Q. What is the penetration rate for household telephone service in Kansas?

A. According to the latest FCC Telephone Subscribership Report [Feb. 1999], 94.3% of the households in Kansas had a telephone. This percentage, a state-wide average for 1998, exactly matches the national average for the same time period. However, telephone penetration rates can vary significantly for smaller geographic areas. In general, telephone penetration rates are higher in more affluent urban areas and lower in poorer rural areas. Telephone penetration rates also have been found to vary with a wide variety of social and demographic measures such as income, education, and household size.

For example, as shown on page 1 of Schedule 2, telephone penetration rates in Kansas differ markedly depending on the household's income level. In 1998 approximately 99% of Kansas households with income over $40,000 had a telephone; just 91.2% of households with income under $10,000 had a telephone. Over the past 14 years – since the FCC has been tracking penetration rates – Kansas households with incomes under $20,000 have consistently had penetration rates lower than the statewide average. The reverse has been true for households with incomes over $20,000, with the higher the income level the higher the telephone penetration rate. [*Telephone Penetration By Income By State*, FCC, February, 1999.] There has been some variation in penetration rates in Kansas within income groups over time. For incomes under $10,000 the highest penetration listed was 92.2% in 1987 comparing to a lowest value of 82.1% is found for 1994. This suggests a 10 percentage point swing over the past 14 years. However, small year to year variations in penetration values are not necessarily statistically significant. Only large fluctuations, or sustained trends in penetration rates, should be considered important for policy analysis.

Q. Page 1 of Schedule 2 indicates that telephone penetration rates in Kansas over the past 14 years have been essentially flat for households with incomes over $20,000 but have risen for lower income households. Why is this?

A. The demand for telephone service is a function of many factors, including price, income, household size, and the like. The telephone penetration rates for the upper income levels have been consistently high since 1984. For these upper income level households, changes in the factors that impact telephone demand over the past 14 years have had only a small effect. Where telephone service is nearly ubiquitous, most changes in factors like price or income will have little effect on demand. Household income and education levels have increased over the past 14 years. Meanwhile -- in real terms -- the end use price of telephone service has tended to be flat or decreasing. All of these factors have tended to maintain or increase telephone penetration rates. However, the increases that have been experienced are concentrated amongst lower income level households.

Q. So far, your discussion of telephone demand hasn't focused on price. Don't economists usually consider that the most important factor in determining demand?

A. Yes. Economists often focus on the impact on the demand for a good or service due to changes in price while holding all other factors constant. The concept of elasticity is a commonly used measure of impact on demand from price changes. A coefficient of elasticity measures the percent change in demand from a percent change in price. For example if elasticity is -.5 and prices increase 100%, demand for that product could be expected to decrease by 50%. Elasticity coefficients can also be developed for other factors that impact demand, such as income or the price of substitute goods.

Q. What studies are you familiar with that have developed measures for the elasticity of telephone service?

A. There have been many studies performed during the past two decades that have developed elasticity coefficients for a host of telecommunication services. The most thorough that deal with residential demand are described in a set of reports prepared by Lewis J. Perl of NERA and Lester Taylor's 1980 book. [Lewis J. Perl, *Residential Demand for Telephone Service 1983, Prepared for the Central Services Organization, Inc. of the Bell Operating Companies,* Dec., 1983; Lester D. Taylor, *Telecommunications Demand: A Survey and Critique,* Ballinger, 1980.] Taylor finds the elasticity for the monthly service charge for telephone access to be approximately -.1 and the income elasticity for access to be about +.5. [Table 5-1, p 174.]

The Perl Reports – prepared for the Bell Operating Companies, GTE, Continental Telephone, and United Telephone – present a sophisticated econometric residential demand model for telephone service. These models do not find a single static value for price elasticity; rather, the elasticity coefficient is varied for different penetration rates and the price of basic service.

> For the NERA access demand model, elasticity is not constant but varies with both the base price and the percentage of household(s) with phones. ... At current prices and penetration rates, the 1983 model implies a price elasticity of 0.032. (A 100 percent increase in price results in a 3.2 percent decrease in penetration.) [Perl, Op. cit, p. 14.]

Perl goes on to state,

> The differences in price elasticity resulting from variation in price and penetration are also important in a different context. There are wide variations in access prices and telephone penetration from area to area in the U.S. [Id.]

Don Reading, currently vice president of Ben Johnson Associates, Inc., conducted an elasticity study based on the Perl model for the state of Idaho during the time he was on the Idaho Commission staff. Using Idaho-specific data, he found that elasticities varied between -.04 and -.11 for Idaho exchanges depending on the price of basic service and the level of penetration. These elasticities are somewhat higher than the national average found by Perl. This should not be surprising considering Idaho is more rural and has lower incomes than the nation at large. In general, rural customers have fewer telephones they can reach toll free. In addition, because penetration rates are lower for rural areas, some neighbors cannot be reached by telephone, reducing the incentive to join the network. There also tends to be more face-to-face contact among individuals living in small towns and rural areas. All these factors make telephone service less valuable in rural areas and they tend to push up the coefficient of price elasticity.

The results of these studies are important not only because they yield elasticity coefficients that can be used to help predict the impact on telephone penetration from price changes, but also because they show that elasticities are higher for those groups that have the lowest penetration rates. These studies also show that penetration rates are lower for those with lower income, lower education levels, and those who live in the more rural areas. Hence, those who already have the lowest penetration rates are the most sensitive to increases in telephone rates and will leave the network in greater numbers than those groups with higher penetration rates. These facts should be understood by policy makers when evaluating potential increases in telephone rates.

An increase in basic service prices will tend to reduce telephone penetration most significantly in those geographic areas and demographic groups that are currently the farthest below the statewide average penetration rate.

Q. Do you know of any more recent studies that find elasticity coefficients for basic service?

A. Yes. The Organization for the Protection and Advancement of Small Telephone Companies (OPASTCO) conducted a survey of nearly 3,000 respondents of small telephone company subscribers in 1994. Part of that survey included questions that asked whether rate increases of $5, $10, $15, and $25 would cause the respondent to leave the network. The results indicated a price elasticity of demand varying between -.1285 for a $5 increase to -.2614 for a $25 increase. [OPASTCO, *Keeping Rural America Connected: Costs and Rates in the Competitive Era*, 1994, p. 5-5.]

It is not surprising that these elasticities are higher than those found in the Perl and Taylor studies. The subscribers of the OPASTCO member companies that responded to the survey would – in general – be from more rural, lower income, areas with much lower penetration rates than the national sample data used by Perl and Taylor. All of these factors would contribute to higher elasticity coefficients. This again indicates a higher sensitivity to price changes for those geographical areas and demographic groups with the lowest telephone penetration rates.

Q. On Page 1 of Schedule 2 you present FCC data for Kansas that indicated significantly lower telephone penetration rates for households with lower incomes. Are there other Kansas-specific data available that would indicate penetration rates?

A. Yes. The latest available data for telephone penetration rates within areas of the state are from the 1990 census. Pages 2 through 4 of Schedule 2 show telephone penetration rates for Kansas counties. Penetration rates vary by ten percentage points from a high of 99.0% in Johnson County to a low of 82.3% in Cherokee County. Pages 2 through 4 of Schedule 2 also show median household income. Note that Johnson County has median household income that is more than double that of Cherokee County. This indicates that the pattern of telephone demand and penetration in Kansas follows the relationships found in the national studies discussed above.

The 1990 Census can also be used to find telephone penetration rates for sub-county areas through the use of ZIP codes. Schedule 3 profiles two ZIP codes, one with a high and one with a low penetration rate.

This illustrative analysis indicates that areas within Kansas that are poorer, more rural, and less educated tend to have significantly lower telephone penetration rates than areas that are richer, more urban, and more educated. This means that the price elasticities for basic service will be higher for those most economically disadvantaged areas, and they will accordingly be more responsive to price changes than other areas of the state. For example, with a base rate of $17.50 and the penetration rate for renters in zip code 66609 (Topeka) an increase in price of $4.00 would result in a drop in penetration rate of only .3 percentage points to 98.1%. However with this same rate increase the penetration rate for renters in zip code 67859 (Kismet) would be expected to drop 2.9 percentage points from 82.3% to 79.4%, as shown on Schedule 4. For

any given rate increase, changes in penetration rates will vary -- sometimes significantly -- among various geographic areas and demographic groups within the state. A rate increase of $4.00 per month might have an acceptably small impact in a high income area with an already high penetration rate, but a price increase of the same magnitude might have an large impact in a rural, low income area where participation on the network is already quite low. At the state wide Kansas average penetration rate of 94.3% an increase of $4.00 in end user rates would cause about a 1% reduction in subscribership, while a $7.00 increase would mean a 2% drop.

Q. Is there any recent evidence whether the elasticities you have discussed are good predictors of changes in statewide penetration rates due to price increases?

A. Yes. A recent Public Utilities Fortnightly article used Perl and Taylor price elasticity estimates for predictions for penetration rate changes in Illinois and compared them to actual changes in penetration rates. [Peter K. Pitsch and David P. Teolis, "Not Mutually Exclusive," *Public Utilities Fortnightly*, March 15, 1996.] From 1986 to 1993 the Illinois Commerce Commission restructured residential telephone rates, mandating the use of local measured service and allowing monthly local rates to increase from 10% to 30%. The authors of the study conclude:

> The experience with mandated LMS in Illinois indicates that the impact of rate restructuring is considerably less than might be expected. In part this conclusion is due to the fact that LMS keeps telephone access prices low in absolute terms. [Ibid, p. 32.]

It should be noted that since the article was completed, penetration rates in Illinois have dropped from 93.7% in 1993 to 92.6% in 1998.

Q. Do you have any recommendations that the Commission could use to help judge the impact of any changes in rates on telephone penetration?

A. Yes. Using values from the Perl study and an end user rate of $17.50 per month, and the state wide penetration rate of 94.3%, basic service elasticity for Kansas is -.05%. Note that these elasticities are based on both penetration rates and the price of basic service. Because elasticities are higher for areas with the lowest penetration rates, the Commission needs to be aware that impacts in those areas could be more severe. As pointed out above, at the state wide penetration rate for 1998 an increase of $4.00 in end user rates would cause about a 1% reduction in Kansas subscribership, while a $7.00 increase would mean a 2% drop. At higher or lower penetration rates the results would vary.