Price and Quality Relationships in Local Service Industries

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products. The results of these studies have also been quite consistent. In general, price and quality are only weakly correlated, with coefficients usually ranging from .20 to .25 [7]. These results are construed as evidence that consumer product markets perform "poorly," with one set of coauthors feeling motivated to title their article "The Chaos of Competition." [10]

This literature suffers from several weaknesses and limitations. Most obviously, the results can be no more reliable than CR's product ratings. Even if it is assumed that all of the CR protocols were appropriate and the tests performed competently, CR might not weight the various performance attributes for complex products such as stereo equipment, dishwashers, or tires in the same manner as would the average consumer.

And, if CR did happen to replicate the tastes of average consumers, significant subsets of buyers might still rank the products differently and willingly pay more for specialized products that might do relatively poorly in the ratings. Further, CR's ratings are not based on aesthetic qualities that may be very important to many consumers and that tend to be directly related to price.

Finally, sole reliance on CR automatically excludes all of the consumer service and retail industries that are supplied locally. Published studies of price and quality correlations for local services are limited to analyses of the legal and optometrical markets, where price advertising has been severely constrained [3]. We therefore have no systematic examinations of price and

Although some establishments refuse to participate in this phase of WCC's research, ratings generally are available for 85-90 percent of the rated firms. WCC confers a check rating for price to the firms with the lowest price index scores.

In addition to price data, WCC customarily contacts local consumer protection offices to determine the number of complaints on file for each of the surveyed firms. (As discussed below, the complaint data provide one means of checking the reliability of the WCC survey results.) Finally, for approximately one-third of the rated industries, WCC gathers information from firms on the number of principal employees, such as auto mechanics or licensed plumbers. This information is used to normalize the complaint data for size of firm, and is not published separately.[3] WCC agreed, however, to provide all available employee data for the most recent rating period. These data serve as a measure of firm size in the statistical analysis.[4]

WCC Magazine is published on a roughly biannual basis, with approximately five or six industries per issue. For certain industries, such as medical professionals and financial institutions, WCC does not provide overall quality ratings and/or price index information. For the current research, suitably complete data were available for 19 service industries. In most cases, each industry was rated on several occasions over time. These industries are presented in Table I below, with the number of individual data sets for each industry given in parentheses.

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[3] Assuming a firm has at least one complaint on file, the employee data can be derived using the absolute number of complaints and the complaint rate index, both of which are provided in the ratings. The majority of firms, however, have no complaints, thus precluding any indirect calculation of employee size.

[4] The ratings already contain a very rough indicator of firm size as measured by the number of respondents rating the various providers. These numbers will, however, be heavily skewed toward providers who have received high ratings in past issues of WCC, since respondents to the WCC questionnaire will be far more likely than the general public to have relied on those prior ratings as a shopping tool.

performance more critically, or be more likely to experience difficulties because of the nature of their particular service requests. Again, this potential bias in the WCC data may weaken or even reverse any positive relationship between price and quality that may actually exist in the surveyed service markets.

The price data published by WCC have their own potential problems. It would not be practical or prudent for WCC to gather price information as part of its consumer satisfaction survey. Even if consumers could remember price information reliably, there would in most instances be no way to pin down the precise nature and scope of the service that was provided. Thus, WCC gathers its own information, and is usually limited by time and budget constraints to soliciting price quotes for a small subset of the wide range of jobs provided by firms in most service industries. As a result, the price index based on these quotes is reliable only to the extent that the sampled prices reflect the prices of the services that consumers actually choose from each provider. As indicated earlier, WCC often publishes hourly labor data to supplement the price index, which provides a rough consistency check for the analysis.

The above difficulties not withstanding, the WCC ratings provide the most comprehensive source of information on price and quality in the local service sector that we are likely to have in the foreseeable future. It would not be economically feasible for a private tester such as Consumers Union to purchase such services directly and evaluate quality. There are simply too many providers and the cost of many of the services is too high. Further, unlike many of the durables tested by CR, services cannot be resold in the used market. The WCC data therefore deserve attention by researchers.

II. HYPOTHESES TESTED

A truly rigorous exploration of this subject area would begin with a complete structural model that would predict the equilibrium correlation between price and quality for firms in a given service industry based on production cost variables, consumer demand functions, and the magnitude of consumer search costs. Such a construct would allow us to test specific hypotheses concerning the absolute value of the correlation coefficient that we should expect in each of the the sample industries.

This study does not provide such a sophisticated underpinning, both due to the heroic scale of the theoretical challenges, and because suitable data would almost certainly not be available for many of the supply and demand variables that would be involved. Absent this theoretical construct, there is really very litt Agny omplyotrelation sg

would also be of interest to test theories that might predict which types of firms *within* a given industry are likely to offer higher levels of quality, or perhaps higher levels of value. That is, in those markets where consumers do not believe they can rely upon price as an accurate indicator of firm quality, are there other firm characteristics or practices that consumers can use as a time and money-saving substitute for extensive search in determining the level of quality and price that a firm is likely to provide?

1. Signaling Mechanisms

This issue has been treated extensively in the "signaling" literature, which originated in 1974 with Spence [15] and Nelson [11]. All else equal, it is hypothesized that higher quality providers will have a greater incentive to signal their advantage through advertising and through other bonding devices such as nontransferable physical capital (e.g., specialized building designs and accoutrements), the value of which is lost if consumers are disillusioned with a provider's quality post-purchase [8, 9]. In such cases, the advertising or other signal need not have any informational content *per se*. It is the mere existence and size of the advertising or other nontransferable physical investment that assures consumers that the firm is trustworthy and prepared to please customers over the long term.[8]

In some respects, service industries do not appear to fit the signaling model very well. First, with the exception of national chains and dealer franchises present primarily in the auto repair industry (discussed separately below), few of the firms in the industries rated by WCC engage in broadcast or other major media advertising. Many of the firms serve smaller regional markets and do not operate at a scale that would justify significant advertising outlays, although such firms may place ads in smaller regional newspapers and church bulletins.

In addition, firms in many of the industries under examination provide their services in the consumer's home. Thus, bonding signals in the form of fancy, imposing office sites would not prove very effective. Many of the remaining service industries perform repair functions, where the physical plant is likely to be a basic facility readily transferrable to other uses. There is, however, one form of advertising in this sector that might perform a signaling function. This is Yellow Pages advertising.

a.. Yellow Pages Advertising

For many consumers, the Yellow Pages will provide the first and sometimes only step in the search process. Firms that wish to stand out in the crowd of listings must pay a substantial

[8] The signaling literature is exceedingly complex, and the various signaling models often incorporate critical assumptions specifying precise consumer knowledge of firms' marginal and fixed costs. If these assumptions are relaxed, a positive relationship between quality and advertising or other signals need not be reached in equilibrium. In the words of a recent survey article, "Anything can happen." [5], p. 34.

[9] This information was provided to the author by Marc Rysman from a data set containing pricing information for almost all Yellow Pages directories in the United States in 1997. See M. Busse and M. Rysman,"Competition and Price Discrimination in Yellow Pages Advertising" Working Paper Series ES, Number 13, Yale School of Management, June 2001.

will satisfy its customers, either in terms of the absolute quality of the service or in terms of quality adjusted for price.

Franchised car dealerships (*e.g.* Toyota, BMW, etc.) may benefit from any goodwill associated with the automobiles they represent, and consumers may assume that dealers have special expertise in repairing their brands of cars. (It should be noted, however, that the potential quality clue offered by franchise status does not constitute a pure signal in the economic sense, since its utility rests on direct information concerning the known quality of the automobile brand and logical inferences concerning the likely expertise a dealership would gain from specializing in the repair of a limited number of automobile brands.)

The hypotheses that chain or dealership affiliation is a reliable indicator of quality or value can be readily tested with the WCC data, since such affiliations are obvious from the title of the firm. Separate zero-one dummy variables were constructed for dealer and chain status, and included as a right-hand term in regressions using WCC quality ratings as a dependent variable.

2. Firm Size

Many consumers may also make quality inferences based on a service provider's size. Size is not a pure signal in the sense described above, since size is a highly complex market outcome rather than a simple short-term investment decision. Further, the relationship between size and quality (as well as price) is an interesting and important economic issue irrespective of whether consumers know a firm's scale of operations or make use of any information they might have. The fundamental question, of course, is whether large size is in fact a market reward for superior performance.

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[10] This is the outcome that Bond *et al*. [3] observed in their analysis of optometrists operating in states that did and did not allow price advertising and large chain operations. In nonrestrictive states, advertisers provided slightly less thorough eye exams than did smaller nonadvertisers, but charged substantially less for the bundled combination of eye glasses and eye exams.

“letting you know cost early,” “starting and completing work promptly,” and in some cases, even

In addition, the error terms for observations within any given firm will be correlated,

Table II
WCC Quality Ratings for Sample Industries

superior. At a minimum, these percentages do not suggest a major market meltdown of the magnitude associated with a "lemons" model outcome.

B. Consistency of WCC Quality Ratings and Complaint Data

As discussed, the WCC ratings list the number of complaints on file at local consumer protection offices for each rated firm. For certain industries, this number is normalized for firm size, as measured by number of employees. The complaint variable was included in the initial regression runs to function as a possible consistency check on the WCC quality ratings. Since a firm's complaint history is really an indirect measure of quality, it cannot be construed properly as a true independent variable in any regression that uses the WCC quality ratings as a dependent variable. It does have the potential, however, to shed some light on the reliability of the respondent ratings.

In particular, the complaint variable can help determine whether the WCC quality ratings are hopelessly biased by the possibly perverse impact that a firm's prices might have on consumer attitudes toward the firm. As described earlier, this interaction between price and consumer satisfaction, combined with possible selection biases, might yield a strong negative correlation between price and quality, even when true quality was in fact directly related to price.

Consumers presumably take the trouble to write complaint letters over what is perceived as truly egregious firm behavior. Although these complaints may involve what a consumer feels is an exorbitant price, complaints should not be generated by the more subtle impact that, say, a somewhat above-average service repair charge price might have on the disposition of a WCC respondent rating the overall performance of a firm. Thus, the complaint rate variable should help flag firms that are genuinely poor performers, and this variable should be negatively associated with the WCC ratings if these ratings are at all reliable.

The results indicate that there is in fact a persistent and strong negative correlation between firm complaint histories and the quality ratings. For the most recent rating periods, WCC provided some form of complaint data for 14 of the 19 industries. In ten cases, the data were adjusted by firm employee size. In seven of these industries, the complaint rate was negatively and significantly correlated with quality. In the three remaining industries, the coefficient sign was negative but not significant. For five industries, WCC provided only the absolute number of complaints a firm had on file. The complaint coefficients for three of these industries were negative and significant, and insignificant in the remaining two. In the entire data base, the complaint rate variable was negative and significant in approximately 90 percent of the industries for which size-adjusted data were provided. These results, though far from conclusive, do suggest that the WCC ratings are at least flagging the very worst performers.

C. Simple Price-Quality Correlations

In this section, we discuss the threshold question of whether price by itself provides a reliable indicator of quality as measured by WCC respondent performance ratings. The regressions reported do not control for any firm characteristic, such as size or status as a franchisee or dealership, or any signaling mechanism, such as Yellow Pages advertising. The analysis simply attempts to determine the extent to which consumers can rely upon price alone as an indicator of firm quality.

The results of the simple quality-price regressions for the most recent ratings period are reported in Table III. The coefficients were obtained by grouped logit analysis using the WCC quality rating as the dependent variable. P values for the price coefficients appear in parentheses.

TABLE III
Quality-Price Correlations in Most Recent Rating Period

Industry	Coefficient Sign for Price (P-value)
Carpet Cleaning	Positive (.009)
Carpet Installers	Positive (.090)
Dry Cleaning	Positive (.102)
Local Movers	Positive (.216)
Pest Control	Positive (.000)
Restaurants	Positive (.000)
Supermarkets	Positive (.000)
Tree Experts	Positive (.403)
Auto Body Shops	Negative (.548)
Air Conditioning-Htg.	Negative (.034)
Appliance Repair	Negative (.000)
Auto Mechanical Repair	Negative (.000)
Computer Repair	Negative (.078)
Electricians	Negative (.001)
Locksmiths	Negative (.003)
Plumbers	Negative (.007)
Shoe Repair	Negative (.131)
Television Repair	Negative (.307)
Watch Repair	Negative (.732)

As hypothesized, those industries with particularly low search costs and relatively frequent purchase generally display significant positive correlations between price and quality. These are Carpet Cleaning, Restaurants, Supermarkets, and, just missing significance at the .10 level, Dry Cleaning (P=.102). In addition, price and quality are also positively correlated for Carpet Installers and Pest Control. The most striking feature of Table III, however, is the relentless procession of negative correlations in the eleven repair industries, seven of which are significant.

The picture does not change substantially when results for all of the ratings periods are considered. Table IV provides a detailed listing of the observed price-quality correlations for each of the 60 data sets in the sample. Table IV reveals significant positive correlations in ten data sets, representing seven industries. Of these industries, however, only Carpet Cleaning, Drycleaners, and Restaurants are consistently positive over time. Supermarkets reports a highly significant positive price-quality correlation in the two later ratings periods, but is insignificant in 1979. Significant negative price-quality correlations can be observed in 22 data sets, accounting for ten industries, and 28 sets display no significant price-quality correlation.

The widespread occurrence of negative price-quality correlations is difficult to rationalize using any rigorous theory of market performance. Even in the presence of extremely high search costs, there are no *a priori* grounds for expecting price to serve as a *perverse* indicator of quality. Rather, we would simply expect a great deal of noise with no systematic relationship between price and quality. If we are to believe the results reported above, firms apparently prosper by choosing a strategy of high prices and poor performance. It is implausible that even serious market imperfections would perpetually reward such a strategy.[11] Thus, we certainly cannot dismiss the hypothesis that the WCC data are biased due to the previously discussed interaction between price and consumer satisfaction with firm performance.

One alternative hypotheses for certain industries in the sample is that the simple quality and price regressions fail to control for relevant firm cost variables, particularly higher rental

[11] Such an outcome might occur under the extreme assumptions that consumers never purchase a service more than once and that absolutely no quality information is available pre-purchase. In that event, some firms might successfully pursue a strategy of high price and low quality, since consumers seeking high quality might specifically target firms quoting the highest price for a service, and by assumption such firms would never be punished for failing to deliver the expected quality. Once these assumptions are relaxed to allow for at least some repeat purchases and limited availability of quality information, it is once again difficult to understand how the high price-low quality strategy could persist so consistently in so many industries over such a long period of time.

Table IV
Quality-Price Correlations for All Industries and Ratings Periods

Industry	Year	Sign	P Value	Observations
AC & Heating Contractors	97	negative	.034	119
	92	negative	.273	106
	87	negative	.428	78
	82	negative	.518	61
	77	positive	.972	44
Appliance Repair	96	negative	.000	46
	91	negative	.002	43
	85	negative	.012	52
	78	negative	.228	60
Auto Body Repair	98	negative	.548	120
	95	negative	.422	106
	90	negative	.393	90
	85	negative	.191	105
	82	negative	.041	71
Auto Mech. Repair	01	negative	.000	482
	97	negative	.000	444
	94	negative	.000	431
	91	negative	.000	380
	88	negative	.000	354
	85	negative	.000	310
	81	negative	.000	289
	76	negative	.004	148
Carpet Cleaning	98	positive	.009	33
	94	positive	.425	31
	87	positive	.727	30
Carpet Sales, Installation	96	positive	.090	24
	89	negative	.723	39

Table IV (Continued)

Industry	Year	Sign	P Value	Observations
Drycleaners	96	positive	.102	211
	90	positive	.038	232
Electricians	96	negative	.001	36
	90	negative	.036	21
Locksmiths	99	negative	.003	25
	94	negative	.499	27
	86	negative	.587	33
Movers	98	positive	.216	28
	92	negative	.720	29
	81	positive	.051	25
Pest Control	97	positive	.000	51
	93	positive	.477	37
	86	negative	.292	46
	77	negative	.030	25
Plumbers	95	negative	.007	134
	89	negative	.045	81
	83	negative	.019	97
	77	positive	.165	58
Restaurants	98	positive	.000	672
	95	positive	.000	718
Shoe Repair	95	negative	.131	95
	88	positive	.213	96
Supermarkets	01	positive	.000	8
	92	positive	.079	7
	79	positive	.997	16
Television Repair	89	negative	.307	36
Tree Experts	99	positive	.403	29
Watch Repair	96	negative	.691	41
	91	negative	.181	30
	80	negative	.002	52

discussed earlier, such firms might deliberately have chosen to limit their scale of operation and would never have considered signaling quality using a larger Yellow Pages ad.

The results provide little support for a Yellow Pages signaling function. A significant positive coefficient was found for only four of the 14 industries. In seven industries, the Yellow Pages variable was negatively and significantly associated with quality. There was no significant relationship in the remaining three industries. Simple regressions were also run to investigate whether the size of an ad might signal higher value as measured by the ratio of the quality rating to the price index. None of these regressions supported this hypothesis. Indeed, a significant negative correlation between Yellow Pages ad size and value was found in five industries.

2. Dealership and Franchisee Status

In two industries, Auto Mechanical Repair and Auto Body Repair, numerous firms in the sample were franchised dealerships for the major auto companies. In four industries (the two auto repair industries, Local Movers, and Pest Control), many of the firms were franchisees for

during which the firm will provide a free follow-up treatment, and the charge for treatment after

ratings. Price is not correlated with either firm size or chain status in this data set. (Dealerships, however, charged significantly higher prices than independents or chains.) Thus, the negative coefficients for the size and chain variables apparently should be accepted at face value.

TABLE V
Full Regression Results For Auto Repair 1997

Dependent Variable = % rating firm superior or adequate

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Logit estimates                                   Number of firms =     441.00

                                                  LR chi2(7)      =     872.69
                                                  Prob > chi2     =     0.0000
Log likelihood = -6423.8417                       Pseudo R2       =     0.0636

------------------------------------------------------------------------------
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     chain97 |   -1.31156    .097349   -13.47   0.000    -1.502361    -1.12076
    dealer97 |  -.9997785   .0806641   -12.39   0.000    -1.157877   -.8416797
     Price97 |   .0046225   .0015918     2.90   0.004     .0015025    .0077424
       Size7 |  -.0147877   .0034198    -4.32   0.000    -.0214904    -.008085
      ASIE97 |  -.8662402   .2126259    -4.07   0.000    -1.282979   -.4495012
       AAA97 |    .189219   .0550878     3.43   0.001     .0812489     .297189
    Safety97 |  -.3748802   .0612289    -6.12   0.000    -.4948866   -.2548739
    Constant |   3.403598   .2461795    13.83   0.000     2.921095    3.886101
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It should also be noted that the price index variable is positively and significantly correlated with quality in Table V, whereas the coefficient was negative and highly significant when used as a single predictor. The primary explanation for the shift in signs is the explicit accounting for dealer performance in this regression. As discussed, dealers tend to be more expensive and do considerably worse in the ratings than independents. Thus, price acts partially as a proxy for dealership status when used alone as a predictor of quality.

The positive correlation in the full regression cannot, however, be interpreted as an indicator of market efficiency. The reversal in sign merely indicates that we have identified and8n merelg stato

E. Stability of Price and Quality Ratings Over Time

2. Individual Firm Performance Over Time

chance events and earn a check rating in 1998. We could not conclude from this pattern, however, that check rated firms tend to milk their reputations and lower quality.

The probit analysis controls for such random fluctuations and shows more clearly whether there are real differences in the propensity for check rated and non-check rated firms to score well in the subsequent period. Still, the results do not lend themselves to an unambiguous test of the milking hypothesis. In the example above, a significant marginal probability of .42 would indicate that there is no pervasive tendency for firms to shirk once a check rating is achieved. But it would not reject the hypothesis that some firms behave in this manner.

Tables VII presents the probit results for the price and quality ratings. In the column labeled Marginal Probability, the first number represents the marginal probability that firms check rated in the earliest ratings period will repeat their performance in the next rating period. The second number iuseWCC s he numrfodex daeaon rxsettinNevst reeth Td numss,catefs pershe pa3(s the ps

TABLE VII
Probability That Firms Check Rated For Price or Quality Will Be Check Rated in Subsequent Evaluation Period

Industry*	Period	Marginal Probability, Price Check	P Value	Marginal Probability, Quality Check	P Value
Auto Body Repair	82-85	-----	>.10	.645	.000
	85-95	-----	>.10	.353	.005
	95-98	-----	>.10	.536	.000
AC & Heating Contractors	77-82	-----	>.10	Insufficient Observations	
	82-87	-----	>.10	.477	.000
	87-92	.334	.010	.423	.000
	92-97	.450	.000	.350	.020
Appliance Repair	78-85	.485	.025	.484	.000
	85-91	.440	.047	.423	.009
	91-96	.590	.001	.409	.025
Auto Mechanical Repair	76-81	----	NA**	.550	.000
	81-85	.325	.000	.543	.000
	85-88	.330	.000	.492	.000
	88-91	.341	.000	.650	.000
	91-94	.449	.000	.657	.000
	94-97	.367	.000	.555	.000
Carpet Cleaners	87-94	----	>.10	Insufficient Observations	
	94-98	.620	.013	.340	.024
Carpet Installers	89-96	Insufficient Observations		----	>.10
Computer Repair	89-94	Insufficient Observations		Insufficient Observations	
	94-98	.576	.045	.420	.080
Drycleaners	90-96	No Price Check Variable		.430	.000

TABLE VII (Cont.)
Probability That Firms Check Rated For Price or Quality Will Be Check Rated in Subsequent Evaluation Period

Industry	Period	Marginal Probability, Price Check	P Value	Marginal Probability, Quality Check	P Value
Electricians	90-96	Insufficient Observations		.500	.041
Local Movers	81-92	Insufficient Observations		----	>.10
	92-98	Insufficient Observations		Insufficient Observations	
Locksmiths	86-94	----	>.10	Insufficient Observations	
	94-99	.420	.070	----	>.10
Pest Control	77-86	----	>.10	Insufficient Observations	
	86-93	----	.10	Insufficient Observations	
	93-97	.544	.009	.681	.000
Plumbers	77-83	.260	.009	.561	.000
	83-89	.250	.050	.268	.020
	89-95	.174	.100	.467	.000
Shoe Repair	88-95	.451	.001	.283	.041
Watch Repair	89-91	Insufficient Observations		----	>.10
	91-96	No Price Check Variable		.470	.002

VII. CONCLUSIONS

The results of this Working Paper paint a very mixed picture of the economic performance of the consumer service sector in the Washington D.C. area. Judging strictly from

does not appear that most firms “milk” any reputation advantage from the WCC ratings by lowering quality.

Overall conclusions are difficult, particularly because of the potentially serious bias introduced by an interaction between price and the WCC quality rankings. It does appear, however, that consumers in the Washington D.C area have a higher probability of reporting a favorable quality assessment to Washington Consumer Checkbook, if they patronize smaller independent service providers and rely on word-of-mouth reputation rather than Yellow Pages displays, or other indirect clues such as firm size, affiliation with a national chain, or status as a franchised dealership.

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APPENDIX A
DETAILED REGRESSION RESULTS

This appendix presents the principal regression results for the most recent ratings period for all industries in the data set. As explained in the main text (see pp. 13-14), the regressions that use the WCC quality ratings as a dependent variable employ a form of logit estimation suitable for use with grouped data. In essence, this procedure unfolds the summary quality rating for a given firm into a series of binary categorical variables, with a zero-one value generated for each respondent rating used in calculating the overall quality score.

Consider, for example, a firm that receives an overall performance rating of 80. For most industries this would mean that 80 percent of the consumers reporting on that firm rated it superior in overall performance. If there were a total of 10 respondents, the logit program would generate a series of dependent variables comprised of eight "one" values and two "zero" values. Each of these dummies would be associated with the corresponding firm-specific independent variables used in the logit regression. Thus, firms with the highest number of individual ratings automatically would be weighted heaviest in the regression estimation procedure. The estimation technique also adjusts standard errors to reflect the expected correlation of error terms among the observations for any given service provider.

The discussion first focuses on regressions that include each of the principal independent variables separately as predictors of the WCC quality score. These bivariate regressions test whether consumers can rely on the attribute in question in isolation as a signal of quality. For the Yellow Pages and firm size variables, regression results are also shown testing the hypothesis that consumers can rely upon the size of a Yellow Pages ad or the size of a firm to signal value, as measured by the WCC quality score divided by the WCC price index.

For those industries with a full complement of independent variables, results are then reported for multivariate regressions that reveal more precisely any independent explanatory power that the various variables might have in predicting firm quality. These results are not, however, directly relevant to the primary signaling hypothesis in question, since such theories do not posit that consumers will consciously or unconsciously control for other factors when viewing a single firm attribute as a possible signal of quality.

Air Conditioning and Heating Contractors (1997)

This data set includes both the Yellow Pages and employment size variables. Regression

Yellow Pages ad to offer better value in terms of quality per dollar. There is actually a significant negative correlation between these two variables. Regression 5 reveals a negative but insignificant correlation between value (the quality rating adjusted for price) and the size of the firm.

Regression 6 discloses a significant positive relationship between Yellow Pages advertising and quality when firm size and price are also included as independent variables. As is shown in Regression 7, the Yellow Pages variable is positively correlated with price and firm size. Because these two variables are in turn negatively correlated with quality, Yellow Pages functions as a partial proxy for price and size in Regression 3 and loses much of its independent positive correlation with quality.

Regression 1: Dependent Variable = %rating firm superior
Independent Variable = WCC price index

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Logit estimates                                   Number of firms =        119
                                                  Wald chi2(1)    =       4.49
                                                  Prob > chi2     =     0.0340
Log likelihood = -4318.1521                       Pseudo R2       =     0.0047

                           (standard errors adjusted for clustering on idno97)
------------------------------------------------------------------------------
```

```
Logit est6imates                                   Number of firms =        119

 17.73                                            Prob > chi2     =     0.0340Log likeliho
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =        115
                                                  Wald chi2(1)    =       0.17
                                                  Prob > chi2     =     0.6767
Log likelihood = -4624.8634                       Pseudo R2       =     0.0002

                          (standard errors adjusted for clustering on idno97)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp97 |   .0013026    .003124     0.42   0.677    -.0048203    .0074255
       _cons |   .9231844   .1079349     8.55   0.000      .711636    1.134733
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = size of Yellow Pages ad
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                 Number of firms =   102
---------+------------------------------               F(  1,  100)  =   13.86
   Model |  5610.21758     1  5610.21758               Prob > F      =  0.0003
Residual |   40478.981   100   404.78981               R-squared     =  0.1217
---------+------------------------------               Adj R-squared =  0.1129
   Total |  46089.1985   101  456.328698               Root MSE      =  20.119

------------------------------------------------------------------------------
    yp97 |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -45.44601   12.20733     -3.723   0.000     -69.66501   -21.22702
   _cons |   57.25293   11.50368      4.977   0.000      34.42995    80.07591
------------------------------------------------------------------------------
```

Regression 5: Dependent Variable = number of employees
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                 Number of firms =   117
---------+------------------------------               F(  1,   115) =    1.66
   Model |  401.425903     1  401.425903               Prob > F      =  0.2001
Residual |   27798.822   115  241.728887               R-squared     =  0.0142
---------+------------------------------               Adj R-squared =  0.0057
   Total |  28200.2479   116  243.105585               Root MSE      =  15.548

------------------------------------------------------------------------------
employ97 |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -10.79503   8.376937     -1.289   0.200     -27.38812    5.798074
   _cons |   26.18363   8.028892      3.261   0.001      10.27994    42.08732
------------------------------------------------------------------------------
```

Regression 6: Dependent Variable = %rating firm superior
Independent Variables = number of employees, size of Yellow Pages ad, WCC price index

```
Logit estimates                                   Number of firms =        101
                                                  Wald chi2(3)    =      14.36
                                                  Prob > chi2     =     0.0025
Log likelihood =  -3994.811                       Pseudo R2       =     0.0143

                           (standard errors adjusted for clustering on idno97)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    employ97 |  -.0141104   .0048582    -2.90   0.004    -.0236323   -.0045885
        yp97 |   .0089862   .0033431     2.69   0.007     .0024337    .0155386
     price97 |  -.0148654    .004524    -3.29   0.001    -.0237323   -.0059986
       _cons |   2.647565   .4989876     5.31   0.000     1.669567    3.625562
------------------------------------------------------------------------------
```

Regression 7: Dependent Variable = size of Yellow Pages ad
Independent Variables = number of employees, WCC price index, %rating firm superior

```
  Source |       SS       df       MS                 Number of firms =   101
---------+------------------------------               F(  3,    97) =   12.87
   Model |  13071.5361     3   4357.1787               Prob > F      =  0.0000
Residual |   32845.053    97  338.608794               R-squared     =  0.2847
---------+------------------------------               Adj R-squared =  0.2626
   Total |  45916.5891   100  459.165891               Root MSE      =  18.401

------------------------------------------------------------------------------
    yp97 |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
employ97 |   .4527038   .1165674      3.884   0.000       .2213497    .6840579
 price97 |   .5658379   .1158479      4.884   0.000       .3359119    .7957638
 super97 |   .1546826   .1265388      1.222   0.225      -.0964618     .405827
   _cons |  -61.42468   17.26251     -3.558   0.001      -95.68598   -27.16337
------------------------------------------------------------------------------
```

Auto Body Repair (1998)

The simple two-way regressions for the 1998 Auto Body Repair data set reveal no significant association between price and quality (Regression 1), and highly significant negative correlations between quality and firm size (Regression 2), dealer status (Regression 6), and chain status (Regression 7). (There is only one national chain represented in this data set). Regression 3 reveals no significant relationship between quality and the size of Yellow Pages advertising, and Regression 4 shows that the Yellow Pages variable is not significantly correlated with the value variable (WCC quality score/WCC price index). In Regression 5, there is a highly significant negative correlation between value and size of firm.

With all of the independent variables included in Regression 8, dealer status and chain status continue to display highly significant negative coefficients. Firm size and Yellow Pages advertising lose significance, however, and price remains insignificant. Further investigation revealed that the dealer dummy variable and firm size are positively correlated (r=.42). Thus, when firm size is used as the only regressor, it functions partially as a proxy for dealer status in predicting firm quality. Taken together, the results for the full regression and si0ria gd:jw Pages

Regression 3: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         95
                                                  Wald chi2(1)    =       0.79
                                                  Prob > chi2     =     0.3730
Log likelihood = -1882.6538                       Pseudo R2       =     0.0009

                          (standard errors adjusted for clustering on idno98)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          yp |  -.0083301   .0093499    -0.89   0.373    -.0266556    .0099954
       _cons |    1.04312   .1049185     9.94   0.000     .8374834    1.248756
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = size of Yellow Pages ad
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                  Number of firms =    95
---------+------------------------------                F(  1,    93) =    1.29
   Model |  130.662894     1  130.662894                Prob > F        =  0.2586
Residual |  9404.25158    93  101.120985                R-squared       =  0.0137
---------+------------------------------                Adj R-squared =  0.0031
   Total |  9534.91447    94   101.43526                Root MSE        =  10.056

------------------------------------------------------------------------------
      yp |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -6.909842   6.078726     -1.137   0.259    -18.98099    5.161304
   _cons |   12.17246    4.41782      2.755   0.007     3.399545    20.94537
------------------------------------------------------------------------------
```

Regression 5: Dependent Variable = number of employees
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                  Number of firms =   120
---------+------------------------------                F(  1,   118) =   25.21
   Model |  558.897059     1  558.897059                Prob > F        =  0.0000
Residual |  2615.85086   118  22.1682276                R-squared       =  0.1760
---------+------------------------------                Adj R-squared =  0.1691
   Total |  3174.74792   119  26.6785539                Root MSE        =  4.7083

------------------------------------------------------------------------------
employ98 |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -12.46466   2.482447     -5.021   0.000    -17.38058   -7.548738
   _cons |   16.65288   1.776893      9.372   0.000     13.13414    20.17161
------------------------------------------------------------------------------
```

Regression 6: Dependent Variable = %rating firm superior
Independent Variable = dealer status (dealer = 1)

```
Logit estimates                                   Number of firms =        138
                                                  Wald chi2(1)    =      52.86
                                                  Prob > chi2     =     0.0000
Log likelihood = -2187.0624                       Pseudo R2       =     0.0293

                          (standard errors adjusted for clustering on idno98)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      dealer |  -.9553177    .131402    -7.27   0.000    -1.212861   -.6977746
       _cons |   1.164308   .0762207    15.28   0.000     1.014918    1.313697
------------------------------------------------------------------------------
```

Regression 7: Dependent Variable = %rating firm superior
Independent Variable = chain status (chain = 1)

```
Logit estimates                                   Number of firms =        138
                                                  Wald chi2(1)    =      53.28
                                                  Prob > chi2     =     0.0000
Log likelihood = -2242.4496                       Pseudo R2       =     0.0047

                          (standard errors adjusted for clustering on idno98)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       chain|  -1.216412   .1666463    -7.30   0.000    -1.543033   -.8897911
       _cons |   .9481478   .0802853    11.81   0.000     .7907916    1.105504
------------------------------------------------------------------------------
```

Regression 8 Dependent Variable = %rating firm superior
Independent Variables = dealer status, wcc price index, size of Yellow Pages ad, number of employees, chain status

```
Logit estimates                                   Number of firms =         95
                                                  LR chi2(5)      =     131.31
                                                  Prob > chi2     =     0.0000
Log likelihood =  -1546.322                       Pseudo R2       =     0.0407

------------------------------------------------------------------------------
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      dealer |  -1.085687   .1257825    -8.63   0.000    -1.332216   -.8391573
       price |   .0057761   .0067361     0.86   0.391    -.0074264    .0189786
          yp |   .0026465    .006309     0.42   0.675    -.0097188    .0150119
    employ98 |  -.0178601   .0101569    -1.76   0.079    -.0377674    .0020471
       chain |  -1.538303   .3354031    -4.59   0.000    -2.195681   -.8809248
       _cons |   .7754602   .6555708     1.18   0.237    -.5094349    2.060355
```

Regression 9: Dependent Variable = %rating firm superior
Independent Variables = dealer status, WCC price index,
number of employees, chain status

```
Logit estimates                                   Number of firms =        120
                                                  LR chi2(4)      =     176.25
                                                  Prob > chi2     =     0.0000
Log likelihood = -1847.7438                       Pseudo R2       =     0.0455

------------------------------------------------------------------------------
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

Regression 1: Dependent Variable = %rating firm superior or adequate
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =        444
                                                  Wald chi2(1)    =      30.05
                                                  Prob > chi2     =     0.0000
Log likelihood = -6770.2166                       Pseudo R2       =     0.0131

                           (standard errors adjusted for clustering on comno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pricin97 |  -.0159178   .0029039    -5.48   0.000    -.0216093   -.0102262
       _cons |   3.679106   .3079504    11.95   0.000     3.075534    4.282678
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior or adequate
Independent Variable = number of employees

```
Logit estimates                                   Number of firms =        515
                                                  Wald chi2(1)    =      55.66
                                                  Prob > chi2     =     0.0000
Log likelihood = -7610.5535                       Pseudo R2       =     0.0311

                           (standard errors adjusted for clustering on comno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    employ97 |  -.0429339   .0057547    -7.46   0.000    -.0542129   -.0316549
       _cons |   2.583182   .0872403    29.61   0.000     2.412194     2.75417
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %rating firm superior or adequate
Independent Variable = size of Yellow Pages advertisement

```
Logit estimates                                   Number of firms =        321
                                                  Wald chi2(1)    =       1.11
                                                  Prob > chi2     =     0.2913
Log likelihood =  -4669.489                       Pseudo R2       =     0.0004

                           (standard errors adjusted for clustering on comno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp97 |  -.0030682   .0029076    -1.06   0.291    -.0087671    .0026306
       _cons |   2.154566   .0848792    25.38   0.000     1.988206    2.320926
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = size of Yellow Pages ad
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                  Number of firms =   278
---------+------------------------------                F(  1,   276) =    3.23
   Model |  1338.41317     1  1338.41317                Prob > F      =  0.0733
Residual |  114319.277   276  414.200277                R-squared     =  0.0116
---------+------------------------------                Adj R-squared =  0.0080
   Total |   115657.69   277  417.536786                Root MSE      =  20.352

------------------------------------------------------------------------------
    yp97 |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |   -10.3485   5.756882     -1.798   0.073      -21.68147    .9844806
   _cons |   19.89839   5.525921      3.601   0.000        9.02008    30.77669
------------------------------------------------------------------------------
```

Regression 5: Dependent Variable = number of employees
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                  Number of firms =   444
---------+------------------------------                F(  1,   442) =  143.80
   Model |  6026.86996     1  6026.86996                Prob > F      =  0.0000
Residual |  18524.6993   442  41.9110844                R-squared     =  0.2455
---------+------------------------------                Adj R-squared =  0.2438
   Total |  24551.5693   443  55.4211496                Root MSE      =  6.4739

------------------------------------------------------------------------------
employ97 |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -16.59809   1.384129    -11.992   0.000      -19.31838    -13.8778
   _cons |    24.0596   1.299164     18.519   0.000       21.50629     26.6129
------------------------------------------------------------------------------
```

Regression 6: Dependent Variable = %rating firm superior or adequate
Independent Variable = dealer status

```
Logit estimates                                   Number of firms  =       515
                                                  Wald chi2(1)     =     137.69
                                                  Prob > chi2      =     0.0000
Log likelihood = -7531.3521                       Pseudo R2        =     0.0412

                           (standard errors adjusted for clustering on comno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    dealer97 |  -1.098344   .0936021   -11.73   0.000    -1.281801   -.9148873
       _cons |   2.591357   .0745284    34.77   0.000     2.445284     2.73743
------------------------------------------------------------------------------
```

Regression 7: Dependent Variable = %rating firm superior or adequate
Independent Variable = chain status

```
Logit estimates                                   Number of firms  =       515
                                                  Wald chi2(1)     =     14.35
                                                  Prob > chi2      =    0.0002
Log likelihood = -7831.9797                       Pseudo R2        =    0.0029

                           (standard errors adjusted for clustering on comno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     chain97 |  -.6145223   .1622175    -3.79   0.000    -.9324628   -.2965818
       _cons |   2.021323   .0574306    35.20   0.000     1.908761    2.133885
------------------------------------------------------------------------------
```

Carpet Cleaning
(1998)

The only variables in this data set are price and size of Yellow Pages advertisement. Price proves to be positively correlated with quality (Regression 1). Yellow Pages advertising displays an insignificant negative correlation with quality in Regression 2, and with value (quality adjusted for price) in Regression 3.

Regression 1: Dependent Variable = %rating firm superior or adequate
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         33
                                                  Wald chi2(1)    =       6.79
                                                  Prob > chi2     =     0.0092
Log likelihood = -893.30575                       Pseudo R2       =     0.0470

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price98 |    .030564   .0117299     2.61   0.009     .0075738    .0535543
       _cons |  -1.467002   1.046967    -1.40   0.161    -3.519019    .5850145
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior or adequate
Independent Variable = size of Yellow Pages advertisement

```
Logit estimates                                   Number of firms =         38
                                                  Wald chi2(1)    =       0.91
                                                  Prob > chi2     =     0.3395
Log likelihood = -1129.8918                       Pseudo R2       =     0.0024

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp98 |  -.0046769   .0048966    -0.96   0.340    -.0142742    .0049203
       _cons |   .7946941   .3790674     2.10   0.036     .0517356    1.537653
```

Yellow Pages ad size and price, or for quality adjusted for price, using either the sales service or installation service satisfaction measure.

Regression 1: Dependent Variable = %rating firm adequate or superior for sales services
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         36
                                                  Wald chi2(1)    =       2.88
                                                  Prob > chi2     =     0.0896
Log likelihood = -279.14817                       Pseudo R2       =     0.0191

                           (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price96 |   .0316688   .0186556     1.70   0.090    -.0048956    .0682331
       _cons |  -1.001684   1.894259    -0.53   0.597    -4.714365    2.710996
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = % adequate or superior, sales services
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         42
                                                  Wald chi2(1)    =       0.46
                                                  Prob > chi2     =     0.4966
Log likelihood = -314.43372                       Pseudo R2       =     0.0021

                           (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |   .0120109   .0176681     0.68   0.497    -.0226181    .0466398
       _cons |   2.197738   .2713814     8.10   0.000     1.665841    2.729636
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %adequate or superior, installation
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         24
                                                  Wald chi2(1)    =       0.04
                                                  Prob > chi2     =     0.8391
Log likelihood = -249.35669                       Pseudo R2       =     0.0001

                           (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price96 |   .0023001   .0113312     0.20   0.839    -.0199086    .0245088
       _cons |   1.345761   1.146281     1.17   0.240    -.9009087    3.592431
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = %adequate or superior, installation
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         28
                                                  Wald chi2(1)    =       2.33
                                                  Prob > chi2     =     0.1268
Log likelihood = -278.00221                       Pseudo R2       =     0.0063

                          (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |   .0190109   .0124501     1.53   0.127    -.0053908    .0434127
       _cons |   1.369419   .1885602     7.26   0.000     .9998473     1.73899
------------------------------------------------------------------------------
```

Computer Repair
(1998)

This data set contains only two independent variables--price and Yellow Pages ad size. In Regression 1, price is negatively associated with quality. In Regression 2, no significant correlation is found between quality and the size of a firm's Yellow Pages ad. Further analysis (not shown) revealed a direct and significant correlation between the Yellow Pages variable and price, and no correlation between Yellow Pages ad size and value as measured by quality adjusted for price.

Regression 1: Dependent Variable = %rating firm adequate or superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         27
                                                  Wald chi2(1)    =       3.10f firms =
                                              sc dhbj T* (Log likelihood = -274224 3b|,mf00
             |              43412714     .DD3.  .010124  0.127.2042------5.6704 4   =     0.
```

Regression 2: Dependent Variable = %rating firm adequate or superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         18
                                                  Wald chi2(1)    =       0.79
                                                  Prob > chi2     =     0.3749
Log likelihood = -396.03579                       Pseudo R2       =     0.0109

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp98 |     .02605   .0293559     0.89   0.375    -.0314865    .0835865
       _cons |   .9515454   .2741594     3.47   0.001     .4142029    1.488888
------------------------------------------------------------------------------
```

Drycleaners
(1996)

The drycleaners data set is one of the largest in the sample, although it does not contain

Regression 2: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =        188
                                                  Wald chi2(1)    =       2.14
                                                  Prob > chi2     =     0.1434
Log likelihood = -2423.9233                       Pseudo R2       =     0.0013

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |   .0521381   .0356334     1.46   0.143     -.017702    .1219782
       _cons |   .4273209   .0758077     5.64   0.000     .2787405    .5759013
------------------------------------------------------------------------------
```

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Regression 1: Dependent Variable = %rating firm superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         36
                                                  Wald chi2(1)    =      10.87
                                                  Prob > chi2     =     0.0010
Log likelihood =  -414.3513                       Pseudo R2       =     0.0314

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price96 |  -.0164893   .0050023    -3.30   0.001    -.0262937    -.006685
       _cons |   2.993674   .5343611     5.60   0.000     1.946345    4.041002
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior
Independent Variable = number of employees

```
Logit estimates                                   Number of firms =         35
                                                  Wald chi2(1)    =       1.65
                                                  Prob > chi2     =     0.1996
Log likelihood = -383.62685                       Pseudo R2       =     0.0061

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    employ96 |  -.0323265   .0252028    -1.28   0.200    -.0817232    .0170701
       _cons |   1.596658   .1849404     8.63   0.000     1.234182    1.959135
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         40
                                                  Wald chi2(1)    =       9.05
                                                  Prob > chi2     =     0.0026
Log likelihood = -449.60778                       Pseudo R2       =     0.0287

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |  -.0224215    .007454    -3.01   0.003    -.0370311    -.007812
       _cons |   1.622553   .1432273    11.33   0.000     1.341832    1.903273
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = size of yellow pages ad
Independent Variable = value (%superior/WCC price index)

```
  Source |       SS       df       MS                  Number of firms =    36
---------+------------------------------                F(  1,    34) =    5.19
   Model |  1636.75634     1  1636.75634                Prob > F        =  0.0291
Residual |   10714.695    34   315.13809                R-squared       =  0.1325
---------+------------------------------                Adj R-squared =  0.1070
   Total |  12351.4514    35  352.898611                Root MSE        =  17.752

------------------------------------------------------------------------------
    yp96 |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -24.25008   10.64073     -2.279   0.029      -45.87465   -2.625506
   _cons |   33.12038   9.236143      3.586   0.001       14.35028    51.89048
------------------------------------------------------------------------------
```

Regression 5: Dependent Variable = number of employees
Independent Variable = value (%superior/ WCC price index)

```
Source |       SS       df       MS                  Number of firms =    32
---------+------------------------------                F(  1,    30) =    1.20
   Model |  31.6064178     1  31.6064178                Prob > F        =  0.2822
Residual |  790.768582    30  26.3589527                R-squared       =  0.0384
---------+------------------------------                Adj R-squared =  0.0064
   Total |     822.375    31  26.5282258                Root MSE        =  5.1341

------------------------------------------------------------------------------
employ96 |      Coef.   Std. Err.       t     P>|t|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |   -3.87234   3.536306     -1.095   0.282      -11.09444    3.349761
   _cons |   8.745292   3.044999      2.872   0.007       2.526574    14.96401
------------------------------------------------------------------------------
```

Locksmiths
(1999)

The 1999 data set for Locksmiths is very small and lacks a Yellow Pages advertisement size variable. When this WCC rating was published, staff resources were no longer available to collect the relevant Yellow Pages data. In addition, WCC did not provide firm size data for Locksmiths. In Regression 1, the WCC price index is seen to be negatively correlated with the WCC quality index.

Regression 1: Dependent Variable = %rating firm superior
Independent variable = WCC price index

```
Logit estimates                                   Number of firms =         25
                                                  Prob > chi2     =     0.0031
Log likelihood = -280.46412                       Pseudo R2       =     0.0175

                          (standard errors adjusted for clustering on idno99)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price99 |  -.0459347   .0155294    -2.96   0.003    -.0763717   -.0154977
       _cons |   5.978987   1.594268     3.75   0.000     2.854279    9.103695
------------------------------------------------------------------------------
```

Major Appliance Repair
(1996)

This data set includes variables for price, firm size and size of Yellow Pages ad. As is evident in regressions 1-3, all of these variables are strongly and negatively associated with quality. Further analysis (not shown) revealed no correlation between the Yellow Pages variable and value as measured by quality adjusted for price. In Regression 4, the value variable is negatively correlated with firm size (as measured by number of employees). It should be noted that there is a high degree of direct intercorrelation among the independent variables in this data set. This can be seen in Regression 5, where none of the variables displays a significant coefficient when all are included in the same regression predicting quality.

Regression 1: Dependent Variable = %rating firm adequate or superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         46
                                                  Wald chi2(1)    =      25.84
                                                  Prob > chi2     =     0.0000
Log likelihood = -840.60736                       Pseudo R2       =     0.0411

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price96 |  -.0473062   .0093066    -5.08   0.000    -.0655468   -.0290657
       _cons |   7.208831   1.048761     6.87   0.000     5.153297    9.264364
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm adequate or superior
Independent Variable = number of employees

```
Logit estimates                                   Number of firms =         54
                                                  Wald chi2(1)    =      23.43
                                                  Prob > chi2     =     0.0000
Log likelihood = -642.45782                       Pseudo R2       =     0.0513

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    employ96 |  -.0778501    .016082    -4.84   0.000    -.1093703   -.0463299
       _cons |     2.7201   .2109764    12.89   0.000     2.306594    3.133606
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %rating firm adequate or superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         35
                                                  Wald chi2(1)    =       6.74
                                                  Prob > chi2     =     0.0095
Log likelihood = -1005.0842                       Pseudo R2       =     0.0203

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |  -.0253057   .0097507    -2.60   0.009    -.0444167   -.0061947
       _cons |      -4ns 5v4133Mc89m |  -Y133j T*t----s40444---0.7201   .2109764    12.89
```

Regression 5: Dependent Variable = %rating firm adequate or superior
Independent Variable = #employees, WCC price index, size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         23
                                                  Wald chi2(3)    =       2.32
                                                  Prob > chi2     =     0.5093
Log likelihood = -214.21189                       Pseudo R2       =     0.0043

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    employ96 |   -.024605   .0360032    -0.68   0.494    -.0951699    .0459599
     price96 |  -.0134052   .0185372    -0.72   0.470    -.0497375    .0229271
        yp96 |    .008471   .0205447     0.41   0.680    -.0317959     .048738
       _cons |   4.198566   1.760559     2.38   0.017     .7479346    7.649198
------------------------------------------------------------------------------
```

Movers Local)
(1998)

This data set lacks information on firm size, but does include the Yellow Pages ad size variable. In addition, a dummy variable is used to identify firms that are agents for national moving company chains. This permits a test of the hypothesis that consumers can rely on a firm's status as an agent to signal higher quality. Two price variables are used in the regressions that follow. The first is the usual WCC price index, which in this sample was only available for 22 firms. The second is a firm's hourly wage rate for a crew of 3 during peak moving season, which was available for 26 firms.

Regressions 1 and 2 find no significant correlation between price and quality using either price measure. In Regression 3, Yellow Page ad size is not associated with quality. Further analysis (not shown) revealed that the Yellow Pages variable was not related to value as measured by the WCC quality score divided by the WCC price index or the hourly wage rate variable

Finally, Regression 4 shows that agents for national chains did not receive higher ratings than independent firms. The coefficient for the agent dummy is negative, although it does not achieve significance.

Regression 1: Dependent Variable = %rating firm superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         22
                                                  Wald chi2(1)    =       0.00
                                                  Prob > chi2     =     0.9951
Log likelihood = -338.99512                       Pseudo R2       =     0.0000

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price98 |   .0001009   .0163045     0.01   0.995    -.0318552    .0320571
       _cons |    1.06614   1.616056     0.66   0.509    -2.101272    4.233553
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior
Independent Variable = hourly wage rate, crew of 3

```
Logit estimates                                   Number of firms =         28
                                                  Wald chi2(1)    =       1.53
                                                  Prob > chi2     =     0.2163
Log likelihood =  -397.5641                       Pseudo R2       =     0.0100

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     hour398 |   .0199081   .0161001     1.24   0.216    -.0116475    .0514638
       _cons |  -.8896816   1.643322    -0.54   0.588    -4.110533     2.33117
------------------------------------------------------------------------------
```

Regression 3: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         28
                                                  Wald chi2(1)    =       0.11
                                                  Prob > chi2     =     0.7346
Log likelihood = -407.55673                       Pseudo R2       =     0.0004

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp98 |   .0014154   .0041744     0.34   0.735    -.0067662     .009597
       _cons |    .991965   .2576976     3.85   0.000      .486887    1.497043
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = %rating firm superior
Independent Variable = agent status (agent=1)

```
Logit estimates                                   Number of firms =         30
                                                  Wald chi2(1)    =       0.37
                                                  Prob > chi2     =     0.5431
Log likelihood =  -425.2212                       Pseudo R2       =     0.0024

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     agent98 |  -.2566645     .42205    -0.61   0.543    -1.083867    .5705383
       _cons |    1.09089   .1886116     5.78   0.000     .7212183    1.460562
------------------------------------------------------------------------------
```

Pest Control Firms
(1997)

The Pest Control data set contains information on firm size and Yellow Pages ad size, as well as two other variables that permit testing of signaling hypotheses. The first is a dummy variable identifying firms that are part of national chains. The second is a variable representing the

[1] This three-part measure consists of (1) a firm's estimated charge for the first treatment of a sample house, (2) the length of period during which the firm will perform a free follow-up treatment, and (3) the estimated charge for treatment after the free followup period. Various alternative specifications were constructed by compiling a composite index that weighted the initial treatment charge by the length of free followup period, and combined this with the charge after the followup period. All such composite measures were either negatively correlated with quality or uncorrelated. In any event, it is not clear which, if any, of the tested specifications is most appropriate, particularly since it is impossible to estimate expected total costs without firm-specific knowledge of the probability that followup treatments will be needed.

correlation between satisfaction and firm status as a member of a national chain. For the final signaling hypothesis, Regression 7 indicates that consumers cannot rely on the length of the warranty period for the initial treatment as a predictor of satisfaction. There is a significant negative correlation between these two variables.

All of the signaling variables are included as predictors of satisfaction in Regression 8. With the exception of size of Yellow Pages ad, all of the variables are significant and retain the same sign as displayed in the simple two way regression. Further analysis showed that the Yellow Pages variable is highly correlated with chain status (r=.52), and loses its explanatory power when both variables are used as predictors.

Regression 1: Dependent Variable = %rating firm superior
Independent Variable = termite inspection charge

```
Logit estimates                                   Number of firms =         51
                                                  Wald chi2(1)    =      16.96
                                                  Prob > chi2     =     0.0000
Log likelihood = -1480.7173                       Pseudo R2       =     0.0173

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    chgter97 |   .0235317   .0057148     4.12   0.000     .0123309    .0347325
```

Regression 3: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of firms =         51
                                                  Wald chi2(1)    =      12.23
                                                  Prob > chi2     =     0.0005
Log likelihood = -1512.4115                       Pseudo R2       =     0.0219

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp97 |  -.0125807   .0035981    -3.50   0.000    -.0196328   -.0055286
       _cons |    .792496   .2053677     3.86   0.000     .3899828    1.195009
------------------------------------------------------------------------------
```

Regression 4: Dependent Variable = size of Yellow Pages ad
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                 Number of firms =    48
---------+------------------------------               F(  1,    46) =    8.75
   Model |  5469.12685     1  5469.12685               Prob > F      =  0.0049
Residual |  28742.3614    46  624.833944               R-squared     =  0.1599
---------+------------------------------               Adj R-squared =  0.1416
   Total |  34211.4883    47  727.904006               Root MSE      =  24.997

------------------------------------------------------------------------------
    yp97 |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -22.58214   7.632881     -2.959   0.005      -37.94634   -7.217952
   _cons |   54.88138   10.37279      5.291   0.000       34.00205    75.76072
------------------------------------------------------------------------------
```

Regression 5: Dependent Variable = number of employees
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                 Number of firms =    51
---------+------------------------------               F(  1,    49) =    4.45
   Model |  66.4344209     1  66.4344209               Prob > F      =  0.0401
Residual |  731.920183    49  14.9371466               R-squared     =  0.0832
---------+------------------------------               Adj R-squared =  0.0645
   Total |  798.354604    50  15.9670921               Root MSE      =  3.8649

------------------------------------------------------------------------------
 empls97 |      Coef.   Std. Err.       t     P>|t|     [95% Conf. Interval]
---------+--------------------------------------------------------------------
   value |  -2.453904   1.163576     -2.109   0.040      -4.792198   -.1156102
   _cons |   8.672254    1.55833      5.565   0.000       5.540673    11.80383
------------------------------------------------------------------------------
```

Regression 6: Dependent Variable = %rating firm superior
Independent Variable = chain status (chain=1)

Plumbers
(1995)

The 1995 data set for Plumbers contains variables for size of firm and Yellow Pages ad. The dependent variable, however, is the less sensitive overall satisfaction measure that combines superior and adequate ratings. A dummy variable was also constructed to identify members of a national chain (of which there was only one.) Analysis (not shown) revealed that this variable was unrelated to consumer satisfaction or to any of the other independent variables.

Regression 1 shows a strong negative correlation between price and quality. Regression 2 reveals a similarly strong negative relationship between quality and firm size. In Regression 3, there is an even more systematic negative relationship between size of Yellow Pages ad and quality. Regression 4 shows that Yellow Pages ad size cannot be used to identify firms providing particularly good value in terms of price-adjusted quality. This reflects a positive correlation between the Yellow Pages variable and price (r=.390). Value is also negatively correlated with firm size, as shown in Regression 5. Finally, Regression 6 reveals that the Yellow Pages variable demonstrates the greatest predictive power in a regression that employs all of the independent variables. This suggests that Yellow Pages ad size is not merely functioning as a proxy for price or firm size in this data set.

Regression 1: Dependent Variable = %rating firm superior or adequate
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =        134
                                                  Wald chi2(1)    =       7.37
                                                  Prob > chi2     =     0.0066
Log likelihood = -1657.9036                       Pseudo R2       =     0.0083

                          (standard errors adjusted for clustering on comidno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior or adequate
Independent Variable = number of employees

Logit estimates Number of firms = 137

Regression 5: Dependent Variable = number of employees
Independent Variable = value (quality/price)

```
  Source |       SS       df       MS                  Number of firms =   133
---------+------------------------------                F(  1,   131) =   11.45
   Model |  2268.99974     1  2268.99974                Prob > F      =  0.0009
Residual |  25955.7296   131   198.13534                R-squared     =  0.0804
  SourCoef.urcetd. Err.34     t      >|t(  Sourc[95%rConf.uInterari]  -T1_1 w    133)Tj 0
```

```
R6gression 5:  Dependent V%rating Numb superio   r ade   te employees
               Independent VWCC (qua i(  x, size    Yellow PagesSourc =   1s)Tj 70 -urcccc
```

coefficients. WCC did not collect firm size data for restaurants, and Yellow Pages ad size data were not collected due to resource constraints and the perceived low probability that such a variable would be correlated with quality in this industry.

Shoe Repair
(1995)

The Shoe Repair data set for 1995 contains price and quality information for 95 firms. Although WCC did not collect information on firm size, the data set does contain a Yellow Pages ad size variable. Regression 1 shows a negative but not quite significant negative correlation

Supermarkets
(2001)

The Supermarkets data set for 2001 includes only 8 firms, but over 10,000 respondents provided ratings based on experiences at dozens of individual stores. Regression 1 shows a very strong positive correlation between price and quality in this industry.

Regression 1: Dependent Variable = % rating store superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of chains =         8
                                                  Wald chi2(1)     =     116.89
                                                  Prob > chi2      =     0.0000
Log likelihood = -6870.3591                       Pseudo R2        =     0.0337

                            (standard errors adjusted for clustering on idno)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Intee Conf. Intal]w 0
             |               Robust
```

Tree Experts
(1999)

The 1999 data set for Tree Experts is limited to information on price and quality. WCC could not provide firm size data, and resources were no longer available to collect Yellow Pages ad size data. Regression 1 shows no significant correlation between price and quality.

Regression 1: Dependent Variable = %rating firm superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         29
                                                  Wald chi2(1)    =       0.70
                                                  Prob > chi2     =     0.4029`
Log likelihood =  -505.6894                       Pseudo R2       =     0.0031

                           (standard errors adjusted for clustering on idno99)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price99 |   .0069715    .008334     0.84   0.403    -.0093627    .0233058
       _cons |   .6667981   .8065977     0.83   0.408    -.9141043    2.247701
------------------------------------------------------------------------------
```

Watch Repair
(1996)

The 1996 data set for Watch Repair contains information on Yellow Pages ad size, but not firm size. In Regression 1, The WCC quality ratings and the WCC price index are uncorrelated. Similarly, in Regression 2, there is no significant relationship between quality and size of Yellow Pages ad. Further analysis (not shown) failed to find any significant correlation between the Yellow Pages variable and price or value (quality divided by price).

Regression 1: Dependent Variable = %rating firm superior
Independent Variable = WCC price index

```
Logit estimates                                   Number of firms =         41
                                                  Wald chi2(1)    =       0.12
                                                  Prob > chi2     =     0.7321
Log likelihood = -622.39017                       Pseudo R2       =     0.0002

                           (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     price96 |  -.0018618   .0054376    -0.34   0.732    -.0125193    .0087958
       _cons |   1.371141   .5230825     2.62   0.009     .3459186    2.396364
------------------------------------------------------------------------------
```

Regression 2: Dependent Variable = %rating firm superior
Independent Variable = size of Yellow Pages ad

```
Logit estimates                                   Number of obs   =         37
                                                  Wald chi2(1)    =       0.01
                                                  Prob > chi2     =     0.9065
Log likelihood = -707.40833                       Pseudo R2       =     0.0000

                           (standard errors adjusted for clustering on idno96)
------------------------------------------------------------------------------
             |               Robust
        supq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        yp96 |  -.0093096   .0792308    -0.12   0.906    -.1645991    .1459799
       _cons |   1.191147   .1316236     9.05   0.000      .933169    1.449124
------------------------------------------------------------------------------
```