

The Estimation of Consumer Surplus Benefits from a City Owned Multipurpose Coliseum Complex

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Abstract

Coliseums can create consumer surplus benefits by providing types of entertainment to local residents that would otherwise not be available to them. This paper estimates consumer surplus for a major city owned entertainment/convention facility, the Greensboro Coliseum Complex (GCC). A novel aspect of this paper is that it estimates the *distribution* of consumer surplus across households of different income levels, as well as aggregate consumer surplus. It is estimated that aggregate consumer surplus from the GCC in 1999 exceeded the public subsidy for this complex, but a disproportionate amount of the consumer surplus benefits go to higher income households.

Introduction

Construction of publicly subsidized sports stadiums and multipurpose coliseums has been a growth industry in the United States in the past twenty years. An important economic question is whether the benefits, broadly defined, of these facilities' exceed their costs. The justification most frequently given for subsidizing these types of facilities by their supporters is that they promote local economic development and employment. Noll and Zimbalist (1997), Rosentraub (1997) and other economists have argued that there is scant evidence, at least for major league sports stadiums, that they do much to promote economic development.¹ Also, even if a sports stadium or a coliseum does promote economic development there remains the difficult and as yet unsolved problem of how to translate this economic development into dollar measures of welfare improvement.

An alternative and more theoretically clear-cut argument for subsidizing sports stadiums or multipurpose coliseums is that these facilities provide locally unique forms of entertainment that create enough consumer surplus to make these projects socially worthwhile. Because of the high fixed costs of construction and the inability of firms to fully capture consumer surplus by engaging in perfect price discrimination, private firms may find such facilities unprofitable even though they may be socially worthwhile.² In the absence of externalities, for a stadium or

coliseum to be a socially worthwhile investment, the discounted sum of consumer surplus plus revenue over time from the facility must exceed the discounted sum over time of the facility's costs.

Two previous studies have estimated consumer surplus from major league franchises. Irani (1997) estimated aggregate consumer surplus from major league baseball franchises based on regression estimates of the demand for major league baseball games. Also, in an analysis of the consumer surplus from all three U.S. major league sports, Alexander, Kern and Neill (2000), using ticket revenue along with alternative parameter values for the price elasticity of demand, estimated consumer surplus from major league baseball, basketball and hockey franchises. Both of these studies find that the consumer surplus from major league sports franchises are substantial, although the latter study finds that the private consumer surplus is generally not large enough to cover the subsidies given to the major league franchises.³

Following an approach used earlier by Layson (1998) and Alexander, Kern and Neill (2000), this paper uses data on ticket revenue along with plausible parameter values for the price and income elasticity of demand for entertainment to estimate consumer surplus for a major multipurpose coliseum, the Greensboro Coliseum Complex (GCC) for fiscal year 1999.⁴ The fiscal year 1999 is used to estimate consumer surplus because it most closely matches the latest U.S. Census information on the distribution of income in Guilford County, NC, and because the 1999 GCC ticket revenue is arguably a conservative estimate of the average annual ticket revenue over the life of the existing GCC structure.

A novel methodological feature of this paper is its focus on estimating consumer surplus at the household level. This approach provides not only an estimate of aggregate consumer surplus but also an estimate of the *distribution of consumer surplus across households of different income levels*. It is often of interest to know not only the aggregate benefits of a project but also the distribution of benefits across households of different income levels.

Irani (1997), Layson (1998) and Alexander, Kern and Neill (2000) all assumed linear *aggregate* demand curves for entertainment in their estimation of consumer surplus. This paper assumes in contrast that the *household* demand functions for GCC entertainment are linear and that the "choke prices" or vertical intercepts of households' inverse demands for GCC entertainment increase with income. In this case, the aggregation of linear household demand curves gives a convex linear segmented aggregate demand curve with a higher measure of aggregate consumer surplus than one would get with a linear aggregate demand curve.

In the benchmark case where the price and income elasticity of aggregate demand for GCC entertainment are assumed to be, respectively, -1 and 1 , aggregate consumer surplus in 1999 from the GCC is \$12.1 million. Even if liberal adjustments are made to exclude the consumer surplus of residents who live outside of Guilford County, consumer surplus from the GCC in 1999 is \$8.5

million, which exceeds the 1999 GCC public subsidy of \$5.92 million. The 1999 GCC public subsidy includes an income loss of \$945,743 plus annual debt service of \$4.98 million on the debt issued from 1991 to 1996 to finance a major renovation of the GCC.⁵

While the aggregate Guilford County consumer surplus from the GCC in 1999 exceeded the GCC subsidy, the distribution of consumer surplus is skewed towards higher income households. For example, more than 60% of the \$8.5 million Guilford County consumer surplus from the GCC went to households with incomes above \$73,000 and more than 42% of the Guilford County consumer surplus went to households with incomes above \$102,000. Conversely, only 2% of the aggregate consumer surplus from the GCC went to households with incomes below \$14,634.

The paper also analyzes the sensitivity of the estimates of consumer surplus to alternative assumed values for the price and income elasticities of demand. The higher the assumed absolute value of the price elasticity of demand, the lower is aggregate consumer surplus. Also, the higher the assumed value of the income elasticity of demand, the higher is aggregate consumer surplus and the more unequal is the distribution of consumer across households. The results of the sensitivity analysis confirm the robustness of the finding that the aggregate consumer surplus from the GCC in 1999 was sufficient to cover the GCC subsidy.

The final section of the paper summarizes the major results of the paper and briefly discusses some relevant issues not discussed in the main body of the paper.

Guilford County Household Demand for GCC Entertainment

Consumer surplus from the Greensboro Coliseum Complex (GCC) is estimated in this paper based on the simplifying assumption that each household in Guilford County has identical linear demand functions for entertainment.⁶ Because the household demand functions include household income, consumption of entertainment varies across households based on their incomes. The Guilford County household demand function for entertainment at the GCC is assumed to be represented by the following linear equation.⁷

$$q_i = \gamma - \alpha(p + t) + \delta y_i = \gamma' - \alpha p + \delta y_i; \gamma' = -\alpha t + \gamma. \quad (1)$$

In the demand function above, q_i is the annual number of events attended at the GCC by the i th household in Guilford County, p is the ticket price of entertainment, t is the parking fees and transportation cost per person at entertainment events and y_i is total consumption expenditure for the i th household. The parameters α , δ and γ' are assumed to be the same across all households.

Total consumption expenditure per household (y_i), henceforth referred to as income, is used as a proxy for permanent income.⁸

The household demand function given in Equation (1) involves aggregation over different entertainment events and aggregation over different quality seats. The price variable in Equation (1) is an average price measured by dividing 1999 GCC gross ticket receipts by total GCC attendance.⁹ Ticket prices at the GCC vary from event to event and for many events ticket prices vary substantially depending on the quality of the seat view. For example, for a popular sporting event, ticket prices for court side seats are much higher than the prices of seats far away from the court.

Solving for the household inverse demand curve for GCC entertainment gives:

$$p = \frac{\delta y_i + \gamma'}{\alpha} - \frac{1}{\alpha} q_i \quad (2)$$

The vertical intercept of the household inverse demand curve or the “choke price” given by the term $\frac{\delta y_i + \gamma'}{\alpha}$ in Equation (2) clearly increases with household income. This means that the aggregate inverse demand curve for GCC entertainment will not be linear but rather a convex demand curve with linear segments.

Aggregating Equation (1) over all households in Guilford County gives the Guilford County aggregate demand for GCC entertainment:

$$Q = \sum_{i=1}^n q_i = n\gamma' - n\alpha p + \delta \sum_{i=1}^n y_i = n\gamma' - n\alpha p + \delta Y. \quad (3)$$

The parameter values for α , δ and γ' in Equation (3) are chosen so that they match the attendance and average ticket prices at the GCC in 1999, as well as chosen values for the price and income elasticity of aggregate demand for GCC entertainment. The Guilford County price and income elasticity are defined, respectively, by $\eta = (\partial Q / \partial p)(p / Q)$ and $\varepsilon = (\partial Q / \partial Y)(Y / Q)$. It follows from Equation (3) and the above definitions of η and ε that:

$$\alpha = -(1/n)\partial Q / \partial p = -(\eta Q) / (pn). \quad (4)$$

$$\delta = \partial Q / \partial Y = \varepsilon Q / Y. \quad (5)$$

and

$$\gamma' = (1 - \eta - \varepsilon)(Q/n). \quad (6)$$

In the expressions for the parameters above, $Y = \$8.6$ billion, aggregate consumption expenditure in Guilford County in 1999, $p = \$11.387$, the average price per GCC event in 1999, $n = 168,710$, the number of households in Guilford County in 1999 and $Q = 1,194,732$, the estimated GCC attendance by Guilford County residents in 1999.¹⁰ In the benchmark case where $\eta = -1$ and $\varepsilon = 1$, Equations (3)–(5) yield $\alpha = .621886$, $\delta = .000139$ and $\gamma' = 7.081572$.

There is a theoretical justification for the assumption that the price elasticity of demand for GCC events is -1 . For most events at the GCC, the performers or their agents set the ticket prices and most of the performers' revenue comes from ticket sales.¹¹ As long as there is sufficient capacity in the facility,¹² the performers maximize revenue by setting ticket prices where marginal revenue is zero, where the price elasticity of demand is -1 . Because the marginal cost of admitting another person to an event is close to zero, the ticket revenue-maximizing price also maximizes profit for performers. The assumption that the price elasticity of demand is -1 is also broadly consistent with the empirical evidence on the price elasticity of demand for major league baseball and the price elasticity of demand for recreation.¹³

Because the GCC offers a wide variety of different forms of entertainment, including sports, comedy, concerts, theatre and family shows, it is reasonable to assume that GCC entertainment expenditure by household income will track the Bureau of Labor Statistics (BLS) consumer survey data on entertainment expenditure on fees and admissions by household income. The BLS 1999–2000 survey data on the shares of Southern households' expenditure spent on entertainment fees and admissions is shown in Exhibit 1.

In Exhibit 1, with the exception of the aberrant income category “Less than \$5,000,” the share of household consumption expenditure spent on entertainment rises rather steadily from a low of .0067 for the income category “\$5,000 to \$9,999” to a high of .0175 for the income category “\$70,000 and over.” The figures in Exhibit 1 clearly show that the income elasticity of demand for fees and admissions entertainment is at least 1. For the broader category of entertainment expenditure, the time series evidence also shows that the share of aggregate consumption spent on entertainment has risen over time with income.¹⁴

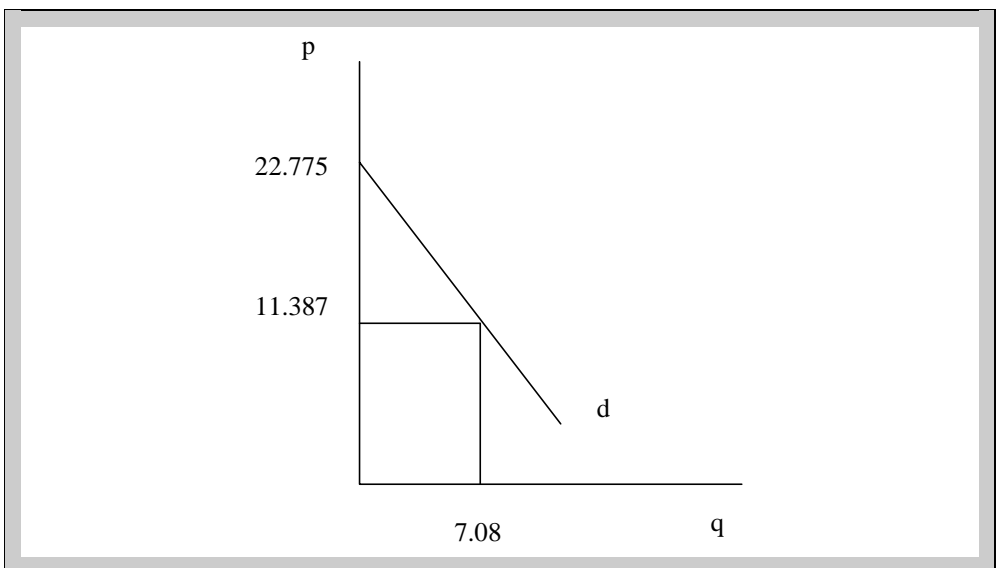
Substituting the benchmark parameter values given earlier ($\alpha = .621886$, $\delta = .000139$ and $\gamma' = 7.081572$) into Equation (1), and setting y equal to its Guilford County mean value, \$51,019, the ordinary inverse demand curve for GCC entertainment by the mean income household in Guilford County is: $p = 22.775 - 1.608q$. The graph of this inverse demand curve is shown in Exhibit 2. At the

Exhibit 1 | Share of Southern Household Expenditure Spent on Entertainment Fees and Admissions by Household Income: 1999–2000

Gross Income Category	Fees & Admissions (Expenditure Share)
Less than \$5,000	.0101
\$5,000 to \$9,999	.0067
\$10,000 to \$14,999	.0070
\$15,000 to \$19,999	.0069
\$20,000 to \$29,999	.0075
\$30,000 to \$39,999	.0088
\$40,000 to \$49,999	.0099
\$50,000 to \$69,999	.0111
\$70,000 and above	.0175
Average	.0117

Notes: The source is: *Bureau of Labor Statistics Data*, Table 33. Southern region by income before taxes: Average annual expenditure and characteristics, Consumer Expenditure Survey 1999–2000 (<http://ftp.bls.gov/pub/special.requests/ce/CrossTabs/y9900/REGbyINC/xregns.TXT>).

Exhibit 2 | Inverse Demand Curve



mean price of \$11.387, the attendance of the mean income Guilford County household is 7.08 per year, which matches exactly the mean household attendance in Guilford County calculated more directly by dividing GCC Guilford County total attendance (1,194,732) by the number of households in Guilford County (168,710).

The Marshallian measure of consumer surplus for the mean income household is \$40.32 and is represented in Exhibit 2 by the triangular area under the linear inverse demand curve “*dd*” above the price of \$11.387.¹⁵ For simplicity, the Marshallian measure of consumer surplus is used here rather than the compensating or equivalent measures of consumer surplus, which hold household utility constant. The difference among these three measures of consumer surplus is negligible in this case because the share of Guilford County income spent on GCC entertainment is so small. The share of Guilford County household income spent on GCC entertainment in 1999 was only .00158. Note that the share of Guilford County income spent on GCC entertainment tickets is much lower than the average share of Southern income spent on entertainment fees and admissions reported in the last row in Exhibit 1, .0117. This is because the GCC ticket expenditure represents only a small fraction of the total amount spent on entertainment fees and admissions in Guilford County.

As mentioned earlier, Exhibit 2 shows the inverse demand curve for the mean income household under the assumption that the aggregate price elasticity of demand for GCC entertainment is -1 at the average ticket price of \$11.387. For higher (lower) income households, the inverse demand curve shown in Exhibit 2 would shift in a parallel fashion to the right (left). If the aggregate price elasticity of demand were assumed to be inelastic (elastic), rather than -1 , then the inverse demand curve shown in Exhibit 2 would become steeper (flatter) and consumer surplus would increase (decrease).

Guilford County Consumer Surplus from the GCC and Its Distribution

To calculate the distribution of consumer surplus across households in Guilford County requires an estimate of the distribution of consumption expenditure across households. The distribution of household consumption expenditure in Guilford County in 1999 is estimated using U.S. Census Bureau 1999 estimates of the distribution of money income before taxes in Guilford County, as well as BLS Southern Region estimates of the relationship between money income before taxes and consumption expenditure in 1999–2000.¹⁶ The first 3 columns of Exhibit 3 report the estimated distribution of income before taxes and consumption expenditure in Guilford County for 1999. The last 2 columns in Exhibit 3 give the distribution of consumer surplus across Guilford County households for the benchmark case where $\eta = -1$ and $\varepsilon = 1$.

Consumer surplus per household given by column 4 in Exhibit 3 rises with household income for two reasons: (1) household GCC attendance increases with

Exhibit 3 | Distribution of Consumption Expenditure and GCC Consumer Surplus in Guilford County:
1999 ($\eta = -1$ and $\varepsilon = 1$)

Income Class (\$)	Average Expenditure (\$)	Number of Households	CS per Household (\$)	CS per Class (\$)
0–7,316	24,475	10,662	9.31	98,934
7,317–14,633	21,251	12,338	7.02	86,311
14,634–21,950	26,659	15,579	11.04	171,510
21,951–29,267	33,238	16,294	17.16	278,842
29,268–43,901	40,482	30,459	25.48	773,216
43,902–58,535	49,151	23,336	37.53	873,277
58,536–73,169	58,612	19,621	53.37	1,044,132
73,170–102,437	71,251	19,822	78.86	1,558,800
102,438 & above	106,069	20,599	174.77	3,589,915
Totals		168,710		8,474,937

Notes: The sources are: *Bureau of Labor Statistics Data*, Table 33. Southern region by income before taxes: Average annual expenditure and characteristics, Consumer Expenditure Survey 1999–2000 (<ftp://ftp.bls.gov/pub/special.requests/ce/CrossTabs/y9900/REGbyINC/xregns.TXT>). U.S. Bureau of the Census, Census 2000, Table DP-3, Profile of Selected Economic Characteristics:2000. (<http://censtats.census.gov/data/NC/05037081.pdf>).

income; and (2) the “choke prices” of the GCC household inverse demand curves rise with household income. Because both the base and the height of the consumer surplus triangle increase with household income, household consumer surplus rises more than proportionally with household income. This is why a disproportionate amount of the GCC consumer surplus goes to higher income households.¹⁷ For example, the total Guilford County consumer surplus from the GCC, \$8,474,937, is found by summing the last column of Exhibit 3. Of the total Guilford County consumer surplus, more than 60% goes to households in the top 2 income categories with incomes exceeding \$73,169. Approximately 42% of the consumer surplus goes to households in the top income category with incomes exceeding \$102,437.

The aggregate Guilford County consumer surplus from the GCC, \$8,474,937, reported in the bottom row and last column of Exhibit 3 has been calculated under the assumption that the “choke prices” of household demand curves for GCC entertainment increase with household income. If instead, one assumed that all household demand curves for GCC entertainment have the same “choke price” so that the aggregate demand curve is linear, then aggregate Guilford County consumer surplus for $\eta = -1$ would be simply one-half of the GCC ticket

expenditures by Guilford County residents or \$6.8 million. The 25% discrepancy between these two estimates of aggregate consumer surplus occurs because the aggregate demand curve for GCC entertainment in this paper is convex rather than linear.

Aggregate Consumer Surplus from the GCC

The Guilford County attendance at the GCC in 1999 was assumed to be 70% of the total attendance at the GCC. If the visitors attending the GCC from outside Guilford County had the same average consumer surplus from attending the GCC as Guilford County residents, then the overall consumer surplus from the GCC in 1999 in the benchmark case is $\$8.5/.7 = \12.1 million.

Sensitivity Analysis of Guilford County GCC

Consumer Surplus

The calculations of Guilford County consumer surplus reported in Exhibit 3 were made under the assumption that the aggregate price and income elasticity of demand were, respectively, $\eta = -1$ and $\varepsilon = 1$. Exhibit 4 reports the Guilford County aggregate consumer surplus from the GCC, measured in millions of dollars, for alternative values of η and ε . The top row of Exhibit 4 denotes different values of the price elasticity of demand from -0.6 to -1.4 and the first column of denotes different values of the income elasticity of demand from 0.6 to 1.4 . As can be readily seen, the higher the absolute value of the price elasticity of demand, the smaller is the aggregate consumer surplus. Also, the higher the income elasticity of demand is, the higher is aggregate consumer surplus.

Not surprisingly aggregate consumer surplus reported in Exhibit 4 is rather sensitive to the assumed value of the price elasticity of demand. For example, starting from the benchmark case where $\eta = -1.0$ and $\varepsilon = 1.0$, if η is changed

Exhibit 4 | Guilford County Consumer Surplus from the GCC for Different Values of ε and η

ε/η	-0.6	-0.8	-1	-1.2	-1.4
0.6	12.341	9.256	7.404	6.170	5.289
0.8	13.121	9.841	7.873	6.561	5.623
1.0	14.125	10.594	8.475	7.062	6.054
1.2	15.351	11.514	9.211	7.676	6.579
1.4	16.801	12.601	10.081	8.401	7.200

from -1.0 to -0.6 , aggregate consumer surplus rises from \$8.475 million to \$14.125 million. If η was changed from -1.0 to -1.4 , holding $\varepsilon = 1.0$, aggregate consumer surplus would fall from \$8.475 million to \$6.054 million. Interestingly, aggregate consumer surplus in Exhibit 4 is also somewhat sensitive to the assumed value of the income elasticity of demand. Starting from the benchmark case where $\eta = -1.0$ and $\varepsilon = 1.0$, if ε is increased to 1.4, holding $\eta = -1.0$, aggregate consumer surplus increases from \$8.475 million to \$10.081 million.

It is worth noting that except for the two smallest values of consumer surplus reported in Exhibit 4, (\$5.289 million, for $\eta = -1.4$ and $\varepsilon = 0.6$, and \$5.623 million, for $\eta = -1.4$ and $\varepsilon = 0.8$) the consumer surplus estimates in Exhibit 4 exceed the 1999 GCC subsidy of \$5.92 million. Because the two smallest consumer surplus estimates occur where the price elasticity is assumed to be -1.4 , which is implausibly high, the results reported in Exhibit 4 strongly suggest that the Guilford County consumer surplus from the GCC in 1999 was sufficient to cover the GCC subsidy.

Aggregate consumer surplus increases in Exhibit 4 with the income elasticity of demand because household consumer surplus increases in a nonlinear fashion with household income. Not only does aggregate consumer surplus increase with the income elasticity of demand but the distribution of consumer surplus across households with different incomes becomes more unequal as the income elasticity of demand rises. Exhibit 5 reports the distribution of Guilford County household consumer surplus measured in dollars for $\varepsilon = 0.6$, 1 and 1.4. As the income elasticity of demand rises from 0.6 to 1.4, the distribution of consumer surplus becomes much more unequal. For example, for $\varepsilon = 0.6$, 30% of the aggregate

Exhibit 5 | Distribution of GCC Consumer Surplus for Different Income Elasticities (ε)
($\eta = -1$)

Income Class (\$)	Average Expenditure (\$)	CS $\varepsilon = 0.6$	CS $\varepsilon = 1.0$	CS $\varepsilon = 1.4$
0-7,316	24,475	203,389	98,934	31,716
7,317-14,633	21,251	210,128	86,311	16,687
14,634-21,950	26,659	319,795	171,510	69,048
21,951-29,267	33,238	410,943	278,842	172,277
29,268-43,901	40,482	942,599	773,216	620,595
43,902-58,535	49,151	900,025	873,277	846,933
58,536-73,169	58,612	938,719	1,044,132	1,155,152
73,170-102,437	71,251	1,224,803	1,558,800	1,933,019
102,438 & above	106,069	2,254,088	3,589,915	5,235,183
Totals		7,404,489	8,474,937	10,080,608

consumer surplus goes to households with incomes above \$102,000 but for $\varepsilon = 1.4$, 52% of the aggregate consumer surplus goes to households with incomes above \$102,000.

Financial Performance of the GCC Over Time

The consumer surplus estimates in this paper are based on GCC gross ticket revenue for the single fiscal year 1999. This year was chosen because it most closely matches the 1999 U.S. Census data on the distribution of income in Guilford County, NC. An important question is how representative is the financial performance of the GCC in 1999 compared to the recent performance, as well as the future prospects of the GCC. Exhibit 6 gives gross ticket revenue and annual income losses for the GCC over the period 1996–2003, the longest period for which the GCC has such data.¹⁸ The income losses are calculated by subtracting from GCC revenue all costs incurred by the GCC including operating costs, maintenance costs and extraordinary costs. The only costs not included are accounting depreciation charges.

Fiscal year 1999 was clearly the strongest year over the eight-year period from 1996 to 2003 for the GCC. In 1999 the ticket sales were at their highest level over this period and the income loss was at its lowest level. From 1999 to 2000 there was a drop in GCC ticket revenue associated with the move of the National Hockey League team the Hurricanes from Greensboro to Raleigh. Ticket revenue bounced back in 2001 but fell sharply again in 2002 in the aftermath of the 9/11 terrorist attacks. The figures for fiscal year 2003, however, indicate that ticket

Exhibit 6 | Ticket Sales and Income Losses from the GCC, 1996–2003
(Millions of \$)

Year	Ticket Sales (\$)	Income Loss (\$)
1996	12,999,309	2,201,395
1997	12,831,921	1,810,145
1998	16,797,334	1,117,340
1999	19,435,323	945,743
2000	12,180,716	2,112,967
2001	19,420,913	1,508,011
2002	11,466,838	1,734,603
2003	19,427,536*	1,800,000*

Notes: The source is: Greensboro Coliseum Complex Income Statements, 1996–2002.
*Preliminary estimates from the GCC staff.

revenue at the GCC was back to its peak level of \$19.4 million although the income loss from the GCC in 2003 was higher than the income loss in 1999.

More important than the financial performance of the GCC over the period from 1996 to 2003 is what ticket revenue, consumer surplus and income losses from the GCC will be over the next twenty years. As discussed earlier, the income elasticity of demand for entertainment based on both time series and cross-sectional data appears to be at least 1. Over the longest period for which County personal income figures are available from the Bureau of Economic Analysis, 1969–2001, personal income in Guilford County has increased by an annual average of 7.7% in nominal dollars and 2.9% per year in real dollars. Assuming this growth trend in real income in Guilford County continues and that the ratio of consumer surplus to ticket revenue remains constant, then consumer surplus at the GCC will rise in real dollars by roughly 2.9% per year. The anticipated growth in GCC demand should also reduce the future income losses from the GCC. For these reasons, the use of 1999 as a benchmark year for measuring consumer surplus from the GCC appears to be quite reasonable.

Conclusion

This paper has estimated Guilford County, NC households' consumer surplus from a major multipurpose coliseum, the Greensboro Coliseum Complex (GCC) for a single year, 1999. The methodology used can be readily applied to estimate household consumer surplus from other sports stadiums or other entertainment complexes that offer locally unique forms of entertainment. An important advantage of focusing on households' demand for entertainment is that it provides an estimate of the distribution of consumer surplus across households, as well as an estimate of aggregate consumer surplus.

In the benchmark case where the price and income elasticity of demand for GCC entertainment are assumed to be, respectively, -1 and 1 , the aggregate consumer surplus from the GCC in 1999 is \$12.1 million, which far exceeds the 1999 GCC income loss plus debt service. Even if liberal adjustments are made to exclude the consumer surplus of GCC attendees who live outside of Guilford County, the estimated aggregate consumer surplus from the GCC was *sufficient to fully cover the income losses and debt service of the GCC* in 1999. This point is worth emphasizing because supporters of public subsidies for stadiums and coliseums have tried to justify these facilities primarily on the basis of economic development, not consumer surplus.

It should also be emphasized that the finding that the aggregate consumer surplus from the GCC exceeds the public subsidies for this facility certainly does not imply that all households in Guilford County benefit from the GCC. Guilford County taxpayers who rarely or never attend GCC events and who do not benefit in some other way from the GCC are worse off as a result of the public subsidies given to the GCC. Also, the distribution of consumer surplus from the GCC is

skewed towards higher income households. For example in the benchmark case, it is estimated that households with incomes above \$102,000, which comprised 12% of Guilford County's households in 1999, received 42% of the aggregate Guilford County consumer surplus from the GCC. Conversely, it is estimated that households with incomes below \$14,634, which comprised 14% of Guilford County's households in 1999, received only 2% of the aggregate consumer surplus from the GCC.

For a full appraisal of whether the GCC or any other facility is a socially worthwhile investment, one should also consider whether the facility creates any significant positive or negative externalities. For example, if an entertainment/convention facility creates traffic jams or other negative spillover effects, this should be counted as part of the facility's costs. On the other hand, if an investment in a facility helps spur welfare enhancing economic development and employment gains then this should be counted as a benefit of the facility. A detailed estimation of the external benefits and costs of the GCC is beyond the scope of this paper.¹⁹

As a final point it should be noted that the consumer surplus estimates were based on the *actual* average prices charged by the GCC in 1999. Because the marginal cost of letting another person attend an entertainment event is zero as long as there are unsold seats, this has important implications for the socially efficient pricing of entertainment events. This is an interesting issue but it is not one discussed in this paper.

Endnotes

- ¹ The apparent failure of major league sports stadiums to have much of an economic impact does not necessarily mean that multipurpose coliseums do not have a significant economic impact. See Layson (1998), for example, for an estimate of the economic impact of the Greensboro Coliseum Complex on Guilford County, NC.
- ² See Spence (1976) and Bresnahan and Gordon (1997) for a good discussion of this issue.
- ³ Because Irani (1997) used a lower (in absolute value) price elasticity of demand for major league baseball (MLB) than that used by Alexander, Kern and Neill's (2000), Irani's estimate of consumer surplus from MLB was larger than the consumer surplus estimate from MLB by Alexander, Kern and Neill. Also, Alexander, Kern and Neill distinguish between private consumer surplus from attending games at the stadium and public consumer surplus from other types of enjoyment that fans get from local sports teams. In this paper, when the term consumer surplus is used it refers to private consumer surplus.
- ⁴ The Greensboro Coliseum Complex is located in the city of Greensboro, North Carolina. The complex consists of an arena that seats 23,000, an auditorium and a special events center. The GCC offers a variety of entertainment and is also used to host conventions and trade shows.
- ⁵ The annual debt service of \$4.98 million assumes that the \$68.5 million GCC debt incurred from 1991 to 1996 for the renovations on the GCC (including highway

improvements) was financed for a term of 30 years at 6% interest. The previous coliseum bonds used to finance the renovations done to the GCC in 1969 have been retired. The costs used to calculate the 1999 GCC income loss of \$945,743 includes all costs other than debt service costs.

- ⁶ One could estimate consumer surplus allowing for varying tastes for entertainment across households. This would clearly affect the distribution of consumer surplus across households, but it would not necessarily affect the aggregate amount of consumer surplus.
- ⁷ The price of non-GCC entertainment in Guilford County is assumed to be unaffected by the amount of entertainment offered by the GCC. This assumption along with the assumption that GCC entertainment enters the utility function in a separable fashion, allows one to use a partial equilibrium measure of GCC consumer surplus.
- ⁸ To be more precise, total consumption expenditure per household is a measure of household permanent income times the marginal propensity to consume.
- ⁹ Alexander, Kern and Neill (2000) also measured price by dividing ticket revenue by attendance.
- ¹⁰ The total annual attendance at the GCC in 1999 was 1,706,760. From discussions with promoters and GCC officials, it is assumed that at most 30% of the total attendance is from residents who live outside of Guilford County.
- ¹¹ For a few events, the promoters received revenue from merchandise sales but these revenues were very small compared to the ticket revenues. For most events, the GCC retains all the revenue from parking fees and concessions.
- ¹² Attendance at most entertainment events at the GCC are below capacity.
- ¹³ See Alexander, Kern and Neill (2000, Table 3, p. 329) and Baye, Jansen and Lee (1992). Irani's (1997) estimate of the price elasticity of demand for Major League Baseball was well below 1 in absolute value (price inelastic). The findings in the current paper show that the more price inelastic demand is assumed to be, the higher is the estimate of consumer surplus.
- ¹⁴ See, for example, the Consumer Expenditure Survey, 1994–1995, Table 5, p. 14.
- ¹⁵ All the estimates of consumer surplus in this paper are based on the assumption that the household demand functions for GCC entertainment are linear. If the inverse demand curve in Exhibit 2 was strictly concave (convex) rather than linear, then consumer surplus would be smaller (larger) than the triangular consumer surplus area.
- ¹⁶ The distribution of household expenditure in Guilford County shown in Exhibit 3 assumes that the ratio of money income to expenditure in Guilford County is the same as the ratio money income to expenditure reported in the 1999–2000 BLS consumer survey of Southern households.
- ¹⁷ The disproportionate amount of consumer surplus received by higher income households is consistent with the voting behavior of Greensboro citizens in the 1990 Greensboro Coliseum Bond Referendum. Voting districts that were wealthier supported the referendum more than poorer districts [see Meadows (1994)].
- ¹⁸ Based on information from the City of Greensboro Finance Department, the income losses for the GCC in 1994 and 1995 were, respectively, \$2,274,008 and \$2,984,791. There is no information on ticket revenue for the GCC before 1996.
- ¹⁹ See Layson (1988) for an estimation of the economic impact of the GCC. To ascertain whether the GCC created negative externalities from traffic jams, parking problems, or

other causes, the author did a computer search of all letters to the editor of the Greensboro newspaper, *News and Record*, from January 1994 to June 2004. During this period, there were more than sixty letters to the editor concerning the GCC but there was only one letter to the editor complaining that GCC created traffic problems and no letters complaining of other externalities.

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