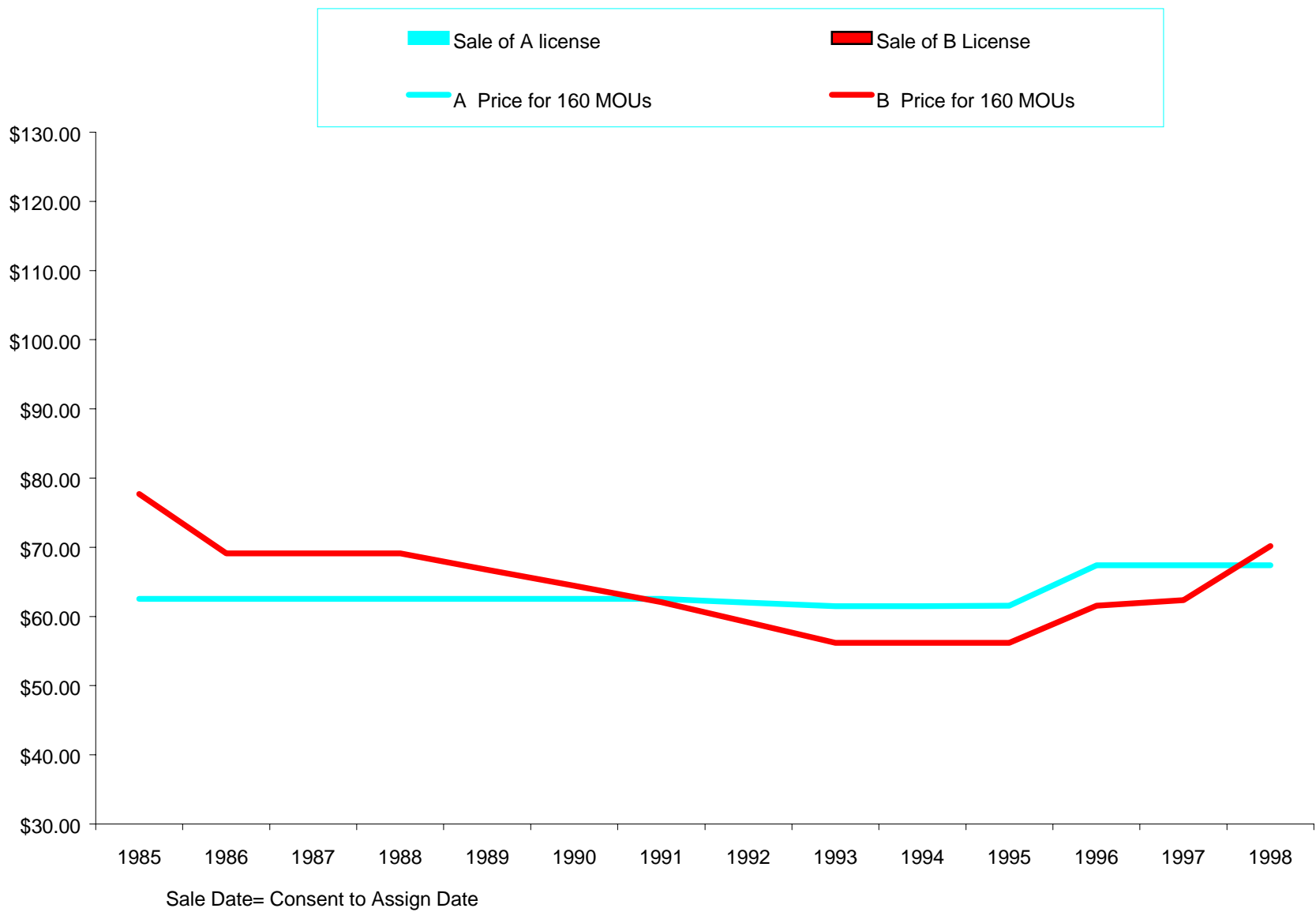
Market #	Market Name	License	Year Transaction	3 Year	3 Year	1 Year	1 Year
				Price Comparison %	Non-Trans. Market Comparison During Transaction Year	Price Comparison %	Non-Trans. Market Comparison During Transaction Year
1	New York	A	1990	0%	1%	2%	3%
1	New York	B	1995	-13%	-14%	-9%	-13%
2	Los Angeles	A	1990	-5%	1%	0%	3%
2	Los Angeles	B	1998	NA	NA	NA	NA
4	Philadelphia	A	1990	19%	1%	23%	3%
4	Philadelphia	B	1995	-23%	-14%	-26%	-13%
5	Detroit	A	1991	12%	-2%	5%	-1%
6	Dallas	A	1995	1%	-14%	4%	-13%
6	Dallas	B	1995	-7%	-14%	8%	-13%
7	Boston	A	1995	-24%	-14%	-24%	-13%
8	Washington, DC	B	1995	-31%	-14%	-32%	-13%
9	San Francisco	A	1990	-4%	1%	0%	3%
10	Houston	A	1990	-5%	1%	-1%	3%
11	Miami	A	1987	NA	NA	NA	NA
12	Atlanta	A	1988	NA	NA	0%	-3%
13	San Diego	A	1995	-45%	-14%	-19%	-13%
13	San Diego	B	1995	-37%	-14%	-22%	-13%
14	Minneapolis	B	1995	-3%	-14%	-9%	-13%
15	St. Louis	A	1995	-14%	-14%	0%	-13%
15	St. Louis	B	1995	-30%	-14%	-9%	-13%
16	Baltimore	A	1991	1%	-2%	1%	-1%
18	Seattle	A	1995	-14%	-14%	-10%	-13%
19	Pittsburgh	A	1995	-22%	-14%	-11%	-13%
19	Pittsburgh	B	1995	-23%	-14%	-15%	-13%
20	Tampa	A	1995	-17%	-14%	0%	-13%
20	Tampa	B	1995	-23%	-14%	-20%	-13%
21	Denver	A	1988	NA	NA	13%	-3%
23	Cleveland	A	1991	-6%	-2%	-3%	-1%
24	San Jose	A	1992	-9%	-2%	-9%	-3%
25	Kansas City	A	1988	NA	NA	-21%	-3%
25	Kansas City	B	1994	-16%	-12%	2%	-3%
26	Cincinnati	A	1992	6%	-2%	3%	-3%
26	Cincinnati	B	1995	-27%	-14%	5%	-13%
27	Portland	A	1995	-7%	-14%	-8%	-13%
28	Milwaukee	A	1988	NA	NA	-8%	-3%
29	Sacramento	A	1998	NA	NA	NA	NA
30	San Antonio	A	1995	0%	-14%	8%	-13%
30	San Antonio	B	1995	-8%	-14%	6%	-13%
<b>Average Change</b>				<b>-12%</b>	<b>-10%</b>	<b>-5%</b>	<b>-8%</b>



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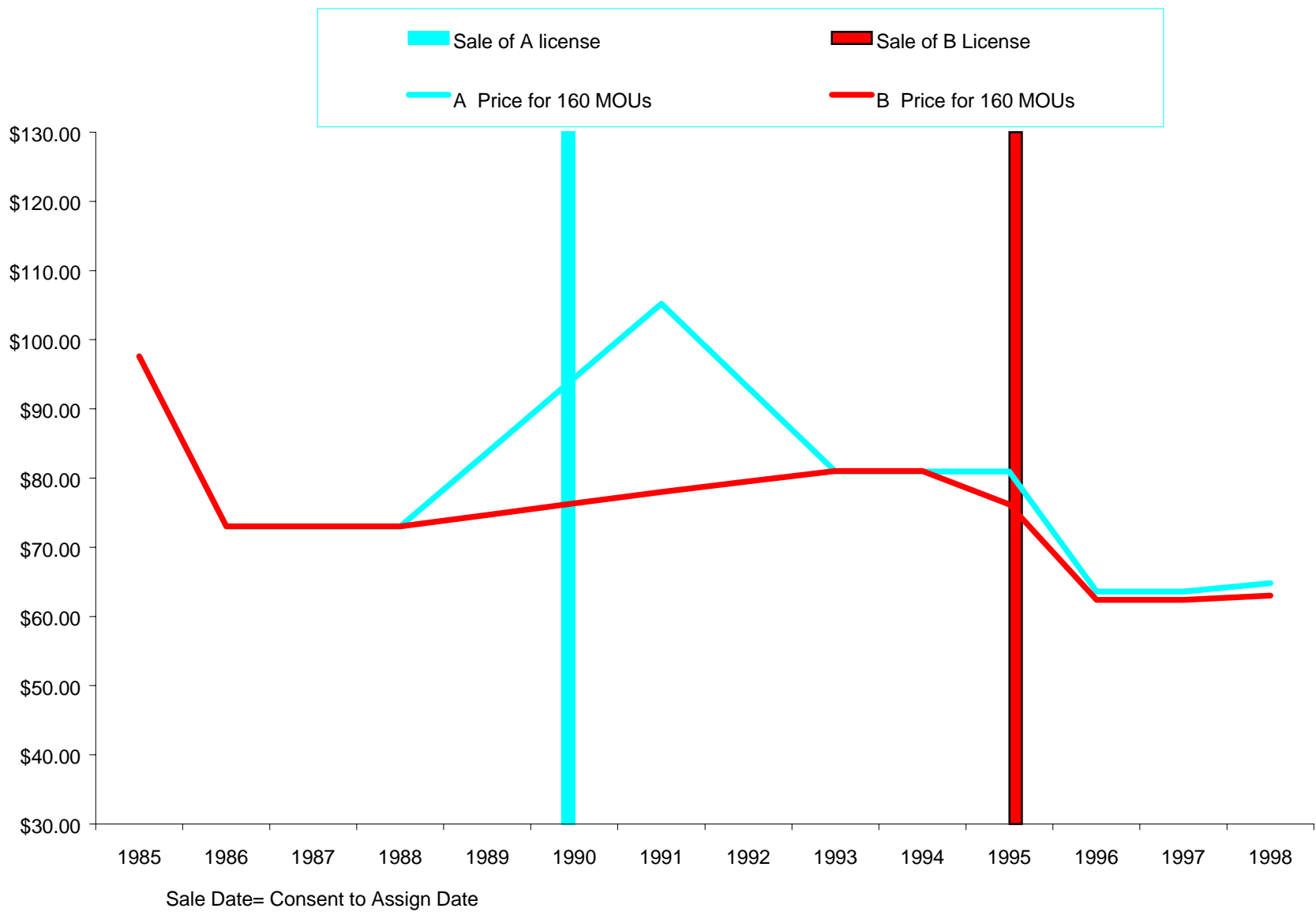


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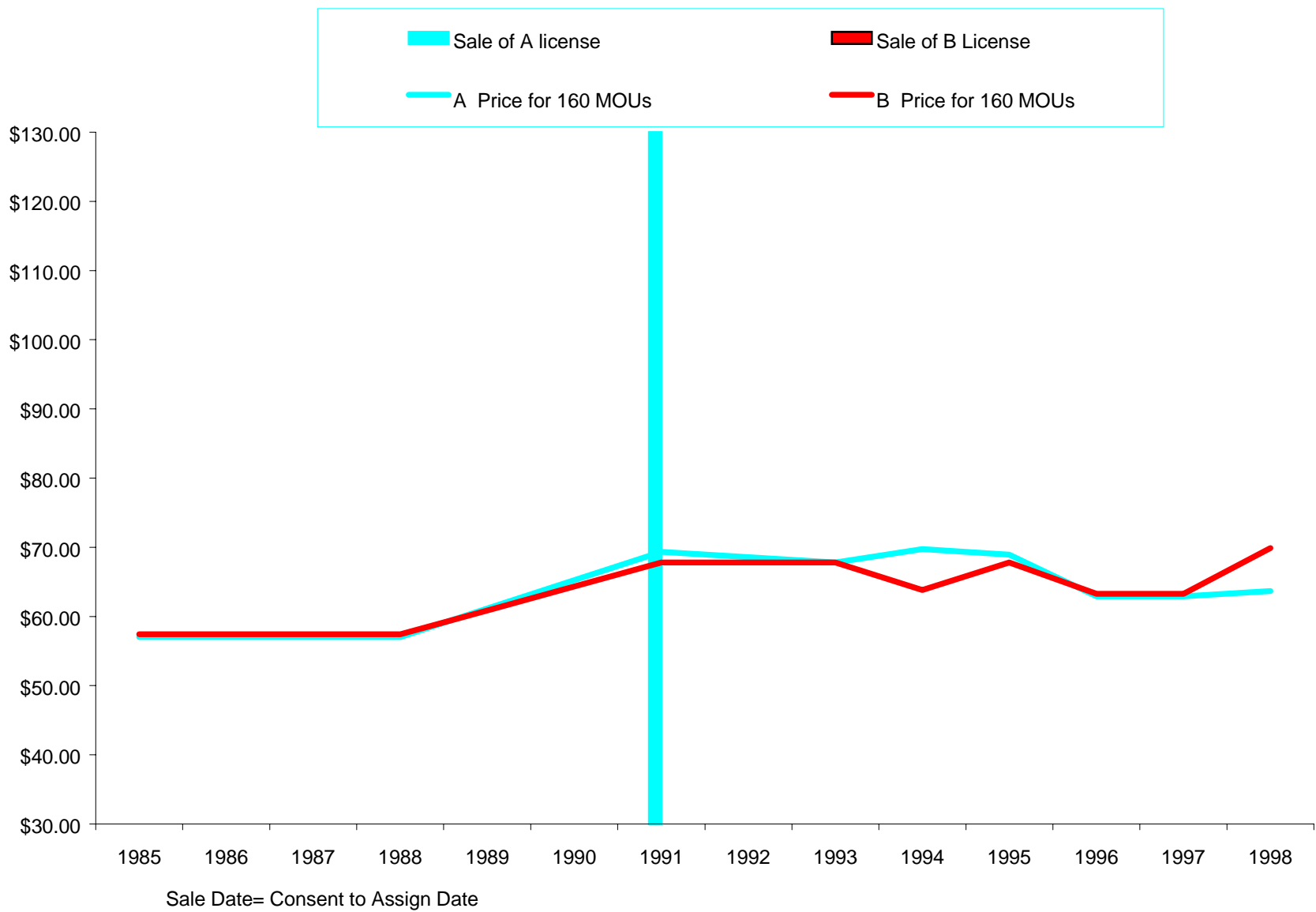


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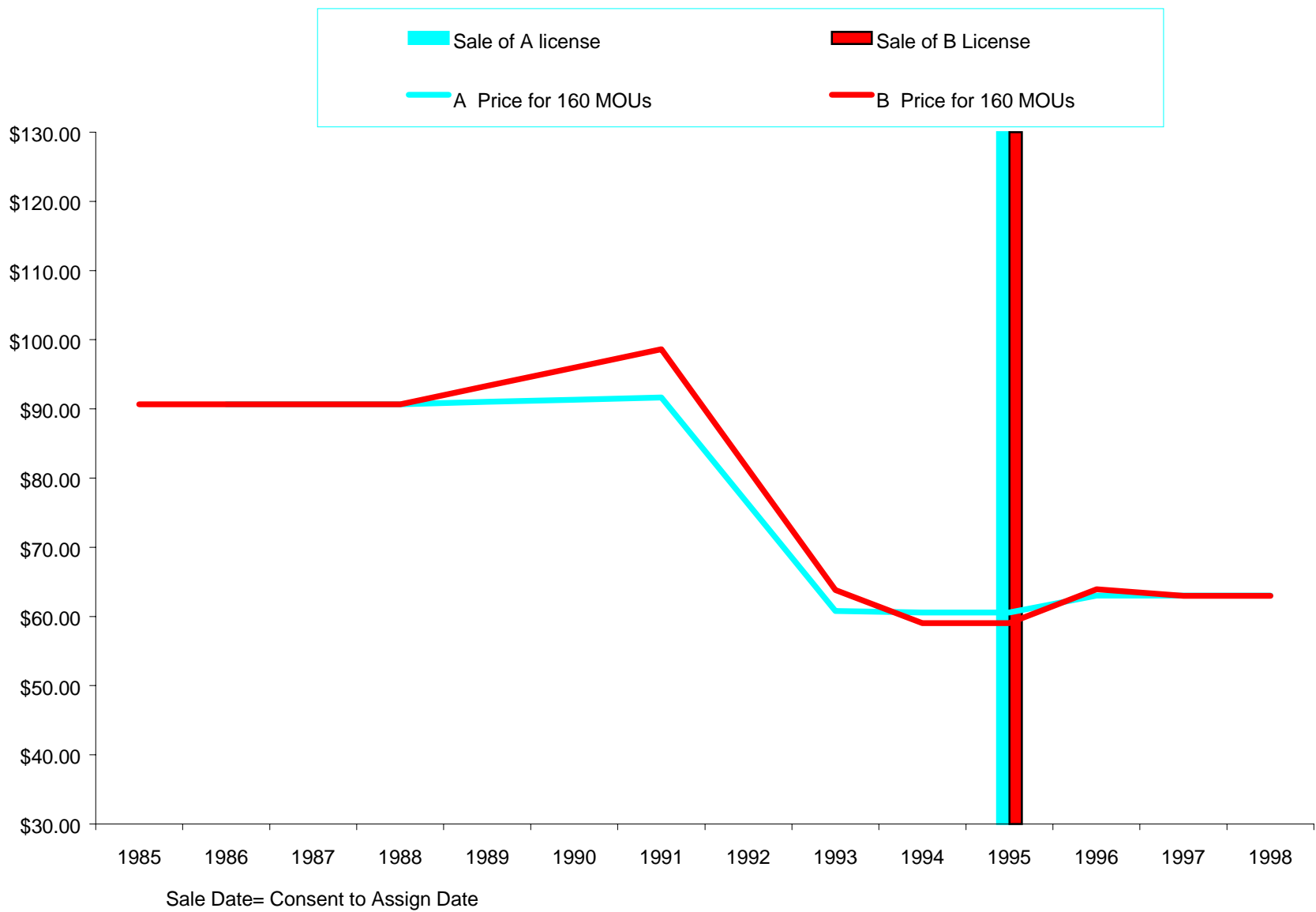




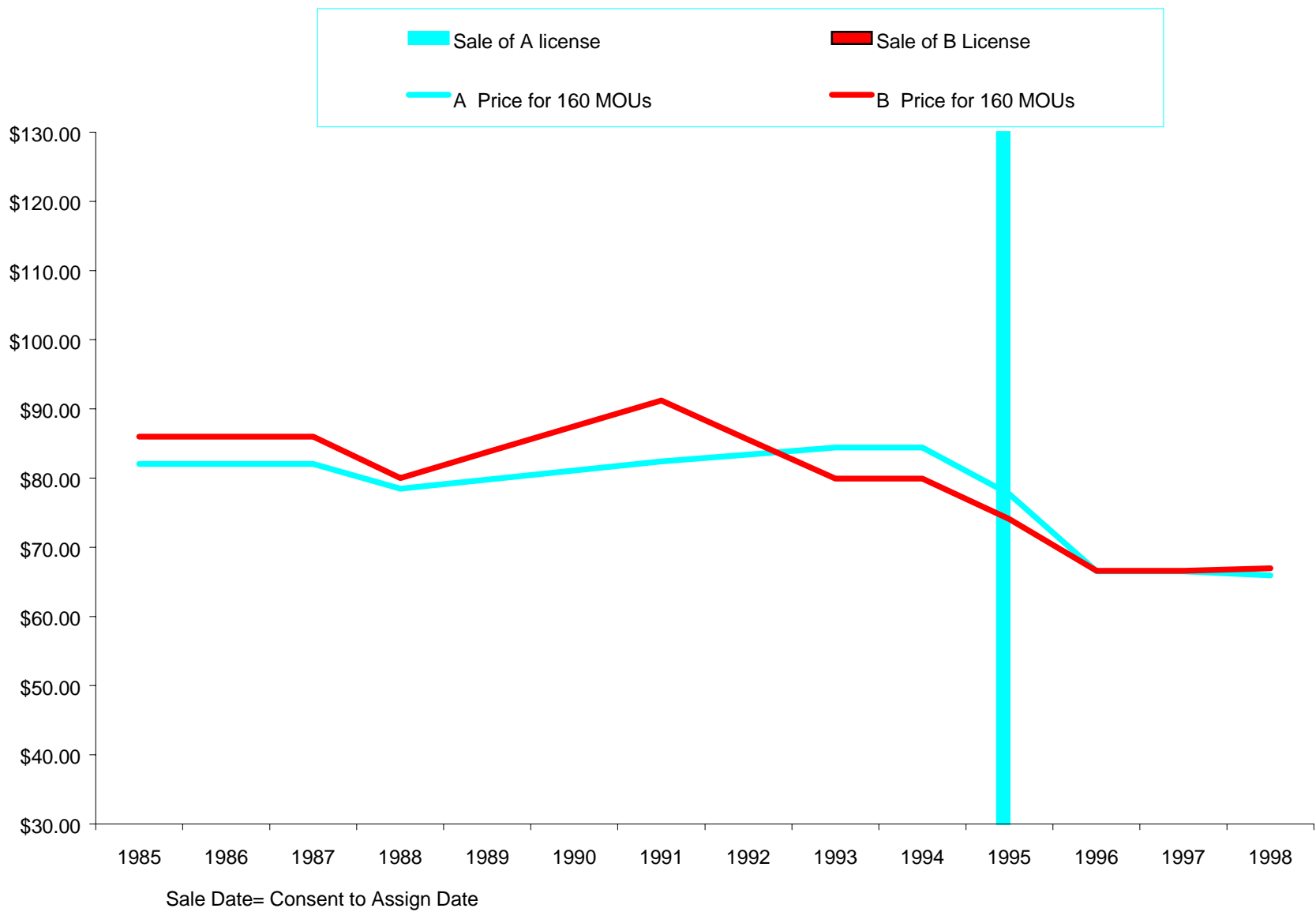
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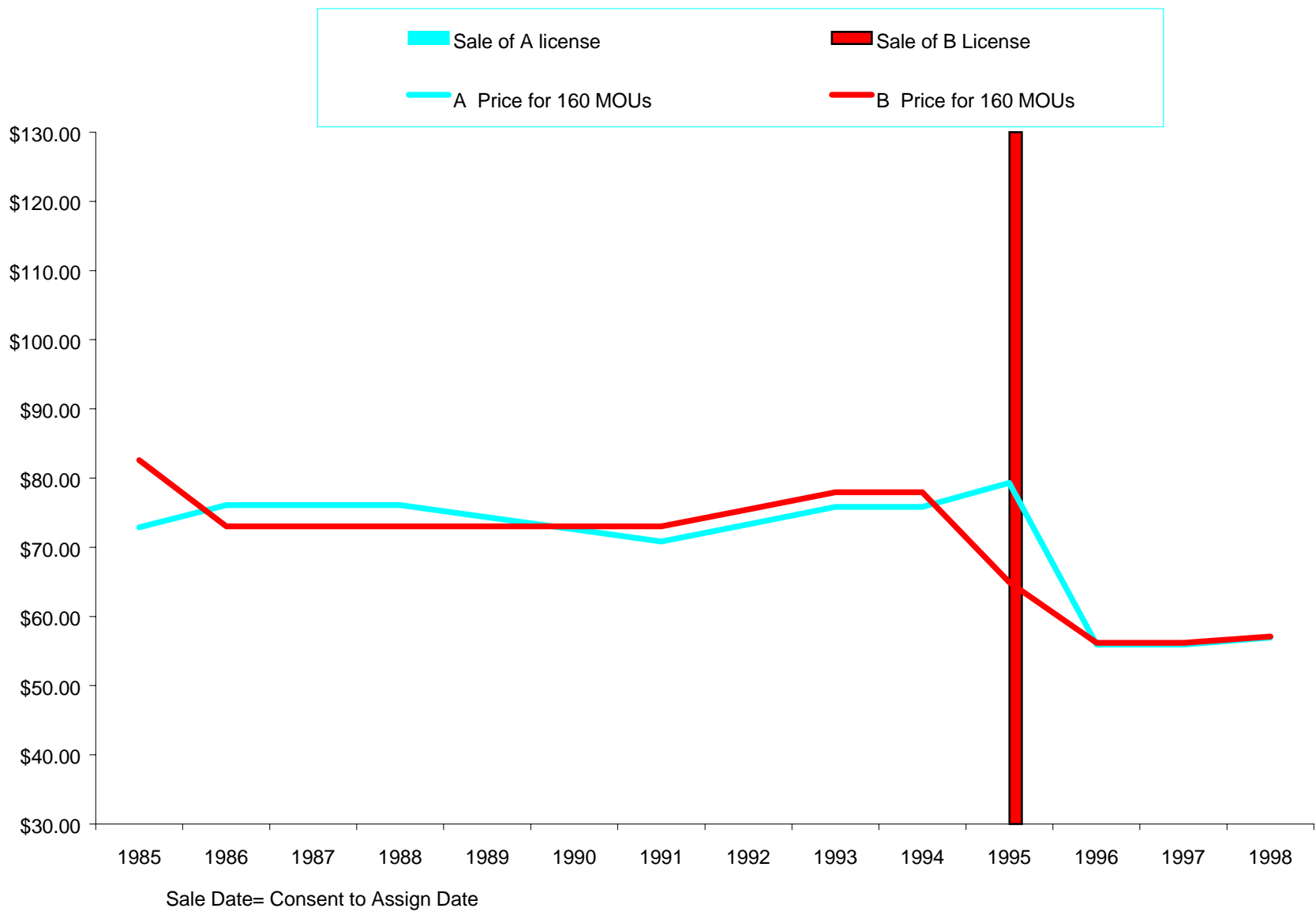
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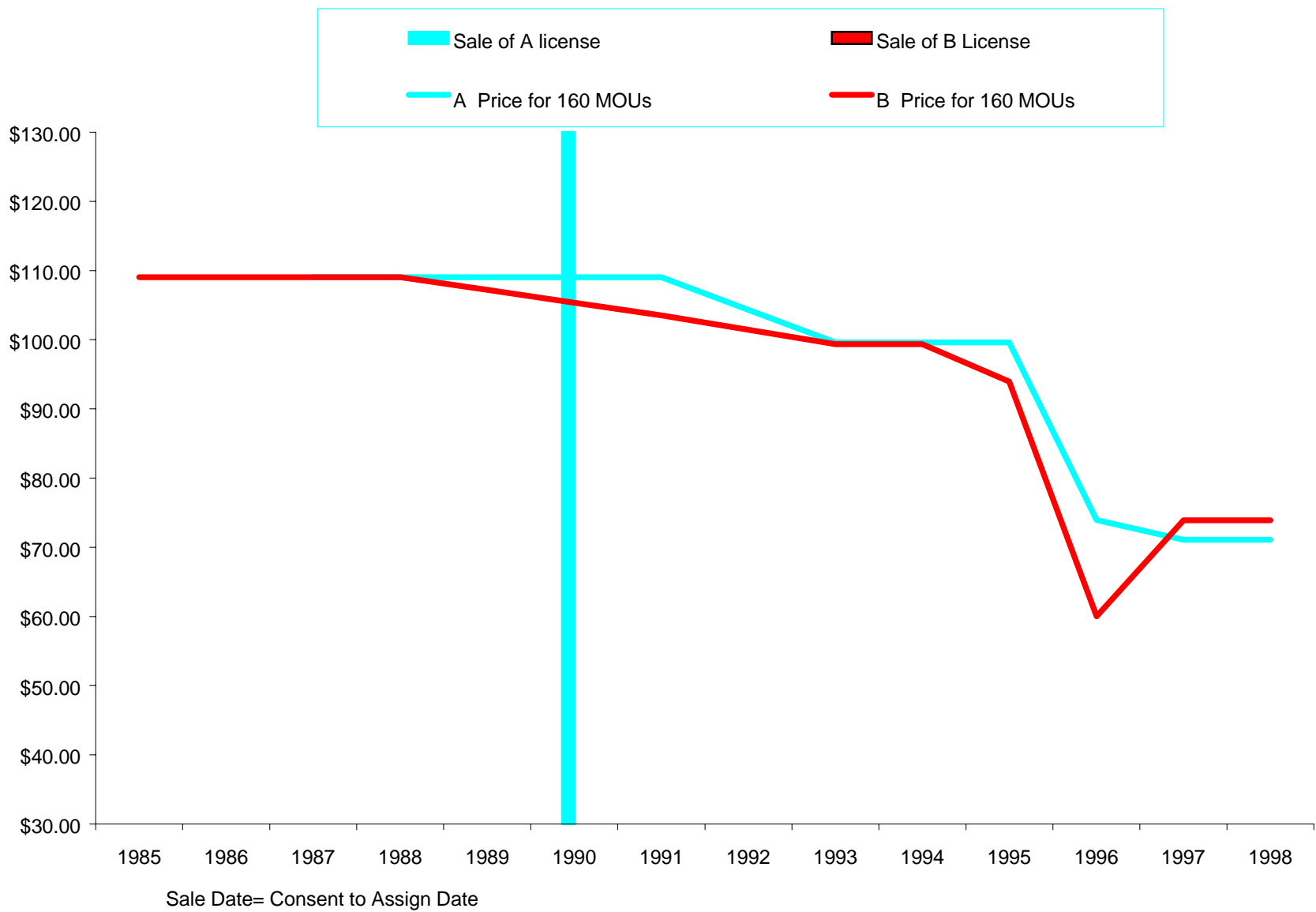
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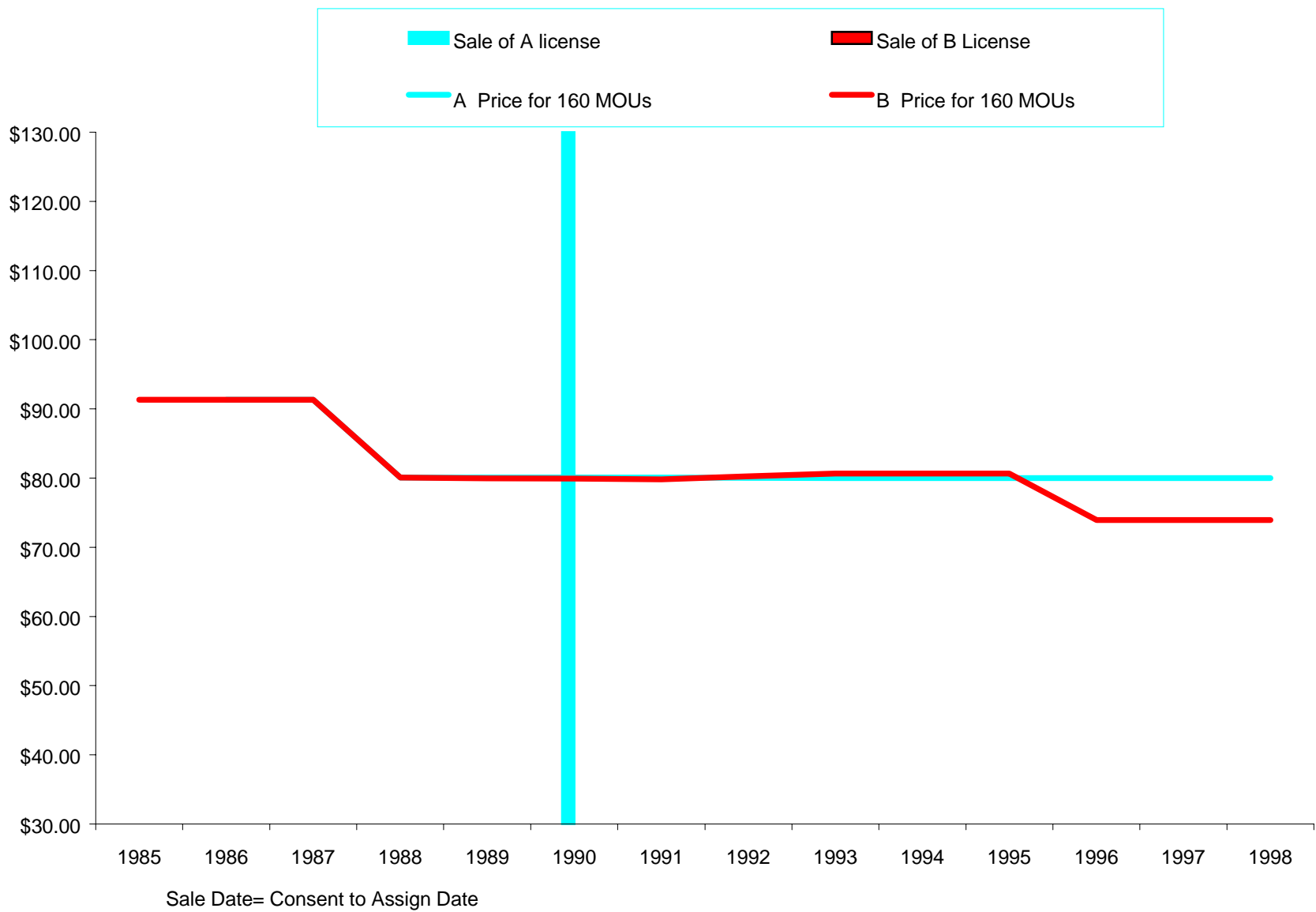
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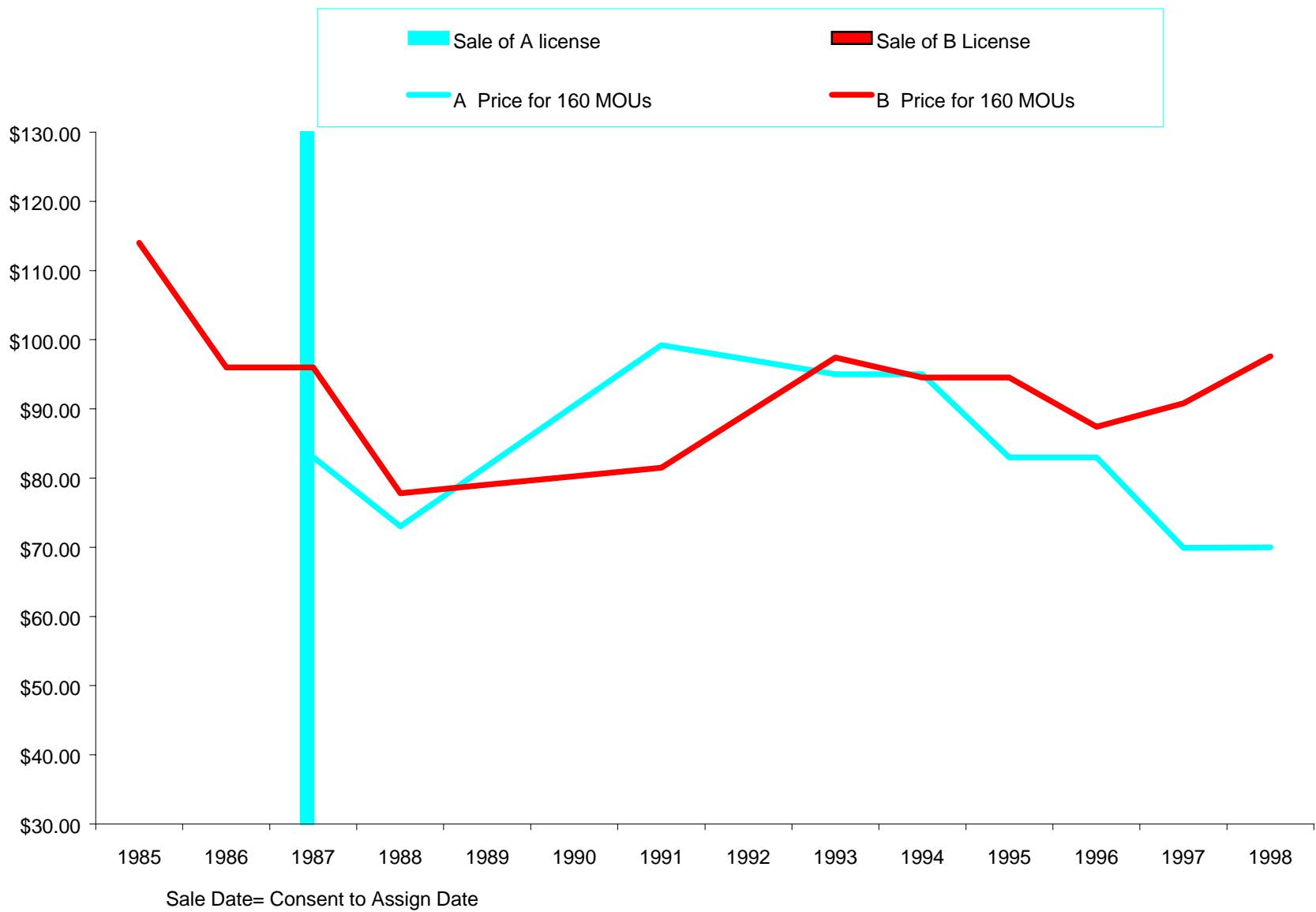
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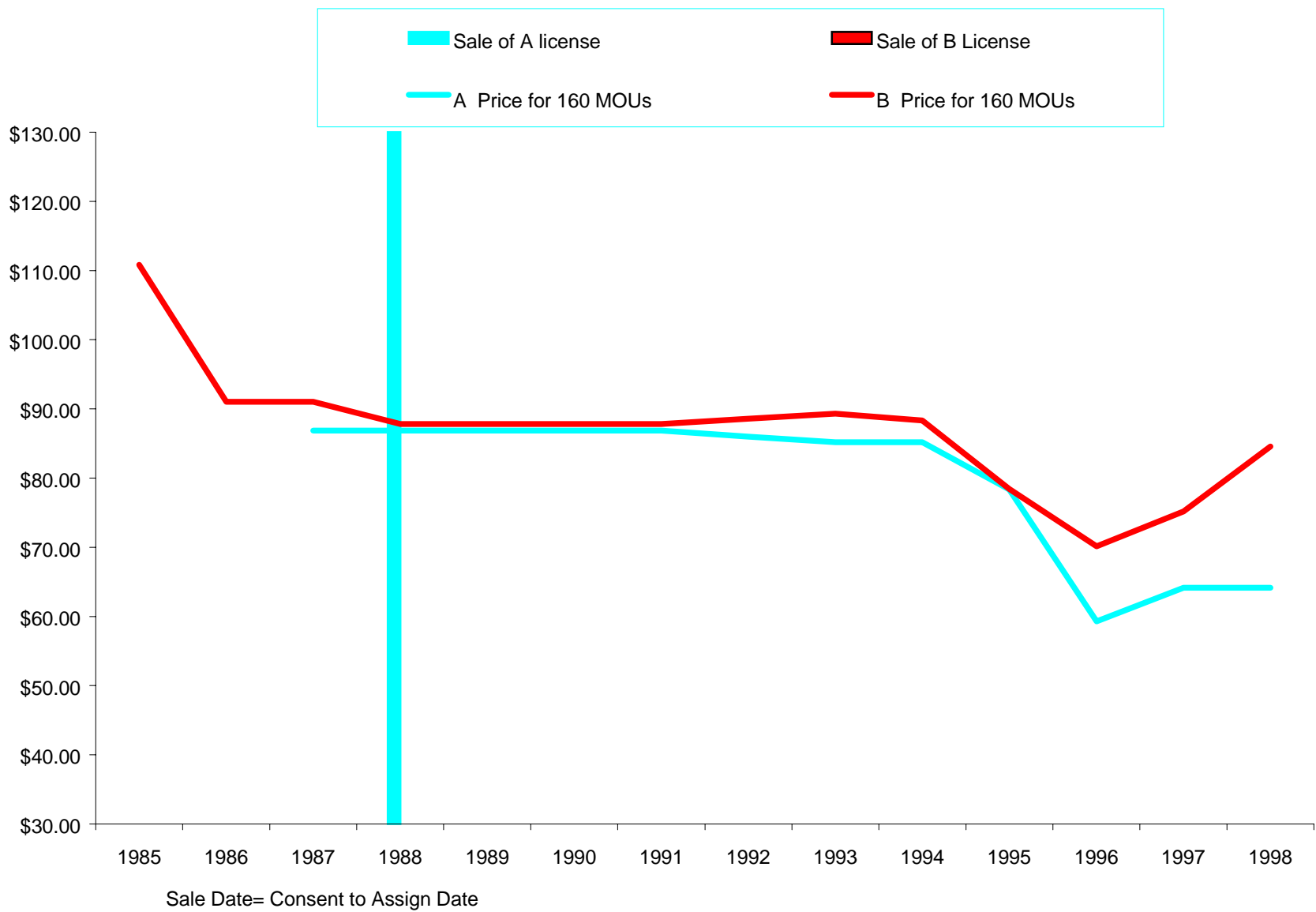


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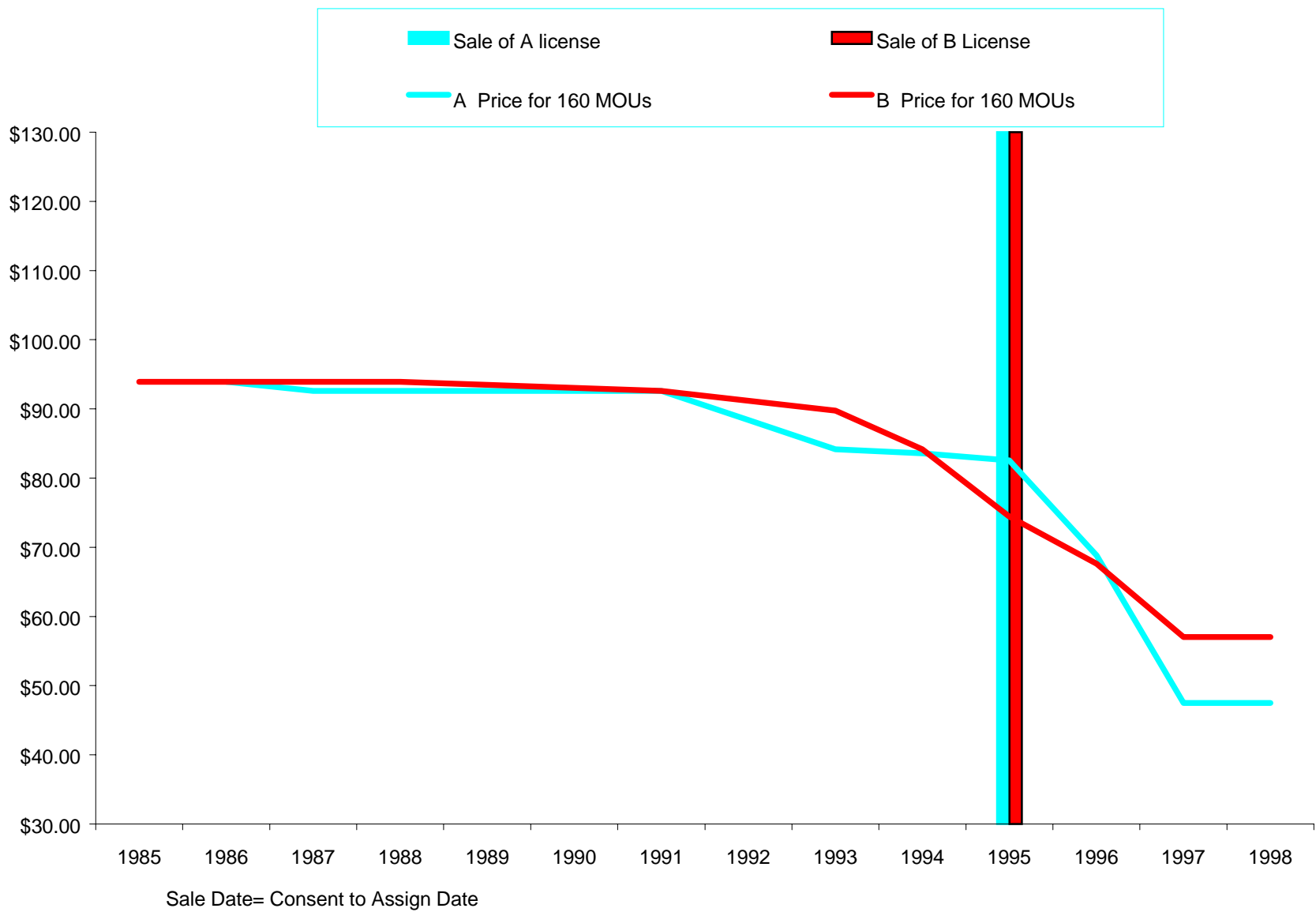


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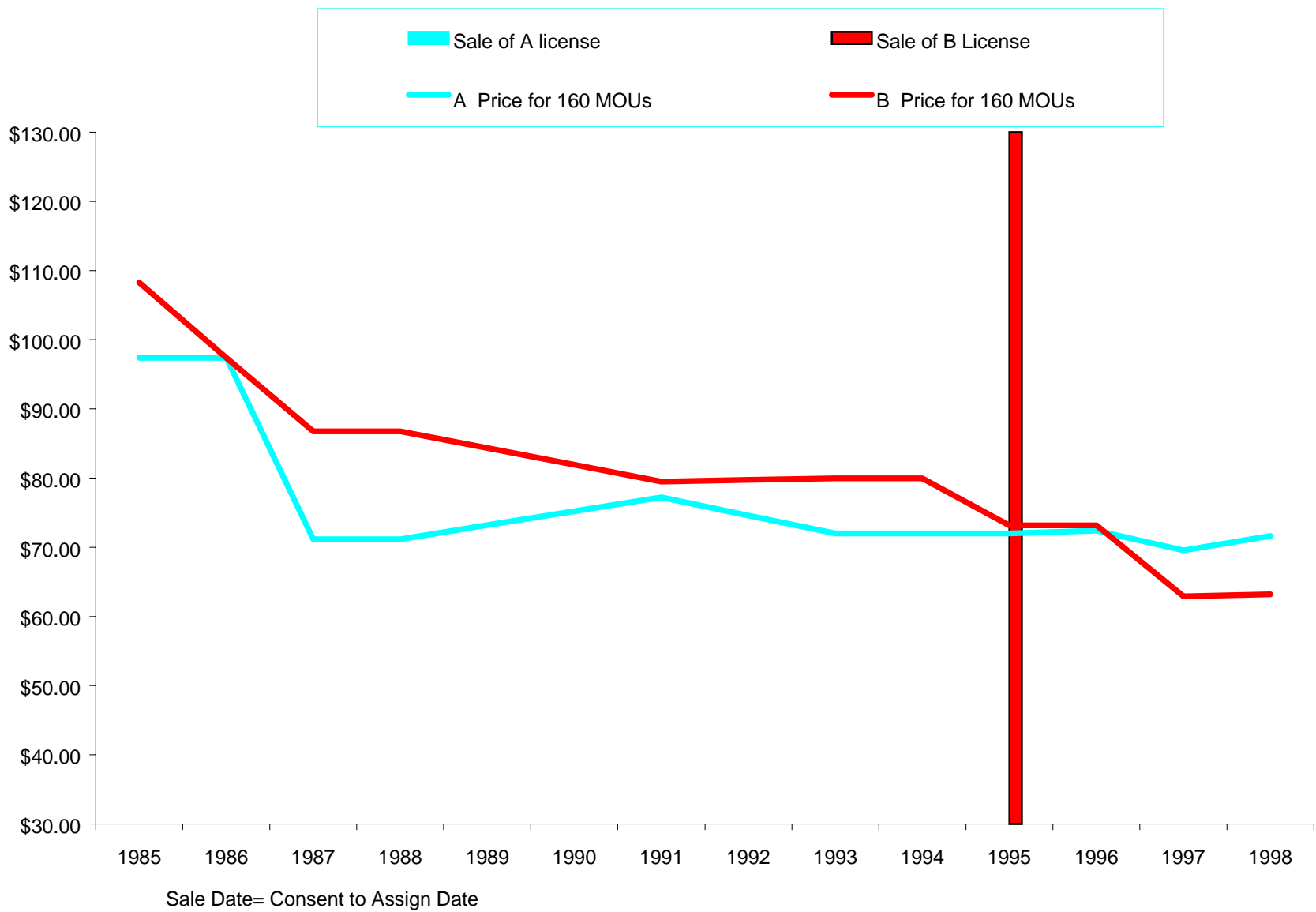




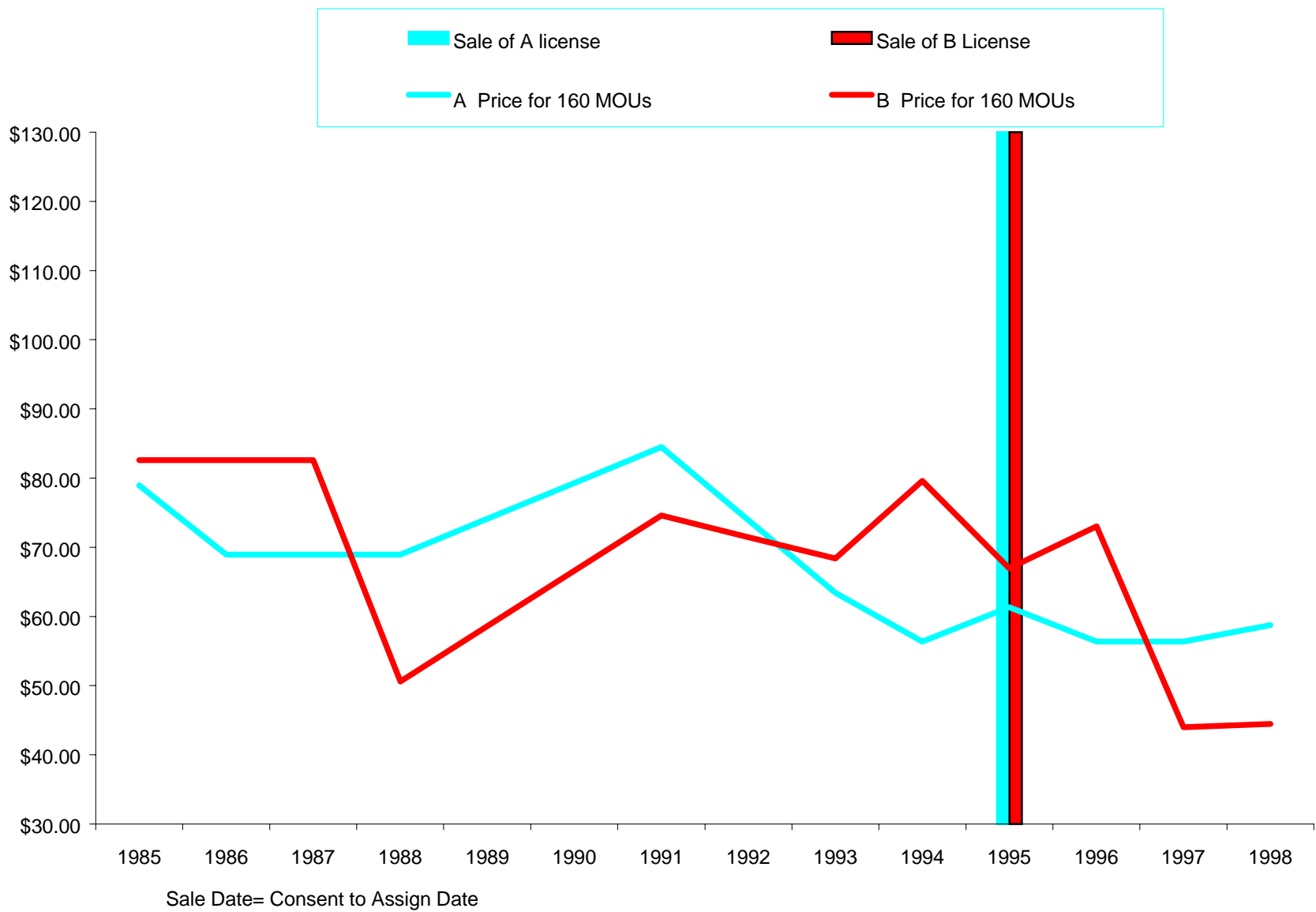
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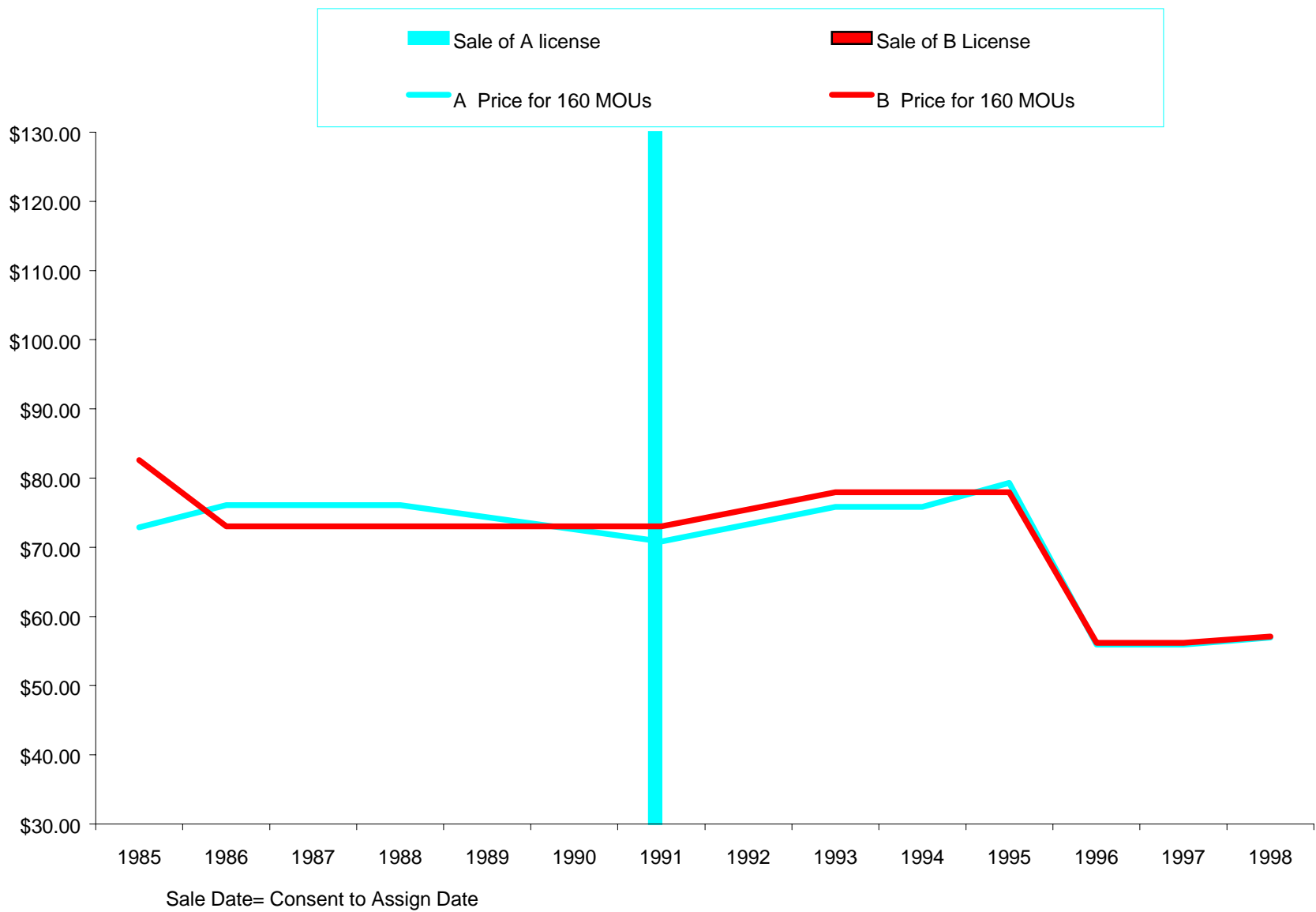
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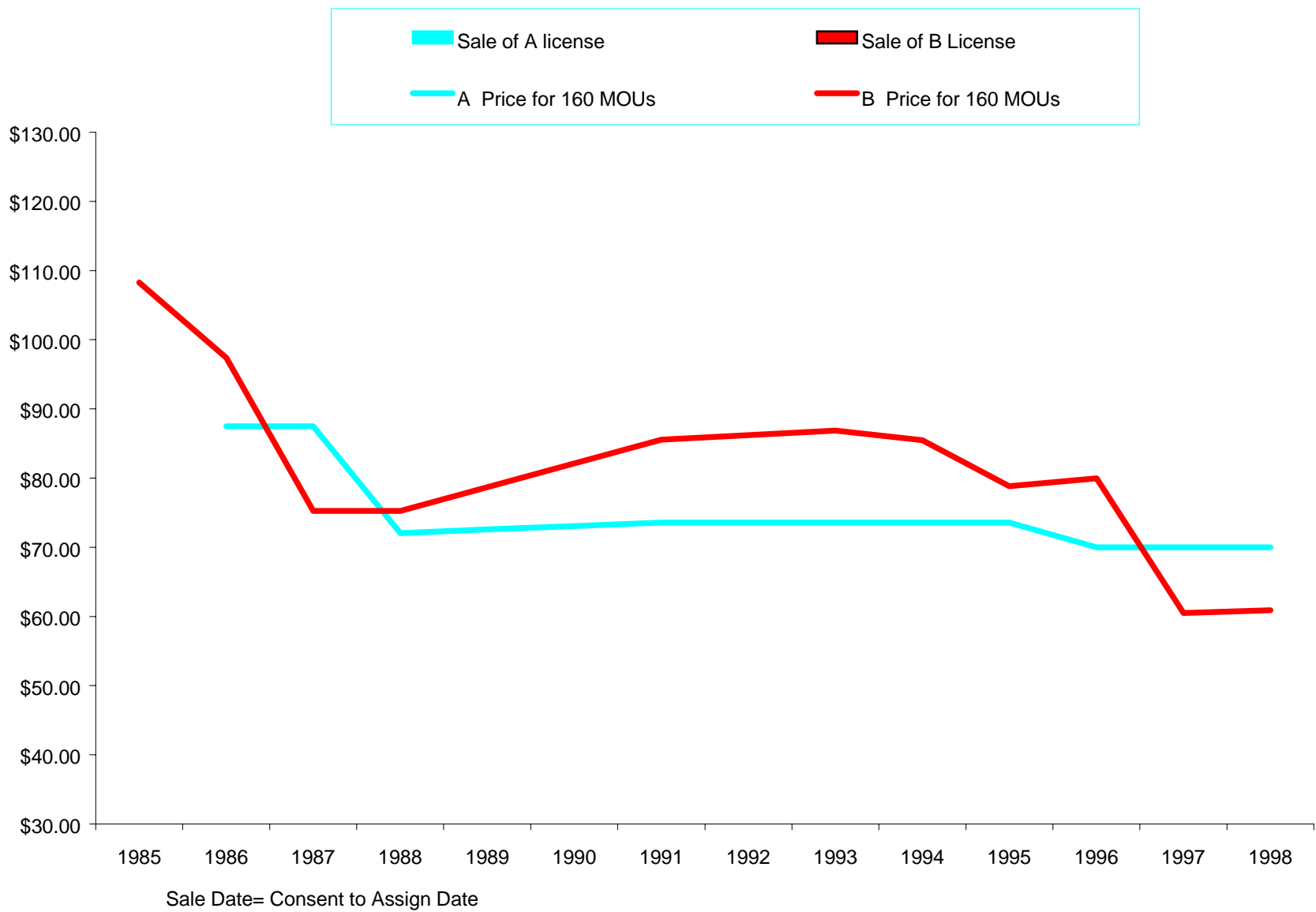
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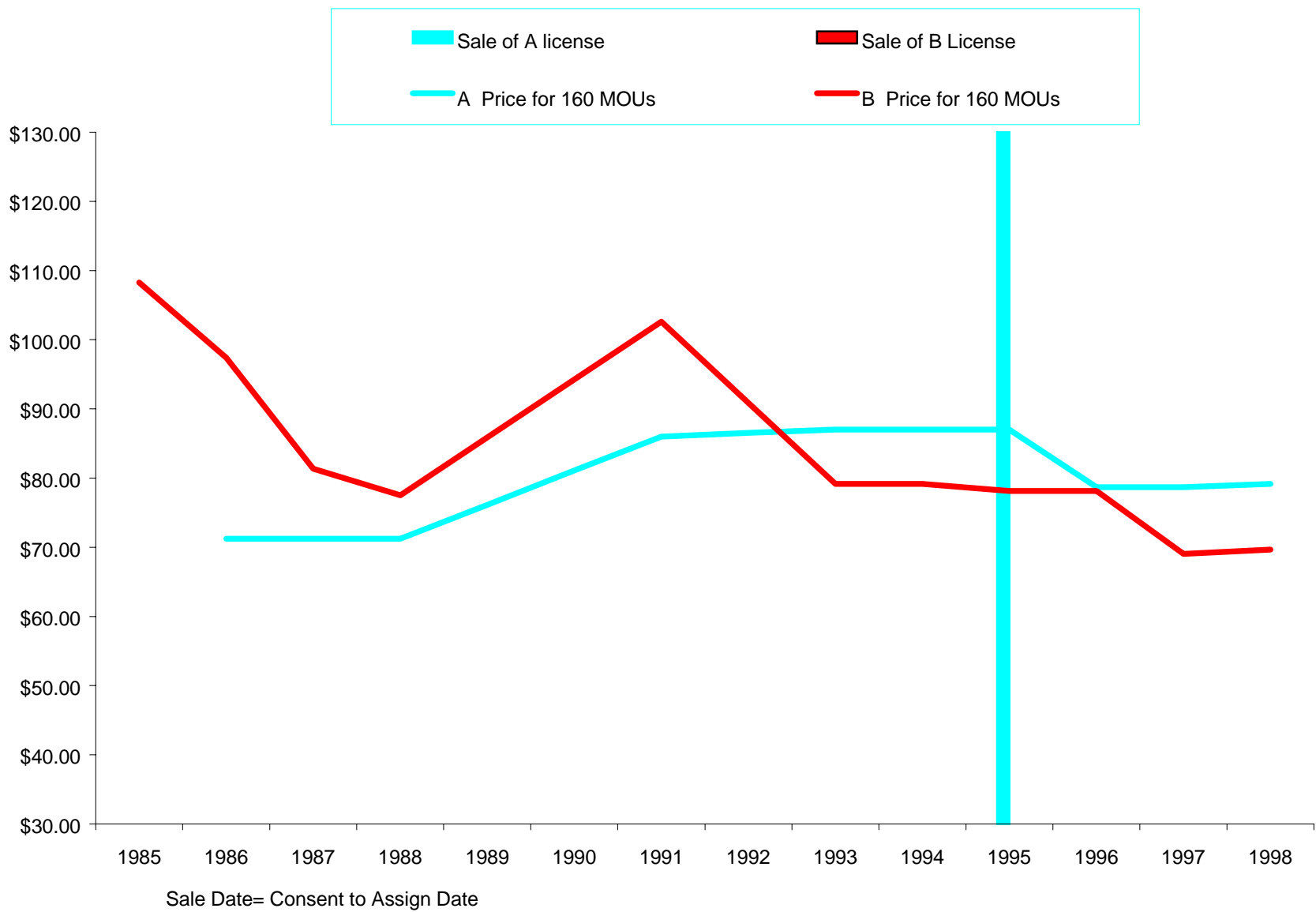
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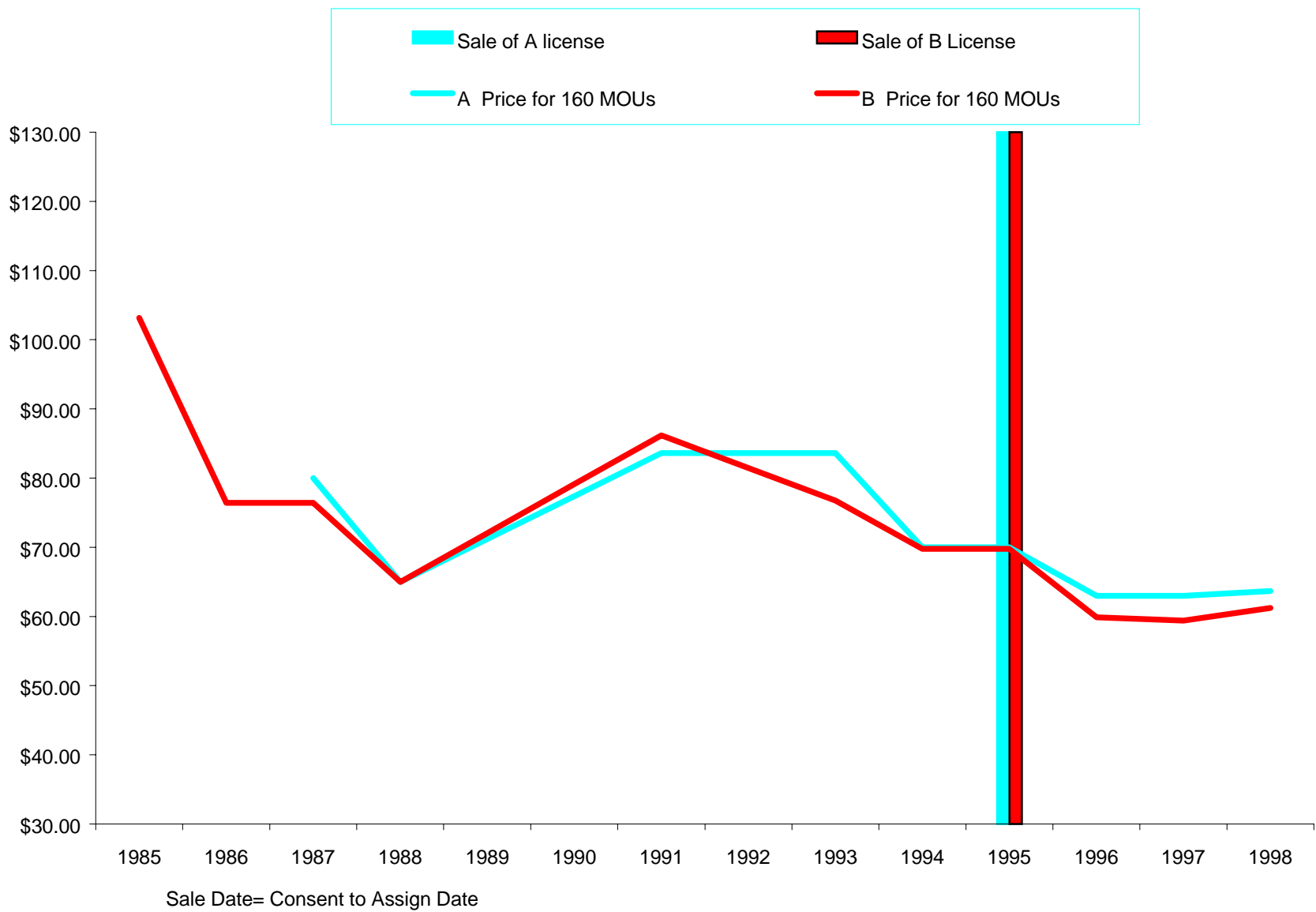
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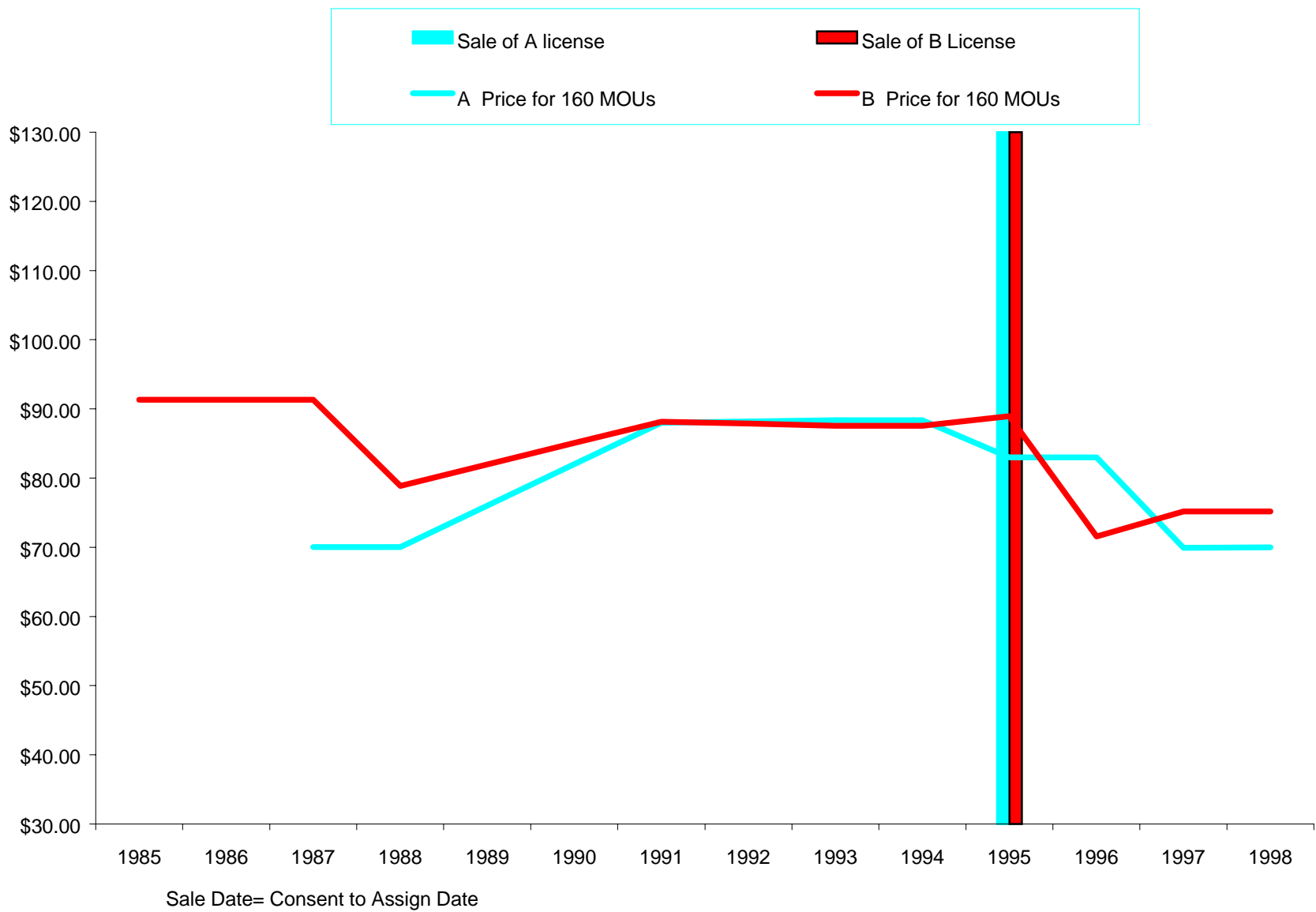


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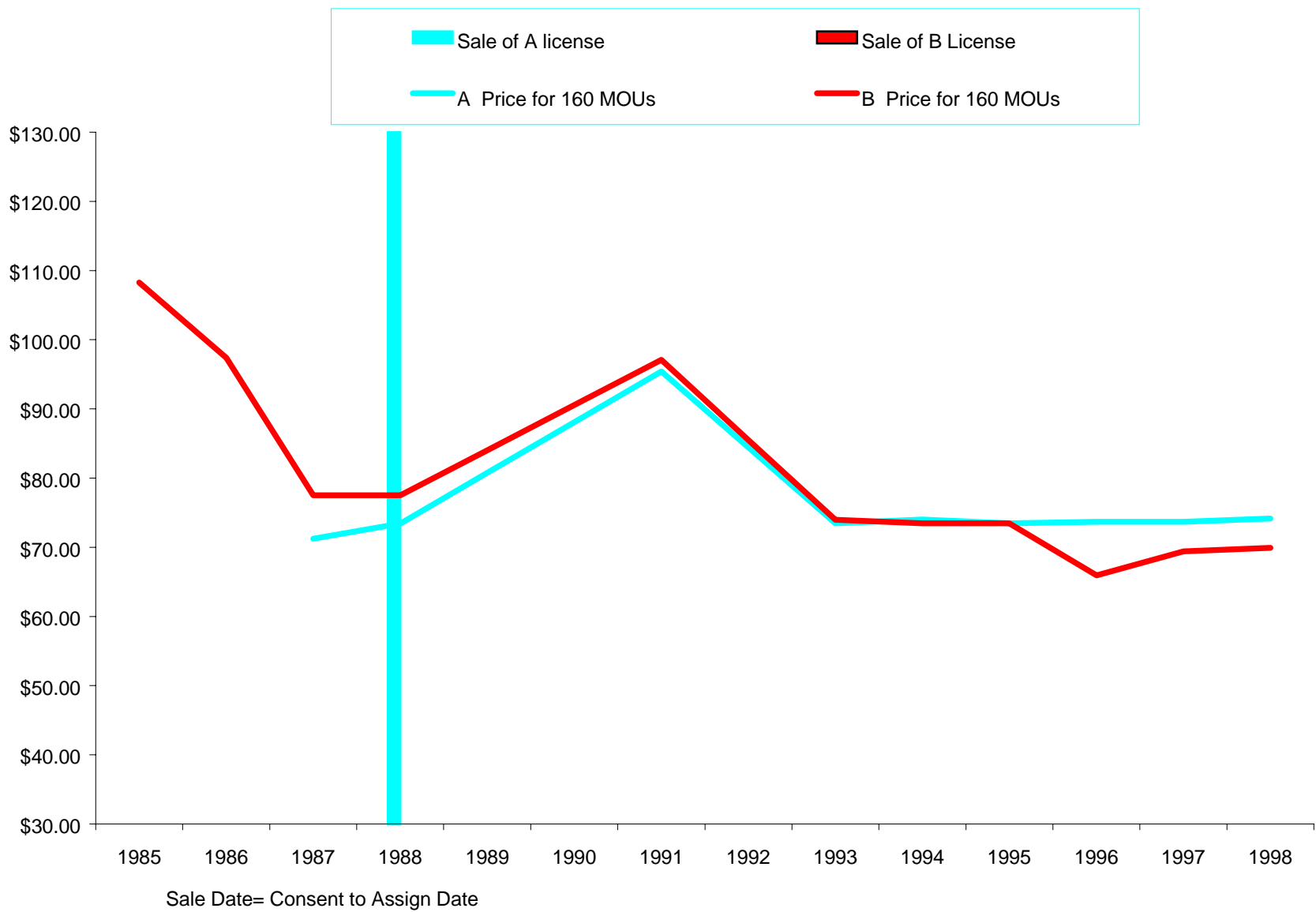


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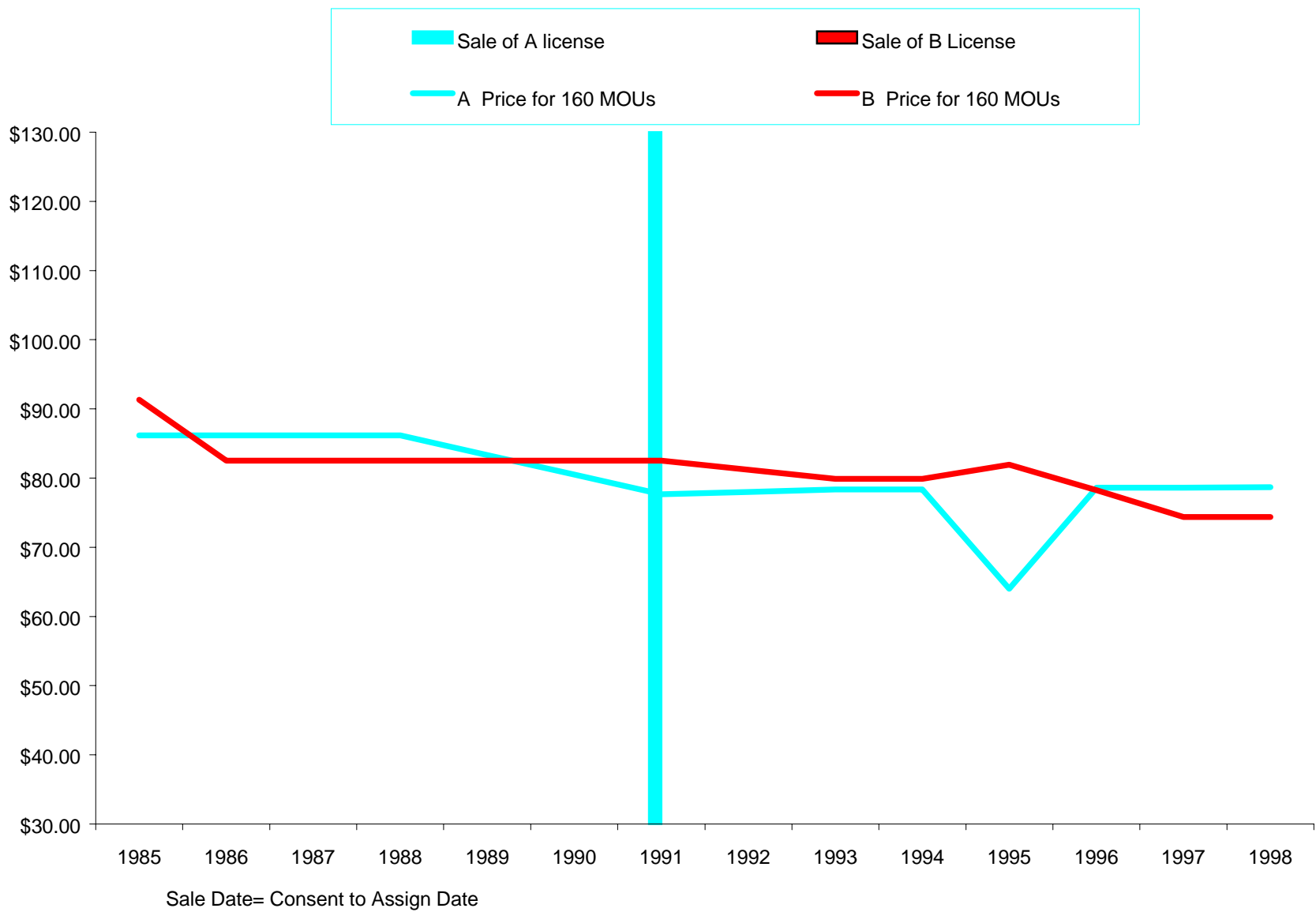




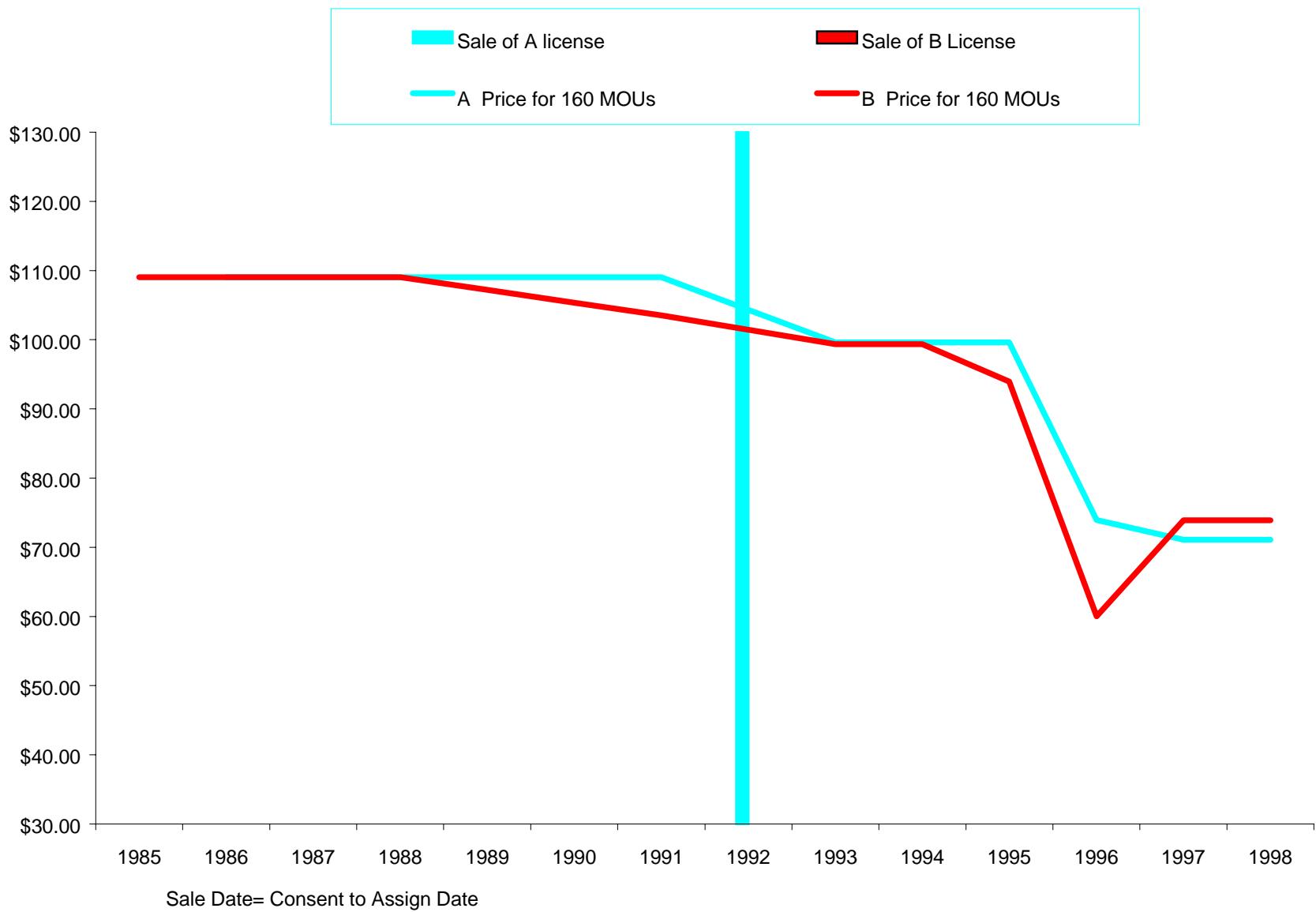
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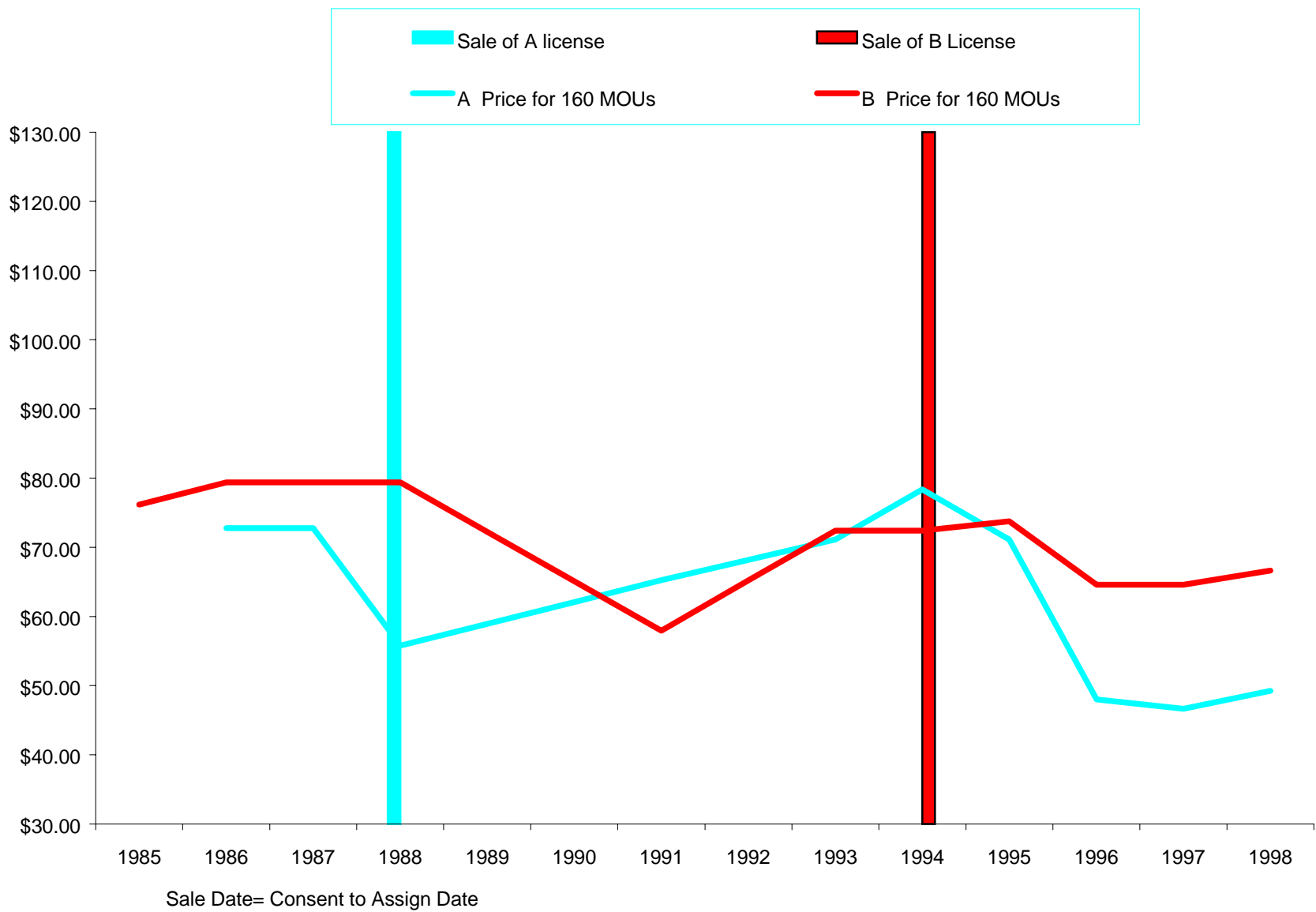
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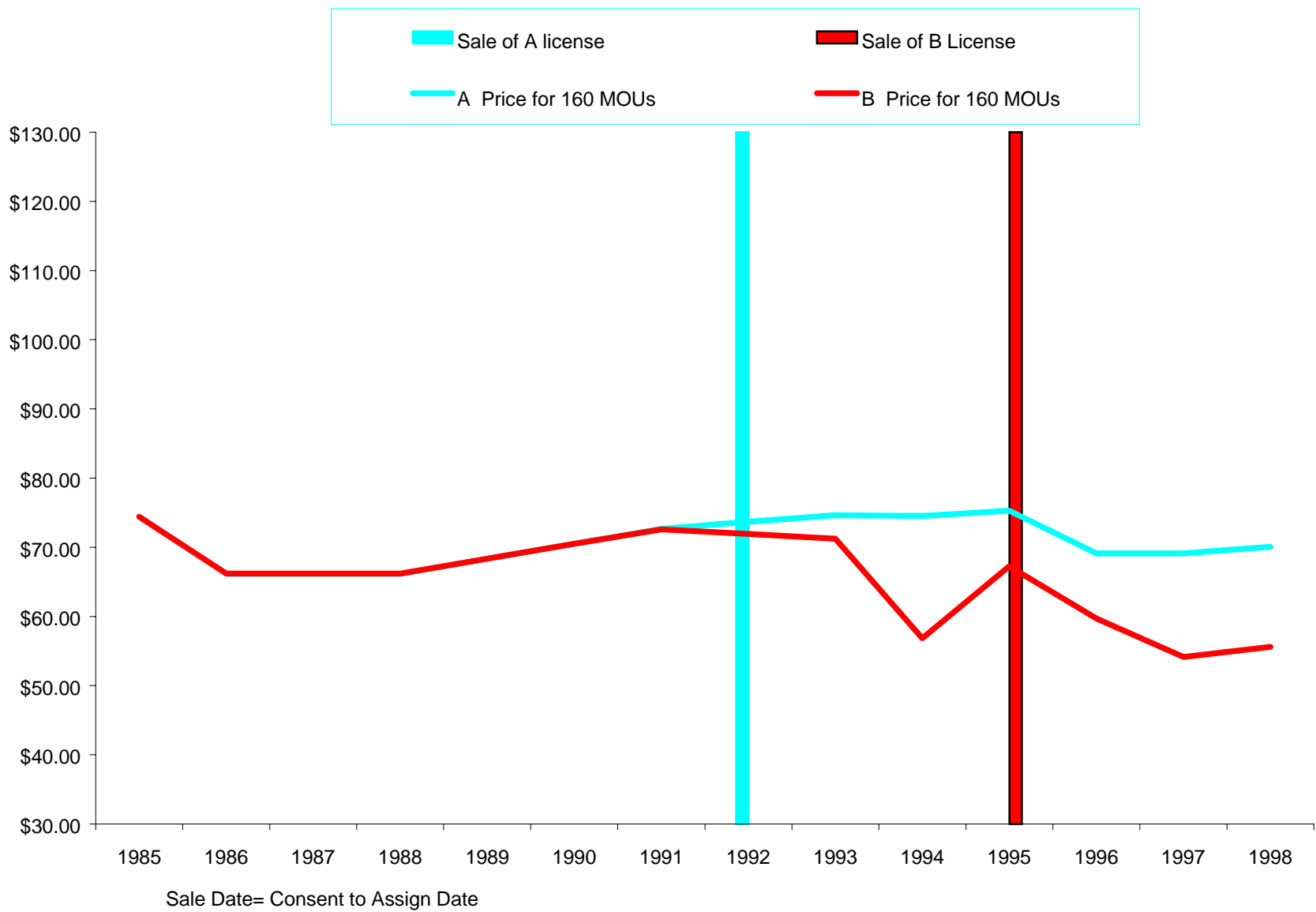
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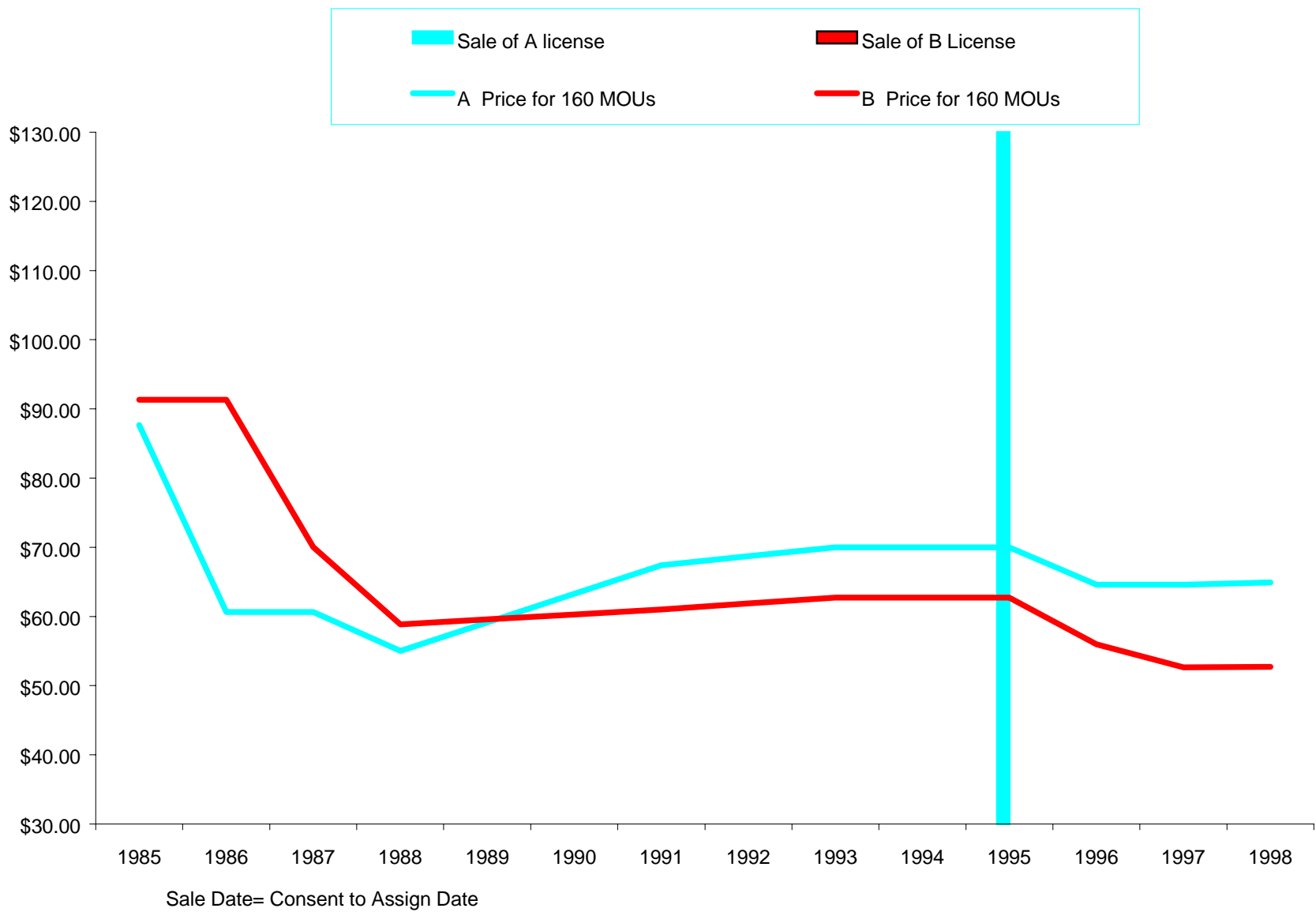
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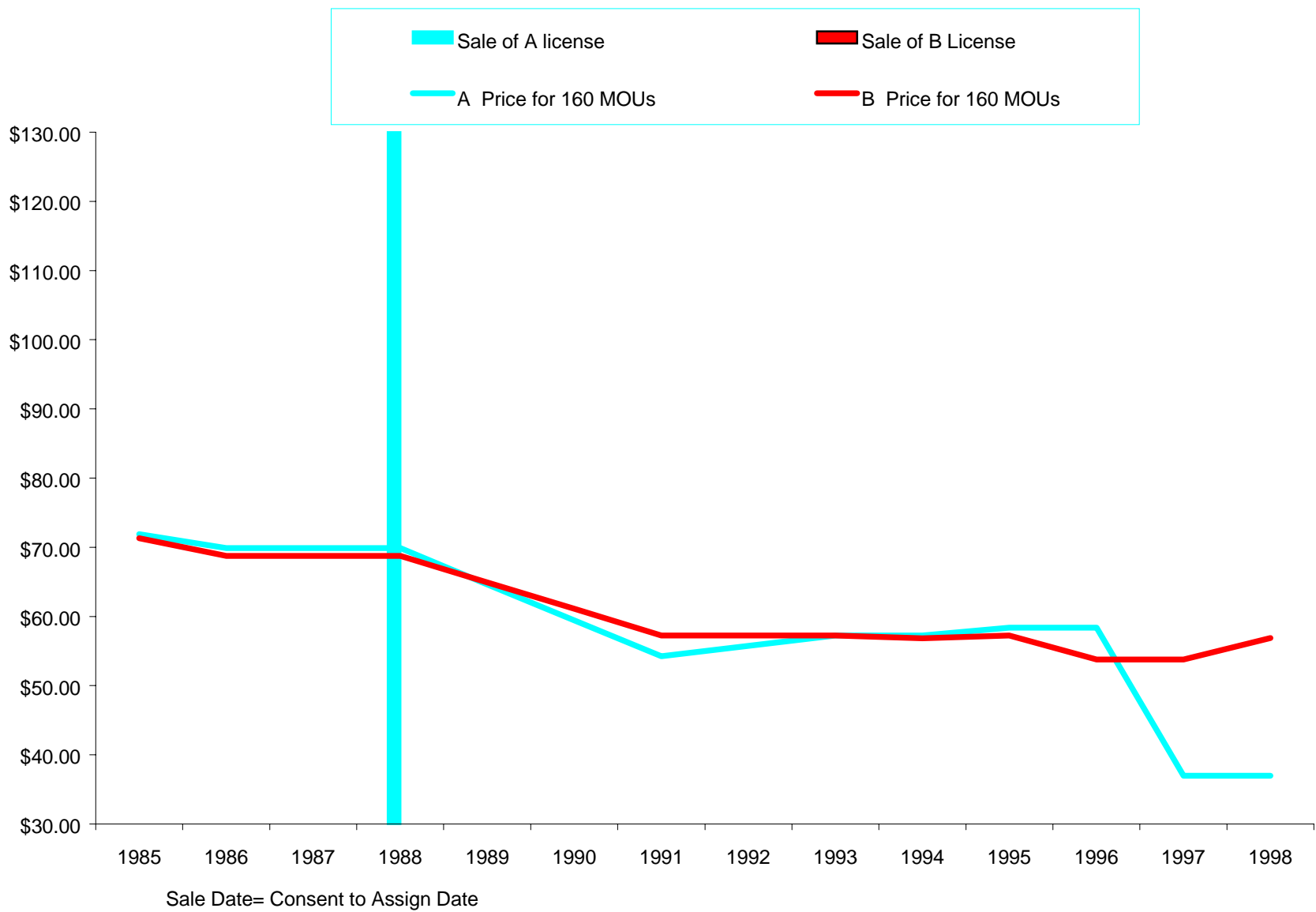
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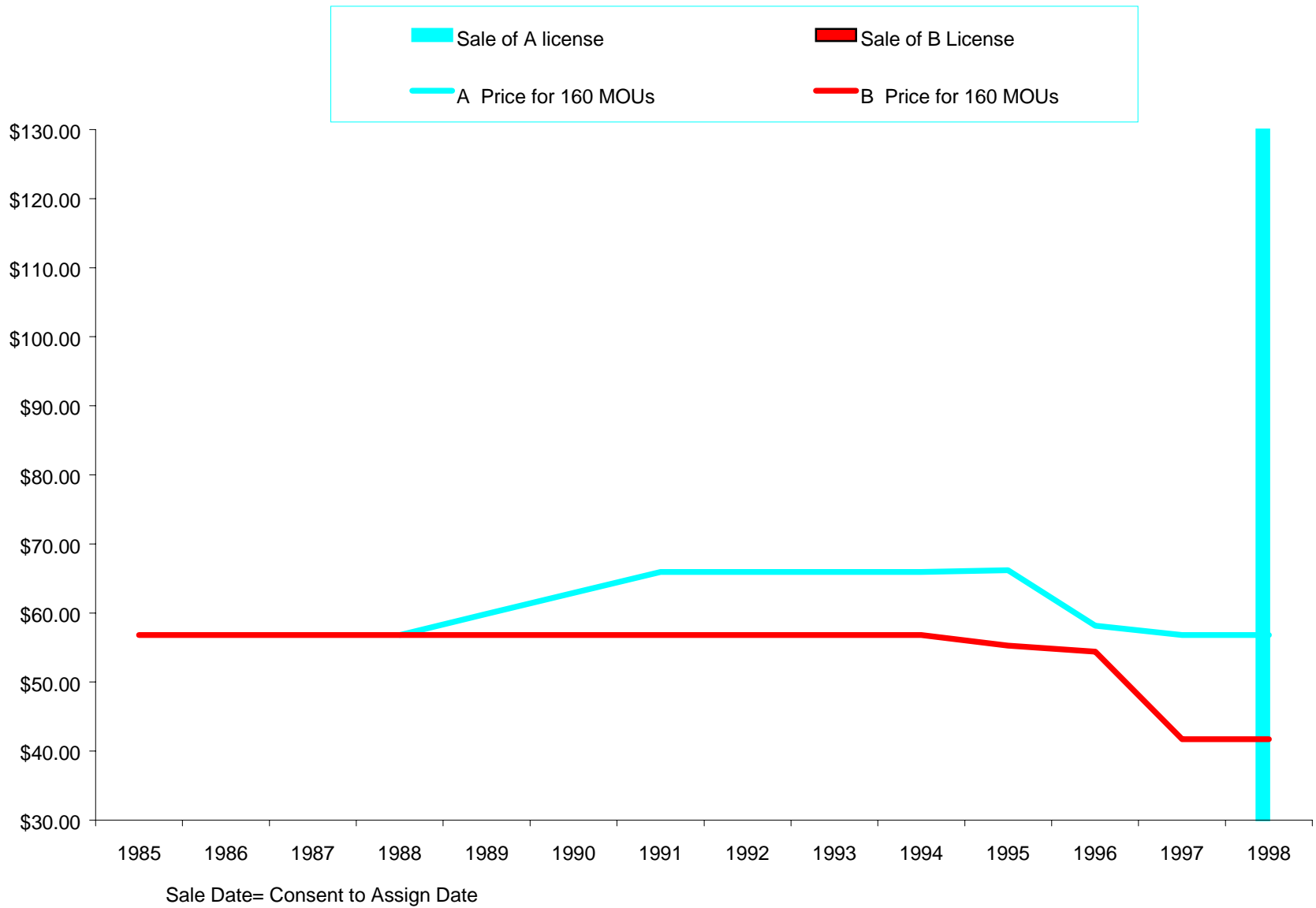


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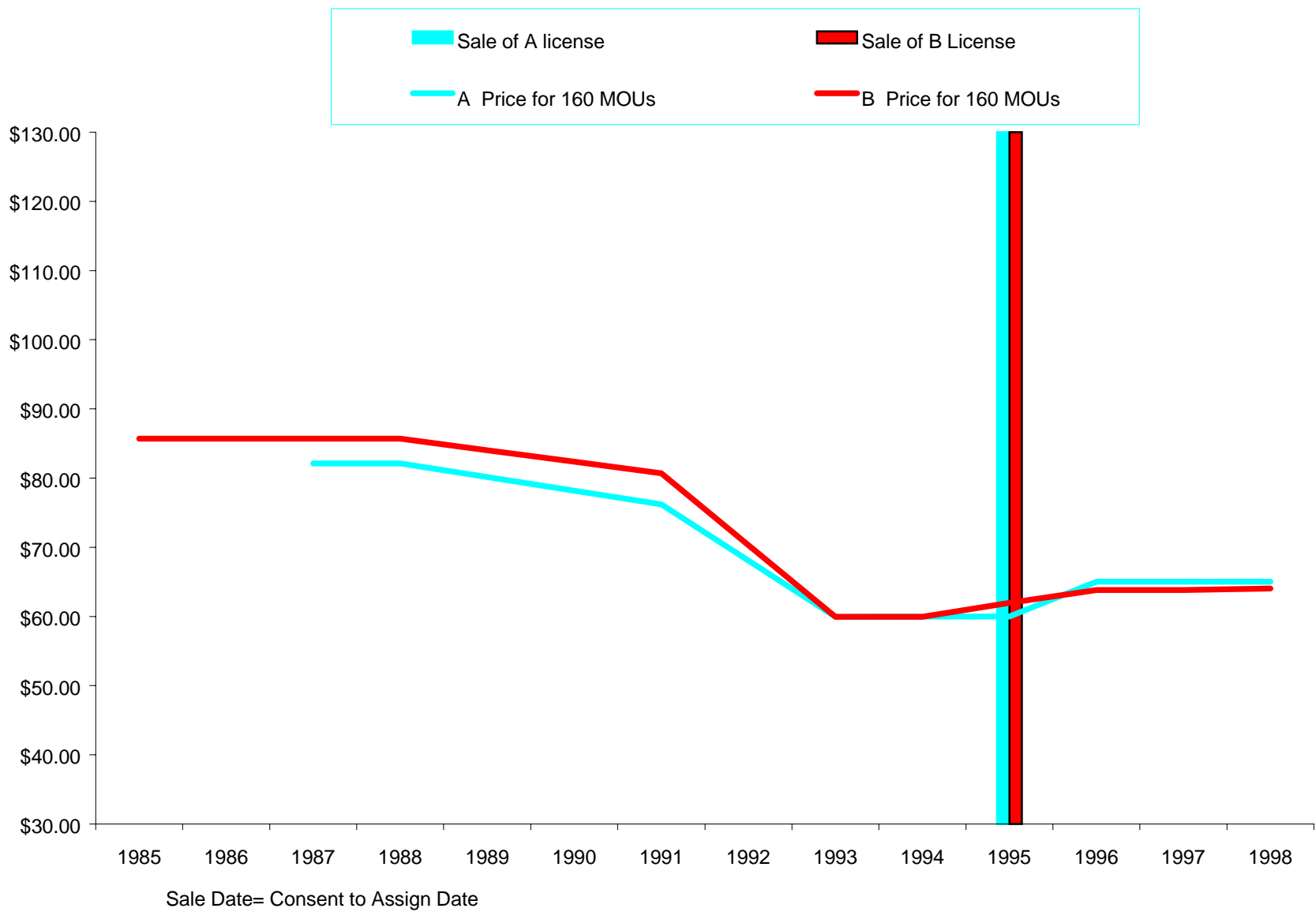


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**MSA 29- Sacramento**



**MSA 30- San Antonio**