



UNIVERSITY OF MASSACHUSETTS SCHOOL OF PUBLIC HEALTH AND HEALTH SCIENCES

# Lottery Revenue and Plainridge Park Casino: Analysis of First Year of Casino Operation

January 19, 2017

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## Executive Summary

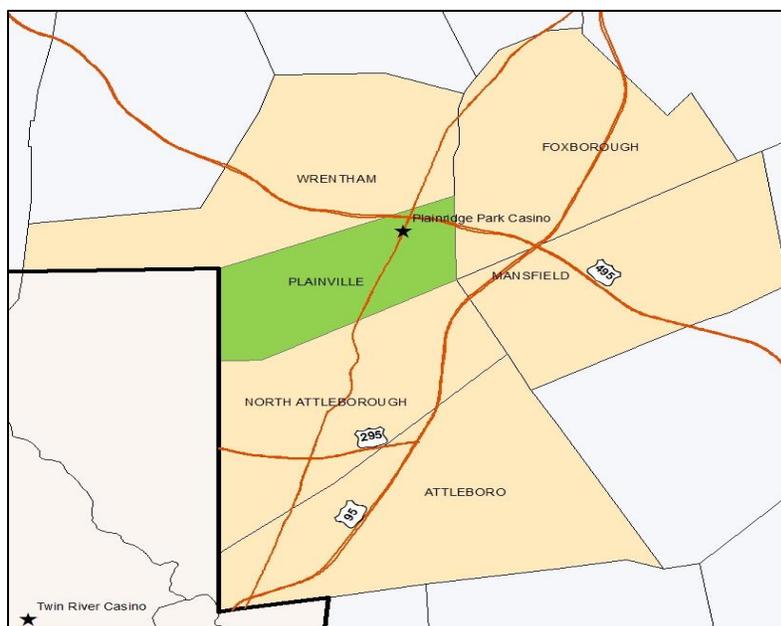
### Background

The slot parlor at Plainridge Park opened in Plainville, Massachusetts on June 24, 2015. Additional casinos are scheduled to open in Everett and Springfield in future years. With the introduction of expanded casino gambling in Massachusetts, the Commonwealth has made protection of the lottery a priority. The Legislature required all prospective casino operators to be a licensed state lottery agent. In Fiscal Year 2015 total lottery sales in Massachusetts were \$5.014 billion. Lottery revenues are the largest source of unrestricted local aid in Massachusetts and the second largest source of all local aid, after Chapter 70 education aid. Local aid is distributed from a single pool according to a formula devised by the legislature; local sales do not determine the amount of local aid that a municipality receives. In Fiscal Year 2015, the Lottery's net profit was \$985.8 million, of which \$945.8 million was distributed to the Commonwealth's municipalities in the form of direct local aid. In Fiscal Year 2015, Plainville received \$675,071 from the Lottery, which represents 15.6 percent of the town's total state aid and 2.3 percent of total receipts.

Casino tax revenue will also contribute to local aid, with 82 percent of tax revenue from Plainridge Park Casino allocated to local aid. The Category 1 casinos scheduled to open in Everett and Springfield will contribute 20 percent of tax revenue to local aid.

### Methods

The Massachusetts Lottery has provided fiscal year and agent-specific lottery sales data to the SEIGMA Economics team at the UMass Donahue Institute. Changes in revenue are analyzed at several levels, including statewide, in the host and designated surrounding communities near the casino, and for agents at different driving distances from the casino. Plainville is the host community and Attleboro, North Attleborough, Foxborough, Mansfield, and Wrentham are the officially designated surrounding communities.

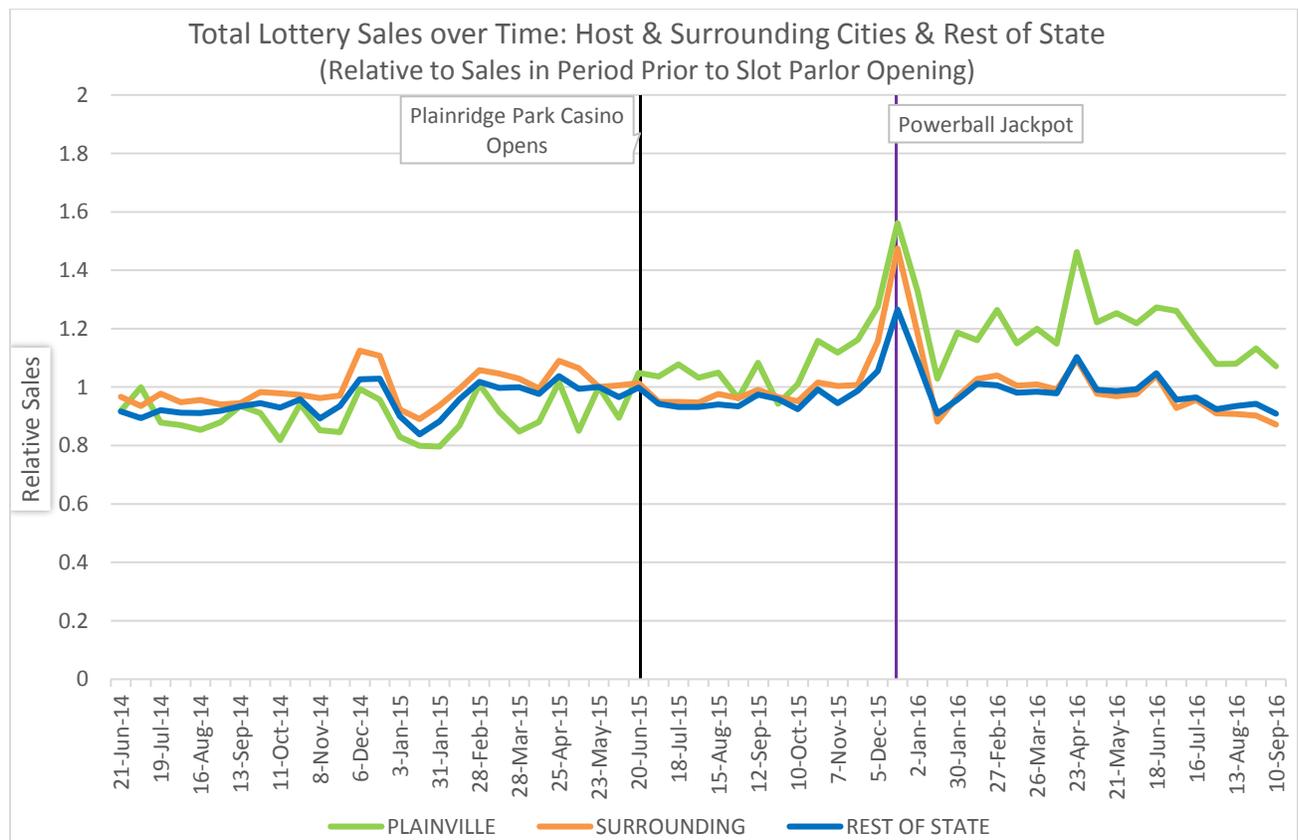


## Key Findings

On average, lottery sales did not decrease near the casino following the opening of Plainridge Park Casino. Lottery revenue near the casino grew more slowly than the rest of the state with the exception of Plainville, where lottery revenue significantly increased.

- Statewide lottery sales increased 4.37% in Fiscal Year 2016, highest since 2012.
- Lottery sales in Plainville increased approximately 23% in Fiscal Year 2016.
- Year-over-year sales (sales in the year after the casino opened compared to the year before) increased 25.78% in Plainville versus 5.19% statewide.
- Year-over-year sales (sales in the year after the casino opened compared to the year before) increased in Plainville, Attleboro, and Mansfield whereas year-over-year sales in Foxborough, North Attleborough, and Wrentham decreased.
- Lottery sales at Plainridge Park Casino significantly increased after the opening of the casino relative to the prior year.
- On average, sales for other agents in Plainville and the surrounding communities did not decrease, but increased less than the rest of the state.
- It is unclear if the casino had differential impacts on communities, but no evidence was detected of negative impacts across all of the communities.

### Bi-Weekly Sales Analysis by Community (June 2014-October 2016)



- Sales were examined bi-weekly since weekly sales are volatile due to when sales are recorded.
- Relative bi-weekly sales (sales each period relative to sales for the period prior to the opening of Plainridge Park Casino) increase for Plainville after the casino opening.
- Relative bi-weekly sales for Plainville were generally below surrounding communities and the rest of Massachusetts prior to the opening of Plainridge Park Casino, but above after.
- Relative bi-weekly sales for surrounding communities follow a similar trend as the rest of Massachusetts over the sample period.
- Relative sales at Plainridge Park Casino increased approximately four-fold after the opening of the casino and account for much of the sales increase in Plainville.
- Consistent with year-over-year sales, no overall decrease in sales in surrounding communities was detected and there was an increase in sales in Plainville.

## **Discussion**

An analysis of lottery revenues one year after the opening of Plainridge Park Casino shows that, on average, lottery revenues have not decreased statewide or nearer the casino, whether this includes designated surrounding communities or agents within various driving distances. However, lottery revenues for agents nearer the casino grew more slowly on average than the rest of the state. Lottery revenues in the surrounding communities of Attleboro and Mansfield increased after the opening of the casino, whereas revenues in Foxborough, North Attleborough, and Wrentham decreased. Whether the casino had differential impacts on communities or is the source of variation in lottery revenue cannot be definitively determined as variation in lottery revenue may stem from other factors. It is also important to recognize that this result is based on one year of data and may not reflect longer term trends. Moreover, the result is not indicative of what may happen when casinos in Everett and Springfield open, both of which will be larger casinos with more non-gambling amenities.

## **Future Directions**

The Economics team at the UMass Donahue Institute, with the cooperation of the Massachusetts Lottery, will continue to gather fiscal year and agent-specific data. This will allow a continued evaluation of lottery sales near Plainridge Park Casino and establish a longer baseline for the host communities of Everett and Springfield and their various surrounding communities.

## Introduction

The Massachusetts Lottery has been operating since 1972. In Fiscal Year 2016, lottery tickets could be purchased at over 8,000 licensed lottery vendors throughout the Commonwealth and total sales exceeded \$5.2 billion.<sup>1</sup> For Fiscal Year 2015, Instant games accounted for 69.1% of lottery sales, followed by Keno (17.3%) and Numbers (6.3%). All other games (e.g., MegaMillions, MassCash, Powerball) each accounted for 2% or less of total sales.

With the introduction of expanded gaming in Massachusetts, the Commonwealth has made the protection of the Lottery and its vendors a priority. Chapter 23K, Section 1 of the 2011 Expanded Gaming Act states that “enhancing and supporting the performance of the state lottery and continuing the commonwealth’s dedication to local aid is imperative to the policy objectives of this chapter”<sup>2</sup> and Section 4 gives the newly created Massachusetts Gaming Commission the power to “coordinate with the office of the treasurer and receiver general on implementing any measures necessary to protect the commonwealth’s lottery and gaming interests.”

The Legislature also placed conditions on all prospective casino operators, aimed at protecting the Lottery. Section 15 (1) of the Expanded Gaming Act states that any applicant for a gaming license must “agree to be a licensed state lottery sales agent under chapter 10 to sell or operate the lottery, multi-jurisdictional and keno games; demonstrate that the lottery and keno games shall be readily accessible to the guests of the gaming establishment and agree that, as a condition of its license to operate a gaming establishment, it will not create, promote, operate or sell games that are similar to or in direct competition, as determined by the commission, with games offered by the state lottery commission, including the lottery instant games or its lotto style games such as keno or its multi-jurisdictional games.” Section 15 (6) requires any applicant to “demonstrate to the commission how the applicant proposes to address lottery mitigation.”

The lottery is a major source of revenue for the Commonwealth and in particular for its 351 cities and towns. Lottery revenues are the largest source of unrestricted local aid in Massachusetts and the second largest source of all local aid, after Chapter 70 education aid. Revenue from Massachusetts Lottery sales are combined and distributed by the state legislature, along with other funds collected for unrestricted local aid, to municipalities according to a formula which takes into account the incomes, property wealth, and population of each municipality. Since most revenue for municipal governments comes from property taxes, many communities in Massachusetts without substantial property wealth rely on this local aid to fund their local government services.

In fiscal year 2015, the Lottery’s net profit was \$985.8 million, of which \$945.8 million was distributed to the Commonwealth’s municipalities in the form of direct local aid.<sup>3</sup> The significance of these funds varies

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<sup>1</sup> 2016 Lottery Commission Statement of Operations, which can be found at

<http://www.masslottery.com/lib/downloads/about/FY2016%20Final%20Statement%20of%20Ops.pdf>

<sup>2</sup> The Expanded Gaming Act can be found at <https://malegislature.gov/Laws/SessionLaws/Acts/2011/Chapter194>.

<sup>3</sup> Funds also go to the Massachusetts Cultural Council and the Massachusetts Council on Compulsive Gambling. See <http://www.masslottery.com/about/communities/> for detail.

across communities based on the magnitude of their other sources of revenue – from 0.03% of total receipts in Chilmark to 13.8% in Adams. As reported on the Lottery website, among the host communities, Everett received \$6,147,468 from the Lottery in fiscal year 2015, 8.8% of Everett’s total state aid and 3.2% of its total receipts, while Plainville received \$675,071 (15.6% of the town’s total state aid and 2.3% of total receipts) and Springfield received \$33,686,269 (9.4% of total state aid and 5.7% of total receipts).<sup>4</sup>

As Massachusetts moves forward with the introduction of casino gaming, one priority of the Massachusetts Gaming Commission and the SEIGMA project is to determine how lottery-product-buying behavior may be affected by the introduction of casino gambling in Massachusetts. Studies have been conducted on the impacts of expanded gambling on lottery revenue in other states, but it is difficult to say how similar the impacts will be in Massachusetts. In 2014, at \$730, Massachusetts has the highest per capita lottery sales in the nation, twice that of the next highest state (New York).<sup>5</sup> This may be in part because of the odds offered by the Massachusetts Lottery. According to the U.S. Census’ 2013 Annual Survey of State Government (the most current as of the time of writing), for every dollar spent on the Lottery in Massachusetts, 77 cents are paid out to players, the most of any state and considerably higher than the U.S. average of 62 cents. The relative popularity of the Massachusetts Lottery may to some extent insulate it from potential negative impacts as casino gambling continues to expand, but its prominent role also means that the consequences of a reallocation of spending towards the casinos and away from the lottery are potentially greater.

In the event that the expansion of gaming in Massachusetts leads individuals to spend less money on lottery and more money at the casinos, this will not necessarily lead to a reduction in local aid funds. As detailed in Figure 1 below, the Category 2 slots parlor that opened in Plainville in the summer of 2015 allocates 82% of its tax revenue to local aid, while the Category 1 resort casinos will allocate 20% of their tax revenue to Local Aid when they open.<sup>6</sup> Thus the net impact on local aid will depend on changes in both casino and lottery revenue. In order to determine the impact of expanded gaming on Massachusetts, the monitoring of lottery performance, statewide and in the communities near the new casinos, is a priority of the SEIGMA team. With the context of its significance to the Commonwealth in mind, this report details the work that the SEIGMA team has done to date to monitor the impact of expanded gaming on the Massachusetts Lottery.

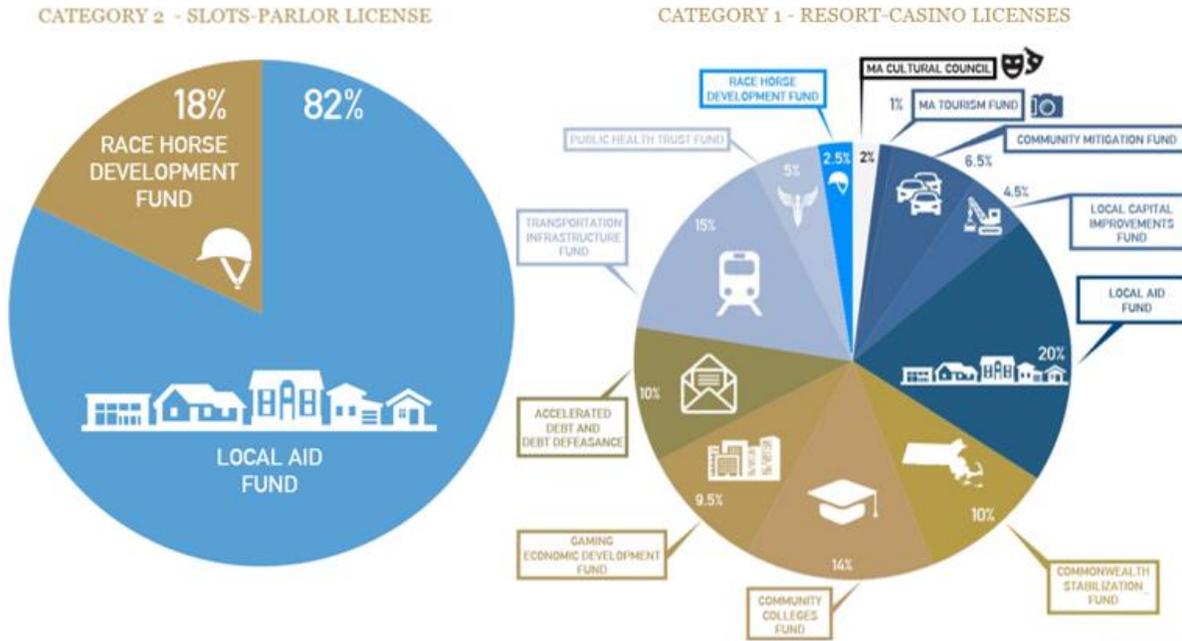
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<sup>4</sup> Data on State lottery disbursements come from the Massachusetts Lottery and can be found at <http://www.masslottery.com/about/communities/complete-list.html>. Data on state aid and total receipts for Massachusetts communities comes from the Massachusetts Department of Revenue, Division of Local Services and can be found at <http://www.mass.gov/dor/local-officials/municipal-databank-and-local-aid-unit/data-bank-reports/municipal-budgeted-revenues.html>.

<sup>5</sup> La Fleur’s Magazine, March/April 2015

<sup>6</sup> From the Massachusetts Gaming Commission. More information can be found at <http://massgaming.com/the-commission/budget/>

**Figure 1: Allocation of Tax Revenue for Category 1 and 2 Casinos**



Source: The Massachusetts Gaming Commission.

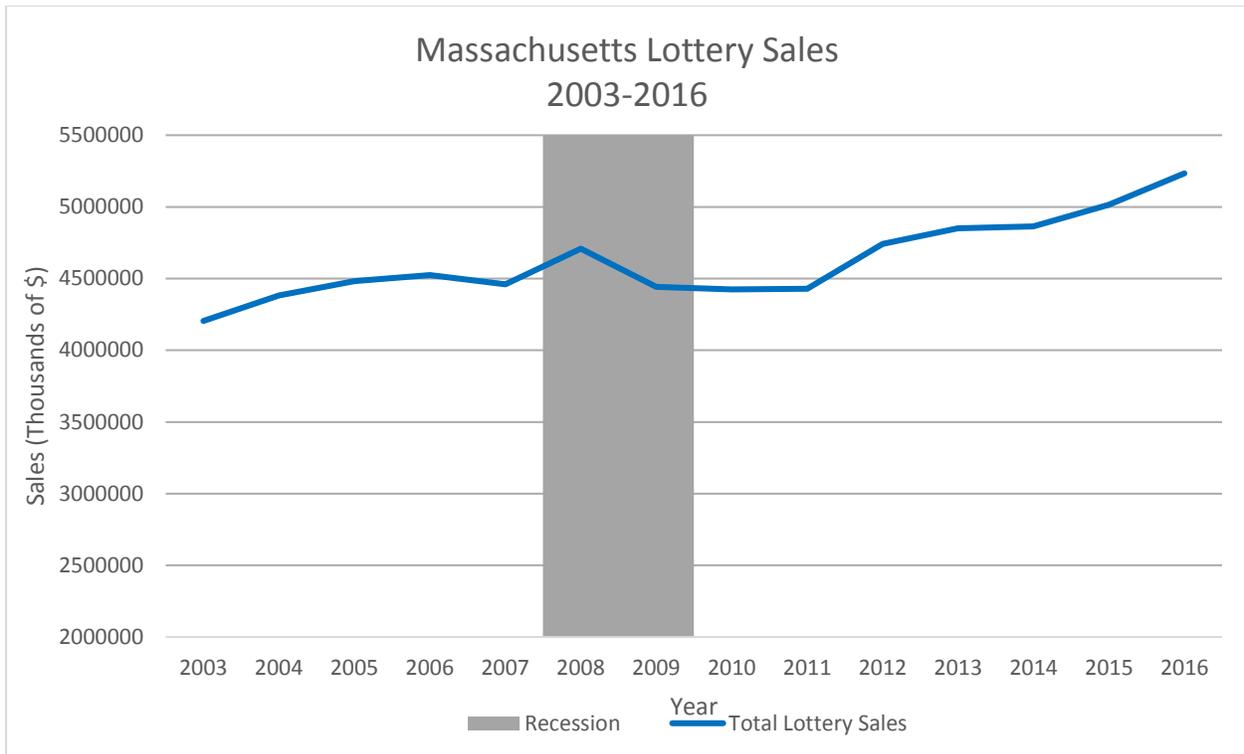
## Massachusetts Lottery Sales 2003-2016

### Statewide Sales

Lottery sales in Massachusetts over the 2003-2016 Fiscal Year period have generally grown slowly, but steadily (see Figure 2). Average annual sales growth over this period is 1.70%.<sup>7</sup> Like many state lotteries, sales during the recession flattened and even declined. Beginning in 2012 sales growth has increased.

<sup>7</sup> Sales are in nominal dollars and not adjusted for inflation, which averaged 2.02% over the sample period. In inflation adjusted dollars, revenue for fiscal year 2016 was approximately the same as revenue for fiscal year 2008 and is below revenue for fiscal year 2003. See Appendix B for inflation-adjusted (real dollar) lottery sales.

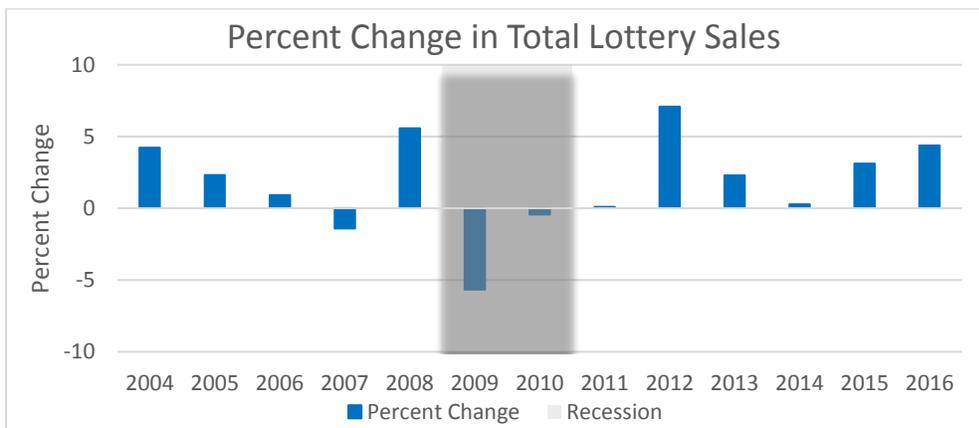
**Figure 2: Nominal MA Lottery Sales, FY 2003-2016**



Source: MA Lottery, FY 2003-2016, nominal dollars. Lottery revenues declined during recession but have grown since 2012. The average annual growth in nominal lottery revenue between 2003 and 2016 was 1.70%

Figure 3 presents the annual percentage change in lottery revenues between 2004 and 2016 in more detail. Massachusetts lottery sales declined 5.5% between 2008 and 2009, followed by several years of little to no growth. In 2012 sales growth increased over 7%, followed by two years of slower growth before rebounding again in fiscal years 2015 and 2016.

**Figure 3: Percent Change in Lottery Sales, FY 2003-2016.**



Source: MA Lottery, FY 2003-2016, nominal dollars. This figure shows annual growth rates. The declines in revenue during the recession are evident. Since the recession the increase in lottery revenue was greatest in 2012 and 2016.

## Casino Gambling and Lottery Sales

The impact on lottery sales from legalizing casino gambling in Massachusetts is uncertain but will become clearer over time. Moreover, the impact on lottery sales is likely dynamic, varying over the immediate, short, and longer term. In this section, we review some of the existing evidence on lottery sales and casino gambling and examine the impact on lottery sales associated with the opening of the slot parlor at Plainridge Park.

### Existing Studies from Other States

There are a handful of academic and professional papers examining the impact of casino legalization on lottery sales or tax revenue. Nearly all of these studies, none of which have been conducted in Massachusetts, find the introduction of casino gambling to be associated with a modest negative impact on lottery expenditures. However, there is evidence that the negative association between casino gambling and lottery expenditures is not permanent, with negative impacts decreasing over time, and dependent on distance, with lottery sales closer to a casino more negatively impacted than those more distant.

Siegel and Anders (2001) is one of the earliest academic studies examining casino legalization and lottery expenditures in Arizona from 1993-1998. They find the two forms of gambling are substitutes, but that the degree of substitution varies by game. In this study, “Scratchers” or instant games are not statistically significantly impacted by the introduction of casino gambling, whereas Lotto revenues are significantly reduced, with a 10% increase in the number of slot machines reducing Lotto revenues by 4.18%. It should be noted, however, that Siegel and Anders use aggregate state level data and are not able to detect spatial variation in sales by proximity to casinos nor do they examine year-to-year changes in lottery revenue.

Elliott and Navin (2002) examine all states with lotteries from 1989-1995 and find that, on average, a \$1 increase in tax revenue from casinos reduces net lottery revenue (revenue after paying winners) by \$0.83, thus finding that lottery and casino are substitute forms of gambling but that total state tax revenues nevertheless increase.<sup>8</sup> Fink and Rork (2003) conduct a similar analysis to Elliott and Navin, but find a smaller decrease in net lottery revenue of \$0.56 from an additional dollar of tax revenue.<sup>9</sup> Here again, neither study examines the spatial variation in lottery sales by proximity to casinos nor examines year-to-year variation. It should also be noted that the time period examined, 1989-1995 was the very beginning of the expansion of casino gambling, making it difficult to generalize these results to a period where both the lottery and casinos are more mature industries.

More recently, Walker and Cummings (2014) estimate the impact of casino legalization in Maryland on lottery sales. Unlike the earlier studies, Walker and Cummings analyze lottery sales at the zip code level and are thereby able to analyze variation in sales by proximity to the casino. Using monthly data from July 2009 through February 2014, they estimate that lottery sales were 2.5% lower due to the

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<sup>8</sup> Elliott and Navin find that each dollar of casino tax revenue reduces lottery expenditures by \$1.38. They assume an average casino tax rate of 20% of gross revenue, implying that \$5 in gross casino revenue reduces lottery expenditures by \$1.38. Elliott and Navin assume a lottery tax rate (amount of revenue going to the state) of 60%, hence the \$0.83 ( $\$1.38 \times 0.6$ ) loss in net lottery revenue. The tax rate in Massachusetts on lottery is closer to 20% (77% is paid back in prizes) and the tax rate on gross casino revenue is 25%, so the increase in tax revenue would be greater.

<sup>9</sup> Fink and Rork (2003) account for selection bias, namely that states whose lottery revenues are low or declining may be more likely to legalize casino gambling as an alternative tax source, thereby making the substitution between lottery and casino gambling appear larger, as is the case with Elliott and Navin (2002).

legalization of casinos. The largest decrease, 5.1%, is from a reduction in Monitor (e.g., Keno) game sales, followed by Instant (2.6%) and Multi-State (2.4%) games. These estimates, however, differ by casino within Maryland, with one casino (Maryland Live) reducing Monitor game sales by 4.2% while the other casinos reduce sales by less than 1%.

Walker and Cummings find evidence that proximity to the casino matters as well. For example, they predict that Monitor game sales for a zip code within a 15 minute drive of the casino would fall by 18%, whereas a zip code one hour away would only experience a 1% decrease. Their prediction for Instant games is a 9% reduction for a zip code within 15 minutes of a casino versus 1% for a one hour distance. However, it is important to note that their estimated impacts are based on a model calculated for the entire state and lottery sales in an average zip code. Their estimates are not the actual changes in lottery sales in nearby zip codes. Moreover, their data end in February 2014. The first casino in Maryland opened in September 2010, so their estimates should not be interpreted as long term impacts.

Additional evidence that declines in lottery sales resulting from casinos may be short term is the fact that Maryland lottery sales for Fiscal Year 2015 increased 2.2% and, as evidenced in Appendix A of this report, lottery sales in Ohio and Pennsylvania initially declined following the expansion of casino gambling, but later increased.<sup>10</sup> In addition, Pennsylvania's Legislative Budget and Finance Committee (2011) reported in 2011 that lottery sales in host counties (counties where casinos are located) underperformed relative to non-host counties and the state average, with host counties growing 1.8% versus 3.6% for non-host counties and 2.7% for the state. However, between 2011 and 2012 host counties grew faster (11.8%) than non-host counties (11%) and the state (9.9%). In later reports, the Legislative Budget and Finance Committee (2014, 2015) concludes that "...increased casino revenues are not negatively affecting Lottery sales to any significant degree."

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<sup>10</sup> Of course, we do not know what the growth in lottery sales would have been had the casinos not opened.

## Results

### Plainville and Surrounding Region Sales: Fiscal Year Revenue Analysis

Evidence from previous studies suggests that the opening of the Plainridge Park Casino has the potential to negatively impact lottery sales since the casino may substitute for lottery expenditures. Previous studies and evidence also suggest that the impact may be geographically and temporally limited. To determine any impact, it is important to compare post-casino lottery revenue with a baseline that provides an estimate of the change in lottery expenditures had the casino not opened. Our approach to establishing a baseline is twofold. First, we compare fiscal year revenue for the years prior to the casino opening (2003-2015) with fiscal year revenue data after the casino opening. Plainridge Park Casino opened June 24, 2015, so FY 2016 revenue reflects a full year of post-casino revenue. Second, we use agent-specific data to compare sales data for the year prior to Plainridge Park Casino opening with sales after opening. These comparisons are made for Plainville, for the Massachusetts Gaming Commission's (MGC) designated surrounding communities of Attleboro, Foxborough, Mansfield, North Attleborough, and Wrentham (see Figure 4), and for agents within varying drive-time distances of Plainridge Park Casino. Sales before and after the opening of Plainridge Park Casino for all of these areas are compared with changes in sales over the same period in the rest of the state.

**Figure 3: Plainville and MGC-designated Surrounding Communities**

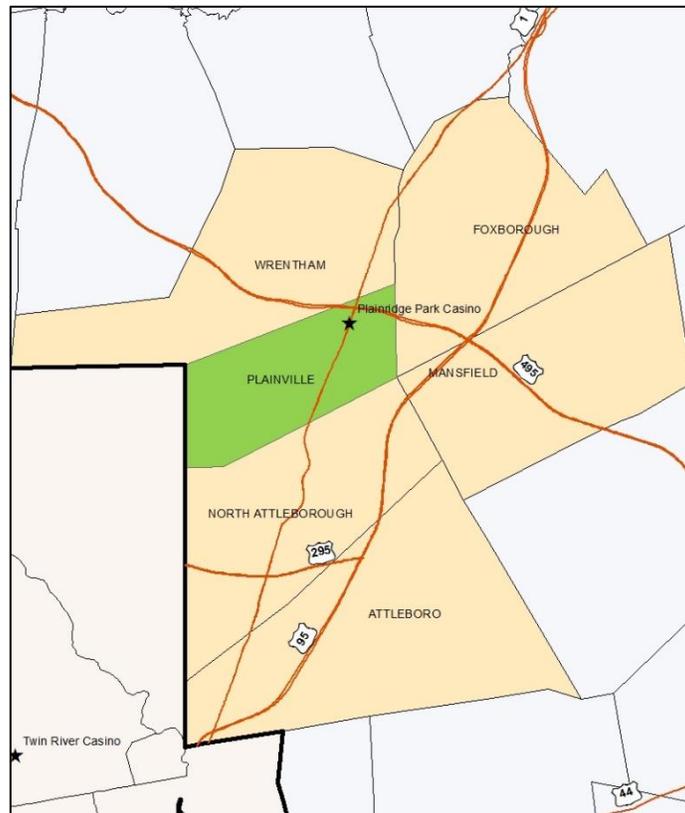
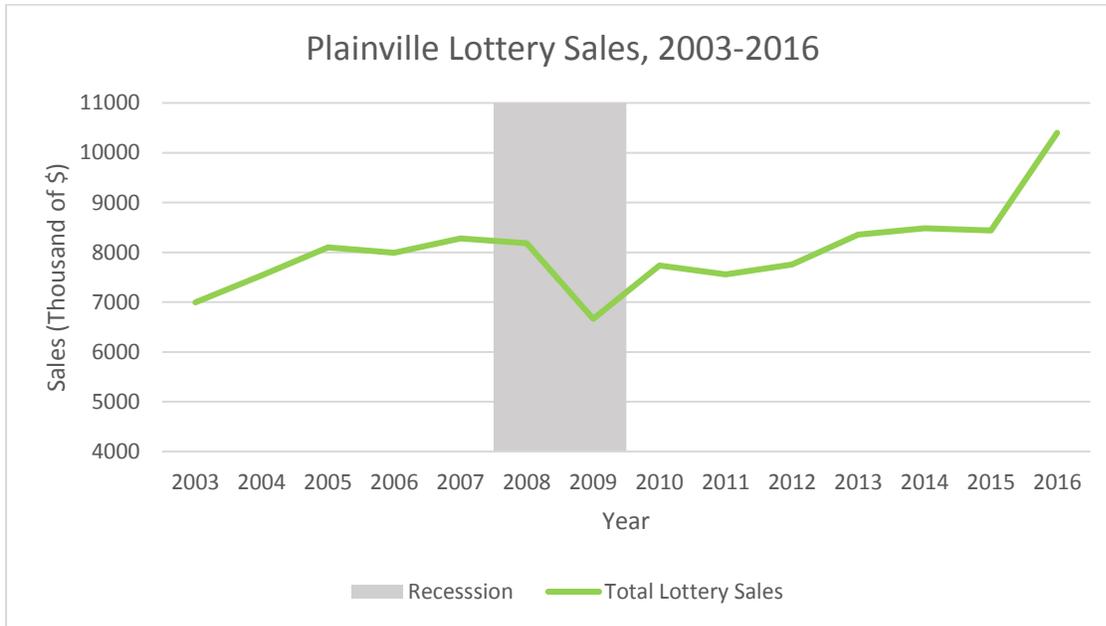


Figure 5 illustrates total lottery sales in the town of Plainville for Fiscal Years 2003-2016. Sales in Plainville, in general, follow the pattern experienced by the state. Lottery sales have grown at an annual average growth rate of 3.09% over the period. This growth has not been steady, however, as sales

declined during the recession. Sales growth increased in 2012 by 7.8%, but has been relatively flat until recently with FY 2016 sales increasing 23.2% over FY 2015 sales.

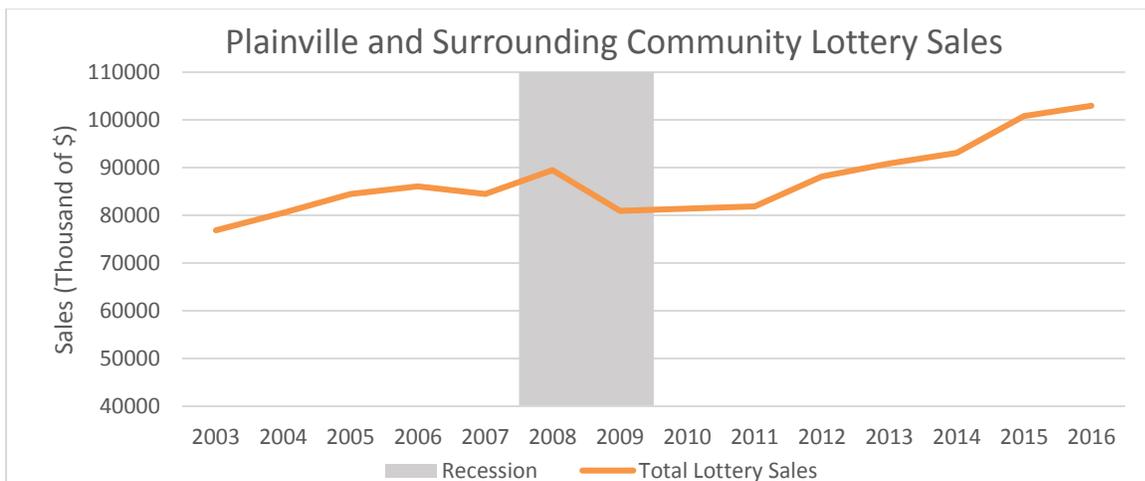
**Figure 4: Nominal Plainville Lottery Sales, FY 2003-2016**



Source: MA Lottery, FY 2003-2016, nominal dollars. Lottery sales in Plainville, like the state as a whole, decreased during the recession but have grown since 2012, with a noticeable increase in FY 2016.

Sales growth for Fiscal Years 2003-2016 for the combined area of Plainville and the MGC designated surrounding communities is also similar to the state as a whole, averaging 2.28% (see Figure 6). Growth declined and flattened during the recessionary years of 2008 to 2011, but has since recovered. For the combined area, FY 2016 revenue increased 2.12% over FY 2015 revenue.

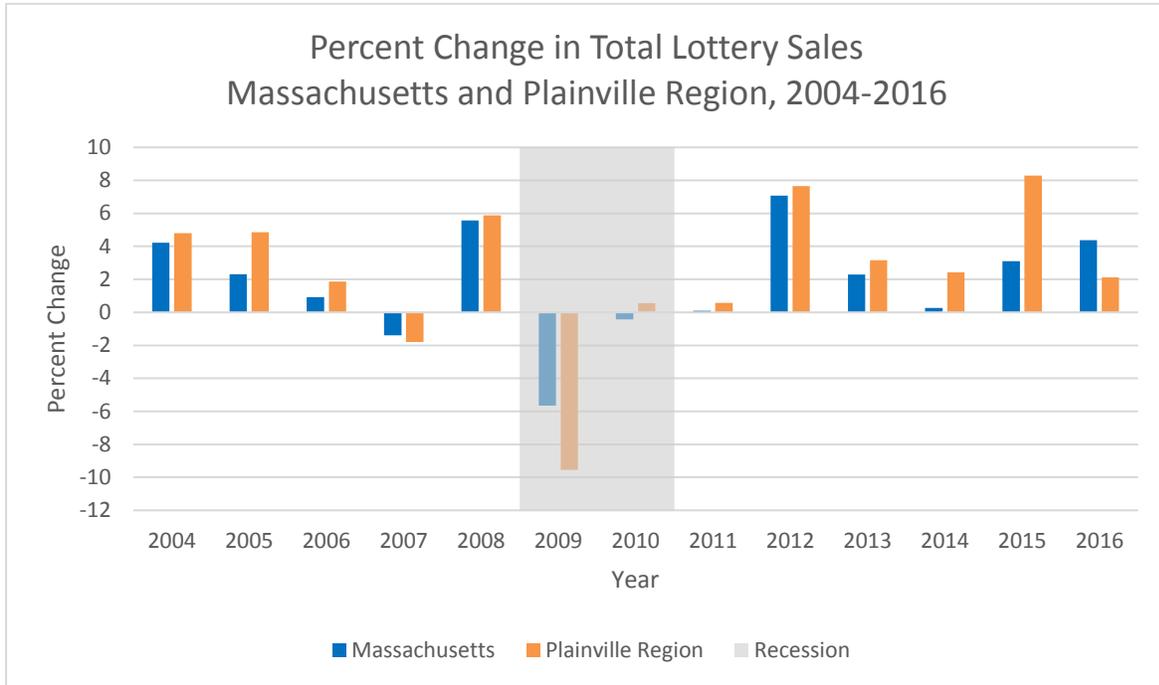
**Figure 5: Nominal Lottery Sales for Plainville and MGC-designated Surrounding Communities, FY 2003-2016**



Source: MA Lottery, FY 2003-2016, nominal dollars. Plainville and the surrounding communities of Attleboro, Foxborough, Mansfield, North Attleborough, and Wrentham, like the rest of the state, experienced declines in lottery revenue during the recession, but lottery revenues have increased each year since 2012.

A comparison of the annual percentage change in total lottery sales for the combined area of Plainville and the surrounding communities relative to the percent change statewide is provided in Figure 7. The decline in lottery sales that occurred during the recession is clear as is the return to more robust growth beginning 2012. Since the recession the growth in lottery sales in Plainville and the surrounding communities of Attleboro, Foxborough, Mansfield, North Attleborough, and Wrentham have generally increased faster than the rest of the state. In FY 2016, lottery sales grew less (2.1%) in the Plainville region compared to growth statewide (4.3%).

**Figure 6: Percent Change in Nominal Lottery Sales, Plainville & Surrounding Communities vs. Massachusetts, FY 2004-2016**



*Source: MA Lottery, FY 2003-2016, nominal dollars. Since the recession the growth in lottery sales in Plainville and the surrounding communities of Attleboro, Foxborough, Mansfield, North Attleborough, and Wrentham have generally increased faster than the rest of the state. In FY 2016, lottery sales grew less (2.1%) in the Plainville region compared to growth statewide (4.3%).*

To analyze the potential impact of the casino opening on lottery sales more closely, the next section analyzes agent-specific sales, thereby allowing a more detailed examination of sales at and near Plainridge Park Casino relative to other areas in the state.

## **Lottery Sales After Plainridge Park Casino Opening: A Year-Over-Year Comparison**

### **Host and Surrounding Communities**

The Massachusetts Lottery has provided agent-specific lottery sales data to the SEIGMA Economics team at the Donahue Institute. These data contain weekly lottery sales, by game, for every lottery sales agent in the state. These data are provided for the week ending June 21, 2014 to October 8, 2016, allowing an

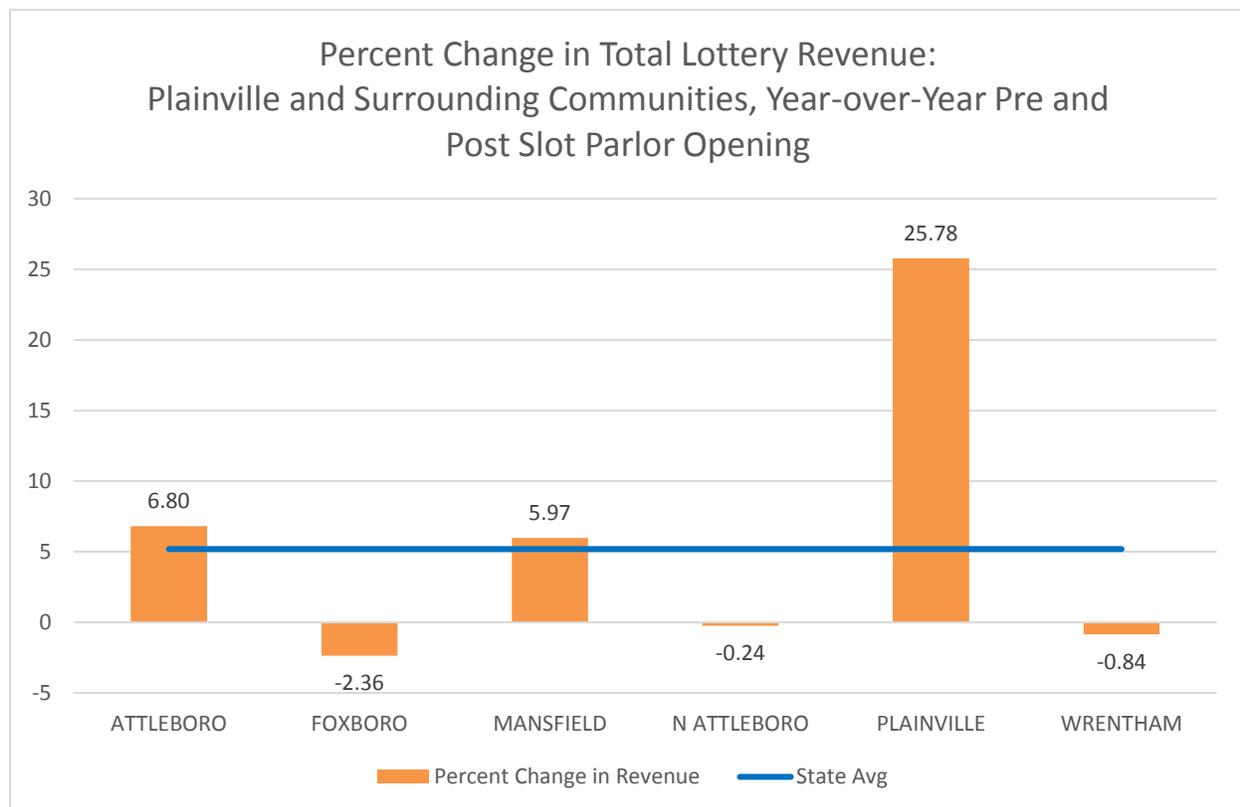
analysis of the immediate impact, if any, on lottery sales resulting from the opening of the Plainville slot parlor on June 24, 2015.

As a result of volatility in weekly sales, in part due to when sales are reported as well as jackpot rollovers, we aggregate the sales data into two-week periods. While confidentiality prevents us from reporting agent-specific sales, it is important to note that a lottery agent began operating at Plainridge Park Racecourse in 1999.

Before presenting bi-weekly results we focus on year-over-year changes, comparing total sales during the period 6/15/2014-6/20/2015 with total sales from 6/21/2015-6/25/2016. Figure 8 presents year-over-year percentage changes in total lottery sales for the host community of Plainville and the MGC designated surrounding communities. Statewide lottery sales increased 5.19% over this time period.

Wrentham, Foxborough, and North Attleborough all experienced small declines in lottery sales. Sales in Foxborough declined the most (2.36%), whereas sales in North Attleborough and Wrentham were essentially unchanged over the time period. In contrast, sales in Attleboro, Mansfield, and Plainville increased at a rate that exceeded statewide growth. The highest rate of growth occurs in Plainville, where total sales increased 25.78%.

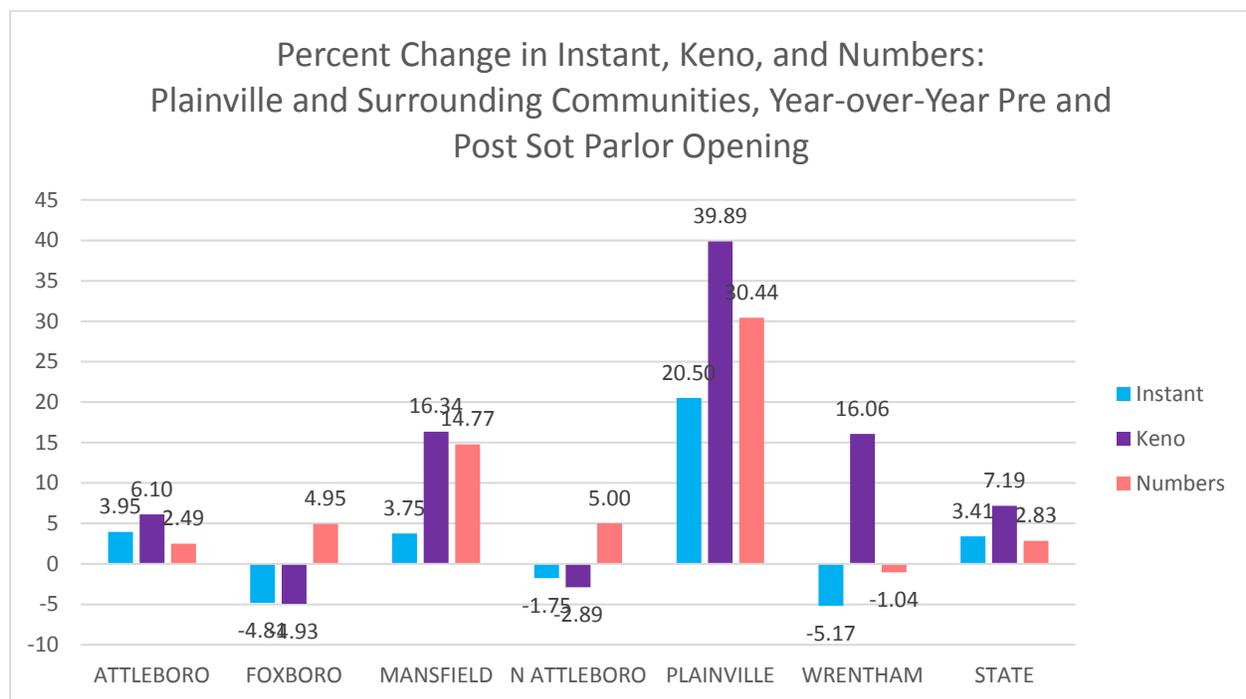
**Figure 7: Percent Change in Nominal Lottery Sales in Plainville & Surrounding Communities, Pre- and Post-Casino Opening**



Source: MA Lottery, bi-weekly sales 6/15/2014-6/20/2015 compared to bi-weekly sales 6/21/2015-6/25/2016, nominal dollars. Sales in Plainville increased dramatically (25.78%). Sales in Attleboro and Mansfield also increased at a rate that is very similar to the state as a whole. Sales in Foxborough declined the most (2.36%), whereas sales in North Attleborough and Wrentham were essentially unchanged over the time period.

As noted above, Instant sales account for approximately 70% of lottery revenue, with Keno and Numbers being the next largest contributors. The year-over-year percentage change in these games for the host and surrounding communities is presented in Figure 9. Paralleling the results for total sales, the largest percentage increase in Instant, Keno, and Numbers sales occurs in Plainville. Foxborough, North Attleborough, and Wrentham witnessed modest declines in Instant ticket sales over this time. Interestingly, Mansfield, Plainville, and Wrentham all experienced notable increases in Keno sales, a game that Walker and Cummings found to be the most negatively impacted by casino openings in Maryland.

**Figure 8: Percent Change in Instant, Keno & Number Sales in Plainville & Surrounding Communities, Pre- and Post-Casino Opening**



Source: MA Lottery, bi-weekly sales 6/15/2014-6/20/2015 compared to bi-weekly sales 6/21/2015-6/25/2016, nominal dollars. This figure shows the year-over-year percentage change in lottery revenue for the most popular lottery games, instant, keno, and numbers.

The above results suggest that lottery sales in the host and surrounding communities suffered no adverse impacts for the communities as a whole. While sales in Plainville noticeably increased, results for neighboring communities are more ambiguous, with some communities experiencing declines in sales and others experiencing increases. Nevertheless, in dollar terms, the gains in revenue in Attleboro, Mansfield, and Plainville, exceed the declines in Foxborough, North Attleborough, and Wrentham. Total lottery sales in the host and surrounding communities were \$5.45 million greater in the year after the casino opened. Excluding the town of Plainville, sales were \$3.27 million greater.

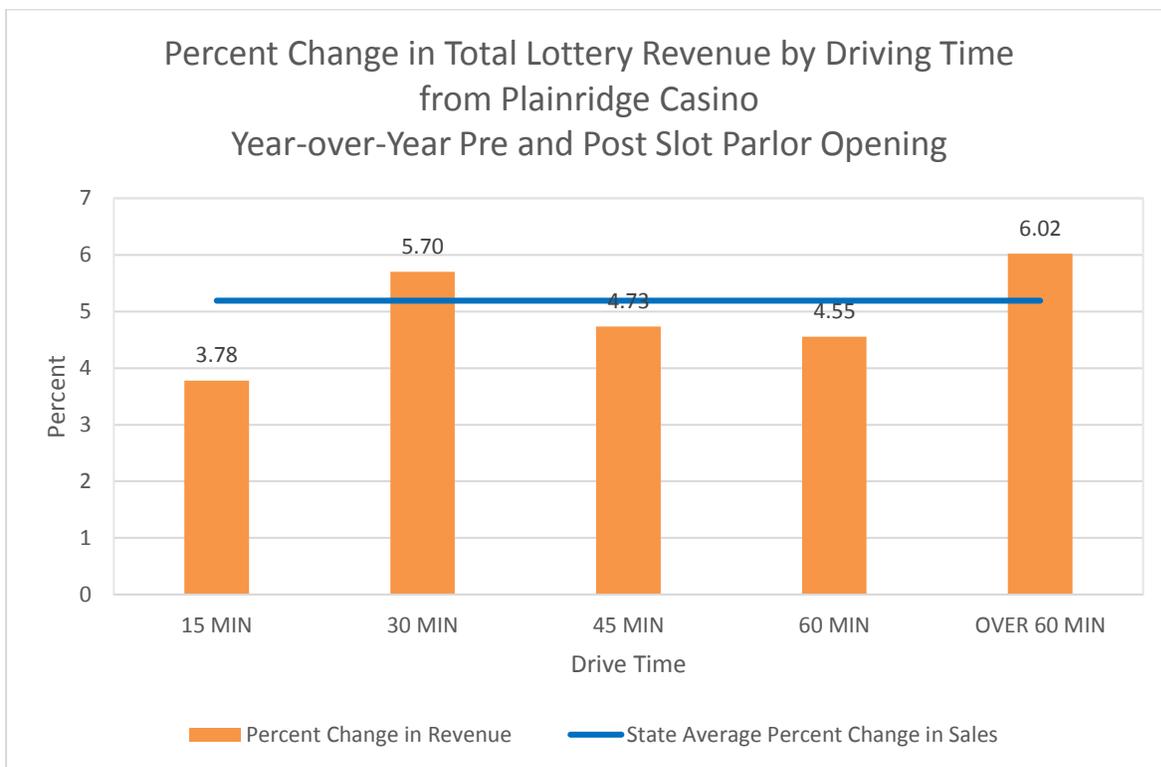
### Lottery Sales by Driving Time from Plainridge Park Casino

In this section, we analyze sales by driving time from the casino. This allows for a broader definition of surrounding community, thereby complementing the MGC designated surrounding community analysis above.

The year-over-year percent change in total lottery sales by driving distance from Plainridge Park Casino is presented in Figure 10. The category labeled 15 MIN includes all lottery agents 15 or fewer minutes' drive time from Plainridge Park Casino, including sales at the casino. The 30 MIN category includes all lottery agents 16 to 30 minutes' drive time from Plainridge Park Casino, and so on. The average percent change for the state is also included.

Outlets within a 15 minute drive of the casino experienced an increase in sales over the entire period of 3.78%, less than the state average of 5.19% and a slightly lower growth rate than outlets operating at a greater distance from the casino. Sales at outlets 16 to 30 minutes from the casino, however, grew more rapidly than sales statewide. Overall, there is no obvious pattern between lottery sales growth and proximity to the casino. That is, sales are not uniformly increasing at greater distances from the casino.

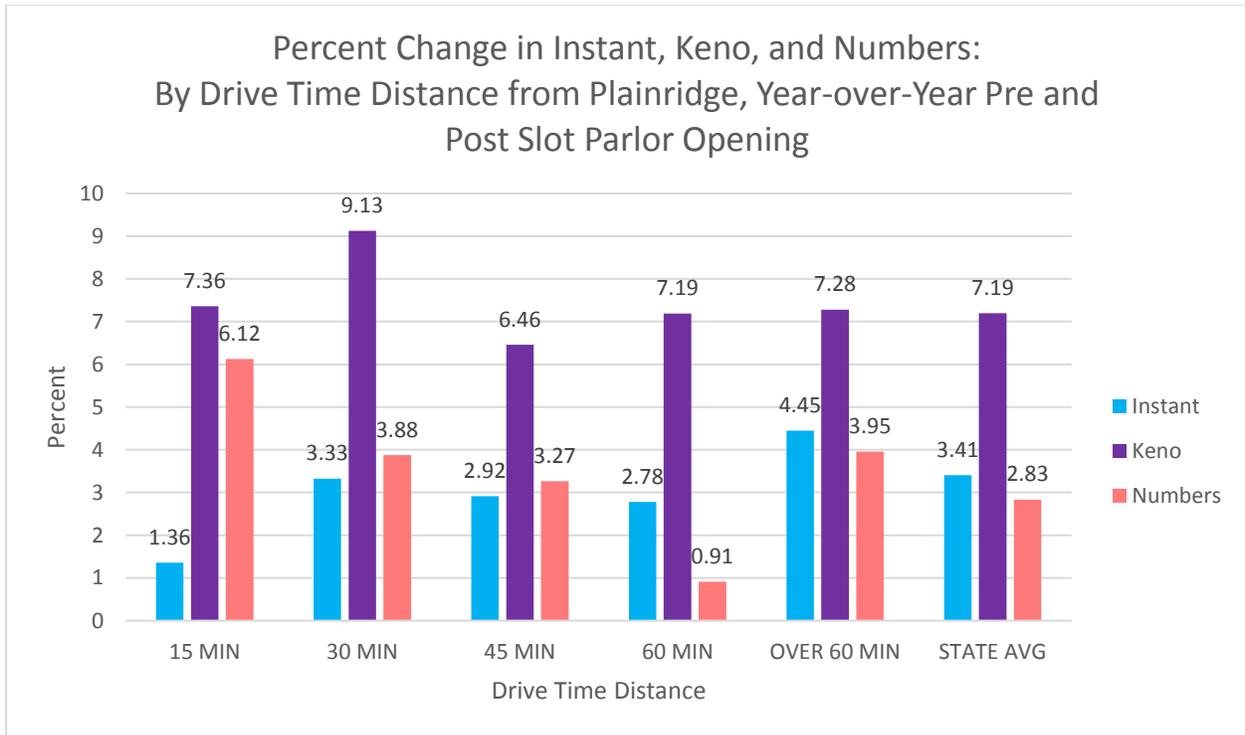
Figure 9: Percent Change in Lottery Sales by Driving Distance from Plainridge Park Casino



Source: MA Lottery, bi-weekly sales 6/15/2014-6/20/2015 compared to bi-weekly sales 6/21/2015-6/25/2016, nominal dollars. 15 MIN category includes Plainridge Park Casino. Sales at lottery agents within 15 minutes of the casino increased 3.78%, slightly below the state average of 5.2%. Sales at agents 16-30 minutes of the casino exceeded the growth state wide. No obvious "distance decay" effect where sales are lowest near the casino and increase at greater distances.

The year-over-year percentage change in sales by game and driving distance is provided in Figure 11. Instant ticket sales for lottery agents within a 15 minute drive of the casino increased 1.36%, below the state average of 3.41% and other agents at a greater distance from the casino. Instant sales for lottery agents 16-30 minutes from the casino grew 3.33%, nearly identical to the statewide average.

**Figure 10: Percent Change in Instant, Keno & Numbers by Driving Distance from Plainridge Park Casino**



Source: MA Lottery, bi-weekly sales 6/15/2014-6/20/2015 compared to bi-weekly sales 6/21/2015-6/25/2016, nominal dollars. This figure reports the year-over-year percentage change by type of game. Instant sales growth for agents within 15 minutes of the casino was below the state average. Growth for agents 16-30 minutes from the casino grew nearly identical to the state as a whole (3.3% vs 3.4%).

The year-over-year changes compare total sales for the year prior to opening with total sales for the year after opening. This analysis clearly shows that sales in Plainville increased. Changes in the surrounding communities show no clear pattern. Foxborough, North Attleborough, and Wrentham experienced modest declines in revenue, whereas Attleboro and Mansfield experienced year-over-year increases. The gains in Attleboro and Mansfield exceed the losses in Foxborough, North Attleborough, and Wrentham. Sales for agents within a 15 minute drive of the casino grew less than the state average whereas sales for agents within a 16 to 30 minute drive grew slightly more than the state average.

## **Lottery Sales After Plainridge Park Casino Opening: Biweekly Agent-Level Analysis over Time**

### **Host and Surrounding Community Analysis**

The analysis so far has examined fiscal year data or year-over-year changes. A year-over-year analysis provides detail on what happened to total lottery revenue before and after the casino opened, but it

does not provide detail on the dynamics of lottery expenditures over time. We now examine biweekly sales over the entire sample, from June 2014 to October 2016. The objective is to visualize and statistically test whether significant changes in lottery expenditures occurred after the opening of Plainridge Park Casino. For consistency with the above analysis, this is done over the same geographic distinctions, i.e., host and surrounding communities and driving distance from Plainridge Park Casino.

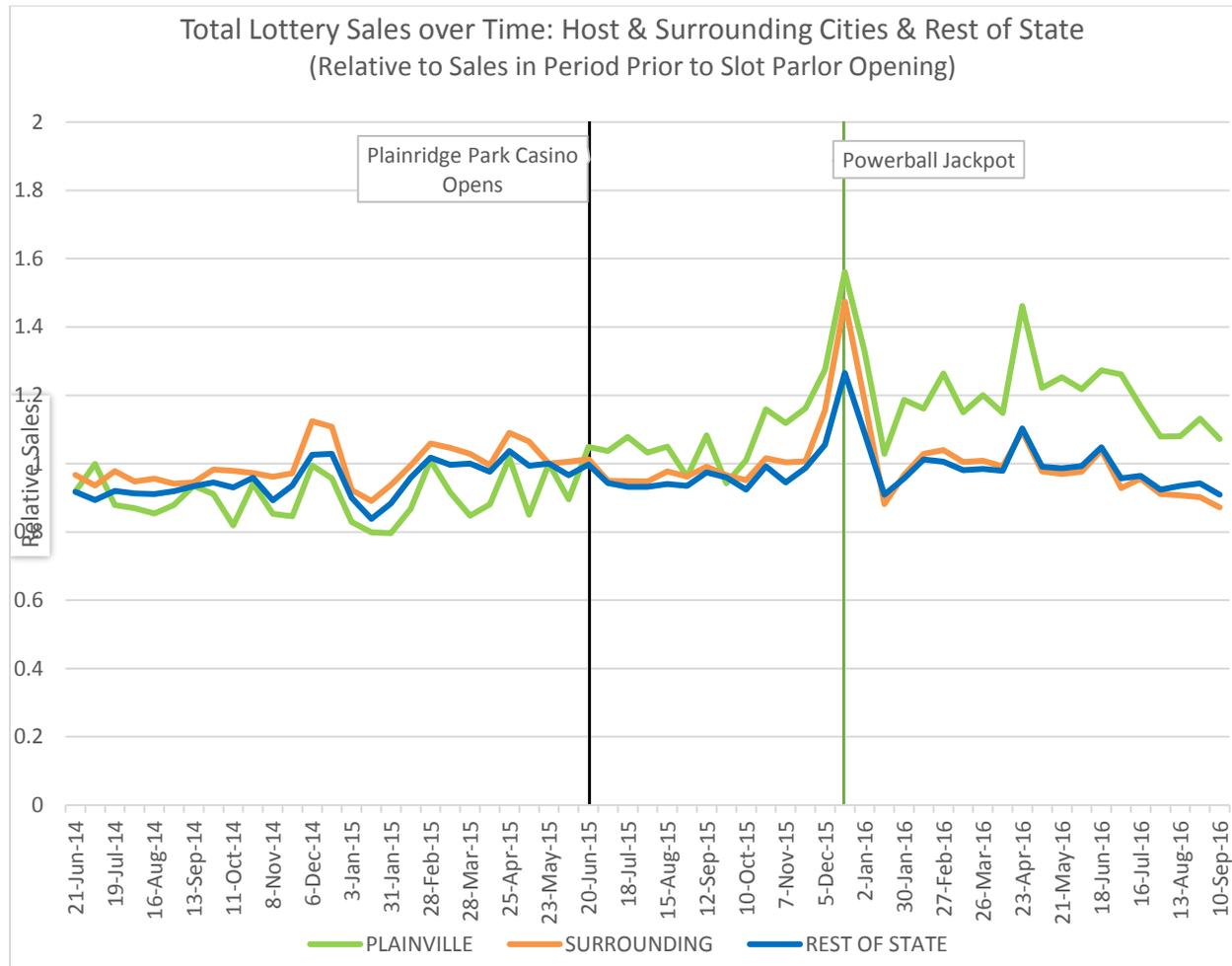
Figure 12 shows bi-weekly total lottery sales over the period June 15, 2014 to October 1, 2016 for the communities of Plainville, the MGC-designated surrounding communities, and the rest of Massachusetts. Because lottery sales in these areas are vastly different (total lottery sales in the rest of Massachusetts are much greater than total sales in Plainville, for example), all sales data are reported relative to total sales during the period prior to the casino opening (June 7, 2015-June 20, 2015). Thus, relative bi-weekly sales equal 1 for all areas for the June 7-June 20, 2015 period. Values greater than one signify bi-weekly sales data that exceed sales during the June 7-June 20 period, whereas values less than one signify lower bi-weekly sales compared to the June 7-20 period.

The June 7-June 20 period was chosen because the main objective of the analysis is to determine what happened to lottery sales after the casino opened. As a result, normalizing on the period immediately prior to opening seems a logical choice. The analysis is done for lottery agents that have been in operation over the entire sample. The overall conclusions are not sensitive to this restriction, and agents open during the whole period account for 76.75% of all observations. The closure and opening of agents, which may occur because a new owner takes over an existing business, or a new business becomes a lottery agent, introduces another source of variation to the data. This is particularly true for new agents that frequently have low initial sales.

Figure 12 reveals many interesting results. Relative sales in Plainville, which include the lottery agent in Plainridge Park Casino, are generally below the surrounding communities and the rest of Massachusetts prior to the casino opening. After the opening of Plainridge Park Casino, relative sales in Plainville equal or exceed relative sales in the surrounding communities and the rest of the state. This confirms the year-over-year analysis demonstrating that sales in Plainville grew faster after the opening of the casino relative to surrounding communities and the rest of Massachusetts.

The surrounding communities are largely unaffected. Prior to the casino opening, relative sales in the surrounding communities were slightly higher than relative sales in the rest of the state. After the casino opening, relative sales in the surrounding communities are more similar to the rest of Massachusetts. Most importantly, perhaps, the trends exhibited by all areas are very similar. If the opening of the casino had a large negative impact on sales in, for example, the surrounding communities, we would expect to see relative sales decline and diverge from the rest of the state. Figure 12 shows no evidence of a negative impact on sales.

**Figure 11: Relative Bi-weekly Lottery Revenue Over Time in Plainville, Surrounding Communities & Rest of Massachusetts**



Source: MA Lottery, bi-weekly sales relative to two-week period prior to opening (June 7-June 20, 2015), nominal dollars. A value of 1 implies that sales during that period were equal to sales during June 7-20. A value greater than one represents higher sales, less than 1 lower sales. Relative sales in Plainville, including Plainridge Park Casino, were lower in Plainville prior to the casino opening and generally equal or exceed sales in the surrounding communities and state after opening. Relative sales for surrounding communities generally follow the sales pattern exhibited in the rest of Massachusetts. A significant negative impact on lottery sales in surrounding communities would be represented by relative sales being lower and falling faster than the rest of Massachusetts.

**Difference-in-Differences Analysis of Host and Surrounding Communities**

Figure 12 visually demonstrates the pattern of lottery sales in the host and surrounding communities before and after the casino opening, comparing that pattern with the rest of the state. Difference-in-Differences (DID) analysis allows us to analyze lottery sales before and after the opening of the casino and determine if any observed changes are statistically significant, that is different from no change. DID analysis involves comparing a “treatment” group with a “control” group. Changes in lottery sales for the treatment group before and after the casino opening are compared with changes in the control group before and after the casino opening. The difference between these changes (i.e., differences) is also compared, hence the name difference-in-differences. Intuitively, we want to know whether lottery

revenue in the treatment group changed differently than the control group, which represents what might have happened had the casino not opened.

In our analysis, the treatment group is defined following the same geographic analysis used above, namely community type (host and surrounding) and driving distance from Plainridge Park Casino. Table 1 provides results from a DID analysis when the treatment group is defined to be all agents in Plainville, including the agent at Plainridge Park Casino. Table 1 shows that prior to the casino opening, average bi-weekly sales per agent in Plainville were \$24,503. After the casino opened, average bi-weekly sales per agent increased to \$31,546, a statistically significant increase of \$7,042. Table 1 also demonstrates that average bi-weekly sales per agent in the rest of Massachusetts increased approximately \$977, from \$26,898 before the casino opened to \$27,875 after the casino opened. The difference between the change in Plainville and the change in the rest of Massachusetts is \$6,065, an increase that is statistically significant (i.e., different than zero) at the 1% level of significance.

Note that the results in Table 1 quantify and reaffirm Figure 12. Prior to the casino opening, average bi-weekly lottery sales per agent in Plainville were below the state average, but after the casino opened they exceeded the state average. This is visually evident in Figure 12.

**Table 1: Difference-in-Differences Analysis of Average Bi-weekly Lottery Sales by Agent, Plainville vs. Rest of Massachusetts**

	Before Plainridge Park Casino	After Plainridge Park Casino	Difference <sup>a</sup>
Plainville <sup>b</sup>	24,503.58 (1,228.83)	31,546.29 (1,614.06)	7,042.71*** (1614.49)
Rest of State	26,898.27 (72.12)	27,875.50 (67.84)	977.23*** (99.40)
Difference in Differences			6,065.48*** (2,169.86)

<sup>a</sup>A \*, \*\*, and \*\*\* represent statistical significance at the 10, 5, and 1 percent level, respectively. Only agents open over the whole sample period.

<sup>b</sup>Including Plainridge Park Casino

*Source: MA Lottery, average bi-weekly sales per agent, 6/15/2014-6/20/2015 compared to average bi-weekly sales per agent 6/21/2015-10/1/2016. Average bi-weekly lottery sales per agent in Plainville increase \$7,042 compared to the rest of the state where average bi-weekly sales per agent increase \$977. Thus, average bi-weekly sales in Plainville increased a statistically significant \$6,065 more than agents in the rest of the state.*

Table 2 presents results for a DID analysis comparing the MGC-designated surrounding communities with the rest of Massachusetts. The results show that average bi-weekly sales per agent in surrounding communities increased by \$228. This increase, however, is not statistically significant, implying that we cannot confidently reject this increase from a change of zero. Average bi-weekly sales per agent for the rest of Massachusetts, however, increased \$1,003. The difference of \$-775 is not statistically significant. Thus, we cannot confidently conclude that the growth in revenue in the surrounding communities is lower relative to the rest of Massachusetts.

**Table 2: Difference-in-Differences Analysis of Average Bi-weekly Lottery Sales by Agent, Surrounding Communities vs. Rest of Massachusetts**

	<b>Before Plainridge Park Casino</b>	<b>After Plainridge Park Casino</b>	<b>Difference<sup>a</sup></b>
Surrounding Communities <sup>b</sup>	27,307.56 (663.90)	27,535.85 (618.44)	228.29 (910.01)
Rest of State	26,885.72 (72.33)	27,889.51 (68.09)	1,003.79*** (99.73)
Difference in Differences			-775.50 (750.20)

<sup>a</sup>A \*, \*\*, and \*\*\* represent statistical significance at the 10, 5, and 1 percent level, respectively. Only agents open over the whole sample period.

<sup>b</sup>Attleboro, Foxborough, Mansfield, North Attleborough, Wrentham

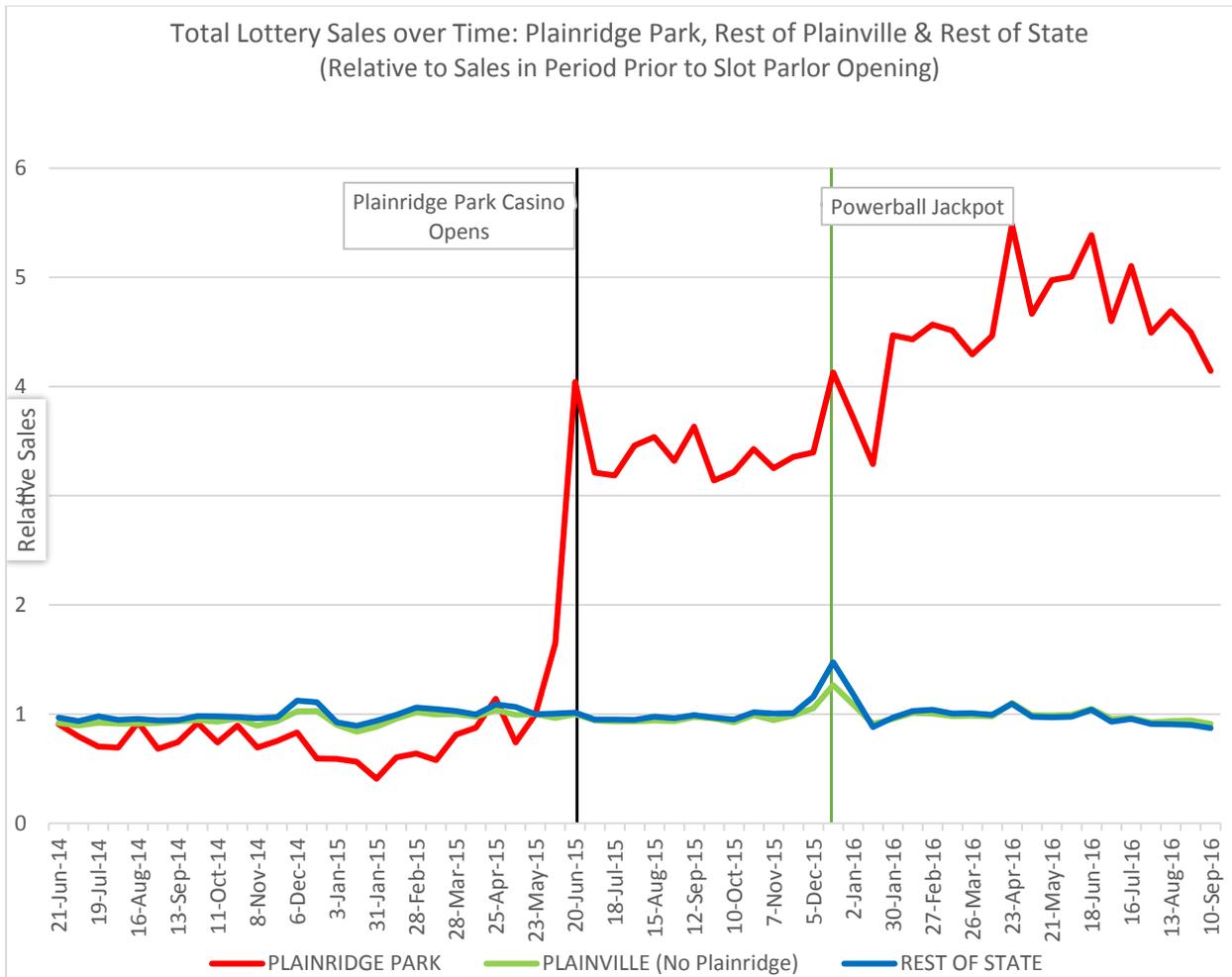
*Source: MA Lottery, average bi-weekly sales per agent, 6/15/2014-6/20/2015 compared to average bi-weekly sales per agent 6/21/2015-10/1/2016. Average bi-weekly lottery sales for agents in surrounding communities increase by \$228, on average, after the casino opened. This is less than the average bi-weekly increase for agents in the rest of the state of \$1003, but the difference is not statistically significant.*

### **Plainridge Park and Other Agents in Plainville**

Figure 13 analyzes Plainville more closely. Specifically, relative sales at Plainridge Park Casino are separated from relative sales for other agents in Plainville. Recall that these are sales over time relative to total sales during the two week period prior to the casino opening.

The most obvious feature of Figure 13 is the large increase in relative sales at Plainridge Park Casino. The increase in relative sales is roughly four-fold. This increase in sales, however, does not appear to have been at the expense of other agents in Plainville. Prior to the casino opening, relative sales at other agents were similar to the rest of Massachusetts. After the opening of the casino, there is no sign of a significant decline in relative sales for other agents. Rather, relative sales remain similar to the rest of Massachusetts.

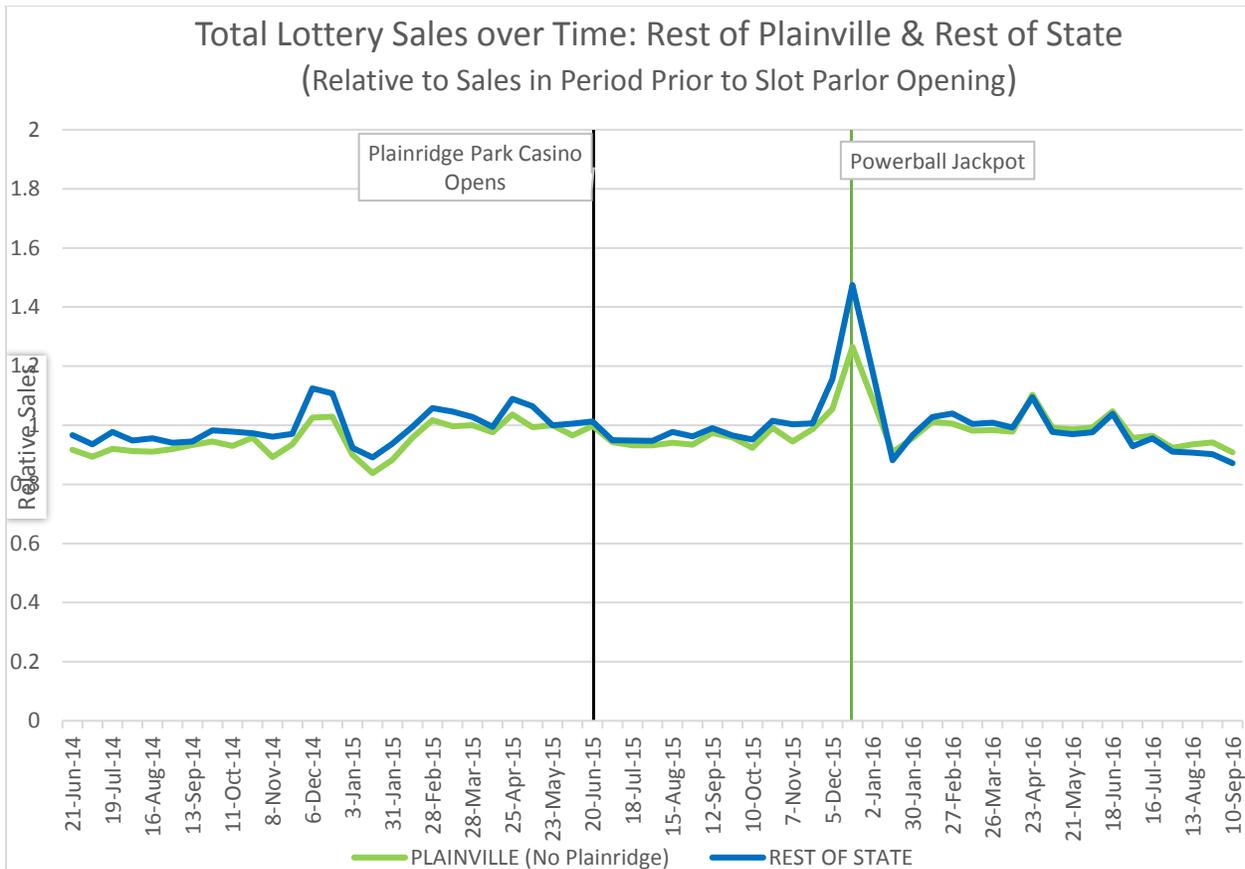
**Figure 12: Relative Bi-weekly Lottery Revenue over Time by PPC, Other Agents in Plainville, and Rest of Massachusetts.**



Source: MA Lottery, bi-weekly sales relative to two-week period prior to opening (June 7-June 20, 2015), nominal dollars. Thus, a value of 1 implies that sales during that period were equal to sales during June 7-20. A value greater than 1 represents higher sales, less than 1 lower sales. Sales at Plainridge Park Casino increase approximately four-fold. Sales at other agents in Plainville do not decline and follow pattern exhibited by the rest of Massachusetts.

Figure 14 excludes the relative sales of Plainridge Park Casino allowing more detailed examination of relative sales for other agents in Plainville compared to relative sales for the rest of the state. Relative sales at other agents in Plainville (excluding Plainridge Park Casino) follow a similar trend to agents in the rest of Massachusetts. Prior to the casino opening, relative sales for other agents in Plainville are slightly higher than the rest of the state, whereas after the casino opening they are more similar, indicating sales for other agents in Plainville did not increase as fast as other agents in Massachusetts. There is no evidence, however, of a notable decline in sales at other agents in Plainville. A DID analysis, not reported here in order to ensure the confidentiality of sales at Plainridge Park Casino, confirms that average bi-weekly sales at other agents increased less than the rest of Massachusetts, but that the difference is not statistically significant.

**Figure 13: Relative Bi-weekly Lottery Revenue Over Time for Other Agents in Plainville and the Rest of Massachusetts**



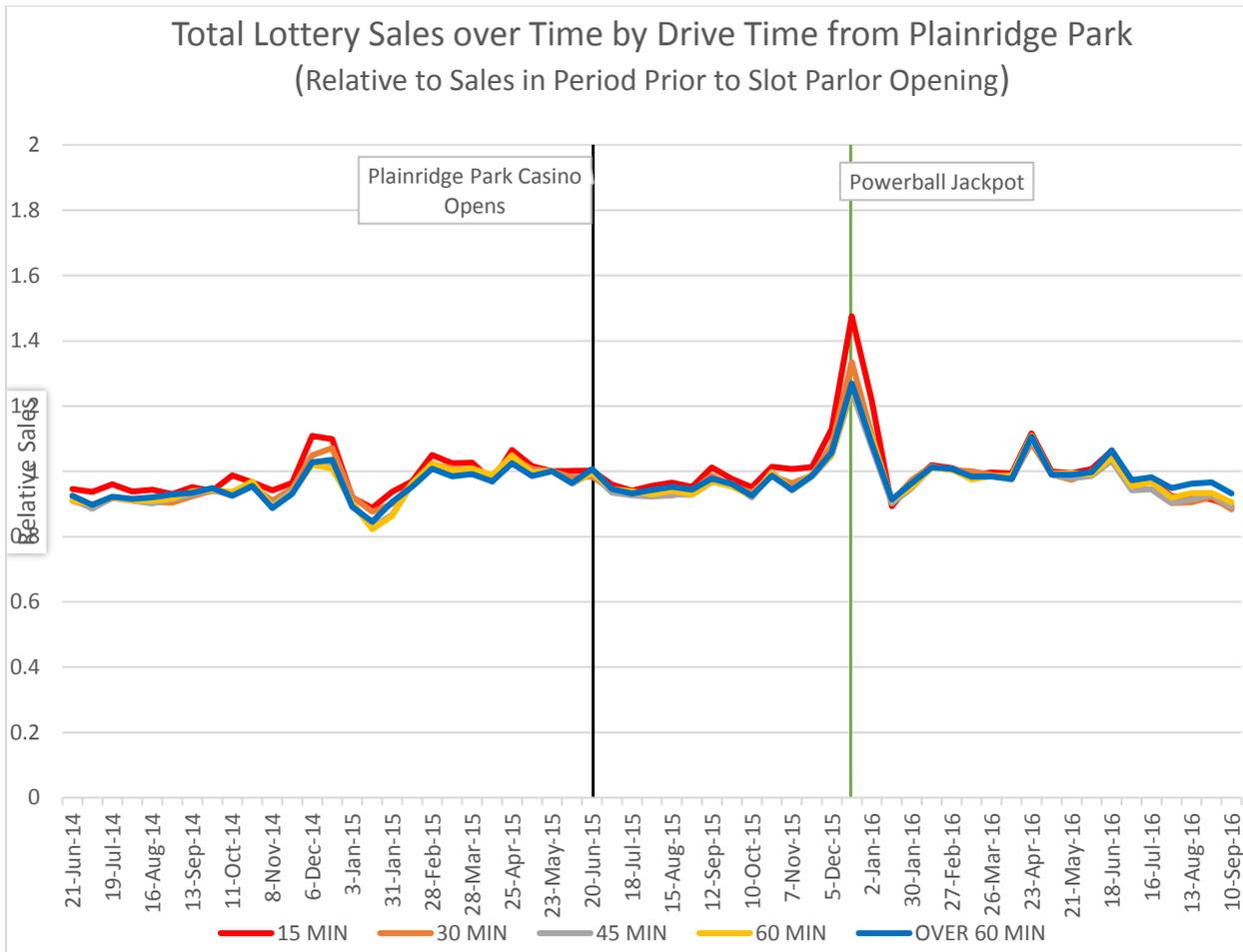
Source: MA Lottery, bi-weekly sales relative to two-week period prior to opening (June 7-June 20, 2015), nominal dollars. Relative sales at other agents in Plainville follow a similar trend as relative sales of other agents in Massachusetts. Relative sales at other agents in Plainville generally slightly above relative sales for other agents in Massachusetts prior to the casino opening and are more similar after the casino opening.

### Drive Time Analysis

The analysis for host and surrounding communities suggests that lottery sales at Plainridge Park Casino significantly increased. Sales at other agents in Plainville and agents in the MGC-designated surrounding communities, on average, increased more slowly than the rest of the state but the difference is not statistically significant.

Figure 15 illustrates relative bi-weekly sales for agents within various drive-time distances of Plainridge Park Casino. Plainridge Park Casino is included in the 15 MIN category, which includes all agents open during the entire sample period between a 0 and 15 minute drive time from Plainridge Park Casino. The 30 MIN category includes all agents open during the entire sample period that are a 16-30 minute drive time from Plainridge Park Casino, etc. Reaffirming the community analysis, relative bi-weekly sales patterns are very similar by drive distance. Relative sales (sales relative to the two-week period prior to opening) for all drive distances follow similar trends, both before and after the casino opening. An adverse impact on lottery sales from the opening of Plainridge Park Casino would likely occur among agents closer to the casino. There is no visual evidence of that in Figure 15.

**Figure 14: Relative Bi-weekly Lottery Revenue Over Time for Agents at Various Distances from PPC**



Source: MA Lottery, bi-weekly sales relative to two-week period prior to opening (June 7-June 20, 2015), nominal dollars. The category 15 MIN includes all agents within 15 minutes of Plainridge Park Casino, including Plainridge Park Casino. 30 MIN represents agents 16-30 minutes away from Plainridge Park Casino, etc. Relative sales for all distances follow a similar trend, showing no sign of a different or adverse impact after the casino opened.

### **Difference-in-Differences Analysis by Drive Time**

Tables 3 and 4 present DID analysis for agents within 15 minutes' drive of Plainridge Park Casino and agents 16-30 minutes from Plainridge Park Casino. For this analysis, we exclude Plainridge Park Casino. This is done because we have already seen that sales at Plainridge Park Casino increased significantly and we are interested in whether any adverse impact was felt by other agents. Similar to the results for the surrounding communities, Table 3 demonstrates that average bi-weekly sales for agents within a 15 minute drive of the slot parlor increased more slowly than agents more distant from the casino. Specifically, average bi-weekly sales for agents within 15 minutes increased by \$134, an increase that is not statistically significant. Average bi-weekly sales for other agents in the state increased by a statistically significant \$1,000. The difference in the average bi-weekly sales, \$-865, however, is not statistically significant. This overall conclusion does not change if Plainridge Park Casino is included.

When including Plainridge Park Casino, the increase for agents within a 15 minute drive is still below the rest of Massachusetts and not statistically significant. The difference is not statistically significant either.

**Table 3: Difference-in-Differences Analysis of Average Bi-weekly Lottery Sales Per Agent Within 15 Minute Drive of PPC vs. Rest of Massachusetts**

	Before Plainridge Park Casino	After Plainridge Park Casino	Difference <sup>a</sup>
Agents within 15 Minute Drive of Plainridge Park <sup>b</sup>	23,104.17 (307.08)	23,239.08 (288.20)	134.91 (422.70)
Rest of State	27,003.71 (73.55)	28,004.07 (69.18)	1000.36*** (101.37)
Difference in Differences			-865.45 (601.78)

<sup>a</sup>A \*, \*\*, and \*\*\* represent statistical significance at the 10, 5, and 1 percent level, respectively. Only agents open over the whole sample period.

<sup>b</sup>Excluding Plainridge Park Casino

*Source: MA Lottery, average bi-weekly sales per agent, 6/15/2014-6/20/2015 compared to average bi-weekly sales per agent 6/21/2015-10/1/2016. Sales for Plainridge Park Casino are excluded from this analysis in order to examine whether other agents experienced adverse impacts. Average bi-weekly sales for agents within 15 minutes of Plainridge Park Casino increased by \$134, an increase that is not statistically significant. Average bi-weekly sales for agents further from the casino increased, on average, by \$1,000. The difference, however, is not statistically significant.*

Table 4 compares agents within a 16-30 minute drive of the casino with agents at a greater distance. Thus, agents within a 0-15 minute drive are not included in the rest of Massachusetts. This was done to be consistent with Table 3 where agents within 15 minutes of the casino were compared with agents more distant.

After the casino opened, average bi-weekly sales for agents within a 16-30 minute drive of Plainridge Park Casino increased a statistically significant \$770. Agents more distant from the casino also experienced a statistically significant increase, on average, of \$1,024. The difference in the change, \$-253, is not statistically significant.

**Table 4: Difference-in-Differences Analysis of Average Bi-weekly Lottery Sales Per Agent Within 16-30 Minute Drive of PPC vs. Rest of Massachusetts**

	<b>Before Plainridge Park Casino</b>	<b>After Plainridge Park Casino</b>	<b>Difference<sup>a</sup></b>
Agents within 30 Minute Drive of Plainridge Park	25,678.17 (236.00)	26,448.57 (222.36)	770.40** (325.58)
Rest of State <sup>b</sup>	27,141.69 (77.39)	28,165.98 (72.78)	1,024.29*** (106.66)
Difference in Differences			-253.89 (346.87)

<sup>a</sup>A \*, \*\*, and \*\*\* represent statistical significance at the 10, 5, and 1 percent level, respectively. Only agents open over the whole sample period.

<sup>b</sup>Does not include agents within 15 minute drive. Results not sensitive to this restriction (D in D equals -241.70).

*Source: MA Lottery, average bi-weekly sales per agent, 6/15/2014-6/20/2015 compared to average bi-weekly sales per agent 6/21/2015-10/1/2016. Agents within a 15 minute drive are not included in the Rest of State. Average bi-weekly sales for agents that are a 16-30 minute drive from Plainridge Park Casino increased, on average by \$770, whereas more distant agents increased \$1,024. Both increases are statistically significant, but the difference between the changes is not.*

Results for agents 31-45 minutes, not separately reported, reveal a similar pattern. Average bi-weekly sales increase \$839 versus \$1,106 for agents that are more distant. The difference, \$-267, is not statistically significant.

## Summary and Future Work

The results presented above demonstrate that nominal lottery revenue (i.e., not adjusted for inflation) has annually increased, beginning in 2012. The introduction of casino gambling in Massachusetts may adversely impact lottery revenues if casinos are a substitutable form of gambling. The above results indicate that the introduction of Plainridge Park Casino did not cause lottery expenditures to decline statewide or, on average, in MGC-designated surrounding and nearby communities.

Statewide lottery revenue grew 4.3% in FY 16, a time period that nearly corresponds to the first full year of operation of Plainridge Park Casino, which opened June 24, 2015. This rate of growth exceeds the historical average of 1.7% and is the second highest rate of growth since 2012. Lottery revenues for the city of Plainville increased 25% in the year after the casino opened relative to the prior year. Much of this increase occurred at Plainridge Park Casino where sales increased nearly four-fold compared to sales prior to the casino opening.

Sales for lottery agents in the surrounding communities of Attleboro, Foxborough, Mansfield, North Attleborough, and Wrentham, *collectively*, and for agents within a 15 minute drive of Plainridge Park Casino (excluding the casino) did not decline following the opening of the new casino. However, while sales for these areas collectively did not decrease, sales did grow more slowly.

There are two important qualifiers to be added. One, as demonstrated above, differences in the change in lottery revenue between agents that are closer to the casino relative to the rest of Massachusetts are not statistically significant. Thus, we cannot say with statistical confidence that the lower growth in lottery revenue for agents near the casino is lower than the rest of the state. Two, the impact in the surrounding communities is not symmetric. As shown above, total year-over-year lottery sales in Attleboro and Mansfield increased slightly more than the state average, but sales in Foxborough, North Attleborough, and Wrentham declined, with Foxboro declining the most at approximately 2.3%, while North Attleborough and Wrentham each declined less than one percent. In aggregate, however, total lottery sales increased. Whether the casino had differential impacts on the surrounding communities cannot be determined, but there is no evidence to suggest that the casino had widespread negative impacts on surrounding lottery agents.

It is important to keep in mind that the post-casino period of July, 2015 to October, 2016 is relatively short and should not be interpreted as representative of longer term impacts. The above results may change as more time elapses. If surrounding communities continue to grow more slowly over time the difference between them and the rest of the state may become statistically significant. Moreover, the slot parlor at Plainridge Park is a different scale compared to the other casinos scheduled to open in Massachusetts, which will be larger and include more non-casino amenities. The above results may not foreshadow results for the casino openings in Springfield or Everett.

Going forward, the Massachusetts Lottery has graciously agreed to continue to provide us agent-specific data. This will allow us to analyze the impact of Plainridge Park Casino over time and also provides extended baseline data for Springfield and Everett and their various surrounding communities. This will include the MGC-designated surrounding communities and communities within various distances from the casinos. We will also continue to analyze data on a calendar year and fiscal year basis by town.

Determining the longer term impact that casinos have on lottery revenues will, by definition, take time. To provide insight into what the impact might be, however, we have gathered data on lottery sales in

Pennsylvania and Ohio both of which have lotteries and opened casinos in 2007 and 2012, respectively. Both states experienced initial declines in lottery sales in the first year after casinos opened (see Appendix A). Lottery revenue in Ohio recovered after the first year. Pennsylvania lottery revenue took longer to recover, but it is difficult to disentangle the effects of the recession from the opening of casinos in that state. As noted above, Pennsylvania's Legislative and Budget Committee initially noted that lottery sales in host counties were below non-host counties, but later concluded that the impact of casinos was negligible. We will continue to gather data for these states as it becomes available.

### **Charity Gaming**

Charity gaming consists of Bingo games, raffles, charity game tickets, and casino functions. Calendar year 2015 gross receipts were \$57,976,236, derived from Bingo games (47.5%), raffles (30%), charity game tickets (22%), and casino functions (0.5%).<sup>11</sup> Charity gaming has generally been declining every year in Massachusetts. For example, Bingo gross receipts were \$88,208,825 for calendar year 2003, but declined to \$27,581,036 in calendar year 2015. Attleboro is the only MGC-designated surrounding community with any charity gaming, so an analysis of the impact of the casino on charity gaming is not practical at this time. Bingo receipts in Attleboro declined 15% in calendar year 2015, but have declined at an average annual rate of approximately 11% since 2003. Given the limited time the casino has been open and that Attleboro is the only surrounding community to have charity gaming, it is not possible to determine any casino-related impacts. We will continue to gather charity gaming data and will analyze those impacts as casinos open in the future.

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<sup>11</sup> Charity Games, 2015 Annual Report, Massachusetts State Lottery Commission.  
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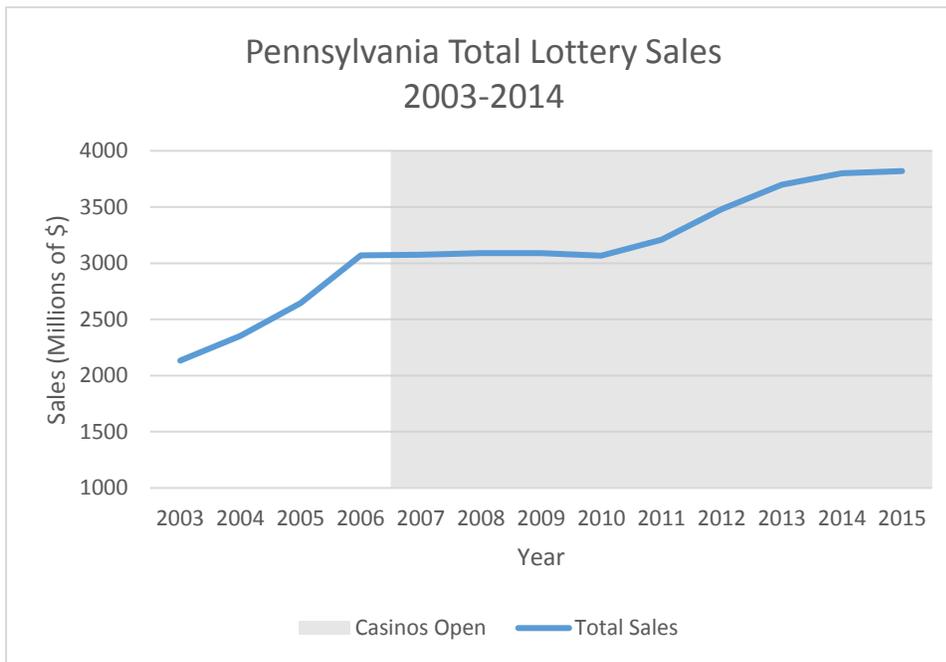
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## Appendix A

### Pennsylvania Lottery Revenue

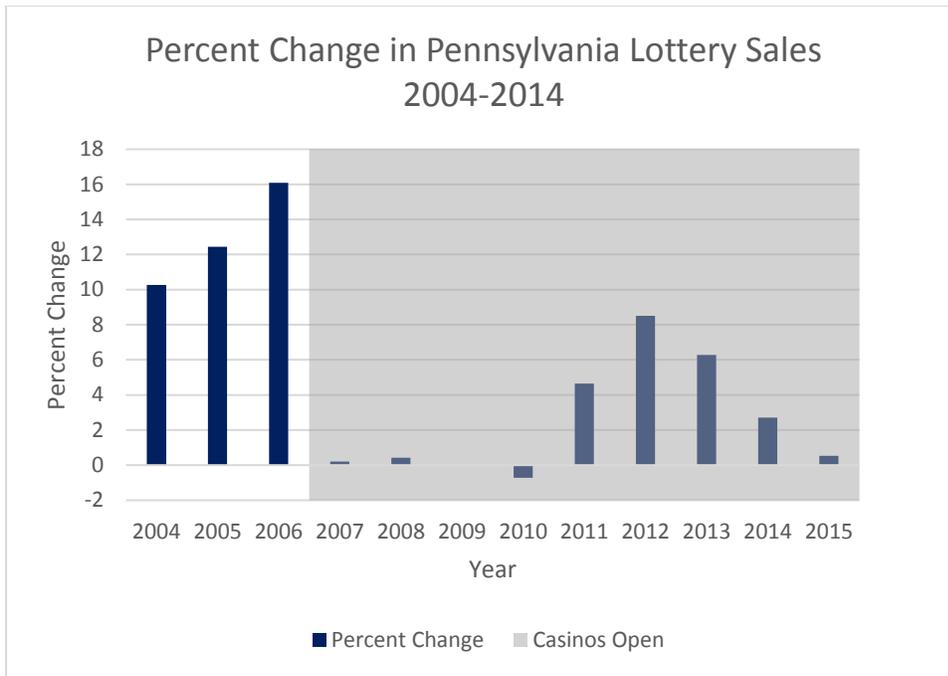
Figures A1 and A2 illustrate lottery revenue and its percentage change in Pennsylvania over the period 2003-2015. Casinos opened in Pennsylvania in 2007. Lottery revenue growth declined dramatically the year casinos opened, growing only 0.20% compared to 16% the year earlier. Revenue growth remained low through 2010 before rebounding in 2011. The years 2007-2010, however, coincide with the recession, making it impossible to determine the impact of the casino openings relative to the economic downturn. The results, however, suggest that there has been little, if any, longer-term impact on lottery revenues in Pennsylvania following the introduction of casino gambling.

**Figure A1: Pennsylvania Lottery Revenue, FY 2003-2015**



Source: Pennsylvania Lottery.

**Figure A2: Percent Change in Pennsylvania Lottery Revenue, FY 2004-2014**



Source: Pennsylvania Lottery.

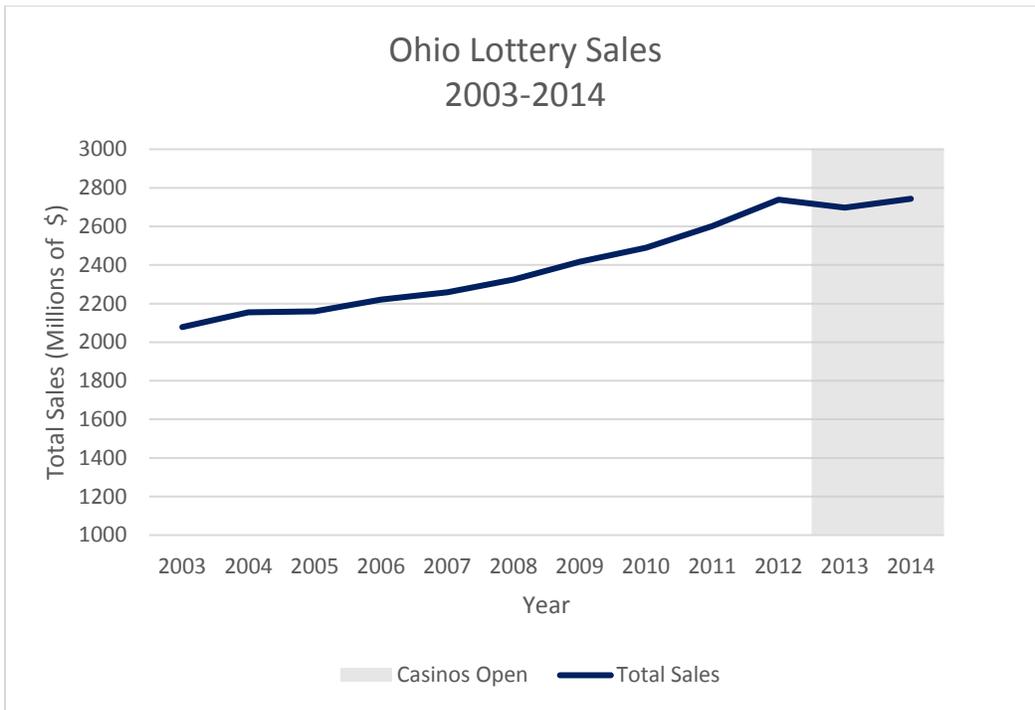
### **Ohio Lottery Revenue**

Figures A3 and A4 provide total lottery revenue and the annual percentage change for Ohio. Ohio opened four casinos beginning May 2012. This provides a useful comparison in that the casinos opened after the recession, allowing a clearer picture of the potential impact resulting from casino openings in Massachusetts. Currently, 2015 data for Ohio are not available.

The results from Ohio demonstrate that lottery revenue declined in fiscal year 2013, which would include 6 months (January-June, 2013) during which the casinos were open. In fiscal year 2014 lottery revenue growth returned, growing 1.67%.

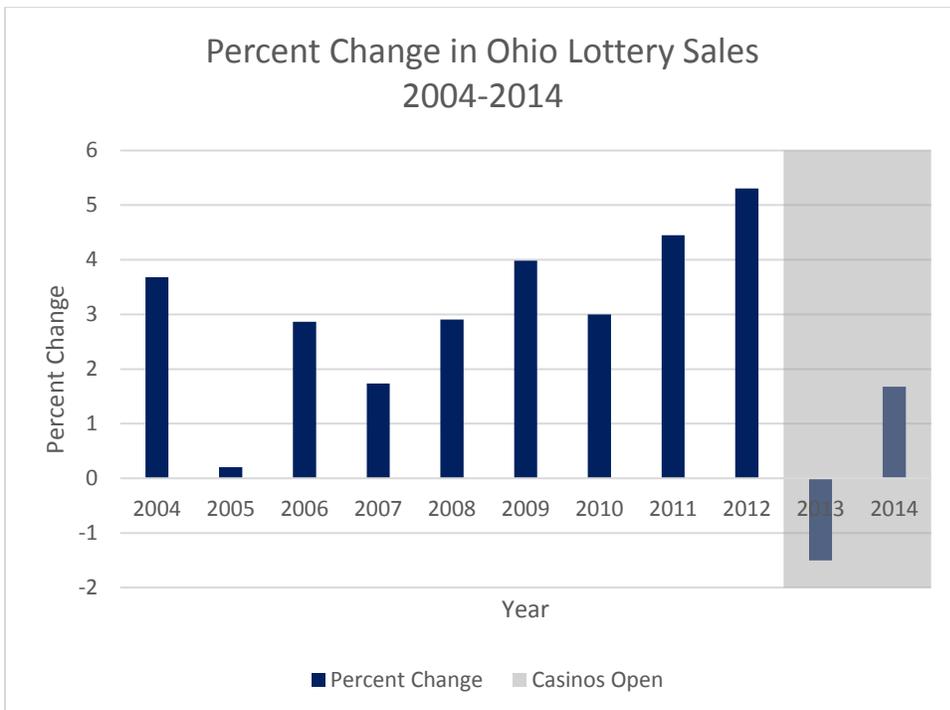
The results for Pennsylvania and Ohio suggest that the opening of casinos has a negative, but transitory impact on lottery revenue. In both states, lottery revenue initially declined after the opening of casinos but later recovered.

**Figure A3: Ohio Lottery Revenue, FY 2003-2014**



Source: Ohio Lottery

**Figure A4: Percent Change in Ohio Lottery Revenue, FY 2004-2015**



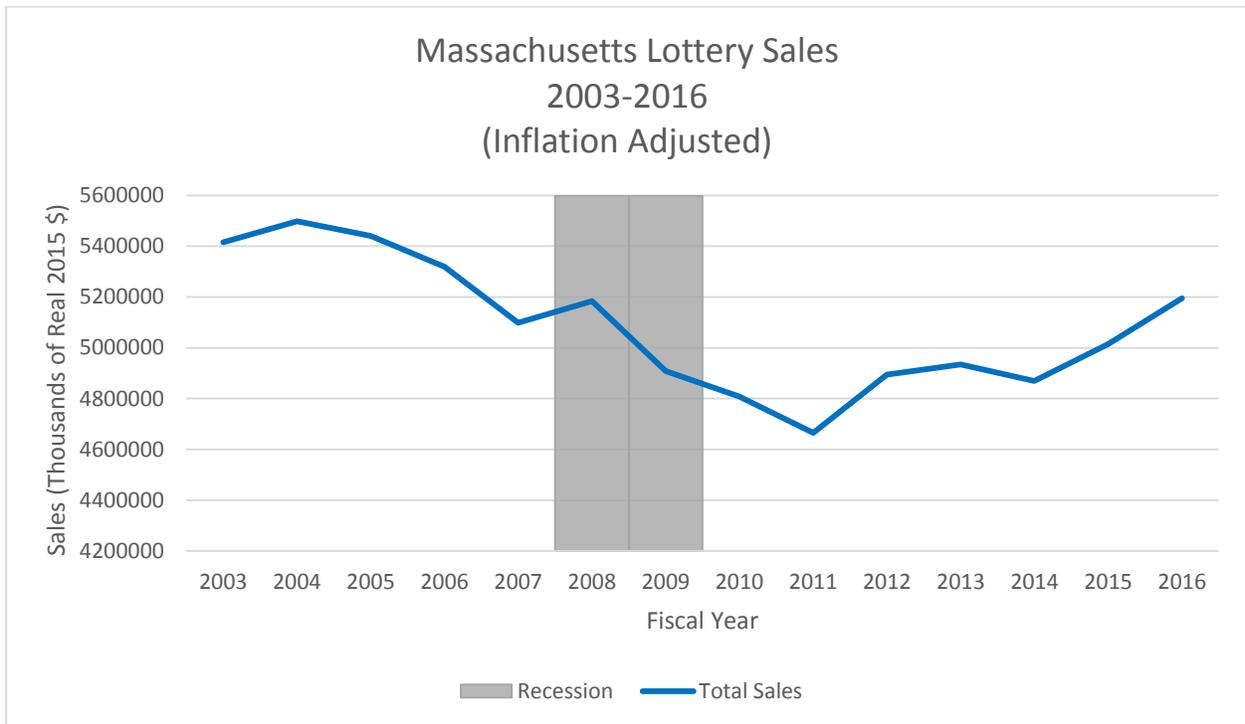
Source: Ohio Lottery.

## Appendix B

### Inflation Adjusted Lottery Sales

Figure B1 below shows total lottery revenues expressed in real 2015 dollars. Nominal dollars have been adjusted for inflation using the Bureau of Labor Statistics CPI-U, the Consumer Price Index for all Urban Consumers.

**Figure B1: Total Lottery Sales, 2003-2016 (in 2015 Dollars)**



Source: MA Lottery and Bureau of Labor Statistics.

Figure B1 shows that nominal lottery revenue growth over the period 2003 to 2016 has not kept up with inflation. The annualized inflation rate over this period was 2.13%, which exceeded the 1.70% annualized growth in nominal revenues. Nevertheless, Figure B1 demonstrates the notable decline in sales resulting from the recession and economic slowdown as well as the recovery in lottery revenues beginning in Fiscal Year 2011. In real terms, lottery revenues have recovered from the Great Recession and are approximately equivalent to real expenditures in Fiscal Year 2008.