

**The Hotel Industry, Texas Stadium and
Hotel Occupancy Taxes:
A Report to the Irving Convention and
Visitors Bureau Board of Directors**

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Acknowledgment

The Center for Economic Development and Research would like to thank the staff of the Irving Convention and Visitors Bureau for their help in gathering information for this report. In addition, we extend our sincere appreciation to the hoteliers who took time from their busy schedules to talk to us and respond to our survey. Finally, we would like to thank Mr. Robert Nunez and other members of the Dallas Cowboys and Texas Stadium staffs for providing data critical to the successful completion of this project.

Executive Summary

The Board of Directors of the Irving Convention and Visitors Bureau commissioned the Center for Economic Development and Research at the University of North Texas to examine several facets of the hotel industry, Texas Stadium and hotel occupancy tax receipts in the City of Irving. The following summarizes the findings of that examination.

- Barring unforeseen major economic events, such as a national recession, the City of Irving's total hotel occupancy tax receipts will continue to grow, exceeding \$10 million per year in the year 2000 (see Table ES1).
- Based on an analysis of the impacts of the October 1987 increase in the local hotel occupancy tax rate, we expect that an increase in the current tax rate would result in a temporary, negative impact on hotel revenues. If the hotel occupancy tax rate is increased by one percentage point, we estimate that taxable revenues at Irving's hotels will decline \$27.6 million over a two-year period. Even with this decrease in taxable revenues, hotel occupancy tax receipts would increase \$2.3 million over the same two-year period (see Table ES2).
- Hoteliers responding to a series of interviews and mail surveys indicated that a one percent increase in the hotel occupancy tax would have some negative impact on their earnings. However, a two or three percent increase in the tax rate is perceived to be burdensome.
- Overall, Irving hotels enjoy impressive occupancy rates. Hoteliers attribute a substantial part of this success to the presence of D/FW Airport and the Las Colinas business district.
- The hotel industry and related spending by hotel guests generate \$234 million in economic activity in the City of Irving, support almost 6,100 local jobs and increase local personal income by \$102 million. Taxes paid by the hotels, their employees and guests add more than \$10 million to city coffers, while local school districts share \$6.8 million per year in direct and indirect property tax receipts (see Table ES3).
- The Dallas Cowboys Football Club and events held at Texas Stadium have a large impact on the Irving economy. Football team and stadium operations, combined with spending by employees and stadium visitors create \$130 million in local economic activity supporting almost 2,000 jobs and paying about \$158 million in earnings. This activity generates \$775,000 per year in city tax receipts and contributes \$630,000 per year to local school districts. Spending for lodging by out of area visitors to events at Texas Stadium adds \$3.8 million per year to room rental revenues at Irving hotels (see Table ES4).

Table ES1

Projected Hotel Occupancy Tax Receipts
(at current tax rates)

Fiscal Year	Convention & Visitors Bureau	Arts Center Operations	Theater Operations	Debt Service	Historic Preservation	City Collection Fee*	Total Projected Tax Receipts
1998	\$ 5,014,000	\$ 1,308,000	\$ 1,559,136	\$ 620,864	\$ 218,000	\$ 279,040	\$ 8,720,000
1999	5,446,400	1,420,800	1,693,594	674,406	236,800	303,104	9,472,000
2000	5,886,275	1,535,550	1,830,376	728,874	255,925	327,584	10,237,000
2001	6,320,975	1,648,950	1,965,548	782,702	274,825	351,776	10,993,000
2002	6,752,800	1,761,600	2,099,827	836,173	293,600	375,808	11,744,000
2003	7,191,525	1,876,050	2,236,252	890,498	312,675	400,224	12,507,000
2004	7,612,425	1,985,850	2,367,133	942,617	330,975	423,648	13,239,000
2005	8,063,225	2,103,450	2,507,312	998,438	350,575	448,736	14,023,000
2006	8,498,500	2,217,000	2,642,664	1,052,336	369,500	472,960	14,780,000
2007	8,933,775	2,330,550	2,778,016	1,106,234	388,425	497,184	15,537,000

* The city collection fee is included in the allocations for all entities except debt service and is based on 4 percent of the first 4 cents of the 5 cent tax.

Table ES2

Estimated Impacts of Increasing the Occupancy Tax Rate
(assumes effective date of October 1, 1998)

FY1999 – FY2000	1 % Increase (total local rate 6%)	2 % Increase (total local rate 7%)
Total hotel taxable revenues	\$ 366,581,204	\$ 338,989,348
Change from projections at current tax rate	- 27,592,156	- 55,184,312
Total city tax receipts	21,994,890	23,719,254
Change from projections at current tax rate	+ 2,286,207	+ 4,020,571

Table ES3
Economic Impacts of the Hotel Industry and Guest Spending* on the City of Irving

Description	Impact
Total economic activity	\$ 234,071,000
Total direct and indirect jobs	6,097
Total direct and indirect earnings	\$ 102,870,000
Total city tax receipts (all sources)	\$ 10,415,000
Total local school district tax receipts	\$ 6,835,000

* Includes spending for food, entertainment, transportation and retail shopping.

Table ES4
Economic Impacts* of the Dallas Cowboys and Texas Stadium on the City of Irving

Category	Impact
Total economic activity	\$ 130,527,422
Total direct and indirect earnings	\$ 157,861,000
Total direct and indirect jobs	1,979
Fiscal Impacts:	
City of Irving sales and occupancy tax receipts	\$ 600,000
City of Irving property tax receipts	\$ 175,000
Local school district tax receipts	\$ 630,000
Irving hotel revenues attributable to Texas Stadium events	\$ 3,840,000

* Includes impacts from out-of-area visitor spending, operations of the Dallas Cowboys Football Club and operations at Texas Stadium (includes retail sales of food and merchandise to area visitors).

Section 1: Introduction

The Board of Directors of the Irving Convention and Visitors Bureau commissioned the Center for Economic Development and Research at the University of North Texas to perform a series of analyses regarding several issues. The following sections report the findings of these analyses.

Section 2 of this report is a ten-year forecast of revenues that the Irving Convention and Visitors Bureau (CVB) can expect from the city's hotel occupancy taxes. Section 3 presents an analysis of the likely tax revenues the city would receive if the hotel occupancy tax were increased by one or two percent. This section also considers the impact an increase in the hotel occupancy tax would have on total revenues of Irving's hotels.

Section 4 reports the findings of an extensive survey of Irving's hoteliers seeking information on a variety of issues. The findings of this survey report hotel demographic data such as number of rooms, number of employees and total employee earnings as well as market information such as average room rates and occupancy rates. In addition, Irving's hoteliers were asked to rate the importance of specified local infrastructure, events and amenities on the local hotel market. The findings also reveal hoteliers' qualitative assessments of the potential impact of increasing the hotel occupancy tax rate.

Section 5 is an assessment of the economic impacts enjoyed by the City of Irving as a result of the presence of local hotels. This assessment includes the impacts of hotel operations as well as the broader impacts of visitor spending in the local economy.

Finally, Section 6 presents an analysis of the economic impacts of events and Texas Stadium and the Dallas Cowboys Football Club on the Dallas/Fort Worth Metroplex and

the City of Irving. Included in the analysis are estimates of the impacts of team and stadium operations as well as the impact of spending by out-of-area visitors to events at Texas Stadium.

Section 2: Ten Year Revenue Forecast

In this section we review the 10 year revenue forecast prepared for the Irving CVB by Center for Economic Development and Research staff. The projected revenues are based on anticipated receipts from the city's hotel occupancy tax. The forecasted revenue does not include any future increase in the hotel occupancy tax rate.

Data for this forecast were provided by Irving CVB staff reflecting quarterly CVB occupancy tax-based revenue receipts from October, 1983 to September 1997. Irving CVB staff adjusted the data prior to analysis to account for changes in the portion of total occupancy tax receipts distributed to the CVB.

The forecast was estimated using several different statistical methodologies. The forecasting methodologies included AutoRegressive Integrated Moving Average (ARIMA) models and three multiplicative seasonal models using differing error-minimization algorithms. (See Technical Appendix I for a more complete description of the statistical procedures used to estimate the forecasted revenues.) Each of the methodologies used in this forecast relies on historical trends, including seasonal variations, to predict future events. These methodologies are widely used in economic and business forecasts.

The results of the four forecasting methodologies were averaged to yield an estimate of quarterly receipts for 40 quarters beginning in October, 1997 inclusively. The forecast shown in Table 2.1 and Figure 2.1 reflect annualized estimates based on fiscal years running from October to September. As with any forecasting methodology, the accuracy of the revenue estimates will likely decline for the most future years in the forecast. Therefore, we advise caution when using these revenue estimates in the last 3 or four years of the forecast when making policy and budget decisions regarding the disposition of revenue generated by the hotel occupancy tax.

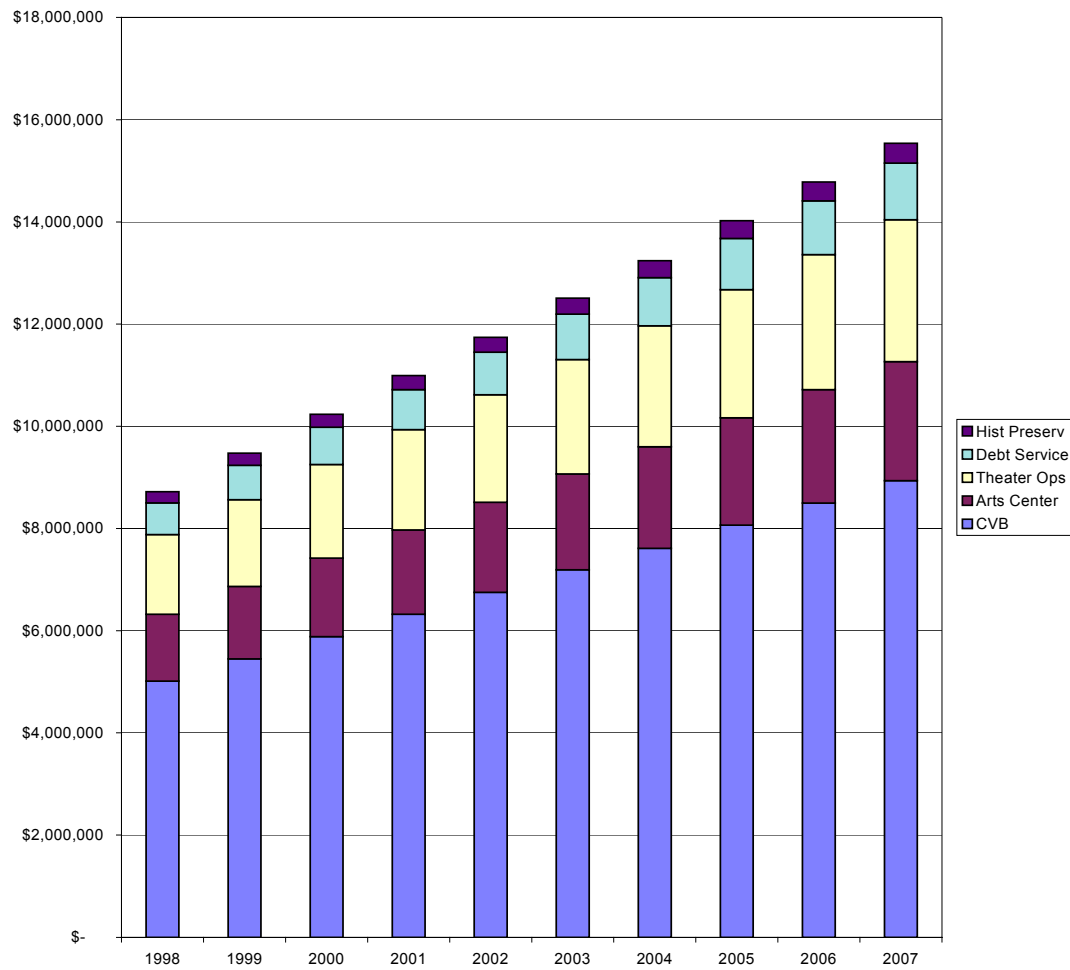
As shown in Table 2.1, 1998 total hotel occupancy tax receipt estimates will likely exceed \$8.7 million. In just two years, we expect annual receipts to exceed \$10 million. Historical trends suggest that the Irving CVB will enjoy continued increases in revenues. To the extent that growth in the development of new hotel properties may slow because of unforeseen events or economic conditions, the estimates of revenue shown below could be overstated. However, based on current construction plans for additional hotel capacity in the Irving market, and general economic conditions that will likely exist in the Dallas/Fort Worth Metroplex for the next several years, we believe our estimates to be appropriately conservative.

Table 2.1
Projected Hotel Occupancy Tax Receipts
(at current tax rates)

Fiscal Year	Convention & Visitors Bureau	Arts Center Operations	Theater Operations	Debt Service	Historic Preservation	City Collection Fee*	Total Projected Tax Receipts
1998	\$ 5,014,000	\$ 1,308,000	\$ 1,559,136	\$ 620,864	\$ 218,000	\$ 279,040	\$ 8,720,000
1999	5,446,400	1,420,800	1,693,594	674,406	236,800	303,104	9,472,000
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2005	8,063,225	2,103,450	2,507,312	998,438	350,575	448,736	14,023,000
2006	8,498,500	2,217,000	2,642,664	1,052,336	369,500	472,960	14,780,000
2007	8,933,775	2,330,550	2,778,016	1,106,234	388,425	497,184	15,537,000

Source: Center for Economic Development and Research, UNT

* The city collection fee is included in the allocations for all entities except debt service and is based on 4 percent of the first 4 cents of the 5 cent tax.

Figure 2.1**Projected Hotel Occupancy Tax Receipts
(at current tax rates)**

Section 3: Likely Impacts of Increasing the Hotel Occupancy Tax Rate

Introduction

In this section, the potential impact of increasing the hotel occupancy tax rate by either one or two percent on room charges is estimated. We begin the analysis by reviewing a sample of the relevant professional literature. Following the literature review, we present an empirical analysis of the impact of the last occupancy tax hike in the City of Irving. We conclude with a discussion of the likely impacts that a one or two percent increase in the hotel occupancy tax rate is likely to have on overall receipts.

Literature review

Historically, hotel occupancy taxes have been viewed as an excellent source of local revenue because the tax is seen to be borne largely by non-residents of the local community and the demand for hotel rooms is usually considered to be relatively inelastic. Inelastic demand means that consumers of hotel rooms don't alter their purchase decision (i.e. travel plans) due to small changes in prices. Obviously, this phenomenon is greatly dependent on local destination travel characteristics as well as the type of traveler frequenting local hotels and motels. For example, some communities are travel destinations for conventions (Dallas), some serve local business locations (Irving), and other communities attract tourists (San Antonio). In reality, many communities attract visitors that fall into more than one of these categories (Orlando, Las Vegas).

Usually, tourism travel has been considered more elastic – more price sensitive – than either convention or business travel. However, in the mid- to late-1980s empirical research began to show that ALL visitors are much more price-sensitive than previously thought (Mak,

1988). Among travel professionals, the most widely cited example of increases in hotel occupancy taxes negatively affecting hotel revenues is the state hotel occupancy tax introduced by New York in 1990.

Wanting to focus the incidence of a tax increase on business and upper-income pleasure travelers, New York imposed a 5 percent occupancy tax on hotel room rentals that exceeded \$100 per night. (Some travel industry experts observe that virtually every “decent” hotel room in New York City and surrounding areas costs at least \$100 per night.) While the rate increase did result in higher occupancy tax receipts, the total number of room rentals declined as well as tax receipts on travel-related expenditures other than hotel rooms. As observed by Glenn (1993): “The state’s strong international travel market is the only factor that saved it from even worse results.” Total losses in the hotel industry attributable to the tax rate increase were severe enough that in June of 1994, the entire five percent tax rate increase was repealed. Moreover, the City of New York simultaneously lowered its hotel occupancy tax rate by 1 percent.

In 1992, Hiemstra and Ismail conducted an empirical analysis of the impact of increasing hotel occupancy tax rates with a nationwide survey of members of the American Hotel and Motel Association. They found that for every 1 percent increase in the occupancy tax rate, hoteliers could expect to have 0.44 percent fewer rooms rented per day. In a follow-up analysis, Hiemstra and Ismail (1993) observed that, in the long run, hotels absorb (lower profit margins) 1 out of every 7 dollars of occupancy tax burden.¹

Im and Sakai (1996), reporting in the journal *Public Finance Quarterly*, observed that the results of their research suggest that higher occupancy tax rates can have disproportionately large

¹ Contrary to these findings, Bonham and Gagnes (1996) did not find a statistically significant impact of a state occupancy tax of 5 percent introduced in 1987 by the State of Hawaii. However, we do not believe that these results can be reasonably inferred to most other travel destinations due to the unique nature of Hawaii’s travel industry.

negative effects on net tax revenues. In light of these findings, we would hypothesize that Irving could expect to see some negative impact on hotel revenues as a result of increasing the occupancy tax rate. To test the validity of this hypothesis, we examined tax receipts before and after the last increase in Irving's occupancy tax rate.

Impact of the 1987 occupancy tax rate increase

In October of 1987, the City of Irving increased its hotel occupancy tax rate from 4 percent to 5 percent. The move should have had little consequence on Irving hotels' competitive posture since most area communities already had higher tax rates and Dallas and Grapevine had also just increased their tax rates. (Table 3.1 below summarizes area communities' occupancy tax rates.)

Table 3.1
Local Hotel Occupancy Tax Rates
(selected communities)

Community	Tax Rate As of 10/87*	Year Implemented	Tax Rate As of 11/97	Year Implemented
Irving	5 %	1987	5 %	1987
Arlington	7 %	1983	7 %	1983
Bedford	NA	NA	7 %	1989
Carrollton	3 %	NA	5 %	1997
Dallas	7 %	1987	7 %	1987
Farmers Branch	5 %	1981	6 %	1992
Fort Worth	7 %	1983	7 % [#]	1983
Grand Prairie	7 %	1983	7 %	1983
Grapevine	5 %	1987	5 %	1987

* Except for provisions of the Brimer Bill, 7 percent is the maximum local rate allowed by Texas law.

Scheduled to increase to 8 percent in 1998. Source: Local area convention and visitors bureaus.

Using Irving Convention and Visitors Bureau tax receipts, we calculated taxable quarterly revenues for the city's hotels and motels beginning in October 1983 (the start of Fiscal Year 1984) through September 1997 (end of Fiscal Year 1997). As can be seen in Figure 3.1 below, taxable hotel revenues show seasonal patterns and, with the exception of two time

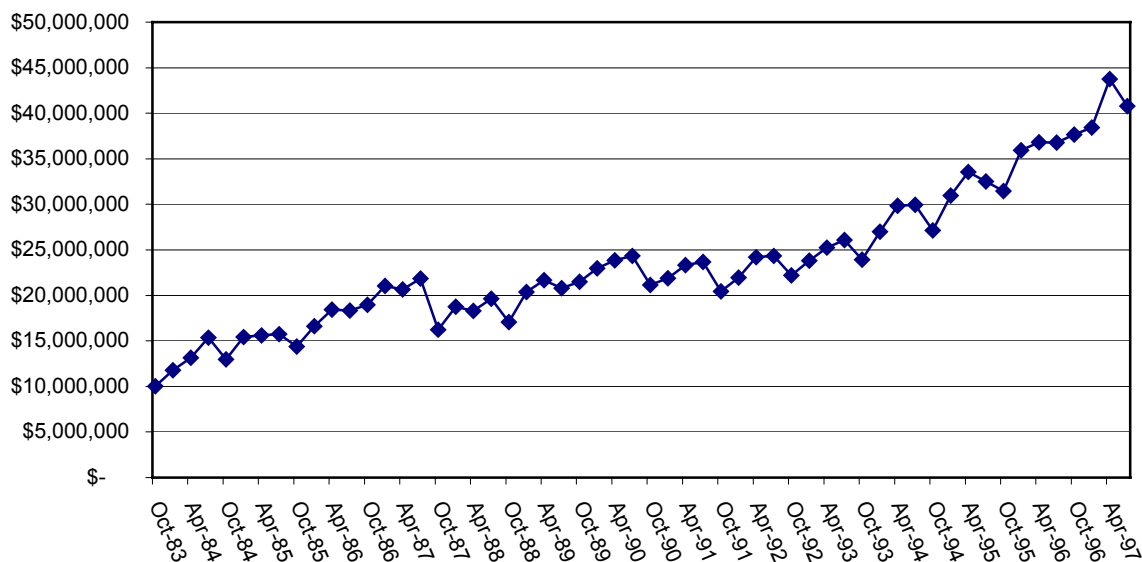
periods, demonstrate continued growth. Between October 1990 and December 1992, a period that included both a national recession and heightened travel-security concerns as a result of military activities in the Persian Gulf, Irving hoteliers experienced relatively flat revenue growth trends. The only other noticeable interruption in revenue growth began in October 1987, simultaneous with the tax rate increase, and continued for about two years. To confirm this casual observation, we employed a research methodology known as an interrupted time series. This methodology seeks to identify the presence and magnitude of the potential impacts of changes imposed on a firm's operating environment.

Using sophisticated analytical procedures to estimate seasonal and overall growth trends, we can isolate the impacts of any changes in the hotels operating environments that occurred during the first quarter of FY88. (Technical Appendix TA2 includes a full description of the methodologies employed in this analysis.) Our findings indicate that hotel revenue declined in the first quarter of FY88 (October through December 1987) by \$2.4 million as a result of increasing the occupancy tax rate.² The magnitude of the decline then showed a steady drop-off, finally disappearing from the data series after two years. The total decline in hotel operating revenues subject to the occupancy tax during the two-year period was \$10.8 million. However, since the impact decayed over a two-year period, total tax receipts still increased. During the initial two years of the 5 percent tax rate, the City of Irving realized revenues of \$7.6 million. If

² The impact was considered to be a result of the occupancy tax rate increase at this time because the methodology would have captured the effects of other environmental changes that occurred during the first quarter of FY88 and lasted through the fourth quarter FY 89. We reviewed historical economic data to attempt to identify any plausible alternatives to the tax rate increase explanation for declining hotel revenues. The most obvious economic event of the first quarter of FY88 was the stock market crash of October 1987. However, we eliminated that possible explanation for two reasons. First, stock prices recovered much quicker than the two-year impact observed in this analysis. Second, a review of other business travel data does not suggest a significant decline in overall business travel immediately after the stock market crash. In discussions with long-time personnel at the Irving CVB, we could not identify any other plausible alternatives to explain the decline in hotel revenue.

we estimate what hotel revenues would have been if the tax rate had not increased, occupancy tax revenues for FY88 and FY89 would have totaled about \$6.5 million.

Figure 3.1
Quarterly Taxable Hotel Revenue
FY1984-FY1997



While the immediate impact of Irving's 1987 occupancy tax rate increase was larger than what is found in most recent empirical studies, other studies have observed permanent impacts. Therefore, in the long run, the impact measured in this analysis is actually smaller than those measured in other recent analyses.

It is likely that a substantial portion of the increase in tax burdens were borne by Irving's hoteliers during the first two years after the tax rate increase. This may have been due to the portion of local hotel business that is covered by long-term contracts with area businesses and the nature of convention and meeting bookings that often are negotiated 1, 2 or even more years into the future.

If the impacts observed for the 1987 tax rate increase hold for any new tax hike, revenue losses would be proportionately larger. For example, the impact of a 1 percent tax rate increase that would become effective in October 1998, using data from the 10-year forecast, can be estimated using the effect-coefficient found in the 1987 rate increase analysis. Hotel revenues for the two-year period beginning in 1998 would decline by about \$27.6 million. The City of Irving would realize a net tax increase of \$2.2 million.

We were also asked to estimate the impact of increasing the occupancy tax rate by 2 percent. A worst-case scenario could assume that the effect-coefficient observed in the analysis of the 1 percent increase of 1987 would hold true for higher tax rate increases. In that case, total hotel revenues over a two-year period would decline by about 14 percent. Using taxable hotel revenue estimates from the 10-year forecast for FY 1999-FY 2000 as a basis, this decline in hotel revenues would total more than \$55 million, although the city would enjoy a \$4 million increase in tax revenues. (See Table 3.2 for a summary of these impact estimates.)

Table 3.2

Estimated Impacts of Increasing the Occupancy Tax Rate
(assumes effective date of October 1, 1998)

FY1999 – FY2000	1 % Increase (total local rate 6%)	2 % Increase (total local rate 7%)
Total hotel taxable revenues	\$ 366,581,204	\$ 338,989,348
Change from projections at current tax rate	- 27,592,156	- 55,184,312
Total city tax receipts	21,994,890	23,719,254
Change from projections at current tax rate	+ 2,286,207	+ 4,020,571

Conclusions

The evidence suggests that though the city would realize increased net revenues from raising the occupancy tax, there is a substantial likelihood that Irving's hoteliers would bear the brunt of an increase in the local occupancy tax rate for about two years. Contrary to the belief of many policymakers across the country, the evidence presented by Irving's tax increase in 1987 suggests that the demand for hotel rooms is price-sensitive, and the ability of hotel owners to simply pass-through the tax increases to clients by way of higher room rental rates is limited. Furthermore, the experience of New York presents a cautionary tale to policymakers considering increasing tourist taxes.

A study reported by Quinn (1994) found that though occupancy tax receipts increased after the state-wide 5 percent tax was imposed, total travel-related tax receipts actually fell. These travel-related taxes included corporate income taxes from hoteliers and restaurateurs, property taxes on related properties and sales taxes for beverages and food served to travelers in addition to occupancy taxes. Specifically, it was found that occupancy taxes increased \$73 million per year; however, declines in receipts for other travel-related taxes amounted to more than \$94 million per year. In other words, if hoteliers can pass the tax burden onto their clients, these same clients will likely spend less money on food and other taxable items during their stay. To the extent that hoteliers realize lower income levels, their properties are not worth as much and may suffer a decline in taxable value. Moreover, this does not consider secondary implications of lost hotel revenue such as lower employment levels.

A final consideration should be made regarding the timing of any future tax increases. As is clearly shown in Figure 3.1, the fourth quarter of the fiscal year consistently trails the other quarters in total revenues. This suggests the possibility that any tax increase imposed during this

comparatively-weak period of demand would exacerbate any negative consequences on hotel revenues. Any future tax rate increases should probably be timed to coincide with the industry's strongest quarter.

Section 4: Survey of Irving Hoteliers

This section presents the results of surveys of Irving hoteliers conducted in November and December of 1997. Stage 1 of the survey included in-person interviews with managers of selected hotels. Responses from the interviews were used to develop a mail survey that was sent to all hotels in Irving that were not included in the in-person interviews. Responses to the surveys are categorized based on hoteliers self-report of their primary target market – full service, limited service or extended stay.

Full service hotels are those that are generally considered high-end and offer a variety of services from food services to meeting rooms. Examples of full-service hotels include the Four Seasons Resort and Club and the WilsonWorld hotel. Limited service hotels are those that generally do not offer food service and have limited or no meeting facilities. This classification includes the broadest range of hotel offerings including Courtyard by Marriott hotels, Hampton Inns and the Budget Inn. Extended stay hotels are often all-suite formats that cater primarily to travelers that are staying from several days to several months in the area.

The response rate to the surveys was high. The Irving hotel market includes 10 full-service, 8 extended-stay and 34 limited-service facilities. We received qualified responses³ through either the interviews or the mail survey from all 10 of the full-service hotels, 7 of the extended-stay properties and 15 limited-service hotels. Tables 4.1, 4.2 and 4.3 report the responses to the surveys by full-service, extended-stay and limited-service properties, respectively. Following each Table is commentary on highlights of the findings and clarification of responses where appropriate.

³ A qualified response is one that is substantially completed, indicates internal consistency in responses, and demonstrates an understanding of the questions posed.

Table 4.1: Survey Results -- Full Service Hotels

	Question	# Responses	Average	Minimum	Maximum
#3	Number of Rooms	10	343	168	506
#6	Monthly Payroll	8	\$361,219	\$100,000	\$1,100,000
#7	Annual Budgeted Procurement	4	\$12,040,000	\$840,000	\$240,000
#8	Percent Procurement Spent in Irving	1	10 %	--	--
#9	Ave. Room Rate - Corporate	10	\$136.90	\$69	\$220
#10	Ave. Room Rate - Group	10	\$110.8	\$65	\$200
#11	Ave. Room Rate - Transient	10	\$156.0	\$79	\$215
#12	Percentage of Revenue Tax-exempt Business	9	4.3%	0%	15%
#13	Average Occupancy October 1996	8	76.2%	68%	85%
#14	Average Occupancy October 1997	10	75.4%	62%	83%
	<u>Average Occupancy</u>				
#15	Mon. - Thurs. 1997	2	82.3%	--	--
#16	Mon. - Thurs. 1996	2	83.3%	--	--
#17	Weekend 1997	2	60.6%	--	--
#18	Weekend 1996	2	59.9%	--	--
	Seasonal Ranking 1 = Highest; 4 = Lowest				
#19	Winter	10	3.6	4	3
#20	Spring	10	2	2	1
#21	Summer	10	3.2	4	2
#22	Fall	10	1.2	2	1
#23	Revpar	9	\$120.6	\$42	\$400
#24	Percentage of Guests from... Corporate Groups	10	54%	25%	70%
#25	Transient Corporate Guests	10	32.3%	0%	50%
#26	Tourists	10	9.5%	0%	20%
#27	Convention Attendants	10	4.2%	0%	20%
#28	Percentage of Guests from Pre-negotiated Agreements	10	45.5%	15%	85%
#29	Percentage of Total Revenues from Pre-negotiated Agreements	10	43.8%	20%	70%
#30	Did the above Agreements include State and Local Taxes? Yes = 1; No = 2	10	1.1	--	--

Table 4.1 Survey Results -- Full Service Hotels (con't)

	Question	# Responses	Average	Minimum	Maximum
	What Impact Did the Following Have on Your Hotel? 1 = a Great Deal; 2 = Some; 3 = None.				
#31	Las Colinas Urban Center	10	1.5		
#32	D/FW Airport	10	1.2		
#33	Texas Stadium	10	2.1		
#34	Byron Nelson	10	2.3		
#35	Dallas Cowboys	5	1.4		
#36	Texas Motor Speedway	10	1.7		
#37	Las Colinas Equestrian Center	10	2.8		
#38	Las Colinas Movie Studios	10	2.9		
#39	Lone Star Park	10	2.7		
#40	The Ballpark at Arlington	10	2.8		
#41	Reunion Arena	3	2.7		
#42	Dallas Convention Center	2	2.7		
#43	Dr. Pepper Star Center	2	3		
#44	Events at Texas Stadium	3	1.7		
#46	What Percentage of Your Guests Visit the Area for the Primary Purpose of Attending An Event at Texas Stadium	10	3.5%	1%	10%
#47	What Percentage of Your Guests Extend Their Stay To Attend an Event at Texas Stadium	10	.5%	0%	0%
#48	Do the Events at Texas Stadium Enhance Awareness of the City Of Irving as a Destination? 1 = A Great Deal, 2 = some; 3 = Very little; 4 = none	10	2.4	2	3
	Describe the Impact if the Irving Hotels Tax Rate Was Increased By... [1 = Some Impact; 2 = Significant Effect; 3 = Excessive Burden]				
#49	One Percent	10	1.2	1	3
#50	Two Percent	10	2.5	1	3
#51	Three Percent	10	2.7	1	3

Comments:

Number 15-18: Questions number 15 through 18 were added to the mail survey after the interviews and improved on questions number 13 and 14. The low response rate to 15 through 18 reflect the proportionately higher number of full-service hotels interviewed in Stage 1 of this analysis. However, the responses to 15 through 18 show consistency with the responses obtained in numbers 13 and 14.

Number 19-22: The order of the seasons for full-service hotel business can be summarized as fall, spring, summer and winter in descending order of business level.

Number 23: Revpar is an industry measure of revenue-per-available-room.

Number 24-27: On average, the vast majority of visitors staying in Irving's full-service hotels are corporate travelers not associated with a convention. Tourists make up the second largest component of visitors with convention business being comparatively weak.

Number 28-30: The comparatively high percentage of hotel guests covered by pre-negotiated agreements provides support for the observation on Section 2 of this report that changes in the occupancy tax rate are not immediately fully reflected in occupancy tax receipts.

Number 31-48: In analyzing the responses to question number 35, the impact on hotel business of the Dallas Cowboys, caution must be used. A non-responses cannot be equated with a "no impact" response.

Number 49-51: Of interest in this series of questions is the rapid escalation of anticipated effects of raising the hotel occupancy tax rate. Whereas a 1 percent increase is not believed to have a large impact, an increase of 2 or 3 percent is perceived as burdensome.

Table 4.2: Survey Results -- Extended Stay Hotels

	Question	# Responses	Average	Minimum	Maximum
#3	Number of Rooms	7	\$126	\$44	\$164
#6	Monthly Payroll	6	\$30,800	\$5000	\$60,000
#7	Annual Budgeted Procurement	0			
#8	Percent Procurement Spent in Irving	1	10 %		
#9	Ave. Room Rate – Corporate	7	\$91.4	\$33	\$148
#10	Ave. Room Rate – Group	2	\$44.5	--	--
#11	Ave. Room Rate – Transient	4	\$75.5	\$40	\$108
#12	Percentage of Revenue Tax-exempt Business	6	19.8%	.6%	60%
#13	Average Occupancy October 1996	6	73.7%	73%	90%
#14	Average Occupancy October 1997 Average Occupancy	5	80.6%	75%	89%
#15	Mon. - Thurs. 1997	1	40		
#16	Mon. - Thurs. 1996	0			
#17	Weekend 1997	1	30		
#18	Weekend 1996	0			
	Seasonal Ranking 1 = Highest; 4 = Lowest				
#19	Winter	6	3.8		
#20	Spring	6	2.2		
#21	Summer	6	1.7		
#22	Fall	6	2.3		
#23	Revpar	7	\$64.7	\$42	\$90
	<u>Percentage of Guests from</u>				
#24	Corporate Groups	7	65.2%	50%	90%
#25	Transient Corporate Guests	7	18.0%	0%	30%
#26	Tourists	7	12.1%	0%	20%
#27	Convention Attendants	7	4.7%	0%	10%
#28	Percentage of Guests from Pre-negotiated Agreements	6	43.3%	15%	65%
#29	Percentage of Total Revenues From Pre-negotiated Agreements	6	40%	15%	60%
#30	Did the above Agreements Include State and Local Taxes? Yes = 1; No = 2	5	1		

Table 4.2: Survey Results -- Extended Stay Hotels (Con't)

	Question	# Responses	Average	Minimum	Maximum
	What Impact Did the Following Have on Your Hotel? 1 = a Great Deal; 2 = Some; 3 = None.				
#31	Las Colinas Urban Center	7	1.4		
#32	D/FW Airport	7	1.3		
#33	Texas Stadium	7	2.1		
#34	Byron Nelson	6	2		
#35	Dallas Cowboys	4	1.8		
#36	Texas Motor Speedway	7	2.1		
#37	Las Colinas Equestrian Center	7	2.4		
#38	Las Colinas Movie Studios	7	2.9		
#39	Lone Star Park	7	2.7		
#40	The Ballpark at Arlington	7	3		
#41	Reunion Arena	2	3		
#42	Dallas Convention Center	2	2		
#43	Dr. Pepper Star Center	2	2.5		
#44	Events at Texas Stadium	2	2		
#46	What Percentage of Your Guests Visit the Area for the Primary Purpose of Attending An Event at Texas Stadium	6	3.3%		
#47	What Percentage of Your Guests Extend Their Stay To Attend an Event at Texas Stadium	6	0%	--	--
#48	Do the Events at Texas Stadium Enhance Awareness of the City Of Irving as a Destination? 1 = A Great Deal, 2 = some; 3 = Very little; 4 = none	7	2.4%	1%	4%
	Describe the Impact If the Irving Hotels Tax Rate Was Increased By... [1 = Some Impact; 2 = Significant Effect; 3 = Excessive Burden]				
#49	One Percent	7	1.1	1	3
#50	Two Percent	7	2.3	1	3
#51	Three Percent	7	2.4	1	3

Comments:

Number 19-22: The order of business levels by season changes from those reported for full-service properties. For extended-stay hotels, Summer is highest with Spring and Fall following and Winter being the slowest business season of the year.

Overall: Other than as noted above, and with notable exceptions of room rates and total payrolls, the extended-stay properties' responses are very similar to those received from full-service facilities.

Table 4.3: Survey Results -- Limited Service Hotels

	Question	# Responses	Average	Minimum	Maximum
#3	Number of Rooms	15	\$90.5	\$77	\$188
#6	Monthly Payroll	12	\$33,036	\$16,883	\$64,000
#7	Annual Budgeted Procurement	6	\$368,000	\$120,000	\$600
#8	Percent Procurement Spent in Irving				
#9	Ave. Room Rate - Corporate	15	\$69.5	\$30	\$114
#10	Ave. Room Rate - Group	12	\$61.1	\$40	\$104
#11	Ave. Room Rate - Transient	14	\$73.1	\$35	\$114
#12	Percentage of Revenue Tax-exempt Business	15	7.3%	0%	35%
#13	Average Occupancy October 1996	13	73.3%	50%	79%
#14	Average Occupancy October 1997	12	69.8%	45%	86%
	Average Occupancy				
#15	Mon. - Thurs. 1997	7	77.4%	60%	90%
#16	Mon. - Thurs. 1996	7	76.1%	55%	90%
#17	Weekend 1997	7	55.3%	10%	85%
#18	Weekend 1996	7	55.9%	10%	88%
	Seasonal Ranking 1 = Highest; 4 = Lowest				
#19	Winter	13	3.3	4	1
#20	Spring	13	2.5	4	2
#21	Summer	13	2.2	4	1
#22	Fall	13	2	3	1
#23	Revpar	12	45.2	25	73
	Percentage of Guests from...				
#24	Corporate Groups	15	39.8%	0%	100%
#25	Transient Corporate Guests	15	33%	0%	80%
#26	Tourists	15	16.8%	0%	54%
#27	Convention Attendants	15	10.3%	0%	25%
#28	Percentage of Guests from Pre-negotiated Agreements	14	21.7%	0%	60%
#29	Percentage of Total Revenues From Pre-negotiated Agreements	14	19.5%	0%	50%
#30	Did the above Agreements Include State and Local Taxes? Yes = 1; No = 2	13	1.2%		

Table 4.3: Survey Results -- Limited Service Hotels (Con't)

	Question	# Responses	Average	Minimum	Maximum
	What Impact Did the Following Have on Your Hotel? 1 = a Great Deal; 2 = Some; 3 = None.				
#31	Las Colinas Urban Center	15	1.7		
#32	D/FW Airport	15	1.1		
#33	Texas Stadium	15	1.8		
#34	Byron Nelson	15	2.2		
#35	Dallas Cowboys	9	1.3		
#36	Texas Motor Speedway	15	1.8		
#37	Las Colinas Equestrian Center	15	2.7		
#38	Las Colinas Movie Studios	15	2.7		
#39	Lone Star Park	15	2.7		
#40	The Ballpark at Arlington	15	2.7		
#41	Reunion Arena	8	2.6		
#42	Dallas Convention Center	8	2.1		
#43	Dr. Pepper Star Center	8	2.6		
#44	Events at Texas Stadium	0			
#46	What Percentage of Your Guests Visit the Area for the Primary Purpose of Attending An Event at Texas Stadium	14	7.40%	0%	20%
#47	What Percentage of Your Guests Extend Their Stay To Attend an Event at Texas Stadium	14	11.8%	0%	75%
#48	Do the Events at Texas Stadium Enhance Awareness of the City Of Irving as a Destination? 1 = A Great Deal, 2 = some; 3 = Very little; 4 = none	15	1.6%	--	--
	Describe the Impact If the Irving Hotels Tax Rate Was Increased By... [1 = Some Impact; 2 = Significant Effect; 3 = Excessive Burden]				
#49	One Percent	15	1.5		
#50	Two Percent	15	2.3		
#51	Three Percent	15	2.6		

Comments:

Number 19-23: The pattern of seasonal business is not as clear for this class of hotels. This likely reflects the relatively broad nature of the group and suggests that there are different sub-groups in this classification serving different markets. On average, Fall is the best season followed by Summer, Spring and Winter, respectively.

Number 47: We have little to no confidence in the average response reported for this question due to a single response indicating that one particular hotel has 75 percent of its guests extending their stay to attend an event at Texas Stadium. If we remove this “outlier”, the mean response becomes 6.9 percent.

Overall Comments:

Several notable conclusions can be drawn from this survey. First, Irving hotels, on average, enjoy very respectable occupancy rates. Second, the presence of D/FW Airport is far and away the most important draw for Irving’s hotels. Businesses located in Las Colinas are also very important to the hotel industry. Third, the percentage of business that is covered by pre-negotiated rate agreements, most of which include state and local taxes in the negotiated rate, suggests that any increase in the occupancy tax rate may not be immediately passed through to hotel guests in the form of higher total rates. Fourth, the imposition of an additional 1 percent occupancy tax is expected to have some, though limited effect on hotel business. However, an increase of 2 or 3 percent in the occupancy tax rate is perceived to be burdensome. Finally, Irving’s hotels support a large number of employees and generate substantial economic activity in the local community. The following section of this report looks more closely at these economic impacts.

Section 5: Economic Impacts of the Hotel Industry on the City of Irving

In this section we present the findings of our analysis of the economic and fiscal impacts of the Hotel Industry on the City of Irving. Our estimates are based on data provided in the survey of Irving hoteliers as described in Section 4 as well as data from the Dallas County Central Appraisal District, the Texas Department of Economic Development, the Dallas Convention and Visitors Bureau and the Survey of Current Business published by the U.S. Department of Commerce. Our analysis is based on estimates that account for differences in employment, wages and occupancy rates for each of the three classes of hotels identified in the survey—limited service, extended stay and full service. Our most significant assumption is that those hoteliers not responding to the survey have employment, wage and occupancy levels comparable to other hotels within their classification.

Our estimates rely on input-output models developed by the Comptroller of Texas and the Bureau of Economic Analysis of the U.S. Department of Commerce adjusted for the Irving economy. The methodology provides appropriately conservative estimates of all impacts.

Hotel operations in the City of Irving represent almost \$200 million in economic activity each year. This activity creates more than 4,000 direct jobs in the Irving economy paying over \$67 million in annual wages and salaries. In addition, personal spending by hotel employees generates additional 748 jobs adding about \$14 million to local personal income. (See Table 5.1 below.)

The hotel industry also generates substantial fiscal benefits for the City of Irving. Estimated taxable property values for all hotels in Irving approach \$388 million, generating about \$1.9 million in property taxes for the City and more than \$6.4 million in school taxes. Hotel employees living in Irving pay an estimated \$99,000 and \$333,000 in city and school

district property taxes, respectively. The City of Irving also realizes sales tax revenues from local spending by hotel employees. These sales tax receipts are estimated at approximately \$17,300 per year.

In addition to the more than \$8 million the city collects in hotel occupancy taxes, there are substantial economic benefits associated with visitor spending. Based on data drawn from the survey of Irving hotels, we estimate visitors staying in Irving hotels totaled more than 2.1 million person-days in 1997. Using data from the Tourism Division of the Texas Department of Economic Development and the Dallas Convention and Visitors Bureau, we estimate that taxable expenditures by these visitors for food services, entertainment, transportation and general retail merchandise in the City of Irving totaled about \$34 million, generating more than \$341,000 in city sales tax receipts. These expenditures support an estimated 917 jobs and about \$15 million in local personal income.

When hotel operations and visitor spending are combined, we estimate that the hotel industry creates more than 6,000 local jobs paying almost \$103 million in annual wages. Total annual city tax receipts from the hotel occupancy, property and sales taxes associated with the hotel industry surpass \$10 million. In addition, the value of hotel properties and housing occupied by related-industry employees contribute \$6.8 million to local school district tax receipts each year.

Table 5.1
Economic Impacts of the Hotel Industry on the City of Irving

Description	Impact
Hotel Operations	
Economic Impacts:	
Total economic activity	\$ 199,944,000
Total direct & indirect earnings	\$ 87,700,000
Total direct & indirect jobs (fte)	5,180
Fiscal Impacts:	
City occupancy tax receipts	\$ 8,045,000
Direct city property tax receipts (hotels)	\$ 1,910,000
Direct school district property tax receipts	\$ 6,444,000
Indirect property tax receipts	\$ 99,000
Indirect sales tax receipts	\$ 17,000
Indirect local school district tax receipts	\$ 333,000
Visitor Expenditures	
Total visitor expenditures*	\$ 34,127,000
Total economic activity	\$ 38,379,000
Jobs created	917
Local earnings	\$ 15,170,000
Direct city sales tax receipts	\$ 341,000
Indirect city tax receipts (sales & property)	\$ 20,000
Indirect local school district tax receipts	\$ 58,000
Total Impacts	
Total economic activity	\$ 234,071,000
Total direct and indirect jobs	6,097
Total direct and indirect earnings	\$ 102,870,000
Total city tax receipts (all sources)	\$ 10,415,000
Total Irving ISD tax receipts	\$ 6,835,000

Source: Center for Economic Development and Research estimates.

* Includes spending for food, entertainment, transportation and retail shopping.

Section 6: Economic Impacts of the Dallas Cowboys and Texas Stadium

In this section we examine the economic and fiscal impacts attributable to operations and game-day events of the Dallas Cowboys Football Club on the City of Irving and the Dallas/Fort Worth Metroplex. In addition, we estimate the impacts of other events held throughout the year at Texas Stadium. Specifically, we examine the impacts of spending by out-of-area visitors who attend a Cowboys game or other event at Texas Stadium, impacts of operations at Texas Stadium and the Cowboys, and the impact of retail sales of food and merchandise at Texas Stadium and Irving-based Dallas Cowboys Pro Shops.

Our estimates of economic impacts, earnings and supported jobs are based on the Regional Input-Output Modeling System developed by the Bureau of Economic Analysis of the U.S. Department of Commerce. This model estimates total economic activity generated in an area as a result of economic activity identified for specific industrial activities. These “direct” impacts also include estimates of total area earnings and jobs supported by these economic activities. In addition, the model estimates “indirect” impacts that result from direct employees spending their earnings in the local economy, thus supporting additional jobs and wages.

On average, there are about 31 or 32 large events held at Texas Stadium each year. In addition to Cowboys games these include college and high school football games, concerts, dirt shows (tractor pulls, motocross), revivals and other events. The events attract almost 1.4 million people per year to Texas Stadium. Almost 350,000 of these visitors come from outside the Dallas/Fort Worth region. Based on average spending estimates prepared by the Dallas Convention and Visitors Bureau, these out-of-area visitors spend more than \$78.2 million on lodging, food, entertainment, retail shopping and transportation during their stay in the Dallas/Fort Worth metro area. This spending boosts total economic activity in the D/FW

Metroplex by \$169.6 million per year and supports more than 6,600 jobs paying \$118.7 million in salaries and wages.

Based on surveys of Irving's hoteliers, described in earlier sections of this report, and estimates of persons familiar with the local hotel market, we estimate that Irving hotels capture \$3.8 million in revenue from out-of-area visitors attending an event at Texas Stadium. Irving's restaurants and retail outlets also enjoy a significant portion of out-of-area visitor spending. About \$14.6 million of total area visitor spending stays in the Irving economy. This spending generates \$16.6 million in local economic activity, creates 1,100 jobs and adds \$19.8 million to local personal income.

Texas Stadium operations, including the sales of food, beverages and retail merchandise at "Pro-shops," as well as stadium maintenance, repair and event operations, generates an estimated \$45.2 million in economic activity for the Dallas/Fort Worth Metroplex. This activity supports about 1,260 direct and indirect jobs paying almost \$32.5 million in earnings. The Irving economy is boosted by about \$25.4 million as a result of stadium operations, which supports about 500 direct and indirect jobs and \$11.8 million in local earnings.

The impacts of the Dallas Cowboys Football Club on the D/FW and Irving economies are very large. Total economic activity in the Dallas/Fort Worth Metroplex directly associated with team operations is estimated at \$240.7 million per year. Due, in part, to player's salaries, this activity generates almost \$267 million in direct and indirect local earnings each year and supports over 3,300 jobs in the area economy. The City of Irving also enjoys substantial economic benefits as a result of team operations. Economic activity in the City of Irving is boosted by \$88.5 million as a result of the presence of the Dallas Cowboys Football Club

(DCFC). Local earnings, including player's salaries, are more than \$157 million per year with over 370 direct and indirect jobs supported.

In sum, total economic activity associated with the Dallas Cowboys and Texas Stadium exceeds \$455 million each year, generates almost \$418 million in earnings and supports over 11,000 jobs in the D/FW metro area. The City of Irving captures \$130.5 million of this economic activity and enjoys a \$157.8 million boost to local earnings and almost 2,000 direct and indirect jobs (see Table 6.1).

The economic activity described above contributes substantially to the City of Irving's tax receipts each year. In addition to spending by out-of-area visitors, Irving realizes substantial tax receipts from food, beverage and merchandise sales by area visitors that might not otherwise occur in the City of Irving. Combined with tickets sales and parking fees, there are about \$38.8 million in taxable spending by Texas Stadium visitors. In addition, a portion of the total earnings enjoyed by Irving residents are spent in local restaurants and retail outlets. Combined, this spending generates \$408,000 in sales tax receipts for the City of Irving. The City also enjoys an estimated \$192,000 in hotel occupancy taxes. The City of Irving and local public school districts also receive property taxes resulting from a portion of local earnings being spent on housing. Our estimates indicate that the City of Irving receives about \$175,000 each year in property taxes paid by the DCFC and residents whose earnings are supported directly or indirectly by events at Texas Stadium. Local school districts receive about \$630,000 in property tax payments from these same sources.

Table 6.1
Economic Impacts of the Dallas Cowboys and Texas Stadium

<u>Category</u>	<u>Impact</u>
DFW Impacts*:	
Total economic impact	\$ 455,539,000
Total direct and indirect earnings	\$ 417,998,000
Total direct and indirect jobs	11,191
City of Irving Impacts*:	
Total economic impact	\$ 130,527,422
Total direct and indirect earnings	\$ 157,861,000
Total direct and indirect jobs	1,979
Irving hotel revenues attributable to Texas Stadium events	\$ 3,840,000
Fiscal Impacts:	
City of Irving sales and occupancy tax receipts	\$ 600,000
City of Irving property tax receipts	\$ 175,000
Local school district tax receipts	\$ 630,000

* Includes impacts from out-of-area visitor spending, operations of the Dallas Cowboys Football Club and operations at Texas Stadium (includes retail sales of food and merchandise to area visitors).

Technical Appendix I

Ten Year Forecast

The ten-year forecast, described in Section 2 of this report, relied on several different time-series forecasting methodologies. These included AutoRegressive Integrated Moving Average (ARIMA) model, classic decomposition model and the Holt-Winter's trend method using multiplicative seasonal adjustments and using the mean square error (MSE), the mean absolute error (MAE) and mean percentage error (MPE) as separate search criterion for estimating the Alpha, Gamma and Beta parameters of the respective models. (The classical decomposition model was subsequently dropped.) The data analysis was performed using the Number Cruncher Statistical Software (NCSS) Version 6.1 system developed by Jerry Hintze (1996).

The data series used in the forecasts included quarterly Irving CVB revenues, standardized for 57.5 percent of total occupancy tax receipts, from FY 1984 through FY 1997. The forecasts did not project any future changes in the occupancy tax rate.

ARIMA

Plots of the autocorrelation and partial autocorrelation functions of the data series clearly indicate that the series is non-stationary both in the regular component and the seasonal component. Therefore, the data series was differenced both regularly and seasonally to obtain stationarity in-the-homogeneous-sense. (See Cook and Campbell, 1979 for an excellent description of this methodology.) Review of the autocorrelation and partial-autocorrelation functions of the differenced data series indicated a $(1,1,0) (2,1,0)_4$ model. Though this is an unusual model, the estimates for each parameter are statistically significant and fall within the bounds of stationarity and invertibility. Moreover, the residuals of this model reveal no

remaining unmodeled autoregressive or moving average components and the Portmanteau test, similar to testing the *Q-statistic*, indicates an adequate model.

Decomposition model

The decomposition model relies on sophisticated algorithms to estimate up to four components in a data series: the mean, trend, cycle and seasonal components. While the NCSS software will generate estimates for the mean, trend and seasonal components, the cycle component must be estimated heuristically. If the cycle component can not be adequately estimated, this component is dropped from the model. While it is likely that there is a long-term cyclical trend in the revenue data series, the series itself has insufficient data points for an accurate assessment of the cycle parameter. Therefore, the model was estimated without the cycle component. This omission leaves us with less confidence with the forecast estimates for this model compared with the other methodologies examined in the preparation of this forecast.

Winter's seasonal trend analyses

This methodology is an exponential smoothing algorithm that computes an evolving trend equation with a multiplicative seasonal adjustment. The algorithm requires estimating three smoothing constants: The *alpha* constant identifies the overall level of the series, the *beta* constant is associated with the series' trend and the *gamma* constant is associated with seasonality factors. The NCSS system will automatically estimate the alpha, beta and gamma smoothing constants based on three models of error minimization that must be specified by the forecaster. The error reflects the difference between forecasted values and actual values in the data series.

The first method employed in this analysis minimized the mean-square-error (MSE) of the forecasted series. Table A below shows the alpha, beta and gamma smoothing constant estimates for each of the error minimization models. The second method used the value of the mean absolute error (MAE) to estimate the smoothing constants. Finally, the third Holt-Winter's method minimized the mean absolute percentage error (MAPE) in the forecast model. The *Pseudo-R*² are strong in all three models generating confidence in the resulting forecasts.

Table A
Holt-Winter's Multiplicative Seasonal Models

Model	Smoothing Constants			Pseudo R ²
	<i>Alpha</i>	<i>beta</i>	<i>gamma</i>	
MSE	0.4116	0.2787	0.4012	0.9819
MAE	0.4120	0.0931	0.4074	0.9817
MAPE	0.4805	0.0952	0.3912	0.9816

Combining the estimates

The forecasts for each of these methods were compared and generated very similar forecasts except for the classical decomposition model. (See Figure TA1 below.) Because of our concerns noted above, the classical decomposition model forecasts were dropped from our estimates. The forecasts generated for the future 40 quarters by the remaining four models were condensed into yearly estimates and averaged to obtain the forecast exhibited in Table 2.1.

Note on Figure TA1: The forecasts for the MAE and MAPE methods are so close that they appear as one line in this chart.

Technical Appendix II Impact of Increasing Hotel Occupancy Tax Rate

The methodology used to estimate the impact of increasing the hotel occupancy tax rate on tax receipts and hotel revenues, as described in Section 3 of this report, follows the Interrupted Time Series design described by Cook and Campbell (1979). The stochastic processes are modeled using the AutoRegressive Integrated Moving Average (ARIMA) methodology, which is based on the Box-Jenkins sophisticated data extrapolation approach. The intrusion (the event under study) is then modeled as either a limited independent variable describing a transfer function or as a dummy variable and tested in an ordinary least squares regression equation.

The data set analyzed represented quarterly taxable hotel revenues for the period of Fiscal Years 1984 through 1997. (See Figure 2.1 in the main body of this report.) The value of hotel revenues is derived from occupancy tax revenues received by the Irving Convention and Visitors Bureau.

Correlograms of the autocorrelation functions (ACF) and partial-autocorrelation functions (PACF) clearly show a non-stationary data series. (See accompanying output at the end of this appendix). Stationarity-in-the-homogeneous-sense is obtained by differencing the data series once in both the regular and seasonal components. Plots of the ACF and PACF, after differencing, indicate one moving average component and one seasonal moving average component in the data series leading to a hypothesized ARIMA (0,1,1) (0,1,1)₄ model. This model was tested using the Number Cruncher Statistical System software. Table TA2-1 below shows the model parameters and parameter estimates of the hypothesized ARIMA model.

Table TA2-1
Model Parameters and Parameter Estimates
Hotel Revenue Data
ARIMA (0,1,1) (0,1,1)₄

Parameter Name	Parameter Estimate	Standard Error	T-Value	Prob Level
MA (1)	0.3163967	0.1357438	2.3308	0.0198
SMA (1)	0.8367933	0.0600124	13.939	0.0000

The parameter estimates fall within the bounds of stationarity and invertibility. Residuals of the specified model are tested using the Portmanteau test procedure. Portmanteau test values indicate that autocorrelations for all lags in the residuals are not significantly different from zero. Therefore, the ARIMA (0,1,1) (0,1,1)₄ model is adequate.

Residuals of the ARIMA model are then used to test for the possibility of other influences not explained by the data series' stochastic processes. As noted by Cook and Campbell (1979), there are three basic non-zero effects an intrusion can have on a data series – a fixed, permanent effect; a pulse effect; and a transfer function effect. Visual inspection of the data series suggests that a transfer function is the best model⁴ with the largest effect in the first quarter of the intrusion (increase in tax rate) and the effect decaying over a two-year period. The intrusion model is analyzed with an ordinary least squares regression equation using the Number Cruncher Statistical System software. Table TA2-2 below shows the regression output of the proposed model.

The R-squared estimate of the model is 0.15248. Model diagnostics show a Durbin-Watson value of 2.1749 indicating that there is no remaining significant autocorrelation that could render the model inefficient. In addition, the model's residuals (error terms) are distributed normally with no indication of heteroskedasticity.

Table TA2-2
Regression Model Output
Transfer Function Intrusion with 2-Year Decay

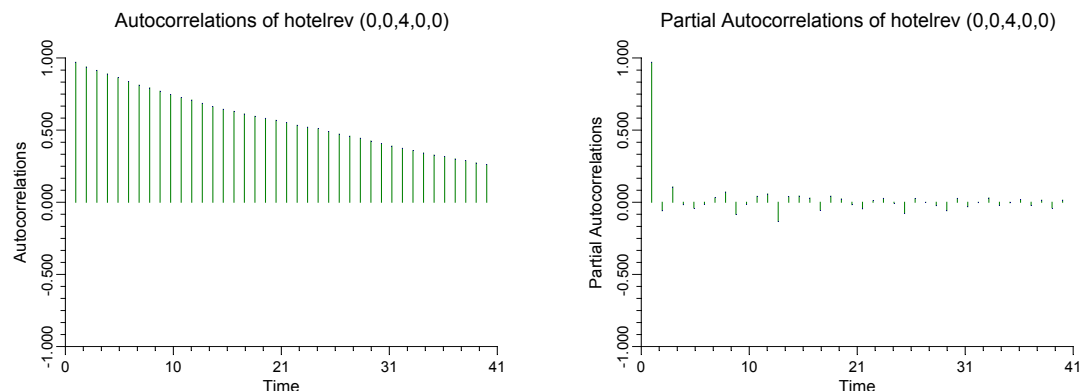
Independent Variable	Regression Coefficient	Standard Error	T- Value	Prob Level	Power
Intercept	127241.1	183980.2	0.6916	0.49215	0.104322
Transdecay2	-2406433.0	772048.8	-3.1169	0.00293	0.864572

⁴ Cook and Campbell (1979) recommend initially modeling any intrusion as a transfer function since a pulse or permanent, fixed effect can be considered special cases of a transfer function.

Autocorrelation Report

Database A:\TAXREV.S0
Variable hotelrev (0,0,4,0,0)

Autocorrelation Plot Section



Autocorrelations of hotelrev (0,0,4,0,0)

Lag	Correlation	Lag	Correlation	Lag	Correlation	Lag	Correlation
1	0.970672	11	0.724649	21	0.551449	31	0.389524
2	0.938821	12	0.708781	22	0.534137	32	0.374178
3	0.913965	13	0.685335	23	0.520211	33	0.358847
4	0.889572	14	0.662608	24	0.508665	34	0.342074
5	0.862817	15	0.644820	25	0.490696	35	0.327127
6	0.835870	16	0.630288	26	0.473046	36	0.315800
7	0.811971	17	0.612089	27	0.458222	37	0.301014
8	0.793168	18	0.594970	28	0.444180	38	0.286951
9	0.770023	19	0.580855	29	0.425082	39	0.273250
10	0.745289	20	0.568151	30	0.406758	40	0.261381

Significant if |Correlation| > 0.267261

Partial Autocorrelations of hotelrev (0,0,4,0,0)

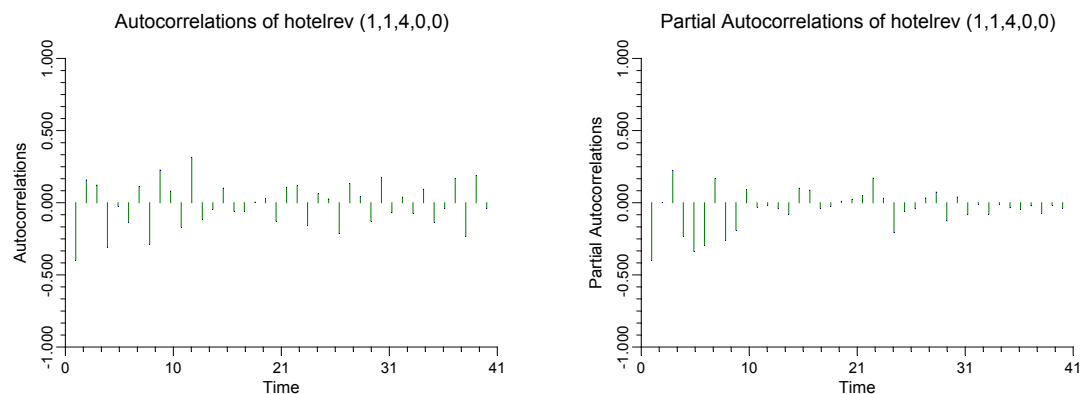
Lag	Correlation	Lag	Correlation	Lag	Correlation	Lag	Correlation
1	0.970672	11	0.040967	21	-0.045833	31	-0.030583
2	-0.058535	12	0.057773	22	0.010548	32	-0.002450
3	0.106836	13	-0.133165	23	0.027215	33	0.029877
4	-0.016257	14	0.038226	24	-0.005137	34	-0.020716
5	-0.040165	15	0.043878	25	-0.077798	35	-0.003402
6	-0.013734	16	0.028892	26	0.025432	36	0.017949
7	0.031137	17	-0.055235	27	-0.000525	37	-0.021797
8	0.071078	18	0.042319	28	-0.022865	38	0.014859
9	-0.083768	19	0.023454	29	-0.059001	39	-0.038205
10	-0.013678	20	-0.016379	30	0.026882	40	0.014958

Significant if |Correlation| > 0.267261

Autocorrelation Report 2nd Iteration

Database A:\TAXREV.S0
Variable hotelrev (1,1,4,0,0)

Autocorrelation Plot Section



Autocorrelations of hotelrev (1,1,4,0,0)

Lag	Correlation	Lag	Correlation	Lag	Correlation	Lag	Correlation
1	-0.398164	11	-0.167419	21	0.107635	31	-0.068006
2	0.159309	12	0.313958	22	0.117619	32	0.038655
3	0.123391	13	-0.117858	23	-0.154218	33	-0.073333
4	-0.307168	14	-0.043514	24	0.062135	34	0.093386
5	-0.022953	15	0.101979	25	0.026431	35	-0.134941
6	-0.135919	16	-0.057125	26	-0.211253	36	-0.039065
7	0.112039	17	-0.059729	27	0.131769	37	0.167888
8	-0.284687	18	0.004534	28	0.043653	38	-0.231610
9	0.227475	19	0.029590	29	-0.127682	39	0.188349
10	0.081379	20	-0.127560	30	0.175993	40	-0.039442

Significant if |Correlation| > 0.280056

Partial Autocorrelations of hotelrev (1,1,4,0,0)

Lag	Correlation	Lag	Correlation	Lag	Correlation	Lag	Correlation
1	-0.398164	11	-0.028329	21	0.049558	31	-0.081215
2	0.000921	12	-0.018991	22	0.171287	32	-0.010675
3	0.222386	13	-0.041007	23	0.030686	33	-0.078866
4	-0.229733	14	-0.078531	24	-0.206918	34	-0.007398
5	-0.337114	15	0.100986	25	-0.055856	35	-0.034677
6	-0.294942	16	0.087137	26	-0.041392	36	-0.046451
7	0.166760	17	-0.036773	27	0.033679	37	-0.020395
8	-0.258269	18	-0.022588	28	0.074827	38	-0.074526
9	-0.189579	19	0.009701	29	-0.125390	39	-0.016947
10	0.091609	20	0.022407	30	0.039620	40	-0.035020

Significant if |Correlation| > 0.280056

ARIMA Report

Database A:\TAXREV.S0
Variable hotelrev

Minimization Phase Section

Itn No.	Error Sum of Squares	Lambda	MA(1)	SMA(1)
0	1.51822E+14	0.1	0.1	0.1
1	1.126344E+14	0.1	0.3477043	0.445814
2	9.944167E+13	0.04	0.2905472	0.8050678
3	9.91696E+13	0.016	0.3231971	0.8257358
4	9.914638E+13	0.0064	0.3094302	0.8339834
5	9.913933E+13	0.00256	0.3163967	0.8364933
6	9.914222E+13	0.001024	0.3132827	0.8379552
7	9.914217E+13	0.01024	0.3133134	0.8379409
8	9.914175E+13	0.1024	0.3135906	0.8378117
9	9.914015E+13	1.024	0.3149193	0.8371901
10	9.91394E+13	10.24	0.3161391	0.8366152
11	9.913933E+13	102.4	0.3163688	0.8365065
12	9.913933E+13	1024	0.3163938	0.8364946
13	9.913933E+13	10240	0.3163964	0.8364934
14	9.913933E+13	102400	0.3163966	0.8364933
15	9.913933E+13	1024000	0.3163966	0.8364933
16	9.913933E+13	1.024E+07	0.3163967	0.8364933
17	9.913933E+13	1.024E+08	0.3163967	0.8364933
18	9.913933E+13	1.024E+09	0.3163967	0.8364933
19	9.913933E+13	1.024E+10	0.3163967	0.8364933
20	9.913933E+13	1.024E+11	0.3163967	0.8364933
21	9.913933E+13	1.024E+12	0.3163967	0.8364933
22	9.913933E+13	1.024E+13	0.3163967	0.8364933
23	9.913933E+13	1.024E+14	0.3163967	0.8364933
24	9.913933E+13	1.024E+15	0.3163967	0.8364933

Normal convergence.

Model Description Section

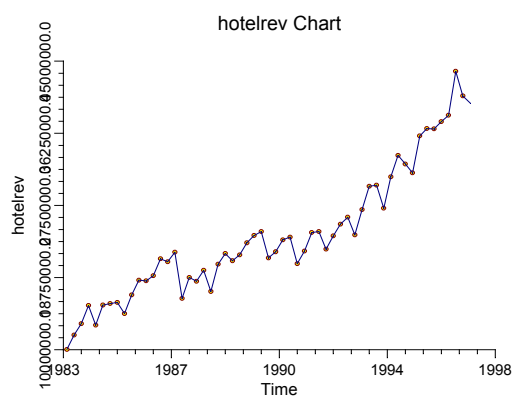
Series	hotelrev
Model	Regular(0,1,1) Seasonal(0,1,1) Seasons = 4
Observations	56
Iterations	24
Pseudo R-Squared	96.975971
Residual Sum of Squares	9.913933E+13
Mean Square Error	2.023252E+12
Root Mean Square	1422411

Model Estimation Section

Parameter Name	Parameter Estimate	Standard Error	T-Value	Prob Level
MA(1)	0.3163967	0.1357438	2.3308	0.019762
SMA(1)	0.8364933	6.001241E-02	13.9387	0.000000

Asymptotic Correlation Matrix of Parameters

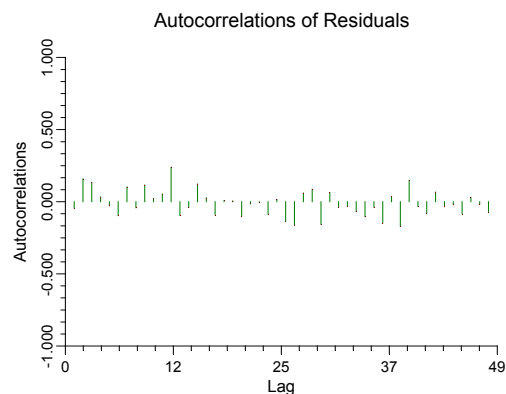
	MA(1)	SMA(1)
MA(1)	1.000000	0.000000
SMA(1)	0.000000	1.000000

Forecast and Data Plot**Autocorrelations of Residuals of hotelrev**

Lag	Correlation	Lag	Correlation	Lag	Correlation	Lag	Correlation
1	-0.042955	13	-0.095613	25	-0.135187	37	0.036589
2	0.159199	14	-0.039405	26	-0.161827	38	-0.169550
3	0.133686	15	0.123537	27	0.059904	39	0.147901
4	0.033980	16	0.027006	28	0.086315	40	-0.031618
5	-0.023066	17	-0.092340	29	-0.157364	41	-0.078990
6	-0.096453	18	0.007628	30	0.062870	42	0.066584
7	0.102083	19	0.005840	31	-0.036913	43	-0.033852
8	-0.041580	20	-0.099314	32	-0.032038	44	-0.018312
9	0.114930	21	-0.014678	33	-0.067743	45	-0.083762
10	0.023356	22	-0.002480	34	-0.104449	46	0.030429
11	0.053808	23	-0.086247	35	-0.037327	47	-0.016865
12	0.239803	24	0.015068	36	-0.147001	48	-0.072514

Significant if |Correlation|> 0.267261

Autocorrelation Plot Section



Portmanteau Test Section hotelrev

Lag	DF	Portmanteau Test Value	Prob Level	Decision (0.05)
3	1	2.54	0.110964	Adequate Model
4	2	2.61	0.271500	Adequate Model
5	3	2.64	0.450670	Adequate Model
6	4	3.20	0.524642	Adequate Model
7	5	3.84	0.571954	Adequate Model
8	6	3.95	0.682925	Adequate Model
9	7	4.80	0.683905	Adequate Model
10	8	4.84	0.774579	Adequate Model
11	9	5.03	0.831324	Adequate Model
12	10	8.99	0.533402	Adequate Model
13	11	9.63	0.564014	Adequate Model
14	12	9.74	0.638668	Adequate Model
15	13	10.87	0.621987	Adequate Model
16	14	10.92	0.692169	Adequate Model
17	15	11.58	0.710283	Adequate Model
18	16	11.59	0.771850	Adequate Model
19	17	11.59	0.824283	Adequate Model
20	18	12.42	0.824875	Adequate Model
21	19	12.44	0.866084	Adequate Model
22	20	12.44	0.900175	Adequate Model
23	21	13.12	0.904374	Adequate Model
24	22	13.14	0.929150	Adequate Model

Multiple Regression Report

Regression Equation Section

Independent Variable	Regression Coefficient	Standard Error	T-Value (Ho: B=0)	Prob Level	Decision (5%)	Power (5%)
Intercept	127241.1	183980.2	0.6916	0.492150	Accept Ho	0.104322
transdecay2	-2406433	772048.8	-3.1169	0.002927	Reject Ho	0.864572
R-Squared	0.152480					

Regression Coefficient Section

Independent Variable	Regression Coefficient	Standard Error	Lower 95% C.L.	Upper 95% C.L.	Standardized Coefficient
Intercept	127241.1	183980.2	-241617.1	496099.2	0.0000
transdecay2	-2406433	772048.8	-3954297	-858567.9	-0.3905
T-Critical	2.004879				

Residual Plots Section

