

STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION

In the matter of

Kearsarge Telephone Company
Wilton Telephone Company
Hollis Telephone Company
Merrimack County Telephone Company

Docket No. DT 07-027

DIRECT TESTIMONY

OF

Pradip K. Chattopadhyay
Assistant Director, Telecom Division

October 12, 2007

1 **Q. Please state your name, business address and occupation.**

2 A. My name is Pradip K. Chattopadhyay. My business address is 21 South Fruit Street,
3 Suite 10, Concord, New Hampshire. I am employed as the Assistant Director,
4 Telecommunications Division for the New Hampshire Public Utilities Commission
5 ("Commission").

6

7 **Q. Please describe your formal education and professional experience.**

8 A. I have a Ph.D. in Economics from the University of Washington, Seattle, which I
9 earned in 1997. I have also taken courses in Energy Planning and Static Optimization
10 with applications to Energy planning from Ohio State University in 2001-02. I have
11 taught several classes at the University of Washington in Microeconomics,
12 Macroeconomics, Managerial Economics, Applied Microeconomics, and Public Sector
13 Economics as an instructor, and was a teaching assistant for several graduate and
14 undergraduate courses in Microeconomics and Macroeconomics while pursuing my
15 Ph.D. at the University of Washington. I am currently an Adjunct Faculty member at the
16 Southern New Hampshire University, where I teach Managerial Economics, Money &
17 Banking, Microeconomics and Macroeconomics.

18

19 From March 1998 to October 1999, I was a Consultant (at the Senior Economist level)
20 with the National Council of Applied Economic Research, New Delhi, India. From
21 November 1999 to August 2001, I was the Economist at the Uttar Pradesh
22 Electricity Regulatory Commission (UPERC) in India, and advised UPERC on tariff
23 issues. From September 2001 to June 2002, I worked at the National Regulatory
24 Research Institute, Columbus, Ohio as a Graduate Research Associate while pursuing
25 advanced courses in Energy Planning in the City and Regional Planning Program at Ohio
26 State University. From June 2002 to July 2002, I worked at the World Bank, Washington
27 D.C. as a short-term consultant/intern with its Energy and Water Division.

28

29 I joined the New Hampshire Public Utilities Commission in August 2002 in the capacity
30 of a Utility Analyst III, and was employed in that capacity until January 2007. My
31 responsibilities at NHPUC as an analyst were in electric utility issues including analyzing

1 and advising the Commission on rate design, cost of capital issues, wholesale market
2 issues, and other regional matters. I briefly worked at the Massachusetts Department of
3 Telecommunications and Energy (later reorganized into Department of Public Utilities
4 (MA-DPU)) starting January 2007 as an Economist. At MA-DPU, I represented the staff
5 and examined gas demand estimation and forecasting, decoupling issues, environmental
6 remediation matters, etc.

7

8 **Q. Have you previously provided testimony before this Commission?**

9 A. Yes. I provided testimony on rate-design matters before the Commission in Docket
10 No. DE 03-200, which was about delivery rates for retail customers of Public Service of
11 New Hampshire (PSNH). I have also provided testimony on cost of capital in Docket
12 No. DE 06-028, which was also about PSNH's delivery rates.

13

14 **Q. What is the purpose of your testimony?**

15 A. The purpose of this testimony is to analyze whether wireless or broadband
16 alternatives in the Hollis & Wilton exchanges are competitive or not.

17

18 **Q. Why is it necessary to analyze whether wireless or broadband alternatives are
19 competitive in Hollis & Wilton?**

20 A. Staff witness Josie Gage has determined that wireless and broadband service is
21 available to the majority of customers in the Hollis & Wilton exchanges. The statute,
22 RSA 374:3b under which the petition was filed, requires at subsection III (a) of RSA
23 374:3-b that the Commission shall approve the alternative regulation plan if it finds that
24 “[c]ompetitive wireline, wireless, or broadband service is available to a majority of the
25 retail customers in each of the exchanges served by such small incumbent local exchange
26 carrier”. RSA 374:3-b defines small ILECs as ILECs serving fewer than 25,000 access
27 lines. As TDS has an exclusive franchise for wireline service in its territory, it suffices to
28 analyze only whether wireless or broadband alternatives in the Hollis & Wilton
29 exchanges are competitive or not.

30

1 **Q. Does availability of wireless or broadband services mean that the services are**
2 **competitive?**

3 A. No. Wireless or broadband services may be available in an exchange, but their
4 availability does not necessarily mean they are competitive with basic local service.
5 Whether the market for basic local service is competitive or not, depends on what we
6 mean by “competitive”. The statute which is the basis for the docket does not define
7 “competitive.”

8

9 **Q. Why is it important to determine whether alternative services are competitive?**

10 A. Subection III (a) of RSA 374:3-b requires that the Commission find that
11 “[c]ompetitive wireline, wireless, or broadband service is available to a majority of the
12 retail customers in each of the exchanges served by such small incumbent local exchange
13 carrier”. The Commission must determine what is meant by “competitive” to determine
14 whether RSA 374:3-b III(a) is satisfied, which is one of the prerequisites to the approval
15 of the alternative regulation requested by the Company.

16

17 **Q. The statute does not specify explicitly with which ILEC services the alternatives**
18 **compete. In staff’s view which ILEC retail service should be the subject of**
19 **competition analysis?**

20 A. The staff recommends that the service of interest should be basic local service. A
21 local exchange carrier (LEC) is required to make such service available to all customers
22 within its franchise area. Such a treatment is not accorded to any other service.
23 Regulatory relief offered by the statute allows the ILEC to be regulated like a CLEC,
24 which by definition competes for basic local service. This prominence suggests that the
25 expectation is that market power will be constrained without price regulation. If it can be
26 demonstrated that the majority of retail customers of basic local service have competitive
27 alternatives in each exchange, price deregulation will not be to the detriment of local
28 exchange customers.

29

30 **Q. Does staff have a recommendation on how to determine whether or not the**
31 **available wireless or broadband service is competitive with basic local service?**

1 A. Yes. In staff's view whether or not the market for basic local service is actually
2 competitive would require understanding how retail customers respond to the change in
3 price of basic local service. While wireless and broadband service may be increasingly
4 available, whether or not basic local service has competitive alternatives, is a question
5 about whether or not in the current environment, price deregulation (with caps or not)
6 would expose a retail customer to unconstrained prices or whether a customer is able to
7 sufficiently substitute away from the ILEC service, to counter any market power that the
8 ILEC may have. How retail customers actually substitute between basic local service
9 and alternatives can ideally be gauged from their observed reaction to changes in the
10 price of basic local service. Such an investigation is the essence of competition analysis.

11

12 **Q. What is staff's understanding of the Company's position on the significance of**
13 **the word "competitive" in the statute?**

14 A. As staff understands it, the company's position is that the legislature has already
15 concluded that wireless and broadband services are competitive alternatives to basic local
16 service provided by a small ILEC, and therefore a determination as to whether or not
17 alternatives are competitive is unnecessary. According to the company, the statute only
18 requires that the Commission determine whether alternatives are available to the majority
19 of retail customers in each of the exchanges served by TDS. The Company's position is
20 captured in a response to a data request.

21 "Given that the General Court has already determined that wireline, wireless and
22 broadband service competes with an ILEC, the only finding necessary by the NHPUC is
23 to determine that the majority (greater than 50%) of retail (i.e., residential and business)
24 customers have available to them a choice of a wireless, wireline or a broadband
25 provider. Mr. Reed's testimony, supporting documents and responses to these data
26 requests shows that this criterion has been met." *Company Responses To Staff Set 1 Data*
27 *Requests, STAFF 1-81*

28
29

30 **Q. Do you agree with that interpretation?**

31 A. No.

32

33 **Q. Why do you disagree with that interpretation?**

1 A. As documented in *2005 New Hampshire Laws Ch. 263 (H.B. 194)*, “[t]he general
2 court finds that the growth of unregulated wireless and broadband telecommunications
3 services has provided consumers alternatives to traditional telephone utility services.”
4 However, the general court has not concluded whether these services have provided
5 competitive alternatives to retail customers. If the general court had indeed found that, it
6 would have said so explicitly, in which case it would not have included in the statute a
7 requirement that the Commission find that “[c]ompetitive wireline, wireless or broadband
8 services is available to a majority of the retail customers in each of the exchanges served
9 by such small incumbent local exchange carrier” before the Commission approves an
10 alternative regulation plan for the small ILEC in question. Also, while the legislature has
11 found that “incumbent local exchange carriers face competition from services that are not
12 regulated” (Sec 263:2, *2005 New Hampshire Laws Ch. 263 (H.B. 194)*), it has not
13 determined whether wireline, wireless or broadband are competitively available to all
14 retail customers in jurisdictions where such ILECs face competition from services. It is
15 possible that while alternative services compete with the incumbent’s retail service in a
16 service area, some customers in that service area may nevertheless find that those
17 alternatives are not competitively available, as the customer is unable to sufficiently
18 substitute away from the incumbent’s service to constrain market power.

19
20 **Q. Has the Company demonstrated that competitive wireline, wireless or broadband**
21 **service is available to the majority of customers in each exchange?**

22 A. No. In staff’s opinion, the Company incorrectly presumes that the General Court has
23 already determined that all wireless and broadband alternatives are *competitively*
24 available to a customer whenever either or both of these alternatives are available to such
25 a customer. TDS, therefore, only attempts to prove that wireless or broadband
26 alternatives are available to the majority of the customers in its service territory. First,
27 staff finds that the Company’s analysis of whether wireless or broadband alternatives are
28 available to the majority of customers in each of the exchanges served by TDS is
29 deficient. Second, even if such services are available to a majority of customers in each
30 exchange, without a careful examination of whether such availability is competitive or
31 not, we cannot address the specific finding required by subsection III (a) of RSA 374:3-b.

1

2 **Q. Staff indicates that the key question about whether availability of wireless or**
3 **broadband service is competitive with basic local service or not, is whether market**
4 **power is constrained under a deregulated price for basic local service. How does**
5 **staff propose to answer this question?**

6 A. To determine whether or not market power would be constrained if prices were
7 deregulated, it is vital to examine whether or not a price increase for the product/service
8 leads to an adequate enough substitution away from the product/service in question, that
9 the company would yield lower net revenue, everything else held the same. This
10 determination requires measuring the price elasticity of demand for basic local service to
11 demonstrate whether the market is sufficiently competitive to defer to deregulated
12 pricing. I will discuss this condition in greater detail later.

13

14 **Q. Please explain price elasticity of demand for a product/service.**

15 A. Price elasticity of demand is defined as the ratio of the percentage change in quantity
16 demanded to the percentage change in price of the product/service, everything else held
17 the same. Since an increase in the price of a product/service leads to a decrease in the
18 quantity demanded of a product, the price elasticity of demand is negative. Also if the
19 quantity demanded changes in absolute terms by a greater percentage than the percentage
20 change in price, the price elasticity is greater than one. If the quantity demanded changes
21 in absolute terms by a lesser percentage than the percentage change in price, the price
22 elasticity of demand is less than one.

23

24 **Q. How can an estimate of the price elasticity of demand for basic local service show**
25 **that deregulating the price will discourage market power?**

26 A. It can be shown that if the price elasticity of demand for basic local service is
27 sufficiently greater than one, the decrease in the quantity demanded for basic local
28 service would be proportionately more than the increase in the price of basic local
29 service, and despite some incremental cost savings, will render a price increase
30 ineffective as net revenue is adversely impacted, discouraging any exercise of market
31 power (see Appendix 1 for a formal proof). Succinctly, this can be represented as

1 $|e| > 1 / ((1 - (c/P)))$, (1)

2 where e is the price elasticity of demand, c is the per unit incremental cost, and P is the
3 product's price. Showing that the inequality (1) holds, would be a reasonable testimonial
4 to the existence of competition in the market for basic local service.

5
6 **Q. Can you provide an intuitive explanation for the above condition?**

7 A. Yes. Intuitively, in response to a percentage increase in price, market power is
8 ineffective, if the percentage decrease in quantity demanded not only negates the
9 percentage change in price, but also negates the savings on account of incremental costs,
10 which in effect implies that the price elasticity of demand cut-off must be greater than
11 one. I will for convenience from here on denote the right hand side of (1) as the critical
12 price elasticity of demand.

13

14 **Q. Has the Company provided estimates of price elasticities of demand for basic**
15 **local service for each of the exchanges?**

16 A. No. The Company indicated that the Petitioners do not have such estimates. Further,
17 the Company refused to estimate price elasticity of demand when asked by staff (see
18 Company's Supplemental Response to Staff 1-6, Attachment 1).

19

20 **Q. Why is it important to have estimates of the price elasticity of demand for basic**
21 **local service?**

22 A. It is important to estimate the price elasticity of demand for basic local service to
23 determine whether available alternatives to basic local service, i.e. wireless and
24 broadband services, are competitive. In order to do this, it is necessary to examine
25 whether inequality (1) is true or not in the case of the ILEC's basic local service, which
26 necessitates having estimates for price elasticity of demand for basic local service. A
27 sufficiently high price elasticity of demand will demonstrate that customer migration
28 caused by price increases would reduce revenue sufficiently to discourage exercise of
29 market power and that competitive alternatives are available to the ILEC's retail
30 customers.

31

1 **Q. Has the staff conducted any estimation of price elasticity of demand for basic**
2 **local service for the exchanges served by TDS?**

3 A. Yes. Since we have found that only Hollis and Wilton (which are single-exchange
4 companies), have passed the test that the majority of retail customers have wireless or
5 broadband service available in each exchange, the staff has econometrically estimated the
6 price elasticities of residential demand for basic local service for Hollis and Wilton
7 respectively, to determine whether the available services are competitive for the majority
8 of customers in those exchanges.

9

10 **Q. Please describe the empirical approach behind the estimations.**

11 A. For an apposite exchange, we modeled several regressions using monthly data that
12 explain the residential demand for basic local service, measured in number of
13 connections, as dependent on the real price per connection of basic local service
14 (calculated as the ratio of price of residential basic service access lines and the Consumer
15 Price Index (CPI)), and other control variables, i.e. NH wide unemployment rate (as a
16 proxy for the state of the economy¹), a normalized price index for wireless service
17 (available at the national level) as a proxy for the price of wireless service, which
18 according to TDS is a substitute for basic local service, and a trend variable. The
19 regressions we used are based on log-linear and linear Ordinary Least Squares (OLS)
20 estimation approaches. Denoting the dependent variable as DV, the independent
21 variable as IV and the errors are ϵ , the general form for all of the regressions is
22 $DV = \text{constant} + \text{coefficient}_1 * IV_1 + \text{coefficient}_2 * IV_2 + \dots + \text{coefficient}_n * IV_n + \epsilon$, where
23 there are n independent variables in the model.

24 The dependent variable and the independent variables for individual regressions are
25 identified in Appendix H for Hollis and Appendix W for Wilton. These regressions were
26 conducted using STATA, a widely used statistical package. To ensure that regressions
27 were econometrically sound, I also checked for autocorrelation in errors, using the
28 Durbin Watson test and autocorrelation graphs, and for heteroskedasticity in errors using
29 the Breusch-Pagan test. As autocorrelation in errors was detected in all of the traditional

¹ Since we could not obtain monthly data on NH's State Domestic Product, we have used the NH wide employment rate, which is available monthly.

1 OLS estimations, we corrected for autocorrelation using the Prais Winsten approach in all
2 of the estimations. The Prais Winsten approach is a reasonably effective way of
3 correcting for autocorrelation in errors when the sample is modestly sized. Also, for our
4 regressions, we have used data from two periods; January 2004 to June 2007 and Dec
5 2004 to June 2007 to run separate regressions for some of the models. This was
6 primarily done to balance the needs for a sufficiently sized data set and the importance of
7 using contemporary data given the evolving nature of telecommunications services.
8

9 **Q. Please explain why you chose the aforementioned empirical approach for the**
10 **estimation of price elasticities of demand?**

11 A. The Company was unable to provide estimates of price elasticities of demand for basic
12 local service even for one exchange or for that matter even at the company level. In the
13 context of this docket, my approach fills an important void to permit the necessary
14 analysis of competition. While one can use other econometric approaches to such
15 estimations, given the data limitations, my approach is a reasonable one. TDS was
16 unable to provide adequate exchange level or even aggregated monthly numbers of basic
17 local service access lines for all customers (See Company's Supplemental Responses to
18 Staff 2-2, 2-3 and 2-4, Attachment 2). Monthly data was also unavailable for exchange
19 specific wireless pricing and some measure of economic activity. In order to analyze
20 specific realities at an exchange level, in the absence of exchange-specific data, I relied
21 on national and state level proxies to capture some of the unavailable variables. My
22 approach produces a range of estimates for the price elasticity of residential demand for
23 basic local service, that can be used to determine whether wireless or broadband
24 alternatives are competitive or not for the majority of the customers in the exchanges
25 studied. The objective behind these estimations is not to precisely estimate price
26 elasticities of demand, but absent specific evidence from the company, to check whether
27 it can be said with enough confidence that market power concerns are not real for the
28 majority of the customers in each studied exchange.
29

30 **Q. Why were the monthly data on the numbers of residential basic local service**
31 **access lines not available?**

1 A. Staff asked the Company to provide such data but the Company was only able to
2 provide *year-end* data for 2004, 2005 and 2006, and year to date through August 2007
3 (See Company's Supplemental Responses to STAFF Set 2 Data Requests, STAFF 2-2,
4 STAFF 2-3 and STAFF 2-4).

5
6 **Q. Since the Company did not provide the monthly data for the actual number of**
7 **basic local service access lines, residential or otherwise, how did you derive the**
8 **monthly data on the number of residential basic local service access lines?**

9 A. The Company provides the monthly total number of access lines (residential plus
10 business) on NHPUC Form ILEC-21 – which reports the number of customer trouble
11 reports per 100 access lines, filed with the Commission each month. To derive the
12 number of residential lines from the monthly total, we used the Company's responses to
13 staff data requests 2-2, 2-3 and 2-4, which indicated that the numbers of residential basic
14 access lines were 75.36%, 75.32%, and 74.66% of the total number of access lines at
15 year-end respectively for 2004, 2005 and 2006 for Wilton. The numbers of residential
16 basic access lines were 80.79%, 80.37%, and 79.96% of the total number of access lines
17 at year-end respectively for 2004, 2005, and 2006 for Hollis. As these percentages for
18 the respective exchanges do not vary much over the two years, we have interpolated and
19 extrapolated percentages to derive the series for residential basic service access lines. We
20 first calculated the uniform per-month change in the percentage points, based on the year-
21 end percentages for 2004 and 2006. For example, for Hollis, the shares of residential
22 customers in total access lines, as indicated above, were 80.79 percent at year end 2004
23 and 79.96 percent at year end 2006. The difference in the percentages is (79.96 -80.79),
24 i.e. -0.83, which when divided by 24 (the number of months over that period), yields
25 approximately -.03 for the per-month uniform percentage points' change. This per-
26 month change in the percentage points was applied both backwards (in which case it is
27 0.03 percentage points' change per month), and forward (in which case it is -0.03
28 percentage points' change per month) around Dec. 2004, to yield a series for the monthly
29 percentages for the period January 2004 to June 2007. The same approach was also
30 applied to Wilton. The relevant series for the monthly percentages were then multiplied
31 by the monthly total access lines for January 2004 to June 2007 for the respective

1 exchanges and rounded to the nearest integer, to yield 42 observations on residential
2 demand for basic local service, measured in number of access lines. Because the
3 company was unable to provide the necessary data, we were compelled and have relied
4 on these series to conduct our analysis. This approximation is reasonable as we find that
5 the percentages, noted above, have not varied significantly over two years.

6
7 **Q. Why did you derive the above series only for residential customers?**

8 A. The price of basic local service, a key explanatory variable in our analysis, is
9 significantly different for residential and business customers. It is generally not
10 appropriate to work with the total number of basic service lines and model the impact of a
11 weighted price on it. Using a weighted price based on residential and business
12 customers' respective shares would compromise the exogeneity of an important
13 explanatory variable (price of basic local service), which is not desirable for my proposed
14 econometric approach. It is however reasonable to postulate that the residential demand
15 for basic local service is influenced by the residential price and the business demand for
16 basic local service is influenced by the business price. To conduct a study of these
17 relationships, it is important to have the number of access lines separately for residential
18 and business customers. In the context of the statute though, since residential customers
19 form a majority of the retail customers, if it is demonstrated that the price elasticity of
20 residential demand for basic local service in an exchange is greater than the critical price
21 elasticity of demand, it can be reasonably concluded that the market is competitive for the
22 majority of retail customers. In the contrary, if it is found that the price elasticity of
23 residential demand for basic local service in an exchange is less than the critical price
24 elasticity of demand, we can conclude that the market for basic local service is not
25 competitive for the majority of the customers in the exchange. It therefore suffices as
26 well as is, expedient to restrict the analysis to residential customers only.

27
28 **Q. Please summarize your empirical findings.**

29 A. The empirical findings are summarized in Appendix H and Appendix W for Hollis
30 and Wilton respectively. I have reported the results for several regressions for both
31 Hollis and Wilton.

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Q. Please explain how you interpret the empirical findings that you have reported in Appendices H and W.

A. While I discuss the findings separately for Hollis and Wilton below, it is helpful to describe the nature of the output that is depicted in Appendices H and W. A quick look at one of the models in Appendix H would therefore be helpful. Let’s discuss Model H1. This model postulates a linear relationship between the logarithm of the residential basic local service access lines and the logarithm of the real residential price for basic local service, normalized wireless price index, NH wide unemployment rate, and a trend variable (time). The model also includes an intercept term. The unexplained deviations are captured by the error term. Based on economic reasoning, demand for basic local service is negatively related to the price of basic local service and unemployment rate (as a proxy for economic “downturn”), and is positively related to the price of wireless service, if basic local service is a substitute for wireless service.

Based on an Ordinary Least Squares (OLS) econometric construct, data on the indicated variables are used to estimate the coefficients associated with the independent variables by minimizing the sum of squares of errors. As the classical OLS modeling assumes that the error terms are randomly distributed with zero mean and a constant variance regardless of the observations, if these assumptions are violated because errors are autocorrelated and/or exhibit heteroskedasticity, corrections for such violations are necessary. We therefore tested for both autocorrelation and heteroskedasticity in errors. As it turns out for Model H1, tests for autocorrelation indicated that error terms are positively correlated when the traditional OLS approach is applied. We therefore had to correct for autocorrelation in the error terms. Using STATA and applying Prais Winsten correction for autocorrelation in errors, we find that the estimates for the intercept and coefficients associated with the logarithm of the real residential price for basic local service, normalized wireless price index, NH wide unemployment rate, and the trend variables were respectively 8.63, -0.38, 0.005, -.008 and -0.003. These numbers are reported in columns 3, 5, 6, 8 and 10 respectively in the row associated with Model H1. The t values and probabilities that these t values will be exceeded in absolute terms are

1 also reported for the respective intercept/coefficients. A look at these numbers will be
2 useful when we discuss the results for the exchanges individually below. For example, if
3 the t value (in Column 6) is so high that the probability that this value will be exceeded is
4 less than five percent, i.e. less than 0.05, it is said that the estimate of the coefficient is
5 statistically significant at 5 percent. Typically the lower the level of significance, the
6 better the statistical result is. 5 and 10 percent levels of significance are often used as the
7 cut-off to consider whether the coefficient's estimate is statistically reliable or not.
8 Column 12 indicates the period from which the monthly data was used for the regression;
9 in the case of Model H1 it is January 2004 to June 2007.

10
11 It is very important to point out that in the context of this docket, the ultimate objective
12 behind these regressions is to get a measure for the relationship between the real price of
13 basic local service and the quantity demanded of basic local service (number of access
14 lines). The estimates of the coefficient associated with the real price for basic local
15 service will be used to derive estimates of the price elasticity of demand for basic local
16 service, which will throw light on the issue of whether market power is constrained, as
17 expected in a competitive market, in the studied exchanges. It is therefore the estimates
18 under columns 4 or 5 that we will discuss the most.

19
20 **Q. Please explain how the estimates of coefficients are associated with the real price
21 of basic local service used to derive the estimates of the price elasticity of demand?**

22 A. For the models H1-H4, W1-W4, W7 and W8, the logarithm of the number of
23 residential basic local service access lines is regressed on the logarithm of the price of the
24 product (and other control variables). For these models, the post-regression estimates for
25 the coefficient associated with the price of residential basic local service are themselves
26 estimates of the price elasticity of demand for residential basic local service.

27
28 For models H5, H6, W5 and W6, the number of residential basic service access lines is
29 directly regressed on the real price of residential basic local service (and other control
30 variables). For these models, the post-regression estimates for the coefficient associated
31 with the real price level for residential basic local service must be multiplied by the ratio

1 of the level of price (at which the elasticity is being measured) to the fitted number of
2 residential basic local service access lines to determine the price elasticity of demand.
3 An example would be helpful for such models. Let's consider Model H5. It produces an
4 estimate of -174.2 for the coefficient associated with the independent variable
5 "realrprice", which is the real price of residential basic local service in Hollis. At the
6 real price for residential basic local service (i.e. 7), wireless price (wlp), unemployment
7 rate (uerate) and the trend variable time for June 2007, the fitted demand for residential
8 local service is 2380 access lines. Since the price elasticity of demand is the estimate of
9 the coefficient associated with "realrprice," i.e. -174.2, multiplied by the ratio of the real
10 price of residential basic local service to the fitted demand for residential local service,
11 i.e. (7/2380), the estimate for the price elasticity of demand is -174.2 multiplied by
12 (7/2380), which yields -0.51. It is important to observe that the price elasticity of demand
13 for residential basic local service for such models will vary positively with the price of
14 residential basic local service.

15

16 **Q. Briefly discuss the empirical findings for Hollis.**

17 A. While we have used data for January 2004 to June 2007 for models H1, H2 and H5,
18 as the telecommunications industry is evolving relatively fast, we have also used a shorter
19 but more recent period, i.e. December 2004 to June 2007, for our analysis, which is
20 reported in models H3, H4 and H6 (See Appendix H). For all models specific to Hollis,
21 we find that the coefficients associated with the price of basic local service, price of
22 wireless, and unemployment rate are all of the sign that is predicted by economic
23 reasoning. Also, the price for basic local service is statistically significant at the 5 percent
24 level for all six regressions. The unemployment rate variable is statistically significant at
25 5 percent (also at the 1 percent level) for all of the models. The wireless price variable is
26 significant at the 5 percent level for one of the regressions (H5) and at the 10 percent
27 level for Models H1, H2 and H6.

28

29 With respect to the price variable, in models where the logarithm of real price of basic
30 local service is used as an explanatory variable, we find that the estimates of the
31 coefficients range between -0.38 and -0.44. We also observe that these estimates did not

1 vary much regardless of whether we used the more recent period or the entire period
2 January 2004 to June 2007, even though the estimates for the coefficient were slightly
3 higher for the “more recent” models compared to the other ones. In the two models H5
4 and H6, the estimates for the coefficient associated with the price of basic local service
5 are respectively -174.2 and -189.1. Again, the estimate for the “more recent” model is
6 higher compared to the other model.

7

8 **Q. Briefly discuss the empirical findings for Wilton.**

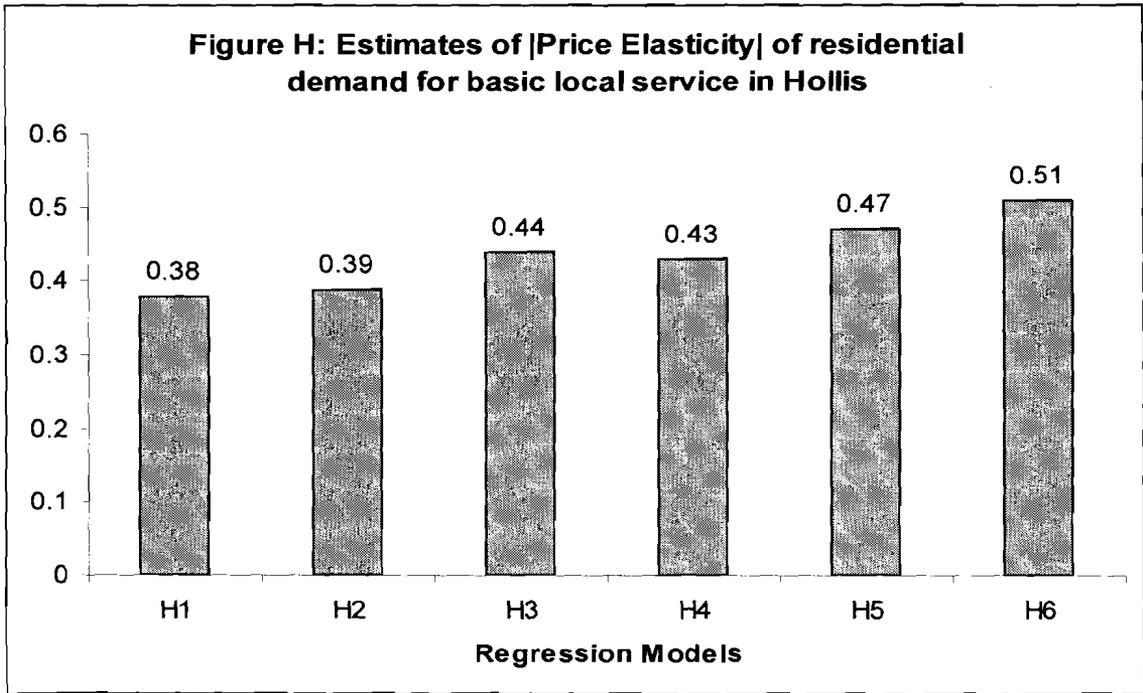
9 A. We have used data for January 2004 to June 2007 for models W1 and W2 and data
10 for December 2004 to June 2007 for models W3-W8 (See Appendix W). We find that
11 the coefficients associated with the price of basic local service, price of wireless, and
12 unemployment rate are all of the sign as predicted by economic reasoning. The price for
13 basic local service is statistically significant at the 10 percent level for Models W6, W7,
14 and W8 (Three other models, i.e. W3, W4, W5, produce estimates for the price of basic
15 local service, which are statistically significant at slightly higher than the 10 percent
16 level). Since the coefficient associated with the unemployment rate variable was found to
17 be highly statistically insignificant in models W1-W5, we excluded unemployment rate
18 from the list of independent variables to get models W6, W7 and W8. The wireless price
19 variable is significant at the 5 percent level for six of the eight regressions.

20

21 Since Models W1 and W2 produce statistically insignificant results for all of the key
22 economic variables (price of basic local service, price of wireless service, and
23 unemployment rate), we restrict our analysis of the basic local service’s price to the other
24 six models, which all use the data set with only the more recent observations. In models
25 where the logarithm of real price of basic local service is used as an explanatory variable,
26 we find that the estimates of the coefficients range between -0.42 and -0.44. In the two
27 models where the real price is directly used as an explanatory variable, the two estimates
28 for the coefficient associated with the price of basic local service are -344.2 and -347.9.
29 The estimates were very similar regardless of whether we model unemployment rate as
30 an explanatory variable or not.

1 **Q. Based on the empirical findings for Hollis, please report the estimates for the**
2 **price elasticity of residential demand for basic local service.**

3 A. For Models H1-H4, where the logarithm of the number of residential basic service
4 access lines is regressed on the logarithm of the real residential price of basic local
5 service, the estimates for price elasticity of residential demand for basic local service for
6 the Hollis exchange are respectively -0.38, -0.39, -0.44 and -0.43. For Models H5 and
7 H6, where the number of residential basic service access lines is regressed on the real
8 residential price of basic local service, we use the data from June 2007, to respectively
9 yield, -0.47 and -0.51 as estimates for price elasticity of residential demand for basic local
10 service in the Hollis exchange (See Figure H).



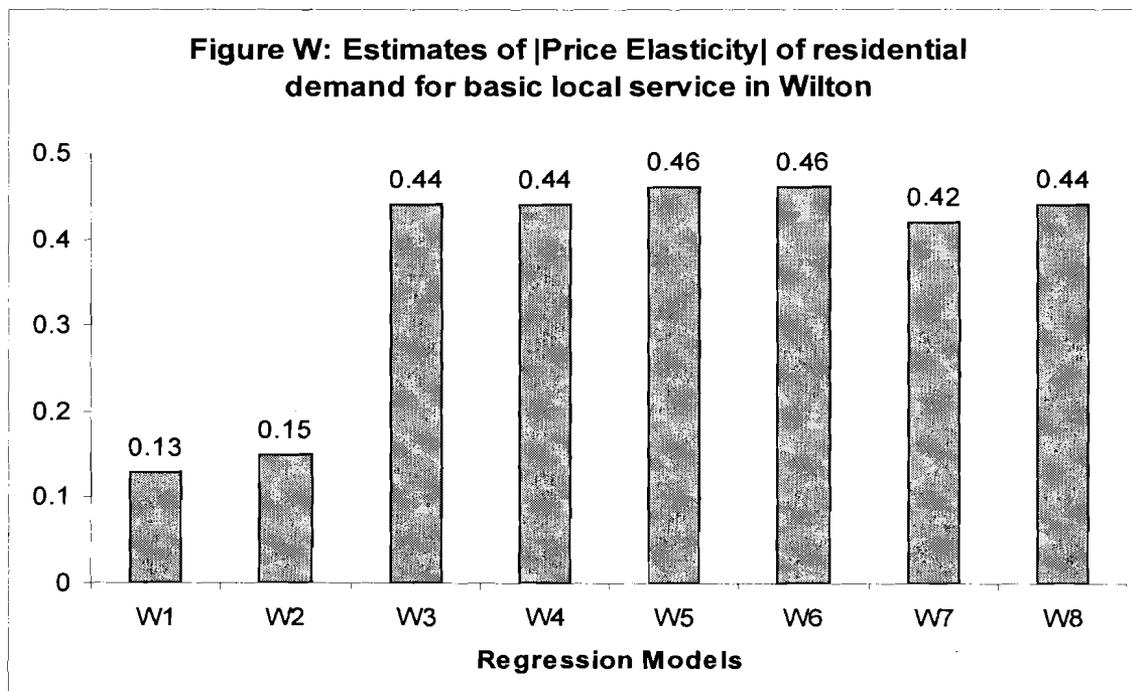
11
12 While staff had queried TDS about the actual rates of return on equity on the intrastate
13 business segment for each of the four TDS companies, the Company did not make them
14 available (See Company response to Staff 1-1, Attachment 3). The presumption therefore
15 should be that the current price for basic local service yields a reasonable return.
16 Nevertheless, it is useful to hypothesize that if a \$2.50 increase in the price per access
17 lines is needed to allow a reasonable return, what would happen to the price elasticity of
18 residential demand for basic local service in Hollis. Using data from June 07 for the
19 other independent variables and plugging in the updated number for the nominal price,

1 we find that Models H5 and H6 respectively yield -0.60 and -0.66 as estimates for price
2 elasticity of residential demand for basic local service in the Hollis exchange in the
3 hypothetical scenario.

4

5 **Q. Based on the empirical findings for Wilton, please report the estimates for the**
6 **price elasticity of residential demand for basic local service.**

7 A. Based on Models W3, W4, W7 and W8, which are log-linear, the estimates for price
8 elasticity of residential demand for basic local service for the Wilton exchange are
9 respectively -0.442, -0.44, -0.42 and -0.437. Using the data from June 2007, both Models
10 W5 and W6 (which are linear models) yield - 0.46 as price elasticities of residential
11 demand for basic local service for the Wilton exchange (See Figure W). Again, if we
12 hypothesize that a \$2.50 increase in the price per access lines is needed to allow a
13 reasonable return on equity, and see what that means for the price elasticity of residential
14 demand for basic local service, using data from June 07 for the other independent
15 variables and plugging in the updated number for the nominal price, we find that Models
16 W5 and W6 yield -0.76 and -0.77 respectively as estimates for price elasticity of
17 residential demand for basic local service in Wilton.



18

1 **Q. In view of the findings above, do you find that competitive alternatives are**
2 **available to the majority of retail customers in Wilton or Hollis?**

3 A. No. As described above, whether competitive alternatives are available to a customer
4 or not can be gauged from whether $|e| > 1 / (1 - (c/P))$ or not.² Even if we assume that the
5 incremental cost savings associated with the disconnection of an access line is zero, the
6 critical price elasticity is 1. In response to the query on the estimate for the incremental
7 cost savings associated with the loss of a basic local service connection, TDS indicated
8 that no such estimates have been prepared (See Company's Supplemental Response to
9 STAFF Set 2 Data Requests, STAFF 2-1, Attachment 4). TDS however indicates that
10 "the only portion of the customer's service not requiring maintenance would be the
11 specific service wire from the customer's service pole to the house and the Network
12 Interface Device on the side of this house," which suggests that even if the incremental
13 cost savings are insignificant, there are some savings. It is therefore reasonable to state
14 that the critical price elasticity for our purpose is at least slightly higher than 1. Based on
15 the empirical results from the models we have investigated, we obtain estimates for price
16 elasticity of residential demand for basic local service that are all comfortably less than
17 one for both Wilton and Hollis. As residential customers form a majority of retail
18 customers in both exchanges, based on the analysis described above, staff concludes that
19 competitive alternatives are *not* available to the majority of retail customers in either the
20 Wilton or Hollis exchanges.

21
22 **Q. Would you please summarize your testimony?**

23 A. TDS did not provide specific evidence that competitive wireline, wireless or
24 broadband service is available to the majority of customers in each exchange. Rather, the
25 company provided a conglomeration of general information which relied considerably on
26 TDS' provision of DSL to demonstrate alternatives are available. The statute requires an
27 exchange specific analysis. Because the company did not provide a precise exchange
28 specific analysis excluding TDS DSL, staff endeavored to determine whether alternative
29 services were available in each exchange (See direct testimony of Josie Gage) and where
30 alternatives were available in each exchange, whether they were competitively available

² e is the price elasticity of demand, c is the per unit incremental cost, and P is the product's price.

1 to the retail customers. TDS did not attempt to prove whether the alternatives were
2 competitively available to the majority of the customers in any of the exchanges.
3
4 Based on my analysis of the price elasticity of residential demand for basic local service
5 for the Hollis and Wilton exchanges, there is no proof that the alternative services are
6 competitively available to the majority of the customers. RSA 378:3-b III (a) requires a
7 finding that wireline, wireless or broadband service are competitively available to the
8 majority of the retail customers. Despite availability of alternatives, TDS' market power
9 is not likely to be constrained for the majority of retail customers in the Hollis and Wilton
10 exchanges. Most of the customers will not be afforded the protection contemplated by
11 the statute if TDS prices are deregulated. Staff therefore recommends the Commission
12 deny TDS' proposal.

13
14 **Q. Does that conclude your testimony?**

15 A. Yes, it does.

1 **Appendix 1:**

2 Let quantity demanded of a product be Q , and the price of that product is P .

3 Assume that the percentage increase in price is x percent which leads to a y percentage
4 decrease in the quantity demanded of that product.

5 Assume that the incremental cost of producing one unit of the product is c .

6 It follows that the savings in incremental cost due to the y percentage decrease in the
7 quantity demanded of the product is c times y times Q .

8 The change in sales revenue therefore is

9 $(1+x)$ time $(1-y)$ time PQ less PQ

10 The change in net revenue therefore is

11 $\Delta NR = (1+x)(1-y)PQ - PQ - cyQ$

12 ΔNR is negative if a price increase renders market power ineffective.

13 The proportional change in net revenue would be negative if

14 $(\Delta NR/PQ) = (1+x)(1-y) - 1 - (cy/P)$ is negative. i.e.

15
$$(1+x)(1-y) - 1 - (cy/P) < 0 \tag{1}$$

16 which reduces to

17
$$x - y - xy < (cy/P) \tag{2}$$

18 Dividing through by x and rearranging, we get

19
$$1 - (y/x) < y + (c/P)(y/x) \tag{3}$$

20 Noting that $-(y/x)$ is the absolute level of price elasticity of demand, i.e. $|e|$, we get

21
$$(1 - (c/P)) |e| > 1 - y \tag{4}$$

22 Since price elasticity is measured for infinitesimally small changes in prices (and

23 therefore quantity; i.e. $y \rightarrow 0$), (4) reduces to

24
$$|e| > 1 / (1 - (c/P)) \tag{5}$$

25 Comment: It follows from (5) that when c is relatively insignificant compared to P (i.e.

26 fixed costs dominate the provision of product/service), the condition collapses to $|e| > 1$.

27 For most regulated products, fixed costs are relatively high compared to the incremental
28 costs, but in most cases incremental costs are not insignificant. More likely therefore the
29 cut-off for the level of price elasticity of demand is higher than 1.