FACTORS RELATED TO CONSUMER'S PERCEPTION OF HOUSEHOLD APPLIANCE REPAIR COSTS

by

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INTRODUCTION

A recent study conducted by the Whirlpool Corporation concluded, ". . . consumers do not enjoy a disposable society" (Whirlpool Corporation, 1983). Of those surveyed 73 percent said they would rather repair than replace a defective product. A large percentage (86 percent) believed that ". . . you can get anything fixed if you take the trouble to find the right people to do it" (Whirlpool Corporation, 1983). These findings indicate that consumers are willing to repair rather than replace non-operative appliances.

Consumers are looking for services along with their appliance purchases. In the Whirlpool study, 73 percent of the respondents said they always or usually preferred to buy from manufacturers that offer consumer services such as local service centers and complaint "hotlines" (Whirlpool Corporation, 1983).

Eighty-two percent of those surveyed said they were satisfied with the services in their area. In regards to whether services have improved or deteriorated, 22 percent said that major appliances services have improved while 24 percent said they have deteriorated (Whirlpool Corporation, 1983).

A survey conducted by the Sentry Insurance Company found, however, a great deal of concern about appliance repairs (Consdorf, 1974). Of those queried, two-thirds were bothered either "a great deal" or "somewhat" by both the poor quality of service after the sale and about appliance repairs. The consumers indicated that they expect that it will become even more difficult to obtain repairs within the next ten years. The problems consumers encountered include the cost of service, the guess-work involved with repeated call-backs to correct an "elusive" defect, and the problem of incomplete or inefficient service (Consdorf, 1977).

Schutz and Casey (1974) also found consumers to be concerned about the quality of service available. Fifty percent of those surveyed said they thought the quality of services has decreased during the past ten years. When asked about the cost of service, 91 percent said they considered the cost of services "high" or "extremely high." The study also indicated that a majority (73 percent) of those surveyed believed there is too little information to make good choices, and 87 percent said they wanted advertising to provide more useful information about services (Schutz, et.al, 1974).

A study conducted by researchers at the Massachusetts Institute of Technology (MIT) also showed that consumers are concerned about the cost and quality of service.. The study found consumers are dissatisfied because they believe repair services are often incomplete and excessively expensive (Massachusetts Institute of Technology, 1974).

In California the state Bureau of Electronic and Appliance Repair voted in early 1984 to authorize the drafting of a legislative proposal that would require mandatory written estimates. This action has resulted from consumer outcries related to repair estimates made in the past (Appliance Service News, 1984).

Many complaints have been received by MACAP (Major Appliance Consumer Action Panel) concerning the excessive cost of appliance repair. From the complaints received one could question the average consumer's awareness of the present cost of appliance repair, unless the consumer has had recent experience in this area (Annis, 1984).

It is the goal of this report to investigate the average homeowners ability to estimate repair costs so that consumer complaints of excessive repair costs can be better understood. This information will also aid the manufacturers of major appliances to better serve consumers and will aid in the development of education programs which can help consumers lower repair costs.

OBJECTIVES

The objectives of this report are to:

1. Determine if consumers are aware of the cost of appliance repair for eight major appliances.

2. Determine if consumers are aware of the cost of new models of eight major appliances.

3. Determine the factors related to the consumer's ability to estimate repair costs.

REVIEW OF LITERATURE

The cost of repairs seems to warrant the concern consumers express, as the aggregate cost of appliance repair is quite large. In 1972, approximately $7.5 billion was spent for the purchase of major appliances. In the same year about 330 million major appliances were in use in the United States. Over $900 million was spent on the repair of all appliances, not including that spent on radios and televisions (Massachusetts Institute of Technology, 1974).

Repair costs may be viewed in the context of the life cycle cost of an appliance. The cost of servicing a refrigerator accounts for about 6 percent of its total life cycle cost, while electrical power accounts for 58 percent and the purchase cost makes up about 36 percent of the total life cycle cost (Massachusetts Institute of Technology, 1974). The life cycle costs of other appliances were not reported.

Service costs can be better understood when the charges are broken down into repair costs and labor charges. Wingstedt (1982) reports that major appliance repair costs have increased to record high levels despite the efforts made by appliance manufacturers, parts distributors, and service dealers to hold these costs down.

According to Behrens (1977) the appliance manufacturer adds a 50 percent mark-up on parts sold to the distributor.

The distributor then adds a 100 percent mark-up on parts sold to the service center. At the service center the mark up on parts varies widely according to how much the center can obtain from the customer. Labor costs are also quite high. For example, in 1982 it was not uncommon for a $50 total charge for a single service call to the customer's home on any major appliance (Wingstedt, 1982).

Service is extremely important for the appliance manufacturer. This is because after the sale of the appliance, the serviceman provides the only link between the manufacturer and the customer (Bethrens, 1982). For this reason, manufacturers have made an effort to make appliances physically easier to service. This is partly due to changes in the warranty. In the 1960s, most warranties only covered the cost of parts. At that time, the labor charges involved were the responsibility of either the distributor, the dealer, or the customer. However, by the early 1980s, most manufacturers were responsible for both parts and labor during the warranty period. For this reason technological changes in both design and materials have been used to make appliances easier to service.

In a survey conducted by Merchandizing magazine, over half (53.6 percent) of appliance owners said they would be willing to try doing the repair themselves if the parts were more easily available. According to the survey, 17.5 percent reported that they usually attempt to do their own repairs. An additional 39 percent said they sometimes try the repairs themselves, depending on the level of difficulty involved. According to the survey, 21.6 percent of the men and 14.7 percent of the women said they usually try to repair a major appliance in their home. Another 41.2 percent of the men and 37.5 percent of the women said they sometimes try to repair a major appliance in their home (Merchandising, 1982).

Accordingly to a survey compiled by the Whirlpool Corporation, five percent of those surveyed said they do some servicing of major household appliances at least once a month. Those most likely to engage in do-it-yourself repair are highly educated, indicating that do-it-yourself repairs are not necessarily motivated by financial necessity. The Whirlpool survey also indicated that men are more likely than women to engage in home service. Also, more members of a traditionally single income family engage in do-it-yourself repair than members of a two income household (Whirlpool Corporation, 1983).

General Electric estimates that between 30 and 40 percent of all major appliance repairs would be done by consumers if the consumer had access to repair manuals and appropriate parts. General Electric attributes the increase in do it yourself repair to the high inflation rate and the poor economic environment of the 1980s.

A second consideration is the consumer's level of skill. Although not a perfect predictor, education level is related to the skill level, especially when repair manuals are available with basic instructions. A person's level of skill is a consideration when one of the alternatives is do-it-yourself repair.

The consumer should consider the additional life to their present appliance that will be obtained by making the repair and compare it to the life expectancy of a new appliance. Also, the financing cost will be different for every consumer, depending on their financial status. Thus, for lower income households the cost of purchasing a new appliance will be greater than that for a middle income household. This is because the lower income consumer must borrow the money at a fairly high interest rate while the middle income consumer can obtain the money from a passbook savings account, where the interest rate is much lower.

Consumers must consider their options when determining whether they should purchase a service contract, repair their old appliance, do their own appliance repair, or purchase a new appliance. Consumers usually consider these options when they first purchase an appliance, especially when a service contract is promoted, and when the appliance becomes inoperative. The cost of each option is not clear initially and involves careful research by the consumer to make the most appropriate choice. This research involves time that many consumers are unwilling to spend. The cost of the component's repair is one factor that must be considered when making the economic decision. However, this information is determined only after the consumer determines which component is inoperative. Sometimes the problem is not obvious.

THE STUDY

THE SURVEY

The study was designed to collect information necessary to determine if the consumer's expectations of appliance repair costs were in line with the actual rates charged by service companies. The repair costs of eight major appliances commonly found in the home were investigated. These appliances included: refrigerators, automatic washers, clothes dryers, electric ranges, gas ranges, dishwashers, microwave ovens, and window air conditioners. The cost of repair by removal and replacement of two components of each of the major appliances was estimated by the respondents. The two components selected from each appliance were those whose cost for repair was most commonly complained about to MACAP (Major Appliance Consumer Action Panel) according to Jason Annis, chairman of MACAP (Annis, 1981). These components were: the refrigerator compressor and defrost timer, the automatic washer motor and transmission, the clothes dryer thermostat and motor, the electric range thermostat and timer clock, the gas range oven ignitor and thermostat, the dishwasher motor and timer, the microwave oven control panel and magnetron tube, and the air conditioner compressor and fan motor.

Other information was also gathered from the respondents in order to determine if any correlations existed between this information and the estimated repair costs. This information included: the date of the purchase of the present appliance, the age category of the person, his or her sex, the date of the last repair for each appliance covered by the survey, and the respondent's estimate on the present cost of a new appliance for each of the appliances covered by the survey. The respondents were also asked if they had ever had either one of the two components replaced on their present appliance where the cost was not covered by the warranty.

RESPONDENT SELECTION

First Phase

The study was conducted in two phases. In the first phase, Adelma L. Vissor gathered data from 49 homowners in Manhattan, Kansas in 1981 using a survey form. This form can be found in Appendix B.

Appliance service companies in Manhattan, Kansas were also surveyed to determine the average charge for replacement of each component, how many brands they were authorized to service, and if they serviced other brands besides those authorized. The survey form used to record this information from the service companies can be found in Appendix C. The service companies also aided in setting up the survey selection procedure, as explained below.

Respondents were chosen in a two-stage process designed to most heavily select from geographic regions of the town that had the greatest number of repairs. To do this, local service companies were surveyed to determine the percentages of repairs they received from each of the three areas of the city of Manhattan (Appendix D). A list of streets and house numbers was then compiled for each of the three areas and the corresponding percentages of addresses was selected from each area. Obvious apartment houses and rental units were avoided.

Second Phase

The second phase of the survey involved collecting similar information from 50 homeowners and local appliance service companies in Overland Park, Kansas in 1982. However, the selection process for the responents was slightly different.

Instead of surveying the service companies to determine the percentages of repairs they received from various areas of the city, a quota method was used for the Overland Park, Kansas survey. This was because the suburb was relatively new and the service companies were not well established. Susan Quiring, Johnson County Extension Home Economist, assisted in selecting areas in which to sample and supplied a list of repair companies that serviced appliances in that area. The quota method involved selecting a predetermined number of addresses by randomly drawing from a list of addresses for the area. A true random technique was not employed because apartments and obvious rental units were avoided.

The fifty consumers from Overland Park, Kansas, were interviewed using the same procedure as in Manhattan. Kathy Sopach completed the surveys using the sampling process as described above.

VARIABLES

The dependent variables of this study were the two component repair costs for each appliance. The independent variables included the number of years since the purchase of the present appliance, the ratio of the other component cost, the estimated error of the new price of that appliance, the mean of the age group to which the subject belonged, the number of years since the last repair of that appliance, the number of years since any appliance had been repaired, and the number of years since either of the two components in question had been repaired.

The surveys were completed in two different years. For this reason the number of years since the purchase, the number of years since the last repair of the appliance, and the number of years since any appliance repair were calculated so that the two sets of data could be compared.

MEASUREMENT OF VARIABLES

Because only age categories were recorded in the survey rather than actual ages, the mean of each age group was used to indicate which age group the subject belonged in. For the "A" group, which included those under 25 years of age, the lower age limit was arbitrarily set at 20 years, for a mean of 22.5 for that category. Similarly for the "F" group of over 65 years of age the upper limit was arbitrarily set at 70 years of age for a mean of 67.5 years.

In the category of "component repair experience" a 1 was assigned if the first component had been repaired and a 2 was assigned if the second component had been repaired. If both components had been repaired a 3 was assigned.

The number of years since any repair and since the last repair was determined by taking the year of the survey minus the date provided by the respondent. The number of years since a puchase was calculated using the same formula.

The actual purchase price was obtained from 1981 and 1982 Sears catalogs for each of the appliances, using an average of all of the models listed in the catalog. Two different years' catalogs were used in order to correspond with the two different years in which the survey was completed. The estimated costs were obtained from the responses of the subjects as indicated on the survey forms (Appendix B).

DATA ANALYSIS

A program to compute the statistics was written in BASIC for the Zenith microcomputer. A BASIC program was used instead of the Statistical Analysis System (SAS) program on the mainframecomputer because of the table generating capability of the microcomputer and also to insure that the values were in accordance with statistical techniques used to complete previous research in the area of Household Equipment in the Department of Family Economics at Kansas State University. The computer program read the data from a file and determined the mean of the X and Y columns, as well as the slope and the correlation coeffienct.

With the aid of a Hewlet Packard programmable calculator the raw data were converted into a ratio of the error of the estimate versus the actual repair costs and present purchase cost and placed in a file using the Zenith BASIC language. The ratio was calculated using the following formula:

$$\text{Ratio, \%} = \frac{\text{Estimation Error}}{\text{Actual}} \text{ X } 100\% = \frac{\text{Actual-Estimation}}{\text{Actual}} \text{ X } 100\%$$

An estimation error was used as a ratio rather than the raw data in order that the two cities and the two components could be compared. A negative value indicated an over-estimation had occurred and a positive value indicated an under-estimation had occurred.

The formulas used to complete the linear regression analysis and the F-tests and two-tailed t-tests are indicated in Appendix E.

PURPOSE OF STATISTICAL TESTS

Linear regression was performed on the data in order to determine if any relationship existed between the dependent and independent variables. T-tests and F-tests were performed to determine if the data could be combined. The t-tests were used to indicate if the means of the data were significantly different while F-tests were used to indicate if significant differences for the variances of the data existed. The exact form of the t-test was determined by the outcome of the F-test.

The independent variables included: the number of years since the purchase of that appliance, the ability to estimate the other repair cost, the ability to estimate the cost of a new appliance, the mean of the age group to which the subject belonged, the number of years since the last repair of that appliance,the number of years since any repair, and the number of years since either of the two components in question had been repaired.

RESULTS

RESULTS OF A COMPARISON OF THE RATIO OF ERRORS IN ESTIMATION

Of the 32 categories analyzed, consumers underestimated the cost of repair in 22 (67 percent) of the cases, while overestimating its cost for 10 (31 percent) of the cases, as indicated in Table 1.

Table 1 indicates the range of overestimation and underestimation for both the ratios and the actual values. Column 1 of Table 1 indicates the data code and corresponds with the data code used in Appendix E. Column 2 indicates what data is being discussed. Column 3 is used to indicate the number of individuals taking part in the survey. Column 4 indicates the actual cost of repair for the particular component in question for that city. The maximum error, the minimum error, and the average error of repair estimation in dollar amounts are indicated in columns 5, 6, and 7 respectively. The ratio of the estimated cost divided by the actual cost of repair as expressed as a percentage, is indicated in columns 8, 9, and 10. The ratio is indicated by the mean of Y for the tables in Appendix E. The minimum and maximum values were found by comparing the raw data. The average is found by taking the sum of the error of the estimated cost of repair and dividing this number by the number of columns that have values. The ratios (columns 8,

Table 1: Comparison of the ratio of estimated error to the actual estimated error for the repair cost for each appliance and each component*

				Repair Estimation			Est./Actual Cost, %		
Date Code	Repair Comparison	No. Obs.	Act Cost	Max Err	Min Err	Ave Err	Max Err	Min Err	Ave Err
A3MA	Manhattan Ref. Comp.	43	$250	$250	$ 0	$ 34	100	0	-13
B3MA	Man.Ref. Timer	42	45	155	5	37	344	11	83
A30A	O.P. Ref. Compressor	46	300	260	0	117	-87	0	-39
B30A	O.P. Ref. Timer	42	71	129	1	5	182	-1	8
C3MA	Man. Washer Motor	45	94	231	6	46	246	6	49
D3MA	Man. Washer Trans.	38	128	122	3	8	95	-2	-7
C30A	O.P. Washer Motor	46	135	365	10	23	270	-7	17
D30A	O.P.Washer Trans.	39	157	143	7	31	91	-4	-20
E3MA	Man.Dryer Therm.	36	40	110	0	26	275	0	73
F3MA	Man.Dryer Motor	35	84	116	1	18	138	3	22
E30A	O.P. Dryer Therm	48	52	98	2	9	189	-4	17
F30A	O.P. Dryer Motor	46	130	170	5	1	131	-4	3

Table 1 (Con't)

Date Code	Repair Comparison	No. Obs.	Act Cost	Repair Estimation Max Err	Min Err	Ave Err	Est./Actual Cost, % Max Err	Min Err	Ave Err
G30A	Man.E.R. Therm.	37	$ 69	$ 81	$ 1	$ 7	118	1	-10
H3MA	Man. E.R. Timer	38	81	61	6	22	-36	-1	-27
G30A	O.P. E.R. Therm	36	114	94	4	52	-82	-4	-46
H30A	O.P .E.R. Timer	37	110	90	10	56	82	-9	-51
I3MA	Man. G.R. Ignitor	3	51	149	24	62	292	47	138
J3MA	Man. G.R. Therm.	5	83	28	3	7	-34	-4	-8
I30A	O.P. G.R. Ignitor	7	89	39	9	5	-44	-10	-17
J30A	O.P. G.R. Therm.	8	121	96	46	70	-79	-38	-58
K3MA	Man. D.W. Motor	27	113	112	12	6	99	11	-5
L3MA	Man. D.W. Timer	26	74	101	26	14	137	35	-19
K30A	O.P. D.W. Motor	38	151	199	1	18	132	-1	-12
L30A	O.P. D.W. Timer	40	76	74	1	16	97	-1	-21
M3MA	Man. M.W. Controls	14	205	295	30	55	144	15	-38
N3MA	Man. M.W. Magnetron	14	136	189	11	33	139	-8	24

Table 1 (Con't)

Date Code	Repair Comparison	No. Obs.	Act Cost	Repair Estimation Max Err	Min Err	Ave Err	Est./Actual Cost, % Max Err	Min Err	Ave Err
M30A	O.P. M.W. Controls	18	$195	$145	$ 5	$ 66	-74	3	-34
N30A	O.P. M.W. Magnetron	17	215	165	15	67	-77	-2	-31
O3MA	Man. A.C. Compressor	13	284	209	84	137	-74	-30	-51
P3MA	Man. A.C. Fan Motor	13	106	56	6	38	-53	-6	-20
O30A	O.P. A.C. Compressor	8	335	285	135	231	-85	-40	-69
P30A	O.P. A.C. Fan Motor	8	140	110	40	81	-79	-29	-58

*The data code corresponds to the data code indicated in the Appendix E. The first letter indicates the appliance and which component using the following list: A-refrigerator compressor, B-defrost timer; C- washer motor, D-transmission; E-dryer thermostat, F-motor; G-electric range thermostat, H-timer clock; I-gas range oven ignitor, J-thermostat; K-dishwasher motor, L-timer; M-microwave control panel, N-magnetron tube; O-air conditioner compressor, P-fan motor. The first number indicates which independent variable according to the following list: 1-years since a purchase, 2-ratio of other cost, 3-ratio of new price, 4-mean of age group, 5-years since last repair, 6-years since any repair, 7-component repair experience. The second letter indicates which city: M-Manhattan, O-Overland Park. The third letter in the value type: S-standard values, A-absolute value.

*Note: Negative signs (-) indicate an overestimation by the individual or average respondent. The absolute value was used in the calculation of the average error. Example: If 1 person overestimated by $10 and 1 person underestimated the error by $10, the estimated error would be $20/2 or $10. This is different than the formula used to calculate the estimated error in Table 2.

9, and 10) can be multiplied by the actual cost of repair (column 4) to obtain the amount of error of the estimated cost of repair (columns 5, 6, 7). Rounding errors may be responsible for one or two point differences in values. The absolute value of the error was used in the calculation of the average error (column 7 of Table 1) while the actual value of the error was used in the calculation of the estimation error (column 6 of Table 2), resulting in a difference in the figures. Figure 1 illustrates the average error of repair cost estimates using the same data as shown in Table 1.

A comparison between the ratio of the estimated to the actual new price and the ratio of the estimated to the actual repair cost for each appliance and each component indicated that in 12 (38 percent of the cases the subject underestimated both prices. The results also showed that in 8 (25 percent) of the cases both cases were overestimated. In 9 cases (28 percent) the new cost was overestimated while the repair cost was underestimated and in 3 cases (9 percent) the new cost was underestimated and the repair cost was overestimated. Figures 2 and 3 illustrate the overall results using ratios while Figures 4 and 5 illustrate the same information using actual values.

Table 2 indicates the amount of overestimation or underestimation of the cost to repair and the new cost of

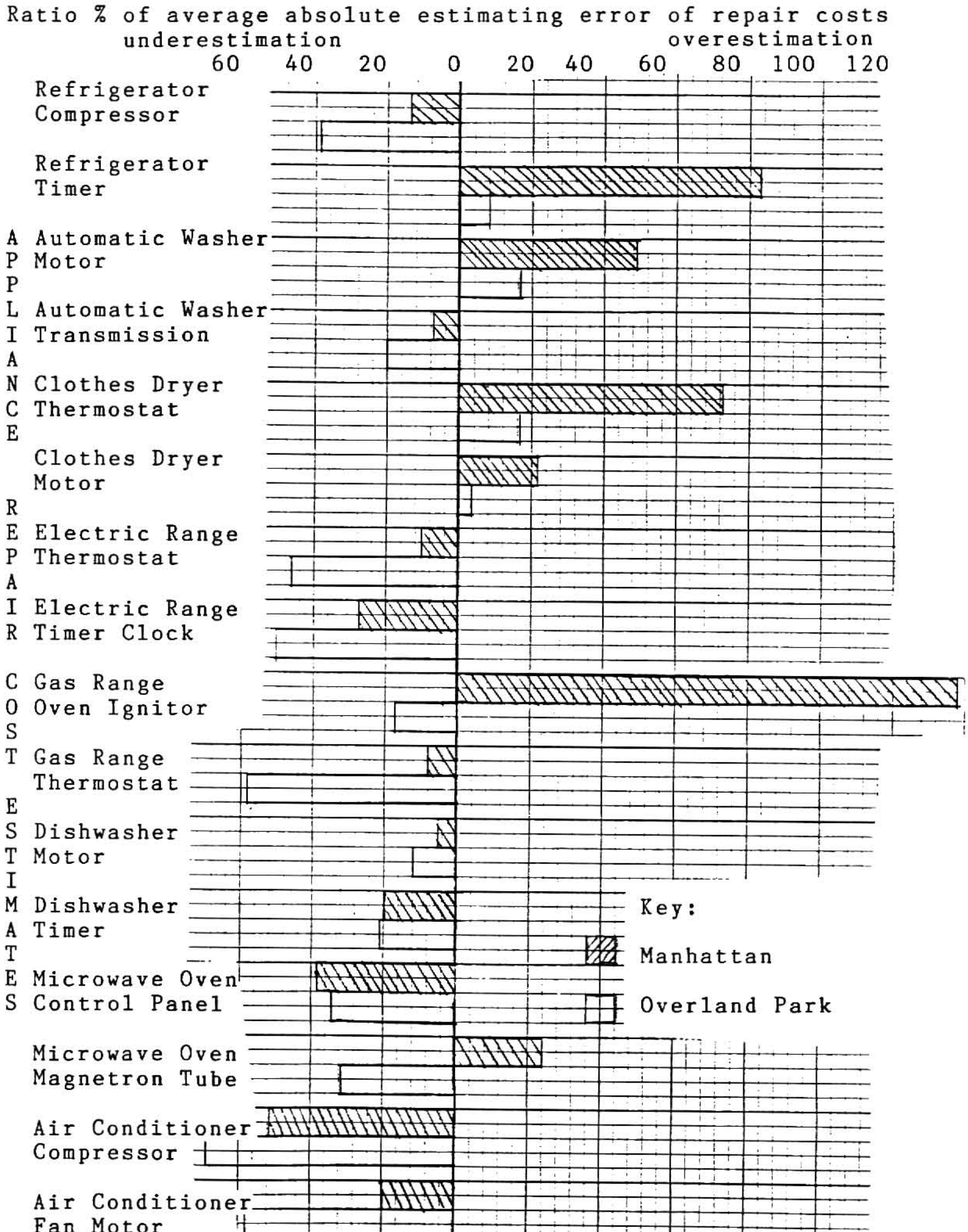

Figure 1: Illustration of the component repair cost using the formuas and data from Table 1.

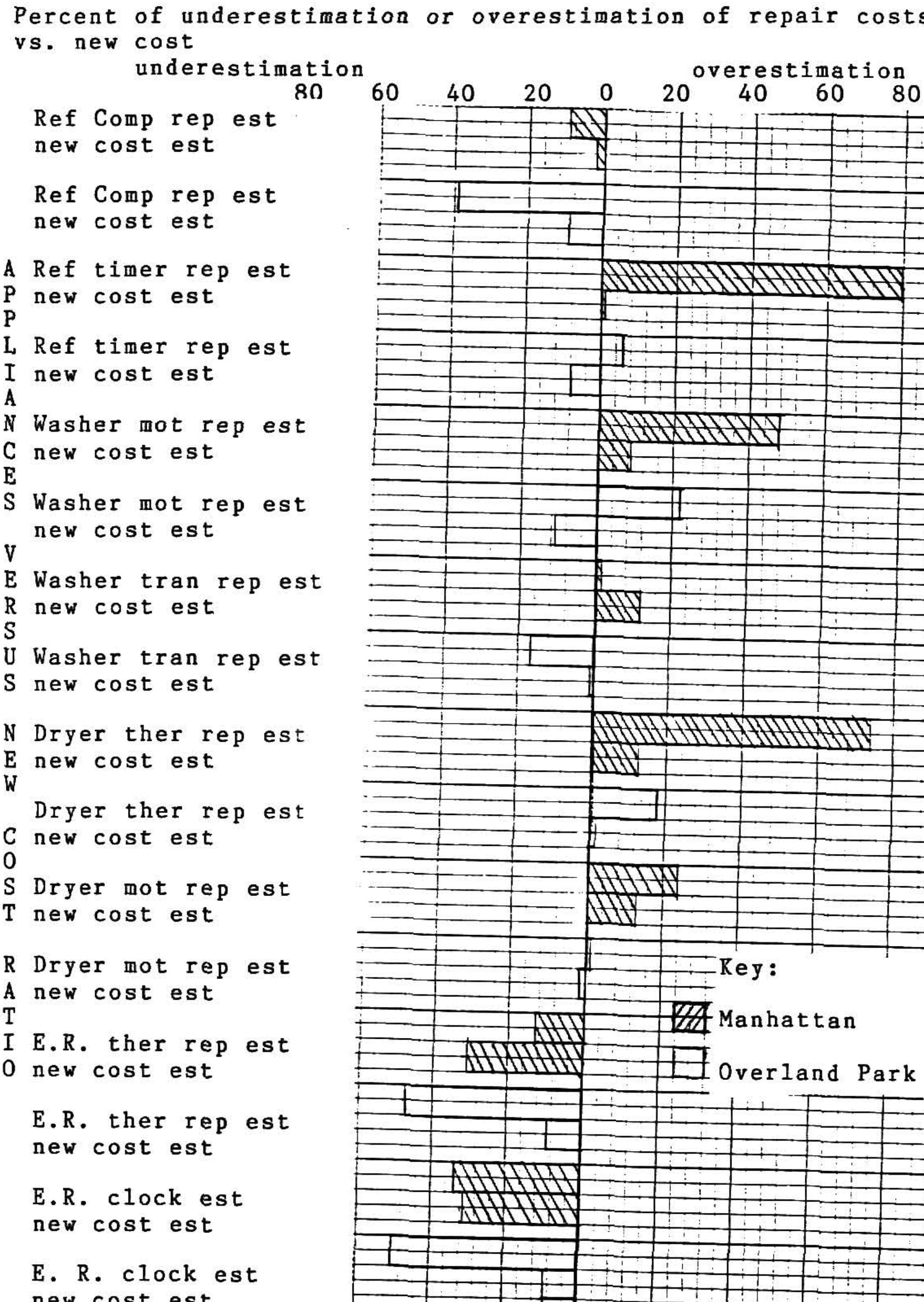

Figure 2: Illustration of the comparison of the new price ratio to the component repair cost ratio for the first 16 cases using the data and formulas from Table 2.

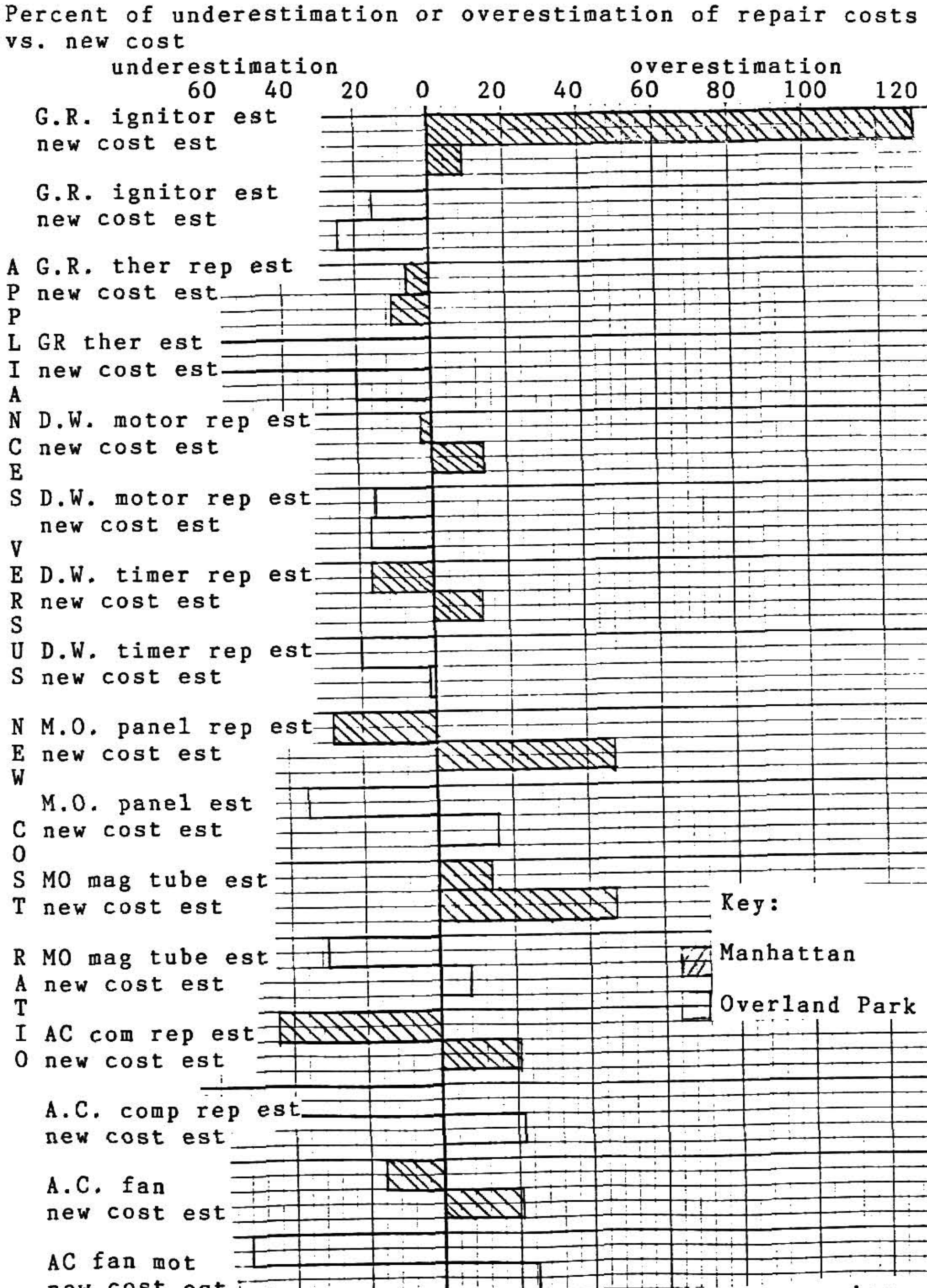

Figure 3: Illustration of the comparison of the new price ratio to the component repair cost ratio for the second 16 cases using the data and formulas from Table 2.

Actual values of underestimation or overestimation error for both repair costs and for new cost

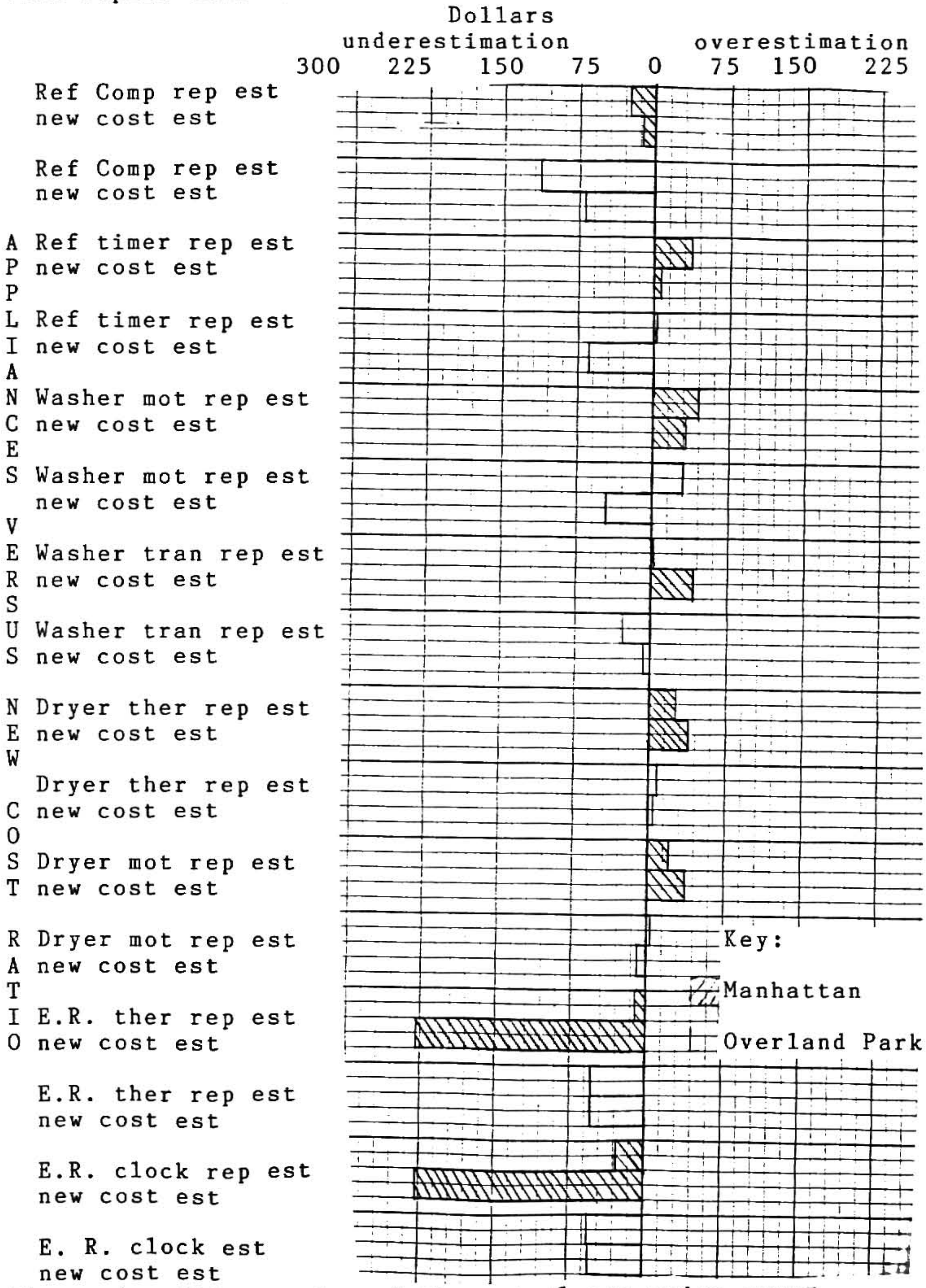

Figure 4: Illustration of the actual new price error estimate versus repair cost error for the first 16 cases using data and formulas from Table 2.

Actual values of underestimation or overestimation error for both repair costs and the new cost

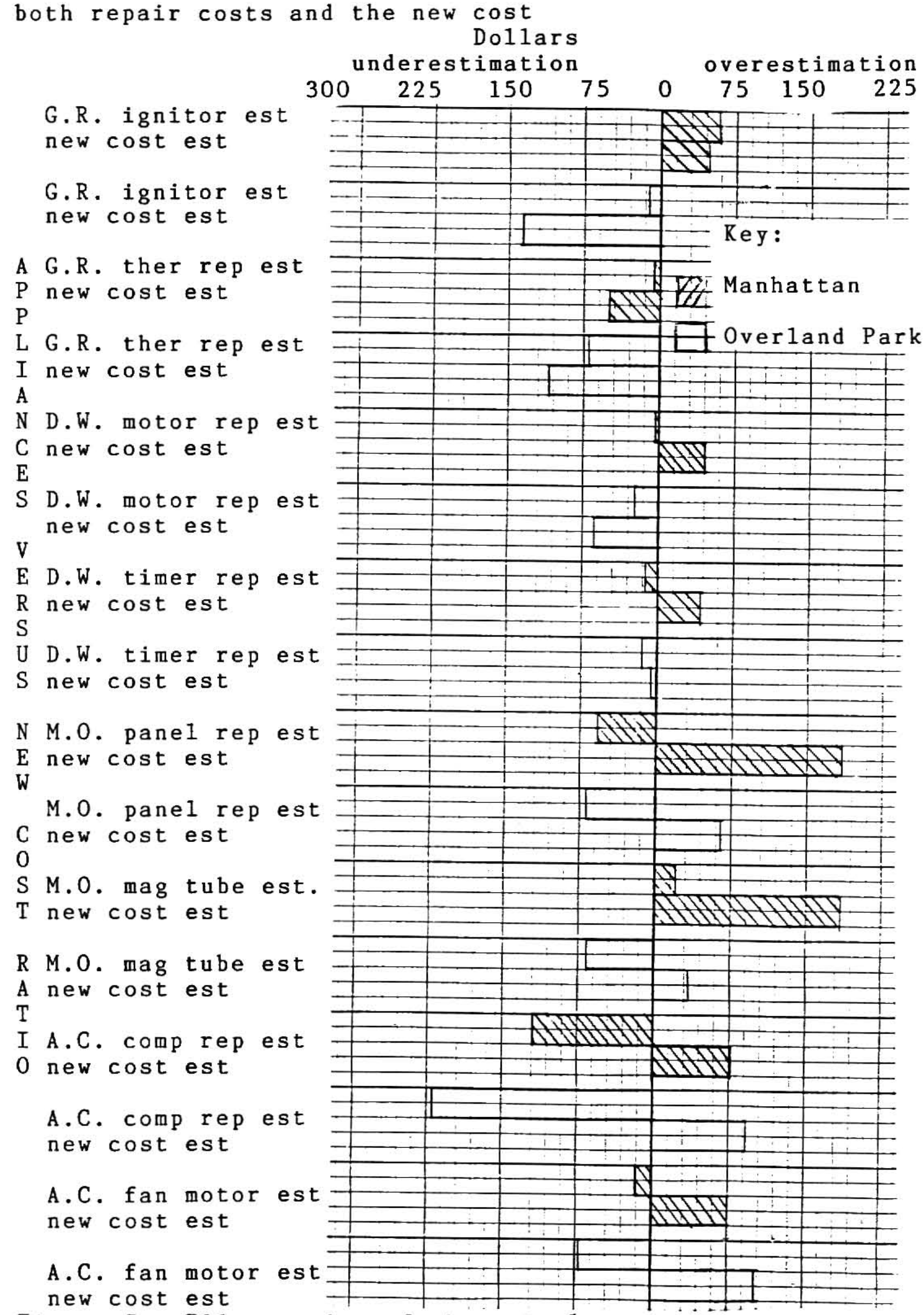

Figure 5: Illustration of the actual new price error estimate versus repair cost error for the second 16 cases using data and formulas from Table 2.

Table 2: Comparison of Actual Cost Versus the Estimation Error for the New Price and the Repair Cost for Each Appliance and Each Component

			Est. Repair Cost			Est. New Cost		
Data Code	Repair Comparison	No. Obs.	Actual Cost	Ratio %	Est. Error	Actual Cost	Ratio %	Est. Error
A3MS	Manhattan Ref. Comp.	43	$250	-10	$ 25	$641	-2	$ 13
B3MS	Man. Ref. Timer	43	45	80	36	641	1	6
A3OS	O.P. Ref. Compressor	46	300	-39	117	782	-9	70
B3OS	O.P. Ref. Timer	42	67	6	4	782	-8	63
C3MS	Man. Washer Motor	43	94	48	45	361	9	33
D3MS	Man. Washer Trans	38	111	1	1	361	12	43
C3OS	O.P. Washer Motor	46	135	22	30	419	-11	46
D3OS	O.P. Washer Trans	39	157	-17	27	419	-1	4
E3MS	Man. Dryer Therm.	36	36	74	27	301	13	39
F3MS	Man. Dryer Motor	35	83	24	20	301	13	39
E3OS	O.P. Dryer Therm.	48	52	18	9	326	1	3
F3OS	O.P. Dryer Motor	46	130	1	1	326	-2	7
G3MS	Man. E.R. Therm.	37	69	-13	9	736	-31	228
H3MS	Man. E.R. Timer	38	81	-34	27	736	-31	228

*Note: Negative signs (-) indicate an underestimation by the respondant.

Table 2 (Con't)

Data Code	Repair Comparison	No. Obs.	Est. Repair Cost: Actual Cost	Est. Repair Cost: Ratio %	Est. Repair Cost: Est. Error	Est. New Cost: Actual Cost	Est. New Cost: Ratio %	Est. New Cost: Est. Error
G30S	O.P. E.R. Therm.	36	114	-47	53	602	-9	54
H30S	O.P. E.R. Timer	37	110	-50	55	602	-9	54
I3MS	Man. G.R. Ignitor	3	45	130	59	537	9	48
J3MS	Man. G.R. Therm.	5	84	-6	5	537	-10	54
I30S	O.P. G.R. Ignitor	7	89	-15	13	547	-25	137
J30S	O.P. G.R. Therm.	8	121	-58	70	547	-20	109
K3MS	Man. D.W. Motor	27	115	-3	3	328	14	46
L3MS	Man. D.W. Timer	26	75	-17	13	328	13	43
K30S	O.P. D.W. Motor	38	151	-15	23	377	-17	64
L30S	O.P. D.W. Timer	40	76	-20	15	377	-1	4
M3MS	Man. M.W. Controls	14	205	-28	57	404	47	190
N3MS	Man. M.W. Magnetron	14	136	14	19	404	47	190
M30S	O.P. M.W. Controls	18	195	-35	68	397	16	64
N30S	O.P. M.W. Magnetron	17	215	-30	65	397	8	32

*Note: Negative signs (-) indicate an underestimation by the respondent.

Table 2 (Con't)

Data Code	Repair Comparison	No. Obs.	Est. Repair Cost Actual Cost	Ratio %	Est. Error	Est. New Cost Actual Cost	Ratio %	Est. Error
03MS	Man. A.C. Compressor	13	269	-44	118	362	21	76
P3MS	Man. A.C. Fan Motor	13	98	-16	16	362	21	76
030S	O.P. A.C. Compressor	8	335	-66	221	415	22	91
P30S	O.P. A.C. Fan Motor	8	140	-52	73	415	25	104

*The data code corresponds to the data code indicated in the Appendix E. The first letter indicates the appliance and which component using the following list: A-refrigerator compressor, B-defrost timer; C-washer motor, D-transmission; E-dryer thermostat, F-motor; G-electric range thermostat, H-timer clock; I-gas range oven ignitor, J-thermostat; K-dishwasher motor, L-timer; M-microwave control panel, N-magnetron tube; O-air conditioner commpressor, P-fan motor. The first number indicates which independent variable according to the following list: 1-years since a purchase, 2-ratio of other cost, 3-ratio of new price, 4-mean of age group, 5-years since last repair, 6-years since any repair, 7-component repair experience. The second letter indicates which city: M-Manhattan, O-Overland Park. The third letter in the value type: S-standard values, A-absolute values.

*Note: Negative signs (-) indicate an underestimation by the respondent. The actual value was used calculation of the estimated error. Example: If 1 person over estimated by $10 and 1 person under estimated the error by $10, the estimated error would be $10 + -$10 = $0. This is different than the formula used to calculate the estimated error in Table 1.

the appliance for each of the categories under investigation. Column 1 of Table 2 indicates the data code and corresponds with the data code used in Appendix E. Column 2 indicates what data is being discussed. Column 3 indicates the number of individuals taking part in the survey. Column 4 indicates the actual cost of repair for the particular component in question for that city. The ratio of estimated repair cost to the actual repair cost, expressed as a percentage, is indicated in column 5. Column 5 thus represents the percent of error of the respondent, as indicated by the mean of Y for the ratio of new cost in the tables of Appendix E. Column 6 indicates the actual dollar amount of error and can be determined by multiplying the straight error ratio (column 5/100) times the actual repair cost (column 4). Column 7 indicates the actual cost of a new appliance according to the average cost of a new appliance according to the average cost of the particular appliance for the year in which the survey was conducted. Because the Manhattan survey was completed a year before the Overland Park survey, the new price values for the Manhattan survey tend to be lower. Column 8 corresponds with column 3 and column 9 corresponds to column 6 except they use actual new prices rather than repair costs and they are obtained by taking the mean of X rather than the mean of Y from the tables in appendix E. Rounding errors may be responsible for one or two point differences. The average value of the error was used in the calculation of the estimated error (column 6 of Table 2) while the absolute value of the error was used in the calculation of the estimated error (column 7 of Table 1), resulting in a difference in the figures.

RESULTS OF LINEAR REGRESSION

Table 3 is a summary of the results obtained when linear regression analysis was performed on the data. Only those pieces of data with a correlation of determination of 50 percent or greater for sample sizes greater than three are recorded in Table 3. The correlation of determination was obtained by taking the square of the correlation coefficient and expressing it as a percent. Appendices E.1 through E.64 indicate the values obtained for all of the data points. Only 12 of the 448 comparisons made indicated that the independent variables had a significant effect on the consumer's ability to estimate component repair costs. Each of the categories of appliances will be described in the following pages concering the results of the linear regression that was performed on them.

Refrigerator

The results of the linear regression of the absolute values of the defrost timer repair cost ratio data on the component repair experience of the subject indicated a 52.85 percent correlation of determination. This means that when the sign of the error was ignored, approximately 53 percent

Table 3: Linear Regression of Manhattan and Overland Park Data, Standard and Absolute Values with a 50 Percent or Greater Coefficient of Determination

Data Code*	Variable Comparison	No. Obs.	Corr. Coeff.	Deter. Coeff.
A7MA	Manhattan refrigerators, compressor repair cost ratio versus the subject's component repair experience, absolute values of the data	6	0.727	52.85%
D7MA	Manhattan automatic washers, transmission repair cost ratio versus the subject's component repair experience, absolute values of the data	4	0.720	51.84%
H7MS	Manhattan electric ranges, timer clock repair cost ratio versus the subject's component repair experience, standard values of the data	5	-0.915	83.72%
J10S	Overland Park gas ranges, thermostat cost ratio vs. the number of years since the purchase of the present range, standard values of the data	8	0.798	63.68%
J10A	Overland Park gas ranges, thermostat cost ratio vs. the number of years since the purchase of the present range, absolute values of the data	8	0.798	63.68%
L7MS	Manhattan dishwashers, timer repair cost ratio versus the subject's component repair experience, standard values of the data	4	0.913	83.36%
M3MS	Manhattan microwaves, touch control panel repair cost repair versus the ratio of the estimated new price standard values of the data	14	0.771	59.44%
M3MA	Manhattan microwaves, touch control panel repair cost ratio versus the ratio of the estimated new price, absolute values of the data	14	0.774	59.91%

Table 3 (Con't`)

Data Code*	Variable Comparison	No. Obs.	Corr. Coeff.	Deter. Coeff.
O2OS	Overland Park window air conditioner compressor repair cost ratio versus the repair cost ratio of the fan motor, standard values of the data	8	0.910	82.81%
O6OS	Overland Park air conditioner compressor repair cost ratio versus the number of years since any appliance repair, standard values of the data	6	-0.726	52.71%
P6OS	Overland Park air conditioner fan motor repair cost ratio versus the number of years since any appliance repair, standard values of the data	6	-0.963	92.74%
O2OA	Overland Park window air conditioner compressor repair cost ratio versus the repair cost ratio of the fan motor, absolute values of the data	8	0.910	82.81%
O6OA	Overland Park air conditioner compressor repair cost ratio versus the number of years since any appliance repair, absolute values of the data	6	-0.726	52.71%

*The data code corresponds to the data code indicated in the Appendix E. The first letter indicates the appliance and which component using the following list: A-refrigerator compressor, B- defrost timer; C-washer motor, D-transmission; E-dryer thermostat, F-motor; G-electric range thermostat, H-timer clock; I-gas range oven ignitor, J-thermostat; K-dishwasher motor, L-timer; M-microwave control panel, N-magnetron tube, O-air conditioner compressor, P-fan motor. The first number indicates which independent variable according to the following list: 1-years since a purchase, 2-ratio of other cost, 3-ratio of new price, 4-mean of age group, 5-years since last repair, 6-years since any repair, 7-component repair experience. The second letter indicates which city: M-Manhattan, O-Overland Park. The third letter indicates the value type: S-standard values, A-absolute values.

of the error in the repair cost estimate was accounted for by the subject's experience in repairing that particular component on his or her refrigerator.

In Manhattan consumers underestimated the cost of compressor repair by an average of 13 percent and overestimated the cost of the defrost timer repair by an average of 83 percent, as indicated in Table 1. Consumers in Overland Park underestimated the cost of the compressor repair by an average of 39 percent and overestimated the defrost timer repair cost by an average of 8 percent, as indicated in Table 1. These findings were indicated by the signs and the values of the means of the y-axis.

A comparison of the Manhattan new cost ratio to the refrigerator compressor repair cost indicated that the consumers underestimated the new price by two percent compared to the ten percent underestimation for the repair cost as indicated in Table 2. A similar comparison between the new cost ratio and the defrost timer repair cost ratio indicated an overestimation for the repair cost by 80 percent and an overestimation of the new cost by 1 percent, as indicated in Table 2. The results of the Overland Park data indicated a 9 percent underestimation of the new cost and a 39 percent underestimation of the compressor repair cost ratio. The results of the same city indicated an 8 percent underestimation of the new cost compared to a 6 percent overestimation of the defrost timer repair cost, as indicated in Table 2.

Automatic Washer

The automatic washer data indicated that a 51.84 percent coefficient of determination existed when the absolute value of the transmission cost was compared to the subject's repair experience with that particular component repair. This relationship indicates that when the sign of the error was not considered, the subjects who had had repair experience of that particular component were better able to estimate the actual cost of the repair. Only four respondents had experience with automatic washer repairs.

The Manhattan data indicated that consumers overestimated the cost of motor repair by an average of 49 percent and underestimated the cost of transmission repair by an average of 7 percent. The Overland Park data indicated a trend to overestimate the motor repair cost by an average of 17 percent and underestimate the cost of the transmission repair by an average of 20 percent, as indicated in Table 1.

Table 2 illistrates a comparison between the Manhattan new cost ratio to the automatic washer motor repair cost indicated that the subjects overestimated the new price by 9 percent compared to the 48 percent overestimation for the repair cost. A similar comparison between the new cost ratio and the transmission repair cost ratio indicated an overestimation of 12 percent for the new price and a 1 percent overestimation for the repair cost. The results of the Overland Park data indicated an 11 percent underestimation of the new cost and a 22 percent overestimation of the motor repair cost ratio. The results of the same city indicated a 1 percent underestimation of the new cost compared to a 17 percent underestimation of the transmission repair cost.

Clothes Dryer

The results of the linear regression performed on the standard value Manhattan clothes dryer data indicated no significant correlations existed between any of the dependent and independent variables.

The mean values of the Manhattan absolute data indicated that the subjects overestimated the cost of the thermostat repair by an average of 73 percent. The subjects also overestimated the cost of the motor repair by an average of 22 percent. The means of the Overland Park absolute data indicated that the subjects overestimated the cost of the thermostat repair by an average of 17 percent and overestimated the cost of the motor repair by an average of 3 percent, as indicated in Table 1.

A comparison of the Manhattan new cost ratio to the clothes dryer thermostat repair cost indicated that the consumers overestimated the new price by 13 percent compared to the 74 percent overestimation for the repair cost. A similar comparison between the new cost ratio and the motor repair cost ratio indicated an overestimation of 13 percent for the new price and an 24 percent overestimation for the repair cost. The results of the Overland Park data indicated a 1 percent overestimation of the new cost and a 18 percent overestimation of the thermostat repair cost ratio and a 2 percent underestimation of the new cost compared to a 1 percent overestimation of the motor repair cost, as indicated in Table 2.

Electric Ranges

The subject's component repair experience also had a significant coefficient of determination of 83.72 percent when compared to the ratio of the actual versus estimated repair cost of the timer clock. This relationship was negative, indicating that consumers who had had the timer clock repaired were much better than the average consumer and those who had had the thermostat repaired were only slightly better at estimating when compared to the average consumer. However, only five pieces of data were available. The mean values of the Manhattan electric range data indicated that the subjects underestimated the cost of the thermostat by an average of 10 percent and underestimated the cost of the timer clock repair by an average of 27 percent. The results of the linear regression performed on the Overland Park electric range data indicated that the subject underestimated the cost of repair of the timer clock by an average of 46 percent and underestimated the timer clock repair costs by an average of 51 percent, as indicated by Table 1.

The results of the comparison between the Manhattan new cost ratio and the electric range thermostat repair cost illustrated in Table 2 indicate that the consumers underestimated the new price by 31 percent compared to the 13 percent underestimation for the repair cost. A similar comparison between the new cost ratio and the timer clock repair cost ratio indicated an underestimation of 31 percent for the new price and a 34 percent underestimation for the repair cost. The results of the Overland Park data indicated a 9 percent underestimation of the new cost and a 47 percent underestimation of the thermostat repair cost ratio. The results of the same city indicated a 9 percent underestimation of the new cost compared to a 50 percent underestimation of the timer clock repair cost.

Gas Ranges

The analysis of the Manhattan gas range data indicated that significant correlations existed between the ratio of the oven ignitor repair cost and several of the independent variables it was tested against. However, only three data points were present. Thus, the data is very questionable and will not be discussed due to the small sample size.

The results of the Overland Park data indicated a 63.68 percent coefficient of determination existed between the standard and absolute values of the thermostat repair cost versus the number of years since a purchase. The sample size was 8. This relationship indicates that the greater number of years since the last repair, the better the subject was at estimating the actual repair cost. This is probably because the subjects with older appliances had more repair experience than those with relatively new appliances.

Table 1 indicates the mean values of the Manhattan data. The results indicated that the subjects overestimated the cost of the oven ignitor repair by an average of 138 percent. The subjects underestimated the cost of the thermostat repair by an average of 8 percent. The Overland Park information indicated that the subjects underestimated the cost of the oven ignitor repair cost by an average of 17 percent and underestimated the cost of the thermostat repair by an average of 58 percent.

A comparison between the Manhattan new cost ratio and the gas range oven ignitor repair cost indicated that the consumers overestimated the new price by 9 percent compared to the 130 percent overestimation for the repair cost. A similar comparison between the new cost ratio and the thermostat repair cost ratio indicated an underestimation of 10 percent for the new price and a 6 percent underestimation for the repair cost. The results of the Overland Park data indicated a 25 percent underestimation of the new cost and a 15 percent underestimation of the oven ignitor repair cost ratio. The results of the same city indicated a 20 percent underestimation of the new cost compared to a 58 percent underestimation of the thermostat repair cost, as indicated in Table 2.

Dishwasher

With a sample size of 4, the standard value Manhattan timer cost ratio data versus the component repair experience of the subject indicated a coefficient of determination of 83.36 percent. This again indicated that subjects with experience at repairing the components in question were better at estimating repair costs than the average subject. The mean values of the Manhattan data indicated that the subjects underestimated the cost of the motor repair by an average of 5 percent and underestimated the cost of the timer repair by an average of 19 percent. The Overland Park data indicated that the subjects underestimated the cost of the motor repair by an average of 12 percent and underestimated the cost of the timer repair by an average of 21 percent, as indicated in Table 1.

The comparison between the Manhattan new cost ratio to the dishwasher motor repair cost indicated that the consumers overestimated the new price by 14 percent compared to the 3 percent underestimation for the repair cost. A similar comparison between the new cost ratio and the timer repair cost ratio indicated an overestimation of 13 percent for the new price and an 17 percent underestimation for the timer repair cost. The results of the Overland Park data indicated a 17 percent underestimation of the new cost and a 15 percent underestimation of the motor repair cost ratio. The results of the same city indicated a 1 percent underestimation of the new cost compared to a 20 percent underestimation of the timer repair cost, as indicated in Table 2.

Microwaves

With a sample size of 14, the control panel cost ratio versus the subject's component repair experience indicated a coefficient of determination of 59.44 percent for the standard value data and 59.91 percent for the absolute value data.

The mean values of the Manhattan data indicated that the subjects underestimated the touch control panel repair cost by an average of 38 percent. The Manhattan subjects overestimated the magnetron tube cost by an average of 24 percent. The Overland Park data indicated that subjects underestimated the touch control panel by an average of 34 percent and underestimated the magnetron tube cost by an average of 31 percent, as indicated in Table 1.

A comparison between the Manhattan new cost ratio and the microwave oven control panel cost indicated that the consumers overestimated the new price by 47 percent compared to the 28 percent underestimation for the repair cost. A similar comparison between the new cost ratio and the magnetron tube repair cost ratio indicated an overestimation of 47 percent for the new price and a 14 percent overestimation for the repair cost. The results of the Overland Park data indicated a 16 percent overestimation of the new cost and a 35 percent underestimation of the touch control panel repair cost ratio. The results of the same city indicated an 8 percent overestimation of the new cost compared to a 30 percent underestimation of the magnetron tube repair cost, as indicated in Table 2.

Window Air Conditioner

The results of the standard and absolute values of the Overland Park air conditioner data indicated that with a sample size of 8, the comparison of the compressor repair cost to the fan motor repair cost ratio had a coefficient of determination of 82.81 percent. This indicated that the subject's were consistent in their estimates of the two repair costs.

The standard and absolute values of the Overland Park compressor data indicated a negative correlation and a 52.71 percent coefficient of determination when compared to the number of years since any repair. Similarly, a 92.74 percent coefficient of determination was indicated when the standard value of the Overland Park fan motor data was compared to the number of years since any repair. These results indicate that the more recent the repair of any appliance, the better the subject is at estimating the repair cost of the compressor. The sample size for these comparisons was six.

Table 1 indicates that from the Manhattan data the subjects underestimated the compressor repair cost by an average of 51 percent while underestimating the fan motor repair cost by an average of 20 percent. The results of the Overland Park data analysis indicated an underestimation of the copressor cost by an average of 69 percent and an underestimation of the fan motor cost by an average of 58 percent.

The comparison between the Manhattan new cost ratio to the window air conditioner compressor repair cost indicated that the consumers overestimated the new price by 21 percent compared to the 44 percent underestimation for the repair cost. A similar comparison between the new cost ratio and the fan motor repair cost ratio indicated an overestimation of 21 percent for the new price and an 16 percent underestimation for the fan motor repair cost. The results of the Overland Park data indicated a 22 percent overestimation of the new cost and a 66 percent underestimation of the compressor repair cost ratio. The results of the same city indicated a 25 percent overestimation of the new cost compared to a 52 percent underestimation of the fan motor repair cost, as indicated in Table 2.

RESULTS OF THE F-TESTS

Tables 4 through 7 indicate the results of the F-tests that were performed on the data. These tests compared the variances of the two components of each appliance for both the Manhattan and Overland Park data. Also the variances of Overland Park data versus the Manhattan data for each component was compared using F-tests.

Table 4 indicates that the variances were significantly different when refrigerators compressors were compared to the defrost timers for both cities and also when the Manhattan data was compared to the Overland Park data for both the compressor and the defrost timer. These results indicate that the data cannot be combined for any of these combinations of the refrigerator data. The variances of motors versus transmissions of automatic washers were found to be significantly different for both cities. However the F-tests indicates that the the variances of the Manhattan versus the Overland Park data were not significantly different for both the automatic washer motor and transmission data.

Table 5 indicated that the variances were significantly different when the Manhattan dryers thermostat data was compared to the motor data and when the Manhattan data was compared to the Overland Park data for the thermostat. However, the variances were found to not be significantly

Table 4: Test of equality of variance: difference between the two estimated repair costs for refrigerators and automatic washer data.

Repair Comparison	Degrees of Freedom	Calculated F-value	F-Table Value	$\sigma_1 = \sigma_2$	$\sigma_1 \neq \sigma_2$
Manhattan refrigerators, compressors vs. defrost timers	42 41	5.14	1.69	no	yes
Overland Park refrigerators, compressors vs. defrost timers	46 42	2.75	1.69	no	yes
Refrigerator compressors, Manhattan vs. Overland Park	42 46	1.79	1.69	no	yes
Refrigerator defrost timers, Manhattan vs. Overland Park	41 42	3.34	1.69	no	yes
Manhattan automatic washers, motors versus transmissions	43 37	2.06	1.69	no	yes
Overland Park automatic washers, motors vs. transmissions	46 38	2.48	1.69	no	yes
Automatic Washer motors, Manhattan versus Overland Park	43 46	1.16	1.69	yes	no
Automatic Washer transmissions, Manhattan versus Overland Park	37 38	1.39	1.69	yes	no

Table 5: Test of equality of variance: difference between the two estimated repair costs for clothes dryers and electric range data.

Repair Comparison	Degrees of Freedom	Calculated F-value	F-Table Value	$\sigma_1 = \sigma_2$	$\sigma_1 \neq \sigma_2$
Manhattan dryers, thermostats versus motors	35 34	3.96	1.76	no	yes
Overland Park dryers, thermostats versus motors	48 46	1.64	1.70	yes	no
Dryer thermostats, Manhattan versus Overland Park	35 48	3.56	1.73	no	yes
Dryer motors, Manhattan vs. Overland Park	34 48	1.47	1.73	yes	no
Manhattan electric ranges, thermostats vs. timers clocks	37 37	1.30	1.71	yes	no
Overland Park electric ranges, thermostats vs. timer clocks	38 39	1.53	1.69	yes	no
Electric Range thermostats, Manhattan vs. Overland Park	37 38	3.02	1.71	no	yes
Electric Range timer clocks, Manhattan vs. Overland Park	37 39	1.52	1.69	yes	no

different when the Overland Park dryer thermostat repair costs were compared to the dryer motor repair costs and when the Manhattan data was compared to the Overland Park data for the dryer motor data. The variances were found to be not significantly different when the electric range thermostats were compared to timer clocks for both the Manhattan and Overland Park data and when the Manhattan data was compared to the Overland Park data for the repair cost of timer clocks. However, when the thermostat data was compared between Manhattan and Overland Park, the variances were found to be significantly different.

Table 6 indicated that the variances were significantly different when the Manhattan gas range ignitor data was compared to the themrostat data and when the Manhattan data was compared to the Overland Park data for the oven ignitor. However, the variances were found to not be significantly different when the Overland Park gas range oven ignitor repair costs were compared to the gas range thermostat repair costs and when the Manhattan data was compared to the Overland Park data for the gas range thermostat. A comparison of the dishwasher data indicated that the variances were found to be significantly different when the motor repair costs were compared to the timer repair costs for both cities. The variances were also found to be significantly different when the Manhattan and Overland Park

Table 6: Test of equality of variance: difference between the two estimated repair costs for gas range and dishwasher data.

Repair Comparison	Degrees of Freedom	Calculated F-value	F-Table Value	$\sigma_1 = \sigma_2$	$\sigma_1 \neq \sigma_2$
Manhattan gas ranges, oven ignitor vs. thermostat	2 4	101.10	6.94	no	yes
Overland Park gas ranges, oven ignitor vs. thermostats	6 7	1.06	4.21	yes	no
Gas Range oven ignitors, Manhattan versus Overland Park	2 6	40.440	5.14	no	yes
Gas Range thermostats Manhattan versus Overland Park	4 7	2.65	6.09	yes	no
Manhattan dishwasher thermostats versus timers	26 25	1.47	1.94	yes	no
Overland Park dishwashers, motor vs. timers	37 40	1.30	1.69	yes	no
Dishwasher motors Manhattan vs. Overland Park	26 37	1.12	1.85	yes	no
Dishwasher timers Manhattan vs. Overland Park	25 40	1.00	1.87	yes	no

Table 7: Test of equality of variance: differences between the two estimated repair cost for microwaves and air conditioner data.

Repair Comparison	Degrees of Freedom	Calculated F-value	F-Table Value	$\sigma_1 = \sigma_2$	$\sigma_1 \neq \sigma_2$
Manhattan microwave ovens, control panels vs.magnetrons	13 13	1.02	2.57	yes	no
Overland Park microwave ovens, control panels vs. magnetrons	17 16	1.54	2.32	yes	no
Microwave oven control panels, Manhattan vs. Overland Park	13 17	4.51	2.35	no	yes
Microwave oven magnetron tube, Manhattan vs. Overland Park	13 16	3.23	2.39	no	yes
Manhattan air conditioner compressors vs. fan motors	12 12	1.33	2.69	yes	no
Overland Park air conditioner compressors vs. fan motors	7 7	1.20	3.79	yes	no
Air Conditioner compressors, Manhattan vs. Overland Park	12 7	1.01	2.91	yes	no
Air Conditioner fan motors, Manhattan vs. Overland Park	12 7	1.57	3.57	yes	no

data was compared for both the motor and the timer repair costs.

Table 7 indicates that the variances of control panels versus magnetron tubes of microwave ovens were found to not be significantly different for both cities. However the F-tests indicates that the the variances of the Manhattan versus the Overland Park data were significantly different for both the microwave oven control panel and magnetron tube data. The variances were significantly different when window air conditioner compressors were compared to the fan motors for both cities and also when the Manhattan data was compared to the Overland Park data for both the compressor and the fan motor.

RESULTS OF t-TESTS

Two tailed t-tests were used to indicate if the means were significantly different. The Manhattan data were compared to the Overland Park data for each component and the two components were compared for both the Manhattan and the Overland Park data. The results are reported in Tables 8 through 11.

Table 8 indicates that the means were significantly different for the refrigerator data when the compressor data and defrost timer were compared for both cities and when the two cities were compared for both components. Similarly,

Table 8: Result of two tailed t-tests: Difference between the two estimated repair costs for refrigerators and washer data.

Repair Comparison	Degrees of Freedom	F-test Conclusion $\sigma_1 = \sigma_2$	t-value	Critical t-value	Null Hypothesis $Ho: \bar{x}_1 = \bar{x}_2$
Manhattan refrigerators, compressors vs. defrost timers	83	no	6.03	1.66	Reject Ho
Overland Park refrigerators, compressors vs. defrost timers.	88	no	4.93	1.68	Reject Ho
Refrigerators compressors, Manhattan vs. Overland Park	88	yes	515	1.68	Reject Ho
Refrigerators defrost timers, Manhattan vs. Overland Park	83	no	4.76	1.66	Reject Ho
Manhattan automatic washers, motors versus transmissions	80	yes	3.60	1.67	Reject Ho
Overland Park automatic washers,motors vs. transmissions	84	no	3.03	1.67	Reject Ho
Automatic Washer motors, 'Manhattan versus Overland Park	89	yes	2.14	1.68	Reject Ho
Automatic Washer transmissions, Manhattan vs. Overland Park	75	yes	1.74	1.67	Reject Ho

the means were found to be significantly different for the same comparisons of the automatic washer data.

Table 9 indicates the means of the data compared for the clothes washer and the electric range data indicated that the only means that proved to be not significantly different was when the thermostat was compared to the timer clock for the Overland Park electric range data. This set of data had also shown to have no significant difference in the variances when the F-test was completed. For this reason, the Overland Park data for the thermostat and timer clock of electric range could theroretically be combined with no significant changes in the mean or variances of the data.

As indicated in Table 10, the means of the gas range data were significantly different for all comparisons except when the oven ignitor repair costs were compared to the thermostat repair costs for the Manhattan data. However, a comparison of the dishwasher data indicated that the means were not significantly different for all comparisons except when the Manhattan data was compared to the Overland Park data for the motor repair costs. The F-test conclusion indicated that variances were not significantly different for all of the dishwasher comparisons.

Table 11 indicates that the means were not significantly different when the control panel repair costs were compared to the magnetron tube repair costs for the

Table 9: Result of two tailed t-test: Difference between two estimated repair costs for automatic washer and electric range data.

Repair Comparison	Degrees of Freedom	F-test Conclusion $\sigma_1 = \sigma_2$	t-value	Critical t-value	Null Hypothesis $Ho: \bar{x}_1 = \bar{x}_2$
Manhattan dryers, thermostats versus motors	69	no	3.05	1.67	Reject Ho
Overland Park Dryers, thermostats versus motors	94	yes	1.82	1.66	Reject Ho
Dryer Thermostats, Manhattan versus Overland Park	83	no	3.80	1.66	Reject Ho
Dryer motors, Manhattan vs. Overland Park	80	yes	2.35	1.67	Reject Ho
Manhattan electric ranges, thermostats vs. timer clocks	74	yes	2.54	1.67	Reject Ho
Overland Park electric ranges, thermostats vs. timer clocks	77	yes	0.22	1.67	Accept Ho
Electric Range thermostats, Manhattan vs. Overland Park	75	no	5.02	1.67	Reject Ho
Electric range thermostats, Manhattan vs. Overland Park	76	yes	2.30	1.67	Reject Ho

Table 10: Result of two tailed t-test: Difference between the two estimated repair costs for gas range and dishwasher data.

Repair Comparison	Degrees of Freedom	F-test Conclusion $\sigma_1 = \sigma_2$	t-value	Critical t-value	Null Hypothesis $Ho: \bar{x}_1 = \bar{x}_2$
Manhattan gas ranges, oven ignitors vs. thermostats	6	no	1.88	1.94	Accept Ho
Overland Park gas ranges, oven ignitors vs. thermostats	13	no	2.75	1.77	Reject Ho
Gas Range oven ignitors, Manhattan versus Overland Park	8	no	2.34	1.86	Reject Ho
Gas Range thermostats Manhattan versus Overland Park	11	no	3.22	1.80	Reject Ho
Manhattan dishwashers, motors versus timers	51	yes	1.51	1.68	Accept Ho
Overland Park dishwashers, motors versus timers	77	yes	0.34	1.67	Accept Ho
Dishwasher motors, Manhattan vs. Overland Park	63	yes	1.69	1.67	Reject Ho
Dishwasher timers, Manhattan vs. Overland Park	65	yes	0.22	1.67	Accept Ho

Table 11: Result of t-test: Difference between the two estimated repair costs for microwave ovens and air conditioner data.

Repair Comparison	Degrees of Freedom	F-test Conclusion $\sigma_1 = \sigma_2$	t-value	Critical t-value	Null Hypothesis $Ho: \bar{x}_1 = \bar{x}_2$
Manhattan microwave ovens, control panels vs.magnetrons	26	no	1.72	1.71	Reject Ho
Overland Park microwave ovens, control panels vs.magnetrons	33	yes	0.27	1.69	Accept Ho
Microwave oven control panels, Manhattan vs. Overland Park	30	no	0.15	1.70	Accept Ho
Microwave oven magnetron tubes, Manhattan vs. Overland Park	29	yes	2.21	1.70	Reject Ho
Manhattan air conditioner compressors vs. fan motors	24	no	2.13	1.71	Reject Ho
Overland Park air conditioner compressors vs. fan motors	14	no	0.46	1.76	Accept Ho
Air Conditioner compressors, Manhattan vs. Overland Park	19	no	1.05	1.73	Accept Ho
Air Conditioner fan motors, Manhattan vs. Overland Park	19	no	2.37	1.73	Reject Ho

Overland Park data and when the Manhattan data was compared to the Overland Park data on the cost of control panel repair. The table also indicates that the variances were found to be not significantly different for the Overland Park control panel versus magnetron tube data. The t-test results on the window air conditioner data indicated that no significant differences in the mean existed when compressors were compared to fan motors for the Overland Park data or when the Manhattan data was compared to the Overland Park data for compressor repair costs.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this report was to determine if consumers were aware of the present cost of appliance repair and determine what factors affect the consumer's ability to estimate repair costs.

From the review of literature it was determined that consumers are concerned with the cost and quality of appliance repair services. Studies completed by the Whirlpool Corporation, the Sentry Insurance Company and the University of California indicated that a majority of the respondents said that the quality of service had decreased in recent years. The University of California study indicated that 91 percent of those surveyed said that service costs were "high" or "extremely high" (Schutz, et.al 1974). A study completed by the Massachusetts Institute of Technology also indicated that consumers were concerned with the cost and quality of appliance repair service. Complaints received by MACAP (Major Appliance Consumer Action Panel) indicated that consumers were upset by excessive repair costs. One possible reason for the concern about repair costs may have resulted from the consumer's inability to estimate repair costs.
Between 33 and 55 percent of all service calls are unnecessary, according to the manufacturer, because the problem is not with the appliance itself but with a product

being used with the appliance or due to improper operating procedures. Yet unnecessary service calls do involve a charge either to the manufacturer or the consumer. This charge may be as high as $50 and results in thousands of wasted dollars.

The three alternatives to excessive appliance repair costs include doing the repair himself, purchasing a service contract, or purchasing a new appliance.

Do-It-Yourself repair is a trend on the rise that has been aided by the recent introduction of Do-It-Yourself plans from two major appliance manufacturers. As many as 54 percent of the appliance owners surveyed by Merchandizing magazine said they would be willing to try doing the repair themselves if the parts were available.

Service contracts tend to cost much more than that of the ordinary consumer's maintenance costs because the rates are based on high risk consumers. The contract business is unregulated and has resulted in a billion dollar business because of this fact.

Improved appliance designs must be considered when deciding whether to repair an old appliance or replace it. However, 73 percent of the consumers surveyed in the Whirlpool study (1983) said they would rather repair than replace a defective product.

In this report the results of a survey completed in Manhattan, Kansas, and Overland Park, Kansas, were analyzed.

The survey had asked the 99 participating subjects to estimate the cost of repair for two components for each of eight major appliances. The results of the survey were broken into 32 categories according to which city, which appliance, and which component was being discussed.

The results indicated that for 22 of the categories the consumer underestimated the cost of repair while overestimating its cost for 10 of the categories. The results are indicated in Table 1 and illustrated in Figure 1.

A comparison between the ratio of the estimated to actual new price and the ratio of the estimated to actual repair cost for each appliance and each component indicated that in 12 (38 percent) of the cases the subject underestimated both prices. The results also showed that in 8 (25 percent) of the cases both costs were overestimated. In 9 cases (28 percent) the new cost was overestimated while the repair cost was underestimated and in 3 cases (9 percent) the new cost was underestimated and the repair cost was overestimated. The results are indicated in Table 2 and illustrated in Figures 2, 3, 4, and 5.

The results of the statistical analysis on the survey responses showed that 12 of the 448 comparisons made indicated that the independent variables had a significant effect on the consumer's ability to estimte component repair costs. "Significant," in this report, has been defined as a correlation having a coefficient of determination of fifty percent or greater. The coefficient of determination was determined by taking the square of the correlation coefficient and expressing this fraction as a percent. The variables that fit this requirement are shown on Table 3. They include the following list: Manhattan refrigerator compressor cost ratio versus component experience cost, absolute value; Manhattan clothes washers, transmission cost ratio versus component repair experience, absolute value; Manhattan electric range timer cost ratio versus component repair experience, absolute value; Overland Park gas range thermostat cost versus number of years since purchase, standard value; Overland Park gas range thermostat cost versus years since purchase, absolute value; Manhattan dishwasher timer cost ratio versus component repair experience, standard value; Manhattan microwave control panel cost ratio versus ratio of new price, standard value; Manhattan microwave control panel cost ratio versus ratio of new price, absolute value; Overland Park air conditioner compressor cost ratio versus fan motor cost ratio, standard value; Overland Park air conditioner compressor cost ratio versus number of years since any repair, standard value; Overland Park air conditioner compressor cost ratio versus ratio of fan motor cost, absolute value; and Overland Park air conditioner compressor cost ratio versus years since any repair, absolute value.

The results indicate that no one factor analyzed had a significant influence of the consumer's ability to estimate repair costs for all cases, although several variables seemed to have had a slight effect, although not significant. Such variables included the subject's experience with that particular component repair, the number of years since the purchase of a new appliance in that category, the ratio of repair cost estimate to the ratio of the new price estimate, and the number of years since any appliance repair .

An additional study where independent variables, including education level, income, etc. were recorded and a larger sample size was used might indicate significant relationships do exist. Statistical analysis using multiple-correlations might also have indicated a relationship did exist.

Due to the small number of responses on the questions concerning component repair experience and the number of years since last purchase, high correlation coefficients were indicated for these two dependent variables.

The correlation coefficients tended to be about the same when the absolute value was used. This indicates that the hypothesis was correct that an error was an error, regardless of whether it was an overestimation or an underestimation.

F-tests and t-tests were completed in order to determine if the data from the two components for each appliance and the two cities, Manhattan and Overland Park, could be combined. The components compared included the compressor versus the defrost timer for refrigerators, the motor versus the transmission for automatic washers, the thermostat versus the motor for clothes dryers, the thermostat versus the timer clock for electric ranges, the oven ignitor versus the thermostat for gas ranges, the motor versus timer for dishwashers, the touch control panel versus the magnetron tube for microwave ovens, and the compressor versus the fan motor for window air conditioners.

The F-test compared variances while the t-test compared means in order to determine if any significant differences existed. Results of the f-test indicated that 13 of the 32 comparisons (41 percent) indicated a significant diffference existed between the variances of the data compared. The t-tests indicated that 23 of the 32 comparisons (72 percent) indicated a significant difference existed between the means compared. However, no clear pattern seemed to exist. The only data which could be combined according to the two tests was the Overland Park electric range repair costs when thermostats were compared to timer clocks, both the Manhattan and Overland Park data when dishwasher motors were compared to timers, when Manhattan and Overland Park data was compared for dishwasher timer repair costs, and when microwave oven control panels were compared to magnetron tubes for the Overland Park data. The results of the F-tests are indicated in Tables 4, 5, 6, and 7. Tables 8, 9, 10, and 11 indicate the t-test results.

According to the literature review, consumers tend to be dissatisfied with the service repair industry, including the excessive cost of repair. A possible reason for this trend toward dissatisfaction may be accounted for by the fact that consumers are unaware of present repair costs until they request service. This study supported this hypothesis.

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APPENDICIES

Appendix A

Below is a letter presented to the participants of the survey explaining the research objective:

KANSAS STATE UNIVERSITY

Department of Family Economics

Justin Hall
Manhattan, Kansas 66506
913-532-5515

RESEARCH OBJECTIVE

The overall objective of this research is to compare the actual cost of appliance repair with the consumer expectation of that cost. Should wide discrepances exist, this information could be the focus of a consumer education program whose goal would be a lessening of consumer dissatisfaction with repair cost and more knowledgeable decision making by consumers faced with the choice of repairing or replacing an appliance.

Assistant Professor
Kansas State University
Patty J. Annis

Appendix B

Age Category

A. Under 25
B. 25-34
C. 35-44
D. 45-54
E. 55-64
F. 65 or older

Male Female

		Refrigerator-Freezer	Clothes Washer	Dryer	Electric Range	Gas Range	Dishwasher	Microwave Oven	Window Air Cond.
Date of purchase.									
Estimate present cost of new appliance (to nearest dollar).									
Date of last repair paid for.									
Of the following, which have been replaced on your appliance?									
a. Refrigerator-Freezer	--Compressor	Y N							
	Estimate cost of repair today.[1]								
b. "	--Defrost-timer	Y N							
	Estimate cost of repair today.								
c. Clothes Washer	--Motor		Y N						
	Estimate cost of repair today.								
d. " "	--Transmission (replaced with rebuilt unit)		Y N						
	Estimate cost of repair today.								
e. Dryer	--Thermostat			Y N					
	Estimate cost of repair today.								
f. "	--Motor			Y N					
	Estimate cost of repair today.								
g. Electric Range	--Oven thermostat				Y N				
	Estimate cost of repair today.								
h. " "	--Timer-clock				Y N				
	Estimate cost of repair today.								
i. Gas Range	--Oven Ignitor (bake or broil)					Y N			
	Estimate cost of repair today.								
j. " "	--Oven thermostat					Y N			
	Estimate cost of repair today.								
k. Dishwasher	--Motor						Y N		
	Estimate cost of repair today.								
l. "	--Timer						Y N		
	Estimate cost of repair today.								
m. Microwave Oven	--Touch control panel							Y N	
	Estimate cost of repair today. (new panel)								
n. " "	--Magnitron tube							Y N	
	Estimate cost of repair today.								
o. Window Air Conditioner (1 ton/12,000 B.T.U.)	--Compressor								Y N
	Estimate cost of repair today.								
p. " " "	--Fan Motor								Y N
	Estimate cost of repair today.								

[1]Estimate all costs to nearest dollar.

Above is the form used by the participants. The information obtained using the form repressented their knowledge of appliance repair costs.

Appendix C

Repair Centers

			Refrigerator-Freezer	Clothes Washer	Dryer	Electric Range	Gas Range	Dishwasher	Microwave Oven	Window Air Conditioner
1.	Check all of the appliances you repair.									
2.	How much would it cost to replace the following component in its respective appliance?[1] (nearest dollar)		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
a.	Refrigerator	--Compressor(____ h.p.)	$							
b.	"	--Defrost-timer (control)	$							
c.	Clothes Washer	--Motor(______ h.p.)		$						
d.	" "	--Transmission (rebuilt unit)		$						
e.	Dryer(Full size)	--Thermostat			$					
f.	" " "	--Motor(__ h.p.)			$					
g.	Electric Range	--Oven thermostat(w/ sensor? Y N)				$				
h.	" "	--Timer-clock				$				
i.	Gas Range	--Oven ignitor(bake or broil)					$			
j.	" "	--Oven thermostat(w/ sensor? Y N)					$			
k.	Dishwasher	--Motor(__ h.p., include H_2O leak)						$		
l.	"	--Timer						$		
m.	Microwave Oven	--Touch control panel(new)							$	
n.	" "	--Magnetron tube							$	
o.	Window Air Conditioner	--Compressor(____ B.T.U.)								$
p.	" " "	--Fan Motor								$

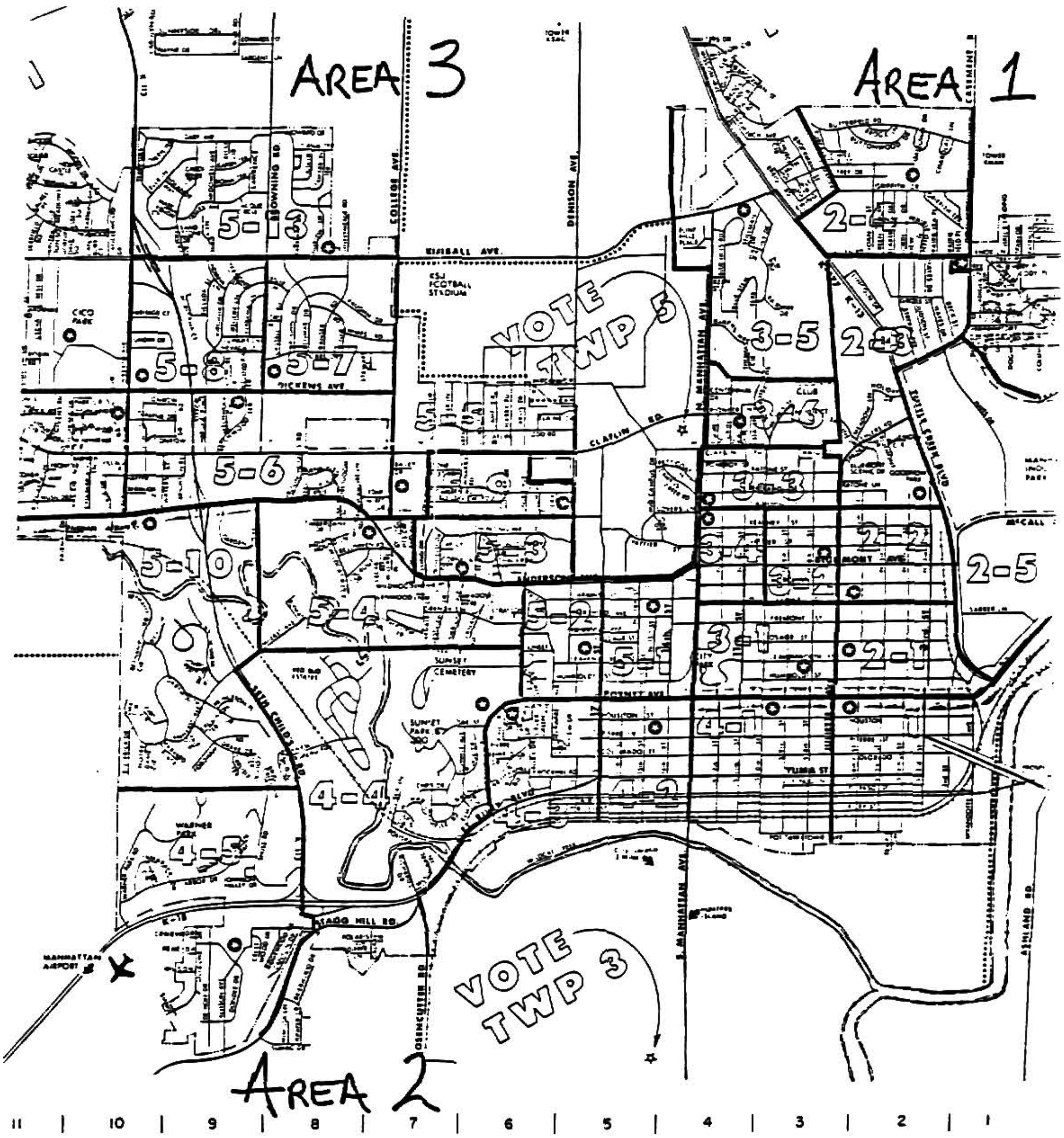
3. Are you a factory authorized service center? (Circle appropriate answer) Yes No
4. If "Yes" to question #3, for how many brands? ________ Do you service brands other than those authorized? Yes No
5. What percentage of your service is in the various parts of the city as divided on the attached map.

[1] No specific make of compenent parts required.

Above is the form used by the service companies. The information obtained using the form represented the actual cost of appliance repair.

Appendix D

Below is a map of Manhattan, Kansas. The map indicates the three areas of the city where the survey information was collected.



Appendix E: Formulas used to complete calculation.

The formula used to determine the mean of "X" is shown below:

$$\bar{X} = \frac{\sum X}{N}$$

where N = number of observations

A similar formula was used to determine the mean of the "Y" column, which is shown below:

$$\bar{Y} = \frac{\sum Y}{N}$$

The slope of the data was determined using the following formula:

$$\text{Slope} = \frac{N*\sum(X*Y)-(\sum X*\sum Y)}{N*\sum(X*X)-(\sum X*\sum X)}$$

In order to determine the y-intercept the formula shown below was used:

$$\text{Y-Intercept} = \frac{(\sum Y*\sum(X*X))-(\sum X*\sum(X*Y))}{(N*\sum(X*X)-\sum X*\sum X)}$$

The formula used to determine the coefficient of correlation is shown below:

$$\text{Correlation Coefficient} = \frac{(X*Y)-(N*\bar{X}*\bar{Y})}{(\sum(X*X)-(N*\bar{X}*\bar{X}))*(\sum(Y*Y)-(N*\bar{Y}*\bar{Y})}$$

A negative slope resulted in a negative correlation. The reason for the use of the absolute value of the data was because an error was an error, regardless of whether it was an overestimation or an underestimation.

The coefficient of determination was reported in percent form throughout this report. It was obtained by taking the square of the correlation coefficient.

Next, F-tests were used to determine if the variances of the two ratios of estimated versus actual repair compoent costs for each appliance were found to be not significantly different. Also the variances of the two cities were compared for the ratios of both repair costs. The formula used to complete the F-tests is illustrated below:

$$\text{F-value} = \frac{\text{larger } \sigma^2}{\text{smaller } \sigma^2}$$

$$\text{where } \sigma^2 = \frac{N \sum X^2 - (\sum X)^2}{N*(N-1)}$$

The F-table values were determined using Applied Statistics by Netter, et.al, 1979. The number of degrees of freedom using the following relationship:

Degrees of freedom = N - 1

The value of α used was 0.05. The calculated value was then compared to the table value of F. If the calculated value was greater than the value found in the f-table, σ_1 was said to be not significantly different from σ_2. Thus, if the calculated value was less than the F-table value, was said to be significantly different from .

Also, two-tailed t-tests were performed for the same sets of data compared using the F-tests. The formulas used are illustrated below:

$$t = \frac{d - do}{s\left(\frac{1}{N} + \frac{1}{N}\right)}$$

$$\text{where } s = \frac{N_1^2 + N_2^2}{N_1 + N_2 - 2}$$

The t-table values were determined using Applied Statistics (Netter, et.al, 1979). The null hypothesis of Ho stated that $\sigma_1 = \sigma_2$. If $\sigma_1 = \sigma_2$ then the null hypothesis was said to be rejected. T-tests were used for both the large and the small samples instead of using z-tests for samples greater than 30 and t-tests for samples less than 30. This was because the results were very similar, regardless of which test was performed. If the t-value was greater than the critical t-value, the null hypothesis (Ho) was rejected. Similarly, if the critical t-value was greater than the t-value, Ho was said to be accepted.

EXPLANATION OF THE DATA CODE*

Example: A1MS

First Letter (A):	Stands for the appliance and which component was in question. See Table A for a listing of the appliance components and their corresponding codes. "A" in the example corresponds to the refrigerator compressor.
First Number (1):	Stands for the dependent variable. See Table B for a listing of the dependent variables and their corresponding codes. The "1" in the example stands for the number of years since the purchase of the present appliance (years since a purchase).
Second Letter (M):	Indicates which city in which the survey was completed. An "M" stands for Manhattan, Kansas, while an "O" stands for Overland Park, Kansas. In the example the "M" stands for Manhattan.
Third Letter (S):	An "S" in this position indicates the data incudes the standard values while an "A" represents the use of the absolute values of the data. The "S" in the example represents the use of the standard values.

Table A: Listing of the appliance components and their corresponding codes.

APPLIANCE COMPONENT	CODE
Refrigerator Compressor	A
Refrigerator Defrost Timer	B
Automatic Washer Motor	C
Automatic Washer Transmission	D
Clothes Dryer Thermostat	E
Clothes Dryer Motor	F
Electric Range Thermostat	G
Electric Range Timer Clock	H
Gas Range Oven Ignitor	I
Gas Range Thermostat	J
Dishwasher Motor	K
Dishwasher Timer	L
Microwave Oven Touch Control Panel	M
Microwave Oven Magnetron Tube	N
Window Air Conditioner Compressor	O
Window Air Conditioner Fan Motor	P

Table B: Listing of the Dependent Variables and their corresponding code.

DEPENDENT VARIABLE	CODE	DESCRIPTION
Years Since A Purchase	1	The number of years since the purchase of the present appliance being discussed
Ratio of. Other Cost	2	The actual - estimated /actual ratio of the other component repair for the appliance in

question.

Ratio of New Price	3	The actual - estimated/actual ratio of the new cost of the appliance in question.
Mean of Age Group	4	The average age of the age group to which the subject belonged.
Years Since Last Repair	5	The number of years since the appliance being discussed was repaired with the repair cost not covered by the warranty.
Years Since Any Repair	6	The number of years since any appliance owned by the subject was repaired when the repair cost was not covered by the warranty.
Component Repair Exp.	7	This indicates whether or not the subject has had the component in question repaired on the present appliance.

Appendix F.1.: Linear regression of the Manhattan refrigerator compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
A1MS	Years Since A Purchase	7.00	0.10	0.07	0.01	0.078	43
A2MS	Ratio of Other Cost	-0.82	0.09	0.12	0.03	0.060	39
A3MS	Ratio of New Price	0.02	0.10	0.10	0.32	0.312	43
A4MS	Mean of Age Group	45.31	0.10	0.30	-0.00	0.172	43
A5MS	Years Since Last Repair	2.38	0.18	0.15	0.01	0.153	16
A6MS	Years Since Any Repair	1.29	0.10	0.13	-0.02	-0.105	28
A7MS	Component Repair Exp.	1.50	0.27	0.29	0.01	-0.017	6

Appendix F.2: Linear regression of the Manhattan refrigerator defrost timer repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
B1MS	Years Since A Purchase	7.33	-0.79	-0.80	0.00	0.013	42
B2MS	Ratio of Other Cost	0.09	-0.82	-0.83	0.13	0.060	39
B3MS	Ratio of New Price	-0.01	-0.80	-0.80	0.45	0.197	41
B4MS	Mean of Age Group	45.45	-0.79	-0.71	-0.00	-0.030	42
B5MS	Years Since Last Repair	2.38	-0.94	-0.87	-0.03	-0.138	16
B6MS	Years Since Any Repair	1.34	-0.87	-0.94	0.05	0.102	29
B7MS	Component Repair Exp.	1.43	-0.81	-2.35	1.08	0.470	7

Appendix F.3.: Linear regression of the Overland Park refrigerator compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
A10S	Years Since A Purchase	6.91	0.39	0.41	-0.00	-0.58	47
A20S	Ratio of Other Cost	-0.07	0.38	0.40	0.24	0.430	47
A30S	Ratio of New Price	0.09	0.39	0.36	0.28	0.346	46
A40S	Mean of Age Group	40.52	0.39	0.36	0.00	0.038	47
A50S	Years Since Last Repair	2.13	0.32	0.41	-0.04	-0.239	16
A60S	Years Since Any Repair	1.63	0.39	0.40	-0.01	-0.088	35
A70S	Component Repair Exp.	1.67	0.50	0.50	0,00	----	3

Appendix F.4.: Linear regression of the Overland Park refrigerator defrost timer repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
B10S	Years Since A Purchase	7.07	-0.06	-0.18	0.02	0.198	43
B20S	Ratio of Other Cost	0.38	-0.07	-0.37	0.79	0.430	40
B30S	Ratio of New Price	0.08	-0.06	-0.06	-0.10	-0.072	42
B40S	Mean of Age Group	40.71	-0.06	-0.20	0.00	0.091	43
B50S	Years Since Last Repair	2.00	-0.02	0.05	-0.01	-0.068	14
B60S	Years Since Any Repair	1.20	-0.04	0.08	-0.10	-0.275	30
B70S	Component Repair Exp.	2.00	0.26	----	----	----	2

Appendix F..5: Linear regression of the Manhattan refrigerator compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
A1MA	Years Since A Purchase	7.00	0.31	0.28	0.00	0.100	43
A2MA	Ratio of Other Cost	0.88	0.31	0.33	-0.02	-0.058	39
A3MA	Ratio of New Price	0.27	0.31	0.32	-0.04	-0.042	43
A4MA	Mean of Age Group	45.31	0.31	0.34	-0.00	-0.052	43
A5MA	Years Since Last Repair	2.38	0.32	0.34	-0.01	-0.140	16
A6MA	Years Since Any Repair	1.29	0.31	0.37	-0.05	-0.338	28
A7MA	Component Repair Exp.	1.50	0.44	-0.06	0.34	0.727	6

Appendix F.6.: *Linear regression of the* Manhattan refrigerator defrost timer repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
B1MA	Years Since A Purchase	7.33	0.84	0.84	0.00	0.002	42
B2MA	Ratio of Other Cost	0.31	0.88	0.94	-0.19	-0.058	39
B3MA	Ratio of New Price	0.26	0.86	0.77	0.33	0.108	41
B4MA	Mean of Age Group	45.45	0.84	0.74	0.00	0.044	42
B5MA	Years Since Last Repair	2.38	0.97	0.90	0.03	0.131	16
B6MA	Years Since Any Repair	1.34	0.89	0.95	-0.05	-0.108	29
B7MA	Component Repair Exp.	1.43	0.87	2.21	-0.94	-0.425	7

Appendix F.7.: Linear regression of the Overland Park refrigerator compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
A10A	Years Since A Purchase	6.92	0.40	0.41	-0.00	-0.024	47
A20A	Ratio of Other Cost	0.31	0.40	0.44	-0.14	-0.210	40
A30A	Ratio of New Price	0.25	0.40	0.42	-0.06	-0.051	46
A40A	Mean of Age Group	40.52	0.40	0.34	0.00	0.087	47
A50A	Years Since Last Repair	2.13	0.37	0.45	-0.04	-0.325	16
A60A	Years Since Any Repair	1.63	0.40	0.43	-0.01	-0.124	35
A70A	Component Repair Exp.	1.68	0.50	0.50	0.00	----	3

Appendix F.8.: Linear regression of the Overland Park refrigerator defrost timer repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
B10A	Years Since A Purchase	6.05	0.23	5.89	0.68	0.032	43
B20A	Ratio of Other Cost	0.39	0.25	0.19	0.15	0.133	40
B30A	Ratio of New Price	0.21	0.23	0.20	0.18	0.153	42
B40A	Mean of Age Group	35.04	0.23	0.15	0.00	0.158	43
B50A	Years Since Last Repair	1.79	0.16	0.10	0.03	0.348	14
B60A	Years Since Any Repair	1.00	0.24	0.21	0.03	0.144	30
B70A	Component Repair Exp.	2.00	0.32	----	----	----	2

Appendix F.9: Linear regression of the Manhattan automatic washer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
C1MS	Years Since A Purchase	7.11	-0.48	-0.47	-0.00	-0.004	44
C2MS	Ratio of Other Cost	0.01	-0.48	-0.48	0.33	0.220	38
C3MS	Ratio of New Price	-0.09	-0.48	0.41	0.74	0.359	43
C4MS	Mean of Age Group	45.41	-0.48	-0.71	0.01	0.126	44
C5MS	Years Since Last Repair	2.94	-0.61	-0.42	-0.07	-0.021	16
C6MS	Years Since Any Repair	1.52	-0.45	-0.43	-0.02	-0.054	31
C7MS	Component Repair Exp.	1.25	-0.45	-0.73	0.23	0.328	5

Appendix F.10: Linear regression of the Manhattan automatic washer transmission repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
D1MS	Years Since A Purchase	6.79	0.01	0.36	-0.05	-0.567	38
D2MS	Ratio of Other Cost	-0.48	0.01	0.08	0.15	0.220	38
D3MS	Ratio of New Price	-0.12	-0.01	0.08	0.56	0.420	38
D4MS	Mean of Age Group	44.21	0.01	0.56	-0.01	-0.443	38
D5MS	Years Since Last Repair	3.31	-0.01	-0.08	-0.00	-0.-22	14
D6MS	Years Since Any Repair	1.39	-0.01	-0.03	0.01	0.058	26
D7MS	Component Repair Exp.	1.25	-0.45	-0.73	0.23	0.328	4

Appendix F.11: Linear regression of the Overland Park automatic washer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
C10S	Years Since A Purchase	7.38	-0.21	-0.08	-0.02	-0.155	45
C20S	Ratio of Other Cost	0.17	-0.18	-0.24	0.36	0.208	39
C30S	Ratio of New Price	0.11	-0.22	-0.24	0.26	0.088	46
C40S	Mean of Age Group	41.59	-0.20	-0.58	0.01	0.200	47
C50S	Years Since Last Repair	2.63	-0.20	-0.15	-0.02	-0.082	16
C60S	Years Since Any Repair	1.68	-0.15	-0.09	-0.04	-0.130	34
C70S	Component Repair Exp.	1.00	-0.03	----	----	----	2

Appendix F.12: Linear regression of the Overland Park automatic washer transmission repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
D1OS	Years Since A Purchase	7.37	0.16	0.21	-0.01	-0.098	38
D2OS	Ratio of Other Cost	-0.18	0.17	0.19	0.12	0.208	39
D3OS	Ratio of New Price	0.01	0.17	0.13	0.39	0.225	39
D4OS	Mean of Age Group	39.60	0.17	0.32	-0.01	-0.126	39
D5OS	Years Since Last Repair	2.08	0.22	0.24	-0.01	-0.047	13
D6OS	Years Since Any Repair	1.72	0.18	0.17	0.01	0.023	29
D7OS	Component Repair Exp.	1.00	0.49	----	----	----	1

Appendix F.13: Linear regression of the Manhattan automatic washer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
C1MA	Years Since A Purchase	7.11	0.56	0.47	0.01	0.107	44
C2MA	Ratio of Other Cost	0.33	0.56	0.33	0.70	0.318	38
C3MA	Ratio of New Price	0.22	0.57	0.37	0.89	0.372	43
C4MA	Mean of Age Group	45.41	0.56	0.63	-0.00	-0.039	44
C5MA	Years Since Last Repair	2.94	0.68	0.46	0.07	0.238	16
C6MA	Years Since Any Repair	1.52	0.53	0.49	0.02	0.085	31
C7MA	Component Repair Exp.	1.00	0.36	0.22	0.14	0.266	5

Appendix F.14: Linear regression of the Manhattan automatic washer transmission repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
D1MA	Years Since A Purchase	6.79	0.33	0.15	0.03	0.479	38
D2MA	Ratio of Other Cost	0.56	0.33	0.25	0.14	0.318	38
D3MA	Ratio of New Price	0.23	0.33	0.22	0.48	0.461	38
D4MA	Mean of Age Group	44.21	0.33	0.09	0.01	0.328	38
D5MA	Years Since Last Repair	3.07	0.32	0.26	0.02	0.179	14
D6MA	Years Since Any Repair	1.38	0.31	0.35	-0.03	-0.247	26
D7MA	Component Repair Exp.	0.75	0.29	0.00	0.39	0.720	4

Appendix F.15: Linear regression of the Overland Park washer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
C10A	Years Since A Purchase	7.38	0.45	0.31	0.02	0.224	45
C20A	Ratio of Other Cost	0.33	0.43	0.35	0.24	0.104	39
C30A	Ratio of New Price	0.18	0.45	0.51	-0.38	-0.120	46
C40A	Mean of Age Group	41.59	0.45	0.57	-0.00	-0.091	47
C50A	Years Since Last Repair	2.63	0.54	0.49	0.02	0.093	16
C60A	Years Since Any Repair	1.68	0.43	0.37	0.04	0.160	34
C70A	Component Repair Exp.	1.00	0.52	---	---	---	2

Appendix F.16: Linear regression of the Overland Park automatic washer transmission repair cost ratio (Y *axis*) vs. the *dependent* variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER- CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
D10A	Years Since A Purchase	7.37	0.33	0.26	0.01	0.232	38
D20A	Ratio of Other Cost	0.43	0.33	0.31	0.05	0.104	39
D30A	Ratio of New Price	0.17	0.33	0.33	0.05	0.033	39
D40A	Mean of Age Group	39.60	0.33	0.23	0.00	0.148	39
D50A	Years Since Last Repair	2.08	0.31	0.32	-0.01	-0.076	13
D60A	Years Since Any Repair	1.72	0.34	0.35	-0.01	-0.055	29
D70A	Component Repair Exp.	1.00	0.49	---	---	---	1

Appendix F.17: Linear regression of the Manhattan clothes dryer thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
E1MS	Years Since A Purchase	8.06	-0.74	-0.79	0.01	0.036	36
E2MS	Ratio of Other Cost	-0.23	-0.79	-0.65	0.60	0.302	34
E3MS	Ratio of New Price	-0.13	-0.74	-0.60	1.10	0.515	36
E4MS	Mean of Age Group	44.25	-0.74	-0.47	-0.01	-0.10	36
E5MS	Years Since Last Repair	3.00	-0.83	-0.58	-0.08	-0.141	10
E6MS	Years Since Any Repair	1.46	-0.86	-0.95	0.01	0.119	26
E7MS	Component Repair Exp.	34.00	-0.42	-0.09	-0.-1	-0.892	3

Appendix F.18: Linear regression of the Manhattan clothes dryer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
F1MS	Years Since A Purchase	7.43	-0.24	-0.10	-0.02	-0.193	35
F2MS	Ratio of Other Cost	-0.79	-0.23	-0.11	0.15	0.302	34
F3MS	Ratio of New Price	-0.13	-0.24	-0.19	0.38	0.357	35
F4MS	Mean of Age Group	43.07	-0.24	-0.27	0.00	0.025	35
F5MS	Years Since Last Repair	3.27	-0.22	-0.24	-0.01	0.038	11
F6MS	Years Since Any Repair	1.57	-0.27	-0.17	-0.06	-0.295	26
F7MS	Component Repair Exp.	1.50	-0.10	-0.92	0.55	1.000	2

Appendix F.19: Linear regression of the Overland Park clothes dryer thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
EIOS	Years Since A Purchase	7.36	-0.15	-0.21	0.01	0.084	47
E20S	Ratio of Other Cost	-0.00	-0.17	0.17	0.39	0.301	47
E30S	Ratio of New Price	-0.01	-0.18	-0.18	0.33	0.164	48
E40S	Mean of Age Group	41.70	-0.16	-0.49	0.01	0.211	49
E50S	Years Since Last Repair	2.31	-0.03	-0.01	-0.01	-0.060	13
E60S	Years Since Any Repair	1.65	-0.17	-0.18	0.00	0.014	34
E70S	Component Repair Exp.	1.00	-0.31	----	----	----	4

Appendix F.20: Linear regression of the Overland Park clothes dryer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS
FIOS	Years Since A Purchase	7.01	0.02	0.02	0.00	-0.002	45
F20S	Ratio of Other Cost	-0.17	-0.00	0.04	0.23	0.301	47
F30S	Ratio of New Price	0.02	-0.01	-0.02	0.72	-0.349	46
F40S	Mean of Age Group	41.80	-0.00	0.05	-0.00	-0.047	47
F50S	Years Since Last Repair	2.42	0.14	0.10	0.017	0.169	12
F60S	Years Since Any Repair	1.69	0.05	0.01	0.023	0.154	32
F70S	Component Repair Exp.	1.00	-0.01	----	----	----	4

Appendix F.21: Linear regression of the Manhattan clothes dryer thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
E1MA	Years Since A Purchase	8.06	0.83	0.87	-0.00	-0.035	36
E2MA	Ratio of Other Cost	0.33	0.86	0.63	0.72	0.335	34
E3MA	Ratio of New Price	0.26	0.83	0.55	1.06	0.461	36
E4MA	Mean of Age Group	44.25	0.83	0.57	0.01	0.108	36
E5MA	Years Since Last Repair	3.00	0.86	0.52	0.11	0.205	10
E6MA	Years Since Any Repair	1.46	0.92	1.00	-0.05	-0.115	26
E7MA	Component Repair Exp.	1.00	0.18	0.09	-0.09	-0.473	3

Appendix F.22: Linear regression of the Manhattan clothes dryer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
F1MA	Years Since A Purchase	7.43	0.34	0.24	0.01	0.158	35
F2MA	Ratio of Other Cost	0.86	0.33	0.19	0.16	0.335	34
F3MA	Ratio of New Price	0.26	0.34	0.25	0.33	0.309	35
F4MA	Mean of Age Group	43.07	0.34	0.23	0.00	0.086	35
F5MA	Years Since Last Repair	3.27	0.26	0.25	0.00	0.021	11
F6MA	Years Since Any Repair	1.58	0.35	0.25	0.07	0.350	26
F7MA	Component Repair Exp.	1.50	0.09	0.09	-0.00	-1.000	2

Appendix F.23: Linear regression of the Overland Park clothes dryer thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
E10A	Years Since A Purchase	7.11	0.37	0.32	0.01	0.097	47
E20A	Ratio of Other Cost	0.31	0.37	0.27	0.32	0.179	47
E30A	Ratio of New Price	0.17	0.38	0.38	0.00	0.001	48
E40A	Mean of Age Group	41.10	0.38	0.30	0.00	0.079	49
E50A	Years Since Last Repair	2.31	0.31	0.35	0.02	-0.210	13
E60A	Years Since Any Repair	1.65	0.41	0.43	-0.02	-0.088	34
E70A	Component Repair Exp.	1.00	0.34	----	----	----	4

Appendix F.24: Linear regression of the Overland Park clothes dryer motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
F10A	Years Since A Purchase	6.67	0.29	4.11	8.85	0.305	45
F20A	Ratio of Other Cost	0.30	0.36	0.26	0.35	0.202	47
F30A	Ratio of New Price	0.14	0.30	0.29	0.12	0.055	46
F40A	Mean of Age Group	40.54	0.30	0.08	0.01	0.426	47
F50A	Years Since Last Repair	2.33	0.22	0.20	0.01	0.143	12
F60A	Years Since Any Repair	1.66	0.28	0.28	0.00	0.001	32
F70A	Component Repair Exp.	1.00	0.14	----	----	----	4

Appendix E.25: Linear regression of the Manhattan electric range thermostat repair cost ratio (Y axis) vs. the dependent varibles (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
G1MS	Years Since A Purchase	6.29	0.12	0.21	-0.02	-0.232	38
G2MS	Ratio of Other Cost	0.36	0.13	-0.04	0.47	0.395	35
G3MS	Ratio of New Price	0.31	0.13	0.01	0.36	0.181	37
G4MS	Mean of Age Group	46.00	0.12	0.18	-0.00	-0.053	38
G5MS	Years Since Last Repair	1.78	0.00	0.25	-0.14	-0.542	9
G6MS	Years Since Any Repair	1.46	0.09	0.05	0.03	0.120	28
G7MS	Component Repair Exp.	1.33	0.12	0.16	-0.04	-0.071	6

Appendix F.26: Linear regression of the Manhattan electric range timer clock repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER- CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
H1MS	Years Since A Purchase	6.13	0.34	0.41	-0.01	-0.227	38
H2MS	Ratio of Other Cost	0.13	0.36	0.31	0.33	0.395	35
H3MS	Ratio of New Price	0.31	0.34	0.15	0.62	0.364	38
H4MS	Mean of Age Group	45.26	0.34	0.62	-0.01	-0.275	38
H5MS	Years Since Last Repair	1.44	0.19	0.18	0.01	0.036	9
H6MS	Years Since Any Repair	1.30	0.33	0.28	0.04	0.195	27
H7MS	Component Repair Exp.	1.40	0.01	1.02	-0.66	-0.915	5

Appendix F.27: Linear regression of the Overland Park electric range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
G10S	Years Since A Purchase	5.79	0.47	0.44	0.01	0.153	38
G20S	Ratio of Other Cost	0.50	0.48	0.20	0.54	0.651	39
G30S	Ratio of New Price	0.09	0.47	0.48	-0.10	-0.175	36
G40S	Mean of Age Group	41.60	0.47	0.41	0.00	0.081	39
G50S	Years Since Last Repair	2.33	0.51	0.50	0.00	0.023	6
G60S	Years Since Any Repair	1.59	0.49	0.46	0.02	0.192	29
G70S	Component Repair Exp.	1.00	0.36	----	----	----	2

Appendix F.28: Linear regression of the Overland Park electric range timer clock repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
H10S	Years Since A Purchase	5.64	0.50	0.43	0.01	0.276	39
H20S	Ratio of Other Cost	0.47	0.50	0.13	0.78	0.651	39
H30S	Ratio of New Price	0.09	0.50	0.50	-0.08	-0.105	37
H40S	Mean of Age Group	41.80	0.50	0.40	0.00	0.112	40
H50S	Years Since Last Repair	2.33	0.58	0.69	-05	-0.325	6
H60S	Years Since Any Repair	1.59	0.47	0.42	0.03	0.264	29
H70S	Component Repair Exp.	1.00	0.54	----	----	----	5

Appendix F.29: Linear regression of the Manhattan electric range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
G1MA	Years Since A Purchase	6.29	0.34	0.26	0.01	0.321	38
G2MA	Ratio of Other Cost	0.44	0.33	0.41	-0.17	-0.147	35
G3MA	Ratio of New Price	0.33	0.34	0.42	-0.20	-0.138	37
G4MA	Mean of Age Group	46.00	0.34	0.18	0.00	0.227	38
G5MA	Years Since Last Repair	1.78	0.34	0.18	0.09	0.489	9
G6MA	Years Since Any Repair	1.46	0.32	0.30	0.01	0.062	28
G7MA	Component Repair Exp.	1.33	0.23	0.33	-0.07	-0.249	6

Appendix F.30: Linear regression of the Manhattan electric range timer clock repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
H1MA	Years Since A Purchase	5.63	0.40	6.39	-1.89	-0.070	38
H2MA	Ratio of Other Cost	0.33	0.44	0.48	-1.13	-0.147	35
H3MA	Ratio of New Price	0.30	0.40	0.24	0.52	0.041	38
H4MA	Mean of Age Group	41.52	0.40	0.32	0.00	0.169	38
H5MA	Years Since Last Repair	1.22	0.26	0.23	0.02	0.146	9
H6MA	Years Since Any Repair	1.26	0.41	0.38	0.03	0.206	27
H7MA	Component Repair Exp.	1.40	0.34	0.42	-0.06	-0.198	5

Appendix F.31: Linear regression of the Overland Park electric range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
G10A	Years Since A Purchase	5.79	0.47	0.44	0.01	0.153	38
G20A	Ratio of Other Cost	0.52	0.47	0.15	0.62	0.630	39
G30A	Ratio of New Price	0.31	0.47	0.52	-0.15	-0.135	36
G40A	Mean of Age Group	41.60	0.47	0.41	0.00	0.081	39
G50A	Years Since Last Repair	2.33	0.51	0.50	0.00	0.023	6
G60A	Years Since Any Repair	1.59	0.49	0.46	0.02	0.192	29
G70A	Component Repair Exp.	1.00	0.36	----	----	----	2

Appendix F.32: Linear regression of the Overland Park electric range timer clock repair cost ratio (Y axis) vs. the dependent vaariables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
H10A	Years Since A Purchase	5.64	0.50	1.97	7.31	0.312	39
H20A	Ratio of Other Cost	0.47	0.52	0.22	0.64	0.630	39
H30A	Ratio of New Price	0.30	0.50	0.54	-0.14	-0.121	37
H40A	Mean of Age Group	40.56	0.50	0.37	0.00	0.198	40
H50A	Years Since Last Repair	2.33	0.58	0.70	-0.05	-0.325	6
H60A	Years Since Any Repair	1.59	0.50	0.46	0.02	0.242	29
H70A	Component Repair Exp.	1.00	0.54	----	----	----	2

Appendix F.33: Linear regression of the Manhattan gas range oven ignitor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
I1MS	Years Since A Purchase	17.33	-1.30	-1.95	0.04	0.594	3
I2MS	Ratio of Other Cost	0.16	-1.30	-2.21	5.84	0.655	3
I3MS	Ratio of New Price	-0.09	-1.30	-1.06	2.76	0.996	3
I4MS	Mean of Age Group	52.50	-1.30	-4.17	0.06	1.000	3
I5MS	Years Since Last Repair	----	----	----	----	----	0
I6MS	Years Since Any Repair	0.00	-1.71	----	----	----	2
I7MS	Component Repair Exp.	----	----	----	----	----	0

Appendix F.34: Linear regression of the Manhattan gas range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
J1MS	Years Since A Purchase	16.80	0.06	16.40	6.61	0.075	5
J2MS	Ratio of Other Cost	1.30	0.16	-2.21	5.84	0.655	3
J3MS	Ratio of New Price	0.10	0.06	0.06	0.00	0.005	5
J4MS	Mean of Age Group	52.90	0.06	-0.20	0.01	0.527	5
J5MS	Years Since Last Repair	----	----	----	----	----	0
J6MS	Years Since Any Repair	0.33	0.06	0.19	-0.39	-0.832	3
J7MS	Component Repair Exp.	----	----	----	----	----	0

Appendix F.35: Linear regression of the Overland Park gas range oven ignitor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO. OBS.
I10S	Years Since A Purchase	8.71	0.15	0.17	-0.00	-0.107	7
I20S	Ratio of Other Cost	0.56	0.15	04	0.18	0.102	7
I30S	Ratio of New Price	0.25	0.15	0.08	0.27	0.389	7
I40S	Mean of Age Group	41.79	0.15	0.37	-0.01	-0.434	7
I50S	Years Since Last Repair	----	----	----	----	----	0
I60S	Years Since Any Repair	2.00	0.25	0.17	0.04	0.500	3
I70S	Component Repair Exp.	----	----	----	----	----	0

Appendix F.36: Linear regression of the Overland Park gas range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
J10S	Years Since A Purchase	9.50	0.58	0.48	0.01	0.798	8
J20S	Ratio of Other Cost	0.15	0.56	0.56	0.06	0.102	7
J30S	Ratio of New Price	0.20	0.58	0.60	-0.11	-0.283	8
J40S	Mean of Age Group	40.25	0.58	0.44	0.00	0.487	8
J50S	Years Since Last Repair	----	----	----	----	----	0
J60S	Years Since Any Repair	2.25	0.58	0.56	0.01	0.118	4
J70S	Component Repair Exp.	----	----	----	----	----	0

Appendix F.37: Linear regression of the Manhattan gas range oven ignitor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
I1MA	Years Since A Purchase	17.33	1.30	1.96	-0.04	-0.594	3
I2MA	Ratio of Other Cost	0.16	1.30	2.21	-5.84	-0.655	3
I3MA	Ratio of New Price	0.09	1.30	1.06	-2.76	-0.996	3
I4MA	Mean of Age Group	52.50	1.30	4.17	-0.06	-1.000	3
I5MA	Years Since Last Repair	----	----	----	----	----	0
I6MA	Years Since Any Repair	0.00	1.71	----	----	----	2
I7MA	Component Repair Exp.	----	----	----	----	----	0

Appendix F.38: Linear regression of the Manhattan gas range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
J1MA	Years Since A Purchase	15.40	0.10	15.82	-4.16	-0.031	5
J2MA	Ratio of Other Cost	1.30	0.16	0.25	-0.07	-0.655	3
J3MA	Ratio of New Price	0.31	0.10	0.12	-0.05	-0.101	5
J4MA	Mean of Age Group	45.00	0.10	-0.01	0.00	0.562	5
J5MA	Years Since Last Repair	----	----	----	----	----	0
J6MA	Years Since Any Repair	0.00	0.12	----	----	----	3
J7MA	Component Repair Exp.	----	----	----	----	---	0

Appendix F.39: Linear regression of the Overland Park gas range oven ignitor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
I10A	Years Since A Purchase	8.71	0.22	0.27	-0.01	-0.392	7
I20A	Ratio of Other Cost	0.56	0.22	0.36	-0.24	-0.221	7
I30A	Ratio of New Price	0.25	0.22	0.20	0.09	0.205	7
I40A	Mean of Age Group	41.79	0.22	0.37	-0.00	-0.473	7
I50A	Years Since Last Repair	0.00	0.00	----	----	----	0
I60A	Years Since Any Repair	2.00	0.25	0.17	0.04	0.500	3
I70A	Component Repair Exp.	----	----	----	----	----	0

Appendix F.40: Linear regression of the Overland Park gas range thermostat repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
J10A	Years Since A Purchase	9.50	0.58	0.48	0.01	0.789	8
J20A	Ratio of Other Cost	0.15	0.56	0.56	0.06	0.102	7
J30A	Ratio of New Price	0.20	0.58	0.60	-0.11	-0.283	8
J40A	Mean of Age Group	40.25	0.58	0.44	0.00	0.487	8
J50A	Years Since Last Repair	----	----	----	----	----	0
J60A	Years Since Any Repair	2.25	0.58	0.56	0.01	0.118	4
J70A	Component Repair Exp.	----	----	----	----	----	0

Appendix F.41: Linear regression of the Manhattan dishwasher motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
K1MS	Years Since A Purchase	4.11	0.03	-0.07	0.02	0.304	27
K2MS	Ratio of Other Cost	0.17	0.00	-0.09	0.54	0.635	26
K3MS	Ratio of New Price	-0.14	0.03	0.04	0.08	0.083	27
K4MS	Mean of Age Group	43.45	0.03	-0.36	0.01	0.316	27
K5MS	Years Since Last Repair	2.29	0.12	-0.08	0.09	0.470	7
K6MS	Years Since Any Repair	1.00	0.02	-0.03	0.04	0.128	21
K7MS	Component Repair Exp.	1.75	0.14	-0.14	-0.00	-0.019	3

Appendix F.42: Linear regression of the Manhattan dishwasher timer repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
L1MS	Years Since A Purchase	4.00	0.17	0.19	-0.01	-0.082	26
L2MS	Ratio of Other Cost	0.00	0.17	0.17	0.75	0.635	26
L3MS	Ratio of New Price	-0.13	0.17	0.21	0.35	0.337	26
L4MS	Mean of Age Group	42.73	0.17	0.35	-0.00	-0.138	26
L5MS	Years Since Last Repair	2.29	0.27	0.28	-0.00	-0.091	7
L6MS	Years Since Any Repair	1.00	0.12	0.14	-0.02	-0.048	21
L7MS	Component Repair Exp.	1.25	0.26	0.01	0.11	0.913	4

Appendix F.43: Linear regression of the Overland Park dishwasher motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
K10S	Years Since A Purchase	3.76	0.15	-0.15	-0.00	-0.005	38
K20S	Ratio of Other Cost	0.20	0.16	0.08	0.40	0.422	38
K30S	Ratio of New Price	0.17	0.15	0.15	0.23	0.163	38
K40S	Mean of Age Group	41.66	0.15	0.44	-0.01	-0.231	38
K50S	Years Since Last Repair	1.59	0.15	0.10	0.04	0.178	9
K60S	Years Since Any Repair	0.89	0.10	0.17	-0.08	-0.170	29
K70S	Component Repair Exp.	1.50	0.01	-0.98	0.66	1.000	2

Appendix F.44: Linear regression of the Overland Park dishwasher timer repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
L10S	Years Since A Purchase	3.98	0.20	3.59	1.94	0.241	40
L20S	Ratio of Other Cost	0.16	0.20	0.13	0.44	0.422	38
L30S	Ratio of New Price	0.01	0.20	0.20	0.16	0.112	40
L40S	Mean of Age Group	40.05	0.20	0.01	0.01	0.170	41
L50S	Years Since Last Repair	0.75	0.16	0.31	-0.197	-0.536	8
L60S	Years Since Any Repair	1.62	0.18	0.15	0.02	0.110	29
L70S	Component Repair Exp.	1.50	0.34	0.34	0.00	----	2

Appendix F.45: Linear regression of the Manhattan dishwasher motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
K1MA	Years Since A Purchase	4.11	0.32	0.27	0.01	0.031	27
K2MA	Ratio of Other Cost	0.32	0.26	0.25	0.26	0.197	26
K3MA	Ratio of New Price	0.29	0.32	0.26	0.19	0.272	27
K4MA	Mean of Age Group	43.35	0.32	0.15	0.00	0.241	27
K5MA	Years Since Last Repair	2.29	0.27	0.17	0.04	0.603	7
K6MA	Years Since Any Repair	1.00	0.30	0.29	0.01	0.059	21
K7MA	Component Repair Exp.	2.33	0.29	0.75	-0.20	-0.927	3

Appendix F.46: Linear regression of the Manhattan dishwasher timer repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
L1MA	Years Since A Purchase	4.00	0.29	0.26	0.01	0.274	26
L2MA	Ratio of Other Cost	0.26	0.32	0.25	0.26	0.197	26
L3MA	Ratio of New Price	0.26	0.32	0.35	-0.12	-0.211	26
L4MA	Mean of Age Group	42.73	0.32	0.36	-0.00	-0.099	26
L5MA	Years Since Last Repair	2.29	-.27	0.28	-0.00	-0.091	7
L6MA	Years Since Any Repair	1.00	0.27	0.28	-0.01	-0.055	21
L7MA	Component Repair Exp.	2.33	0.26	0.10	0.07	0.500	4

Appendix F.47: Linear regression of the Overland Park dishwasher motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
K10A	Years Since A Purchase	3.76	0.33	0.32	0.00	0.004	38
K20A	Ratio of Other Cost	0.38	0.32	0.28	0.09	0.077	38
K30A	Ratio of New Price	0.22	0.33	0.31	0.07	0.044	38
K40A	Mean of Age Group	41.66	0.33	0.16	0.00	0.198	38
K50A	Years Since Last Repair	0.89	0.32	0.35	-0.04	-0.144	9
K60A	Years Since Any Repair	1.59	0.37	0.36	0.01	0.062	29
K70A	Component Repair Exp.	1.50	0.33	0.31	0.02	1.0001	2

Appendix F.48: Linear regression of the Overland Park dishwasher timer repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
L10A	Years Since A Purchase	3.98	0.37	4.37	-1.09	-0.082	40
L20A	Ratio of Other Cost	0.32	0.38	0.36	0.07	0.077	38
L30A	Ratio of New Price	0.22	0.37	0.32	0.20	0.138	40
L40A	Mean of Age Group	40.05	0.36	0.32	0.00	0.056	41
L50A	Years Since Last Repair	0.75	0.24	0.22	0.03	0.103	8
L60A	Years Since Any Repair	1.62	0..39	0.35	0.02	0.163	29
L70A	Component Repair Exp.	1.50	0.34	0.34	0.00	----	2

Appendix F.49: Linear regression of the Manhattan microwave oven touch control panel repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
M1MS	Years Since A Purchase	2.61	0.28	0.17	0.05	0.163	13
M2MS	Ratio of Other Cost	-0.15	0.28	0.35	0.41	0.435	13
M3MS	Ratio of New Price	-0.47	0.28	0.59	0.67	0.771	14
M4MS	Mean of Age Group	40.86	0.28	0.55	-0.01	-0.154	14
M5MS	Years Since Last Repair	1.00	0.63	----	----	----	1
M6MS	Years Since Any Repair	1.11	0.30	0.26	0.04	0.115	9
M7MS	Component Repair Exp.	2.00	0.63	----	----	----	1

Appendix F.50: Linear regression of the Manhattan microwave oven magnetron tube repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
N1MS	Years Since A Purchase	2.43	-0.14	2.33	-0.69	-0.190	14
N2MS	Ratio of Other Cost	0.28	-0.15	-0.28	0.46	0.435	13
N3MS	Ratio of New Price	-0.47	-0.14	0.04	0.40	0.430	14
N4MS	Mean of Age Group	38.04	-0.14	0.18	-0.01	-0.244	14
N5MS	Years Since Last Repair	1.00	0.63	----	----	----	1
N6MS	Years Since Any Repair	0.44	-0.16	-0.31	0.34	0.326	9
N7MS	Component Repair Exp.	2.00	-0.29	----	----	----	1

Appendix F.51: Linear regression of the Overland Park microwave oven touch control panel repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
M10S	Years Since A Purchase	2.78	0.35	0.24	0.04	0.288	18
M20S	Ratio of Other Cost	0.32	0.35	0.15	0.62	0.716	15
M30S	Ratio of New Price	-0.16	0.35	0.39	0.25	0.279	18
M40S	Mean of Age Group	39.53	0.35	0.35	0.00	0.001	18
M50S	Years Since Last Repair	3.00	0.31	0.81	-0.17	-1.000	2
M60S	Years Since Any Repair	1.87	0.34	0.39	-0.03	-0.306	15
M70S	Component Repair Exp.	----	----	----	----	----	0

Appendix F.52: Linear regression of the Overland Park microwave oven magnetron tube repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
N1OS	Years Since A Purchase	2,18	0.30	1.77	1.35	0.170	17
N2OS	Ratio of Other Cost	0.35	0.35	0.11	0.69	0.707	15
N3OS	Ratio of New Price	-0.08	0.30	0.33	0.34	0.205	17
N4OS	Mean of Age Group	30.21	0.30	0.08	0.01	0.561	17
N5OS	Years Since Last Repair	3.00	0.30	0.65	-0.12	-1.000	2
N6OS	Years Since Any Repair	1.71	0.33	0.35	-0.02	-0.189	14
N7OS	Component Repair Exp.	----	----	----	----	----	0

Appendix F.53: Linear regression of the Manhattan microwave oven touch control panel repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
M1MA	Years Since A Purchase	2.61	0.58	0.48	0.04	0.275	13
M2MA	Ratio of Other Cost	0.48	0.58	0.42	0.33	0.456	13
M3MA	Ratio of New Price	0.47	0.55	0.39	0.36	0.774	14
M4MA	Mean of Age Group	40.86	0.55	0.27	0.01	0.313	14
M5MA	Years Since Last Repair	1.00	0.63	----	----	----	1
M6MA	Years Since Any Repair	1.11	0.62	0.70	-0.07	-0.365	9
M7MA	Component Repair Exp.	2.00	0.63	----	----	----	1

Appendix F.54: Linear regression of the Manhattan microwave oven magnetron tube repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
N1MA	Years Since A Purchase	2.43	0.49	0.64	-0.05	-0.271	13
N2MA	Ratio of Other Cost	0.58	0.48	0.12	0.64	0.456	13
N3MA	Ratio of New Price	0.49	0.45	0.34	0.23	0.350	14
N4MA	Mean of Age Group	38.04	0.45	-0.09	0.01	0.446	14
N5MA	Years Since Last Repair	1.00	0.29	----	----	----	1
N6MA	Years Since Any Repair	0.56	0.40	0.64	-0.44	-0.603	9
N7MA	Component Repair Exp.	----	----	----	----	----	0

Appendix F.55: Linear regression of the Overland Park microwave oven touch control panel repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTERCEPT	SLOPE OF LINE	CORR COEFF	NO OBS
M10A	Years Since A Purchase	2.78	0.36	0.25	0.04	0.310	18
M20A	Ratio of Other Cost	0.37	0.36	0.12	0.63	0.597	15
M30A	Ratio of New Price	0.21	0.36	0.38	-0.13	-0.126	18
M40A	Mean of Age Group	39.53	0.36	0.34	0.00	0.019	18
M50A	Years Since Last Repair	2.00	0.22	0.30	-0.04	-0.294	3
M60A	Years Since Any Repair	1.87	0.35	0.39	-0.02	-0.277	15
M70A	Component Repair Exp.	----	----	----	----	----	0

Appendix F.56: Linear regression of the Overland Park microwave oven magnetron tube repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
N10A	Years Since A Purchase	2,18	0.30	1.77	1.35	0.170	17
N20A	Ratio of Other Cost	0.35	0.34	0.09	0.71	0.704	15
N30A	Ratio of New Price	0.14	0.30	0.21	0.68	0.294	17
N40A	Mean of Age Group	30.21	0.30	0.08	0.01	0.561	17
N50A	Years Since Last Repair	3.00	0.30	0.65	-0.12	1.000	2
N60A	Years Since Any Repair	1.71	0.33	0.35	-0.01	-0.189	14
N70A	Component Repair Exp.	----	----	----	----	----	0

Appendix F.57: Linear regression of the Manhattan window air conditioner compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
01MS	Years Since A Purchase	6.50	0.48	0.65	-0.03	-0.580	12
02MS	Ratio of Other Cost	0.16	0.44	0.41	0.21	0.240	13
03MS	Ratio of New Price	-0.21	0.44	0.45	0.06	0.106	13
04MS	Mean of Age Group	55.58	0.44	0.74	-0.01	-0.303	13
05MS	Years Since Last Repair	1.67	0.63	0.72	-0.05	-0.961	3
06MS	Years Since Any Repair	1.56	0.54	0.59	-0.04	-0.561	9
07MS	Component Repair Exp.	2.00	0.62	0.50	0.06	1.000	2

Appendix F.58: Linear regression of the Manhattan window air conditioner fan motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER- CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
P1MS	Years Since A Purchase	6.50	0.21	5.77	3.45	0.171	12
P2MS	Ratio of Other Cost	0.44	0.16	0.04	0.28	0.240	13
P3MS	Ratio of New Price	-0.21	0.16	0.13	-0.14	-0.215	13
P4MS	Mean of Age Group	55.58	0.16	0..30	-0.00	-0.124	13
P5MS	Years Since Last Repair	1.67	0.11	-0.10	0.12	0.277	3
P6MS	Years Since Any Repair	1.56	0.19	0.10	0.06	0.455	9
P7MS	Component Repair Exp.	2.00	0.39	0.15	0.12	1.000	2

Appendix F.59: Linear regression of the Overland Park window air conditioner compressor repair cost rato (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
01MS	Years Since A Purchase	6.00	0.66	0.73	-0.01	-0.469	8
02MS	Ratio of Other Cost	0.52	0.59	0.07	1.00	0.910	8
03MS	Ratio of New Price	-0.22	0.66	0.67	0.04	0.247	8
04MS	Mean of Age Group	43.00	0.66	0.72	-0.00	-0.108	8
05MS	Years Since Last Repair	1.00	0.85	----	----	----	1
06MS	Years Since Any Repair	1.83	0.72	0.89	-0.09	-0.726	6
07MS	Component Repair Exp.	----	----	----	----	----	0

Appendix F.60: Linear regression of the Overland Park window air conditioner fan motor repair cost ratio (Y axis) vs. the dependent variables (X axis), standard values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
P10S	Years Since A Purchase	5.75	0.52	0.50	0.00	0.093	8
P20S	Ratio of Other Cost	0.59	0.52	0.03	0.83	0.910	8
P30S	Ratio of New Price	-0.25	0.52	0.51	-0.02	-0.091	8
P40S	Mean of Age Group	39.31	0.52	0.25	0.01	0.496	8
P50S	Years Since Last Repair	1.00	0.79	----	----	----	1
P60S	Years Since Any Repair	1.83	0.61	0.88	-0.14	-0.963	6
P70S	Component Repair Exp.	----	----	----	----	----	0

Appendix F.61: Linear regression of the Manhattan window air conditioner compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
01MA	Years Since A Purchase	6.50	0.52	0.61	-0.01	-0.451	12
02MA	Ratio of Other Cost	0.33	0.49	0.46	0.09	0.067	13
03MA	Ratio of New Price	0.40	0.49	0.49	-0.02	-0.033	13
04MA	Mean of Age Group	55.58	0.49	0.68	-0.00	-0.266	13
05MA	Years Since Last Repair	1.68	0.63	0.72	0.05	-0.961	3
06MA	Years Since Any Repair	1.56	0.54	0.60	-0.03	-0.561	9
07MA	Component Repair Exp.	2.00	0.62	0.50	0.06	1.000	2

Appendix F.62: Linear regression of the Manhattan window air conditioner fan motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
P1MA	Years Since A Purchase	6.50	0.32	9.10	-8.03	-0.220	12
P2MA	Ratio of Other Cost	0.49	0.33	0.31	0.05	0.067	13
P3MA	Ratio of New Price	0.40	0.33	0.33	-0.01	-0.012	13
P4MA	Mean of Age Group	55.58	0.33	0.36	-0.00	-0.055	13
P5MA	Years Since Last Repair	1.67	0.41	0.60	0.11	-0.979	3
P6MA	Years Since Any Repair	1.57	0.35	0.29	0.04	0.637	9
P7MA	Component Repair Exp.	2.00	0.62	0.50	0.06	1.000	2

Appendix F.63: Linear regression of the Overland Park window air conditioner compressor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
010A	Years Since A Purchase	6.00	0.66	0.73	-0.01	-0.469	8
020A	Ratio of Other Cost	0.52	0.59	0.07	0.10	0.910	8
030A	Ratio of New Price	0.66	0.66	0.65	0.01	0.059	8
040A	Mean of Age Group	43.00	0.66	0.72	-0.00	-0.108	8
050A	Years Since Last Repair	1.00	0.85	----	----	----	1
060A	Years Since Any Repair	1.83	0.72	0.90	-0.09	-0.726	6
070A	Component Repair Exp.	----	----	----	----	----	0

Appendix F.64: Linear regression of the Overland Park window air conditioner fan motor repair cost ratio (Y axis) vs. the dependent variables (X axis), absolute values

DATA CODE*	X-AXIS	MEAN OF X	MEAN OF Y	Y-INTER-CEPT	SLOPE OF LINE	CORR COEFF	NO OBS
P10A	Years Since A Purchase	5.75	0.52	4.44	2.53	0.093	8
P20A	Ratio of Other Cost	0.59	0.52	0.03	0.83	0.910	8
P30A	Ratio of New Price	0.66	0.52	7.31	-2.00	-0.276	8
P40A	Mean of Age Group	39.31	0.52	2.92	0.07	0.133	8
P50A	Years Since Last Repair	1.00	8.00	----	----	----	1
P60A	Years Since Any Repair	1.83	3.83	4.28	-0.25	-0.120	6
P70A	Component Repair Exp.	----	----	----	----	----	0

FACTORS RELATED TO CONSUMER'S PERCEPTION

OF HOUSEHOLD APPLIANCE REPAIR COSTS

by

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The purpose of this report was to determine if consumers were aware of the present cost of appliance repair and determine what factors affect the consumer's ability to estimate repair costs.

From the review of literature it was determined that consumers are concerned with the cost and quality of appliance repair services. Three of the studies reviewed reported that the respondents said that the quality of service had decreased in recent years. The studies also indicated that consumers were concerned with the cost and quality of appliance repair service. One possible reason for the concern about repair costs may have resulted from the consumer's inability to estimate repair costs.

The results of a survey completed in Manhattan, Kansas, and Overland Park, Kansas, were analyzed. The survey had asked the 99 participating subjects about what they estimated the cost of repair would be for two components from a list of eight major appliances. The results of the survey was broken into 32 categories according to which city, which appliance, and which component was being discussed.

In twenty-two of the categories the consumer underestimated the cost of repair while overestimating its cost for ten of the categroies. Statistical analysis of the survey responses indicated that 12 of the 448 comparisons made indicated that the independent variables had a significant effect on the consumer's ability to estimte component repair costs. "Significant," in this report, has been defined as a correlation having a coefficient of determination of fifty percent or greater. The variables that fit this requirement are shown on Table 3 of this report.

F-tests and t-tests were completed to determine if the data could be combined. The F-tests and t-tests compared Manhattan data to the Overland Park data for each repair component studied. Also the two component repair costs for each appliance were compared for both cities. The results of the both the F-tests and the t-tests were inconclusive because no clear pattern existed. The F-tests indicated that 41 percent of the variances were significantly different. However, 72 percent of the means were found to be significantly different.

The results indicate that no one factor analyzed had a significant influence of the consumer's ability to estimate repair costs for all cases, although several variables seemed to have had a slight effect, although not significant. Such variables included the subject's experience with that particular component repair, the number of years since the purchase of a new appliance in that category, the ratio of repair cost estimate to the ratio of the new price estimate, and the number of years since any appliance repair .

An additional study where the subject's income and education were recorded and a larger sample size might indicate significant relationships do exist.

According to the literature review, consumers tend to be dissatisfied with the service repair industry, including the excessive cost of repair. A possible reason for this trend toward dissatisfaction may be accounted for by the fact that consumers are unaware of present repair costs until they request service. This study supported this hypothesis.