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REPORT ON

MARKET-BASED LAND AND PROPERTY ASSESSMENT PROJECT

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By

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ABSTRACT

This report describes a small project to analyze the market for apartment properties in Yerevan, Armenia, in mid-1997; evaluate the usefulness of modern computer-assisted mass appraisal (CAMA) methods in estimating market values; and determine whether it would be feasible to tax property in Armenia on the basis of market value. The researchers concluded that the housing market was behaving predictably and that CAMA methods could be used to estimate market values. Multiple regression analysis was used to calibrate multiplicative price models that were as powerful as those used in other countries in property taxation. From this, the researchers concluded that market value could be the basis for property taxation. Moreover, market value would be superior to the current artificial "cadastral" value basis. Taxes would be more equitably distributed, and the tax base would be more buoyant. The report identifies the main issues in converting to a market value basis for property taxation.

EXECUTIVE SUMMARY

BACKGROUND

The Market-based Land and Property Assessment Project was a small valuation research project designed to test the practicality of modern computer-assisted mass appraisal (CAMA) methods in Armenia. This is a non-technical summary of the background, approach, and conclusions of the project.

Land and buildings now are taxed in Armenia on the basis of highly regulated and artificial "cadastral" values (according to a regulation known as Decision 306). The project was designed to help the Republic of Armenia (RoA) prepare for a conversion to market value-based land and property taxes as early as 1999. It was carried out under a memorandum of understanding signed in May 1997 by officials of the Republic and the International City/County Management Association (ICMA), a contractor for the U.S. Agency for International Development (USAID). ICMA agreed to provide technical assistance, organize seminars, and assist in developing methodologies for estimating the market value of real property for land and building tax purposes.

Armenia has a thriving if unsophisticated housing market. Other property markets are emerging. If property markets behave predictably, modern mass valuation methods will work satisfactorily. An objective of the project was to evaluate property market behavior. As estimating market values is a novel activity for many in government, another objective was to demonstrate modern mass appraisal methods.

Fortunately, with the decision to create a State Unified Real Estate Cadastral Department in June 1997, the RoA completed a reorganization of property registration and valuation institutions in time for experts from the new Cadastral Department to participate in the project (along with experts from the Tax Inspectorate).

The RoA envisages that the land tax and the property tax will become important sources of revenue for the new local governments created under the Law on Local Self Government. Although the taxes now produce about 5 percent of the nation's total tax revenues, converting from the current regulated base to a market value base promises a more buoyant tax base.

APPROACH

The project organization included the research team, working group members, and a steering committee. The steering committee's role was to ensure that the government's interests were furthered. Working group members from the Cadastral Department and State Tax Inspectorate lent their expertise and received training. The research team comprised two U.S.-based advisors and an Armenian project assistant. They were assisted by an Estonian valuation expert who had participated in the introduction of a market value-based land tax in his country. Cooperating brokers provided data and contributed to the modeling effort.

The project design was heavily influenced by the fact that actual selling prices generally are concealed in Armenia (a problem property tax administrators encounter in many other countries). On the other hand, the prices at which properties were advertised for sale ("asking prices") were freely available. If asking prices varied predictably according to differences in apartment attributes (location, size, and quality) and if the ratio between asking prices and actual prices could be estimated, then market values also could be estimated.

The initial plan was to collect asking price and property attribute data directly from newspaper advertisements and from participants in the open-air real estate market. However, representatives of three brokerage organizations with whom ICMA had been working generously agreed to supply asking price and attribute data in digital form as long as the researchers held the individual data items confidential. (In Armenia, brokers represent buyers, so they do not identify properties for sale until the buyer is interested in a specific property.) Obtaining data in digital form meant that more data were available for analysis. Moreover, each file contained a consistent set of property attributes. Although all three files were analyzed, the report presents results only from the two sources that also furnished a map of market areas (zones). Each reported source contained more than 1,000 price observations.

Statistical software for personal computers was used to analyze the asking price data. After calculating basic descriptive statistics and producing graphics to help visualize the data, the researchers constructed housing price models that explained more than 85 percent of the differences in asking prices. The average difference between the actual asking prices and the estimated asking prices was about 16 percent. (The first index is known as the adjusted R-Square, and the second index is known as the coefficient of dispersion or "COD.") The degree of valuation accuracy achieved compares satisfactorily with achievements in countries with long-established markets and systems for collecting price and attribute data. (Multiple regression analysis was used to calibrate the models, and multiplicative models produced better results than additive models.)

Next, it was necessary to estimate by how much estimated asking prices should be reduced to produce reasonable estimates of actual sales prices. To obtain actual price data, workers at the [Yerevan] Real Estate Registration and Inventory Department interviewed buyers as they left the department's office under a pledge of confidentiality. The department also supplied Decision 306 values and a standard set of property characteristics, except that the zone characteristic referred to the official zone, not the zone used by brokers. There were 380 sales in this file, 353 of which were deemed suitable for analysis.

Expert opinion suggested that actual prices typically were 5 to 10 percent less than asking prices. The empirical analysis suggested the ratio could be as much as 15 to 20 percent. Use of a ratio at the upper end of the range would have the practical advantage of slightly under-valuing property, which would reduce the number of complaints about over-valuation.

Last, the researchers compared actual sales prices to Decision 306 values to evaluate the magnitude of changes in taxable value that would result from converting from regulated taxable values to market values as a basis of taxation. Currently, Decision 306 values are less than 40

percent of current market prices of apartments. In other words, the tax base could be increased by a factor of 2.5. As noted below, not every property would experience the same increase. The taxable value of a few apartments might go down under a conversion to market value. (See charts.)

CONCLUSIONS

Three closely related main conclusions can be drawn from the market-based land and property assessment project:

1. Yerevan has a rational housing market.

2. Because of that, market-based mass valuation methods work well.

3. Market value-based assessments would be better than current assessments under Decision 306. The property tax would be more equitably and rationally distributed, and the tax base would be greater.

Why move from the current system of valuation (Decision 306) to a system based on estimated market values? Taxes can be evaluated according to administrative, social justice, economic, and political criteria. When *taxpayers* evaluate the economics of a tax, they typically relate the amount of taxes paid to sales prices, rents, and the like. The ratio of taxes paid to a measure of (market) value is called an *effective tax rate*. The average effective tax rate on apartments in Yerevan appears to be about 0.08 percent (40 percent of the *nominal* tax rate of 0.2 percent). An artificial value concept such as the "value" derived by applying Decision 306 is irrelevant. Only effective tax rates provide a rational economic basis for evaluating the fairness and uniformity of a tax. When taxpayers perceive that their effective tax rates are too high, they will take some action to reduce the taxes. When they perceive that there are extreme, unexplainable variations in effective tax rates, their acceptance of the tax erodes, and the credibility of government suffers.

It is widely appreciated in Yerevan that Decision 306 values bear little relationship to current market values. The project confirmed this. Apartments in zone 1 *and* zones 5 and 6 tend to be relatively under-assessed because the coefficients in Decision 306 do not reflect market relationships. For similar reasons, apartments in prefabricated buildings tend to be over-assessed relative to apartments in stone buildings. Apartments on higher floors tend to be over-assessed relative to apartments on lower floors. The average variation in the ratio of the Decision 306 value to market price was 35 percent (in contrast to 16 percent achieved by the market models). To understand the tax consequences of such valuation errors better, assume that there are three apartments, each of which has a market value of $8,000 (the median of the sample of 353 actual sales). Further assume that one is assessed correctly at $8,000, one is under-valued by 35 percent ($5,200), and the last is over-valued by 35 percent ($10,800). Finally assume a tax rate of 0.2 percent. The top part of the following table displays the taxes these properties would pay (actual

Exhibit ES-1
Histogram of Difference Between Sale Price and Official Value

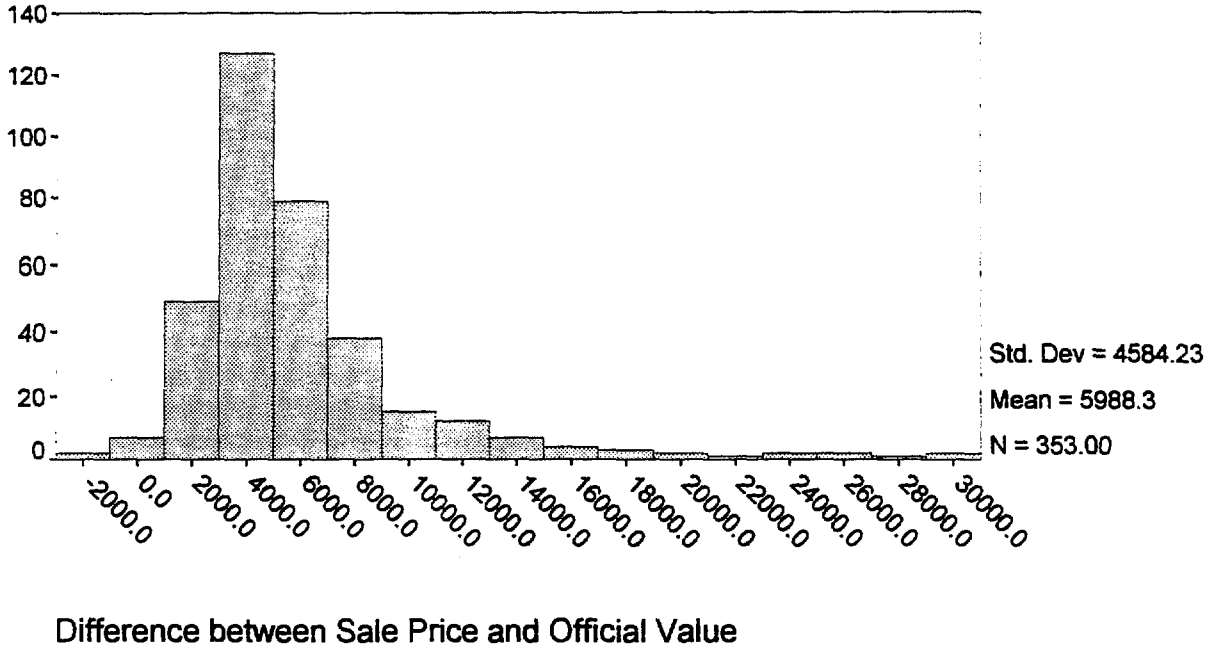

Exhibit ES-2
Chart of Median Sale Price and Official Value by Zone

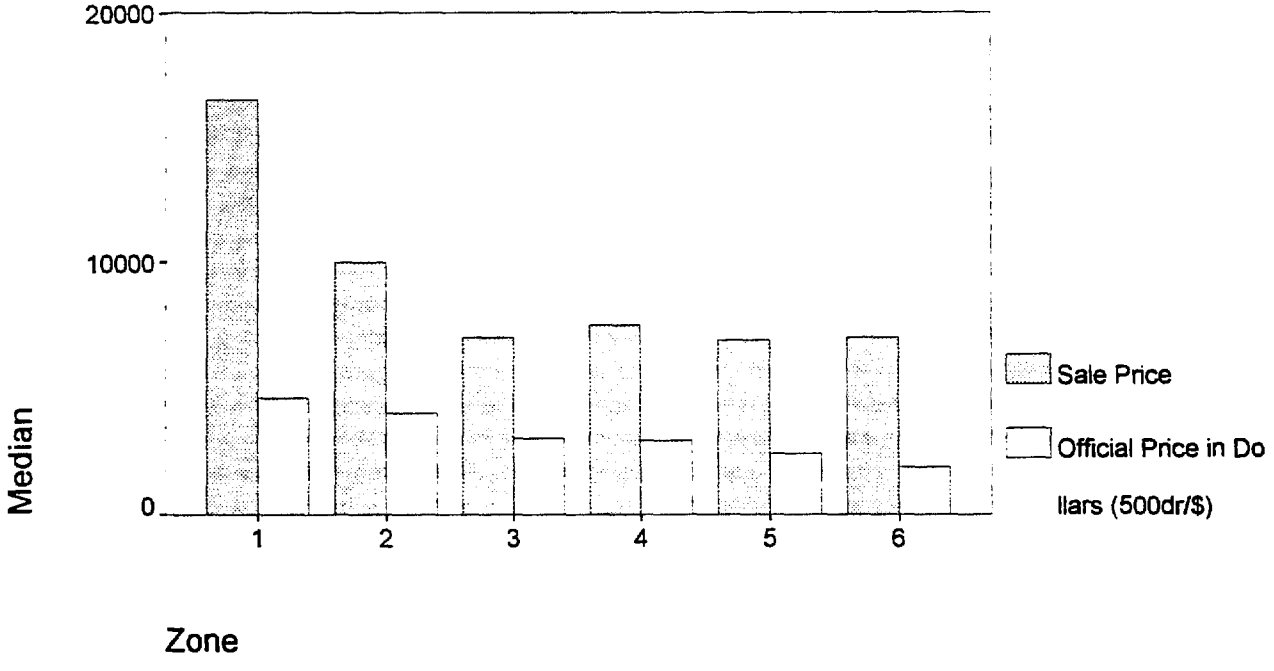

Table ES-1. Illustration of Advantages of Market-based Assessments

Assessed Value	Property Taxes	Effective Tax Rate	Percent Difference
8,000	16.00	0.20	
5,200	10.40	0.13	-35.00
10,800	21.60	0.27	107.69
6,800	13.60	0.17	-15.00
9,200	18.40	0.23	35.29

deviations from uniform taxation may be much greater or much less). The lower part displays the results of reducing the under- and over-valuations to 15 percent. As can be seen, property tax burdens would be more fairly distributed under a market-based assessment system.

In addition, greater property tax revenues could be realized because complaints from taxpayers who are over-taxed tend to deter legislators from setting property tax rates at a level the under-assessed would accept. Possibly, administrative and compliance costs could be reduced, because market-based methods require fewer attribute data than "cost"-based methods, such as Decision 306.

What must be done to convert to market-based assessments for property tax purposes? The government of Armenia already seems committed in principle to converting to market-based assessments as soon as practicable. The following things should be done:

1. The valuation unit in the Cadastral Department needs to increase its expertise in computer-assisted mass valuation methods.

2. The valuation unit should begin market-monitoring and should make valuation pilot studies in other regions of Armenia and of other property types. The unit should establish zones and other attribute data elements that reflect market preferences.

3. Computer systems should be developed to support a modern fiscal cadastre, and mass valuation methods should begin.

4. The legislative framework should be changed to support market-based assessments.

5. Property tax relief should be provided to poor persons whose privatized apartments are more expensive than they can afford.

Above all, the momentum for reform that has characterized the introduction of property taxes in Armenia should be maintained.

REPORT ON MARKET-BASED LAND AND PROPERTY ASSESSMENT PROJECT

1 INTRODUCTION

1.1 Background

The Market-based Land and Property Assessment Project was a joint project of the Republic of Armenia (RoA) and the U.S. Agency for International Development (USAID), represented by its contractor, the International City/County Management Association (ICMA). The project was an element of an action plan developed in March 1997 and was ratified in a memorandum of understanding (MOU) signed in May 1997. Under the MOU, ICMA agreed to provide technical assistance, organize seminars, and assist in developing methodologies for estimating the market value of real property for land and building tax purposes. The project began in May 1997. As will be seen, a confluence of events made the timing appropriate.

Currently, there are two "property" taxes in Armenia: a land tax introduced in 1994, which is levied chiefly on agricultural land, and a property tax introduced in 1995, which is levied on housing units, other privately owned structures, industrial assets, vehicles, and livestock (Almy, 1997). Initially, the central government received the revenues from both taxes. With the passage of the Law on Local Self Government and the budget law, most revenues (95 percent) are to go to the new local governments. Both taxes currently are based on Soviet-era regulated ("cadastral") values, which do not reflect current market values. Structures owned by citizens are valued in accordance with Decision 306. In 1997, the State Tax Inspectorate (STI) drafted new land and property tax laws. The aim of these interim changes is to correct problems with the current laws, simplify administration, and harmonize the two taxes. The STI also wants to increase revenue yields significantly. The eventual goal is to merge the taxes and base them on market values, perhaps as early as 1999.

The introduction of the land and property taxes was marred by fragmented administrative responsibilities, inadequate systems for registering property ownership, and the fact that "valuation" is an integral part of registration. A short timetable and limited resources contributed to difficulties with the introduction of the property tax in 1995. The decision in June 1997 to create a State Unified Real Estate Cadastral Department under the Ministry of Justice will simplify administration. The Department will be responsible for inventory, assessment, and registration of real property. The existing Republican Real Estate Registration and Inventory Department and the [Yerevan] Real Estate Registration and Inventory Department, which are under the Ministry of Urban Development, will come under the jurisdiction of the Cadastral Department in September. Later, the Ministry of Agriculture will transfer its registration and valuation materials to the Department. Additional funding was provided to valuation agencies in 1997, and the STI forecasts a substantial increase in property tax revenues in 1997.

Armenia has created the legislative framework for private property institutions and has privatized most housing units and agricultural land (Anlian and Vanian, 1997), and enterprises are being privatized. There is a thriving housing market in Yerevan. A brokerage industry has been established. ICMA has sponsored market monitoring activities since 1991, and it began to support valuation research and training in 1995. However, property markets are regarded as unruly, market value is not well understood in a formal sense, and estimating market values is a novel activity for most government officials.

The project organization included the research team, working group members, and a steering committee. The steering committee's role was to ensure that the government's interests were furthered. Working group members lent their expertise and received training. Cooperating brokers provided data and contributed to the modeling effort.

1.2 Objectives

The general objective of the Market-based Land and Property Assessment Project was to help the RoA prepare to convert to a market-based tax on land and buildings successfully. Specific objectives included:

- Demonstrating the practicality of modern computer-assisted mass appraisal (CAMA) methods and the advantages of converting to market-based assessments as the basis for property taxation.

- Refining an earlier apartment valuation model by adding a better location variable and condition variables.

- Estimating the typical ratio of actual prices to asking prices (the so-called "discount factor").

- Comparing estimated market prices with Decision 306 values systematically using "ratio study" methods.

- Identifying or estimating the costs and benefits of market-based assessment methods over normative methods.

- Estimating tax shifts associated with basing assessments on market values.

- Establishing a "phase 2" expanded set of objectives (other property types, other geographic areas).

1.3 Overview of Research

The Market-based Land and Property Assessment Project was small in scale and short in duration. Elements of the project included:

- Capturing a better set of asking price data (incorporating location and condition variables).
- Specifying and calibrating valuation models.
- Evaluating the options for estimating the "discount factor." Options included using expert opinion or deriving the factor by comparing asking and actual prices. The former was more practical, if less objective.
- Building a sample data set containing both estimated market values and Decision 306 values.
- Making a stratified "ratio study" comparing Decision 306 values with estimated market values. The strata included location variables.

The project also had an education and training component. Activities in this area included defining market value, describing valuation, and outlining the advantages of market value as a basis for taxation. Workshop sessions included exercises designed to demonstrate the technology and increase understanding of the concepts in hopes of eventually creating a small cadre of self-sufficient valuers.

2 VALUATION RESEARCH

As outlined in section 1.3, the main elements of the Market-based Land and Property Assessment Project were to assemble data for analysis, develop one or more valuation models designed to explain differences in the asking prices of apartments in Yerevan, estimate the ratio of actual sales prices to asking prices, and compare estimated market values with Decision 306 values. If the models predicted prices with sufficient accuracy, it would be feasible to convert to a market value-based system of property taxation.

2.1 Background

This section provides background information on valuation concepts, including the definition of "market value." Professional valuation treatises—and many property tax laws—define market value in such terms as "the most probable sale price of a property in terms of money in a competitive and open market, assuming that the buyer and seller are acting prudently and knowledgeably, allowing sufficient time for the sale, and assuming that the transaction is not affected by undue pressures" (Eckert et al., 1990). Such a price is hypothetical and unobservable. However, actual sales prices, provided the circumstances of the sales closely match the conditions in the definition of market value, provide the most direct evidence of market values.

It is the job of a valuer to *estimate* market values. The nature of the valuation assignment influences how the valuer goes about doing that. There are two broad orientations to valuation: "single-property appraisal" and "mass appraisal." Mass appraisal has been defined as "the process of valuing a group of properties as of a given date, using standard methods, and allowing for statistical testing" (Eckert et al., 1990). But more is involved. As most valuation treatises, valuation education programs, and valuer credentialing programs focus on appraisals of specific properties, or "single-property" appraisal, perhaps the best way to illustrate what is involved in mass appraisal is to contrast it with single-property appraisal. Table 2-1 highlights the differences in the seven stages in the single-property appraisal and mass appraisal processes.

Mass appraisal requires the maintenance of sales files and other market information. Mass appraisal also requires valuers to develop *mass appraisal models*, which are mathematical representations of how supply and demand factors affect market values. The development process involves model *specification* and *calibration*. Calibrated models, sometimes referred to as *valuation standards*, take many forms, such as the tables in Decision 306 and Exhibit 2-20.

2.2 Software

Practically speaking, mass appraisal requires computer assistance. Most analytical work can be done on personal computers (PCs) using general-purpose database, spreadsheet, and statistical software. The research team used a standard statistical package, SPSS for Windows. (Other packages available in the United States include NCSS and SAS.)

Table 2-1. Single-Property and Mass Appraisal Processes Contrasted

1. Problem Definition

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
For each assignment, the valuer must: (1) Identify and locate the real estate	In mass appraisal for property tax purposes, (1) The real estate to be appraised is all assessable property in the district, requiring cadastral maps and property records
(2) Identify the property rights to be valued	(2) Usually legislation requires the assessor to assume that fee simple rights are possessed in all cases
(3) Establish the date(s) of the value estimate(s)	(3) Usually legislation specifies a standard date
(4) Identify the use of the appraisal	(4) By definition, the use is for property tax purposes;
(5) Define the value(s) to be estimated	(5) Usually legislation specifies market value or another standard
(6) Identify limiting conditions or limitations.	(6) Legislation may specify other limiting conditions, and resource and time constraints may impose others.

2. Preliminary Analysis and Plan: Select and Collect Data

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
Depending on problem definition, the valuer must decide what analyses and valuation methods will be used and collect the necessary data on the general market in question, the subject property, and any competitive (comparable) properties, including sales, rents, and costs. Unless the valuer specializes in the area and type of property, there is little opportunity to build a database.	The valuer (assessor in this case) must build and maintain comprehensive computerized records on all assessable land parcels and buildings and other structures. A computerized sales file also should be maintained. Rental data should be collected. Computerized cost schedules should be maintained. Market trends should be monitored on an ongoing basis.

3. Estimate Highest and Best Use

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
Based on the preliminary analysis and plan, the valuer must estimate highest and best use.	Legislation usually specifies the use (usually highest and best use) that is to be considered in valuation. The uses that are the basis of valuations are recorded during field inspections and maintained in property records.

4. Estimate Land/Site Value (as Defined)

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
The valuer usually estimates land value on a case-by-case basis.	The valuer (assessor) specifies several land valuation models (usually at least one for each use type or market area), collects and analyzes available market data using recognized methods, and develops basic rates and adjustment factors, which reside in computerized tables and which should be displayed on maps. The computer-assisted mass appraisal (CAMA) system is used to apply the model(s).

5. Estimate Improved Property Value (as Defined)

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
The valuer usually estimates improved property value on a case-by-case basis.	The valuer (assessor) specifies several valuation models (usually at least one for each use type or market area). The CAMA system is used to calibrate and apply the models.

6. Reconcile Value Indicators: Reach Defined Value Estimate

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
Professional standards require the valuer to use as many of the three approaches to value as are applicable, evaluate the supportableness of each approach and the indicated value, and choose the best indicator of value or choose another figure.	In mass appraisal, if multiple preliminary estimates of value are produced, a valuer during the review process would essentially "reconcile" the estimates as in single-property appraisal. In addition, the valuation models would have been tested in other ways, including ratio studies.

7. Report Estimate(s) of Value as Defined

SINGLE PROPERTY APPRAISAL	MASS APPRAISAL
Professional standards allow single-property appraisals to be reported in a number of ways, ranging from a form to a full narrative report.	In mass appraisal, the assessment roll entry and assessment notice constitute minimum documentation of each value. In many Western jurisdictions, taxpayers can request a copy of their property record. Professional standards recommend a "mass appraisal summary report," which is a narrative describing the valuation program in general. Of course, considerable additional documentation exists in data files and tables in CAMA systems.

SPSS for Windows is a powerful, easy-to-use package. It contains a data "window" that resembles a spreadsheet, although SPSS's database is not "dynamic" like a spreadsheet, as variables are not linked. Data files can be imported and exported in a variety of file types (the research team received data as files in Microsoft® Excel—a spreadsheet package). SPSS has powerful analytical capabilities, including the ability to produce the descriptive statistics and multiple regression analysis models described in sections 2.4 and 2.5. The analytical capabilities are accompanied by the capability to produce graphics like those contained in the exhibits. SPSS is well documented, and some of the documentation is available in Russian.

ICMA acquired several copies of SPSS for participants to use in the November 1996 seminar on computer-assisted mass appraisal (CAMA). Following the seminar, copies were distributed to State Tax Inspectorate and the Republican and Yerevan Real Estate Registration and Inventory Departments. (At the time, the Cadastral Department lacked a suitable computer.) The research team used the computers in these departments to prepare the data analyzed in this project and to demonstrate the results of the project research in the August 1997 workshops. (The research team's November 1996 seminar materials, together with SPSS's documentation, provide additional information on how SPSS can be used.)

2.3 Data

2.3.1 Introduction

The Market-based Land and Property Assessment Project examined several aspects of the data needed to estimate market values and to calculate Decision 306 values. Valuation obviously requires data on the prices of apartments. Equally important are data on the characteristics of apartments that make them attractive or unattractive in the marketplace. Decision 306 requires additional data. An operational property tax system would require data needed to determine taxability. For reasons of economy, only essential data should be collected and maintained. This section discusses the data the research team wanted and the data obtained.

Ideally, there would be a reliable, easily accessible source of information on actual sales prices such as an automated legal cadastre. In the absence of a system of incentives to declare actual prices accurately, Armenian buyers have an incentive to declare a price no higher than the Decision 306 value. Therefore, the prices declared in real property transfer documents are generally regarded as unreliable. In contrast, asking prices of apartments are readily available along with the chief characteristics that the seller thinks make her or his apartment saleable. In Armenia, the exact location of properties for sale is not revealed until the would-be buyer is judged serious.

Generally, a would-be seller advertises a property for sale at a price that is higher than the price for which he or she would be willing to sell the property. The increment depends on a number of factors, including the seller's knowledge of the market and how badly the seller wanted to sell the property. One role of a real estate broker is to help the seller set a realistic price. Often a

property that is advertised for sale at too high a price will remain unsold until the seller lowers the asking price. Consequently, the ratio of actual price to asking price cannot be expected to be uniform.

Despite these difficulties with asking prices, their ready availability led the research team to test whether they varied according to property attributes in the same way that actual transaction prices did. If they did, a valuation model derived from asking prices could be used to estimate transaction prices provided that the team could also estimate how much asking prices should be reduced to reflect actual market prices.

Buyers, sellers, and real estate experts quickly agree that certain property attributes influence market values. These include location variables (such as zone), building (or unit) size, and structural quality and condition. Additional characteristics can be important. The research team took advantage of this general agreement to identify the attribute data desired. During previous missions the team evaluated the attributes contained in inventory records and required for Decision 306. The team asked experts in the Cadastral Department, inventory bureaus, and Tax Inspectorate for their opinions. They also asked brokers.

The data elements needed to calculate Decision 306 values are specified in the Decision itself. Fortunately, they include many elements important in estimating market values. The chief weakness of the Decision 306 valuation methodology is that the coefficients were not directly derived from market analysis, because the methodology was developed at the same time that it became possible for Armenians to own their apartments and to sell them if they wished. Another problem is that the starting per-unit value comes from a 1980s Soviet cost manual. (Attachment A contains an evaluation of Decision 306 made before this project.)

Initially, the research team planned to compile asking price data from newspaper advertisements and by directly contacting sellers. This would have been time-consuming, and it would have been difficult to obtain a consistent set of property attributes. Fortuitously, ICMA had been working with several real estate brokers on a number of projects, and the team asked them if they would supply data. Generously, the Armenian Real Estate Association (AREA) and the brokerage firms of "Agat" and "Dia" agreed to supply sample data sets on diskette. This had several advantages. The research team received larger data sets than they could have obtained if they had had to key data from newspapers. Within each data set, the team avoided the problem of duplicate listings. Although each broker collected slightly different sets of attributes and some attributes (notably zone) were coded differently, each data set was internally consistent. The chief disadvantage of the data sets the team was given was the lack of a specific location for each apartment. (Brokers in Armenia represent potential buyers, so location information is withheld to protect commissions.)

To obtain actual price data, the research team interviewed buyers as they left the [Yerevan] Real Estate Registration and Inventory Department under a pledge of confidentiality. The team also used this opportunity to collect Decision 306 values but did not collect asking prices. The

team also obtained a standard set of property characteristics, except that the zone characteristic referred to the official zone, not the zone used by brokers.

One aspect of the Market-based Land and Property Assessment Project demonstrated how data must be prepared for analysis. The words and phrases people use to describe properties usually are too long and too inconsistent for practical storage in a cadastral system. More important, such information cannot be analyzed until it is reduced to numerical codes. Variable codes should be designed to cover all possibilities (such as an "all others" category) and to contain no duplications.

Codes can represent yes-no conditions, and such variables are called binary or "dummy" variables. They typically are coded "1" for "yes" and "0" for "no." Codes also can represent classes, and these are called categorical or dichotomous variables. The team's data set has several examples of these (zone and type of building, for example). Such codes require careful analysis, because the change in value from a code 1 to a code 2 may not be the same as going from a code 2 to a code 3 (and so on). In other words, the relationship between the values of the attribute and property value may not be in even increments or be "linear."

The files were not merged because of the likelihood of duplicating properties and because different brokers use different characteristics.

2.3.2 The Data Sets

Except as noted, the data files from AGAT, AREA, DIA, and buyers contained the following information.

1. **Identification Number.** A case number was assigned for general reference purposes. The AGAT, AREA, and DIA files contained a source code and the broker's identification number.

2. **Zone.** Zone was the research team's most important location attribute. However, each data set contained a different zoning scheme. There are six official zones. The research team had only a small-scale map that depicted five zones, and requests for a larger-scale map showing the six zones were never satisfied. The team does not know the basis of the official zones, but they appear to correspond empirically to broad areas of equal market desirability. AREA also uses six zones based on the organization's more refined judgments of areas of equal market desirability. AREA publishes a map of the zones in the center of Yerevan. AGAT employs nine zones, also based on market judgments, which in many respects correspond to AREA's. AGAT gave the team a map of its zones in the center. DIA employs twenty zones (but no subzones). No map was received from DIA. The team had hoped to overlay the brokers' zones on a large map of official zones to develop discrete market areas but could not. This would be important in an operational valuation program. The buyers' database had a greater portion of properties in zones distant from the center than the brokers' databases.

3. **Subzone.** AGAT and AREA divided some zones into subzones, an important refinement. The team did not receive a map of subzones.

4. **Street Name.** The research team recorded street name and considered developing street name codes as a possible location variable, but this was not feasible with the time and resources available. Ideally, the team also would have been able to record building number and apartment number, but this information was not available from the sources used.

5. **Number of Rooms.** The team recorded the official number of rooms (excluding kitchens, bathrooms, halls, and other areas partitioned off by occupants) in each apartment. The maximum number of rooms in the AREA and buyers' databases was five. In the others, the maximum was four. Number of rooms is a convenient way to categorize the size of an apartment.

6. **Story.** The story in the building on which an apartment is located generally is believed to affect the value of the apartment. But the relationship is complex. A low story is undesirable for living purposes because of traffic disturbances but is desirable for business purposes. A high story with a good view would be desirable if elevator service were reliable, but the top story may be less desirable because of a build-up of heat in the summer. The maximum number of stories in apartment buildings is sixteen. All of the team's data files had the story level of the apartment. The AGAT data set coded some stories as "1.5," apparently when the first story was below the grade level of the street.

7. **Number of Stories in Building.** As discussed above, the number of stories in a building is believed to affect the value of story level. The type of building (next) affects the number of stories. All data sets contained the number of stories.

8. **Type of Building.** Armenian experts identified five building types as significantly affecting apartment desirability. In the general order of desirability, they are: (1) stone construction with concrete ceilings, (2) stone construction with wood ceilings, (3) high-rise concrete framed panel buildings, (4) lower panel buildings, and (5) prefabricated buildings. Type and number of stories are linked. Moreover, stone buildings, which are older, generally are of better quality, and are more common in the center of Yerevan.

9. **Ceiling Height.** Ceiling height is an indicator of quality, with higher ceilings being preferred. Three classes were identified: (1) typical ceilings (2.7 to 2.8 meters), high ceilings (3 meters or more), and (3) low ceilings (2.5 to 2.6 meters).

10. **Total Area.** Official records generally contain a measurement of the total area of an apartment in square meters (inside measurements). Area obviously affects desirability. The team's variable "other area" is total area minus living area. It is a measure of the area of the

kitchen, bathrooms, halls, and the like. Apartments in the buyers' database were smaller than those in the brokers' databases.

11. **Living Area.** Official records also generally contain a measure of the area of the rooms included in (5) above.

12. **Condition.** Brokers devised a general rating of the state of repair or condition of the apartment, as condition or age generally is an important determinant of value. The ratings were: (1) bad, (2) average, (3) good, and (4) excellent.

13. **Balconies.** Separate variables were devised for three types of balconies, which provided both additional usable space (*xoz* and *lodjia* balconies, which sometimes are "illegally" enclosed) and an indicator of desirable amenities (*parad* balconies, which face the street). For each type of balcony, the number of balconies was recorded. The team could not easily do this for the AREA database, because it provided only the dimensions of balconies.

14. **Garage.** Each database included a binary variable indicating whether a garage was included in the sale.

15. **Basement.** Each database included a binary variable indicating whether basement space was included in the sale.

16. **Additional Construction.** Except AREA's, each database included a binary variable indicating whether any other type of additional construction was included in the sale. The buyers' database included a binary variable indicating whether furniture was included in the sale.

17. **Price and Value.** As mentioned, the brokers' databases included an asking price in U.S. dollars. The buyers' database did not contain asking prices but contained declared sales prices in U.S. dollars (which the team believes to be reasonably accurate) and official (Decision 306) values in Armenian drams. The team converted drams to dollars using a rate of 500:1. The average price in the buyers' database was substantially lower than the averages in the brokers' databases, reflecting the differences between asking prices and actual sales prices, the smaller size of apartments, and the fact that there were more apartments in distant neighborhoods.

18. **Date.** The brokers' data sets contained a listing date, which basically is the date the property was listed or the listing was updated. The buyers' data set contained three dates: the sale date, the valuation date, and the date the record was created. The team did not find this information useful because of the short time spans involved. Such date information should be included in a sales file to permit studies of price level changes over time caused by inflation and changes in supply and demand.

2.4 Valuation Modeling

2.4.1 Introduction

As mentioned, data on asking prices and property attributes were supplied by the real estate firms AGAT, AREA, and DIA. The available data are described in 2.3.2 above. The research team tested additive and multiplicative models designed to predict the asking prices of apartments in Yerevan. The team used multiple regression analysis (MRA) to calibrate the models. This section reports the results of an additive model using the AGAT database (2.4.2) and a multiplicative model using the AREA database (2.4.3). (The team focused on the AGAT and AREA databases because they were larger than the DIA database.) The models possess good explanatory and predictive powers and compare favorably with models developed for similar properties in other countries. In addition, the team applied the AREA multiplicative model to an independent data set of actual sales prices in an attempt to evaluate the probable ratio between actual and asking prices. It appears that this ratio is 0.80 or higher.

2.4.2 AGAT Additive Model

Mass appraisal models may be either additive or multiplicative. Additive models are the simpler and more common. In an additive model, the contribution of each variable upon price is determined and added. The results of an additive model using the AGAT data are reported below.

Exhibit 2-1 shows descriptive statistics for the AGAT data, which include asking prices on 1,059 apartments in Yerevan. The data range from the center of the city (zone A) to the city's outskirts. The typical apartment has three rooms and one balcony. The average size is 77 square meters, of which 42 square meters is living area (exclusive of kitchens, baths, and halls). The average asking price is $23,103. As the last page of the exhibit shows, asking prices vary substantially with zone and subzone, from less than $10,000 to over $40,000 in the most central area.

Exhibits 2-2 through 2-5 show graphs of asking prices with key property characteristics: living area (Exhibit 2-2), zone (Exhibit 2-3), stories (Exhibit 2-4), and story level (Exhibit 2-5). Exhibit 2-2 is an example of a scatter diagram produced by SPSS. Exhibit 2-3 is an example of a "box plot" produced by SPSS. In a "box plot," each category (in this case, zone) is represented by a separate box. In each box, the dark horizontal line shows the median (middle or 50th percentile) price for the zone in question. The top and bottom lines of the box show the 25th and 75th percentiles—half the prices fall within this range. The "whiskers" show the highest and lowest values not considered outliers (extreme values). The circles and stars show outliers. Exhibit 2-5 indicates a general market preference for lower floors (four and below) relative to higher floors.

To develop the model, the research team eliminated from analysis properties for which the attribute data were incomplete. The team also eliminated apartments with unusually low or high asking prices, on the belief that they were unrepresentative of the apartment market. The AGAT

model used 893 properties with asking prices between $10,000 and $150,000 and with complete data on required property characteristics. Exhibit 2-6 presents the model. The adjusted R-Square (second page) is 0.767, indicating that the model is able to explain more than three fourths of the variation in asking prices above and below the average price. Significant variables in the model are living area, other area, zone and subzone, story level (levels three and four are most preferred), construction type and condition, ceiling height, and presence of a garage. All the coefficients have the expected signs and appear reasonable. As shown on the bottom of the third page of the exhibit, the model achieved a median ratio of predicted to actual asking price of 1.025 and a "coefficient of dispersion" (COD) of the ratios of 18.03. The latter indicates that the average difference between actual and predicted asking prices is 18.03 percent. (See section 2.5 for additional information on this type of ratio analysis.)

Exhibits 2-7 through 2-10 show the relationship of estimated-to-actual asking prices with living area, zone, story level, and rooms. Except for categories with relatively few data, the graphs generally show consistency in valuation levels across the range of these key variables.

2.4.3 AREA Multiplicative Model

Except for zones and subzone codes, the AREA data are similar in format to the AGAT data. Exhibit 2-11 shows descriptive statistics for 1,144 sales in the database. Exhibit 2-12 is an example of a histogram produced by SPSS. It depicts the distribution of the asking prices in the form of a bar chart. Exhibits 2-13 and 2-14 show graphs of asking prices per square meter with story level in zones 1 and 3 (zones with the most sales).

In this case, the research team constructed a multiplicative model. In a multiplicative model, the impact of each variable in the model is multiplied rather than added. This requires additional care in model specification and the mathematics are somewhat more complex, requiring the use of logarithms. However, multiplicative models are adept at capturing nonlinear and interactive relationships. They often work better when sales prices exhibit wide variance, making percentage adjustments more advantageous.

All 1,144 asking prices, ranging from $3,000 to $120,000, were used in the model. Exhibit 2-15 shows the results. The model achieves an adjusted R-Square of 0.875 (versus 0.767 for the AGAT additive model). The same characteristics important in the AGAT model also proved important in the AREA model, although the format is different as the adjustments are on a percentage basis. The model achieves a median ratio of predicted to actual asking price of 1.010 and COD of 16.55. Exhibits 2-16 through 2-19 indicate good equity with respect to living area, zone, story level, and estimated asking price.

For explanatory and demonstration purposes, the model was converted to a table or "base home" format (Exhibit 2-20). The base apartment is assumed to be 70 square meters, of which 40 square meters is living area. It has standard construction, is in average condition, has a standard 2.75 meter ceiling height, no garage, and is located on a lower level floor (5 or below) in zone 3.

For such a property, the model projects an asking price of $19,147. The exhibit shows the factors applied for each variation in characteristics. For example, an extra 10 square meters of living area would increase the value by 25 percent and location in zone 6 or 7 would reduce value by 45.7 percent. The exhibit illustrates how a multiplicative model could be converted to table format for value explanation and application purposes (similar in form to the tables in Decision 306)

2.4.4 AGAT Multiplicative Model

Because of the relative success of the multiplicative AREA model structure, the research team also developed a multiplicative model for the AGAT data. As Exhibit 2-21 shows, the model achieves an adjusted R-Square of 0.846 (versus 0.767), median ratio of predicted to actual asking price of 1.002, and COD of 15.4 (versus 18.0). This substantial improvement suggests that a multiplicative structure will work considerably better for such properties. Accordingly, the team illustrated and discussed this approach in the valuation workshop.

2.4.5 Relationship of Actual to Asking Prices

During June and July 1997, with the cooperation of the [Yerevan] Real Estate Registration and Inventory Department and persons registering their apartment purchases, the research team was able to collect data on actual sales prices on 380 transactions, along with property characteristics similar to those provided by brokers. However, the zone characteristic referred to the official zone (1 through 6) versus the zone used by the brokers.

In order to explore the relationship between asking and final prices, the AREA model was applied to this data set to estimate an asking price and to compare this result with the reported actual price. Of the 380 transactions, 353 appeared to be usable sales of apartments with complete data required for analysis. Exhibit 2-22 shows a histogram of these sales prices. The median and mean prices were $8,000 and $9,434, respectively, considerably lower than the central prices observed in the real estate broker data.

Because the zones in the two databases did not correspond, some assumptions had to be made. First, it was assumed that sales in official zone 1, which encompasses AREA zones 1 and 2, follow the same distribution as the AREA data in those two zones. This implies that fully 93 percent of the sales in official zone 1 were in AREA zone 1 and only 7 percent in AREA zone 2. Since values are considerably higher toward the center of the city, a figure below 93 percent would reduce computed asking prices and accordingly the indicated ratio of actual sales prices to asking prices.

Second, it was assumed that values do not decline substantially beyond official zone 3. This assumption was necessary because over half of the actual 353 sales occurred in official zones 4 through 6; which appeared not to have been covered by the brokers' zones. The assumption of constant location value beyond zone 3 may or may not be heroic. Official valuation tables show a

substantial decline. However, a plot of average sale price by zone shows little change (Exhibit 2-23).

Finally, the research team also assumed that prices were reported correctly. That is, the reported price was assumed to be the price actually paid for the property.

With the above assumptions in mind, Exhibit 2-24 displays a histogram of the ratio of actual sales prices to estimated asking prices. The ratios range from 0.256 to 1.899, due to both model and market imperfections. The median and mean ratios are 0.845 and 0.870, respectively. If one focuses just on official zone 2, which appears to correspond well with AREA zone 3 and for which 55 usable sales are available, the corresponding figures are 0.787 and 0.824. These results suggest a maximum discount rate in the range of 15-20 percent. Relatively mild relaxation of the rather stringent assumptions discussed above could reduce the range to the 5-10 percent often suggested by brokers and other market observers.

2.5 Comparison of Estimated Market Values to Decision 306 Values

Using the data on actual sales prices described in 2.4.5 above, Decision 306 values were compared with reported actual prices to help evaluate the relationship between the two sets of values and the effect of shifting to market-based assessments.

A comparison of the two values involves a "ratio study," which is a type of statistical analysis commonly used in North America and elsewhere. In a ratio study, ratios (R) of the estimates produced by the property tax administration (A) are compared to independent indicators of market value, usually sales prices (S), as in the following formula:

$$R = A/S.$$

Ratio study statistics describe the level of the ratios, as indicated by the median or mean ratio, and the uniformity of the ratios, as indicated by the COD described in 2.4.2 above. These statistics are generally calculated by key property characteristics, such as zone, size, and story level, to detect whether some types of property are valued more accurately than others. Chapter 20 of Eckert et al. (1990) contains detailed information on making ratio studies.

Exhibit 2-25 presents medians and CODs for the 353 available sales, including results by zone, size groups, and selected floor level groupings. The overall median ratio is 0.368, indicating that Decision 306 values are typically only 36.8 percent of current market levels. The overall COD is 35.0, indicating that ratios differ from the median by 35.0 percent on average. In other words, an apartment owner would typically be either under- or over-assessed by 35 percent relative to the typical apartment tax payer. Such a high figure is generally regarded as unacceptable. Exhibit 2-25 also reveals some inequities by property groups, most notably zone. Finally, Exhibits 2-26, 2-27, and 2-28 show ratios by zone, living area, and story level graphically. In a

reassessment, equity would be evaluated based on other property characteristics in a similar manner.

A shift to market value assessment could be expected to have certain definite results in terms of sales ratio statistics. First, the overall level of assessment (as indicated by the median ratio) would be much closer to 100 percent. Second, the equity of assessment, as indicated by the COD and graphical analyses, should improve considerably. Based on the exploratory models discussed in section 2.4 above, inequities would be cut at least in half. Further, the generally higher and more realistic level of assessment would have greater credibility and alert owners to potential over-valuations due to data errors or other administrative shortfalls.

2.6 Cost-Benefit Considerations

A factor influencing the decision on whether to convert to a market-based system of property taxation is whether the benefits of doing so exceed the costs. The Market-Based Land and Property Assessment Project was designed to shed light on cost-benefit issues. As with many areas of government activity, measuring costs and benefits in property tax administration is conceptually and practically difficult. Measures of increased effectiveness generally are used to represent the direct benefits of a better system of property tax administration. However, benefits depend on one's point of view. For example, increased accuracy in appraisals results in greater equity overall but means some taxpayers pay relatively less in property taxes while others pay more. Costs also are elusive, as a reduction in the costs of tax administration often is obtained by increasing taxpayer compliance costs, which are not accounted for. Conceptually, cost-effectiveness combines measures of effectiveness with measures of efficiency.

2.6.1 Benefits

Effectiveness (or benefit) measures in property taxation include (1) increasing coverage (that is, reducing the number of properties that escape taxation altogether), (2) increasing appraisal accuracy (more about this below), and (3) increasing collection efficiency (that is, collecting close to 100 percent of the taxes levied).

There are two dimensions to increasing appraisal accuracy. The first is to bring the overall level of valuation closer to current market levels. That is, the average (or median) ratio of estimated market values to actual sales prices should approach 1.0 (or 100 percent). The research team's valuation methodology (multiple regression analysis) automatically produces overall ratios near 1.0. In contrast, Decision 306 values for Yerevan apartments currently appear to be less than 40 percent of market values. Of course, one could simply apply a coefficient of approximately 2.5 to bring Decision 306 values into line with market values. Doing so, however, would do nothing to correct any other inadequacies in the Decision 306 valuation formula.

Exhibit 2-1 Descriptive Statistics - AGAT Data

ZONE Zone

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	A	246	23.2	23.2	23.2
	B	166	15.7	15.7	38.9
	C	205	19.4	19.4	58.3
	D	137	12.9	12.9	71.2
	E	2	.2	.2	71.4
	F	141	13.3	13.3	84.7
	H	105	9.9	9.9	94.6
	O	30	2.8	2.8	97.5
	Z	27	2.5	2.5	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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SUBZONE SubZone

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	522	49.3	49.3	49.3
	2	364	34.4	34.4	83.7
	3	144	13.6	13.6	97.3
	4	20	1.9	1.9	99.2
	5	9	.8	.8	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

DESCRIPTIVE STATISTICS - AGAT DATA

NROOMS Number of Rooms

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	170	16.1	16.1	16.1
	2	341	32.2	32.2	48.3
	3	478	45.1	45.1	93.4
	4	63	5.9	5.9	99.3
	5	7	.7	.7	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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STORIES Number of stories in the building

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	1	.1	.1	.1
	2	3	.3	.3	.4
	3	34	3.2	3.2	3.6
	4	148	14.0	14.0	17.6
	5	368	34.7	34.7	52.3
	6	24	2.3	2.3	54.6
	7	18	1.7	1.7	56.3
	8	7	.7	.7	56.9
	9	260	24.6	24.6	81.5
	10	46	4.3	4.3	85.8
	11	23	2.2	2.2	88.0
	12	38	3.6	3.6	91.6
	13	3	.3	.3	91.9
	14	41	3.9	3.9	95.8
	15	2	.2	.2	95.9
	16	43	4.1	4.1	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

DESCRIPTIVE STATISTICS - AGAT DATA

STORY Story

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.0	90	8.5	8.5	8.5
	1.5	91	8.6	8.6	17.1
	2.0	169	16.0	16.0	33.1
	3.0	154	14.5	14.5	47.6
	4.0	155	14.6	14.6	62.2
	5.0	147	13.9	13.9	76.1
	6.0	54	5.1	5.1	81.2
	7.0	53	5.0	5.0	86.2
	8.0	49	4.6	4.6	90.8
	9.0	49	4.6	4.6	95.5
	10.0	16	1.5	1.5	97.0
	11.0	9	.8	.8	97.8
	12.0	13	1.2	1.2	99.1
	13.0	5	.5	.5	99.5
	14.0	3	.3	.3	99.8
	16.0	2	.2	.2	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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BLDTYPE Building type

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Stone, concr.	1	494	46.6	46.6	46.6
Stone, wood	2	89	8.4	8.4	55.1
Highrise-panel	3	453	42.8	42.8	97.8
Panel	4	3	.3	.3	98.1
Prefabricated	5	20	1.9	1.9	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

DESCRIPTIVE STATISTICS - AGAT DATA

CEILING Ceiling

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
2.75m	1	774	73.1	73.1	73.1
more than 3m	2	221	20.9	20.9	94.0
2.5m-2.6m	3	64	6.0	6.0	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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FLATCOND Condition of Flat (repair)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Bad	1	333	31.4	31.4	31.4
Average	2	477	45.0	45.0	76.5
Good	3	212	20.0	20.0	96.5
Excellent	4	37	3.5	3.5	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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XOZBALC Number of big balconies

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	252	23.8	23.8	23.8
	1	773	73.0	73.0	96.8
	2	33	3.1	3.1	99.9
	3	1	.1	.1	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

DESCRIPTIVE STATISTICS - AGAT DATA

PARBALC Number of small balconies facing the str

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	886	83.7	83.7	83.7
	1	163	15.4	15.4	99.1
	2	7	.7	.7	99.7
	3	2	.2	.2	99.9
	5	1	.1	.1	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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LODJIA Number of ? balconies

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	1003	94.7	94.7	94.7
	1	53	5.0	5.0	99.7
	2	2	.2	.2	99.9
	3	1	.1	.1	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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GARAGE Garage

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
No	0	960	90.7	90.7	90.7
Yes	1	99	9.3	9.3	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

DESCRIPTIVE STATISTICS - AGAT DATA

BASEMENT Basement

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
No	0	917	86.6	86.6	86.6
Yes	1	142	13.4	13.4	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

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ADDCONST Additional Construction

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
No	0	1038	98.0	98.0	98.0
Yes	1	21	2.0	2.0	100.0
	Total	1059	100.0	100.0	

Valid cases 1059 Missing cases 0

Variable	Mean	Std Dev	Minimum	Maximum	Valid N	Label
TOTAREA	76.76	24.12	29.00	230.00	1059	Total Area
LIVAREA	42.13	15.19	12.00	120.00	1059	Living Area
PRICE	23103.40	16256.06	$5,000.00	$180000.0	1059	Asking Price

DESCRIPTIVE STATISTICS - AGAT DATA

- - Description of Subpopulations - -

Summaries of	PRICE	Asking Price
By levels of	ZONE	Zone
	SUBZONE	SubZone

Variable	Value	Label	Mean	Std Dev	Cases
For Entire Population			23103.3994	16256.0573	1059
ZONE	A		38460.5691	21295.5708	246
SUBZONE	1		41158.4906	22243.7057	159
SUBZONE	2		33529.8851	18570.9708	87
ZONE	B		27357.8313	13274.7892	166
SUBZONE	1		30692.1053	14827.4948	76
SUBZONE	2		24542.2222	11131.8954	90
ZONE	C		23410.0000	10082.1496	205
SUBZONE	1		23771.2903	9453.8076	155
SUBZONE	2		22290.0000	11857.9389	50
ZONE	D		12871.1679	4934.7124	137
SUBZONE	1		16112.5000	6088.9928	16
SUBZONE	2		13466.3043	4284.1057	46
SUBZONE	3		11814.6667	4738.6192	75
ZONE	E		12400.0000	4808.3261	2
SUBZONE	1		9000.0000	.	1
SUBZONE	4		15800.0000	.	1
ZONE	F		13250.0000	4680.1290	141
SUBZONE	1		15247.5000	4832.9863	20
SUBZONE	2		14739.6552	4618.3060	58
SUBZONE	3		11798.8636	3867.7631	44
SUBZONE	4		11190.0000	3349.1127	10
SUBZONE	5		8594.4444	3938.4677	9
ZONE	H		11259.5238	3620.0304	105
SUBZONE	1		11803.1250	4007.4984	48
SUBZONE	2		10741.6667	3362.8296	24
SUBZONE	3		10852.0000	3570.9616	25
SUBZONE	4		10825.0000	1494.5138	8
ZONE	O		11806.6667	3771.8726	30
SUBZONE	1		12090.0000	3915.8450	20
SUBZONE	2		10622.2222	3203.0368	9
SUBZONE	4		16800.0000	.	1
ZONE	Z		17477.7778	8258.2049	27
SUBZONE	1		17477.7778	8258.2049	27

Exhibit 2-2

Graph of Price and Living Area - AGAT Data

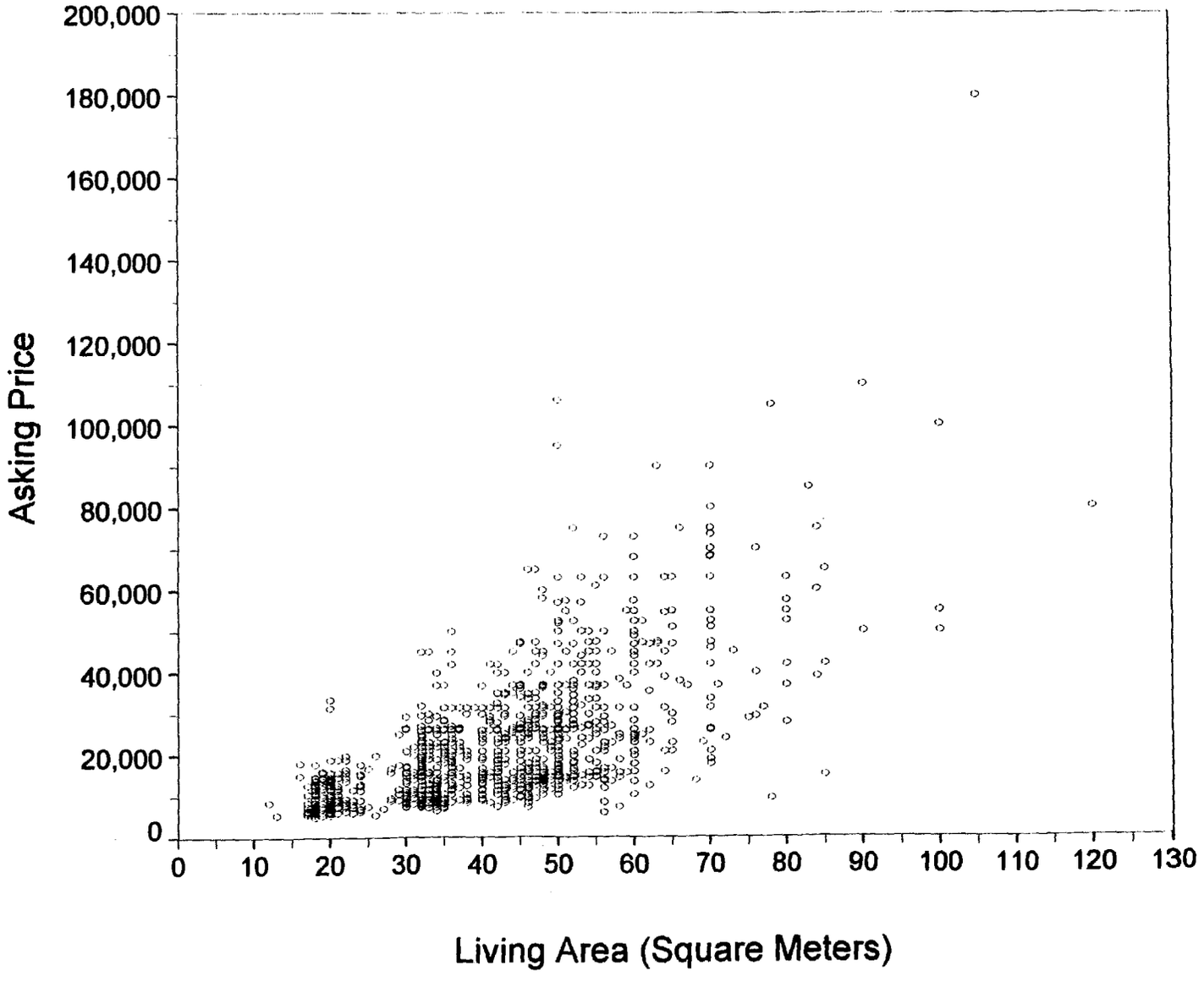


Exhibit 2-3

Graph of Price with Zone - AGAT Data

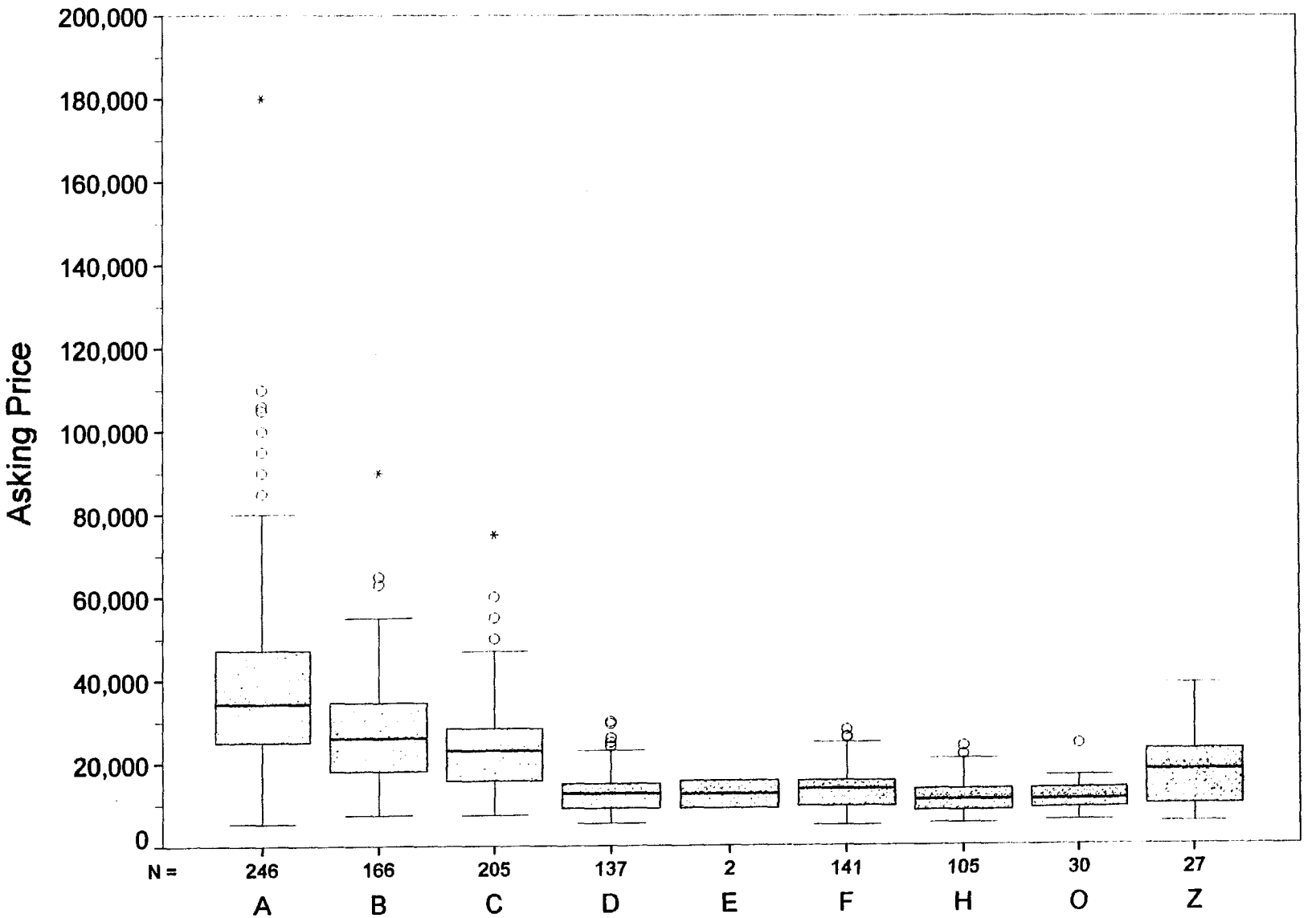


Exhibit 2-4

Graph of Price with Stories - AGAT Data

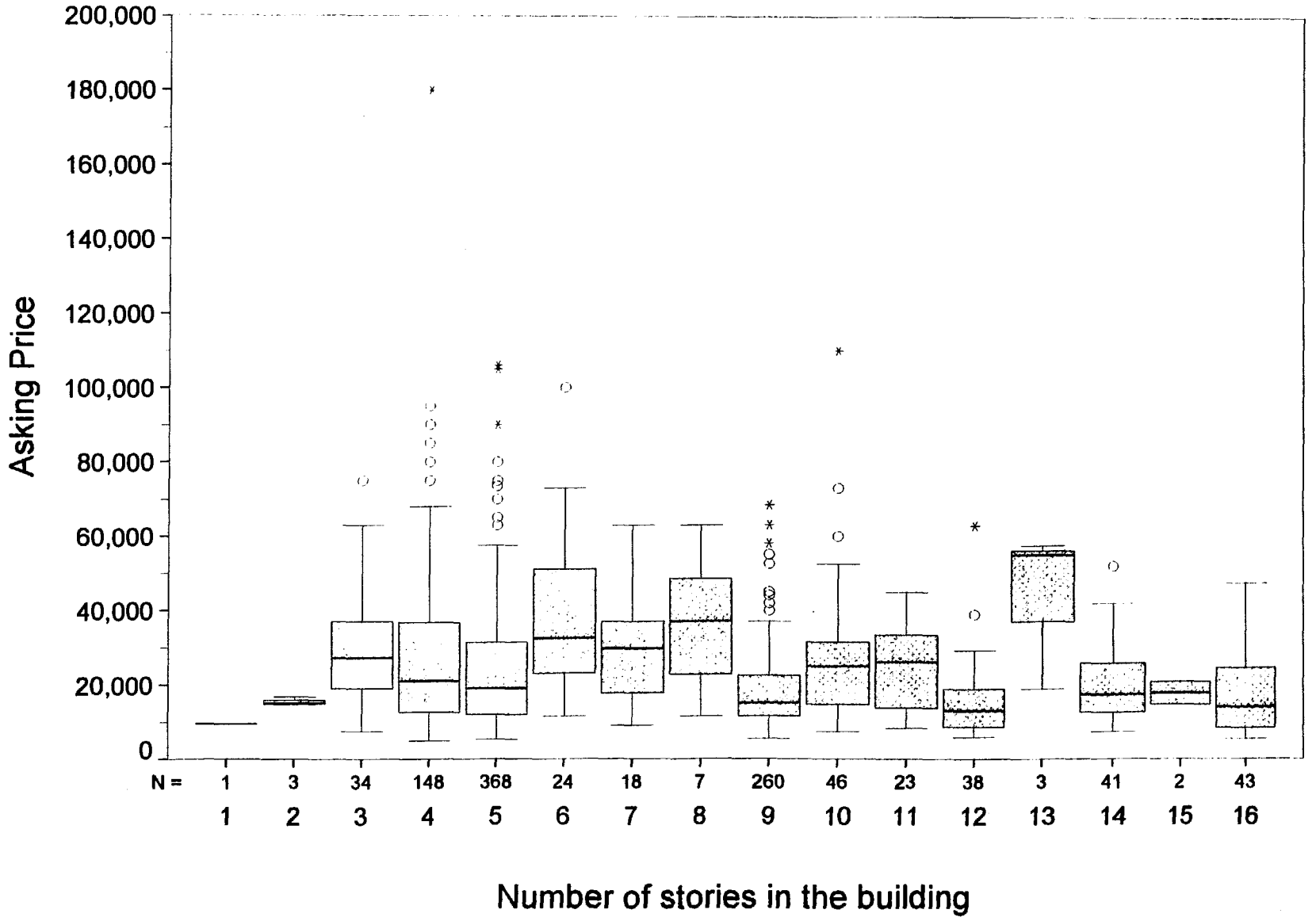


Exhibit 2-5

Graph of Price with Story Level - AGAT Data

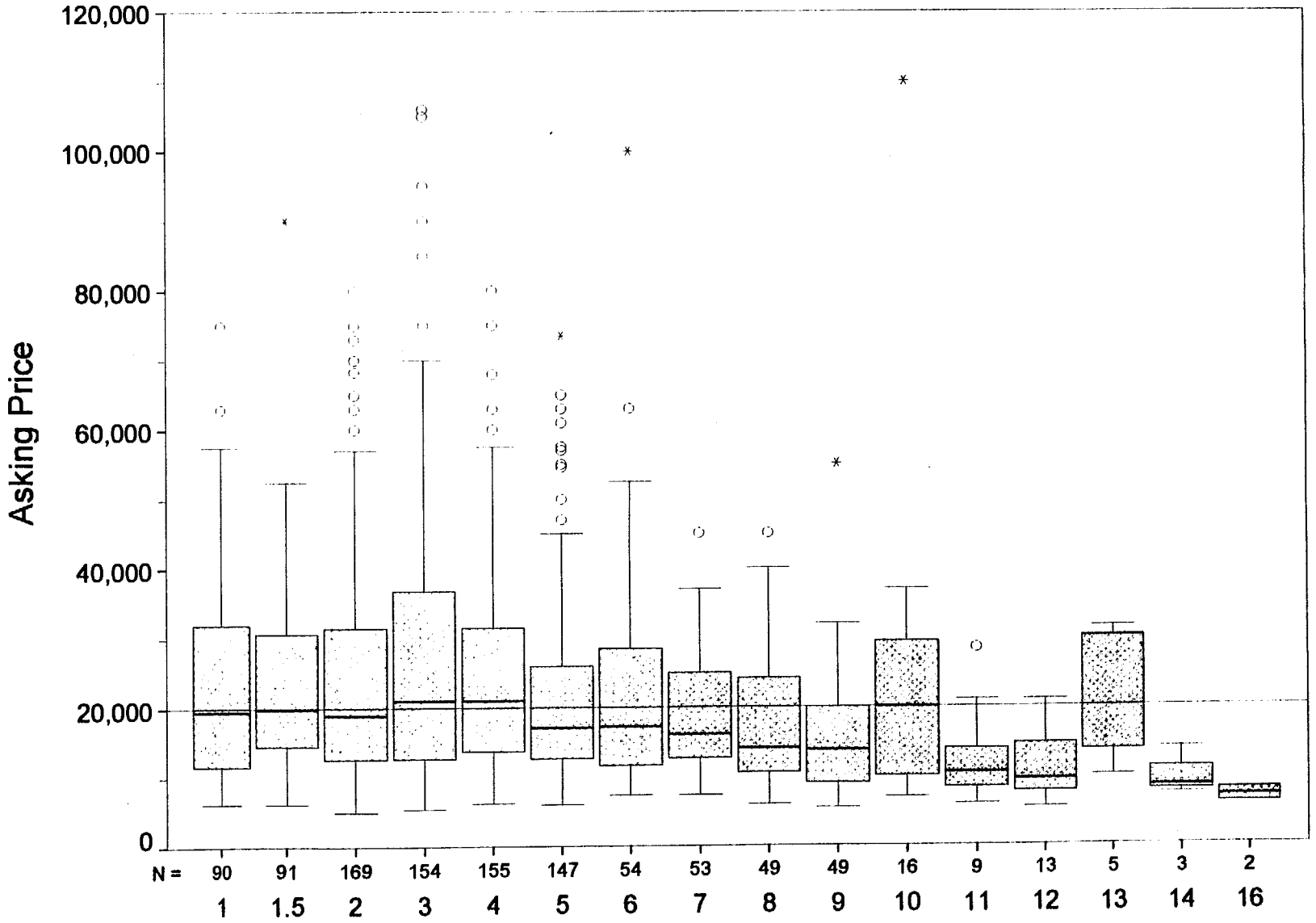


Exhibit 2-6
Additive Regression Analysis - AGAT DATA
(Asking Prices of $10,000 - $150,000)

* * * * M U L T I P L E R E G R E S S I O N * * * *

	Mean	Std Devia	Label
PRICE	25720.941	15376.809	Asking price
LIVAREA	44.679	14.369	Living area
OTHAREA	36.180	11.436	Other area
ONEROOM	.097	.297	One room apartment
STORY34	.305	.460	Story 3 or 4
STORY_HI	.357	.479	High story
STONE_WD	.097	.297	Stone walls with wood ceiling
PANEL	.427	.495	Panel construction
CEIL_LO	.043	.202	Low ceiling
CEIL_HI	.230	.421	High ceiling
COND_ADJ	.006	.828	Condition adjustment
XOZ_ADJ	-.186	.480	Mumber of large rear balconies
PARBALC	.186	.451	Number of small balconies
LODJIA	.060	.261	Number of lodjia balconies
GARAGE	.109	.311	Garage
BASEMENT	.143	.351	Basement
ADDCONST	.022	.148	Added area
ZONE_A1	8.197	19.136	
ZONE_A2	4.467	15.053	
ZONE_B1	3.882	13.575	
ZONE_B2	4.038	13.452	
ZONE_C2	2.072	9.447	
ZON_DH1	2.804	10.763	
ZON_D2F2	4.729	14.574	
ZON_DFH3	4.546	13.618	
ZON_EH45	.871	6.734	
ZONE_O	1.000	6.855	
ZONE_Z	1.065	7.302	

N of Cases = 893

Exhibit 2-6
Additive Regression Analysis - AGAT DATA
(Asking Prices of $10,000 - $150,000)

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent Variable.. PRICE Asking Price

Block Number 1. Method: Stepwise Criteria: PIN .10 POUT .15

Step	MultR	Rsq	F(Eqn)	SigF		Variable	BetaIn
1	.5805	.3370	452.823	.000	In:	LIVAREA	.5805
2	.7195	.5177	477.742	.000	In:	ZONE_A1	.4383
3	.7612	.5795	408.356	.000	In:	ZONE_A2	.2592
4	.7846	.6156	355.516	.000	In:	ZONE_B1	.1965
5	.7979	.6366	310.796	.000	In:	COND_ADJ	.1469
6	.8102	.6564	282.134	.000	In:	ZONE_B2	.1462
7	.8211	.6743	261.715	.000	In:	OTHAREA	.1600
8	.8325	.6931	249.554	.000	In:	PANEL	-.1446
9	.8394	.7045	233.951	.000	In:	ZON_DFH3	-.1128
10	.8495	.7216	228.661	.000	In:	ZON_D2F2	-.1450
11	.8558	.7324	219.180	.000	In:	ZON_EH45	-.1068
12	.8615	.7422	211.140	.000	In:	ZON_DH1	-.1071
13	.8667	.7511	204.039	.000	In:	ZONE_O	-.0997
14	.8704	.7576	195.960	.000	In:	GARAGE	.0840
15	.8725	.7613	186.444	.000	In:	ZONE_Z	-.0647
16	.8748	.7652	178.451	.000	In:	STORY_HI	-.0690
17	.8770	.7691	171.472	.000	In:	STONE_WD	-.0727
18	.8778	.7705	163.022	.000	In:	ADDCONST	-.0379
19	.8784	.7717	155.276	.000	In:	CEIL_HI	.0463
20	.8790	.7726	148.139	.000	In:	STORY34	.0357

Variable(s) Entered on Step Number
20.. STORY34

Multiple R	.87898
R Square	.77261
Adjusted R Square	.76739
Standard Error	7416.15174

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	20	162950658080.44530	8147532904.02227
Residual	872	47959395329.40900	54999306.57042

F = 148.13883 Signif F = .0000

Exhibit 2-6
Additive Regression Analysis - AGAT DATA
(Asking Prices of $10,000 - $150,000)

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
LIVAREA	390.086761	25.586215	.364529	15.246	.0000
OTHAREA	229.942616	26.662922	.171013	8.624	.0000
STORY34	1193.060072	625.912498	.035729	1.906	.0570
STORY_HI	-1716.957859	643.174541	-.053535	-2.670	.0077
STONE_WD	-4810.428028	1070.487720	-.092819	-4.494	.0000
PANEL	-2350.753926	626.867969	-.075654	-3.750	.0002
CEIL_HI	1658.537316	804.137348	.045386	2.063	.0395
COND_ADJ	2707.399812	313.773083	.145718	8.629	.0000
GARAGE	4115.971209	845.657589	.083337	4.867	.0000
ADDCONST	-3628.077386	1719.221850	-.034932	-2.110	.0351
ZONE_A1	332.931555	18.732469	.414328	17.773	.0000
ZONE_A2	182.159563	20.945477	.178327	8.697	.0000
ZONE_B1	83.961274	21.942500	.074125	3.826	.0001
ZONE_B2	41.478797	22.045147	.036288	1.882	.0602
ZON_DH1	-187.249646	25.640160	-.131065	-7.303	.0000
ZON_D2F2	-229.913982	20.765100	-.217909	-11.072	.0000
ZON_DFH3	-242.367401	21.355485	-.214648	-11.349	.0000
ZON_EH45	-319.056709	38.870770	-.139720	-8.208	.0000
ZONE_O	-237.596277	38.645794	-.105913	-6.148	.0000
ZONE_Z	-134.305496	36.171139	-.063779	-3.713	.0002
(Constant)	269.423483	1045.878825		.258	.7968

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
ONEROOM	-.010332	-.017209	.368665	-.508	.6116
CEIL_LO	-.008233	-.016555	.455933	-.489	.6252
XOZ_ADJ	.021213	.042343	.455911	1.251	.2113
PARBALC	.013702	.027676	.454942	.817	.4141
LODJIA	.001275	.002621	.454983	.077	.9384
BASEMENT	.016190	.031565	.453566	.932	.3516
ZONE_C2	-.015797	-.029587	.421539	-.874	.3826

End Block Number 1 PIN = .100 Limits reached.

RATIO

Mean	1.040	Std err	.008	Median	1.025
Mode	.882	Std dev	.242	Variance	.059
Kurtosis	2.213	S E Kurt	.163	Skewness	.771
S E Skew	.082	Range	2.063	Minimum	.320
Maximum	2.382	Sum	928.667	COD	18.03

Valid cases 893 Missing cases 0

Exhibit 2-7

Graph of Ratios with Living Area

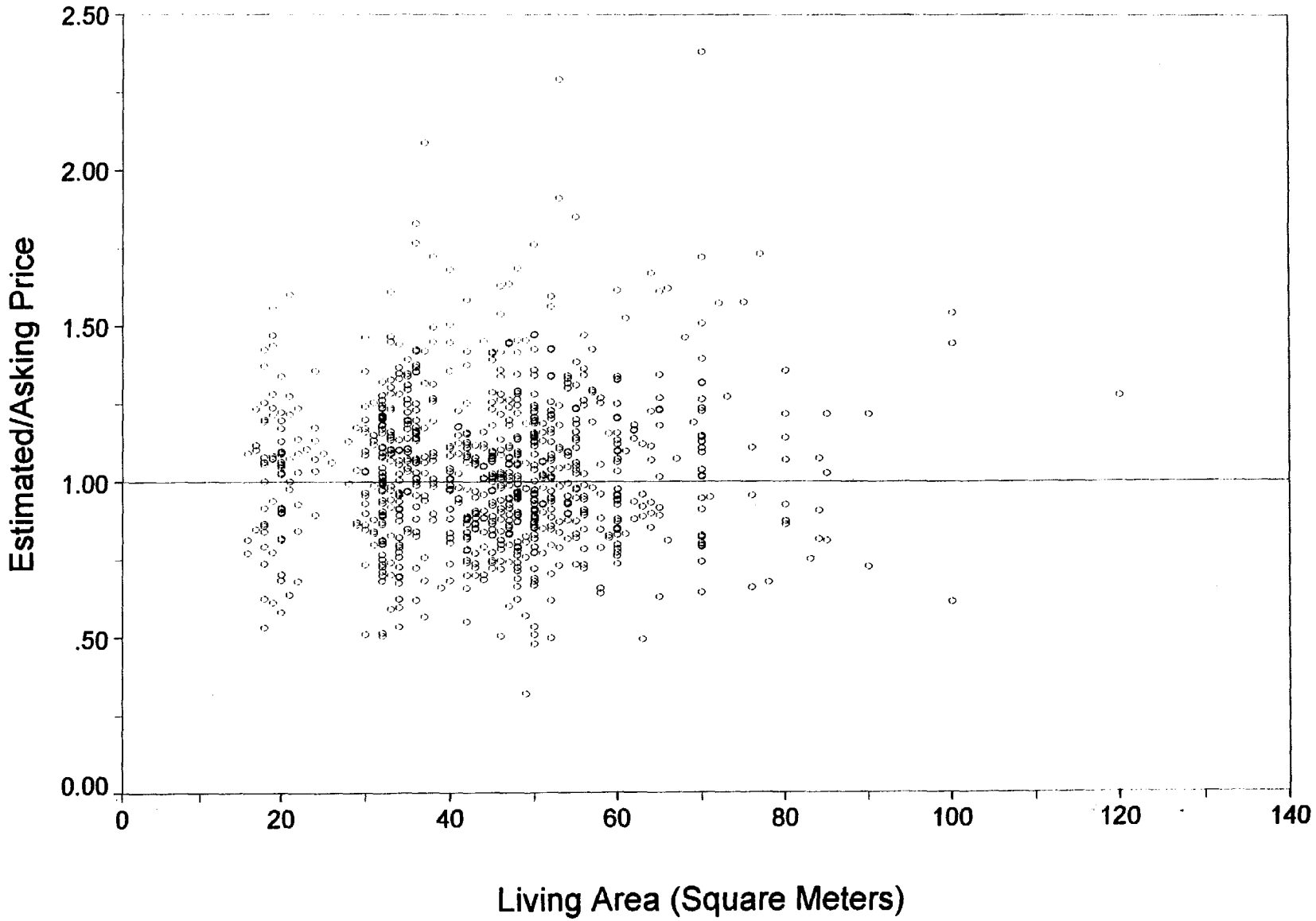


Exhibit 2-8

Graph of Ratios with Zone

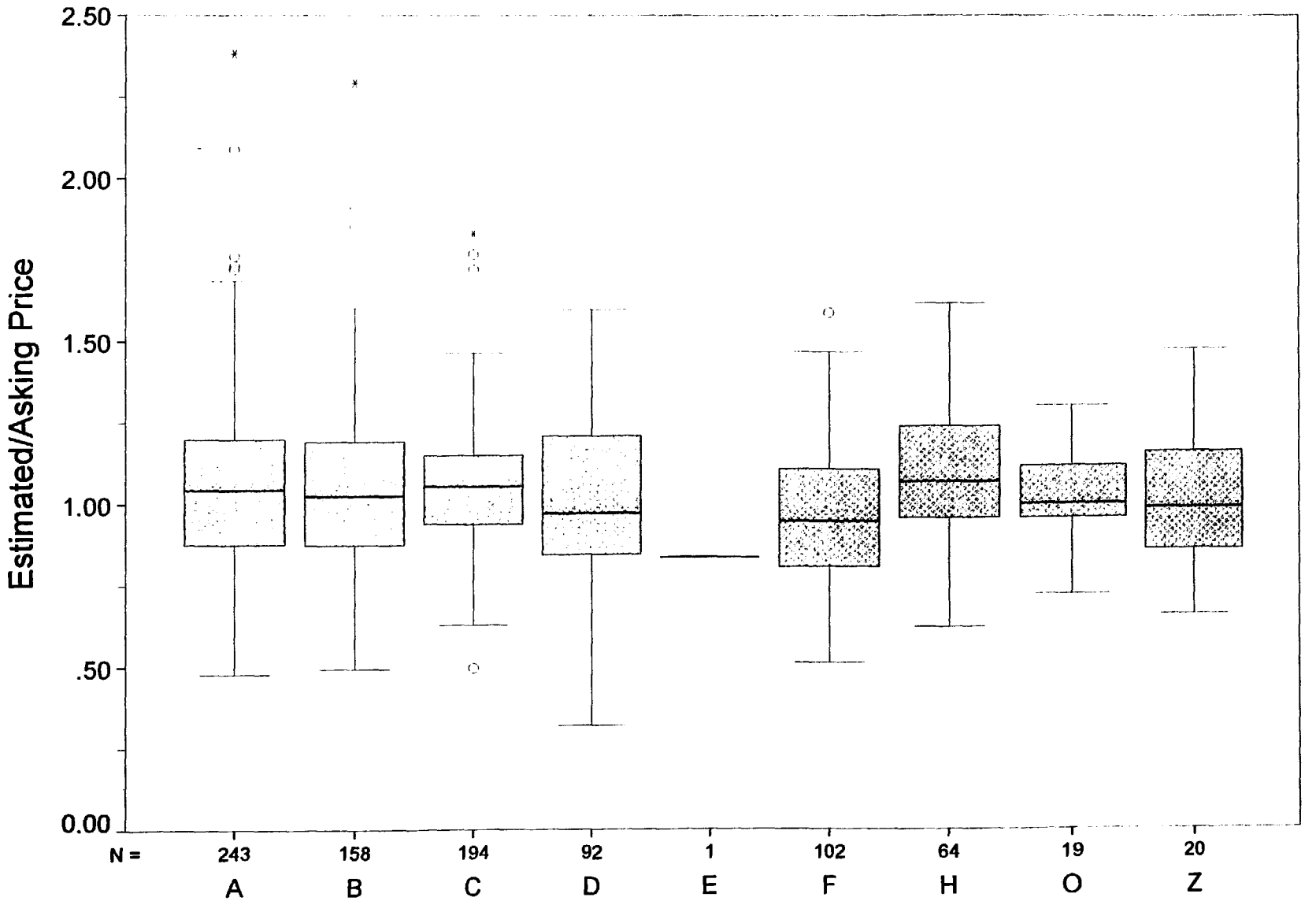


Exhibit 2-9

Graph of Ratios with Story Level

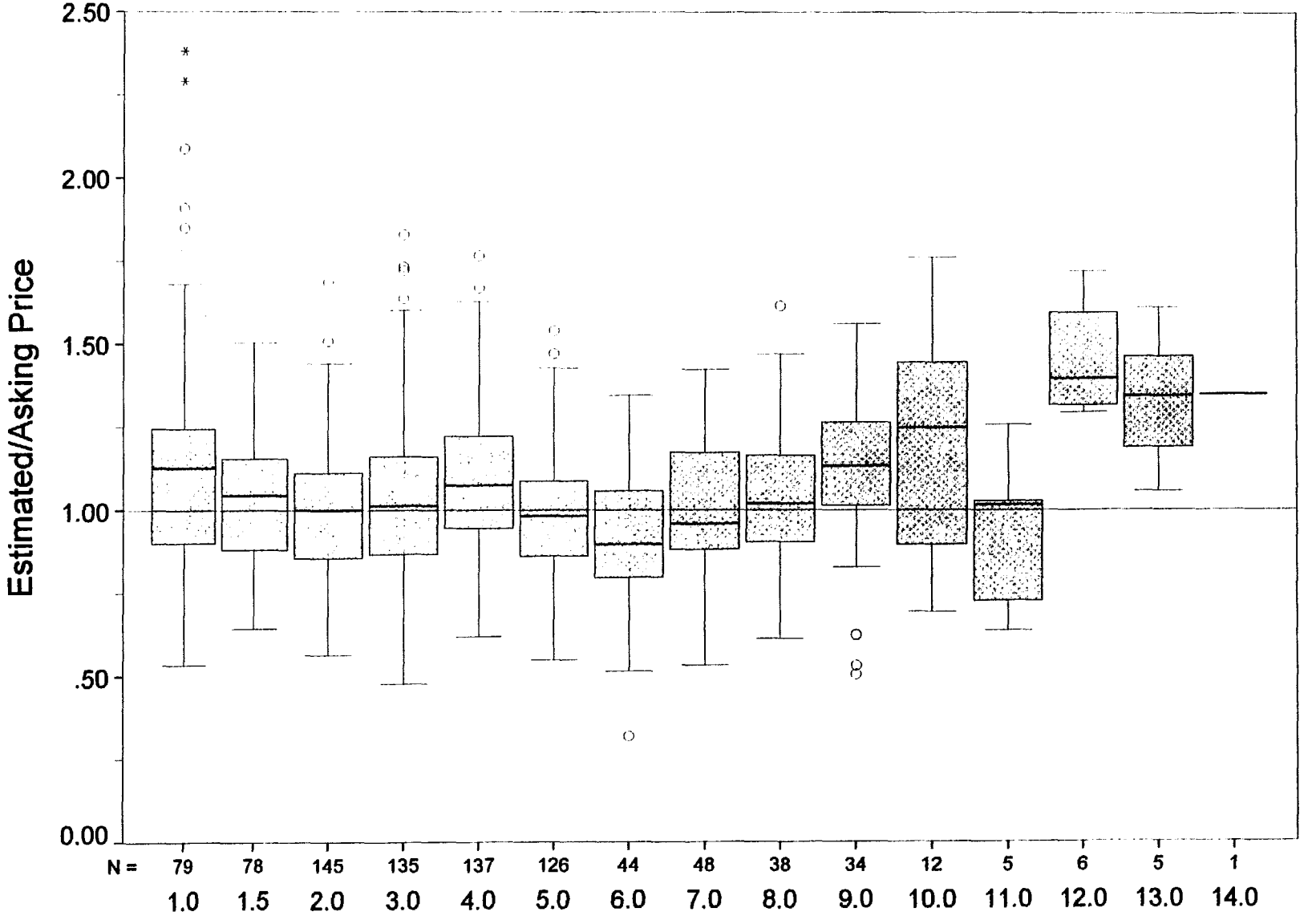


Exhibit 2-10

Graph of Ratios with Rooms

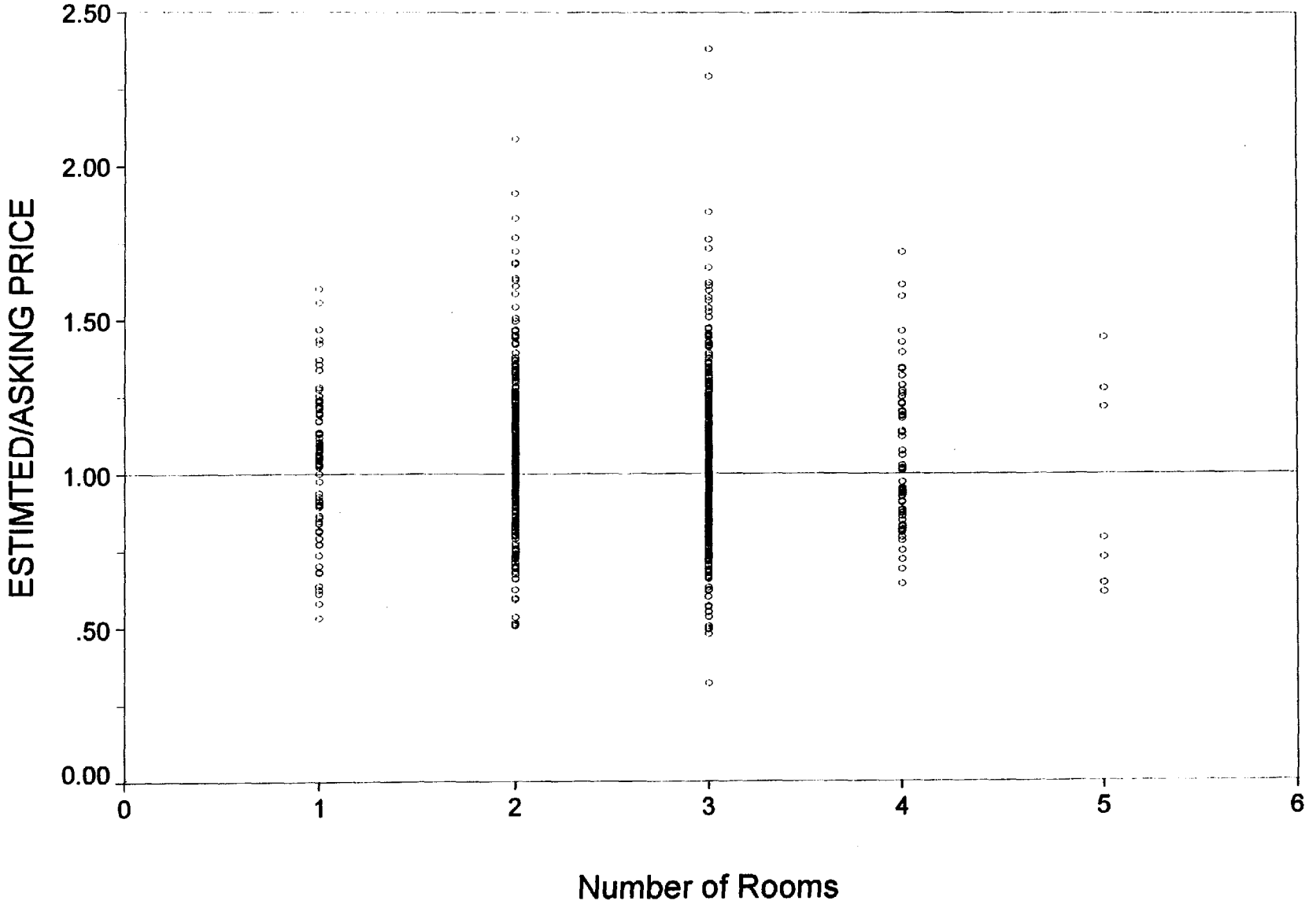


Exhibit 2-11
Descriptive Statistics - Area Data

ZONE Zone

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	316	27.6	27.6	27.6
	2	24	2.1	2.1	29.7
	3	382	33.4	33.4	63.1
	4	183	16.0	16.0	79.1
	5	138	12.1	12.1	91.2
	6	85	7.4	7.4	98.6
	7	16	1.4	1.4	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

- -

SUBZONE SubZone

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	83	7.3	7.3	7.3
	1	307	26.8	26.8	34.1
	2	240	21.0	21.0	55.1
	3	410	35.8	35.8	90.9
	4	65	5.7	5.7	96.6
	5	33	2.9	2.9	99.5
	6	6	.5	.5	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

Exhibit 2-11
Descriptive Statistics - Area Data

NROOMS Number of Rooms

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	289	25.3	25.3	25.3
	2	353	30.9	30.9	56.1
	3	391	34.2	34.2	90.3
	4	111	9.7	9.7	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

- -

STORIES Number of stories in the building

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2	2	.2	.2	.2
	3	25	2.2	2.2	2.4
	4	138	12.1	12.1	14.4
	5	434	37.9	37.9	52.4
	6	30	2.6	2.6	55.0
	7	20	1.7	1.7	56.7
	8	5	.4	.4	57.2
	9	291	25.4	25.4	82.6
	10	22	1.9	1.9	84.5
	11	20	1.7	1.7	86.3
	12	34	3.0	3.0	89.2
	13	5	.4	.4	89.7
	14	49	4.3	4.3	94.0
	15	5	.4	.4	94.4
	16	64	5.6	5.6	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

Exhibit 2-11
Descriptive Statistics - Area Data

STORY Story

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	168	14.7	14.7	14.7
	2	185	16.2	16.2	30.9
	3	199	17.4	17.4	48.3
	4	173	15.1	15.1	63.4
	5	149	13.0	13.0	76.4
	6	70	6.1	6.1	82.5
	7	59	5.2	5.2	87.7
	8	45	3.9	3.9	91.6
	9	35	3.1	3.1	94.7
	10	14	1.2	1.2	95.9
	11	17	1.5	1.5	97.4
	12	7	.6	.6	98.0
	13	12	1.0	1.0	99.0
	14	5	.4	.4	99.5
	15	3	.3	.3	99.7
	16	3	.3	.3	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

- -

BLDTYPE Building Type

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Stone, concr. ceilin	1	524	45.8	45.8	45.8
Stone, wooden ceilin	2	76	6.6	6.6	52.4
Highrise-panel	3	495	43.3	43.3	95.7
Panel	4	25	2.2	2.2	97.9
Prefabricated	5	24	2.1	2.1	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

Exhibit 2-11
Descriptive Statistics - Area Data

CEILING Height of ceiling

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
2.75m	1	856	74.8	74.8	74.8
more than 3m	2	233	20.4	20.4	95.2
2.5m-2.6m	3	55	4.8	4.8	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

- -

FLATCOND Condition of Flat

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Bad	1	49	4.3	4.3	4.3
Average	2	711	62.2	62.2	66.4
Good	3	314	27.4	27.4	93.9
Excellent	4	70	6.1	6.1	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

- -

GARAGE Garage

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
No	0	1056	92.3	92.3	92.3
Yes	1	88	7.7	7.7	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

Exhibit 2-11
Descriptive Statistics - Area Data

BASEMENT Basement

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
No	0	1008	88.1	88.1	88.1
Yes	1	136	11.9	11.9	100.0
	Total	1144	100.0	100.0	

Valid cases 1144 Missing cases 0

Variable	Mean	Std Dev	Minimum	Maximum	Valid N	Label
TOTAREA	72.11	23.63	26.00	220.00	1144	Total Area
LIVAREA	38.97	14.89	12.00	100.00	1144	Living Area
PRICE	20875.46	13800.58	3000.00	120000.00	1144	Asking Price

Exhibit 2-11
Descriptive Statistics - Area Data

- - Description of Subpopulations - -

Summaries of PRICE Asking Price
By levels of ZONE Zone and SUBZONE

Variable	Value	Label	Mean	Std Dev	Cases
ZONE	1		31879.4304	16252.3177	316
SUBZONE	1		31931.3993	16297.3894	293
SUBZONE	2		31217.3913	16005.5573	23
ZONE	2		25883.3333	16615.4895	24
SUBZONE	2		25883.3333	16615.4895	24
ZONE	3		21341.0995	10279.1720	382
SUBZONE	1		24000.0000	14431.5360	14
SUBZONE	2		23341.5094	11464.5681	53
SUBZONE	3		20914.3770	9825.2953	313
SUBZONE	4		16500.0000	13435.0288	2
ZONE	4		14092.3497	7465.2563	183
SUBZONE	1		17495.4545	10492.5133	22
SUBZONE	2		15066.1290	8018.0318	62
SUBZONE	3		12506.2500	5521.5085	32
SUBZONE	4		12906.6667	6102.7881	60
SUBZONE	5		12185.7143	6619.7756	7
ZONE	5		10557.9710	3615.6758	138
SUBZONE	1		11388.5714	3925.8398	35
SUBZONE	2		11059.4595	3397.2587	37
SUBZONE	3		10731.4286	3556.2514	35
SUBZONE	5		8424.0000	2959.0652	25
SUBZONE	6		10500.0000	3549.6479	6
ZONE	6		9879.1765	4121.1996	85
SUBZONE	1		8481.8182	3256.8808	22
SUBZONE	2		10355.5556	4302.8525	36
SUBZONE	3		10536.0870	4195.7281	23
SUBZONE	4		7000.0000	4000.0000	3
SUBZONE	5		17000.0000	.	1
ZONE	7		9906.2500	4153.6279	16
SUBZONE	1		11375.0000	7215.4348	4
SUBZONE	2		8440.0000	1656.2005	5
SUBZONE	3		10114.2857	3462.8642	7

Total Cases = 1144

Exhibit 2-12

Graph of Asking Prices - AREA Data

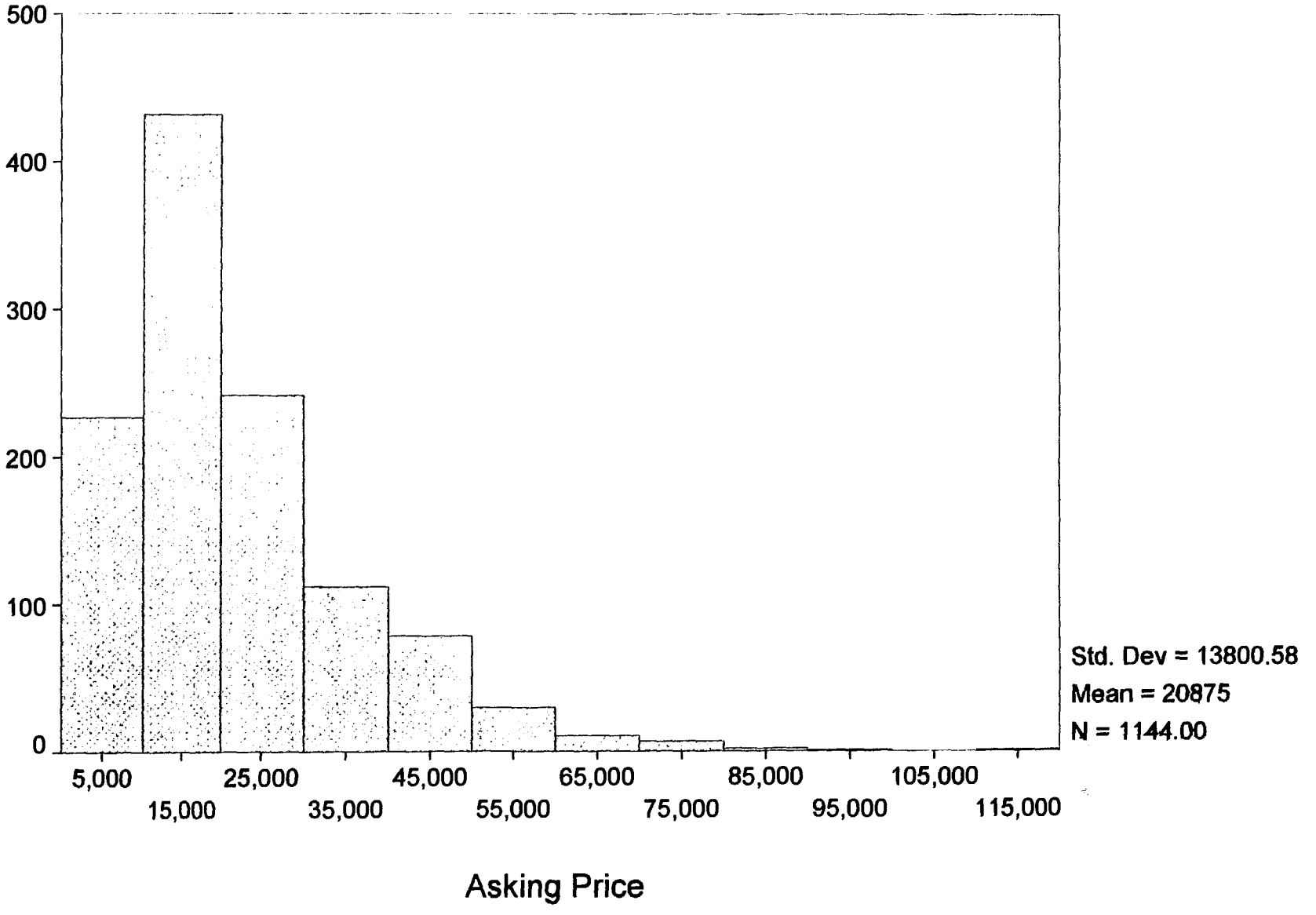


Exhibit 2-13

Graph of Price PSM with Story - Zone 1

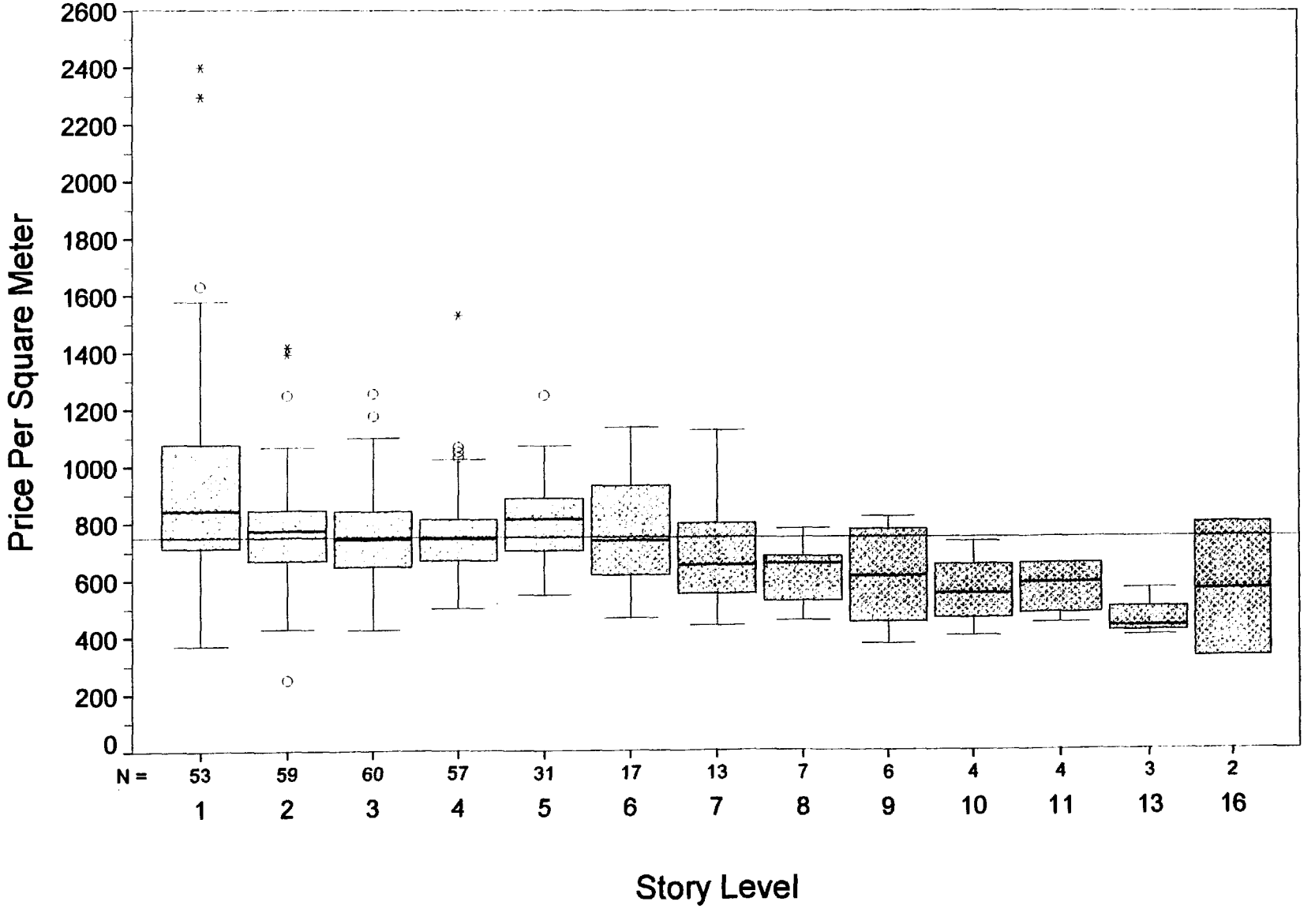


Exhibit 2-14

Graph of Price PSM with Story - Zone 3

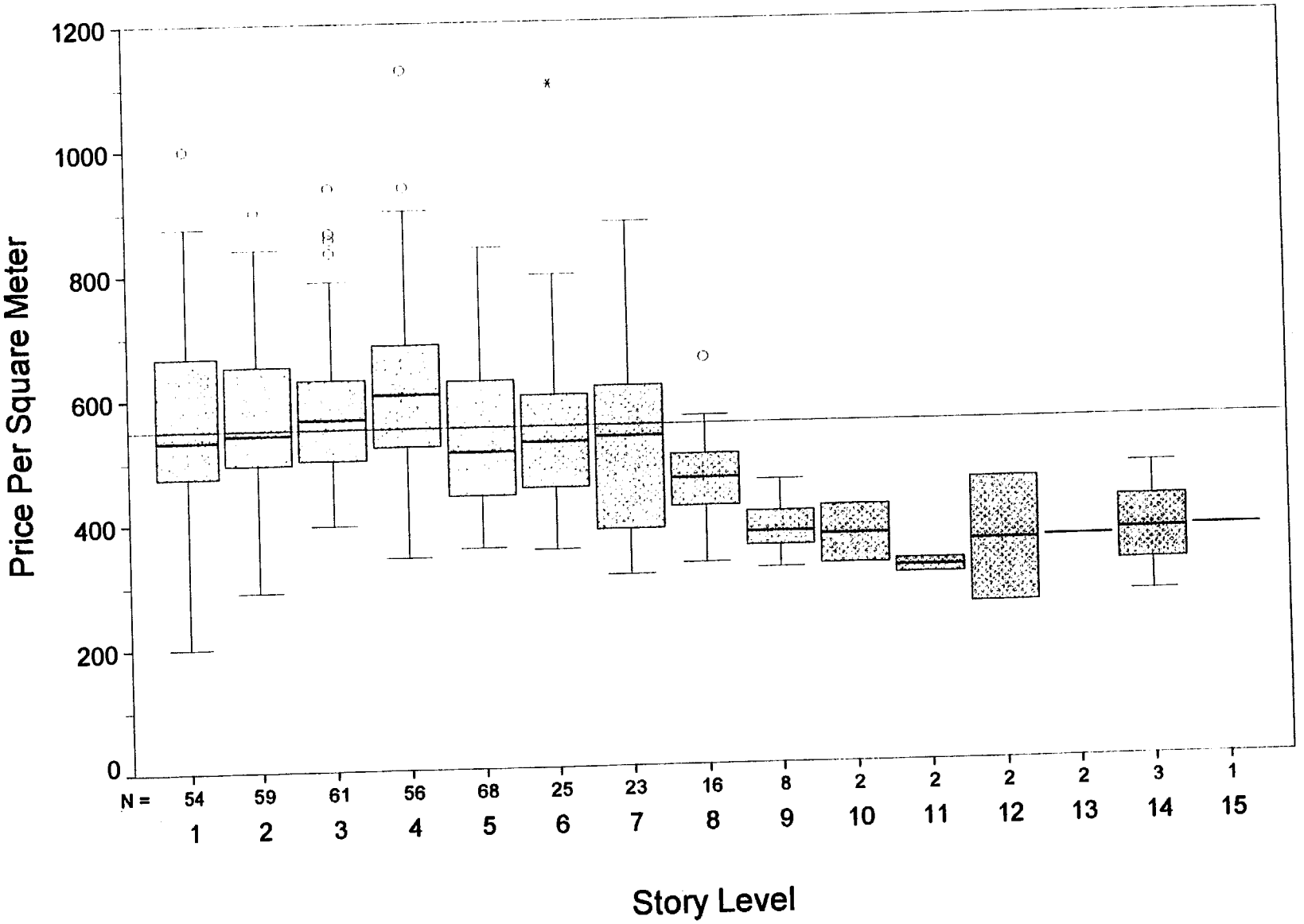


Exhibit 2-15
Multiplicative Regression Model - AREA Data

* * * * M U L T I P L E R E G R E S S I O N * * * *

	Mean	Std Dev	Label
LPRICE	9.755	.616	LN(PRICE)
LLIVAREA	3.586	.403	LN(LIVING AREA)
LOTHAREA	.637	.134	LN(OTHER AREA)
ONEROOM	.253	.435	ONE ROOM
STONE_WD	.066	.249	STONE, WOOD CEILING
PANEL	.476	.500	PANEL/PREFABRICATED
CEIL_LO	.048	.214	2.75m CEILING
CEIL_HI	.204	.403	3m+ CEILING
COND_PR	.043	.203	POOR CONDITION
COND_GD	.274	.446	GOOD CONDITION
COND_EX	.061	.240	EXCELLENT CONDITION
GARAGE	.077	.267	Garage
BASEMENT	.119	.324	Basement
STORY1	.147	.354	
STORY2	.162	.368	
STORY45	.281	.450	
STORY678	.152	.359	
STORY9UP	.084	.277	
ZONE1	.276	.447	
ZONE2	.021	.143	
ZONE4	.160	.367	
ZONE5	.121	.326	
ZONE67	.088	.284	

N of Cases = 1144

Exhibit 2-15
Multiplicative Regression Model - AREA Data

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent Variable.. LPRICE

Block Number 1. Method: Stepwise Criteria: PIN .10 POUT .15

Step	MultR	Rsq	F(Eqn)	SigF		Variable	BetaIn
1	.6745	.4550	953.407	.000	In:	LLIVAREA	.6745
2	.8070	.6513	1065.468	.000	In:	ZONE1	.4441
3	.8379	.7022	895.818	.000	In:	ZONE5	-.2317
4	.8762	.7678	941.418	.000	In:	ZONE67	-.2648
5	.9032	.8158	1008.124	.000	In:	ZONE4	-.2421
6	.9142	.8358	964.861	.000	In:	STORY9UP	-.1443
7	.9207	.8477	902.977	.000	In:	LOTHAREA	.1362
8	.9248	.8553	838.886	.000	In:	COND_EX	.0882
9	.9285	.8620	787.330	.000	In:	COND_GD	.0846
10	.9321	.8688	750.376	.000	In:	PANEL	-.0931
11	.9336	.8715	698.181	.000	In:	GARAGE	.0535
12	.9344	.8731	648.283	.000	In:	ZONE2	.0399
13	.9351	.8745	605.556	.000	In:	STORY678	-.0437
14	.9357	.8755	567.321	.000	In:	CEIL_HI	.0411
15	.9363	.8767	534.844	.000	In:	COND_PR	-.0352
16	.9366	.8772	503.309	.000	In:	ONEROOM	-.0403

Variable(s) Entered on Step Number
16.. ONEROOM

Multiple R	.93661
R Square	.87723
Adjusted R Square	.87549
Standard Error	.21750

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	16	380.95984	23.80999
Residual	1127	53.31485	.04731

F = 503.30926 Signif F = .0000

Exhibit 2-15
Multiplicative Regression Model - AREA Data

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent Variable.. LPRICE

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
LLIVAREA	1.010444	.031471	.661060	32.107	.0000
LOTHAREA	.663966	.060981	.144584	10.888	.0000
ONEROOM	-.057152	.026619	-.040306	-2.147	.0320
PANEL	-.067433	.017922	-.054657	-3.763	.0002
CEIL_HI	.068661	.020119	.044880	3.413	.0007
COND_PR	-.107702	.032461	-.035394	-3.318	.0009
COND_GD	.115247	.015333	.083472	7.516	.0000
COND_EX	.277102	.027703	.107794	10.002	.0000
GARAGE	.114326	.024829	.049445	4.605	.0000
STORY678	-.076273	.020851	-.044457	-3.658	.0003
STORY9UP	-.290406	.025829	-.130685	-11.243	.0000
ZONE1	.317421	.017721	.230356	17.912	.0000
ZONE2	.149615	.046131	.034801	3.243	.0012
ZONE4	-.371819	.019769	-.221220	-18.808	.0000
ZONE5	-.548379	.022930	-.289884	-23.915	.0000
ZONE67	-.611062	.024960	-.281380	-24.482	.0000
(Constant)	5.813859	.135620		42.869	.0000

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
STONE_WD	-.014236	-.033524	.255116	-1.126	.2606
CEIL_LO	-.005625	-.015245	.250349	-.512	.6090
BASEMENT	.015929	.043664	.256973	1.467	.1428
STORY1	.004896	.013468	.256673	.452	.6514
STORY2	-.007905	-.021769	.256601	-.731	.4651
STORY45	-.013728	-.036384	.256815	-1.222	.2221

End Block Number 1 PIN = .100 Limits reached.

RATIO

Mean	1.023	Std err	.007	Median	1.010
Mode	.740	Std dev	.226	Variance	.051
Kurtosis	7.019	S E Kurt	.145	Skewness	1.292
S E Skew	.072	Range	2.675	Minimum	.293
Maximum	2.968	Sum	1170.850	COD	16.55

Valid cases 1144 Missing cases 0

Exhibit 2-16

Graph of Ratios with Size - AREA Model

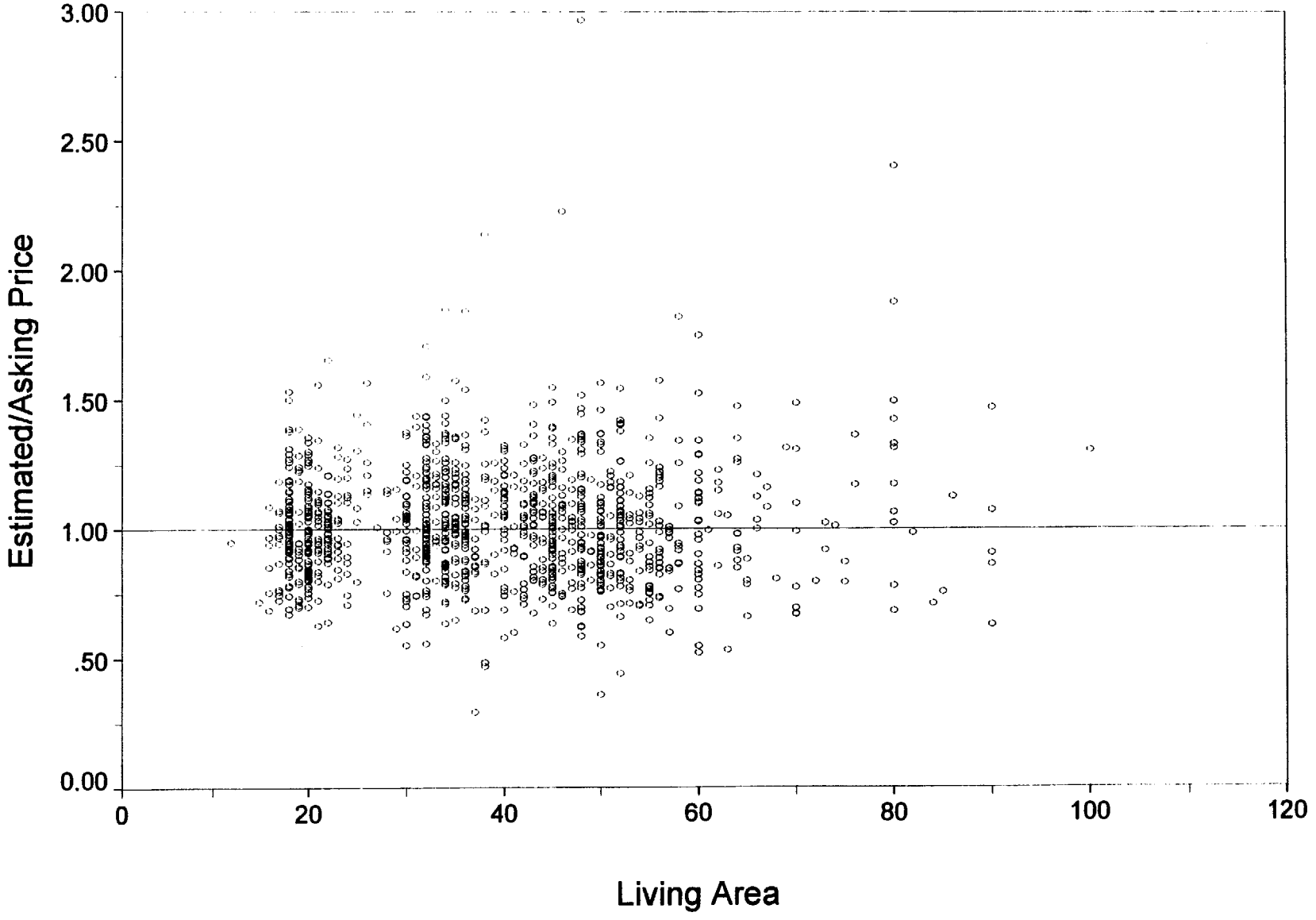


Exhibit 2-17

Graph of Ratios with Zone - AREA Model

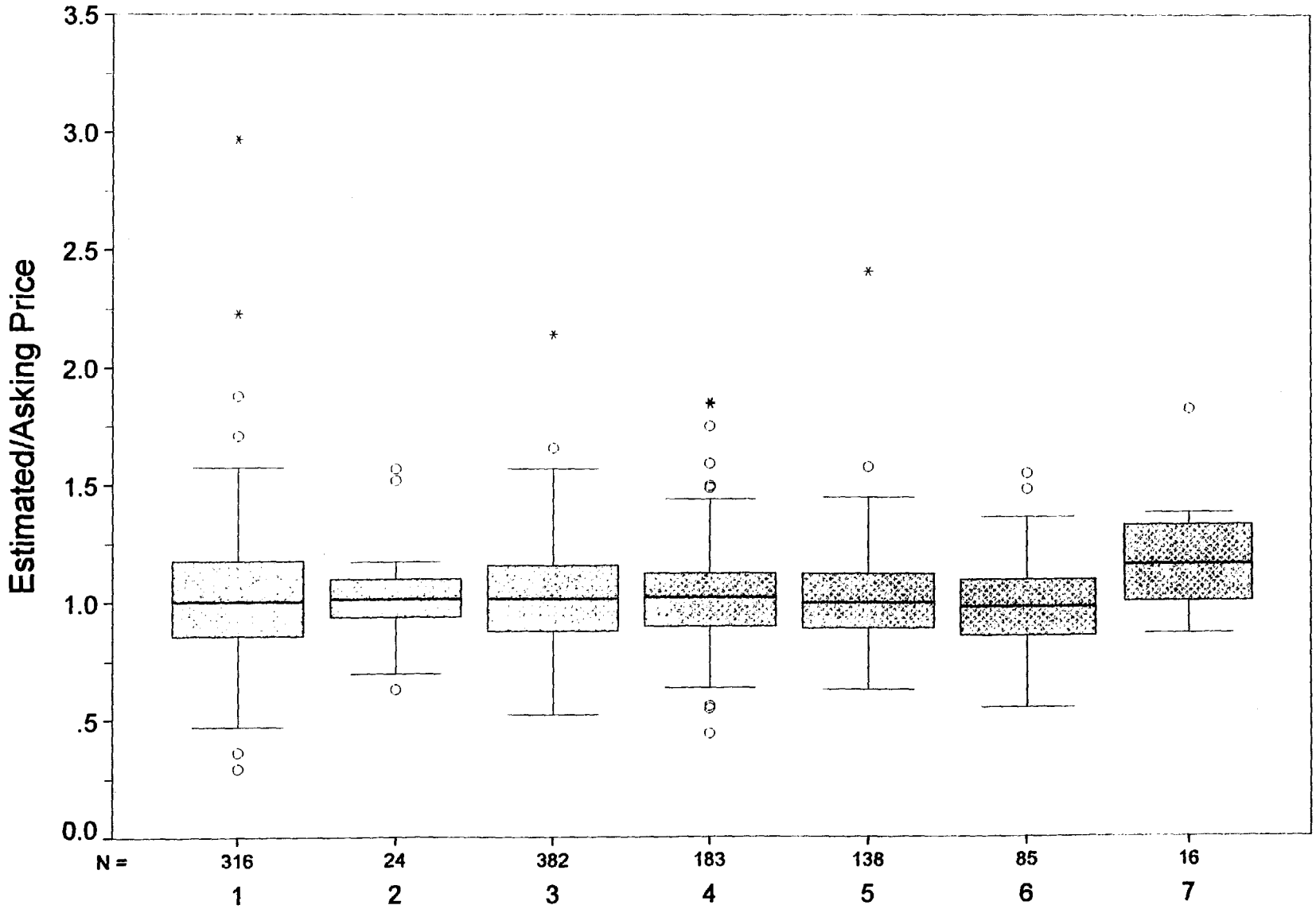
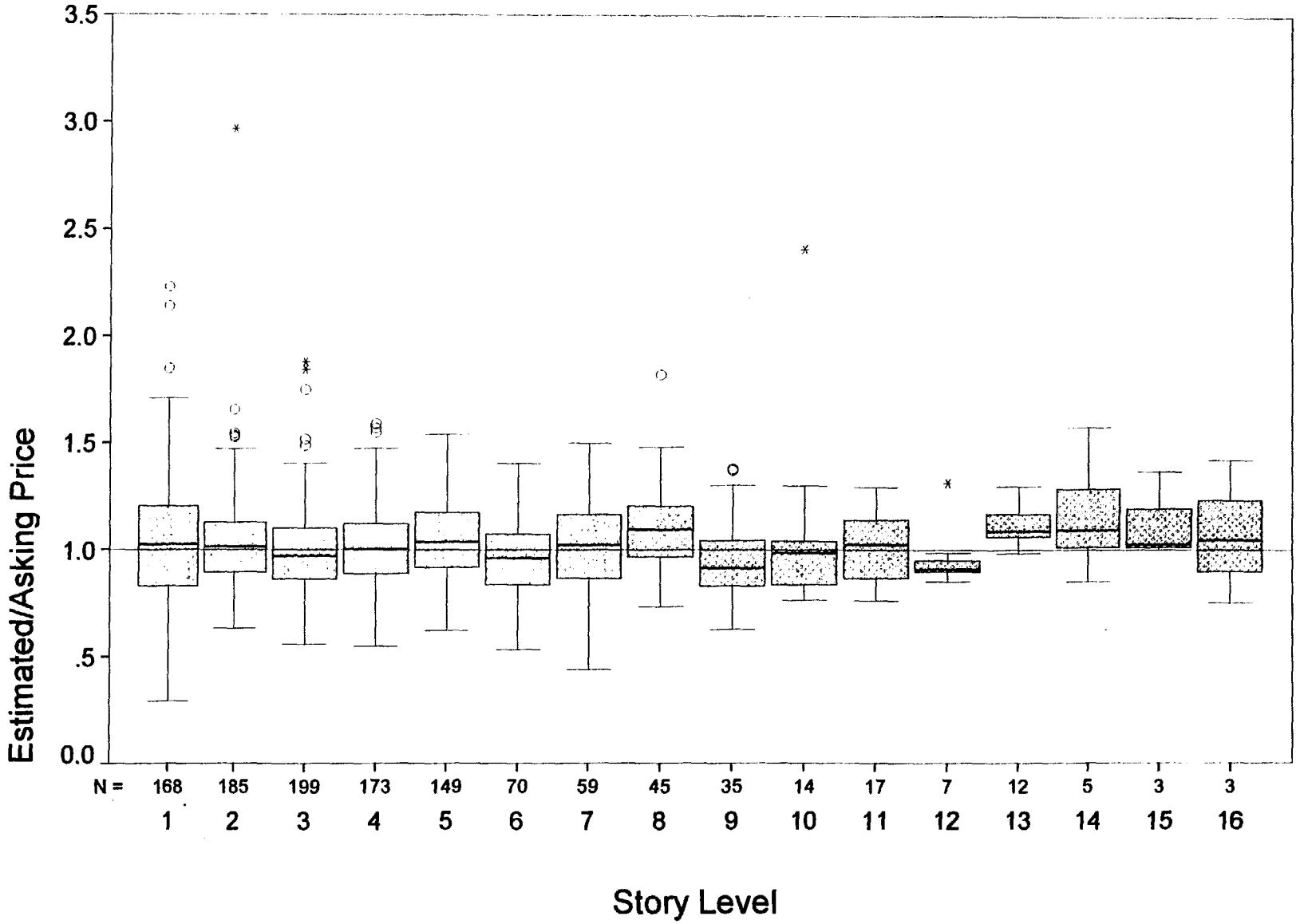


Exhibit 2-18

Graph of Ratios with Story - AREA Model



GRAPH OF Exhibit 2-19

Graph of Ratios with Price - Area Model

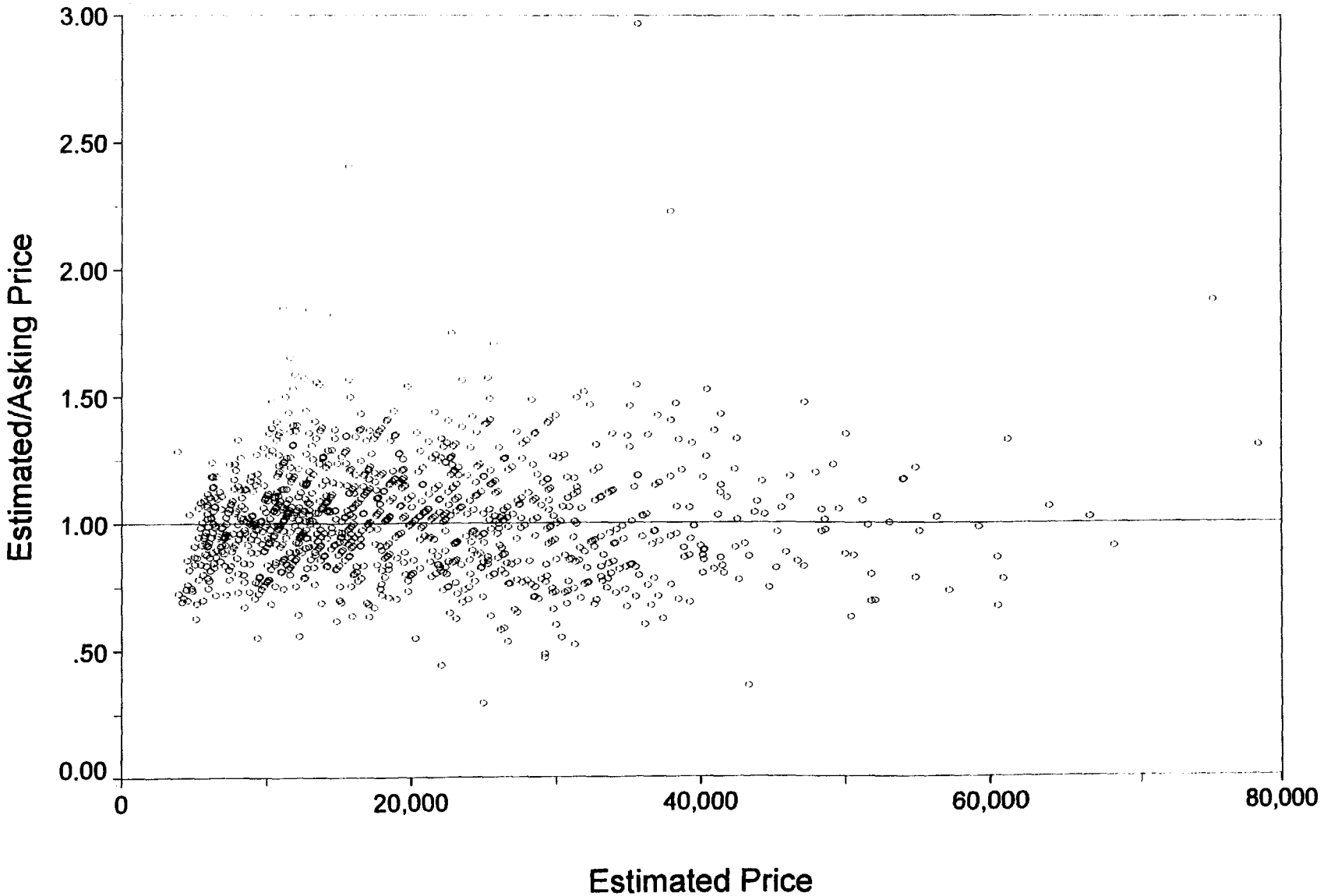


Exhibit 2-20
AREA Valuation Model in Base Home Format

VALUE = 19,147 x ADJUSTMENTS

ADJUSTMENTS:

1. LIVING AREA: LIVAREA/40. Benchmarks::

   20 = .500, 25 = .625, 30 = .750, 35 = .875, 40 = 1.000, 45 = 1.125, 50 = 1.250
   55 = 1.375, 60 = 1.500, 65 = 1.625, 70 = 1.750, 75 = 1.875, 80 = 2.000, 85 = 2.125
   90 = 2.250, 95 = 2.375, 100 = 2.500, 105 = 2.625, 110= 2.750, 115= 2.875, 120 = 3.000

2. OTHER AREA: (TOTAREA/LIVAREA)^.664 ÷ (70/40)^.664

   1.00 = 0.690, 1.05 = 0.712, 1.10 = 0.737, 1.15 = 0.757, 1.20 = 0.733, 1.25 = 0.800
   1.30 = 0.821, 1.35 = 0.842, 1.40 = 0.862, 1.45 = 0.883, 1.50 = 0.903, 1.55 = 0.923
   1.60 = 0.952, 1.65 = 0.961, 1.70 = 0.981, 1.75 = 1.000, 1.80 = 1.019, 1.85 = 1.038
   1.90 = 1.056, 1.95 = 1.074, 2.00 = 1.092, 2.10 = 1.154, 2.20 = 1.164, 2.30 = 1.199
   2.40 = 1.233, 2.50 = 1.267, 2.60 = 1.301, 2.70 = 1.334, 2.80 = 1.367, 2.90 = 1.398

3. ONE ROOM: .0.944

4. PANEL CONSTRUCTION: 0.935

5. HIGH CEILING: 1.071

6. CONDITION: POOR = 0.898; AVE = 1.00, GOOD = 1.122, EXC = 1.319

7. GARAGE: NO = 1.00, YES = 1.121

8. STORY: 1-5 = 1.00, 6-8 = 0.927, 9+ = .748

9. ZONE: 1 = 1.374, 2 = 1.161, 3 = 1.00, 4 = 0.689, 5 = 0.578, 6-7 = .543

EXAMPLE: LIVAREA = 50, TOTAREA = 75, ROOMS = 3, ZONE = 2

CONSTRUCTION = STONE/CONCRETE, CEILING = 2.75m

CONDITION = GOOD, STORY = 4, GARAGE = NO

VALUE = 19,147 x 1.250 x .903 x 1.122 x .161 = **28,152**

Exhibit 2-21
Multiplicative Regression Model - AGAT Data
(Asking Prices of $10,000 - $150,000)

* * * * M U L T I P L E R E G R E S S I O N * * * *

Equation Number 1 Dependent Variable.. LPRICE LN(PRICE)

Block Number 1. Method: Stepwise Criteria: PIN .10 POUT .15

Step	MultR	Rsq	F(Eqn)	SigF		Variable	BetaIn
1	.5645	.3187	416.787	.000	In:	LLIVAREA	.5645
2	.7008	.4911	429.413	.000	In:	ZONE_A1	.4154
3	.7454	.5556	370.506	.000	In:	ZON_D2F2	-.2580
4	.7978	.6366	388.819	.000	In:	ZON_DFH3	-.2912
5	.8222	.6760	370.139	.000	In:	ZON_DH1	-.2034
6	.8471	.7176	375.295	.000	In:	ZON_EH45	-.2062
7	.8701	.7571	394.148	.000	In:	ZONE_O	-.2009
8	.8811	.7763	383.394	.000	In:	LOTHAREA	.1690
9	.8878	.7882	365.116	.000	In:	PANEL	-.1151
10	.8937	.7986	349.834	.000	In:	ZONE_A2	.1079
11	.8997	.8094	340.175	.000	In:	GARAGE	.1064
12	.9041	.8174	328.358	.000	In:	COND_EX	.0902
13	.9088	.8259	320.738	.000	In:	COND_GD	.0959
14	.9128	.8332	313.187	.000	In:	ZONE_Z	-.0875
15	.9155	.8381	302.609	.000	In:	STORY_HI	-.0769
16	.9174	.8416	291.002	.000	In:	ZONE_B1	.0651
17	.9186	.8438	278.021	.000	In:	STONE_WD	-.0538
18	.9199	.8462	267.193	.000	In:	ZONE_B2	.0576
19	.9207	.8477	255.811	.000	In:	COND_PR	-.0434
20	.9211	.8484	244.050	.000	In:	ZONE_C2	-.0297
21	.9215	.8491	233.438	.000	In:	STORY34	.0309
22	.9218	.8496	223.456	.000	In:	CEIL_HI	.0312
23	.9220	.8501	214.294	.000	In:	ONEROOM	-.0331

Variable(s) Entered on Step Number 23.. ONEROOM ONE ROOM

Multiple R	.92202
R Square	.85011
Adjusted R Square	.84615
Standard Error	.20248

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	23	202.06962	8.78564
Residual	869	35.62731	.04100

F = 214.29397 Signif F = .0000

Exhibit 2-21
Multiplicative Regression Model - AGAT Data
(Asking Prices of $10,000 - $150,000)

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
LLIVAREA	.663480	.032041	.442935	20.707	.0000
LOTHAREA	.310941	.027176	.189310	11.442	.0000
ONEROOM	-.057538	.034609	-.033071	-1.663	.0968
STONE_WD	-.114487	.029228	-.065803	-3.917	.0001
PANEL	-.093432	.017260	-.089569	-5.413	.0000
CEIL_HI	.038791	.022311	.031620	1.739	.0825
COND_PR	-.051806	.016541	-.045921	-3.132	.0018
COND_GD	.106563	.018294	.085646	5.825	.0000
COND_EX	.268293	.036155	.103636	7.421	.0000
GARAGE	.149623	.022971	.090241	6.514	.0000
STORY34	.033949	.017147	.030284	1.980	.0480
STORY_HI	-.071653	.017586	-.066550	-4.074	.0001
ZONE_A1	.438883	.025580	.323817	17.157	.0000
ZONE_A2	.262468	.028791	.150081	9.116	.0000
ZONE_B1	.117011	.029484	.063286	3.969	.0001
ZONE_B2	.085813	.028829	.048032	2.977	.0030
ZONE_C2	-.074636	.035060	-.031646	-2.129	.0336
ZON_DH1	-.389386	.031280	-.190401	-12.448	.0000
ZON_D2F2	-.516451	.027795	-.301350	-18.581	.0000
ZON_DFH3	-.529669	.027252	-.313584	-19.436	.0000
ZON_EH45	-.790132	.055715	-.196814	-14.182	.0000
ZONE_O	-.586160	.050544	-.163950	-11.597	.0000
ZONE_Z	-.272288	.048959	-.078093	-5.562	.0000
(Constant)	6.504075	.124736		52.143	.0000

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
CEIL_LO	-.014752	-.036278	.376694	-1.070	.2851
BASEMENT	.012115	.029025	.376525	.855	.3925
ADDCONST	-.011690	-.029385	.373081	-.866	.3867

End Block Number 1 PIN = .100 Limits reached.

RATIO

Mean	1.020	Std err	.007	Median	1.002
Mode	.858	Std dev	.206	Variance	.042
Kurtosis	2.259	S E Kurt	.163	Skewness	.793
S E Skew	.082	Range	1.721	Minimum	.475
Maximum	2.196	Sum	910.897	COD	15.4

Valid cases 893 Missing cases 0

Exhibit 2-22

Graph of Recorded Sales Prices

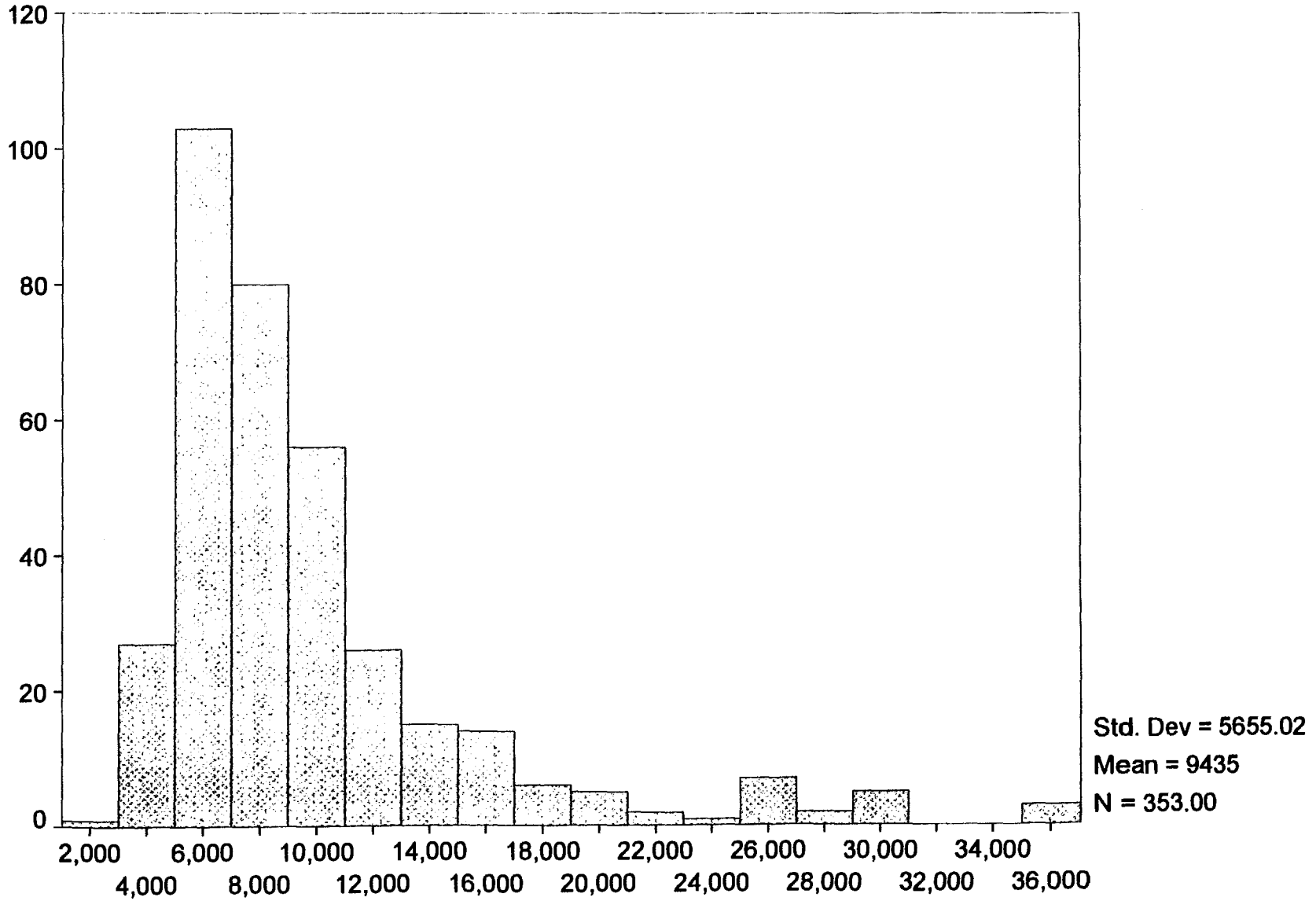


Exhibit 2-23

Graph of Sales Prices by Official Zone

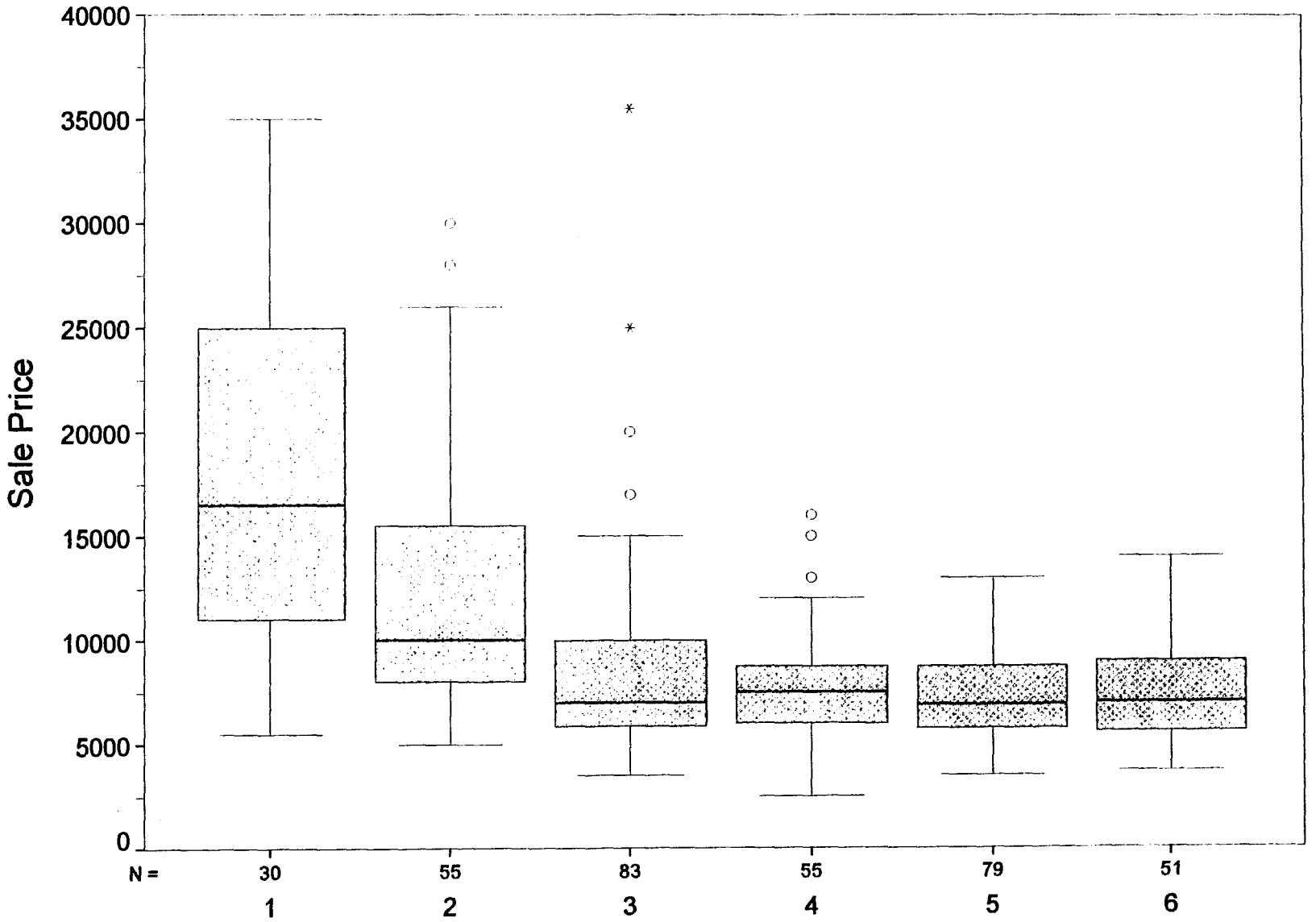


Exhibit 2-24

Ratio of Actual Price to Estimated Asking Price

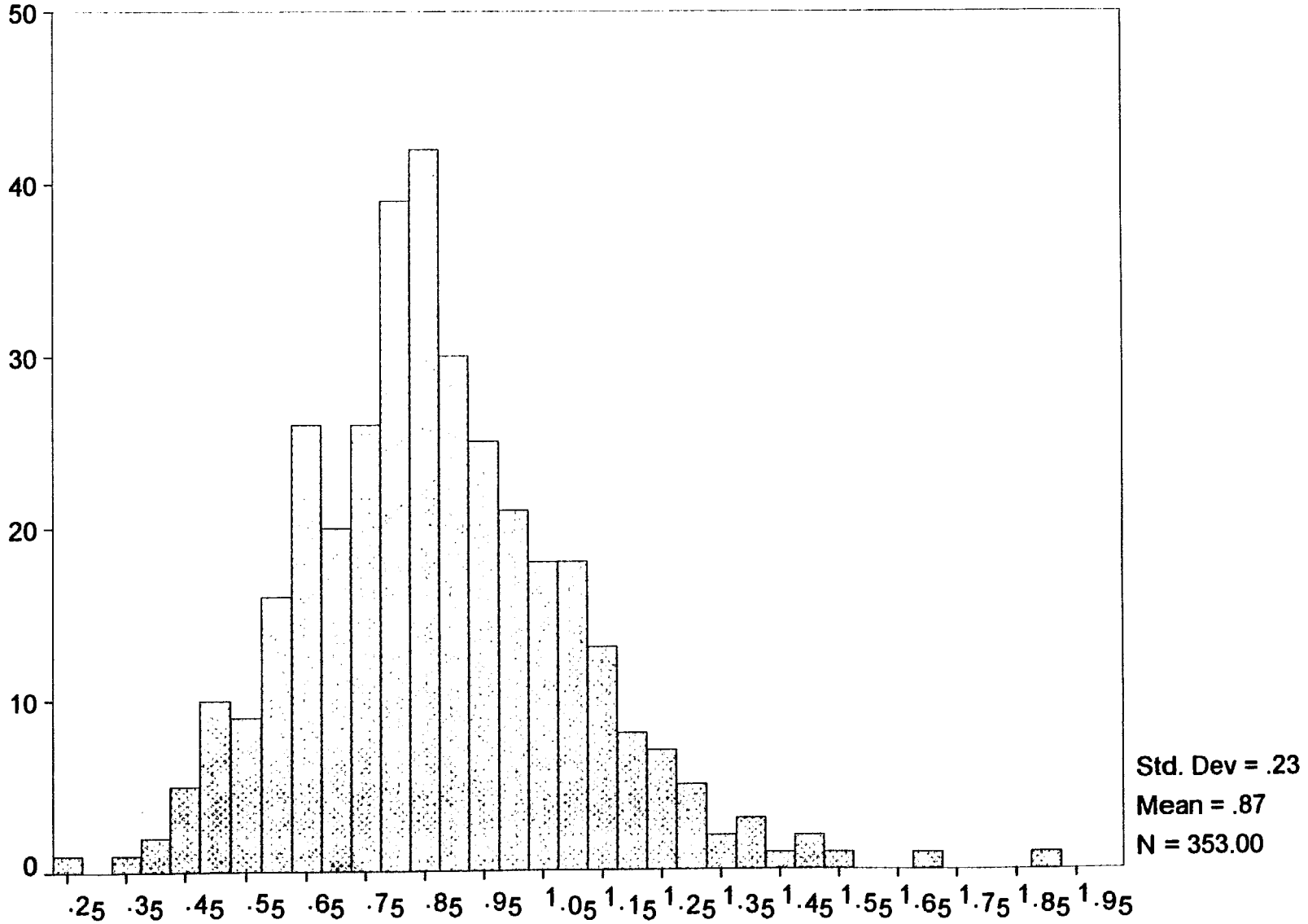


Exhibit 2-25
Sales Ratio Statistics - Decision 306 Values

Property Group	Median	COD	Sales
All Properties	0.368	35.0	353
Zone 1	0.339	39.1	30
Zone 2	0.369	30.4	55
Zone 3	0.428	32.0	83
Zone 4	0.429	26.6	55
Zone 5	0.343	35.1	79
Zone 6	0.274	41.7	51
< 25 Square Meters	0.364	30.9	121
25 - 40 Square Meters	0.371	33.5	135
> 40 Square Meters	0.360	43.2	97
Floors 1-2	0.351	38.3	103
Floors 3-4	0.369	35.4	134
Floors 5+	0.400	33.4	116

Exhibit 2-26

Graph of Ratios with Zone

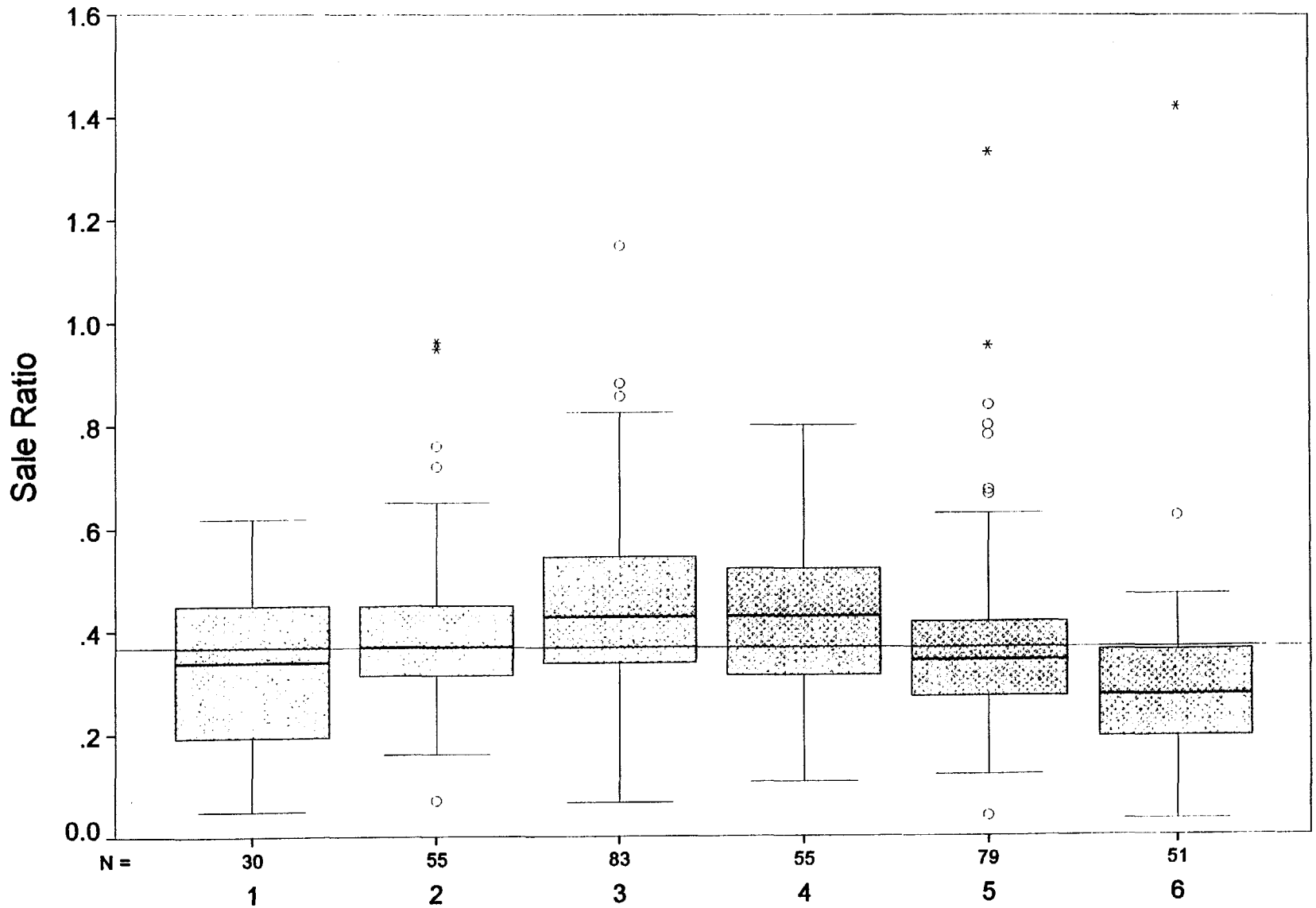


Exhibit 2-27

Graph of Ratios with Living Area

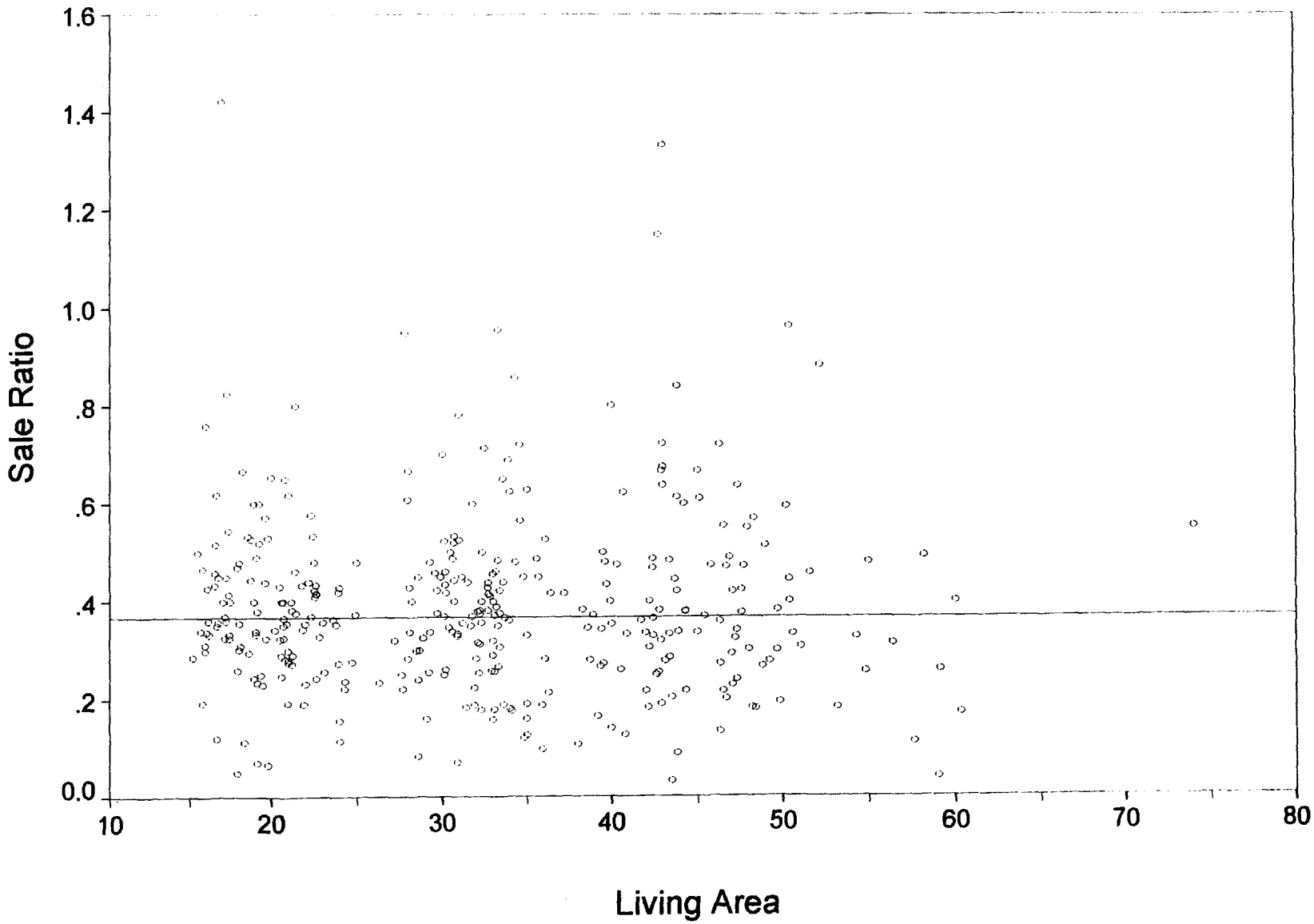
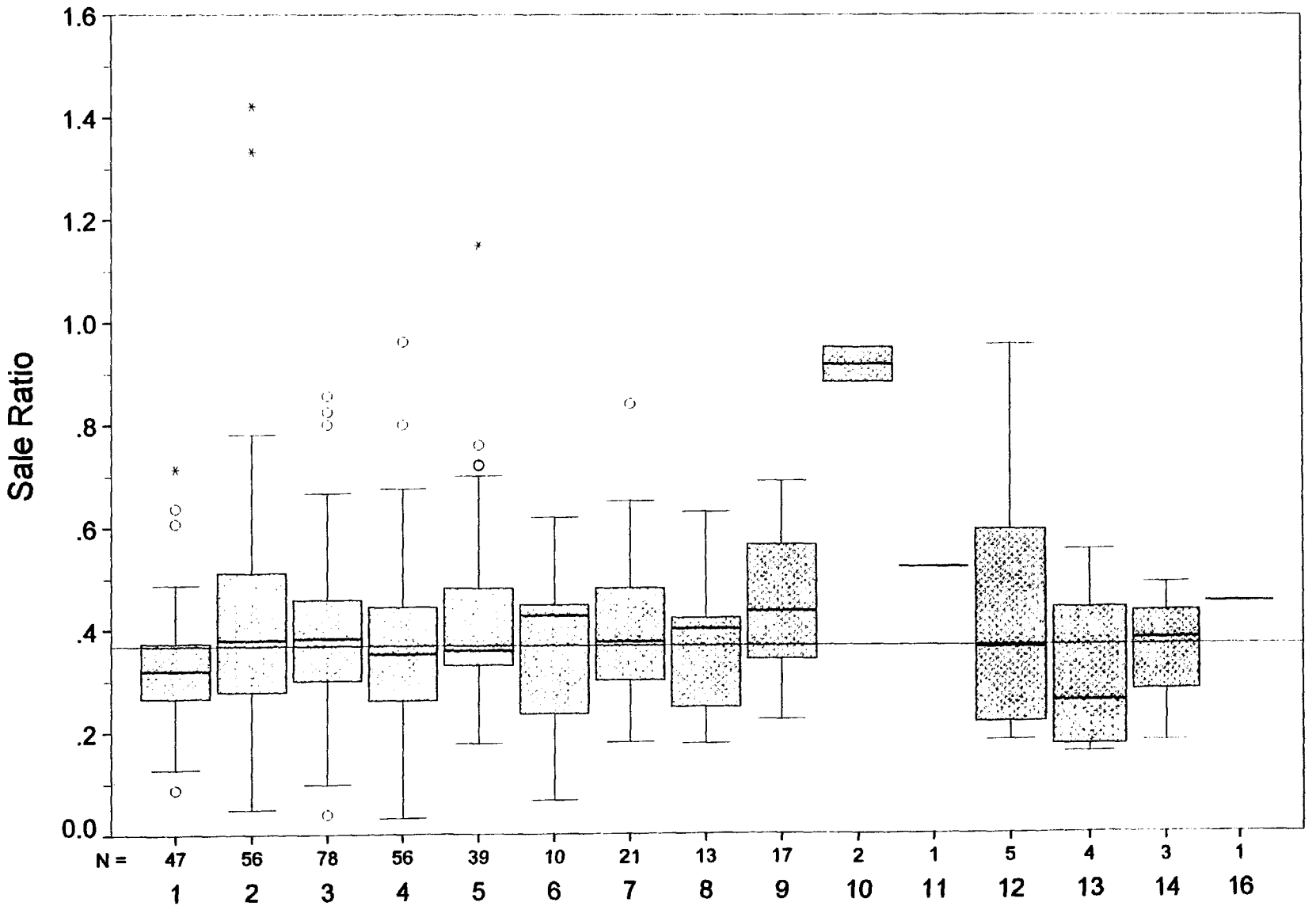


Exhibit 2-28

Graph of Ratios with Story Level



Consequently, the second, more important dimension of appraisal accuracy is to simultaneously reduce the variation in ratios of estimated values to sales prices. The COD (see section 2.5) is an index of this variation. That is, the lower the COD, the greater the uniformity of appraisals. The more uniform appraisals are, the more equitably property tax burdens are distributed. Because of unexplainable market behavior, appraisals and actual sales prices cannot be expected to coincide. Therefore, the COD cannot be expected to equal zero. However, CODs as low as 15 (which is an international standard for residential property) probably could be achieved in the valuation of apartments in Yerevan. As previously discussed, the CODs for the research team's AREA and AGAT multiplicative models were only slightly above 15, in contrast to the COD for Decision 306 values of 35. (Attainable CODs for other types of property or property in other areas of Armenia may be higher.)

Assuming that a typical apartment is worth $8,000 and the tax rate is 0.2 percent, the typical tax bill would be $16. A COD of 35 implies an average property tax error of $5.60. Reducing the COD to 15 would reduce the error to $2.40, an improvement of $3.20. One school of thought holds that as long as the costs of making the improvements in valuation procedures are less than this amount, the improvements could be cost justified. As will be noted later, converting to market value-based assessments may actually cost less than maintaining the current system.

2.6.2 Costs

As noted above, the costs of administering a tax include costs initially borne by the tax administration (administrative costs) and costs initially borne by taxpayers (compliance costs). In comparison to income and consumption taxes, property taxes have high administrative costs associated with maintaining the fiscal cadastre (which is a store of information that has value to the private sector as well as to government) and comparatively low compliance costs. Of course, all costs ultimately are borne by taxpayers.

The costs of administering the property tax in Armenia are spread between the costs borne by the State Tax Inspectorate and the costs borne by the inventory bureaus (now the Cadastral Department). The STI's costs chiefly are collection costs, while the Cadastral Department's costs chiefly will be associated with the fiscal cadastre and valuation.

The usual index of administrative costs is the ratio of those costs to total property tax revenues. There are no internationally agreed upon standards as to a reasonable administrative cost ratio. In the United States, the costs of maintaining the fiscal cadastre and valuation typically are less than 1.5 percent of property tax collections. Collection costs probably are less, so one could say that administrative costs generally are less than 3 percent. In the United Kingdom, which has a legal framework that is more expensive to administer, collection costs alone are about 3 percent of collections, and apparently valuation costs cannot be identified. Of course, the higher the level of property taxation, the lower the ratio of administrative costs, all other things being equal. In some developing countries with low levels of property taxation, administrative costs exceed 25 percent of collections. Other complicating factors include the fact that start-up

costs generally are higher than the costs of ongoing operations. In addition, if revaluations are infrequent, the costs of the valuation essentially are amortized over the period between revaluations, so that one should average cost ratios over the interval. The research team believes that an initial administrative cost ratio of 10 percent should be viewed as acceptable but that the target ratio should be about 5 percent.

Data are not currently available to calculate the administrative cost ratios for the land and property taxes in Armenia. (The Tax Inspectorate has concluded that collection costs are too high, chiefly because collections depend too much on personal contact between inspectors and taxpayers.) As the property tax is only now being implemented, there is no record of the costs of valuation and compiling the fiscal cadastre (23 million drams were allocated in 1997 to expedite the implementation of the property tax). Initially, property owners paid the costs of valuation under customary registration procedures. Normally, valuation costs are initially borne by the assessor (the Cadastral Department), and the fact that taxpayers had to pay for a valuation to gain the "privilege" of paying property taxes has been a major impediment to the successful introduction of the property tax. (The valuation fee is 600 drams for regular service and 6,000 drams for expedited service.)

Based on the research team's current understanding of the Decision 306 valuation procedure, ongoing valuation costs under a market value-based property tax should be less than the costs of current valuation methods. Current methods require detailed information on how a building is constructed and on what costs of construction are. If the current valuation methodology is maintained, the Soviet-era cost manual now in use should be replaced. The research needed to do this would be at least as costly as developing market price models directly. The cost of collecting additional construction details also is expensive, especially when some of the details are not relevant to the current value of the property. Although market-based valuation methods would benefit from better location and condition variables, those variables also would be needed to improve the cost method.

2.7 Conclusions

The research team's main conclusion is that with respect to apartment properties in Yerevan, it would be desirable and practical to convert soon to a property tax based on market values. There appear to be sufficient market data to tax family houses and apartments in other cities on the same basis.

To implement a market value-based property tax, several things should be done:

- Increase the expertise of the valuation unit in the Cadastral Department in computer-assisted mass appraisal (CAMA) methods. Three or four people should be proficient in CAMA valuation.

- Make additional valuation pilot studies to decide whether market-oriented valuation methods will work satisfactorily in valuing housing in other regions of Armenia and in valuing other types of property. The research also should focus on defining market areas to replace current official zones and to satisfy any other data needs (such as a better age or condition variable than the one used in this project). It should be recognized, however, that valuing some types of property is difficult in any country due to a shortage of market transactions. The valuer's job in these situations is to develop value estimates that appear reasonable in relation to value estimates that are well supported by market data.

- Begin work on designing computer systems to support CAMA methods (the system designed by the Tax Inspectorate would seem to be a good beginning). The system should support the creation of a modern fiscal cadastre, provide for downloading market and property attribute data for analysis, provide for uploading valuation algorithms to recalculate estimated market values during a revaluation, and transmit assessment information to the Tax Inspectorate.

- Develop and pursue an acceptable strategy for building a fiscal cadastre in Armenia. The initial aim of the development strategy should be to (1) ensure that a record of every plot of land, apartment, and valuable building is included in the cadastre and (2) capture sufficient data about the attributes of each such property to enable it to be valued with acceptable accuracy. Although the fiscal cadastre should be map-based for control purposes, coverage does not need to be complete initially (the focus should be on developed areas), and highly accurate maps are not necessary initially.

- Monitor market activity routinely. The valuation unit in the Cadastral Department should begin its own monitoring program. However, it should establish ongoing relations with the brokerage community in Armenia. It could contract with appropriate real estate organizations such as the REACT Center or AREA for market data services.

- Create a legal and administrative framework to provide incentives for accurate price disclosures (see Annex 3 of Almy [1994a], and note the preemptive right of purchase in Estonia). The framework should include property tax relief measures to protect poor owners of privatized apartments situated in valuable areas. The partial exemption in the current property tax law is one approach. Another is to defer property taxes until the taxpayer disposes of the property or dies.

Doubtless the Cadastral Department already has begun to work on these matters in conjunction with the Tax Inspectorate.

3 PROPOSALS

The recent creation of the Cadastral Department, which of necessity has had to focus on administrative matters, and the recent shift of emphasis in ICMA-supported technical assistance in Armenia make detailed technical assistance proposals in the areas of valuation and property tax administration inappropriate at this time. The Cadastral Department has not had sufficient time to consider developmental activities in detail. ICMA may focus more on local government assistance. However, if desired by the Cadastral Department and if within the scope of work of ICMA, a mission to work with the Cadastral Department in laying out a program to accomplish matters discussed in section 2.7 could be organized. An appropriate training strategy also could be developed. Further assistance in valuation model building may be requested.

Assistance in the areas of property tax policy, legislation, and administration to the Tax Inspectorate and Ministry of Finance could be continued. The operational changes required to introduce a market-based land and property tax should have appropriate legal foundations. Advice on tax rate structures may be requested. Issues will include "revenue neutral" rates, whether there should be sectorial differentiation (classification), and whether rates should be progressive. Advice on tax relief measures may also be requested. There may be a need for transitional relief and relief for poor people with housing in valuable locations. A specialized property tax appeal system may be needed.

Relative to market monitoring, advisors could help design and initiate routine time-series data useful in their own right and as background for valuation. The statistical series might include price and volume trends broken down by property type and region. Initially, the focus would be on Yerevan housing prices, but series covering other market indicators, locations and property types should be established as soon as feasible.

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ATTACHMENT A
DECISION 306 VALUATION MODEL

Explanation of the Decision 306 valuation model from "Report of Mission on the Introduction of the Law on Property Tax of the Republic of Armenia," June 1995 (mission in April-May).

1. The Valuation Model

The valuation model embedded in the valuation regulation is of the following form:

Value = Size*Base Cost Rate*Inflation Adjustment*Condition Adjustment* Depreciation Adjustment*Infrastructure and Facilities Adjustment*Vertical Location Adjustment* Geographic Location Adjustment.

Basic costs are adjusted upward for inflation and downward for factors that are assumed to diminish the value of the structure. Multiplicative factors are used, simplifying calculations and making possible simple computer-calculation routines. The adjustment factors are contained in five tables in the valuation regulation. The highest possible valuation is 0.98 of the inflation-adjusted base rate. The lowest is 0.00945. I discuss these adjustments in the following sub-sections.

a. Base Costs: The basic cost of a structure is calculated by multiplying the calculated area (m^2) or volume (m^3) of the structure by the appropriate per-unit construction cost rate. The rate is selected from the appropriate table in a forty-three page 1984 compulsory insurance regulation. (1984 was chosen because it was a stable economic period.) The tables covering basic structures, balconies, garages, fences and gates, underground facilities, and so on.

Property licenses ("passports") contain a cost calculation based on the 1984 regulation. It is not clear whether the values are indexed.

b. Cost Trend (Inflation) Adjustments: The State Department of Architecture and Urban Development calculates an inflation index quarterly (formerly, the index was calculated annually). In April 1995 (when one dollar equaled approximately 420 drams), the index was 75,000.

I pointed out the need, which the Tax Inspectorate already had anticipated, to update the cost index as frequently as the minimum monthly wage is indexed. Otherwise the tax base could be reduced dramatically.

c. Condition Factors: The first structural adjustment factor is for "technical state" (Table 1 in the regulation). This has to do with structural soundness (and would be affected by design, quality of construction, and state of repair). A structural engineer or architect would be needed to evaluate this condition, although many buildings already have been classified for soundness. The classes (with adjustment factors in parentheses) are as follows:

0	=	ideal (1.0)
I	=	no seismically dangerous cracks, only minor cracks (0.95)
II	=	no seismically dangerous cracks, however, repairs are urgently needed (0.85).
III	=	cracks are dangerous but feasible to repair (0.5)
IV	=	cracks are dangerous and not economically feasible to repair (0.0).

The factors do not necessarily reflect typical repair costs. As a category III classification would reduce property taxes by more than 40 percent, the valuation regulation may encourage people to locate in dangerous buildings and may discourage the repair of dangerous conditions.

Class IV buildings are not being privatized and are slated for demolition. There currently are 119 occupied buildings so classified, including eighty-two in Yerevan, fifteen in Gumri, and twenty in Vanadzor.

Technical condition factors should be reevaluated in future years. Ideally, they would be based on direct market evidence, including actual repair costs.

d. Depreciation Factors: The valuation regulation provides for depreciation of estimated structure costs, a desirable feature that is likely to result in taxable values that parallel market values. Table 2 of the regulation contains a simple depreciation table with eight structure age categories and corresponding depreciation factors that range from 2 to 40 percent (on a "percent good" basis, the factors range from 0.98 to 0.60, with steps ranging from two to eight percentage points). Structures are depreciated at an increasing rate until they are thirty years of age. No further depreciation is allowed after a structure reaches an age of forty-one years.

Market analysis would be necessary to evaluate the reasonableness of the depreciation table.

e. Infrastructure and Facility Adjustments: Downward adjustments are made to the value of housing units if they are not provided with connections to certain municipal services and if, in the case of units on the fifth or higher floors of a building, an elevator is not available. If all applicable facilities are lacking, values are reduced by 50 percent. Table 3 of the regulation contains the following adjustments (which are summed and subtracted from 1.0 to arrive at the appropriate multiplier):

Electricity Supply	0.09
Gas Supply	0.07
Water Supply	0.09
Sewerage	0.07
Central, Local Heating	0.05
Telephone Line	0.05
Radio Line	0.05
Availability of Elevator	0.03

Public acceptance of these factors may be difficult to obtain. First, although many buildings may be technically supplied with most or all of the services, many residents may not actually receive the service because of the energy blockade or because the service network is in poor repair. This problem will be similar to the objections land taxpayers made to having their land classified as "irrigated" when, in fact, they were not supplied with water.

Another problem is that the factor amounts do not appear to reflect the cost of providing access to the service or the value of the service. As regards costs, line connections generally are less expensive than pipe connections. As regards values, not all residents would value radio lines equal to heating and more than availability of an elevator.

There is another issue: the cost of collecting and maintaining the data for each building or each apartment may outweigh any increase in the accuracy or acceptability of the valuations. In many cases, the availability of service connections will be a factor that affects a group of units or buildings. Any effect on value would be reflected in land values or could be reflected as a composite "neighborhood" factor. Alternatively, it might be better to deal with substantial deficiencies in service connections on an exception basis.

f. Vertical Location Adjustments: The valuation regulation makes an adjustment for the vertical location of flats in an apartment block. Basement and semi-basement flat values are adjusted downward by factors of 0.45 and 0.65, respectively. Table 4 contains adjustment factors for ground-floor and above flats. Flats on the third floor are considered standard and hence have a factor of 1.0. Second-floor flats have a factor of 0.95 and first-floor flats have a factor of 0.8. Adjustment factors for fourth- through sixteenth-floor flats range between 0.95 and 0.45.

My discussions with real property market observers in Yerevan suggest that many people believe that ground-floor and top-floor flats are undesirable. Table 4 reflects the same beliefs, although some might question some of the apparent anomalies (which may be typographical errors in the English translation).

More fundamentally, the factors should be supported by market analysis. (My initial analysis of flat sales did not reveal a clear pattern of declining value in higher-floor flats, although my sample of sales was small.) In addition, the vertical location adjustment should be reconciled with the elevator availability adjustment. If elevators and other services are available and functioning, there is no reason to believe that height adjustments should be significant.

g. Geographic Location Adjustments: The final adjustment factor is for geographic location. This is an important feature of the regulation, as geographic location ordinarily is a key determinant of market value. Table 5 contains factors ranging from 1.0 for zone I to 0.14 for zone VI. The six categories of territorial valuation zones correspond to zones set forth in Resolution No. 16 of the State Commission for Privatization and Denationalization of the Republic of Armenia "On Adjustment Coefficients for Valuation of the Premises of Privatized 'Small'

Units," dated 14 June 1994, which I did not review. Zone I embraces the center of Yerevan. Zone V territories have poor communications and infrastructure. Zone VI territories are on the frontier.

The Department of Architecture and Urban Development is drafting a new zoning decision, which will have regional and sub-regional zones. This promises to be an important improvement, as large zones can be anticipated to have pockets of more valuable and less valuable property. I recommend that the Department consider evidence gathered by AURI and AREA. Each organization has developed a different zoning scheme. In order to avoid confusion, it would be desirable to agree on a single scheme. I also recommend that value patterns and trends be analyzed on an ongoing basis.

2. Model Application

The program for the implementation of the property tax on citizens' structures contemplates that members of the staffs of the inventory offices will manually calculate the value of each taxable property. Annex 1 to the valuation regulation contains a form to be used for this purpose. The form is satisfactory as a valuation record. It contains space to record information about each property characteristic and its associated factor.

Ideally, the valuation process would be computerized. That is, the computer would do table look-ups and make calculations. In this situation, inventory office staff members would record structure characteristics on a data-entry form, which other staff would use to enter the necessary data into computers. This would require a form designed for the purpose.

The approved form may be adapted for use as either a data entry form or a value calculation form. To make assessment record keeping easier and to reduce problems associated with duplicate names and other ambiguities, the form may contain spaces to record a taxpayer identification number (which others have recommended) and a cadastral number (including a building and unit number). It assumes that basic cost rates are indexed in the computer.

If computer processing cannot be accomplished, it should be possible to simplify manual calculations by constructing tables that combine some of the adjustment coefficients. For example, Tables 1, 2, and 5 could be combined as illustrated in the following Exhibit A-1.

Exhibit A-1. Illustrative Composite Multiplier Table for Structures Located in Zone II

Age Group	Structural Condition Category				
	O	I	II	III	IV
1-5	0.70	0.66	0.59	0.35	0.00
6-10	0.67	0.64	0.57	0.34	0.00
11-15	0.65	0.61	0.55	0.32	0.00
16-20	0.62	0.59	0.53	0.31	0.00
21-25	0.58	0.55	0.49	0.29	0.00
26-30	0.53	0.51	0.45	0.27	0.00
31-40	0.48	0.46	0.41	0.24	0.00
41 & more	0.43	0.40	0.36	0.21	0.00

Tables that combine the above multipliers with the per-unit costs in drams would be especially useful. If this tabular approach were used, the valuation forms should be modified to facilitate the use of the tables.

An additional simplification would be merely to index the values in existing passports. If valuation could be further simplified, taxpayers could be asked to make their own valuation calculations. These simplifications would be especially attractive in the first year of the property tax.