The Economic Impact of Michigan's Dr. Ron Davis Smoke-Free Air Law: A Report to the Michigan Department of Community Health

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August 3, 2012

Executive Summary

The state of Michigan banned smoking in workplaces, including restaurants and bars, effective May 1, 2010. This report presents an analysis of aggregate data for the state of Michigan from 2006 to 2011 to see whether restaurant and bar sales were lower after the ban took effect than would have been expected based on the historical trend. The report also analyzes the impact of the ban on sales of cigarettes and Club Keno cards. Using an interrupted time series design, the report finds no significant negative effect of the ban on aggregate bar and restaurant sales or on cigarette sales. Overall, the evidence is consistent with the results of studies from other states and localities that have found no significant negative economic effects associated with smoking bans.

1. Background

In December of 2009, Michigan amended its clean indoor air law to ban smoking in workplaces including bars and restaurants. The ban took effect on May 1, 2010 amid widespread concern among bar and restaurant owners that the ban would be bad for business.[1] Evidence from other states and localities suggests that smoking bans have no impact on economic outcomes (see reviews by Eriksen and Chaloupka [2007] and Hahn [2010]). Studies using objective measures such as sales figures reported for tax purposes or employment reported to government agencies are much more likely to find that bans have no impact than are studies using subjective outcomes such as restaurant owners' reports of how their business would be affected or was affected by a ban (Scollo, Lal, Hyland and Glantz 2003).

This report presents an analysis of aggregate data for the state of Michigan from 2006 to 2011 to see whether restaurant and bar sales were lower after the ban took effect than would have been expected based on the historical trend. The report also analyzes the impact of the ban on cigarette sales and sales of Club Keno cards.

2. Design of this study

The basic approach in this study is to see whether economic activity that is related to smoking – bar and restaurant sales, as well as cigarettes and lottery sales – were lower after May 2010 than would have been expected given the trend in each activity prior to May 2010. The validity of this "interrupted time series" design relies on two assumptions:

1. First, it requires the assumption that if there had been no ban, economic outcomes for bars and restaurants in Michigan would have continued on the path that they were already on prior to May 2010. Ideally, we would have a "control group" of bars and restaurants that were unaffected by the ban but were similar in other ways to the affected establishments to provide evidence on what might have happened in the absence of a ban. Lacking a control group, a multivariate model with covariates such as the state unemployment rate can control to some extent for underlying economic conditions that may have been changing at the same time that the ban went into effect.

2. Second, the interrupted time series approach makes sense only if it is possible to fit a reasonably accurate model of what was happening before the ban. For a series that has been trending linearly for five years it is probably reasonable to expect that this would continue, so that the interrupted time series design makes sense. For a series that was already moving unpredictably before the ban it is less reasonable. Fortunately, as will be shown below, most of the economic outcomes we analyze were following a generally linear path plus a predictable seasonal component.

3. Data

[1] See, for example, "MRA Survey on Smoking Ban Shows No Economic Benefit," Michigan Restaurant Association, August 17, 2010; available at http://www.michiganrestaurant.org/displaycommon.cfm?an=1&subarticlenbr=1172.

3A. Sales tax collections from retail eating and drinking establishments. These data were provided by the Michigan Department of Treasury. Sales tax collections represent approximately 6% of retail sales for these establishments and as such are an excellent indicator of overall economic activity in this industry.[2] Throughout this report, I use the phrase "restaurants and bars" interchangeably with "retail eating and drinking establishments."

The data on restaurants and bars are broken down into detailed subgroups using Standard Industry Classification (SIC) codes. Table 1 shows the distribution of annual sales tax collections across these subgroups from 2006 through 2010. Sales tax collection data were provided through September 2011, so annual totals for 2011 are not included in Table 1, although all of the data will be used in the subsequent time series analysis.

It is not possible to distinguish perfectly between establishments that serve alcohol and those that do not. Taverns – including both SIC code 581, "taverns with liquor, food incidental" and SIC code 582, "taverns with wine/beer only, food incidental" – are, obviously, establishments that serve alcohol. However, establishments in other categories such as night clubs (SIC code 583), hotel dining rooms (SIC code 584), family restaurants and cafeterias (SIC code 585), fast food/pizza/lunch counters (SIC code 586), and caterers/concessions/vending (SIC code 587) may also serve alcohol. Some results will be presented separately for taverns (SIC codes 581 and 582) and non-taverns (SIC codes 583 through 587).

3B. Cigarette and lottery sales. These data were provided by the Michigan Department of Treasury. Lottery sales are total Club Keno sales, including the new Club Keno to Go product as of October 2010.

3C. Additional data. In some analyses, dollar amounts (restaurant and bar sales tax collections and Club Keno sales) are inflated to real December 2011 levels using the U.S. Bureau of Labor Statistics (BLS) current price index for all urban consumers (CPI-U; BLS series CUUR0000SA0). All tables and figures include notation indicating whether dollar amounts are real or nominal.

Some multivariate models also include additional controls for Michigan's unemployment rate, population, and Gross Domestic Product (GDP). Data on Michigan's unemployment rate by month are from BLS series LAUST26000006. Annual data on Michigan's population are from the Census Bureau. Annual data on Michigan's GDP are from the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.

4. Results

Figure 1 shows quarterly averages for the different monthly outcomes: restaurant and bar sales tax collections in millions of real December 2011 dollars, cigarettes sold in tens of millions of

[2] The sales tax rate is 6%; however, not-for-profit organizations do not pay taxes on their purchases from retail eating and drinking establishments, so sales tax collections are not exactly 6% of total sales. There is no reason to think that this biases the results.

cigarettes, and Club Keno sales in millions of real December 2011 dollars. A heavy vertical line indicates the second quarter of 2010, when the smoking ban went into effect. Several things are evident from this figure. First, all three outcomes show strong seasonal patterns. The seasonality differs across the three outcomes, with restaurant and bar sales and cigarette sales peaking in the third quarter (July-August-September), while lottery sales peak in the first quarter (Jan-Feb-March). Second, cigarette sales were clearly already trending downward. Third, although "eyeball tests" are often unreliable, there is no obvious jump in any of the outcomes in the second quarter of 2010.

The multivariate analysis tests more formally to see whether there is in fact any discontinuous change in any of the three outcomes occurring in May 2010. In order to do this, I model each time series as a linear function with a break in both intercept and slope in May 2010. In effect this means that I am fitting two lines to the data: one for January 2006 through April 2010 and another one for May 2010 and later. The multivariate regression framework yields standard errors so that I can say whether the slopes and intercepts of the two lines are significantly different from one another.

The basic model specification is:

$$y_t = b_0 + b_1 \cdot (trend) + b_2 \cdot (post\ May\ 2010) + b_3 \cdot (trend) \cdot (post\ May\ 2010) \qquad (1)$$

I estimate these models using ordinary least squares (OLS) regression. I then use the coefficients b_0, b_1, b_2 and b_3 to calculate predicted trend lines, with a break in May 2010, which I then superimpose on the raw data in Figures 2 through 6 in order to provide a graphic illustration of the basic results for the main outcome.

Because of the possibility, discussed above, that other underlying determinants of economic outcomes may have been different after May 2010, I also estimate models including additional controls for Michigan's unemployment rate, Michigan's population, and Michigan's GDP (annual). These expanded models also include controls for calendar month in order to capture the strong seasonality of the outcomes noted in Figure 1. The expanded specification is:

$$\begin{aligned} y_t = {} & c_0 + c_1 \cdot (trend) + c_2 \cdot (post\ May\ 2010) + c_3 \cdot (trend) \cdot (post\ May\ 2010) \\ & + c_4 \cdot (MI\ unemployement\ rate) + c_5 \cdot (MI\ population) + c_6 \cdot (MI\ GDP) \\ & + c_7 \cdot (month\ dummies) \end{aligned} \qquad (2)$$

While Figures 2 through 6 provide a useful visual overview of the results from the basic model, the expanded model results presented Tables 2 and 3 are the preferred ones since they include both additional controls and standard errors on the estimates.[3]

[3] The results reported in Tables 2 and 3 are the usual OLS standard errors. Models with Newey-West standard errors assuming either one or two serially correlated lags in the error term yield very similar results.

Results for bars and restaurants

The results from the basic model are presented visually for all eating and drinking establishments in Figure 2, for taverns in Figure 3, and for eating and drinking establishments other than taverns in Figure 4. These figures tell a clear and consistent story: overall bar and restaurant sales stayed on pretty much the same track after the ban that they had been on before. The regression coefficients reported in columns 1 through 6 of Table 2 confirm this: the trends after May 2010 are not significantly different, in a statistical sense, from the trends prior to May 2010. This is evident from the fact that the coefficient on the variable "May 2010 or later" and on the interaction term, "linear time trend*(May 2010 or later)" is never statistically significant. Although the lines in Figures 2 through 4 may make it look like the long, slow decline in restaurant and bar sales flatten out a bit after May 2010, suggesting a *positive* impact of the ban, the multivariate models show that this flattening out is not statistically significant.

Table 3 shows results from the expanded model for each detailed type of eating and drinking establishment. With one exception these results confirm the bigger picture of no significant change following the ban. The only exception is night clubs (SIC 583), a very small category for which the multivariate model shows that sales tax collections had, on average, been increasing before the ban and which were declining or flat after the ban. It seems quite plausible that a smoking ban would have affected night clubs more adversely than other types of bars and restaurants. On the other hand, the raw data, shown in Figure 5, are very noisy. In particular, there is a large unexplained spike in June 2007. Even without the spike, the data for night clubs do not exhibit the same kind of reasonably smooth trend as the other series. This is reflected in the relatively low explanatory power for this model (R^2 of 0.51 for the model in column 3 of Table 3) and may call into question the validity of the interrupted time series approach for this outcome.

Results for cigarette sales

Table 2 reports the results of the basic model (column 7) and the expanded model (column 8) for cigarette sales. Figure 6 presents the results in column 7 visually. As Figure 6 makes clear, and the multivariate statistical results confirm, there is no break in May 2010 in the consistent decline in cigarette sales occurring throughout this period. The ban may have shifted where people smoke but does not seem to have accelerated the decline in overall smoking, which is surprising in light of existing evidence on the impact of clean indoor air laws (Tauras, 2006).

Results for Keno sales

Keno sales appear to have dropped sharply in June 2010 (see Figure 7). In fact this change is not statistically significant, since none of the coefficients in either the basic or the extended model is significant (Table 2, columns 9 and 10). But the Keno model is imprecisely estimated; note the relatively low explanatory power for the models in columns 9 and 10 of Table 2 (R^2 of 0.37 even on the expanded model), indicating that the data do not really follow a simple linear or piecewise linear path. For the other outcomes, in contrast, the piecewise linear model fits quite well, so that R^2 for the expanded models in Table 2 is between 0.67 and 0.89. Another consequence of the relatively poor fit is large standard errors, which make it hard to say precisely whether there was a change or not. So in the case of Keno, we can say there is no

statistically significant change, but we cannot rule out the possibility that there was an economically significant drop in sales.

Replication and extension of the Michigan Department of Treasury results. The Michigan Department of Treasury has released two reports evaluating the impact of the indoor smoking ban: the first in December 2010 and an update in December 2011. The basic method in both reports is the same. Using the same outcomes evaluated in this report, plus several more, they calculate annual averages for three twelve-month periods: May 2008 through April 2009, May 2009 through April 2010, and May 2010 through April 2011. The first two of these periods are before the smoking ban went into effect and the third is after. Next, they calculate the percent change in economic activity from the first period to the second (both before the ban) and from the second period to the third (before the ban to after the ban). Comparing these changes yields their estimate of the impact of the ban. The report cautions that "the overall impact is still evolving…any initial impact discussed here is based on a relatively short time period. In addition, turbulent economic times make it difficult to confidently interpret the preliminary data presented here and attribute any result directly to the smoking ban." Nonetheless, the report notes that sales tax collections at taverns dropped following the ban, while collections at other eating and drinking establishments did not.

I replicate the Department of the Treasury's analysis, then extend it in two ways. First, I use data back to 2006 to calculate two additional year-over-year changes prior to the ban. Second, I repeat the analysis using inflation-adjusted dollar amounts. Tables 4 and 5 contain the results of this analysis. Two things are clear. First, the inflation adjustment has little effect on the general pattern of results. Second, while it is true that year-over-year collections were down for taverns in the twelve-month period after the ban, compared with before the ban, the year-over-year changes look even worse for the period ending in May 2009, well before the ban. This result underscores the importance of taking into account as much data as possible in order to try to disentangle the effects of the ban from other changes in the economy that were occurring at the same time.

Discussion

The evidence presented here suggests that in the aggregate, the smoking ban had no statistically or substantively significant negative effect on the bar and restaurant industry in Michigan. The overall lack of a negative effect is consistent with numerous studies evaluating indoor smoking bans in other states and localities (reviewed by Eriksen and Chaloupka [2007] and Hahn [2010]). It is important to note that the lack of an overall negative effect does not mean that individual establishments or even types of establishments (e.g. night clubs) have not been adversely affected by the ban. It is almost certainly the case that there were both winners and losers in terms of the ban's economic consequences: some restaurants saw an increase in business while others saw decreases. Overall, however, the evidence presented in this report supports the view that eating and drinking establishments in Michigan as a whole were not adversely affected by the smoking ban.

References

Eriksen, Michael and Frank Chaloupka. 2007. "The Economic Impact of Clean Indoor Air Laws," CA: A Cancer Journal for Clinicians (57):367 – 378.

Hahn, Ellen J. 2010. "Smokefree Legislation: A Review of Health and Economic Outcomes Research," American Journal of Preventive Medicine 39(6), Supplement 1: S66-S76.

Scollo M., A. Lal, A. Hyland and S. Glantz. 2003. "Review of the quality of studies on the economic effects of smoke-free policies on the hospitality industry," Tobacco Control (12):13-20.

Tauras, John A. 2006. "Smoke-Free Air Laws, Cigarette Prices, and Adult Cigarette Demand," Economic Inquiry 44(20): 333–342.

Tax Analysis Division, Office of Revenue and Tax Analysis, Michigan Department of the Treasury. 2010. "Early Impact of the Michigan's Smoking Ban."

Tax Analysis Division, Office of Revenue and Tax Analysis, Michigan Department of the Treasury. 2011. "Update on the Impact of the Indoor Smoking Ban."

Table 1
Annual values of outcome variables, 2006 - 2011

	Year					
	2006	2007	2008	2009	2010	2011
Total sales tax collections from eating & drinking establishments (real $ millions)	**$671.7**	**$673.1**	**$646.0**	**$627.6**	**$633.4**	**-**
Taverns	84.1	82.7	77.8	74.3	72.7	-
581. Taverns with liquor, food incidental	73.7	72.3	68.4	65.8	64.6	-
582. Taverns with beer/wine only, food incidental	10.4	10.4	9.4	8.4	8.2	-
Non-Taverns	587.5	590.4	568.2	553.3	560.6	-
583. Night clubs	3.8	7.3	5.3	3.3	3.1	-
584. Hotel dining rooms	1.3	1.9	3.4	3.5	3.6	-
585. Family restaurants and cafeterias	317.4	320.2	305.7	299.6	307.0	-
586. Fast food, pizza, lunch counters	236.6	233.5	229.0	227.0	227.5	-
587. Caterers, concessions, and vending	28.5	27.4	24.8	20.0	19.5	-
Cigarettes (millions)	**11,268.6**	**10,736.4**	**10,406.2**	**9,876.2**	**9,373.7**	**9,123.6**
Keno sales (real $ millions)	**$492.5**	**$559.2**	**$546.9**	**$546.3**	**$502.0**	**$505.9**

Table 2
Regression results, Part 1
Results for eating and drinking establishments overall, cigarettes, and Keno sales

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Outcome variable:									
Explanatory variables:	Sales tax collections, all eating & drinking establishments: real millions of dollars		Sales tax collections, taverns (SIC 581 + SIC582): real millions of dollars		Sales tax collections, eating & drinking establishments other than taverns (SIC 583 - SIC587): real millions of dollars		Cigarette sales: millions of cigarettes		Keno sales: real millions of dollars	
Linear time trend	-0.112	-0.122	-0.025	-0.024	-0.087	-0.098	-3.20	-4.12	0.079	0.482
	(0.037)**	(0.108)	(0.006)**	(0.011)*	(0.033)**	(0.101)	(0.66)**	(1.71)*	(0.053)	(0.223)*
May 2010 or later	-6.424	-8.683	-0.626	-0.566	-5.797	-8.118	-56.25	-224.55	-10.436	14.942
	(12.301)	(10.942)	(1.851)	(1.133)	(10.787)	(10.280)	(174.38)	(150.87)	(13.957)	(19.658)
Linear time trend*	0.159	0.167	0.016	0.010	0.143	0.157	1.21	3.39	0.058	-0.375
(May2010 or later)	(0.204)	(0.184)	(0.031)	(0.019)	(0.179)	(0.173)	(2.84)	(2.55)	(0.227)	(0.332)
R-squared	0.13	0.73	0.30	0.90	0.10	0.68	0.43	0.85	0.12	0.39
Observations	69	69	69	69	69	69	72	72	72	72
Are additional controls in model?	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes to Table 2:
*statistically significant at 5%; ** statistically significant at 1%
Standard errors are in parentheses.
The model without additional controls includes the three variables shown in the table plus an intercept term.
The model with additional controls includes the three variables shown in the table plus an intercept term, and controls for month of the year, unemployment rate, and population.
Data for the analysis of sales tax collections in columns 1 through 6 span the period January 2006 through September 2011.
Data for the analysis of cigarette and Keno sales span the period January 2006 through December 2011.

Table 3
Regressions results, Part 2
Results for eating and drinking establishments by detailed type of establishment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Taverns with liquor, food incidental	Taverns with beer/wine only, food incidental	Night clubs	Hotel dining rooms	Family restaurant and cafeterias	Fast food, pizza, lunch counters	Caterers, concessions, and vending
	SIC581	SIC582	SIC583	SIC584	SIC585	SIC586	SIC587
Linear time trend	-0.025	0.001	0.020	0.007	-0.064	-0.051	-0.010
	(0.009)**	(0.006)	(0.005)**	(0.002)**	(0.062)	(0.039)	(0.007)
May 2010 or later	-0.780	0.214	1.349	0.280	-6.526	-1.940	-1.281
	(0.932)	(0.624)	(0.503)**	(0.193)	(6.297)	(3.925)	(0.726)
Linear time trend*	0.014	-0.004	-0.027	-0.006	0.126	0.042	0.022
(May2010 or later)	(0.016)	(0.011)	(0.008)**	(0.003)	(0.106)	(0.066)	(0.012)
R-squared	0.87	0.82	0.64	0.85	0.56	0.76	0.86
Observations	69	69	69	69	69	69	69
Are additional controls in model?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes to Table 2:
*statistically significant at 5%; **statistically significant at 1%
Standard errors are in parentheses.
All models include the three variables shown in the table plus an intercept term, and controls for month of the year, unemployment rate, and population.
Data for the analyses in this table span the period January 2006 through September 2011.

Table 4
Replication of Treasury Department December 2011 Analysis and Extension back to 2006
Dollar amounts in nominal millions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	June 06 – May 07	June 07 – May 08	June 08 – May 09	June 09 – May 10	May 10 – June 11	Percent change (1) to (2)	Percent change (2) to (3)	Percent change (3) to (4)	Percent change (4) to (5)
581. Taverns with liquor, food incidental	$65.8	$65.9	$63.8	$62.8	$61.1	0.13%	-3.24%	-1.52%	-2.76%
582. Taverns without beer/wine only, food incidental	9.6	9.7	8.7	8.0	7.7	0.28%	-10.37%	-7.75%	-3.71%
583. Night clubs	4.6	6.1	4.4	3.0	3.0	30.79%	-26.85%	-32.64%	1.27%
584. Hotel dining rooms	1.3	2.2	3.4	3.3	3.6	69.14%	57.90%	-3.81%	10.13%
585. Family restaurants and cafeterias	286.8	290.6	288.4	289.4	301.4	1.30%	-0.74%	0.33%	4.15%
586. Fast food, pizza, lunch counters	212.1	213.9	219.2	216.5	220.6	0.83%	2.46%	-1.21%	1.90%
587. Caterers, concessions, and vending	25.2	24.6	21.8	18.6	19.9	-2.29%	-11.65%	-14.70%	7.41%
Total collections eating & drinking establishments	605.5	612.9	609.6	601.5	617.4	1.22%	-0.54%	-1.33%	2.64%
Eating and drinking establishments except taverns	530.1	537.3	537.2	530.7	548.6	1.37%	-0.03%	-1.20%	3.37%
Keno	469.0	517.6	520.4	520.7	482.4	10.35%	0.55%	0.05%	-7.35%
Cigarettes (millions)	11,114.6	10,559.8	10,116.4	9,753.4	9,169.0	-4.99%	-4.20%	-3.59%	-5.99%

The shaded cells are identical to results in Table 1 of the Michigan Department of Treasury's "Update on the Impact of the Indoor Smoking Ban," December 2011.

Table 5
Replication of Treasury Department December 2011 Analysis and Extension back to 2006
Dollar amounts in real millions (base period = May 2010 – June 2011)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	June 06 – May 07	June 07 – May 08	June 08 – May 09	June 09 – May 10	May 10 – June 11	Percent change (5) to (2)	Percent change (6) to (3)	Percent change (7) to (4)	Percent change (8) to (5)
581. Taverns with liquor, food incidental	$71.2	$68.9	$65.4	$63.9	$61.1	-3.27%	-5.07%	-2.28%	-4.47%
582. Taverns without beer/wine only, food incidental	10.4	10.1	8.9	8.1	7.7	-3.13%	-12.06%	-8.45%	-5.40%
583. Night clubs	5.0	6.4	4.6	3.0	3.0	26.34%	-28.23%	-33.15%	-0.51%
584. Hotel dining rooms	1.4	2.3	3.5	3.3	3.6	63.39%	54.92%	-4.55%	8.19%
585. Family restaurants and cafeterias	310.4	303.8	295.8	294.6	301.4	-2.14%	-2.62%	-0.44%	2.33%
586. Fast food, pizza, lunch counters	229.6	223.6	224.8	220.4	220.6	-2.60%	0.52%	-1.97%	0.11%
587. Caterers, concessions, and vending	27.3	25.7	22.3	18.9	19.9	-5.61%	-13.32%	-15.35%	5.52%
Total collections eating & drinking establishments	655.4	640.8	625.3	612.3	617.4	-2.23%	-2.41%	-2.09%	0.83%
Eating and drinking establishments except taverns	573.7	561.8	551	540.2	548.6	-2.08%	-1.92%	-1.96%	1.55%
Keno	507.6	541.1	533.8	530.0	482.4	6.60%	-1.35%	-0.72%	-8.98%

Figure 1
Restaurant and bar sales tax collections, lottery sales, and cigarretes sold
Michigan, 2006 through 2011

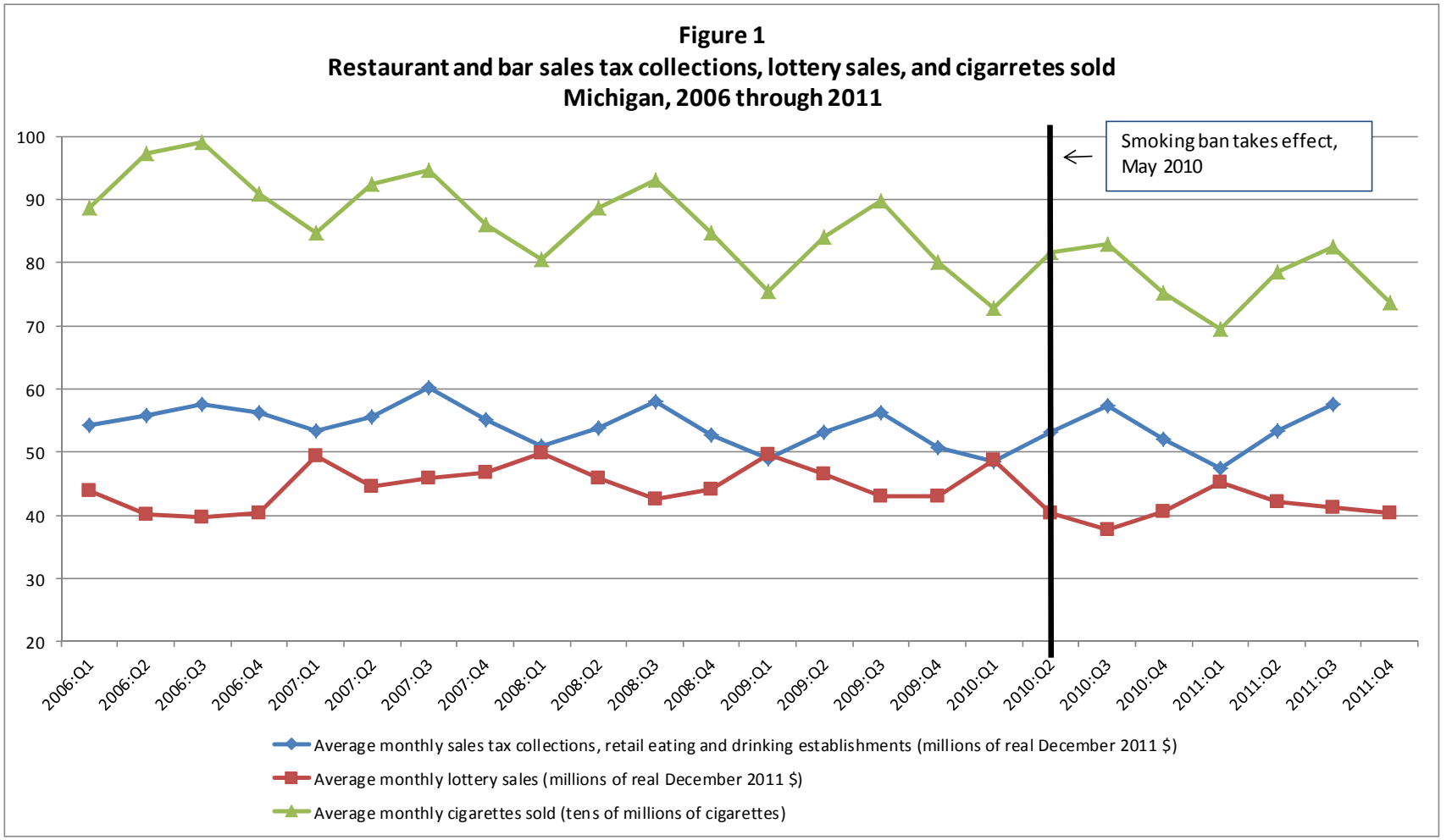


Figure 2
Total monthly sales tax collections (millions of real December 2011 $)
All eating and drinking establishments (SIC 581-SIC587)

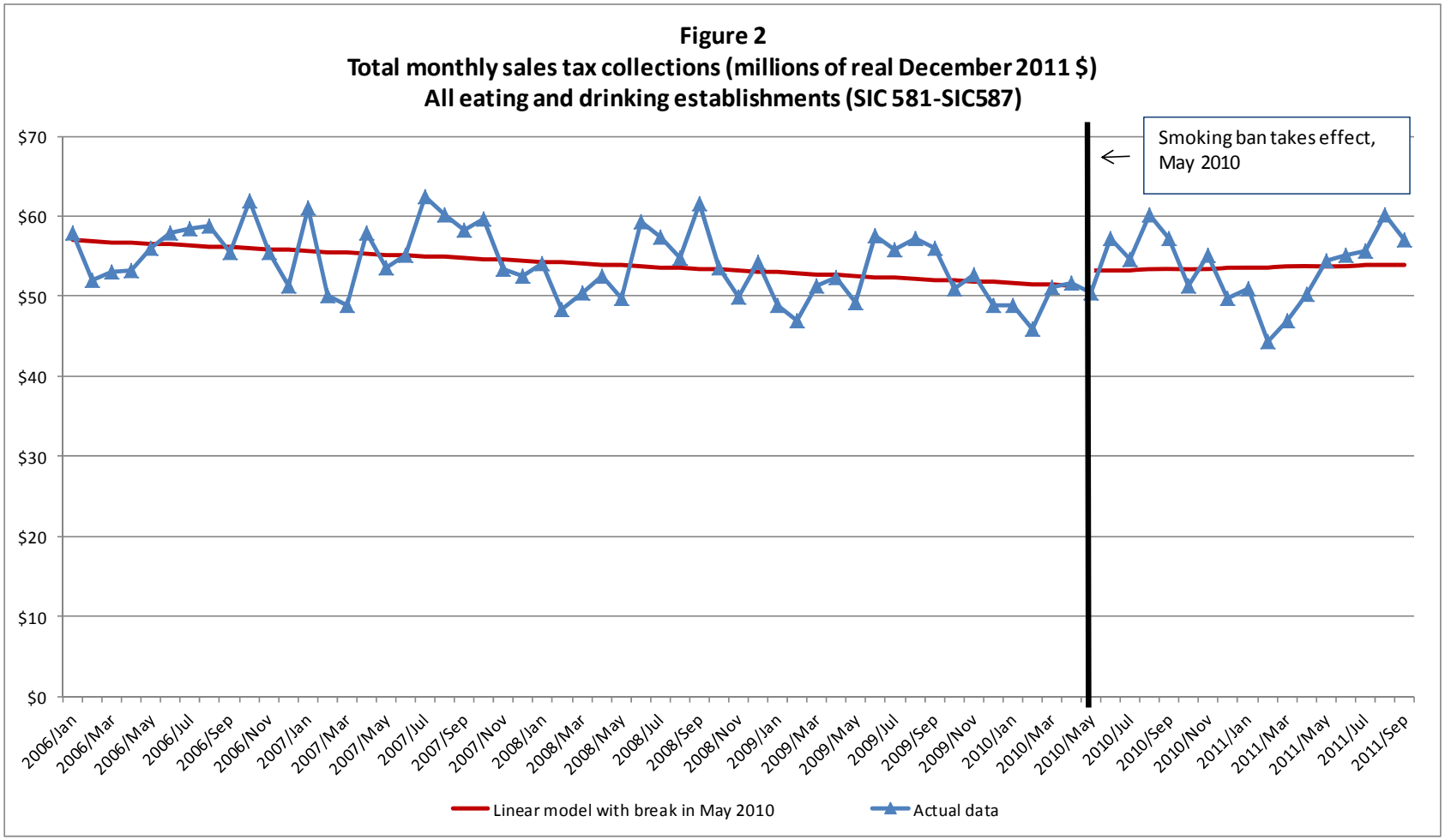


Figure 3
Total monthly sales tax collections (millions of real December 2011 $)
Taverns (SIC 581 + SIC582)

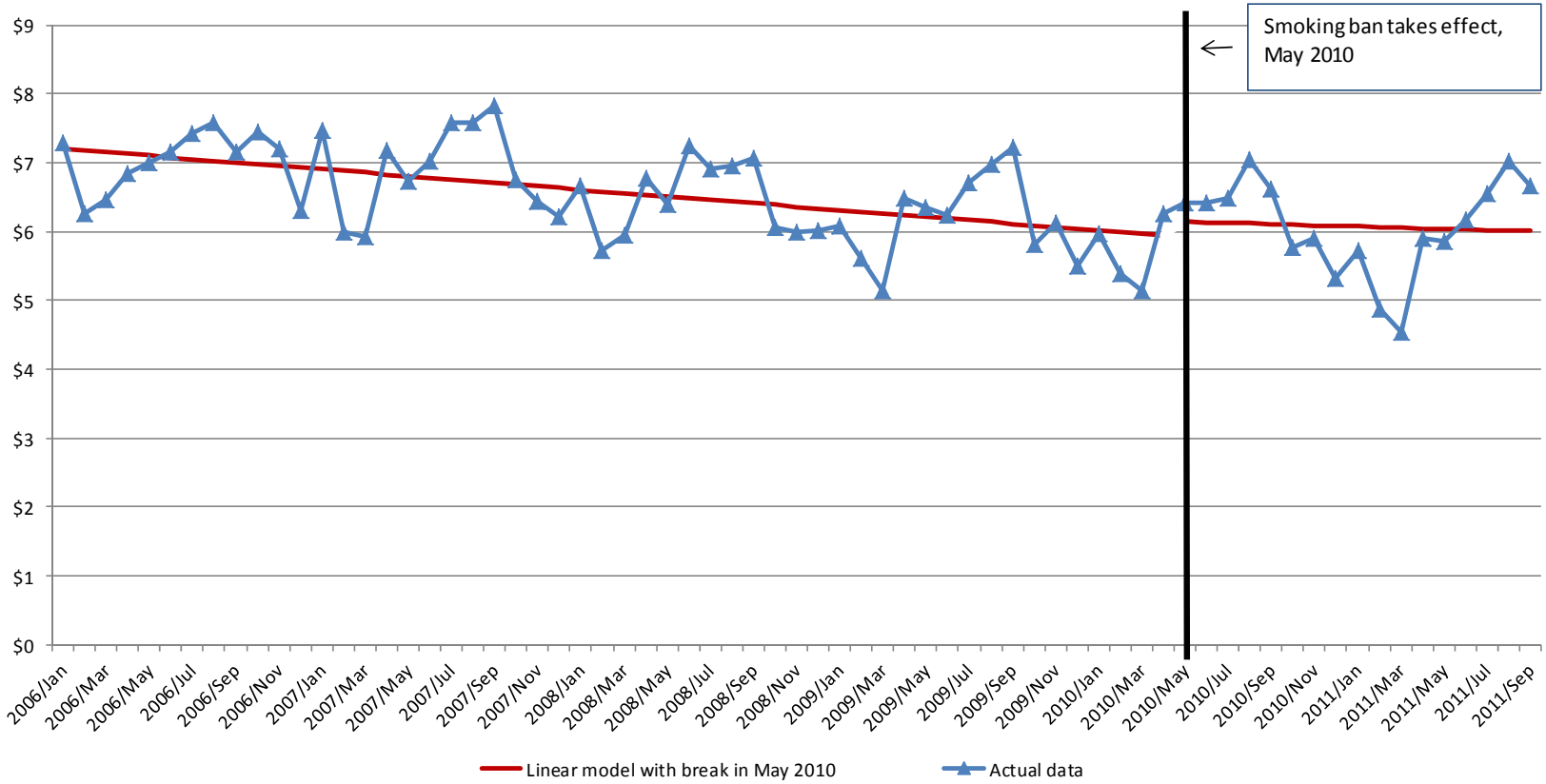


Figure 4
Total monthly sales tax collections (millions of real December 2011 $)
Eating & drinking establishments other than taverns (SIC 583 - SIC587)

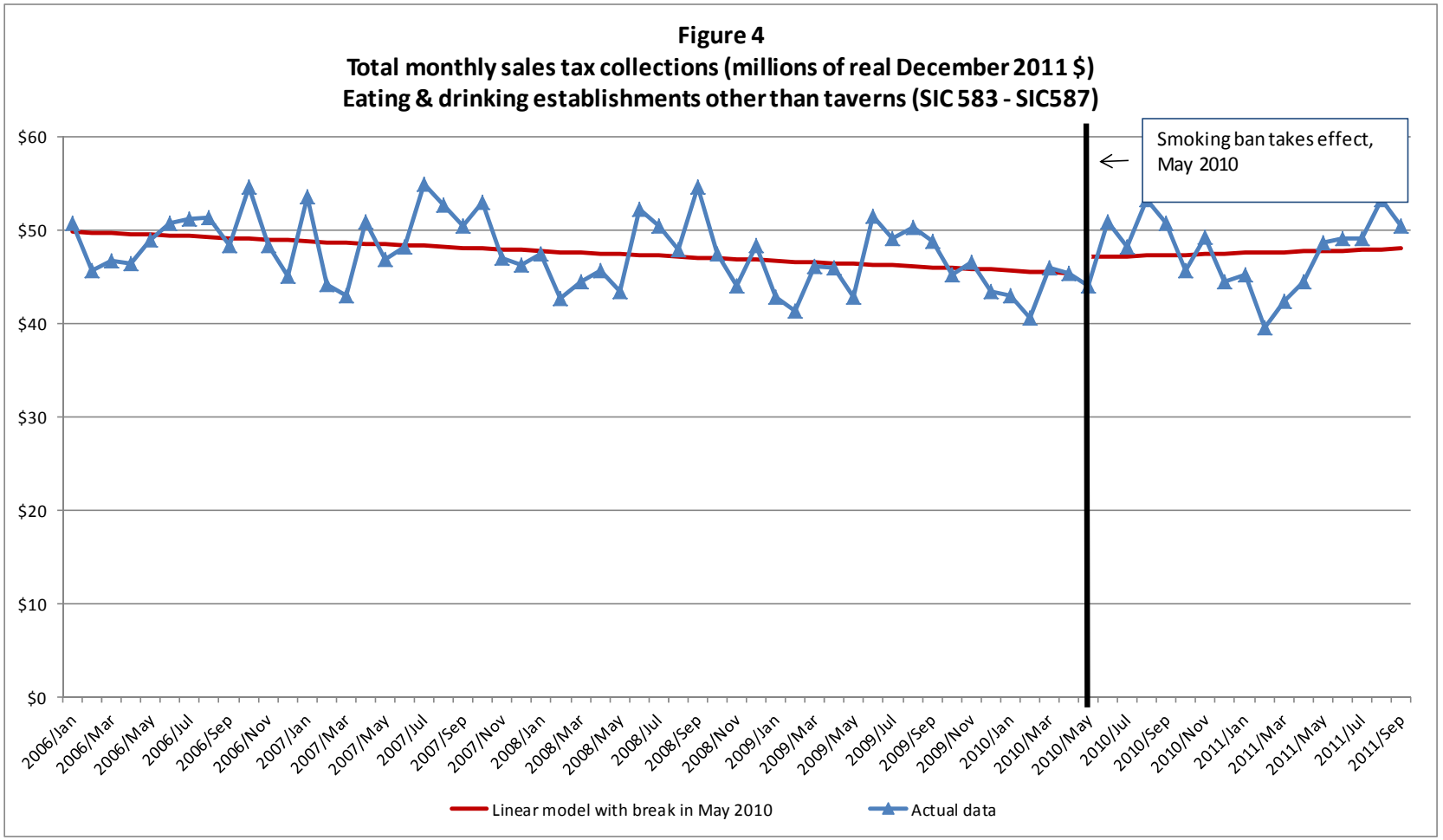
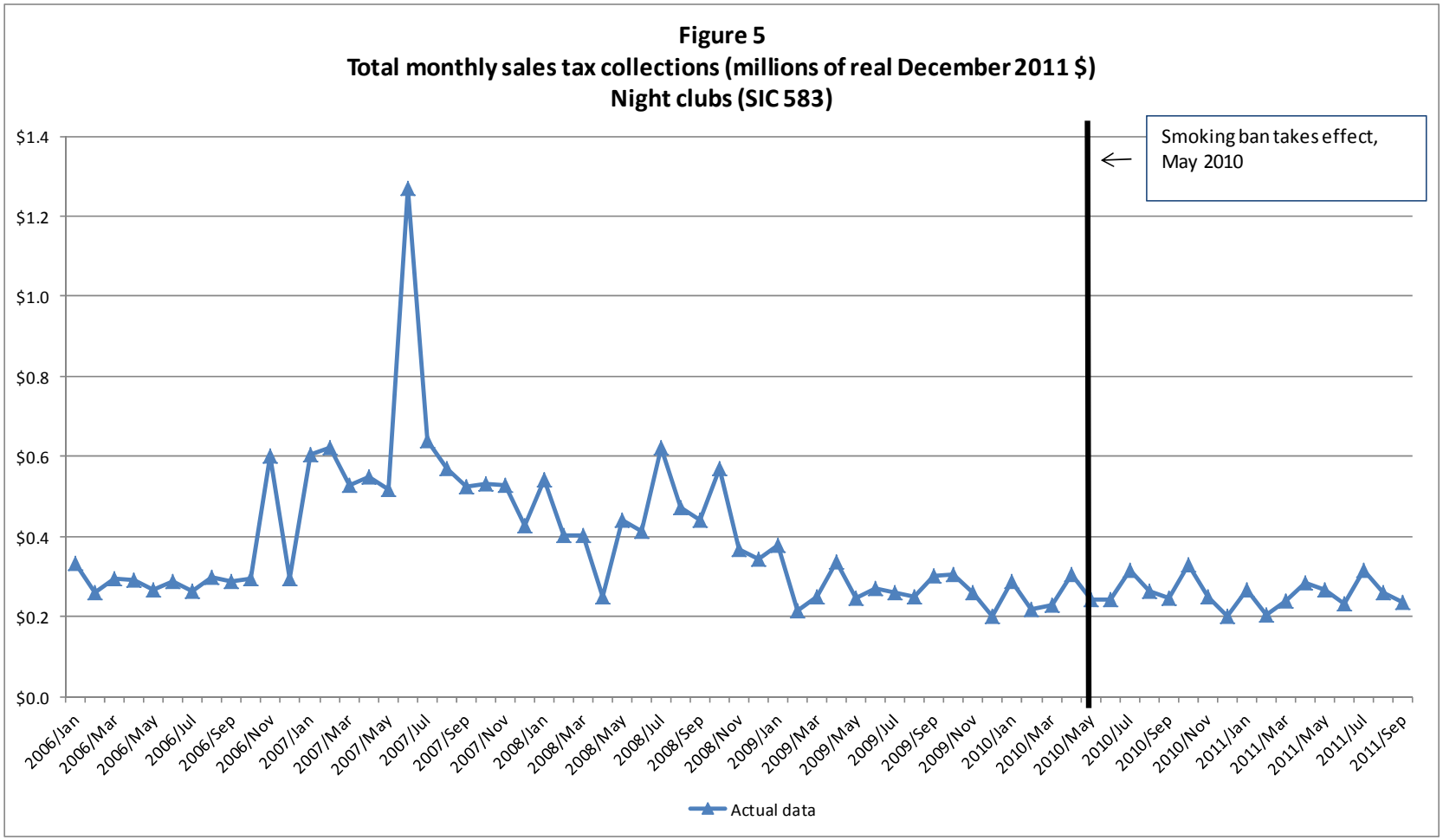


Figure 5
Total monthly sales tax collections (millions of real December 2011 $)
Night clubs (SIC 583)



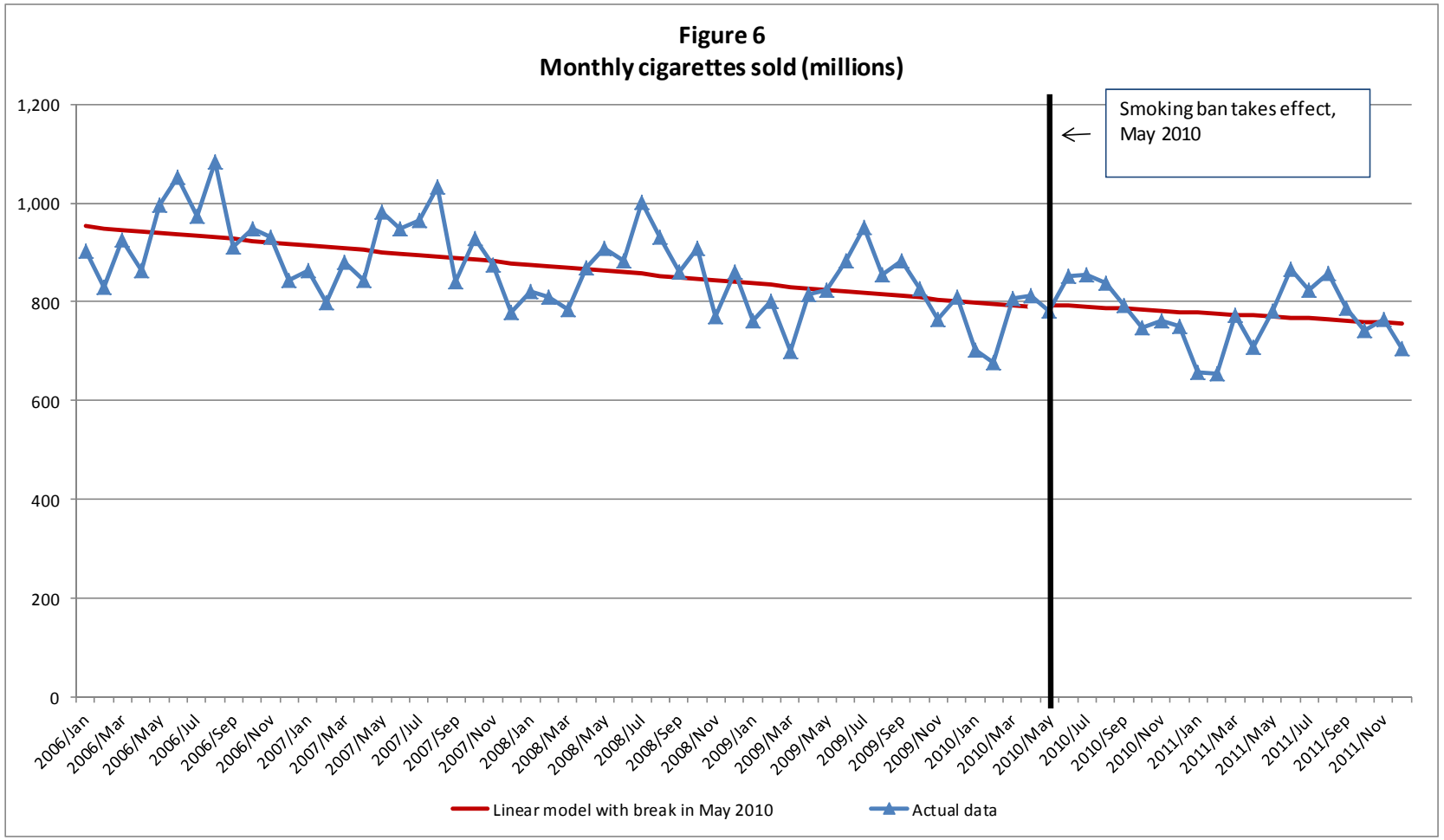


Figure 6
Monthly cigarettes sold (millions)
1,200
1,000
800
600
400
200
0
Smoking ban takes effect, May 2010
2006/Jan
2006/Mar
2006/May
2006/Jul
2006/Sep
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2010/Jul
2010/Sep
2010/Nov
2011/Jan
2011/Mar
2011/May
2011/Jul
2011/Sep
2011/Nov
Linear model with break in May 2010
Actual data

Figure 7
Total monthly Keno sales (millions of real December 2011 $)