## Cover Sheet

Event: Super Bowl XLV

Date: $\quad$ February 6, 2011
Location: Arlington, Texas
Report date: September 4, 2013

## Post Event Analysis of Super Bowl XLV

## I. Introduction

This post-event analysis is intended to evaluate the short-term tax benefits to the state through review of tax revenue data to determine the level of incremental tax impact to the state of Texas from Super Bowl XLV. A primary purpose of this analysis is to determine the reasonableness of the initial incremental tax estimate made by the Comptroller's office prior to the event. The initial estimate is included in Appendix A.

While an analysis of tax data may shed some light on tax impact, some factors must be considered when looking at tax collections data during the time of Super Bowl XLV. A winter storm blanketed the Dallas area roads in ice and some snow during the week before the Super Bowl. This may have kept some from attending the game or reduced the time they spent in the area. Also, a taxi cab strike in the area may have reduced visitors' ability to travel around and visit various retail establishments. While Texas had emerged from the recession and regained many of the jobs that were lost, visitors from outside the state may have been dealing with slower economic conditions and less disposable income to spend on travel and leisure.

Despite the challenges mentioned above, larger events, particularly "premier events" such as the Super Bowl, with heavy promotion, corporate sponsorship and spending, and "luxury" spending by visitors create larger ripples in the local economy than smaller events, and are therefore, reasonably straightforward and less problematic to evaluate than smaller events, despite the fact that the event occurred in a population center of 5 million people.

## II. Methodology

The METF statute requires the Comptroller's office to estimate the incremental increase in taxes for both the state and any municipality (or county) that contributes local matching funds. For the purposes of this analysis, staff attempted to determine if there was a measurable change in state taxes due to the event. This presents challenges for two primary reasons: the size and population of the state and the fact that taxes are remitted to the state based on receipts from $30-90$ day periods, depending on the tax type. The incremental tax increase in the state due to an event in a large and dynamic tax system may not be readily distinguishable from incremental changes due to other factors.

Also, measuring the actual incremental tax increase produced, with certainty, as a result of a particular event with accuracy requires certain information that is not readily available. The primary determinants that would be required to accurately measure the incremental increase in taxes are:

- The number of out of state visitors;
- The length of stay for those visitors; and
- The expenditures per day for those visitors.

The incremental taxes attributable to the out of state fans for the event make up the majority of the estimate (approximately $65-75 \%$ of the total estimated incremental taxes).

Since the exact number of out of state visitors, length of stay, and expenditures per day is not known, this analysis relies on overall changes in tax collections to make an informed judgment as to whether the initial estimate was reasonable.

Incremental tax impact to the state, for these purposes, is estimated by gauging exogenous or out-of-state spending. It is assumed that all attendees have limited disposable income for entertainment, and that Texas residents would likely have chosen to spend their entertainment dollars at another Texas venue or event in the absence of the Super Bowl. While it is impossible to track all out-of-state visitors and their spending habits, a noticeable increase in taxable activities points to a positive economic impact due to a major event. This analysis uses two methods for examining tax data.

Method 1 looks at the past five years of quarterly tax data to determine average collections for any given quarter for the cities that were likely most affected by the event - the 5 cities that were "endorsing municipalities" as defined by the METF program (Dallas, Fort Worth, Arlington, Irving and Grapevine). Standard deviations are calculated and if collections for the period when the Super Bowl occurred are beyond the average and standard deviation, it is assumed that an event, presumably the Super Bowl, must have pushed sales upward. The more the sales deviate from the average plus the standard deviation or outside the normal distribution, the stronger the indication of the magnitude of the impact.

Method 2 looks at only the quarter in question for the past eight years, but excludes 2010 and 2011. These two years were excluded because the quarter in question for these years included the NBA All-Star game and the event for which impact is being assessed, the Super Bowl. Since this analysis attempts to measure the impact of a major event to state tax revenues, including data from these two quarters would inflate the average and standard deviations, and is thus excluded. Based on sales subject to tax, average collections and standard deviations are calculated for the cities that were likely most affected by the event. Like the method described previously, if collections for the period when the Super Bowl occurred are beyond the average and standard deviation, it is assumed that an event, presumably the Super Bowl, must have pushed sales upward. The magnitude of the impact can be gauged by measuring the amount of state taxes collected over the average plus the standard deviation.

Both methods, while valid, will tend to be conservative because they focus on changes in state taxes attributed to the cities most affected by the event, however, under the METF, the initial estimate included state taxes for a four county market area. To have included the entire market area in this analysis would likely have over stated the results, so it is a conscious decision to err on the conservative side.

## The methodology used for this analysis focuses on direct taxes, since indirect and induced impacts are calculated using a dynamic modeling software package.

The Comptroller's Office also ran statistical tests (Appendix B) on the three tax types that generated the most revenue that could be verified (Sales and Use, Hotel Occupancy, and Mixed Beverage). The test indicated at the 99 percent confidence level that the amount subject to state tax was not normal during the period that the Super Bowl occurred and is statistically different from similar collections from the same time period in previous years. This statistical difference implies that the event may have been responsible for the difference in tax collection levels for the period.

## Analysis

The METF statute requires that the Comptroller estimate the incremental tax increase that is expected for an event for 5 specific tax types:

1. Sales and Use Tax
2. Hotel Occupancy Tax
3. Rental Car tax
4. Mixed Beverage Tax
5. Title 5, Alcoholic Beverage Code tax

Of these 5 taxes, the estimate of general Sales and Use tax, Hotel Occupancy tax (HOT), and Mixed Beverage tax are the largest verifiable tax types. In the case of the 2011 Super Bowl, the Sales and Use tax and the HOT made up roughly 56 and 21 percent respectively, while the Mixed Beverage tax made up 7 percent. Based on figures used for initial estimates, the Rental Car tax made up 15 percent and the Title 5 Alcohol tax made up less than one-half of one percent.

Rental car taxes are paid by rental car companies at the state-wide level and are not attributable to specific geographic locations. Title 5 Alcohol taxes make up a small percentage of the overall estimate and due to the small amount, any change due to a specific event is difficult to calculate. Due to these challenges involved and relatively minor amounts of rental car tax and Title 5 alcohol, this analysis uses initial estimates and does not attempt to quantify changes in these two tax types.

## II A Analysis-All Tax Types



The above chart illustrates that sales tax makes up the majority of additional estimated revenue to the state from major events. Taxes collected from sales tax, mixed beverage tax, and hotel occupancy tax make up nearly 85 percent of the funds generated by an event for the 5 specific tax types that are addressed in the statute.

The charts below depict HOT taxable receipts, mixed beverage tax allocations, and gross sales subject to state tax.

## II B Analysis--Hotel Occupancy Tax:



This graph does not represent all quarterly HOT receipts, but only those that are taxable. The dollar value that corresponds to any one quarter represents the HOT taxable receipts that are attributable to that quarter. This graph includes HOT taxable receipts for only the following five cities located in the Dallas-Fort Worth-Arlington MSA: Arlington, Dallas, Ft. Worth, Grapevine, and Irving. ${ }^{1}$ The 2010 NBA All-Star Game took place during the 1st quarter of 2010, on February 14, 2010, at Cowboys Stadium in Arlington, TX. Super Bowl XLV took place during the 1st quarter of 2011, on February 6, 2011, at Cowboys Stadium in Arlington, TX.

The average HOT taxable receipts for this area from 1Q 2002 to 4Q 2011 was $\$ 261,774,222$ with a standard deviation of $\$ 43,700,875$. The peak in the graph represents taxable receipts of $\$ 346,762,188$, which is higher than any other quarter going back to 1Q 2002. The average taxable receipts plus the standard deviation is $\$ 305,475,097$, which is $\$ 41,287,091$ less than receipts during the quarter when the Super Bowl occurred. The state hotel occupancy tax rate is six percent. This represents additional tax revenue of $\$ 2,477,225$ during this quarter.

Considering only the first quarter HOT receipts for the five aforementioned cities in the DallasFort Worth-Arlington MSA from 2002 to 2009, the average amount subject to state tax was $\$ 261,144,059$ with a standard deviation of $\$ 48,061,542$. The average taxable receipts plus the standard deviation is $\$ 309,205,601$, which is $\$ 37,556,587$ less than receipts during the quarter

[^0]when the Super Bowl occurred. This represents additional tax revenue of $\$ 2,253,395$ during this quarter.

While an analysis of tax revenues might not tell how much of this spending came from out-ofstate visitors, a comparison of other direct spending estimates, using different assumptions and methodologies, can help put these numbers into perspective. A conservative analysis of additional HOT revenues to the state was estimated to be $\$ 2,253,395$. The initial pre-event estimate had predicted $\$ 3,695,598$ in additional revenue, while a third-party post-event study estimated this figure to be $\$ 3,261,496$.

|  | Initial | Third-Party |
| :--- | :--- | :---: |
| Tax Type | Estimate | Post-Event |
| HOT | $\$ 3,695,598$ | $\$ 3,261,496$ |

Considering actual observed tax data, it could reasonably be stated that the event host city experienced positive economic activity due to this event.

## II C Analysis--Mixed Beverage Tax:

Mixed Beverage Tax Allocation for DFW Area


This graph includes only historical mixed beverage tax allocation amounts by calendar quarter. The quarterly mixed beverage tax allocation amounts correspond to the quarter in which they were distributed. These allocation amounts generally represent taxes remitted to the Texas Comptroller's Office during the calendar quarter immediately preceding the month the allocation is distributed. This graph includes allocation amounts for only the following five cities located in the Dallas-Fort Worth-Arlington MSA: Arlington, Dallas, Ft. Worth, Grapevine, and Irving. ${ }^{2}$ The 2010 NBA All-Star Game took place February 14, 2010, and is thereby represented in the allocation amount corresponding to the 2nd quarter of 2010. Super Bowl XLV took place on February 6, 2011, and is thereby represented in the allocation amount corresponding to the 2nd quarter of 2011.

The average mixed beverage tax allocation for this area from 1Q 2003 to 2Q 2012 was $\$ 3,052,110$ with a standard deviation of $\$ 363,569$. The peak in the graph represents taxable receipts of $\$ 3,783,790$, which is higher than any other quarter going back to 10 2003. The average taxable receipts plus the standard deviation is $\$ 3,415,679$, which is $\$ 368,111$ less than receipts during the quarter when the Super Bowl occurred. Since these figures are based on allocations to the local areas, it only represents a portion of what the state receives.

The next method of analysis considered mixed beverage receipts only for the month of February for the five aforementioned cities in the Dallas-Fort Worth-Arlington MSA from 2002 to 2009. The average taxable receipts, which are 14 percent of gross receipts, were $\$ 8,358,064$ with a standard deviation of $\$ 1,071,194$. The average taxable receipts plus the standard deviation is $\$ 9,429,259$ which is $\$ 2,235,907$ less than receipts during the month when the Super Bowl occurred. The state gets roughly 79 percent of taxable receipts. This represents additional revenue of $\$ 1,766,367$ during the month of the Super Bowl.

A conservative analysis of mixed beverage revenues estimated that the state received an additional $\$ \mathbf{1}, \mathbf{7 6 6}, \mathbf{3 6 7}$. The initial pre-event estimate had predicted $\$ 1,211,022$ in additional revenue, while a third-party post-event study estimated this figure to be $\$ 1,405,134$.

|  | Initial <br> Estimate | Third-Party <br> Post-Event |
| :--- | :--- | :---: |
| Mixed Beverage | $\$ 1,211,022$ | $\$ 1,405,134$ |

Considering actual observed tax data, it could reasonably be stated that the event host city experienced positive economic activity due to this event.

[^1]Gross Sales Subject to State Tax in DFW Area


The graph above is the sum of taxable sales within the following 2-digit North American Industry Classification System (NAICS) code categories: NAICS code 72 (Accommodation \& Food Services Industry); NAICS code 71 (Arts, Entertainment, \& Recreation Industry); and NAICS codes 44-45 (Retail Trade Industry). This graph includes sales amounts for only the following five cities located in the Dallas-Fort Worth-Arlington MSA: Arlington, Dallas, Ft. Worth, Grapevine, and Irving. The graph includes data only from holders of sales tax permits; businesses that sell only goods that are outside the sales tax base are not covered by these reports. A business that files yearly reports will show up only in a single quarter. ${ }^{3}$ The 2010 NBA All-Star Game took place during the 1st quarter of 2010, on February 14, 2010, at Cowboys Stadium in Arlington, TX. Super Bowl XLV took place during the 1st quarter of 2011, on February 6, 2011, at Cowboys Stadium in Arlington, TX. The peak in this graph actually occurs in the quarter preceding the Super Bowl (4Q 2010), presumably due to holiday spending.

The average amount subject to sales tax for this area from 1Q 2002 to 3Q 2011 was $\$ 4,584,414,883$ with a standard deviation of $\$ 422,597,796$. The amount subject to sales tax in the quarter during the Super Bowl was $\$ 4,763,300,736$, which is $\$ 243,711,943$ less than the sum of the average amount subject to sales tax and the standard deviation.

[^2]Another analysis of sales tax data that looks at only the first quarter of each year illustrates a slightly different picture. Average collections subject to sales taxes for the industries mentioned above for the first quarter of each year (from 2002 to 2009) were averaged for the same cities mentioned above. Average collections subject to sales taxes for the first quarter were $\$ 4,219,443,128$ with a standard deviation of $\$ 350,857,683$. The average plus the standard deviation is $\$ 4,570,300,811$. Collections subject to sales taxes for the first quarter 2011 were $\$ 4,763,300,736$, which is $\$ 192,999,925$ more than the average plus the standard deviation. At the state sales tax rate ( $6.25 \%$ ), this amounts to an additional $\$ 12,062,495$ to the state as a result of increased sales.

While there clearly was increased sales tax revenue collected during the same time an event occurred in a given area, the increase is almost certainly not all due to one major occurrence. A conservative method of analysis estimates that the state of Texas received $\mathbf{\$ 1 2 , 0 6 2 , 4 9 5}$ additional sales tax dollars from the DFW MSA during the first quarter of 2011. A pre-event analysis estimated that the state would receive an additional $\$ 9,630,912$ in sales and use tax due to the Super Bowl. A third-party post-event study conducted for the North Texas Super Bowl XLV Host Committee estimated that direct event spending would lead to an additional $\$ 11,121,217$ in sales and use taxes for Texas.

| Tax Type | Initial <br> Estimate | Third-Party <br> Post-Event |
| :--- | :--- | :--- |
| Sales and <br> Use | $\$ 9,630,912$ | $\$ 11,121,217$ |

Considering actual observed tax data, it could reasonably be stated that the event host city experienced positive economic activity due to this event.

## II E Analysis--Rental Car Tax:

The state of Texas imposes a tax on motor vehicle rentals, but the rate is based on the length of the rental contract. For contracts of 1-30 days, the state rate is 10 percent of gross receipts less discount and separately stated fees for insurance, fuel, and damage assessments. Because of how this tax is reported, it is a little different than the previously discussed tax types.

Unlike the other tax types, rental car tax is not reported to the Comptroller by location address. For example, if a corporate taxpayer has multiple locations in the state, they file one return for all gross rental tax. Taxpayers do not report to the Comptroller's Office based on location and the Comptroller's Office does not permit the taxpayer based on each location. For this reason, an examination of this tax type by location provides no useful data for these analyses.

In order to provide a complete estimate of direct-spending tax revenue from this tax type, the CPA initial estimate number was used for this post-event analysis.

|  |  |  |
| :--- | :--- | :--- |
| Tax Type | Initial <br> Estimate | Third-Party <br> Post-Event |
| Rental Car | $\$ 2,594,981$ | $\$ 1,868,091$ |

## II F Analysis--Title V Alcoholic Beverage Code Tax:

The state of Texas also imposes a tax on the amount of alcohol that manufacturers sell to retail establishments. The tax rate varies by class on the amount of alcoholic content of beverages by class per gallon. Distilled spirits are taxed at the highest rate at $\$ 2.40$ per gallon, while beer that is $4 \%$ and lower is taxed at $\$ 0.193548$ per gallon.

While wholesalers are not reporting wholesale alcohol sales by location, they do submit how much volume they sold to retail establishments. Determining how much volume each retail establishment in the DFW area purchased for each class of alcohol, then deriving how much tax was paid based on the volume and class would be extensive. Therefore, given how much state revenue is derived from this tax type (less than one-half of one-percent of the total of all taxes collected for this analysis) comparative to the other tax types, for the purpose of this analysis, the initial estimate was used.

| Tax Type | Initial <br> Estimate | Third-Party <br> Post-Event |
| :--- | :--- | ---: |
| Not |  |  |
| Title V ABC | $\$ 73,395$ | calculated |

## III. Conclusion

1. Third-Party Post-Event Study

Post event analysis conducted by SPORT\$IMPACTS estimated economic impact based on direct spending and multiplier effects. Based on their analysis, they estimated that the total impact to the state of Texas was $\$ 28,474,936$ in additional revenues. It was estimated that total direct state taxes would increase by $\$ 17,845,377$ due to the event with a multiplier effect adding an additional $\$ 10,629,559$.

## 2. Comptroller Analysis

The Comptroller estimate prior to the event was $\mathbf{\$ 2 6 , 8 5 6 , 9 5 0}$.
Data suggest that the Dallas-Fort Worth-Arlington metro area experienced significant increased economic activity during Super Bowl XLV. The amount of additional tax revenue that the agency estimated after this post event analysis does not significantly differ from the 3rd party estimate contracted by the North Texas Super Bowl Committee. This office concludes that the initial estimate of direct, indirect, and induced tax impact of $\mathbf{\$ 2 6 , 8 5 6 , 9 5 0}$ is reasonable and most likely slightly conservative.

## APPENDIX A

The tables below show the various tax types and the additional revenue amount estimates. The first table illustrates the three largest verifiable tax revenue generators and the amount estimated by three different analyses. The last three tables show the analysis of additional revenue to the state from all 5 tax types as estimated by three different methods. All tables in this appendix are state share only, and direct taxes only.

| Tax Type | Initial Estimate | 1Q 2011 <br> Actual <br> minus 1Q <br> Average <br> and <br> Standard <br> Deviation <br> (2002-09) | Third-Party Post-Event |
| :---: | :---: | :---: | :---: |
| Sales and Use | \$9,630,912 | \$12,062,495 | \$11,121,217 |
| HOT | \$ 3,695,598 | \$2,253,395 | \$3,261,496 |
| Mixed Beverage | \$ 1,211,022 | \$1,766,367 | \$1,405,134 |
| Total | \$14,537,532 | \$16,082,257 | \$15,787,847 |


| Initial Analysis (Pre-event) |  |  |
| :--- | ---: | ---: |
| Tax Type | State Share of <br> Tax | Percent <br> of Total |
| 1. Sales and Use Tax | $\$ 9,630,912$ | $56 \%$ |
| 2. Hotel Occupancy Tax | $\$ 3,695,598$ | $21 \%$ |
| 3. Rental Car tax | $\$ 2,594,981$ | $15 \%$ |
| 4. Mixed Beverage Tax | $\$ 1,211,022$ | $7 \%$ |
| 5. Title 5, Alcoholic <br> Beverage Code tax | $\$ 73,395$ | $0 \%$ |
| Total | $\$ 17,205,908$ | $100 \%$ |


| 1Q 2011 Actual minus 1Q Average and Standard |  |  |
| :--- | ---: | ---: |
| Deviation (2002-09) |  |  | Tax Type | State Share of <br> Tax |  | Percent <br> of Total |
| ---: | ---: | ---: |
| 1. Sales and Use Tax | $\$ 12,062,495$ | $64 \%$ |
| 2. Hotel Occupancy Tax | $\$ 2,253,395$ | $12 \%$ |
| 3. Rental Car tax* | $\$ 2,594,981$ | $14 \%$ |
| 4. Mixed Beverage | $\$ 1,766,367$ | $9 \%$ |


| Tax** |  |  |
| :--- | ---: | ---: |
| 5. Title 5, Alcoholic <br> Beverage Code tax* | $\$ 73,395$ | $0 \%$ |
| Total | $\$ 18,750,633$ | $100 \%$ |

*Initial estimate used due to how this tax is reported. See
"Analysis" section (II E and II F) for further explanation.
**State share was derived using Gross Collections for February (2002-09); not quarterly

Historical averages and standard deviations were calculated and subtracted from 2011 actual figures. The tax rate was then applied to the difference to arrive at the "State Share of Sales Tax" figure.

| \$portsimpact\$ |  |  |
| :--- | ---: | ---: |
| Tax Type | State Share of <br> Tax | Percent <br> of Total |
| Sales and Use Tax | $\$ 11,121,217$ | $63 \%$ |
| HOT | $\$ 3,261,496$ | $18 \%$ |
| Rental Car | $\$ 1,868,091$ | $11 \%$ |
| Mixed Bev | $\$ 1,405,134$ | $8 \%$ |
| Title 5 Alcohol |  |  |
| Total | $\$ 17,655,938$ | $100 \%$ |

## APPENDIX B

Given the historical amount subject to state tax, is it statistically feasible that Super Bowl XLV caused the observed increase in taxable sales? A single sample test of hypothesis was conducted to answer this question. The steps used in conducting these tests for each tax type are as follows:

## Sales and Use Tax:

1. Stating the hypothesis:
a. Null Hypothesis (Ho): The increase in the amount subject to state tax in the Dallas—Fort Worth—Arlington MSA during the time of the Super Bowl is equal to what would have been expected.
b. Alternative Hypothesis (Ha): The increase in the amount subject to state tax in the Dallas-Fort Worth—Arlington MSA during the time of the Super Bowl is not equal to what would have been expected.
2. Level of Significance (probability of rejecting Ho when it is true): According to Lind, Marchal and Wathen ${ }^{4}$, it is traditional to use the following levels of significance for the following types of studies:
a. $0.1(10 \%)$ for political polling;
b. $0.05(5 \%)$ for consumer research projects; and
c. 0.01 (1\%) for quality assurance.

For the purpose of this analysis, we use the 0.01 ( $1 \%$ level) of significance. This means that we want to be $99 \%$ confident that the Ho would not be rejected if it is true.
3. Test Statistic: 2-tailed, t-test is used to test for a population mean when the sample size is small.
4. Decision Rule: Reject Ho if the estimated $t$ value ( $t^{*}$ ) is less than -3.250 or greater than 3.250.
5. Test

| Sales and Use Tax | Are observed tax <br> collections <br> statistically <br> probable? | Using Nominal <br> Values |
| :--- | :---: | :---: |
|  | Null (Ho) | $\mathrm{u}=\$ 4.3$ Billion |
|  | Alternative (Ha) | u not = \$4.3 Billion |
| Level of Significance (Confidence Interval) |  | 0.01 (99\%) |
| Statistical Test = 2-tailed t-test |  |  |
| Decision Rule | Reject Ho if | $\mathrm{t}^{*}<-3.250$ |
|  |  | $\mathrm{t}^{*}>3.250$ |

[^3]| Estimated $\mathrm{t}=$ | $\mathrm{t}^{*}$ | 4.059806137 |
| :---: | :---: | :---: |
| Action (result) | Reject Ho |  |
| Based on the test, the actual collections subject to state tax for the period in <br> question is not statistically probable. This means that the sales and use tax <br> collected for the period is not normally seen given historical data. |  |  |

## Hotel Occupancy Tax (HOT):

1. Stating the hypothesis:
a. Null Hypothesis (Ho): The increase in the amount subject to state tax in the Dallas-Fort Worth-Arlington MSA during the time of the Super Bowl is equal to what would have been expected.
b. Alternative Hypothesis ( Ha ): The increase in the state share of revenue in the Dallas-Fort Worth—Arlington MSA during the time of the Super Bowl is not equal to what would have been expected.
2. Level of Significance (probability of rejecting Ho when it is true): According to Lind, Marchal and Wathen ${ }^{5}$, it is traditional to use the following levels of significance for the following types of studies:
a. $0.1(10 \%)$ for political polling;
b. 0.05 (5\%) for consumer research projects; and
c. $0.01(1 \%)$ for quality assurance.

For the purpose of this analysis, we use the 0.01 ( $1 \%$ level) of significance. This means that we want to be $99 \%$ confident that the Ho would not be rejected if it is true.
3. Test Statistic: 2-tailed, t -test is used to test for a population mean when the sample size is small.
4. Decision Rule: Reject Ho if the estimated $t$ value ( $\mathrm{t}^{*}$ ) is less than -3.250 or greater than 3.250 .
5. Test

| Hotel Occupancy Tax (HOT) | Are observed tax <br> collections <br> statistically <br> probable? | Using Nominal <br> Values |
| :---: | :---: | :---: |
|  | Null (Ho) | $\mathrm{u}=\$ 271$ Million |
|  | Alternative (Ha) | u not $=\$ 271$ <br> Million |
| Level of Significance (Confidence Interval) |  | 0.01 (99\%) |
| Statistical Test = 2-tailed t-test |  |  |

[^4]| Decision Rule | Reject Ho if | $\mathrm{t}^{*}<-3.250$ |
| :---: | :---: | :---: |
|  |  | $\mathrm{t}^{*}>3.250$ |
| Estimated $\mathrm{t}=\quad$ | $\mathrm{t}^{*}$ | 4.700930899 |
| Action (result) |  |  |
| Based on the test, the actual collections subject to state tax for the period in <br> question is not statistically probable. This means that the hotel occupancy tax <br> collected for the period is not normally seen given historical data. |  |  |

## Mixed Beverage Tax:

1. Stating the hypothesis:
a. Null Hypothesis (Ho): The increase in the state share of gross receipts in the Dallas-Fort Worth-Arlington MSA during the time of the Super Bowl is equal to what would have been expected.
b. Alternative Hypothesis (Ha): The increase in the state share of gross receipts in the Dallas-Fort Worth-Arlington MSA during the time of the Super Bowl is not equal to what would have been expected.
2. Level of Significance (probability of rejecting Ho when it is true): According to Lind, Marchal and Wathen ${ }^{6}$, it is traditional to use the following levels of significance for the following types of studies:
a. $0.1(10 \%)$ for political polling;
b. 0.05 (5\%) for consumer research projects; and
c. $0.01(1 \%)$ for quality assurance.

For the purpose of this analysis, we use the 0.01 ( $1 \%$ level) of significance. This means that we want to be $99 \%$ confident that the Ho would not be rejected if it is true.
3. Test Statistic: 2-tailed, t-test is used to test for a population mean when the sample size is small.
4. Decision Rule: Reject Ho if the estimated $t$ value ( $\mathrm{t}^{*}$ ) is less than -3.250 or greater than 3.250 .
5. Test

| Mixed Beverage Tax | Are observed tax <br> collections <br> statistically <br> probable? | Using Nominal <br> Values |
| :---: | :---: | :---: |
|  | Null (Ho) | $\mathrm{u}=\$ 7$ Million |
|  | Alternative (Ha) | u not $=\$ 7$ Million |
| Level of Significance (Confidence Interval) |  | 0.01 (99\%) |

[^5]| Statistical Test $=2$-tailed t-test |  |  |
| :---: | :---: | :---: |
| Decision Rule | Reject Ho if | $\mathrm{t}^{*}<-3.250$ |
|  |  | $\mathrm{t}^{*}>3.250$ |
| Estimated $\mathrm{t}=$ | t* | 6.121317362 |
| Action (result) |  | Reject Ho |

Based on the test, the state share of gross receipts for the period in question is not statistically probable. This means that the state share of gross receipts for the mixed beverage tax for the period is not normally seen given historical data.


[^0]:    ${ }^{1}$ Hotel occupancy taxable receipt values were acquired through the Texas Comptroller's Office, and can be found by city and/or hotel at: http://aixtcp.cpa.state.tx.us/hotel/hotel qtr all srch.php.

[^1]:    ${ }^{2}$ These allocation amounts were acquired through the Texas Comptroller's Office, and can be found by city or county at: https://ourcpa.cpa.state.tx.us/allocation/MixBev.jsp.

[^2]:    ${ }^{3}$ The data for this graph were acquired through the Texas Comptroller's Office, and can be found by city, county, and NAICS Code at: https://ourcpa.cpa.state.tx.us/allocation/HistSales.jsp.

[^3]:    ${ }^{4}$ Basic Statistics for Business and Economics (5 ${ }^{\text {th }}$ Edition), McGraw-Hill Irwin.

[^4]:    ${ }^{5}$ Basic Statistics for Business and Economics (5 ${ }^{\text {th }}$ Edition), McGraw-Hill Irwin.

[^5]:    ${ }^{6}$ Basic Statistics for Business and Economics (5 ${ }^{\text {th }}$ Edition), McGraw-Hill Irwin.

