CYPRUS REPUBLIC

DEPARTMENT OF LANDS AND SURVEYS
MINISTRY OF INTERIOR
HEADQUARTERS

The Study on Refining the Parameters of the CAMA Model

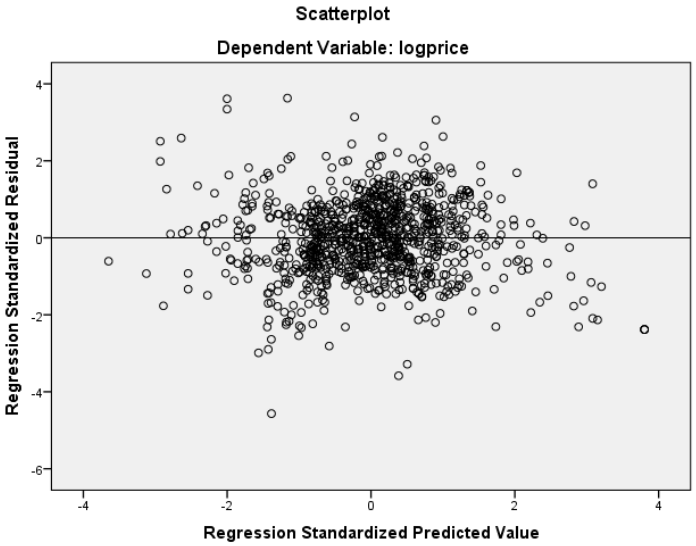

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Table of Contents

ABBREVIATIONS AND ACRONYMS

AV	Assessment Value
CAMA	Computer Assisted Mass Appraisal
CBC	Central Bank of Cyprus
COD	Coefficient of dispersion
CYSTAT	Statistical Office of Cyprus
CILIS	Cyprus Integrated Land Information System
DLS	Department of Lands and Surveys
EC	European Commission
ETL	Extract-Transform-Load
GVTS	General Valuation and Taxation Section
GIS	Geographic Information System
IAAO	International Association of Assessing Officers
IPT	Immovable Property Tax

LI	Local Inspection
MoF	Ministry of Finance
MoI	Ministry of the Interior
MoU	Memorandum of Understanding
MPP	Model Predicted Price
PRD	Price Related Differential
RPPI	Residential Property Price Index
SAS	Statistical Analysis System (business analytics software)
TA	Technical Assistance
VS	Valuation Section

APPENDICES

Appendix A - Sample of Property Characteristics Report

Appecdix B - CBC Residential Property Price Index

Appendix C - IMF Draft Report on the Short Term Expert visit on Property Taxation (March 10 – 14, 2014) prepared by Niall O' Hanlon.

Executive Summary

The key objectives of this study are to refine the use and application of the current parameters which are being used within the CAMA models for the GV and to identify for future CAMA development which other parameters would have a significant value influence on property value. Furthermore, this study is intended not to assess the accuracy of the recent GV as the approach was different. For the recent GV, no MRA statistics were performed but the valuations were based on the sale transactions and on the valuer's knowledge and practical experience of the property market and the Cyprus economy. Also, market research was carried out at each district in order to collect and analyse the market performance as at the general valuation date. This study was a joint effort between the DLS staff and the IMF Expert Niall O' Hanlon, under the supervision of the EC Support Group for Cyprus (SGCY).

The sales comparison method is one of the internationally recognized accepted methods for performing valuations or general valuations for taxation purposes. In principle, this method uses sales transactions that have been agreed between a willing seller and willing buyer in the open market. The aim is to value a single or a group of properties in case of mass appraisal, by adjusting the sale price of comparable properties for differences between the comparable properties and the subject property or properties. This information is then used to estimate the market value of a property at a specific point in time. Time adjustment is also another characteristic that has a significant role to play in the study as well as in mass appraisals. The sales comparison method is commonly applied by DLS valuers manually; however the application of Multiple Regression Analysis (MRA) has been recently used extensively for the completion of this study as well as forward looking with the view to developing the potential for a MRA based approach in the future GVs.

For the purpose of this study sale transactions have been exported from the Cyprus Integrated Land Information System (CILIS) for three major groups of properties (land, units horizontally divided and non-horizontally divided). In order to achieve an adequate level of accuracy and at the same time maintaining sufficient number of sale observations to be used in the analysis, shared sold properties have been excluded from the sample. Individual sales that have a difference in declared and accepted price beyond 20% were also excluded. The DLS will investigate whether these can be included in future analysis or after verifying their quality.

DLS sales data sets were selected and analysed for the period Q1 2008 to Q2 2014 for flats and vacant land, while for buildings for the period Q1 2008 to Q3 2013. The sales were time adjusted to 01.01.2013 for flats and houses by applying the CBC Residential Property Price Index. For the land, no statistical analysis was performed as no land index was available, either within the DLS, CBC or CYSTAT. CBC will provide the DLS with an unofficial land index for analysis, in February 2015.

As regards the data quality and assurance, these were examined as part of the previous mission and the results were that the quality of the subsets of data analysed appeared to be good and not suffering from any systematic data quality issues.

The development of appraisal models involves two steps, specification and calibration. Specification involves deciding on which property characteristics likely have a significant effect on values (often largely determined by the availability of data on property characteristics) and how those characteristics are assumed to affect value. Calibration is the process of quantifying the coefficients associated with the variables in the model.

A backward stepwise regression approach to specification and calibration of the models was employed. Under this approach, models are built including the available property characteristics and then successively removing variables that improve the model the most by being deleted until no further improvement is possible. The stepwise regression output lists the property characteristics utilised in the final model in the order of their significance.

In this study the micro location effect was analysed by applying two approaches. The first one was to run a model for each district with location at level of municipality controlled for. The second one was to run a model separately for some municipalities. Also, in another case the planning zone types and planning zone densities were also tested for the houses only and the planning zone density was finally kept by the model. In the recent GV, the DLS valuers have determined geographically a small number of locations (A, B, C and D) for the purpose of adjusting the property values (upward/downward). This is an issue to be examined by the DLS in the future as well as the determination of micro locations to a greater extent in various geographical areas.

A summary of the statistical results in each district is presented below:

Nicosia District

Two models have been applied for flats. In the first regression, Nicosia municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 3.012. In this regression the model kept the variables "class", "view", "enclosed extent", "covered and uncovered verandah" and "age".

In the second regression, Aglantzia municipality was statistically analysed separately, because it was rejected by the model in the first regression. In this regression the model kept the variables "class", "view", "enclosed extent", "covered verandah" and "age".

Another model has been applied for houses. In this regression, Nicosia municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 540. In this regression, the model kept the variables "class", "unit enclosed extent", "permitted density" and "age".

Famagusta District

One model has been applied for flats. In this regression, Paralimni municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The

total number of observations was 289. In this regression the model kept the variables "condition", "view", "enclosed extent", "covered and uncovered verandah" and "age".

The number of observations was very limited to allow for the model to be applied for houses.

Larnaca District

Two models have been applied for flats. In the first regression, Larnaca municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 1.595. In this regression the model kept the variables "class", "view", "enclosed extent", "covered and uncovered verandah" and "age".

In the second regression, Aradippou municipality was statistically analysed separately, because it was rejected by the model in the first regression. In this regression the model kept the variables "enclosed extent", "uncovered verandah" and "age".

The number of observations was very limited to allow for the model to be applied for houses.

Limassol District

Two models have been applied for flats. In the first regression, Limassol municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 1.789. In this regression the model kept the variables "class", "condition", "view", "enclosed extent", "covered and uncovered verandah" and "age".

In the second regression, Limassol municipality was statistically analysed separately. In this regression the model kept the variables "condition", "enclosed extent" and "age".

Another model has been applied for houses. In this regression, Limassol municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 693. In this regression, the model kept the variables "condition", "unit enclosed extent", "view", "permitted density" and "age".

Paphos District

Two models have been applied for flats. In the first regression, Paphos municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 1.020. In this regression the model kept the variables "enclosed extent", "covered and uncovered verandah" and "age".
In the second regression, Chloraca municipality was statistically analysed separately. In this regression the model kept the variables "enclosed extent", "covered and uncovered verandah" and "age".

Another model has been applied for houses. In this regression, Paphos municipality was selected as the dummy variable, while all the other municipalities were used as variables in the model. The total number of observations was 360. In this regression, the model kept the variables "class", "unit enclosed extent", "covered extent", "view", "permitted density" and "age".

The comments of the DLS valuers on MRA results are described in detail in the chapter 7 of this study.

The DLS has established a predicted model by selecting a random number of sales (n=30), to show the capabilities in using regression analysis for predicating prices as well as testing the veracity of the estimates (ratio study).

In this study, due to the absence of full data sets of property characteristics by the DLS, an attempt was made to extract information from the CBC database, which information is kept for producing the Residential Property Price Index. The significant variables for flats and houses by district are presented in chapter 8.

This study covers the technical feasibility of applying the existing CAMA. The existing CAMA within CILIS is described as well as its basic components and capabilities as well as the steps forward for upgrading the existing CAMA. For the recent GV the existing Base and Cost models were applied which are considered simple and efficient. Also, within this upgrade, the successful vendor will examine the possibility of using more integrated and friendly procedures between CILIS and SPSS or other statistical packages. More details are described in chapter 11.

The DLS has made a significant progress in developing statistical capabilities by assigning a member of the staff, with 3rd level of qualification in maths and statistics, to full time analyses of data. Also, the DLS has acquired statistical analysis software for this reason. This was made possible by coaching provided by IMF external expert during the study as well as collaborating with CYSTAT and CBC staff. DLS will continue to research and assess the current approach to MRA of sales.

Finally, the DLS has prepared a number of recommendations under a short to medium and long term planning as a step forward, by which the next general valuation can be performed by using advanced statistical technics and methodologies. More details of the planning are described in chapter 13.

1. Scope of the Report

The Memorandum of Understanding (MoU) detailed a requirement for two studies, dealing with refining of the parameters of the revaluation methodology. The first study, to be completed by 31st December 2014, should refine the use and application of the current parameters which are being used within Computer-Assisted Mass Appraisal Models (CAMA) for the General Valuation (GV) of property and also identify for future CAMA development which other parameters would have a significant value influence on property value.

This first study has two key objectives:

- To refine the use and application of the current parameters which are being used within the CAMA models for the GV.
- To identify for future CAMA development which other parameters would have a significant value influence on property value.

It is important to highlight that the purpose of this study was not an attempt to assess the accuracy of the recent GV, but rather forward looking with the view to developing the potential for a MRA based approach in the future GVs. The accuracy of the recent GV is to be assessed through the ratio or variance study which is the second study requested by EC/ECB/IMF under measure 3.8 of the MoU.

In response to a request by the Cypriot authorities, a technical assistance mission visited Nicosia during November 4 - 14, 2014, to provide advice and assistance in the preparation of the first study. The Terms of Reference for the study were prepared by DLS and SGCY and agreed with the expert. The study was jointly conducted by the DLS Staff and the IMF expert, Niall O' Hanlon. The study continued after the mission and further statistical analysis was performed by the DLS statistician and DLS seniors with the guidance and assistance of Niall O' Hanlon.

The MRA analysis was performed by Maria Charalambous (Land Clerk-Mathematician/Statistician) with assistance and guidance provided by Varnavas Pashoulis (Senior General Valuation and Taxation Officer) and Niall O'Hanlon (Expert). Also, Efi Savvidou (Senior Valuation Officer) contributed to the preparation of this report and participated in discussions of various issues in respect of the statistical analysis, outputs and valuations. Also, the five District Approved Valuation Officers, namely Maria Georgiou (Land Officer A'), Anastasios Aristidou (Land Officer B'), Eleftherios Eleftheriou (Land Officer B'), Stephanos Rousias (Land Officer B') and Panayiota Flori (Land Officer B'- Data Capture Coordinator) provided comments on the statistical output and the characteristics of the local property markets. Aristi Christofidou (Limassol District Officer) also contributed to this effort, especially in the preparation and cleaning of the sales data and property characteristics. For the preparation of the sales data support was also provided by the staff of the Valuation Section as well as from the General Valuation and Taxation Section at each District Office. In addition, Neoclis Neocleous (CILIS Support and Administration Section Leader) provided the various sale datasets needed for the analysis and participated in discussion on the data and statistical analysis. Also, Mr.

Neocleous has produced a separate chapter on the technical feasibility of applying the existing CAMA.

The Study also involved collaboration and exchange of information with George Thoukididies and Thalia Kounouni from the Real Estate Unit of the Central Bank of Cyprus (CBC), who are responsible for the production of the CBC Residential Property Price Index. A meeting was held at CBC to discuss various aspects of the study. Nasia Petsa from the Statistical Service of Cyprus (CYSTAT) also provided some assistance in respect of statistical issues.

2. Introduction to the sales comparison approach and CAMA

The "sales comparison approach" to property valuation uses information on recent open-market sale prices. The aim is to estimate the value of a property or properties (in the case of a mass appraisal of properties) by adjusting the sale price of comparable properties for differences between the comparable properties and the subject property or properties. This will allow for a determination of how differences in the characteristics of recently sold properties (such as their type, location, size and quality) will influence their prices. This information is then used to estimate what the properties being valued are worth.

The analytical approach to determine the value adjustments for specific characteristics of property that is currently employed by the Department is largely based around traditional manual methods. While this is an accepted approach, a more objective approach would be to use Multiple Regression Analysis (MRA). This is a powerful analytical tool that is data hungry but if applied correctly can identify the market adjustments required for the Computer Assisted Mass Appraisal (CAMA) exercise.

Multiple regression analysis describes a statistical process which estimates the relationship between several independent or predictor variables (such as property characteristics) and a dependent variable (or 'criterion variable'), such as the value of a property. It facilitates the analysis of how the typical value of the dependent variable (or 'criterion variable') changes when any one of the independent variables is varied, while the other independent variables are held fixed.

The sales comparison approach is usually the preferred approach for estimating values of residential properties and non-agricultural land, where sufficient transactions can be observed.[1] The approach should use only arm's-length (open-market) transactions. In accordance with Circular 807, dated 29.10.2009, all sales transactions are stamped and signed on the basis of three different scenarios:

[1] IAAO (2011), Standard on Mass Appraisal of Real Property

- The first scenario is applied where the declared price is equal to the accepted sales price. That means that the transaction is considered genuine. The sales analysis indicator in CILIS automatically assigns code 1 to these sales.
- The second scenario is applied where the accepted sale price is higher or lower than the declared price and thus code 2 or 3 is applied in CILIS. Code 2 is D≠C without Local Inspection and code3 is where D≠C with Local Inspection
- The third scenario is applied where the decision of the accepted sales price is issued by the Court, and thus code 4 is D≠C with Local Inspection and court decision and recorded in CILIS.

For the purpose of this study it was assumed that those residential properties (buildings and land) where the declared price and the DLS accepted price (the valuation DLS applies to each transaction) differed by 20 per cent or more were not arm's-length and therefore not suitable for inclusion in the MRA. In any future formal application of the sales comparison approach the appropriateness and impact of this threshold should be assessed. A summary table of the declared/accepted sales price difference and property type (flats and houses only) by district is presented below.

FLATS - HORIZONTALLY DIVIDED					
Sales from 01.01.2008 to 31.10.2014 (Whole shares only)					
District	Declared price = Accepted price	1%-20% difference	21-30% difference	More than 30% difference	Total
Nicosia	2.513	391	93	160	3.157
Limassol	1.367	288	103	146	1.904
Larnaca	1.147	294	160	243	1.844
Paphos	690	217	166	302	1.375
Famagusta	121	71	34	63	289
					8.569

HOUSES					
Sales from 01.01.2008 to 31.07.2013 (Whole shares only)					
District	Declared price = Accepted price	1%-20% difference	21% - 30% difference	More than 30% difference	Total
Nicosia	501	52	23	58	634
Limassol	624	90	39	72	825
Larnaca	7	2	2	2	13
Paphos	367	53	32	68	520
Famagusta	28	16	8	19	71
					2.063

In addition, comments were also provided on the declared/accepted sales price difference for sales data used in each separate regression analysis and are presented below.

Comments on Flats by District

Nicosia Flats:

Difference between declared and accepted sale prices for Flats

Only 5% of the total sample shows a value difference of more than 30% between the declared and accepted price. This is considered as a good indicator in terms of accuracy.

Famagusta Flats

Difference between declared and accepted sale prices for Flats

22% of the total sample shows a value difference of more than 30% between the declared and accepted price.

Larnaca Flats

Difference between declared and accepted sale prices for Flats

13% of the total sample shows a value difference of more than 30% between the declared and accepted price. This can be considered as a good indicator in terms of accuracy.

Limassol Flats

Difference between declared and accepted sale prices for Flats

8% of the total sample shows a value difference of more than 30% between the declared and accepted price. This can be considered as a good indicator in terms of accuracy.

Paphos Flats

Difference between declared and accepted sale prices for Flats

22% of the total sample shows a value difference of more than 30% between the declared and accepted price. Further analysis is required to verify the reasons for difference, which looks high.

For all districts, it should be noted that the difference between the declared and accepted price by more than 20% can also be used in the future for analysis, as long as their accuracy is verified. Also, where a sale transaction has been challenged at court as regards its market value these sales can also be considered as genuine for analysis. As noted in the previous paragraphs, for the purpose of this study only sales that differ up to 20% (between the declared and accepted sales price) have been selected for analysis.

Comments on Houses by District

Nicosia Houses

Difference between declared and accepted sale prices for houses

Only 9% of the total sample shows a value difference of more than 30% between the declared and accepted price. This is considered as a good indicator in terms of accuracy.

Limassol Houses

Difference between declared and accepted sale prices for houses

Only 8% of the total sample shows a value difference of more than 30% between the declared and accepted price. This is considered as a good indicator in terms of accuracy.

Paphos Houses

Difference between declared and accepted sale prices for Houses

Only 13% of the total sample shows a value difference of more than 30% between the declared and accepted price. This is considered as a good indicator in terms of accuracy.

For all districts, it should be noted that the difference between the declared and accepted price by more than 20% can also be used in the future for analysis, as long as their accuracy is verified. Also, where a sale transaction has been challenged at court as regards its market value these sales can also be considered as genuine for analysis. As noted in the previous paragraphs, for the purpose of this study only sales that differ up to 20% (between the declared and accepted sales price) have been selected for analysis.

In order for the approach to be utilised successfully, sufficient transactions, and property characteristics of sold properties, must be recorded. Where sales are infrequent, and/or they are inadequately recorded (in terms of either the characteristics of the property or the accuracy of the data), the sales comparison approach cannot be applied successfully.

3. DLS Data

The DLS maintains a register of all real property transactions in Cyprus. Each transaction is processed and recorded through the Land Information System (LIS). The following characteristics are recorded:

- Sale file and date;
- Declared sale price;
- Accepted sale price;
- Sales analysis indicator (code 1: D=C without local inspection, code 2 D≠C without local inspection, code 3 D≠C with, code 4 D≠C with local inspection and court decision);
- Property identifier;

- Contract of sale file and date;
- Seller and buyer;
- Planning zone and category;
- Property type;
- Remarks;

The seller and the buyer attend the District Lands Office at the date of the transfer. Under existing laws, both the seller and buyer declare the agreed value of the property and the Department charges the relevant transfer fees based on that amount. An authorized valuer evaluates the sale transaction, at the date of the transfer, to determine if the declared sales price corresponds to the market value. If the declared value does not equal to the market value at the date of the transfer, the authorized valuer proceeds with a new valuation that is considered to be the true market value of the property based on comparable sales in the neighbourhood. The buyer has to pay transfer fees on the estimated market value, otherwise he can object within 45 days by providing a valuation report that he believes is the true market value. The District Lands Office (DLO) Valuer will assess the evidence of the private valuation and proceed with a local inspection of the property, if necessary. The resultant decision is communicated to the buyer within 3 months. If the buyer disagrees with the decision of the DLO Valuer, then he can apply to the Supreme Court for the determination of the market value under Section 80 of the Immovable Property Law (tenure, registration and valuation) Cap. 224.

When the declared value equals the accepted sale price in the LIS, the sales analysis indicator automatically shows the code 1, which means "genuine sale". In cases where the unit is under construction and it does not yet have a title, parties agree to sign a contract of sale instead of directly proceeding with the transfer. There are also some cases where the parties agree to sign a contract of sale, rather than complete the transfer, even with the existence of a title. In such cases, the contract of sale date, rather than the transfer date, is used for valuation purposes.

The existing process for registration of transactions does not record property characteristics beyond those listed above. On the other hand, the valuer gathers additional data on property characteristics from the buyer/seller during the transfer process.

For the purpose of this study, the sales register has been supplemented by information on property characteristics that have been collected from owners during the registration of transactions as well as during the data capture process and from the external inspection of properties for the implementation of the new GV. This database was utilised in the study to test the potential for applying MRA analysis in the application of the sales comparison approach to mass appraisal of property.

For Flats, the following property characteristics were available for analysis for the period Q1 2008 – Q2 2014:

- Enclosed area in square meters;
- Covered area in square meters;
- Uncovered area in square meters;

- Year built;
- Class (luxury, A- very good, B- standard, C below standard, D- very poor);
- Condition (very good, good, fair, bad);
- View (restricted, standard, premium, sea view);
- District (5 administrative district of Cyprus);
- Town/village identifier;
- Quarter of town/village;
- Planning zone type (17 different types);
- Planning zone density.

For houses, the following property characteristics were available for analysis for the period Q1 2008 – Q3 2013:

- Enclosed area in square meters;
- Covered area in square meters;
- Uncovered area in square meters;
- Year Built;
- Class (luxury, A- very good, B- standard, C below standard, D- very poor);
- Condition (very good, good, fair, bad);
- View (restricted, standard, premium, sea view);
- District (5 administrative district of Cyprus);
- Town/village identifier;
- Quarter of town/village;
- Planning zone type (17 different types);
- Planning zone density.

For undeveloped land, the following property characteristics were available for analysis for the period Q1 2008 – Q3 2014:

- Area in square meters;
- District (5 administrative district of Cyprus);
- Town/village identifier;
- Quarter of town/village;
- Planning zone type;
- Planning zone density;
- Accessibility (no access, access, right of way);
- Road parcel relation type (none, side access, corner, two sides, three sides, four sides);
- Shape (regular, irregular, highly irregular).

3.1 Limitations to the availability of data and data format

It was not possible to automatically extract the planning zone density and coverage variables for the sales of land. Therefore it was necessary to populate these variables manually by GV staff. Additionally, a number of missing values were identified in the sales characteristics file and these were populated by staff at District Offices.

Furthermore, during the analysis procedure the contract of sale dates and sales dates were not recognised by the SPSS software package, although these variables were imported from excel and characterised as numeric fields. To overcome this problem new variables were created (quarter of contract of sale and quarter of sale).

3.2 Data quality issues and quality assurance

A previous mission examined the underlying quality of the residential property data using a number of statistical techniques (minimum, maximum mean and median values, statistical dispersion and missing value counts). That examination found that the quality of the subsets of data analysed appeared to be good and not suffering from any systematic data quality issues. There was no systematic evidence of obviously spurious values and in only a handful of cases were values missing.

It is vital, for the purposes of the MRA, that characteristics are correctly recorded. Where this is not possible then DLS will populate the characteristic as part of a quality assurance process.

DLS will also conduct a review of the recording of property characteristics at district office level and issue new instructions to district office staff, where necessary, to ensure that all characteristics are recorded as accurately as possible during the registration process.

3.3 Preparation of data for study by DLS

The initial export of sales data set from the CILIS system included three different files, namely a) Units (flats/other -horizontally divided) b) buildings (houses/industrial etc) and c) vacant land (fields and building sites of all uses). The data below includes shared properties but does not include transfers by gifts. The initial data sets are stratified by district, property type and use. These are presented below:

VACANT LAND (JUN. 2008 -SEPT. 2014)

DISTRICT	FIELDS														
	RESIDENTIAL		COMMERCIAL		TOURISTIC		INDUSTRIAL		AGRICULTURAL		OTHER		TOTAL		
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Total
NICOSIA	609	782	8	2	0	0	94	58	199	2.200	53	877	963	3.919	**4.882**
LIMASSOL	89	519	10	3	2	16	8	7	44	644	41	600	194	1789	**1.983**
LARNACA	162	172	1	0	0	41	43	5	262	312	147	256	615	786	**1.401**
PAPHOS	39	205	1	3	13	22	0	14	37	559	19	398	109	1201	**1.310**
FAMAGUSTA	182	32	8	0	141	4	16	0	240	138	99	83	686	257	**943**
TOTAL	**1.081**	**1.710**	**28**	**8**	**156**	**83**	**161**	**84**	**782**	**3.853**	**359**	**2.214**	**2.567**	**7.952**	**10.519**

DISTRICT	BUILDING SITES														
	RESIDENTIAL		COMMERCIAL		TOURISTIC		INDUSTRIAL		AGRICULTURAL		OTHER		TOTAL		
DISTRICT	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Total
NICOSIA	712	153	35	0	0	0	6	10	4	10	1	6	758	179	**937**
LIMASSOL	597	628	47	6	7	37	17	0	0	3	13	12	681	686	**1.367**
LARNACA	406	323	19	1	0	24	1	1	0	6	1	2	427	357	**784**
PAPHOS	155	233	14	1	6	0	0	7	0	259	3	21	178	521	**699**
FAMAGUSTA	84	16	3	0	3	0	0	0	0	2	0	0	90	18	**108**
TOTAL	**1.954**	**1.353**	**118**	**8**	**16**	**61**	**24**	**18**	**4**	**280**	**18**	**41**	**2.134**	**1.761**	**3.895**

UNITS Horizonatlly Divided (JUN. 2008 -SEPT. 2014)

DISTRICT	UNITS HORIZONTALLY DIVIDED (e.g flats)														
	RESIDENTIAL		COMMERCIAL		TOURIST		INDUSTRIAL		AGRICULTURA		OTHER		TOTAL		
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Total
NICOSIA	3.221	29	375	0	0	0	1	0	0	0	136	0	3.733	29	**3.762**
LIMASSOL	1.879	76	428	106	287	258	0	0	0	0	150	0	2.744	440	**3.184**
LARNACA	1.494	411	169	6	17	103	0	0	0	0	80	0	1.766	520	**2.286**
PAPHOS	1.213	199	107	3	149	7	0	0	0	0	27	30	1.496	239	**1.735**
FAMAGUSTA	283	12	40	0	86	0	0	0	1	0	125	0	535	12	**547**
TOTAL	**8.090**	**727**	**1.119**	**115**	**539**	**368**	**1**	**0**	**1**	**0**	**518**	**30**	**10.274**	**1.240**	**11.514**

UNITS (JUN. 2008 -JULY 2013)

DISTRICT	UNITS (Not horizontally divided e.g houses)														
	RESIDENTIAL		COMMERCIAL		TOURISTIC		INDUSTRIAL		AGRICULTURAL		OTHER		TOTAL		
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Total
NICOSIA	1.044	450	19	2	0	0	0	0	1	19	14	3	1.078	474	**1552**
LIMASSOL	653	854	15	5	5	0	0	0	1	36	9	15	683	910	**1593**
LARNACA	74	4	4	0	0	0	0	0	0	0	2	0	80	4	**84**
PAPHOS	117	320	4	12	5	2	0	0	11	25	8	35	145	394	**539**
FAMAGUS	58	40	5	0	64	0	0	0	8	8	10	2	145	50	**195**
TOTAL	**1.946**	**1.668**	**47**	**19**	**74**	**2**	**0**	**0**	**21**	**88**	**43**	**55**	**2.131**	**1.832**	**3.963**

4. Data availability

The transactions highlighted in the previous chapter were filtered to include only those transactions of properties with whole share where the declared/accepted sale price difference did not exceed the 20% threshold.

The total number of transactions for land and residential property in Cyprus fell from 6,005 in 2008 to 2,658 in 2012. These greatly reduced levels of transactions limit the potential for application of the sales comparison approach and in particular the granularity of analysis that can

be performed in respect of location. This problem is exacerbated by the growing share of non arm's-length transactions in recent periods. In 2008, 17 per cent of transactions of residential buildings and land were deemed non arm's-length but in 2012 the figure the share of non arm's-length was 30 per cent.

The following tables detail the number of transactions available (for each quarter and in each district) to the study for analysis.

Table 1. Sales of Flats available for analysis

Year	Quarter	District					Total
		Nicosia	Famagusta	Larnaca	Limassol	Paphos	
2008	**1**	350	29	132	224	75	**810**
2008	**2**	304	33	139	206	78	**760**
2008	**3**	214	38	104	182	64	**602**
2008	**4**	192	10	81	109	37	**429**
2009	**1**	124	9	44	63	26	**266**
2009	**2**	160	13	69	79	26	**347**
2009	**3**	194	14	65	103	31	**407**
2009	**4**	208	11	89	135	36	**479**
2010	**1**	162	10	64	105	21	**362**
2010	**2**	185	19	72	120	39	**435**
2010	**3**	192	13	67	96	37	**405**
2010	**4**	161	10	80	105	39	**395**
2011	**1**	115	7	66	90	33	**311**
2011	**2**	131	18	66	109	34	**358**
2011	**3**	92	13	68	54	28	**255**
2011	**4**	115	5	50	103	49	**322**
2012	**1**	96	8	48	95	37	**284**
2012	**2**	86	12	48	85	52	**283**
2012	**3**	49	8	44	50	29	**180**
2012	**4**	46	8	40	68	49	**211**
2013	**1**	31	3	35	38	41	**148**
2013	**2**	21	8	52	39	45	**165**
2013	**3**	42	6	40	48	30	**166**
2013	**4**	40	12	34	69	45	**200**
2014	**1**	27	8	41	59	52	**187**
2014	**2**	33	7	60	85	50	**235**
Total		**3,370**	**332**	**1,698**	**2,519**	**1,083**	**9,002**

Table 2. Sales of Houses available for analysis

Year	Quarter	District					Total
		Nicosia	Famagusta	Larnaca	Limassol	Paphos	
2008	**1**	69	3	6	69	24	**171**
	2	70	4	5	83	39	**201**
	3	49	4	7	70	22	**152**
	4	51	3	1	52	18	**125**
2009	**1**	34	0	1	44	17	**96**
	2	40	2	4	40	18	**104**
	3	48	6	0	46	21	**121**
	4	77	4	2	52	21	**156**
2010	**1**	51	4	1	53	16	**125**
	2	58	2	1	52	26	**139**
	3	42	3	2	44	21	**112**
	4	46	5	0	52	22	**125**
2011	**1**	32	2	2	46	23	**105**
	2	34	3	1	52	28	**118**
	3	18	1	1	35	11	**66**
	4	34	1	2	46	22	**105**
2012	**1**	33	2	0	31	15	**81**
	2	21	2	1	32	10	**66**
	3	24	3	1	25	17	**70**
	4	12	5	0	23	15	**55**
2013	**1**	7	3	0	17	16	**43**
	2	8	3	1	12	7	**31**
	3	2	0	0	3	1	**6**
Total		**860**	**65**	**39**	**979**	**430**	**2,373**

Table 3. Sales of Residential Land available for analysis

Year	Quarter	District					Total
		Nicosia	Famagusta	Larnaca	Limassol	Paphos	
2008	1	178	23	69	107	48	**425**
2008	2	152	25	85	123	59	**444**
2008	3	152	13	26	95	34	**320**
2008	4	97	7	22	37	14	**177**
2009	1	51	6	13	15	5	**90**
2009	2	52	4	24	24	5	**109**
2009	3	54	7	21	48	18	**148**
2009	4	91	5	19	44	13	**172**

2010	1	65	3	22	35	8	**133**
2010	2	65	3	29	52	2	**151**
2010	3	48	4	19	33	14	**118**
2010	4	70	4	20	50	18	**162**
2011	1	74	1	5	38	13	**131**
2011	2	57	4	16	31	9	**117**
2011	3	34	0	15	35	3	**87**
2011	4	48	2	14	33	6	**103**
2012	1	54	0	16	30	13	**113**
2012	2	64	3	21	36	12	**136**
2012	3	29	3	31	23	10	**96**
2012	4	38	3	16	25	6	**88**
2013	1	24	1	16	28	5	**74**
2013	2	19	0	18	25	4	**66**
2013	3	14	2	20	29	7	**72**
2013	4	18	7	33	60	11	**129**
2014	1	17	2	17	25	6	**67**
2014	2	14	2	17	29	8	**70**
2014	3	7	2	14	36	6	**65**
2014	4	0	0	0	1	0	**1**
Total		**1,586**	**136**	**638**	**1,147**	**357**	**3,864**

The tables show that:

- While there are a good number of transactions of Flats available for analysis (9,002) and these are reasonably well distributed across the 5 valuation districts, Famagusta suffers from a lower level of available data with just 332 observations during the period Q1 2008 – Q2 2014;

- Transactions of houses are currently available for the period Q1 2008 – Q3 2013 only. The MRA analysis should benefit from the future inclusion of transactions from more recent period. Only 2,373 observations are available for analysis and Larnaca (39) and Famagusta (65) in particular suffer from very low levels of available data; The low levels were also due to the fact that filtering was necessary to achieve accurate and genuine observations for analysis;

- There are a reasonable number of transactions available for sales of residential land (3,864) covering the period Q1 2008 – Q3 2014. Again, Famagusta suffers from a low number of transactions (136).

5. Data preparation during study

Sale prices for flats and houses were adjusted, on a quarterly basis, for changes in market conditions using the residential property price indices published by the Central Bank of Cyprus (CBC). This is presented in **Appendix B**. Sales from a number of years can be used to increase

the number of available observations for use in mass appraisal models. In general, at least several years of data can be effectively analysed and adjusted to a common date. However, longer time periods and structural breaks that may have occurred in the market make this analysis more complex.

For the purposes of developing the prototype mass appraisal models for Cyprus, the mission adjusted property prices to an average of the indices for the fourth of quarter of 2012 and the first quarter of 2013, reflecting the valuation date of January 1st 2013. Alternatively, prices could be adjusted to the first quarter of 2013.

There is currently no published price index for land in Cyprus. Consequently it was not possible, at the time of the study to utilise sales from a number of years. An analysis of median prices for land sales over the period for which sales data were available did not produce a usable indicator of price development. In order to maximise the number of sales that could be included in the MRA, 4 quarters of data, averaging around the valuation date (Q3 2012 – Q2 2013) were pooled. Also, an attempt was made by the DLS to identify recurrent sales in municipal authorities where sales were concentrated. However, only a very small number of recurring sales were identified and consequently it was not possible to produce a robust analysis from them.

The CBC does however compile an unofficial index for internal analysis (this was not known during the study). The DLS will update land sale prices using this unofficial index in order to increase the number of observations that can be utilised future MRA work. The DLS has been informed that the land index will be made available for analysis during February 2015.

6. Model specification and calibration

The central idea of mass appraisal is the development of appraisal models that are applied to groups of properties in the real property database (the full and comprehensive database of all real property). The development of appraisal models involves two steps, specification and calibration. Specification involves deciding on which property characteristics likely have a significant effect on values (often largely determined by the availability of data on property characteristics) and how those characteristics are assumed to affect value. Calibration is the process of quantifying the coefficients associated with the variables in the model.

Where sale price is analysed against a number of predictor variables (property characteristics), multivariate appraisal models are developed. These can be additive, multiplicative or hybrid (the first two being more commonly employed). The study specified and calibrated additive models for property types in each district of Cyprus. In an additive model, the dependent variable (price or a transformation of price) is estimated by multiplying each independent variable by its coefficient and adding results to a constant. Additive models are commonly employed in mass appraisal. They are relatively easy to specify and calibrate and their results can be easily interpreted. However, they do not capture nonlinear relationships effectively and cannot make percentage adjustments.

Log-linear models (where sale price was log transformed) performed better models using price as the dependent variable. This was expected given the positively biased distribution of recorded sale independently of prices. The constant and coefficients of log-linear models are converted into real monetary values by taking their exponential.

A backward stepwise regression approach to specification and calibration of the models was employed. Under this approach, models are built including the available property characteristics and then successively removing variables that improve the model the most by being deleted until no further improvement is possible. The stepwise regression output lists the property characteristics utilised in the final model in the order of their significance (importance).

Property values can be expected to vary significant between geographical areas. Additionally, the value of property characteristics may also show significant variation between areas. While separate models can be developed for market areas in response, low numbers of sales can limit the potential for stratification of models in this way. In such cases, quality of micro location or neighbourhood indicators, where available, can be employed.

A previous study developed a model for Flats in Larnaca which included a predictor variable for the ratio of building land value in the planning zone to the geometric average of valuations per planning zone across the entire district of Larnaca (IMF mission report: visit in March 10-14, 2014). This variable acted as a proxy for quality of neighborhood, which is an important factor in the determination of property prices. While the regression output seemed promising this approach was problematic in that the inclusion of DLS valuations of planning zones meant that the analysis included current CAMA parameters and was not therefore independent of the current valuation process.

This study focused on two approaches to estimating locational effects on value. Firstly, models were run for each district with location at level of town controlled for. It is important to note that towns and villages where relatively small numbers of sales occurred were excluded from the models by the stepwise regression approach as they could not produce statistically significant coefficients. Secondly, separate models were run for those municipalities where there were a sufficient number of transactions. Models which controlled for micro location through use of planning zone types and planning zone densities were also tested. The DLS has determined a small number of micro locations which have been defined by valuers at district level and updated on the property level. The identification and extraction of this data from CILIS in conjunction with the sales data was not possible, despite the fact that the very limited number of sales with a micro location factor would not produce any sound conclusions. This is an issue to be examined in the future as well as the determination of micro locations where needed in all districts.

7. Statistical results

DLS overall assessment of results

- Overall, performance of sales comparison approach limited by low transaction numbers. Potential for improved performance as market returns to normal levels of activity.

- MRA performs best for Flats. It is currently not suitable for land due to the very limited number of observations and the lack of a land price index.

- District level adjustments in the first regression results for flats were relatively sound for the reason that the majority of sales data were concentrated in municipality areas. As regards land or houses, the regression output was not sufficiently robust because of the small number of sales available as well as the dispersion of these sales across many geographical areas.

- The sales comparison approach cannot be applied to all properties nationally. In particular it is not suitable for use in rural areas where sales are very sparse. It is also unsuited to atypical properties (particularly very low and very high value properties). Additionally, the transactions for commercial and industrial properties are too low for any sound analysis.

- Consequently, the sales comparison approach cannot be considered, at this time, as presenting an alternative to more traditional valuation methods. However, it could be used to supplement the current approach applied by the DLS.

- The experience gained through the various statistical analysis has given the DLS additional insights into the following issues:

    - Data availability, data capture and data quality;
    - Statistical methods, strengths and weaknesses and alternative options ;
    - Valuation methods in relation to statistical methods;
    - CAMA model, export/import functions, data management issues;
    - Quality control and assurance of the output;
    - Human resources including expertise in statistical analysis;
    - Cooperation and collaboration with CBC and CYSTAT on technical and data issues;

The best performing models for both Flats and houses in each of the five administrative districts were presented to district valuers for their assessment.

The following section presents the best performing models and an assessment of each of them by the district valuers.

Note: td*** refers to dummies for different municipalities, towns or villages.

7.1 Flats

Nicosia Flats

The MRA did not support an adjustment for location based on either planning zones or densities. Instead, the adjustment for location was based on stratification (using dummy variables) for the main municipalities. Two final models were selected; the first covering Nicosia Municipality and the other main municipalities excluding Aglantzia which was rejected by the step wise analysis. A second separate model was developed for Aglantzia.

Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

Model Selection and Calibration

No of Observations: 3.012
Use: Residential
Declared/accepted % difference covered: 0- 20%

Nicosia Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,857[a]	.735	.733	.204344300	.735	360.259	23	2988	0.000
2	,857[b]	.735	.733	.204312860	.000	.080	1	2988	.777
3	,857[c]	.735	.733	.204300446	.000	.637	1	2989	.425
4	,857[d]	.735	.733	.204351227	.000	2.487	1	2990	.115

a. Predictors: (Constant), td233, td109, td231, td106, td105, td232, td108, Unit_class_code, td225, td107, td24, td10, Unit_uncovered_extent, Unit_view_code, td11, td23, Unit_covered_extent, td13, td21, Unit_condition_code, td12, Unit_enclosed_extent, age

b. Predictors: (Constant), td233, td109, td231, td106, td105, td232, td108, Unit_class_code, td225, td107, td24, td10, Unit_uncovered_extent, Unit_view_code, td11, td23, Unit_covered_extent, td13, td21, td12, Unit_enclosed_extent, age

c. Predictors: (Constant), td233, td231, td106, td105, td232, td108, Unit_class_code, td225, td107, td24, td10, Unit_uncovered_extent, Unit_view_code, td11, td23, Unit_covered_extent, td13, td21, td12, Unit_enclosed_extent, age

d. Predictors: (Constant), td233, td231, td106, td105, td232, td108, Unit_class_code, td225, td107, td24, td10, Unit_uncovered_extent, Unit_view_code, td11, td23, Unit_covered_extent, td21, td12, Unit_enclosed_extent, age

e. Dependent Variable: logprice

Nicosia Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp
		B	Std. Error	Beta			Lower Bound	Upper Bound	
4	(Constant)	10.728	.053		200.592	0.000	10.623	10.832	45,595.42
	Unit_class_code	.043	.016	.027	2.675	.008	.012	.075	1.04
	Unit_view_code	.072	.012	.057	5.809	.000	.048	.097	1.07
	Unit_enclosed_extent	.009	.000	.677	54.222	0.000	.009	.010	1.01
	Unit_covered_extent	.007	.001	.148	12.325	.000	.006	.009	1.01

Unit_uncovered_extent	.002	.000	.077	7.989	.000	.001	.002	1.00
age	-.017	.000	-.489	-40.798	.000	-.018	-.016	0.98
td10	-.042	.022	-.019	-1.915	.056	-.086	.001	0.96
td11	.069	.015	.044	4.465	.000	.038	.099	1.07
td12	.028	.010	.032	2.933	.003	.009	.047	1.03
td21	-.036	.013	-.030	-2.845	.004	-.061	-.011	0.96
td23	-.068	.015	-.046	-4.511	.000	-.098	-.039	0.93
td24	-.144	.035	-.039	-4.070	.000	-.213	-.074	0.87
td105	-.178	.102	-.016	-1.737	.083	-.379	.023	0.84
td106	-.292	.145	-.019	-2.017	.044	-.576	-.008	0.75
td107	-.328	.035	-.089	-9.307	.000	-.398	-.259	0.72
td108	-.316	.073	-.041	-4.338	.000	-.459	-.173	0.73
td225	-.192	.039	-.047	-4.950	.000	-.267	-.116	0.83
td231	-.288	.145	-.019	-1.990	.047	-.572	-.004	0.75
td232	-.187	.078	-.023	-2.402	.016	-.339	-.034	0.83
td233	-.382	.145	-.025	-2.639	.008	-.666	-.098	0.68

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	Although retained by the step wise MRA, the output is unsound as the coefficient is positive instead of negative.	Further investigation is needed.
Condition	This characteristic was rejected by the MRA.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.7% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum rate was adopted by the valuers.
View	This characteristic was included in the model. However, the difference between	The coefficient looks reasonable. This feature was not so significant in Nicosia Municipalities

	the standard and premium view code was only 7.5%.	because the sea factor does not exist.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.75% on total value.	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10 sq.m). A 77% increase was found by the model on the base value per sq.m. Further analysis is needed.
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.13% on total value.	There is logic between the % difference of covered compared with the uncovered area. It is common that the uncovered area is cheaper than the covered area. Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 18,46% increase was found by the model on the base value per sq.m. The % adopted by the model needs further analysis.

Model Selection and Calibration

No of Observations: 314
Use: Residential
Declared/accepted % difference covered: 0- 20%

Aglantzia Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2
1	,844[a]	.711	.705	.218801703	.711	107.808	7	306
2	,843[b]	.710	.704	.219018259	-.002	1.608	1	306
3	,841[c]	.708	.703	.219528122	-.002	2.436	1	307

a. Predictors: (Constant), age, Unit_uncovered_extent, Unit_view_code, Unit_covered_extent, Unit_condition_code, Unit_enclosed_extent, Unit_class_code

b. Predictors: (Constant), age, Unit_uncovered_extent, Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_class_code

c. Predictors: (Constant), age, Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_class_code

d. Dependent Variable: logprice

Aglantzia Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
3	(Constant)	10.205	.223		45.755	.000	9.766	10.644	27,033.71
	Unit_class_code	.140	.073	.090	1.912	.057	-.004	.284	1.15
	Unit_view_code	.087	.032	.088	2.766	.006	.025	.149	1.09
	Unit_enclosed_extent	.010	.001	.698	15.905	.000	.009	.012	1.01
	Unit_covered_extent	.014	.002	.226	5.541	.000	.009	.018	1.01
	age	-.012	.002	-.283	-5.545	.000	-.016	-.007	0.99

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	This characteristic was included in the model for Aglantzia Municipality. The output is unsound however, as the coefficient is positive instead of negative.	Further investigation is needed.
Condition	This characteristic was rejected by the MRA.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.7% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum rate was adopted by the valuers.
View	The difference between the categories was estimated to be only 9.1%.	The coefficient looks reasonable. This feature is not so significant in Nicosia Municipalities because the sea factor does not exist.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 1.4% on total value.	Further analysis is needed to establish the degree of accuracy.
Uncovered verandah	This characteristic was rejected by the MRA	There is a need to assign a value for this coefficient in order to take into account in valuation of those flats which have this extra amenity.

General Comments

The relatively low number of sales observations limited the potential for MRA. The parameter for "view" was as strongly significant in Nicosia District as in other Districts which are impacted by proximity to the coast. Furthermore, the terrain in Nicosia Municipalities is very even and the variable "slope" was not significant in the MRA. Furthermore, statistical analysis may also be required on the basis of value per sq.m by planning zone rather than on the total value.

Finally, Nicosia District is boarded by the buffer zone. Consequently, the property market, particularly in those areas that are in close proximity to the buffer zone, has been negatively affected.

Famagusta Flats

The MRA did not support an adjustment for location based on either planning zones or densities. Instead the adjustment for location was based on stratification (using dummy variables) for the main municipalities. Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

Location adjustments for Sotiras Municipality and Liopetri village were excluded from the model. However, separate models could not be developed for these strata due to the low number of transactions occurring in them.

Model Selection and Calibration

No of Observations: 289
Use: Residential
Declared/accepted % difference covered: 0- 20%

Famagusta Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,888[a]	.789	.781	.189774444	.789	94.378	11	277	.000
2	,888[b]	.789	.782	.189441191	.000	.024	1	277	.876
3	,888[c]	.789	.782	.189201666	.000	.295	1	278	.588
4	,888[d]	.788	.782	.189340791	-.001	1.412	1	279	.236

a. Predictors: (Constant), td104, td103, Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_condition_code, td102, Unit_uncovered_extent, age, Unit_class_code, td100

b. Predictors: (Constant), td104, td103, Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_condition_code, td102, Unit_uncovered_extent, age, td100

c. Predictors: (Constant), td104, Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_condition_code, td102, Unit_uncovered_extent, age, td100

d. Predictors: (Constant), Unit_view_code, Unit_covered_extent, Unit_enclosed_extent, Unit_condition_code, td102, Unit_uncovered_extent, age, td100

e. Dependent Variable: logprice

Famagusta Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
4	(Constant)	10.599	.119		89.129	.000	10.365	10.833	40,102.92
	Unit_condition_code	-.054	.023	-.100	-2.358	.019	-.098	-.009	0.95
	Unit_view_code	-.086	.045	-.055	-1.900	.058	-.174	.003	0.92
	Unit_enclosed_extent	.014	.001	.690	21.807	.000	.013	.015	1.01
	Unit_covered_extent	.008	.003	.107	3.163	.002	.003	.013	1.01
	Unit_uncovered_extent	.004	.001	.209	6.842	.000	.003	.005	1.00
	age	-.011	.002	-.250	-6.407	.000	-.014	-.008	0.99
	td100	.083	.044	.092	1.885	.060	-.004	.169	1.09
	td102	-.080	.039	-.062	-2.062	.040	-.156	-.004	0.92

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer's Assessment
Class	This characteristic was rejected by the MRA.	Further analysis is needed
Condition	This characteristic was included in the model. The difference between each categorical value was estimated to be 5.7%	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.48% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers. The two estimates are close.
View	This characteristic was included in the model. However, the coefficient was negative instead of positive. No sea	A ratio of 2:1 between sea and non-sea view Flats is typically employed by valuers, but this varies with location. The characteristics and

	view properties were recorded in the sales data.	location should be reexamined.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.54% on total value.	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10sq.m). A 82,7% increase was found by the model on the base value per sq.m. Further analysis is needed.
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.3% on total value.	There is consistency in the % difference between covered and uncovered verandah areas. It is common that the uncovered area has a smaller impact on price. Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 37% increase was found by the model on the base value per sq.m.The % adopted by the model will need further analysis.

General comments

Generally, the low numbers of observations for both Flats and buildings did not support a robust MRA analysis. Location adjustments were particularly problematic for this district.

All Famagusta Municipalities are close to the coast and thus values are affected by this additional feature. Residential areas are also used for touristic accommodation because of the close proximity to the coast. The terrain of the municipal authorities is even. In some costal municipalities, there is a foreign demand for tourist/residential properties and thus the property market is affected by foreign investment. Derinia Municipality as well as other Communal Authorities is close to the buffer zone this feature greatly affects values. In addition, the tourist activity is seasonal (hotels are closed from the beginning of November to the end of March) and this seasonality also affects property values. This has also been observed by CYSTAT in their analysis.

Larnaca Flats

The MRA did not support an adjustment for location based on either planning zones or densities. Instead the adjustment for location was based on stratification (using dummy variables) for the main municipalities. Two final models were selected; the first covering Larnaca Municipality and the other main municipalities excluding Aradippou Municipality which was rejected by the step wise analysis. A second separate model was developed for Aradippou Municipality.

Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

Model Selection and Calibration

No of Observations: 1.595
Use: Residential
Declared/accepted % difference covered: 0- 20%

Larnaca Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,855[a]	.732	.728	.199281818	.732	201.731	21	1552	0.000
2	,855[b]	.732	.728	.199225268	.000	.119	1	1552	.730
3	,855[c]	.732	.729	.199170907	.000	.152	1	1553	.697
4	,855[d]	.732	.729	.199116592	.000	.152	1	1554	.697
5	,855[e]	.732	.729	.199088538	.000	.562	1	1555	.454
6	,855[f]	.732	.729	.199060790	.000	.566	1	1556	.452
7	,855[g]	.731	.729	.199050509	.000	.839	1	1557	.360
8	,855[h]	.731	.729	.199119927	.000	2.088	1	1558	.149

a. Predictors: (Constant), td300, Unit_class_code, td104, td122, td106, td212, td125, td111, Unit_enclosed_extent, td14, Unit_view_code, td110, td120, td10, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, Unit_condition_code, age

b. Predictors: (Constant), td300, Unit_class_code, td104, td122, td106, td212, td125, td111, Unit_enclosed_extent, td14, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, Unit_condition_code, age

c. Predictors: (Constant), td300, Unit_class_code, td104, td122, td106, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, Unit_condition_code, age

d. Predictors: (Constant), td300, Unit_class_code, td122, td106, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, Unit_condition_code, age

e. Predictors: (Constant), td300, Unit_class_code, td122, td106, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, age

f. Predictors: (Constant), td300, Unit_class_code, td122, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, age

g. Predictors: (Constant), Unit_class_code, td122, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, age

h. Predictors: (Constant), Unit_class_code, td212, td125, td111, Unit_enclosed_extent, Unit_view_code, td110, td120, td112, td11, td102, Unit_uncovered_extent, Unit_covered_extent, age

i. Dependent Variable: logprice

Larnaca Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
8	(Constant)	10.228	.057		179.796	0.000	10.116	10.340	27,667.32
	Unit_class_code	-.053	.012	-.069	-4.283	.000	-.077	-.029	0.95
	Unit_view_code	.350	.018	.260	19.274	.000	.315	.386	1.42
	Unit_enclosed_extent	.011	.000	.598	37.942	.000	.010	.012	1.01
	Unit_covered_extent	.005	.001	.113	6.702	.000	.004	.007	1.01
	Unit_uncovered_extent	.002	.000	.123	8.771	.000	.002	.003	1.00
	age	-.017	.001	-.362	-20.606	.000	-.018	-.015	0.98
	td11	-.051	.020	-.034	-2.482	.013	-.091	-.011	0.95
	td102	-.127	.019	-.095	-6.762	.000	-.164	-.090	0.88
	td110	-.092	.032	-.039	-2.865	.004	-.156	-.029	0.91
	td111	-.112	.031	-.048	-3.620	.000	-.173	-.051	0.89
	td112	-.058	.027	-.029	-2.161	.031	-.110	-.005	0.94
	td120	.177	.082	.028	2.154	.031	.016	.337	1.19
	td125	-.295	.115	-.034	-2.560	.011	-.522	-.069	0.74
	td212	.338	.141	.031	2.394	.017	.061	.614	1.40

a. Dependent Variable: logprice

Other Comments

Although analysis was performed for separate geographical areas, the results were not robust due to very limited observations as regards the buildings (houses). Further, it is noted that the terrain of the Municipal Authorities is even. On the other hand many Communal Authorities are built in slopping land, therefore further analysis is required in the future for this variable "slope/elevation". These are very common in mountainous geographical areas.

Generally the limited number of transaction of both Flats and buildings did not support robust MRA.
About half of the Municipalities Larnaca (Larnaca, Livadia and Meneou-Dromolaxia) are close to the coast and thus values are affected by this additional factor. Residential areas are also used for touristic accommodation because of their close proximity to the coast. The terrain of the municipal authorities is even. In some costal municipalities, there is foreign demand for tourist/residential properties which has an impact on prices.

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	This characteristic was included in the model. For every inferior class a 5% is deducted by the model.	This % looks low, thus this has to be investigated, both on data and value.
Condition	This characteristic was rejected by the MRA.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.7% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was included in the model The difference between each categorical value was estimated to be 42%.	A ratio of 2:1 between sea and non-sea view Flats is typically employed by valuers, but this varies with location. The characteristics and location should be reexamined.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.5% on total value	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10sq.m). A 52% increase was found by the model on the base value per sq.m. Further analysis is needed.
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.2% total value	There is consistency in the % difference between covered and uncovered verandah areas. It is common that the uncovered area has a smaller impact on price. Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 21% increase was found by the model on the base value per sq.m.The % adopted by the model will need further analysis.

Model Selection and Calibration

No of Observations: 179
Use: Residential
Declared/accepted % difference covered: 0- 20%

Aradippou Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2
1	,830[a]	.688	.674	.142373697	.688	46.957	8	170
2	,830[b]	.688	.676	.141974306	.000	.042	1	170
3	,830[c]	.688	.677	.141627889	.000	.162	1	171
4	,828[d]	.686	.677	.141660046	-.002	1.079	1	172

a. Predictors: (Constant), q2, Unit_covered_extent, Unit_uncovered_extent, age, q1, Unit_enclosed_extent, Unit_class_code, Unit_condition_code

b. Predictors: (Constant), q2, Unit_covered_extent, Unit_uncovered_extent, age, q1, Unit_enclosed_extent, Unit_condition_code

c. Predictors: (Constant), q2, Unit_uncovered_extent, age, q1, Unit_enclosed_extent, Unit_condition_code

d. Predictors: (Constant), q2, Unit_uncovered_extent, age, q1, Unit_enclosed_extent

e. Dependent Variable: logprice

Aradippou Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Exp.
4	(Constant)	10.793	.077		139.718	.000	10.640	10.945	48,665.71
	Unit_enclosed_extent	.014	.001	.700	15.502	.000	.012	.015	1.01
	Unit_uncovered_extent	.002	.000	.159	3.542	.001	.001	.003	1.00
	Age	-.037	.006	-.275	-6.059	.000	-.049	-.025	0.96
	q1	-.109	.023	-.216	-4.685	.000	-.155	-.063	0.90
	q2	-.125	.036	-.165	-3.431	.001	-.197	-.053	0.88

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	This characteristic was rejected by the MRA.	This is because the majority of Flats have the same quality (class B) and thus this variable was considered insignificant. Further investigation is needed;
Condition	This characteristic was rejected by the MRA.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.7% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was rejected by the MRA.	This is because all Flats were characterised by the same code (standard). The municipality is not close to the sea and the terrain is flat. The characteristics and location of sales should be reexamined.
Covered verandah	This characteristic was rejected by the MRA	There is a need to have a value for this coefficient in order to assign a value for those Flats which have this extra amenity.
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.17% on total value	Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 17% increase was found by the model on the base value per sq.m. Further analysis is needed.

Limassol Flats

The MRA did not support an adjustment for location based on either planning zones or densities. Instead the adjustment for location was based on stratification (using dummy variables) for the main municipalities. Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

Two models were developed. In the first, all municipalities with significant location coefficients were included. In a second model, Limassol Municipality was investigated separately.

Separate models could not be developed for those municipalities excluded from the first model, due to the low number of transactions occurring in them.

Model Selection and Calibration

No of Observations: 1.789
Use: Residential
Declared/accepted % difference covered: 0- 20%

Limassol Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,872[a]	.760	.757	.2100452	.760	253.128	22	1763	0.000
2	,872[b]	.760	.757	.2099889	.000	.053	1	1763	.818
3	,871[c]	.760	.757	.2099406	.000	.188	1	1764	.664
4	,871[d]	.759	.757	.2098922	.000	.186	1	1765	.666
5	,871[e]	.759	.757	.2098501	.000	.291	1	1766	.590
6	,871[f]	.759	.757	.2098109	.000	.341	1	1767	.560
7	,871[g]	.759	.757	.2097729	.000	.359	1	1768	.549
8	,871[h]	.759	.757	.2097401	.000	.446	1	1769	.504
9	,871[i]	.759	.757	.2097264	.000	.768	1	1770	.381
10	,871[j]	.759	.757	.2097170	.000	.841	1	1771	.359
11	,871[k]	.759	.757	.2097520	.000	1.591	1	1772	.207

a. Predictors: (Constant), td351, td203, td201, td227, td212, td20, td211, td100, td210, td124, td21, Unit_view_code, td11, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

b. Predictors: (Constant), td351, td203, td201, td227, td212, td211, td100, td210, td124, td21, Unit_view_code, td11, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

c. Predictors: (Constant), td351, td203, td201, td227, td211, td100, td210, td124, td21, Unit_view_code, td11, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

d. Predictors: (Constant), td351, td203, td201, td227, td211, td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

e. Predictors: (Constant), td351, td203, td227, td211, td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

f. Predictors: (Constant), td203, td227, td211, td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

g. Predictors: (Constant), td203, td211, td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

h. Predictors: (Constant), td203, td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

i. Predictors: (Constant), td100, td210, td124, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

j. Predictors: (Constant), td100, td210, td21, Unit_view_code, td22, Unit_enclosed_extent, td12, td13, Unit_class_code, Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

k. Predictors: (Constant), td100, td210, td21, Unit_view_code, Unit_enclosed_extent, td12, td13, Unit_class_code,

Unit_uncovered_extent, Unit_covered_extent, age, Unit_condition_code

l. Dependent Variable: logprice

Limassol Flats - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
11	(Constant)	11.095	.040		279.304	0.000	11.017	11.173	65,819.43
	Unit_class_code	-.030	.013	-.039	-2.279	.023	-.057	-.004	0.97
	Unit_condition_code	-.052	.014	-.071	-3.852	.000	-.079	-.026	0.95
	Unit_view_code	.025	.013	.024	1.974	.049	.000	.049	1.03
	Unit_enclosed_extent	.011	.000	.672	48.839	0.000	.011	.012	1.01
	Unit_covered_extent	.002	.001	.053	3.789	.000	.001	.003	1.00
	Unit_uncovered_extent	.001	.000	.051	4.163	.000	.001	.002	1.00
	age	-.015	.001	-.402	-22.772	.000	-.016	-.014	0.99
	td12	.035	.018	.024	1.924	.054	-.001	.070	1.04
	td13	.044	.016	.032	2.656	.008	.011	.076	1.04
	td21	-.162	.041	-.046	-3.923	.000	-.242	-.081	0.85
	td100	-.189	.061	-.036	-3.096	.002	-.309	-.069	0.83
	td210	-.274	.057	-.057	-4.826	.000	-.386	-.163	0.76

a. Dependent Variable: logprice

Comments on MRA results

Variable name:	Model output	Valuer Assessment
Class	This characteristic was included in the model. For every inferior class 3% is deducted by the model.	This % looks low, thus it has to be investigated, both on data and value.
Condition	This characteristic was included in the model. For each level of inferior condition, 5% is deducted.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.

Age	This characteristic was included in the model. The depreciation rate is 1.49% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was included in the model. The difference between the standard and sea view code was only 20%.	It looks low. The characteristics and location should be reexamined. Maybe the sales are not seafront properties but secondary zone, hence the lower adjustment. Common practice is that seafront flats are double in price compared with the secondary zone, other things being equal.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.22% on total value	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10sq.m). A 22 increase was found by the model on the base value per sq.m. This percentage looks very small. Further analysis is needed
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.13% on total value.	There is consistency in the % difference between covered and uncovered verandah areas. It is common that the uncovered area has a smaller impact on price. Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 13,5% increase was found by the model on the base value per sq.m. The % adopted by the model will need further analysis.

Model Selection and Calibration

No of Observations: 1.101
Use: Residential
Declared/accepted % difference covered: 0 - 20%

Limassol Municipality Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2
1	,894[a]	.799	.782	.1689209	.799	46.572	10	117
2	,894[b]	.799	.784	.1682277	.000	.034	1	117
3	,894[c]	.799	.785	.1677431	-.001	.315	1	118
4	,893[d]	.798	.786	.1673230	-.001	.400	1	119
5	,893[e]	.797	.787	.1669285	-.001	.430	1	120
6	,892[f]	.796	.788	.1667300	-.001	.710	1	121
7	,890[g]	.792	.785	.1676858	-.004	2.414	1	122

a. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, q1, Unit_view_code, Unit_enclosed_extent, Unit_class_code, q3, Unit_covered_extent, age

b. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, Unit_view_code, Unit_enclosed_extent, Unit_class_code, q3, Unit_covered_extent, age

c. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, Unit_enclosed_extent, Unit_class_code, q3, Unit_covered_extent, age

d. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, Unit_enclosed_extent, q3, Unit_covered_extent, age

e. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, Unit_enclosed_extent, q3, age

f. Predictors: (Constant), q4, Unit_uncovered_extent, Unit_condition_code, Unit_enclosed_extent, age

g. Predictors: (Constant), q4, Unit_condition_code, Unit_enclosed_extent, age

h. Dependent Variable: logprice

Limassol Municipality - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
7	(Constant)	11.275	.090		124.650	.000	11.096	11.454	78,792.94
	Unit_condition_code	-.094	.041	-.101	-2.264	.025	-.175	-.012	0.91
	Unit_enclosed_extent	.011	.001	.755	17.622	.000	.010	.012	1.01
	Age	-.022	.002	-.487	-10.256	.000	-.026	-.017	0.98
	q4	.253	.053	.204	4.792	.000	.148	.357	1.29

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer's Assessment
Class	This characteristic was excluded from the model.	This is because the majority of Flats have the same quality and therefore this variable is not significant. Further investigation is needed.
Condition	This characteristic was included in the model. For each level of inferior condition, 7% is deducted.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.67% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was excluded from the model.	The property characteristics and location should be reexamined.
Covered verandah	This characteristic was excluded from the model.	There is a need to assign a value for this coefficient in order to take into account in valuation of those flats which have this extra amenity.
Uncovered Verandah	This characteristic was excluded from the model.	Properties with this characteristic is not common and the reason that the model has excluded this variable.

Paphos Flats

The MRA did not support an adjustment for location based on either planning zones or densities. Instead the adjustment for location was based on stratification (using dummy variables) for the main municipalities. Two final models were selected; the first covering Paphos Municipality and the other main municipalities excluding Chloraca Municipality which was rejected by the step wise analysis. A second separate model was developed for Chloraca Municipality.

Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

Model Selection and Calibration

No of Observations: 1.020
Use: Residential
Declared/accepted % difference covered: 0- 20%

Paphos Municipality Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,826[a]	.682	.676	.2176315	.682	119.359	18	1001	.000
2	,826[b]	.682	.677	.2175252	.000	.021	1	1001	.885
3	,826[c]	.682	.677	.2174373	.000	.190	1	1002	.663
4	,826[d]	.682	.677	.2173551	.000	.240	1	1003	.624
5	,826[e]	.682	.677	.2172961	.000	.455	1	1004	.500
6	,826[f]	.682	.678	.2172467	.000	.542	1	1005	.462
7	,826[g]	.681	.678	.2172132	.000	.689	1	1006	.407
8	,825[h]	.681	.678	.2172210	.000	1.072	1	1007	.301
9	,825[i]	.681	.678	.2172437	.000	1.212	1	1008	.271

a. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td111, Unit_view_code, td24, td11, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_class_code, Unit_covered_extent, Unit_condition_code

b. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td111, Unit_view_code, td24, td27, td26, td22, td10, td20, age,

Unit_enclosed_extent, td133, Unit_class_code, Unit_covered_extent, Unit_condition_code

c. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td111, td24, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_class_code, Unit_covered_extent, Unit_condition_code

d. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td111, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_class_code, Unit_covered_extent, Unit_condition_code

e. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_class_code, Unit_covered_extent, Unit_condition_code

f. Predictors: (Constant), td343, Unit_uncovered_extent, td101, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_covered_extent, Unit_condition_code

g. Predictors: (Constant), Unit_uncovered_extent, td101, td27, td26, td22, td10, td20, age, Unit_enclosed_extent, td133, Unit_covered_extent, Unit_condition_code

h. Predictors: (Constant), Unit_uncovered_extent, td101, td27, td26, td22, td10, age, Unit_enclosed_extent, td133, Unit_covered_extent, Unit_condition_code

i. Predictors: (Constant), Unit_uncovered_extent, td101, td27, td26, td22, td10, age, Unit_enclosed_extent, td133, Unit_covered_extent

j. Dependent Variable: logprice

Paphos Municipality - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
9	(Constant)	10.605	.031		337.561	0.000	10.543	10.666	40,322.17
	Unit_enclosed_extent	.014	.000	.698	35.085	.000	.013	.014	1.01
	Unit_covered_extent	.002	.001	.040	1.936	.053	.000	.004	1.00
	Unit_uncovered_extent	.001	.000	.047	2.486	.013	.000	.002	1.00
	Age	-.017	.001	-.283	-14.440	.000	-.020	-.015	0.98
	td10	-.145	.031	-.085	-4.641	.000	-.206	-.083	0.87
	td22	-.133	.057	-.042	-2.332	.020	-.245	-.021	0.88

td26	.140	.063	.040	2.214	.027	.016	.264	1.15
td27	-.118	.057	-.037	-2.078	.038	-.230	-.007	0.89
td101	.353	.067	.095	5.300	.000	.222	.484	1.42
td133	-.150	.024	-.116	-6.253	.000	-.198	-.103	0.86

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer's Assessment
Class	This characteristic was excluded from the model.	Further analysis is needed.
Condition	This characteristic was excluded from the model.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 1.7% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was excluded from the model.	This feature is significant because most municipal authorities are close to the coast. Further analysis is needed.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.2%.	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10sq.m). A 21% increase was found by the model on the base value per sq.m. This percentage looks very small. Further analysis is needed
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.1% on the total value.	There is consistency in the % difference between covered and uncovered verandah areas. It is common that the uncovered area has a smaller impact on price. Two standard flats have been compared and the only difference was that the first flat had one uncovered verandah (10sq.m). A 11% increase was found by the model on the base value per sq.m. The % adopted by the model will need further analysis.

Model Selection and Calibration

No of Observations: 87
Use: Residential
Declared/accepted % difference covered: 0- 20%

Chloraca Flats - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2
1	,777[a]	.604	.569	.2650858	.604	17.016	7	78
2	,777[b]	.603	.573	.2638286	-.001	.252	1	78
3	,774[c]	.599	.574	.2635214	-.004	.814	1	79
4	,767[d]	.588	.567	.2655105	-.011	2.227	1	80

a. Predictors: (Constant), age, Unit_uncovered_extent, Unit_view_code, Unit_class_code, Unit_enclosed_extent, Unit_condition_code, Unit_covered_extent

b. Predictors: (Constant), age, Unit_uncovered_extent, Unit_view_code, Unit_enclosed_extent, Unit_condition_code, Unit_covered_extent

c. Predictors: (Constant), age, Unit_uncovered_extent, Unit_enclosed_extent, Unit_condition_code, Unit_covered_extent

d. Predictors: (Constant), age, Unit_uncovered_extent, Unit_enclosed_extent, Unit_covered_extent

e. Dependent Variable: logprice

Chloraca Municipality - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Exp.
4	(Constant)	10.547	.134		78.520	.000	10.280	10.814	38,067.99
	Unit_enclosed_extent	.011	.002	.535	6.186	.000	.007	.014	1.01
	Unit_covered_extent	.011	.005	.216	2.314	.023	.001	.020	1.01
	Unit_uncovered_extent	.004	.001	.195	2.634	.010	.001	.007	1.00
	Age	-.008	.005	-.135	-1.692	.095	-.018	.001	0.99

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer's Assessment
Class	This characteristic was excluded from the model.	Further investigation is needed;
Condition	This characteristic was excluded from the model.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 0.8% per annum.	In the CAMA model, a depreciation rate of 1.3% per annum was adopted by the valuers.
View	This characteristic was excluded from the model.	No sales for "sea view" were included in the data.
Covered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 1% on the total value.	Further analysis is needed to verify the results
Uncovered verandah	This characteristic was included in the model. For each additional sq.m, the price increased by 0.38% on the total value	Two standard flats have been compared and the only difference was that the first flat had one covered verandah (10sq.m). A 38% increase was found by the model on the base value per sq.m. Further analysis is needed to verify the results

7.2 Houses

All Municipalities with less than 6 recorded sales were excluded from the analysis.

The MRA did not support an adjustment for location based on planning zones. Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV. However, a parameter for permitted density was successfully utilised. This was applicable for all districts.

Nicosia Houses

Model Selection and Calibration

No of Observations: 540
Use: Residential
Declared/accepted % difference covered: 0 - 20%
Whole share

Nicosia Houses - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,795[a]	.632	.609	.663496432	.632	27.914	25	407	.000
2	,795[b]	.632	.610	.662683869	.000	.001	1	407	.971
3	,795[c]	.632	.611	.661891437	.000	.022	1	408	.881
4	,795[d]	.631	.612	.661180437	.000	.120	1	409	.730
5	,795[e]	.631	.612	.660528401	.000	.190	1	410	.663
6	,794[f]	.631	.613	.659857705	.000	.164	1	411	.686
7	,794[g]	.631	.614	.659149828	.000	.114	1	412	.735
8	,794[h]	.631	.614	.658820633	-.001	.587	1	413	.444
9	,794[i]	.630	.615	.658646383	-.001	.781	1	414	.377
10	,793[j]	.629	.615	.658584311	-.001	.922	1	415	.338
11	,793[k]	.628	.615	.658639069	-.001	1.069	1	416	.302
12	,792[l]	.627	.615	.658765676	-.001	1.161	1	417	.282
13	,791[m]	.626	.614	.658862840	-.001	1.124	1	418	.290
14	,790[n]	.625	.614	.659419702	-.002	1.710	1	419	.192
15	,789[o]	.623	.613	.660398537	-.002	2.251	1	420	.134

a. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, view, td24, td225, td302, td13, td404, td10, td23, td107, Unit_uncovered_extent, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

b. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, view, td24, td225, td302, td13, td10, td23, td107, Unit_uncovered_extent, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

c. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, view, td24, td225, td302, td13, td10, td23, td107, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

d. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, td24, td225, td302, td13, td10, td23, td107, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

e. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, td24, td225, td302, td10, td23, td107, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

f. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, td225, td302, td10, td23, td107, td105, td11, td21, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

g. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, td225, td302, td10, td23, td107, td105, td11, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

h. Predictors: (Constant), Permitted density, td243, td300, td109, td424, td227, td225, td302, td10, td23, td107, td105, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

i. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td225, td302, td10, td23, td107, td105, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

j. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td302, td10, td23, td107, td105, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, Unit_condition_code, age

k. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td302, td10, td23, td107, td105, Unit_covered_extent, Unit_class_code, td12, Unit_enclosed_extent, age

l. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td302, td10, td23, td107, td105, Unit_class_code, td12, Unit_enclosed_extent, age

m. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td302, td10, td23, td107, td105, Unit_class_code, Unit_enclosed_extent, age

n. Predictors: (Constant), Permitted density, td300, td109, td424, td227, td302, td23, td107, td105, Unit_class_code, Unit_enclosed_extent, age

o. Predictors: (Constant), Permitted density, td300, td109, td424, td302, td23, td107, td105, Unit_class_code, Unit_enclosed_extent, age

p. Dependent Variable: logprice

Nicosia Houses - Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
15	(Constant)	12.018	.213		56.445	.000	11.600	12.437	165,743.22
	Unit_class_code	-.185	.056	-.170	-3.325	.001	-.294	-.076	0.83
	Unit_enclosed_extent	.005	.001	.398	9.423	.000	.004	.006	1.00
	age	-.004	.002	-.105	-2.276	.023	-.007	-.001	1.00
	td23	-.385	.204	-.057	-1.889	.060	-.785	.016	0.68
	td107	-.692	.177	-.119	-3.917	.000	-1.039	-.345	0.50
	td105	-.634	.257	-.075	-2.472	.014	-1.139	-.130	0.53
	td109	-.753	.224	-.101	-3.362	.001	-1.192	-.313	0.47
	td300	-1.074	.256	-.128	-4.200	.000	-1.576	-.571	

								0.34
td302	-1.881	.276	-.207	-6.814	.000	-2.424	-1.338	0.15
td424	-.701	.226	-.094	-3.110	.002	-1.145	-.258	0.50
Permitted density	.001	.000	.215	6.431	.000	.001	.001	1.00

a. Dependent Variable: logprice

General Comments

The relatively low number of sales observations limited the potential for MRA. The systematic misrecording of age of building has previously been noted and this significantly limits the potential for MRA for Nicosia houses.

The parameter for "view" was not as strongly significant in Nicosia District as in other Districts which are impacted by proximity to the coast. Furthermore, the terrain in Nicosia Municipalities is very even and the variable "slope" was not significant in the MRA. Furthermore, statistical analysis may also be required on the basis of value per sq.m by planning zone rather than on the total value.

Finally, Nicosia District is boarded by the buffer zone. Consequently, the property market, particularly in those areas that are in close proximity to the buffer zone, has been negatively affected.

Comments on MRA results

Variable name	Model output	Valuer's Assessment
Class	This characteristic was included in the model The coefficient was results in a 17% reduction for each category.	The output is considered reasonable.
Condition	This characteristic was excluded from the model.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 0.4% per annum.	In the CAMA model, a depreciation rate of 1.4% per annum was adopted by the valuers. Systematic misrecording of the age of property needs to be addressed.
View	This characteristic was excluded from the model.	This feature is not particularly significant in Nicosia because the sea factor does not exist.
Covered verandah	This characteristic was excluded from the model.	There is a need to have a value for this coefficient in order to assign a value for those houses which have this extra amenity.
Uncovered verandah	This characteristic was excluded from the model.	There is a need to have a value for this coefficient in order to assign a value for those houses which have this extra amenity.

Famagusta Houses

The very low number of records of sales of houses in Famagusta over the period of observation did not support analysis of the sales comparison approach.

Larnaca Houses

The very low number of records of sales of houses in Larnaca over the period of observation did not support analysis of the sales comparison approach.

Limassol Houses

The MRA did not support an adjustment for location based on planning zones. Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

However, a parameter for permitted density was successfully utilised.

All Municipalities with less than 6 recorded sales were excluded from the analysis.

Model Selection and Calibration

No of Observations: 693
Use: Residential
Declared/accepted % difference covered: 0- 20%
Whole share

Limassol Houses - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,898[a]	.806	.791	.515933301	.806	53.656	42	542	.000
2	,898[b]	.806	.791	.515462715	.000	.010	1	542	.921
3	,898[c]	.806	.792	.515051679	.000	.133	1	543	.716
4	,898[d]	.806	.792	.514669177	.000	.191	1	544	.662
5	,898[e]	.806	.792	.514382688	.000	.392	1	545	.531
6	,898[f]	.806	.793	.514176313	.000	.561	1	546	.454
7	,897[g]	.805	.793	.514034191	.000	.697	1	547	.404
8	,897[h]	.805	.793	.514069087	.000	1.075	1	548	.300
9	,897[i]	.805	.793	.514012104	.000	.878	1	549	.349

10	,897[j]	.804	.793	.514102342	.000	1.193	1	550	.275
11	,897[k]	.804	.792	.514222478	.000	1.258	1	551	.263
12	,896[l]	.804	.793	.514187097	.000	.924	1	552	.337
13	,896[m]	.803	.792	.514894687	-.001	2.526	1	553	.113
14	,895[n]	.802	.791	.515620806	-.001	2.566	1	554	.110
15	,895[o]	.801	.791	.516204078	-.001	2.259	1	555	.133
16	,895[p]	.800	.790	.516710881	-.001	2.094	1	556	.148
17	,894[q]	.799	.790	.517287480	-.001	2.246	1	557	.135
18	,894[r]	.798	.789	.518039004	-.001	2.625	1	558	.106

a. Predictors: (Constant), td351, age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, Unit_uncovered_extent, td12, td330, Unit_covered_extent, td13, td300, Unit_enclosed_extent, Unit_condition_code, Unit_class_code

b. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, Unit_uncovered_extent, td12, td330, Unit_covered_extent, td13, td300, Unit_enclosed_extent, Unit_condition_code, Unit_class_code

c. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, Unit_uncovered_extent, td12, td330, td13, td300, Unit_enclosed_extent, Unit_condition_code, Unit_class_code

d. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, Unit_uncovered_extent, td12, td330, td300, Unit_enclosed_extent, Unit_condition_code, Unit_class_code

e. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, Unit_uncovered_extent, td12, td330, td300, Unit_enclosed_extent, Unit_condition_code

f. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td124, td125, td322, td311, td211, Permitted density, td12, td330, td300, Unit_enclosed_extent, Unit_condition_code

g. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td318, td325, td210, td307, td326, td100, td312, td306, td125, td322, td311, td211, Permitted density, td12, td330, td300, Unit_enclosed_extent, Unit_condition_code

h. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td325, td210, td307, td326, td100, td312, td306, td125, td322, td311, td211, Permitted density, td12, td330, td300, Unit_enclosed_extent, Unit_condition_code

i. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td122, td226, td21, td227, td313, td131, td325, td210, td307, td326, td100, td312, td306, td125, td322, td311, td211, Permitted density, td330, td300, Unit_enclosed_extent, Unit_condition_code

j. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td226, td21, td227, td313, td131, td325, td210, td307, td326, td100, td312, td306, td125, td322, td311, td211, Permitted density, td330, td300, Unit_enclosed_extent, Unit_condition_code

k. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td226, td21, td227,

td313, td131, td325, td210, td307, td326, td312, td306, td125, td322, td311, td211, Permitted density, td330, td300, Unit_enclosed_extent, Unit_condition_code

l. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td226, td21, td227, td313, td131, td325, td210, td307, td326, td312, td306, td125, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

m. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td21, td227, td313, td131, td325, td210, td307, td326, td312, td306, td125, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

n. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td11, td315, td107, td212, td101, td21, td227, td313, td131, td325, td210, td307, td326, td312, td306, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

o. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td315, td107, td212, td101, td21, td227, td313, td131, td325, td210, td307, td326, td312, td306, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

p. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td315, td107, td212, td101, td21, td313, td131, td325, td210, td307, td326, td312, td306, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

q. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td107, td212, td101, td21, td313, td131, td325, td210, td307, td326, td312, td306, td322, td311, td211, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

r. Predictors: (Constant), age, td128, td127, td350, view, td129, td130, td107, td212, td101, td21, td313, td131, td325, td210, td307, td326, td312, td306, td322, td311, Permitted density, td330, Unit_enclosed_extent, Unit_condition_code

s. Dependent Variable: logprice

Limassol Houses – Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
18	(Constant)	12.402	.385		32.179	.000	11.645	13.159	243,263.60
	Permitted density	.001	.000	.206	9.683	.000	.001	.001	1.00
	Unit_condition_code	-.094	.037	-.096	-2.513	.012	-.167	-.020	0.91
	Unit_enclosed_extent	.006	.000	.428	15.866	.000	.005	.007	1.01
	View	-.369	.187	-.038	-1.979	.048	-.736	-.003	0.69
	Age	-.006	.001	-.153	-3.765	.000	-.009	-.003	0.99

td21	-.584	.130	-.087	-4.487	.000	-.839	-.328	0.56
td101	-.591	.200	-.057	-2.950	.003	-.984	-.197	0.55
td107	-.289	.143	-.039	-2.027	.043	-.569	-.009	0.75
td127	-.758	.176	-.083	-4.317	.000	-1.103	-.413	0.47
td128	-.448	.167	-.051	-2.685	.007	-.776	-.120	0.64
td129	-.346	.175	-.038	-1.973	.049	-.691	-.002	0.71
td130	-1.067	.216	-.095	-4.948	.000	-1.491	-.644	0.34
td131	-1.759	.189	-.181	-9.298	.000	-2.131	-1.388	0.17
td210	-.227	.114	-.038	-1.988	.047	-.452	-.003	0.80
td212	-.598	.159	-.072	-3.758	.000	-.910	-.285	0.55
td306	-1.217	.203	-.117	-5.996	.000	-1.615	-.818	0.30
td307	-.618	.219	-.055	-2.819	.005	-1.049	-.187	0.54
td311	-.405	.192	-.042	-2.108	.035	-.783	-.028	0.67
td312	-.577	.156	-.073	-3.692	.000	-.885	-.270	0.56
td313	-.951	.217	-.085	-4.384	.000	-1.377	-.525	0.39
td322	-.609	.146	-.083	-4.169	.000	-.897	-.322	0.54
td325	-.678	.202	-.065	-3.361	.001	-1.074	-.282	0.51

td326	-1.094	.180	-.119	-6.080	.000	-1.447	-.740	0.33
td330	-.841	.140	-.122	-6.000	.000	-1.116	-.565	0.43
td350	-.369	.177	-.040	-2.086	.037	-.716	-.022	0.69

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	This characteristic was excluded from the model.	This exclusion was unexpected because the sample was spread across all categories. Further investigation is needed.
Condition	This characteristic was included in the model. The coefficient was results in a 9% reduction for each category.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 0.056% per annum.	In the CAMA model, a depreciation rate of 1.4% per annum was adopted by the valuers. The model results look very low. Further analysis is needed and there may be an issue in respect of the recording of age of building.
View	This characteristic was included in the model. However, the adjustment was negative rather than positive.	Further investigation is needed for this behavior.
Covered verandah	This characteristic was excluded from the model.	There is a need to have a value for this coefficient in order to assign a value for those houses which have this extra amenity.
Uncovered verandah	This characteristic was excluded from the model.	There is a need to have a value for this coefficient in order to assign a value for those houses which have this extra amenity.

Paphos Houses

The MRA did not support an adjustment for location based on planning zones. Because the inclusion of planning zones was not supported by the MRA, the constant value given by the model could not be assessed, by the district valuer against the data used in the CAMA for the recent GV.

However, a parameter for permitted density was successfully utilised.

All Municipalities with less than 6 recorded sales were excluded from the analysis.

Model Selection and Calibration

No of Observations: 360
Use: Residential
Declared/accepted % difference covered: 0- 20%
Whole share

Paphos Houses - Final Models Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,844[a]	.713	.687	.392473780	.713	28.300	22	251	.000
2	,844[b]	.712	.688	.391987317	.000	.376	1	251	.540
3	,844[c]	.712	.689	.391452501	.000	.310	1	252	.578
4	,843[d]	.711	.689	.391270589	-.001	.764	1	253	.383
5	,843[e]	.710	.690	.390968507	-.001	.606	1	254	.437
6	,843[f]	.710	.691	.390551006	-.001	.454	1	255	.501
7	,842[g]	.709	.691	.390196708	-.001	.534	1	256	.466
8	,842[h]	.708	.691	.390155709	-.001	.946	1	257	.332
9	,841[i]	.707	.691	.390042472	-.001	.850	1	258	.358
10	,840[j]	.705	.691	.390580043	-.002	1.717	1	259	.191

a. Predictors: (Constant), td353, td220, td123, td121, td132, td10, td111, td20, td23, td120, td22, td11, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, td133, Unit_condition_code, Unit_enclosed_extent, Unit_class_code, age, td26

b. Predictors: (Constant), td353, td220, td123, td121, td132, td10, td111, td20, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, td133, Unit_condition_code, Unit_enclosed_extent, Unit_class_code, age, td26

c. Predictors: (Constant), td353, td220, td123, td121, td132, td10, td111, td20, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, td133, Unit_enclosed_extent, Unit_class_code, age, td26

d. Predictors: (Constant), td353, td220, td123, td121, td132, td10, td111, td20, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age, td26

e. Predictors: (Constant), td353, td220, td123, td121, td132, td111, td20, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age, td26

f. Predictors: (Constant), td353, td220, td123, td121, td132, td111, td20, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age

g. Predictors: (Constant), td353, td220, td123, td121, td132, td111, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age

h. Predictors: (Constant), td220, td123, td121, td132, td111, td23, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age

i. Predictors: (Constant), td220, td123, td121, td132, td111, td120, td22, Unit_uncovered_extent, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age

j. Predictors: (Constant), td220, td123, td121, td132, td111, td120, td22, Unit_covered_extent, Permitted density, view, Unit_enclosed_extent, Unit_class_code, age

k. Dependent Variable: logprice

Paphos Houses – Final Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Exp.
		B	Std. Error	Beta			Lower Bound	Upper Bound	
10	(Constant)	12.107	.205		59.015	.000	11.703	12.511	181,162.77
	Permitted density	.000	.000	.178	4.605	.000	.000	.001	1.00
	Unit_class_code	-.115	.048	-.130	-2.388	.018	-.209	-.020	0.89
	Unit_enclosed_extent	.004	.000	.412	8.426	.000	.003	.005	1.00
	Unit_covered_extent	-.025	.014	-.067	-1.803	.073	-.051	.002	0.98
	view	.097	.022	.174	4.398	.000	.054	.140	1.10
	age	-.009	.002	-.261	-5.565	.000	-.012	-.006	0.99
	td22	-.267	.120	-.078	-2.231	.027	-.502	-.031	0.77
	td111	-.231	.136	-.059	-1.704	.090	-.499	.036	0.79
	td120	-.222	.124	-.062	-1.787	.075	-.468	.023	0.80
	td121	-.559	.151	-.126	-3.705	.000	-.856	-.262	0.57
	td123	-.480	.165	-.100	-2.904	.004	-.805	-.154	0.62

td132	-.371	.143	-.089	-2.599	.010	-.653	-.090	0.69
td220	-.567	.173	-.118	-3.280	.001	-.907	-.226	0.57

a. Dependent Variable: logprice

Comments on MRA results

Variable name	Model output	Valuer Assessment
Class	This characteristic was included in the model. The coefficient results in a 10.8% reduction for each category.	The output is considered reasonable.
Condition	This characteristic was excluded from the model.	This variable is considered as subjective and it has to be evaluated in a holistic approach with all other variables. Further analysis is needed.
Age	This characteristic was included in the model. The depreciation rate is 0.9% per annum.	In the CAMA model, a depreciation rate of 1.4% per annum was adopted by the valuers. The model results look very low and there may be problems with the recording of the age of buildings. Further analysis is needed.
View	This characteristic was included in the model. The coefficient results in a 10.18% reduction for each category.	The coefficient looks reasonable
Covered verandah	This characteristic was included in the model. However, the coefficient was negative rather than positive.	Further investigation is needed.
Uncovered verandah	This characteristic was excluded from the model.	Uncovered verandah is rarely recorded and in the absence of data the analysis is very difficult.

General Comments

The relatively low number of sales observations limited the potential for MRA.

Almost all Paphos Municipalities are close to the coast and thus values are affected by this additional feature. In addition, the topology of the urban area of Paphos urban that elevates from south west (sea level) to north east produces different value zones. Furthermore, a considerable number of foreigners live in the Municipalities of Paphos Municipalities and therefore the market is affected by foreign investments in property. Future analysis may be required on the value per sq.m by planning zone. Although the slope variable was included in this analysis, it is considered an important parameter and should be investigated in the future.

8. DLS testing of veracity of estimates

DLS has established a predicted model by which 30 flats in Nicosia were selected and appraised on 01.01.2013 prices. The reason was twofold. First was to show the capabilities of the DLS in using regression analysis for predicting prices and secondly a small sample of 30 properties was selected to test the veracity of the estimates. The predicted model value (PMV) results were tested against the 30 sales prices. The sales prices were time adjusted as at 01.01.2013 to improve the quality of the outcome. The results of the ratio study at a small scale are presented below in a table as well as the statistical measures.

Nicosia District - Flats				
S/N	**Sbpi_id_no**	**Adjusted Sales Price**	**Model Predicted Price**	**Ratio (M.P.P/ Sale price*)**
1	333299	186998,6	176370,8837	0,943166867
2	371615	63437	63621,87003	1,00291423
3	10229155	58496	47283,54269	0,808320957
4	352348	147139,3	136480,3872	0,927559036
5	60446	105165	104301,7093	0,991791084
6	11722484	99803,7	113157,8987	1,133804646
7	12172049	162590,2	137211,7794	0,843911745
8	10012018	67256,5	74116,80811	1,102002158
9	12033778	193320,8	149530,9593	0,77348614
10	76114	124545,6	131559,6342	1,056316997
11	376964	44418	49103,91317	1,105495816
12	4303	91609,6	105458,2968	1,151170803
13	63645	109680	146948,9484	1,339797123
14	333009	130844,3	132542,2884	1,012977168
15	360774	124920	147829,4908	1,183393298
16	11980526	99946,3	113719,7336	1,137808339
17	179409	93366	106719,222	1,143020178
18	11151733	146370	172513,6429	1,178613397
19	12122564	136662,1	148489,9063	1,086547816
20	354413	69228	80382,12085	1,161121524
21	359484	120732,6	118484,1019	0,981376214
22	24180	192780	244882,9101	1,270271346
23	10782230	334836	223159,9005	0,666475231
24	11670134	97660,5	100092,8904	1,024906594
25	349774	360712,8	275615,9278	0,764086907
26	368551	151144	138303,5649	0,915045023
27	11794305	95510	101031,4031	1,057809686
28	349258	180642	175387,4615	0,970911867
29	358301	120584,2	135174,0411	1,120992975
30	12088764	160495,7	182354,4133	1,136195009

*sales prices were time adjusted to 01.01.2013

Ratio Statistics

Case Processing Summary

	Count
Overall	30
Excluded	0
Total	30

Ratio Statistics for Model_Predicted_Price / Sales_Price

Mean	95% Confidence Interval for Mean		Median	95% Confidence Interval for Median			Weighted Mean	Confidence Interval for Weighted Mean		Min	Max	Std. Deviation	Range	Price Related Differential	Coefficient of Dispersion	Coefficient of Variation
	Lower Bound	Upper Bound		Lower Bound	Upper Bound	Actual Coverage		Lower Bound	Upper Bound							Median Centered
1,033	,975	1,091	1,057	,981	1,134	95,7%	,990	,903	1,078	,666	1,340	,155	,673	1,043	,114	14,8%

The confidence interval for the median is constructed without any distribution assumptions. The actual coverage level may be greater than the specified level. Other confidence intervals are constructed by assuming a Normal distribution for the ratios.

The median ratio of Model Predicted Price against adjusted sales Price is 1,057 which is good. The IAAO Standards recommend this to be 0,9 <=R =<1,1. Also, in terms of uniformity, which is measured by the coefficient of dispersion (COD), this is 11,4%. The IAAO standards recommend 5% -15% for COD. The Price Related Differential (PRD) is very close to the higher accepted level. This is 1,043 and the IAAO standards recommend a value between and 0,98 to 1,03.

9. Identify for future CAMA development which other parameters would have a significant value influence on property value

In the absence of full data set in terms of property characteristics by the DLS, an attempt was made to collect information from the database of the CBC. A meeting took place at CBC and although it was not possible to extract valuation information in relation to their property characteristics in so short a time, the CBC proved a detailed analysis of those property characteristics that were considered as the most significant and therefore utilized in the compilation of the CBC residential property price indices.

While this analysis can help to inform the DLS as to the most significant property characteristics, it should be noted that the CBC dataset is based on valuations for the purposes of property purchases and the restructuring of loans. Consequently the CBC data has considerably more observations available for analysis (for example between Q1 2010 and Q2 2010 the CBC dataset contained 10,783 observations for flats in Nicosia as opposed to 1,746 observations in the DLS data) and supports the inclusion of a significant number of characteristics in some of the regression models. The property characteristics for flats in Nicosia, Limassol and Larnaca that are utilised in the CBC property price index are:

Nicosia Flats	Limassol Flats	Larnaca Flats
Internal Area (log)	Internal Area (log)	Internal Area (log)
Age (square root)	Age (square root))	Age (square root)
Central Heating	Central Heating	Touristic area
Quality: Luxurious	Quality: Luxurious	Area of Uncovered Verandas
Area of Covered Verandas	Area of Covered Verandas	Maintenance: Poor
Area of Uncovered Verandas	Area of Uncovered Verandas	No Air Condition
Maintenance: Very Good	Maintenance: Very Good	Coverage Coefficient
Maintenance: Poor	Maintenance: Poor	Sea View
Maintenance: Average	Maintenance: Average	Area of Covered Verandas
Central Air Condition	Central Air Condition	
Building Coefficient	Building Coefficient	
Urban Area	Urban Area	
Quality: Ordinary or Below Ordinary	Quality: Ordinary or Below Ordinary	

There are a less observations available for flats in Paphos and Famagusta and the number of characteristics that can be analysed within the MRA is therefore considerably reduced. The characteristics utilised in the CBC residential property price indices for Flats in Paphos and Famagusta are:

Paphos Flats	Famagusta Flats
Internal Area (log)	Internal Area (log)
Age (square root)	Age (square root)
Quality: Luxurious	Sea View
Area of Uncovered Verandas	Split Air Condition
No Pool	No Pool
Maintenance: Poor	

The property characteristics for houses that are utilised in the CBC property price index are:

Nicosia Houses	Limassol Houses	Larnaca Houses
Internal Area (log)	Internal Area (log)	Internal Area (log)
Urban Area	Maintenance: Very Good	Touristic Area
Share to be valued	Urban Area	Share to be valued
Central Heating	Share to be valued	Urban Area
Basement Area (square root)	Basement Area (square root)	Basement Area (square root)
Maintenance: Very Good	Age (square root)	No Pool
Proportion of Land Area to Structure	No Swimming Pool	Central Heating
Maintenance: Poor	House on Plot	Area of Uncovered Verandas (square root)
Private Pool	Touristic Area	Proportion of Land Area to Structure
Area of Covered Verandas	Maintenance: Poor	

House on Plot	Maintenance: Average
Maintenance: Average	Proportion of Land Area to Structure
No Air Condition	No Air Condition
Covered Parking (square root)	Area of Uncovered Verandas
Central Air Condition	Detached House
Area of Uncovered Verandas	Sea View
Under Construction	Number of Covered Parking Spaces
Age (square root)	Quality: Luxurious
Detached House	Quality: Over-Luxurious
Building Coefficient	
View Other	

Paphos Houses	Famagusta Houses
Internal Area (log)	Internal Area (log)
No Swimming Pool	No Swimming Pool
Share to be valued	Share to be valued
No Air Condition	Urban Area
House on Plot	Touristic Area
Basement Area (square root)	Maintenance: Very Good
Touristic Area	Area of Uncovered Verandas (square root)
Area of Uncovered Verandas (square root)	Area of Covered Verandas (square root)
Under Construction	Sea View
Area of Covered Verandas (square root)	Proportion of Land Area to Structure
Urban Area	
Land Area	
Maintenance: Very Good	

Recommendations

In order to develop the analysis of the most significant property characteristics (and therefore those which should be systematically recorded), the DLS will need to collect a full set of property characteristics for one representative area for which there is an adequate number of observations (sales). This will allow the DLS to conduct a new analysis on a pilot area. On the other hand, this study has demonstrated that the various coefficients may need to be determined at lower level of geographical area than district. Alternatively, it may be possible to use, as a benchmark, the coefficients produced by the CBC. This will be kept under constant review. The analysis should focus on residential flats and houses only, as there are not currently a sufficient number of transactions of other types of property. With respect to the characteristics of land, further analysis will be conducted after the CBC provides the DLS with the unofficial land price index and possibly a statistical analysis of those characteristics that are considered significant for the compilation of that index.

10. Existing General Valuation progress after publication of results

The period of valuation objections has been extended to 25th April 2015 by the House of Representatives. The General Valuation Section in collaboration with the Valuation Section is evaluating the valuation objections as well as the applications for correction of property characteristics. In case, a correction will be needed, the Valuation/General Valuation Section will proceed with correction of data and revaluation of each individual property by applying the CAMA model based on 01.01.2013 parameter values. If a special property cannot be handled the CAMA or for some other data reason, the valuation is performed manually and approved by an approved officer and recorded into CILIS. The process is now covered under circulars 919/31.7.2014, 920/19.9.2014 and 924/19.9.2014. The results are communicated to the owner in writing and as well as to all taxing authorities. The objective of both Sections is to clear all data correction applications and valuation objections the soonest and before the general valuation data are supplied to all taxing authorities for the year 2015. At the same time, the two Sections have the obligation to perform general valuations on 01.01.2013 for all properties where new titles are issued under measure 5.3 of the MoU. Concurrently, the two Sections are examining the values in specific geographical areas with special features that complaints have been raised at local level for high prices. Instructions have been given to valuers at district level to examine these complains and if needed to define specific micro locations for further consideration.

11. Technical feasibility of applying the existing CAMA

DLS has a long history of efforts in establishing the foundations for the development and application of CAMA within its Land Information System CILIS since 1999.

Since the release of the first version of CILIS, CAMA models were developed and tested before 1999.

These included:

- Base and Cost Model
- Sales Comparison Model
- Rent Comparison (Capitalisation) Model
- Regression Model (to be used for annual adjustments)

Due to various changes in the Oracle Database over the years, the Base and Cost Model was retested in 2004 before the outsourced vendor company, operating CILIS, was released from the maintenance of the system. Due to high complexity the rest of the models were not tested. The Base and Cost model was also retested and a lot of new development took place during 2013 and 2014 before the run of the new General Valuation.

The Base and Cost Model is considered to be a unique, friendly and simple valuation model. It basically uses parameters for an "ideal" property type in an area (at the sub-property level),

adding and subtracting (adjusting for any differences) in comparison with the property being valued. This method was efficiently used in the last General Valuation of 2014 and mass valuation was performed for the first time in Cyprus (1.1 million properties including 500 thousand buildings / units), successfully, meeting all the requirements specified in the MOU with the Troika. The actual valuation time spend for the final running of the models (only two large tests were performed beforehand) was 7 days, as each district was run separately each day. There were two districts run twice.

The model basically consists of 4 main general aspects:

- Data Capture and Data Input of Land and Building characteristics in CILIS – Oracle Tables.
- Data Analysis (either manual or using external statistical software) of sales and other data in order to derive parameters for characteristics (plus loading them into specific Oracle Tables)
- Running of the models to perform calculations and derive the final value of each property in Cyprus.
- Approval of the Mass Valuation.

The Base and Cost Model uses parameters for characteristics derived from analysis. Analysis maybe derived using MRA or any other approach. In the case of the last General Valuation of 2014, the analysis of the parameters was derived using the manual approach and not using any specific statistical software. The results were very high in terms of quality (taking into account the large numbers of properties being valued) and errors occurred were not so much based on the model itself but on the lack of data; data specific to the local situation in Cyprus (i.e. parcels with more than one planning zone); insufficient population of micro-location data; and various other less significant factors. It is worth noting that the use of this model limits the restrictions of the typical Sales Comparison Models (usually based on MRA), where sales are not apparent or efficient enough for automatic selection.

It is important to note that the initial plan in 1999 was to use MRA and derive the necessary parameters using the SAS Software. For this reason, the technical capability was built in order to be able to extract sales data using Oracle Views into SAS, analyse and import them back to the Oracle Database, using a client application in between. A specific procedure of SAS – the SAS GENMODE procedure proved to be the right one at the time. SAS allowed for heavy customisation and parameterisation including various model calibration techniques. It also allowed the use of various models within the procedure, i.e. log-linear which also proved at that time very efficient. The analysis at the time, was unfortunately performed by a single individual, however, many and various models were run.

The various efforts using SAS came to an end in 2006 since DLS has not managed to build the necessary in-house teams and embark into a culture of scientific data analysis. This came along with the restraining of resources in general and the lack of decision making by the Government to proceed with a new General Valuation at the time.

It is important to note however, that the Sales Comparison Model inside CILIS is very dynamic and uses the whole philosophy of MRA in order to derive results. This model has not been re-tested since 1999 and definitely needs a lot of new customisation in order to run efficiently. Its application code is very extensive and complicated and will need very specific corrections by the same experts who initially designed it in 1999 (something quite difficult to occur for the time being).

Its philosophy is based on MRA and automatic selection of the most suitable sales inside a geographical area and planning zone is performed (the most suitable being a repeated sale for the same property), adjusting accordingly both for the differences in characteristics, as well for any time adjustment needed. Annual increase is derived using the best and more suitable five sales in comparison with the valued property. Cumulative and Multiplicative percentage adjustments can be used to recognize interrelations among factors. The use of measures of confidence is built within the model including the measures of confidence for individual comparables and even for comparables as a Group (number of adjustments and absolute gross adjustments are taken into account), as well as selecting the relative weight which changes the relative contribution of the attribute to the metric (various algorithms are built within the model).

The CILIS system which started its operations in 1999 is now entering into a new face and the need for an upgrade is highly needed. Although, it fully supports an Integrated Umbrella Organisation like DLS, the need for an upgrade in technology is evident. The CILIS Support and Administration Sector of DLS, in association with KPMG Cyprus has already prepared the necessary RFP for the general upgrade of the existing LIS. The total cost is estimated to be around €20 million and the plan is to use EU funding for this purpose.

The RFP also includes the upgrade of the existing CAMA system. However, it is important to note that the successful vendor will be asked to determine whether an outsourced external solution (a tailor –made existing CAMA software from the market) will be more suitable, rather than re-designing and developing from scratch the existing CILIS models using new technologies. It is our belief that this will be a more efficient option for the new system (rather than redesigning the wheel) and DLS will endorse a robust CAMA software which already exists in the market for many years and used by many countries. However, such CAMA software will also need customisation in order either to incorporate, transform and comprehend the already existing local data or be able to use an intermediary client to extract, transform and load data into the outsourced solution. Moreover, it also important to stress the fact that the current CAMA models inside CILIS fully correspond to the existing data model of the system, and more generally, to the existing model of registration in Cyprus (based on the sub-property theory), hence, the strategic decision to move towards an outsourced solution will have to go through a very detailed business use case analysis, before being implemented.

Using more integrated and friendly procedures between CILIS and SPSS is also a target and various ETL techniques will be examined by the successful vendor. In the meantime, an automatic and very holistic approach in the development of our own DLS price index based on

market sales and on-line data, derived automatically and daily through the Oracle DB will also be examined by the successful vendor.

12. Progress made by DLS in developing its statistical capabilities

Since the March technical assistance mission, the DLS has assigned a member of staff, with 3rd level qualifications in maths and statistics, to full time analyse of data. Additionally, the DLS has acquired licences for SPSS, statistical analysis software to facilitate data analysis and in particular MRA. The DLS has therefore, significantly enhanced its statistical capabilities. This has been helped by coaching provided by the external expert during the study and in follow up collaboration.

The DLS has also undertaken significant data compilation and preparation work in advance of this study and will continue to further develop its data to further improve the potential for potential for research and analysis. DLS understands the importance of developing an improved data infrastructure. The G.V Section will draw up a new data strategy to formalise and prioritise the collection and processing of existing and new data.

In the shorter term the DLS will continue to research and assess the current approach to MRA of sales data. A final assessment by the external expert recommended that categorical variables (class, condition and view) should be tested in the regression models as dummy, rather than continuous, variables. It is expected that this could significantly improve the usefulness of these characteristics. The DLS will also expand the property characteristics that buyers/sellers must report as part of the registration of property transfer.

The DLS will continue to develop closer links to the CYSTAT and the CBC with a view to enhanced cooperation and collaboration. This may extend to data sharing;

13. Recommendations - Moving forward

The DLS has prepared a number of recommendations that can be implemented as part of the short to medium and long term planning is order to reach a point by which a general valuation can be performed using advanced statistical technics and methodologies. Therefore, the DLS will fully utilize all its present limited resources effectively and efficiently in order to achieve

- the best accurate results on regular time intervals
- fairness and equity between the taxpayers
- low cost maintenance and administration of general valuation system

The short to medium/long term planning is described below with specific activities/actions that will allow the DLS to move forward to the next general valuation.

13.1 Short Term Planning

- Preparation of a strategy plan that will include all issues that need further investigation and action by the GV Branch in collaboration with Valuation Branch and CILIS Support and Administration Section in order to be able to reach a level by which a new general valuation can be implemented in the future using the latest technology, statistical expertise and various tools for market analysis.
- Investigation and analysis of the difference in price between the declared and accepted sales price over 20% and possible actions for improvement.
- Further analysis is needed for the shared ownership sales by property type in order to determine whether these sales can also be used to improve the quality of the analysis bearing in mind the limited number of sales.
- The variable "slope" may have a significant effect in the GV assessment and thus further analysis is needed. For this reason data capture will be needed to record this attribute. GIS can be used to identify geographical areas with high slopes.
- A new process is currently being finalised, and a circular will be issued in January 2015, requiring the buyer/seller to detail the property characteristics on a survey form, at the date of each property transfer. This form must be jointed submitted by the buyer and seller together with the application for the registration of the property transfer. The property characteristics required are detailed under **Appendix A.**
- Application of the unofficial land index produced by the CBC, when available for the purpose of analysing vacant land with the stepwise regression. This will be available in February 2015.
- Assess the quality of recorded property characteristics and employ new procedures, as necessary, for quality control.
- Establish the legal basis under Cap 224, for compulsory self-declaration of property characteristics of new buildings or changes in the existing status and imposing administrative fines for non-compliance. Similar legislation is applied at the Spanish Directorate for Cadastre – as noted during DLS mission to Spain.
- Further investigation is needed of the potential for extrapolating "time adjustments" at a lower level than the existing CBC property indices which are only available at district level.
- The SPSS software has only recently been made available to the DLS statistician and the GV Section. To date no training on the use of SPSS has been provided to users. It is recommended that training to be organized in the near future. An expert specializing in mass appraisals and especially applying regression analysis using SPSS software will be an added value.

13.2 Medium to Long Term Planning

- Further statistical analysis should be conducted on the planning zone level rather than on planning category level. The existing CAMA model operates on a planning zone level.

- Assess the introduction of modern technologies in data capture processes and updating.
- The micro location approach needs to be decided after thorough investigation and analysis. Thereafter there is a need to initiate a project to digitize specific geographical areas.
- Further analysis and research is needed to assess property characteristics of sales that would significantly improve the quality of assessment in relation to the CAMA models.
- Fully assess the potential for introducing "off the shelf" CAMA software and incorporating its functionality into the GV business processes.
- Staffing the GV Section with appropriate expertise at district and headquarters level in order to be able to meet its strategic and operational objectives.
- The technical assistance and support provided to the DLS should continue in 2015 in order to reach a level by which the GV Section can fully utilize the statistical tools available for the next general valuation, where sufficient data permits so.
- In the medium to longer term the DLS will extend the MRA to more complex geospatial analysis with a view to producing more robust parameter adjustments, particularly at sub-district level.

Appendix - A

Sample of Property Characteristics Report

ΣΥΝΤΗΡΗΣΗ ΧΑΡΑΚΤΗΡΙΣΤΙΚΩΝ ΟΙΚΙΣΤΙΚΗΣ ΜΟΝΑΔΑΣ (LFMF0061)

	Επαρχία	Πόλη/Χωριό	Ενορία	Τμήμα	Αρ. Εγγραφής
Αριθμός Εγγραφής					

	Επαρχία	Πόλη/Χωρ.	Ενορία	Φύλλο	Σχέδιο	Τμήμα	Τεμάχιο
Χωρομ. Αναφορά Α							

ΠΕΡΙΓΡΑΦΗ ΜΟΝΑΔΑΣ

Αρ. Θύρας Μονάδος ☐ ☐ **Αρ. Ορόφου** ☐ **Ορόφοι Μονάδας** ☐

Είδος ☐

Ανελκυστήρας Προσωπικού ☐ **Ανελκυστήρας Εμπορευμάτων** ☐

ΦΥΣΙΚΗ ΚΑΤΑΣΤΑΣΗ

Ηλικία 1. Νέο ☐ 2. Μέσης ηλικίας ☐ 3. Παλαιό ☐ 4. Χωρίς Αξία (Πεπαλαιομένο) ☐

Ετος Ανέγερσης ☐

Κατηγορία 1. Πολυτελείας ☐ 2. Κατηγορία Α ☐ 3. Κατηγορία Β ☐ 4. Κατηγορία Γ ☐ 5. Κατηγορίας Δ ☐

Είδος Ανακαίνισης 0. Καμμιά ☐ 1. Μερική ☐ 2. Ουσιαστική ☐ 3. Πλήρης ☐

Ετος Ανακαίνισης ☐

ΛΕΠΤΟΜΕΡΕΙΕΣ ΚΑΤΑΣΚΕΥΗΣ

Είδος Σκελετού 1. Πέτρα ☐ 2. Τούβλα διάκενα ☐ 3. Πλιθάρι ☐ 4. Οπλισμένο Σκυρόδεμα ☐ 5. Ξύλο ☐ 6. Μεταλλικός ☐

Είδος Τοιχοποιίας 1. Τούβλα διάκενα ☐ 2. Τσιμεντομπλόκς ☐ 3. Οπλισμ. Σκυρόδεμα ☐ 5. Πλιθάρι ☐ 7. Προκατ/σμένοι Τσιμεντότοιχοι ☐ 8. Ξύλο ☐ 10. Υαλοπίνακες ☐ 11. Τσίγκος ☐ 13. Πέτρα ☐

Τύπος Οροφής 2. Ξύλινος ☐ 3. Βολίτζια ☐ 4. Επίπεδη με οπλισμένο σκυρ. ☐ 5. Κεκλιμένη με οπλισμένο σκυρ. ☐ 6. Μεταλλικός ☐

Επικάλυψη Οροφής 0. Τίποτε ☐ 1. Κεραμίδια ☐ 4. Μεταλλικά κεραμίδια ☐ 5. 'Αχυρα/Καλάμια ☐ 6. Φύλλα Αμιάντου ☐ 13. Φύλλα Τσίγγου ☐ 15. Άλλο ☐

ΤΕΛΕΙΩΜΑΤΑ

Επιχρίσματα Εξωτ. Τοίχου 0. Τίποτε (ασουβάτιστο) ☐ 1. Μπογιά όλων των τύπων ☐ 2. Ξύλινο ☐ 6. Πέτρα ☐

Επικάλυψη Πατώματος 15. Πολυτελείας ☐ 16. Καλό ☐ 17. Φτωχό ☐

Παράθυρα 5. Μονό Γυαλί Χωρίς Εξωτερικά ☐ 6. Διπλό Γυαλί Χωρίς Εξωτερικά ☐ 8. Μονό Γυαλί Με Εξωτερικά ☐ 9. Διπλό Γυαλί Με Εξωτερικά ☐

ΑΛΛΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ

Θέα 1. Περιορισμένη ☐ 2. Κανονική ☐ 3. Προνομιακή ☐ 4. Δάσος ☐ 5. Θάλασσα ☐ 6. Πανοραμική ☐

ΥΠΗΡΕΣΙΕΣ

Τύπος Θέρμανσης 0. Καμμιά ☐ 1. Πετρέλαιο ☐ 3. Θερμοσυσσωρευτές ☐ 5. Μονάδες Κλιματισμού ☐

Τύπος Ψύξης 0. Καμμιά ☐ 6. Μονάδες Κλιματισμού ☐

Appendix B

CBC Residential Property Price Index

TABLE 1 Residential property price indices by type and by district
(quarterly data , 2010Q1 = 100)

	Residences by type		Residences by district					
Quarter	**Apartments**	**Houses**	**N/sia**	**L/sol**	**L/ca**	**Paphos**	**F/sta**	**RPPI**
2007 Q1	84,5	82,2	82,8	75,8	82,3	88,6	82,9	83,6
Q2	89,1	89,6	90,1	82,2	87,9	90,8	89,2	90,0
Q3	93,8	91,3	91,2	88,0	93,2	93,1	90,6	92,2
Q4	97,5	94,7	91,0	91,1	99,3	98,5	98,7	96,1
2008 Q1	104,4	103,2	103,0	99,7	103,6	99,7	102,9	103,5
Q2	104,6	107,9	104,3	103,5	104,9	99,9	100,6	106,3
Q3	104,4	108,9	106,9	103,2	104,3	102,5	113,4	107,3
Q4	105,8	104,3	104,4	106,6	100,0	102,4	108,9	105,1
2009 Q1	100,9	98,8	99,7	95,6	99,4	103,7	108,3	100,0
Q2	96,8	101,2	100,8	93,7	99,3	104,1	106,0	100,1
Q3	101,0	100,6	101,1	96,7	103,4	102,6	101,1	101,3
Q4	102,1	103,0	100,2	101,5	103,0	101,6	102,3	103,6
2010 Q1	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Q2	99,2	98,8	100,1	96,7	99,5	96,8	95,9	99,0
Q3	97,9	99,5	100,7	96,0	95,9	94,2	95,1	98,8
Q4	96,9	97,4	101,1	96,5	95,8	90,3	94,9	97,2
2011 Q1	93,5	96,1	100,7	93,6	92,7	86,6	91,7	95,0
2011 Q2	92,7	95,2	100,6	92,7	91,3	84,6	90,2	94,2

Source:CBC.

TABLE 2 Residential property price by type and by district
(quarterly data, 2010Q1 = 100)

	Apartments					Houses				
Quarter	**N/sia**	**L/sol**	**L/ca**	**Paphos**	**F/sta**	**N/sia**	**L/sol**	**L/ca**	**Paphos**	**F/sta**
2010 Q1	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Q2	100,0	96,8	100,0	95,0	94,5	100,3	96,7	99,1	98,2	97,0
Q3	100,9	93,1	98,3	91,6	95,9	100,6	97,6	94,0	96,2	93,9
Q4	102,4	97,6	97,2	84,5	94,2	100,2	96,0	94,8	94,1	95,4
2011 Q1	101,2	93,4	90,2	79,5	87,9	100,3	93,7	94,6	93,1	94,1
2011 Q2	101,2	92,8	89,2	77,5	84,8	100,1	92,7	92,9	90,9	93,5

Source: CBC.

TABLE 1 **Residential property price indices by type and by district**
(quarterly data, 2010 Q1 = 100)

	Residences by type		Residences by district					
Quarter	Apartments	Houses	N/sia	L/sol	L/ca	Paphos	F/sta	Residential property price index
2010 Q1	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Q2	98,6	100,0	99,2	99,5	99,3	99,6	98,5	99,4
Q3	97,3	100,4	99,9	98,0	98,3	99,7	99,1	99,1
Q4	96,5	99,9	99,9	97,5	97,4	97,8	97,8	98,5
2011 Q1	94,4	99,0	99,6	95,7	95,9	95,5	93,0	97,1
Q2	93,0	98,0	99,3	94,3	94,0	92,2	93,4	95,9
Q3	92,0	96,7	98,6	93,6	92,6	89,9	90,8	94,8
Q4	90,5	94,9	97,4	92,2	90,6	87,4	88,9	93,1
2012 Q1	89,9	93,8	96,5	91,9	89,0	85,6	88,2	92,2
Q2	88,4	91,8	95,0	90,3	86,3	85,1	84,6	90,4
Q3	87,3	90,9	94,0	89,8	85,2	82,7	84,9	89,5
Q4	86,2	90,3	92,9	89,7	83,5	81,8	84,6	88,6
2013 Q1	84,6	89,1	91,0	88,8	80,5	82,1	84,8	87,2
Q2	81,9	87,2	89,1	86,7	79,2	80,5	78,3	85,0
Q3	80,7	84,8	87,1	84,8	76,2	79,0	75,8	83,0
Q4	78,3	82,9	85,1	83,0	74,0	76,0	74,3	80,9
2014 Q1	76,2	80,7	82,9	80,6	72,1	75,2	72,2	78,8
Q2	74,6	79,3	81,5	78,8	70,6	74,2	70,4	77,2

Source: CBC.

TABLE 2 **Apartment and house price indices by district**
(quarterly data, 2010 Q1 = 100)

	Apartments					Houses				
Quarter	N/sia	L/sol	L/ca	Paphos	F/sta	N/sia	L/sol	L/ca	Paphos	F/sta
2011 Q1	99,5	93,3	91,3	87,6	86,5	99,7	97,1	99,4	102,4	97,9
Q2	99,4	91,9	89,8	84,0	83,4	99,2	95,6	97,3	99,5	101,1
Q3	99,1	91,8	88,0	80,3	80,7	98,2	94,5	96,1	98,6	96,9
Q4	97,9	90,2	85,8	78,8	81,8	97,0	93,2	94,5	95,9	92,7
2012 Q1	96,4	90,5	85,4	78,7	79,5	96,5	92,5	91,9	92,5	92,3
Q2	95,3	88,6	83,0	78,2	76,6	94,7	91,1	88,7	92,1	88,2
Q3	95,4	87,3	81,1	75,5	75,8	92,9	91,0	88,0	90,1	89,1
Q4	93,5	86,7	79,4	75,1	75,4	92,4	91,3	86,1	88,2	89,1
2013 Q1	92,1	86,6	75,0	74,3	74,5	90,0	90,0	84,5	89,1	90,0
Q2	90,1	83,0	73,3	72,2	71,2	88,3	88,8	83,8	88,1	81,5
Q3	88,0	81,8	70,5	71,9	69,9	86,3	86,6	80,7	85,4	78,4
Q4	86,0	80,0	67,7	68,4	71,6	84,4	84,7	79,3	84,1	75,6
2014 Q1	83,5	76,9	65,6	69,2	69,7	82,4	82,8	77,3	81,0	73,3
Q2	82,4	75,3	63,6	67,3	66,6	80,7	81,3	75,8	80,9	72,3

Source:CBC.

Appendix C

IMF Draft Report on the Short Term Expert visit on Property Taxation (March 10 – 14, 2014) prepared by Niall O' Hanlon.

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INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

DRAFT

CYPRUS

DRAFT REPORT ON THE SHORT TERM EXPERT VISIT ON PROPERTY TAXATION
(March 10–14, 2014)

Prepared by Niall O'Hanlon

March XX, 2014

Contents **Page**

ACRONYMS

CAMA	Computer-assisted Mass Appraisal
CBC	Central Bank of Cyprus
DLS	Department of Lands and Surveys
GV	General Valuation
IAAO	International Association of Assessing Officers
MoU	Memorandum of Understanding
MRA	Multiple regression Analysis
RPPI	Residential Property Price Index
TA	Technical Assistance

EXECUTIVE SUMMARY

- A previous Technical Assistance (TA) mission visited Nicosia during October 14-25, 2013, to provide advice and assistance with the design and implementation of a modern market-value-based property tax in order to strengthen revenue mobilization and improve fairness. The previous mission proposed a follow-up short term expert visit to assist the authorities in developing the first of the two studies, referred to in the MoU, dealing with refining of the parameters of the revaluation methodology. The purpose of the mission was to assist the Department of Lands and Surveys (DLS) in getting the study underway.

- The main issues addressed during the mission included: i) reviewing what data is available for the study and is it representative across districts and property; ii) developing prototype Multiple Regression Analysis (MRA) software to help kick start the study; iii) agree on a work plan for completion of the study, including consideration of the need for follow-up TA.

- The authorities provided the mission with a number of datasets representing recent property transactions for specific homogeneous subsets of the property market in Cyprus (e.g. apartments in Nicosia). Three variables in these data had to be recoded from Greek characters to numeric values in order to facilitate multiple regression analysis (MRA) and this recoding should be extended to the entire database, from 2008 onwards, prior to the full study.

- The mission reviewed the availability and quality of data on property sales in Cyprus which will be used in the study. While the number of sales has greatly reduced in recent years, the quality of the property sales data compiled by DLS appears to be good and not suffering from any systematic data quality issues. The study should provide a full report on data quality so that any issues arising can be dealt with by the authorities in the recording of future sales.

- The mission discussed with the authorities the requirement for supplementing the database with additional variables for the physical characteristics of buildings. The mission was of the view that this will not be necessary, due to the limited number of transactions available (considering the principle of parsimony in MRA) and the high explanatory power of the prototype models developed.

- The mission price designed a number of methodologies for price adjusting historic sales to the valuation period and developed prototype MRA software to help kick start the study. The results from this analysis demonstrated to the authorities the potential Computer-assisted Mass Appraisal (CAMA) analysis offers for assisting in the mass appraisal of property. A series of sales-based appraisal models (both additive and multiplicative) were specified and calibrated, and the results discussed with the authorities. The mission tested the inclusion of an additional variable, derived from estimates of "average value of building land per planning zone", for

apartments in Larnaca and found that this significantly improved the appraisal, with calibration tests exceeding International Association of Assessing Officers (IAAO) standards. The mission was of the view that this variable will serve as a very effective proxy for the quality of micro location within each of the five districts of Cyprus. The mission recommended that the variable should be mapped on a spreadsheet to every planning zone in the country prior to the study to facilitate the inclusion of the variable in the full MRA analysis.

- The mission will develop a prototype model for the valuation of non-developed land, prior to the study.

- The mission will continue to liaise with the authorities in advance of the study to ensure that all preparatory tasks, to be undertaken by both the authorities and the mission, are completed ahead of the study.

- The mission is of the view that the full study can be successfully completed during a final two week follow-up TA mission, providing that the DLS has fully implemented the necessary tasks specified in the detailed work plan to guide the authorities. The authorities strongly support this approach.

PROJECT FRAMEWORK SUMMARY (ACTION PLAN)

PROJECT DESCRIPTION

Technical Assistance to support a project to support the design and implementation of a modern market-value-based property revenue mobilization and improve fairness

PROJECT OBJECTIVES 1.0

Description	Verifiable Indicators	Assumptions/Risk
Refine the parameters of the revaluation methodology	Study completed	Preparatory tasks must be completed in advance of the study

PROJECT OUTCOMES

DQAF	Priority	Outcomes Description	Verifiable Indicators	Completion Date	Implementation Status
	H	DLS should further develop in-house analytical capability	Analytical unit in place	12/31/2014	Resource dependent
	H	Record the total number of open market transactions as specified	Analysis completed	06/01/2014	
	H	Study should report on data quality	Full report prepared	By end of study	Study
	H	Recoding of variables as specified	Variables recoded and available for analysis	06/01/2014	Underway
	H	Decide on the appropriate period to adjust prices to	Quarter selected	06/01/2014	
	H	Study to recommend most appropriate methodology for price adjustment	Methodologies selected and implemented	By end of study	Study
	H	Examine the classification of class and condition variables	Variables examined	06/01/2014	Informal review will suffice
	H	Test Larnaca flats model for multicollinearity	Test completed and results discussed with DLS	04/30/2014	Mission
	H	Prepare spreadsheet of building land values	Spreadsheet available for use	06/01/2014	Vital to success of the study
	H	Consider what other neighborhood indicators might be employed	Issue considered and action plan developed if appropriate	By end of study	Can be discussed during study
	H	Include predictor variable for quality of planning zone	Included in all models where appropriate	By end of study	Study
	H	Develop prototype model for non-developed land	Model developed and discussed with the authorities	05/16/2014	Study

Priority Scale

H - High M - Medium O - Other

I. INTRODUCTION

1. **In response to a request from the Cypriot authorities, a Technical Assistance (TA) mission visited Nicosia during March 10–14, 2014, to provide follow-up technical assistance to a project to support the design and implementation of a modern market-value-based property tax in order to strengthen revenue mobilization and improve fairness.** This project is coordinated by the EC Support Group for Cyprus (SGCY).

2. **Authorities from the Department of Lands and Surveys provided complete access to all requested data, and engaged very positively with the mission.** In particular the mission wishes to sincerely thank Mr. Varnavas Pashoulis for his tireless cooperation.

3. **A previous technical assistance mission visited Nicosia during October 14-25, 2013, to provide advice and assistance with the design and implementation of a modern market-value-based property tax in order to strengthen revenue mobilization and improve fairness.**

4. **The previous mission proposed a follow-up short term expert visit to assist the authorities in developing the first of the two studies, referred to in the Memorandum of Understanding (MoU), dealing with refining of the parameters of the revaluation methodology.** The proposal emphasized, given the size of the study, that while technical assistance could assist the authorities in developing the study, the authorities would need to provide necessary resources and take on the main responsibility for developing and completing it (possibly with the assistance other institutions).

5. **The mission was of the opinion that the Department of Lands and Surveys should further develop its in-house analytical capability.** This will require the appointment of at least one statistician (or equivalent). Furthermore, the authorities must develop an appropriate IT infrastructure (including the procurement of appropriate statistical software such as SPSS or SAS) to facilitate the analysis and flow of data within the department.

6. **The mission reviewed the availability and quality of data on real property sales in Cyprus.** The mission noted the low levels of arm's-length transactions, particularly in recent years. However, data quality is generally very good and will benefit from some recoding of variables to facilitate further multiple regression analysis.

7. **Because several years of transactions will be utilized in the study, prices must be adjusted to the valuation date.** Prices can be adjusted on the basis of trends observed in the sales data itself, or with reference to the Residential Property Price

Index published by the Central Bank of Cyprus. The authorities must decide on the appropriate valuation quarter.

8. **A series of appraisal models were specified and calibrated so as to build confidence in the approach and to help kick start the study.** For the analysis of values of Larnaca apartments, the inclusion of a predictor variable for the ratio for building land value in the planning zone to the geometric average of values of planning zone across the entire district was found to significantly improve the appraisal model. The authorities must prepare a single spreadsheet containing the estimated building land values in every planning zone in Cyprus.

9. **The mission and the authorities were very encouraged by the prototype results and are strongly of the opinion that the study can be completed in a final two week follow up mission.** This mission should coincide with the mission to complete the second study specified in the MoU.

10. **The mission will continue to liaise with the authorities in advance of the study to ensure that all preparatory tasks, to be undertaken by both the authorities and the mission, are completed ahead of the study.** This effort will maximize the potential for a successful study.

II. INSTITUTIONAL ISSUES

11. **The previous mission suggested that DLS should create a small in-house research team to undertake analysis of property transactions and begin to develop more robust MRA models.** The current mission reemphasized the new for a more developed analytical capability. This will require the appointment of at least one statistician (or equivalent), assigned solely to analytical duties. Furthermore, the authorities must develop an appropriate IT infrastructure (including the procurement of appropriate software such as SPSS or SAS) to facilitate the analysis and flow of data within the department.

12. **It is vital that this analytical capability is developed such that it is sustainable.**

Recommendation

- DLS should further develop in-house analytical capability.

III. THE STUDY ON REFINING THE PARAMETERS OF THE CAMA MODEL

1. **The MoU detailed a requirement for two studies, dealing with refining of the parameters of the revaluation methodology**. The first study, to be completed by 31st

July 2014, should refine the use and application of the current parameters which are being used within Computer-Assisted Mass Appraisal Models (CAMA) for the General Valuation (GV) of property and also identify for future CAMA development which other parameters would have a significant value influence on property value. The purpose of the current mission was to assist the authorities in getting the study underway.

14. **The first study has two key objectives:**

- To refine the use and application of the current parameters which are being used within the CAMA models for the GV.
- To identify for future CAMA development which other parameters would have a significant value influence on property value.

15. **In relation to the first objective the following are the currently prescribed parameters.**

For land:

- Area in sq.m
- Accessibility
- Road access relation
- Shape
- Slope

For buildings:

- Property type
- Enclosed area in sq.m
- Covered verandah in sq.m
- Uncovered verandah in sq.m
- Year built
- Category of unit (Luxury, V. good, good, bad, obsolete)
- Condition (Very good, good, fair, bad)
- Type of Structure (reinforced concrete, Wood/Steel structure)

16. **The current analytical approach to determine the value adjustments for each of the above parameters that is being adopted by the Department is largely based around traditional manual based methods.** While this is an accepted approach a more objective approach would be to use Multiple Regression Analysis (MRA). This is a powerful analytical tool that is data hungry but if applied correctly can identify the market adjustments required for the CAMA exercise.

17. **The study has two deliverables:**

Deliverable 1: This deliverable should therefore apply MRA techniques to quantify the adjustment factors for each of the current parameters being applied to land and buildings. These parameters will also have a spatial element and therefore the MRA

model specification will have to be cognizant of this. In addition, the MRA derived adjustment factors should be compared with the same adjustment factors derived from manual analysis.

Deliverable 2: This deliverable should investigate supplementing the current parameters with other value influence parameters. The research should consider mechanisms to collect this data, its recording and measurement of their significance in terms of model improvement.

18. **The previous mission listed a number of prerequisites of the deliverables as follows:**

- It will be essential that sufficient transaction data is made available in a suitable format to allow analysis. Given the paucity of usable data transactions (full and clean records) at present the Department should provide date over at least 3 years for residential and possibly 5 years for non-residential property. The Department should also aggregate planning zones which have similar property types and economic factors to allow for location modeling effects.

19. **The second study should report on mechanisms to measure the variance between GV assessed.**

IV. Review of the Availability and Quality of Data for the Study

A. Data Availability

20. **The "sales comparison approach" to property valuation uses information on recent open-market sale prices.** The aim is to decide how differences in the characteristics of recently sold properties influence their prices. This information is then used to estimate what the properties being valued are worth. The DLS maintains a register of all real property transactions in Cyprus and this database will be used to apply the sales comparison approach.

21. **The sales comparison approach is usually the preferred approach for estimating values of residential properties and non-agricultural land, where sufficient transactions can be observed.**[1] In order for the approach to be utilized successfully, sufficient transactions, and property characteristics of sold properties, must be recorded.

22. **The mission noted that the total number of property transactions (including land and commercial building sales) in Cyprus fell from almost 25,000 in the first nine months of 2007 to less than 5,000 in the same period of 2013.** These greatly reduced levels of transactions may limit the granularity of analysis that can be per-

[1] IAAO (2011), Standard on Mass Appraisal of Real Property

formed. This problem is exacerbated by the growing share of non-arm's length transactions in recent periods (for example in 2012, 53 per cent of transactions of apartments in Larnaca were identified as non-arm's length). Typically, only open market transactions are used in the development of mass appraisal models – even where open market values have been estimated for non-arm's length transactions.

23. **The mission recommended that the authorities prepare a spreadsheet detailing the total number of open market transactions in each quarter since the first quarter of 2008 for the different categories of property which the study will cover (houses, apartment and land) in each of the five administrative districts.** This will help to prioritise the development of CAMA models for different elements of the property market.

24. **For apartments the following relevant property characteristics are currently recorded as part of the registration of sales process and therefore available for analysis.**

- Enclosed area in sq.m
- Covered area in sq.m
- Uncovered area in sq.m
- Year Built
- Class (Luxury, Very good, Standard, Below standard, Very poor)
- Condition (Very good, good, fair, bad)
- Planning zone

25. **For houses the following relevant property characteristics are currently recorded as part of the registration of sales process and therefore available for analysis.**

- Enclosed area in sq.m
- Covered area in sq.m
- Uncovered area in sq.m
- Year Built
- Class (Luxury, Very good, Standard, Below standard, Very poor)
- Condition (Very good, good, fair, bad)
- Planning zone
- View (standard, premium, sea view)

26. **For undeveloped land the following relevant property characteristics are currently recorded as part of the registration of sales process and therefore available for analysis.**

- Area in sq.m
- Planning zone

- Accessibility (No access, Access, Right of way)
- Road parcel relation type (None, Side access, Corner, Two sides, Three sides, Four sides)
- Shape (Regular, Irregular, Highly irregular)

27. **The authorities provided the mission with a number of subsets of sales transactions covering apartments (for the administrative districts of Nicosia and Larnaca), houses (for Nicosia and Larnaca) and non-developed land (for the municipalities of Strovolos, Aglanzia, Engomi and Dhali).**

28. **In each case the data covered all recorded sales from the beginning of 2008 to the third quarter of 2013.**

29. **The mission discussed with the authorities the potential for adding additional property descriptors to the sales data.** The mission was of the opinion that additional physical descriptors need not be added at this stage given the low numbers of transactions available for analysis (reflecting current market conditions). The principle of parsimony is an important consideration in multiple regression analysis – lower numbers of observations will only support the inclusion of a limited number of predictor (or independent) variables.

Recommendations

- Record the total number of open market transactions in each period between the first quarter of 2008 and the last quarter of 2012 for the different categories of property which the study will cover (houses, apartment and land) in each of the five administrative districts in a spreadsheet.

- Additional physical descriptors of property are not required for the study.

B. Data Quality

30. **The mission examined the subsets of residential property data provided using a number of statistical techniques (minimum, maximum mean and median values, statistical dispersion and missing value counts).** The mission was of the opinion that the quality of the subsets of data analyzed appeared to be good and not suffering from any systematic data quality issues. There was no systematic evidence of obviously spurious values and in only a handful of cases were values missing.

31. **On that basis the mission recommended that the database of property sales need not be subject to additional scrutiny of data quality prior to the study.** However**,** it is possible that the broader MRA analysis to be conducted during the study may highlight some issues in subsets of data not examined during the current mission. The study should therefore provide a full report on data quality so that any issues arising can be dealt with by the authorities (in the recording of future property sales).

Recommendations

- The database of property sales does not require additional scrutiny of data quality prior to the study.
- The study should provide a full report on data quality**.**

V. PROTOTYPE MASS APPRAISAL MODELS

A. Data Preparation

32. **Prior to developing mass appraisal models, three data preparation tasks were undertaken.**

33. **Firstly, the mission requested that the authorities recode three variables in the sales dataset ("planning zone", "planning zone density" and "sub property type") from Greek alphabet characters to numeric values to facilitate their analysis in statistical software.** This recoding was performed promptly by the authorities**.** The importance of storing data in formats that facilitate analysis was discussed with the authorities and it is vital that prior to the next study, this recoding is extended to all records of property sales since 2008.

34. **Secondly, a series of data examination programs were developed to assess data quality and facilitate MRA.** These programs produce a series of descriptive statistics for each subset of data. Outputs highlight potential data quality issues that might be present in the data and describe the evolution of the property market in over recent years, with particular reference to activity levels in submarkets (for example, the sale of apartments in a specific municipality in Nicosia). The design of sales comparison based appraisal models should be cognizant of the relative importance of sales of different types of properties.

35. **Thirdly, sale prices were adjusted, on a quarterly basis, for changes in market conditions.** Sales from a number of years can be used to increase the number of available observations for use in mass appraisal models. In general, at least several years of data can be effectively analysed and adjusted to a common date. However, longer time periods and structural breaks that may have occurred in the market make this analysis more complex.

36. **For the purposes of developing the prototype mass appraisal models for Cyprus, the mission adjusted property prices to the fourth of quarter of 2012, reflecting the period closest to, but not exceeding the valuation date of January 1st 2013.** Alternatively, prices could be adjusted to the first quarter of 2013. The authorities should decide on the appropriate period to which prices will be adjusted prior to the study. The adjustment of prices should be carried out accordingly during the study.

37. **The mission developed simple time-dummy based property price indices for Nicosia apartments and houses, and Larnaca apartments.** These were compared to indices published by the Central Bank of Cyprus (CBC). The indices followed broadly similar trends although the CBC indices are less volatile and more monotonic. Given the change in market conditions during 2009 and 2010 and the fact that CBC indices by type of residential property for each of the five districts of Cyprus are available from the first quarter of 2010 onwards only, the mission recommended that the residential property models should be restricted to sales from 2010 onwards only, at least where there are sufficient data to support robust analysis.

38. **For non-residential property, prices could be adjusted on the basis of indices constructed from the property sales database or an alternative source such as the Royal Institution of Chartered Surveyors property price indices for Cyprus.** The study should recommend the most appropriate method for conducting the price adjustment of non-residential properties and adjust prices accordingly.

Recommendations

- Recoding of "planning zone", "planning zone density" and "sub property type" variables from Greek alphabet characters to numeric values is extended to all records of property sales since 2008.
- Decide on the appropriate period, to which prices should be adjusted, prior to the study.
- The residential property models should be restricted to sales from 2010 onwards only, at least where there are sufficient data to support robust analysis.
- The study should recommend the most appropriate method for conducting the price adjustment of non-residential properties and adjust prices accordingly.

B. Model Specification and Calibration

39. **The central idea of mass appraisal is the development of appraisal models that are applied to groups of properties in the real property database (the full and comprehensive database of all real property).** The development of appraisal models involves two steps, specification and calibration. Specification involves deciding on which property characteristics likely have a significant effect on values (often largely determined by the availability of data on property characteristics) and how those characteristics are assumed to affect value. Calibration is the process of quantifying the coefficients associated with the variables in the model, in this case using MRA. The mission undertook some specification and calibration analysis to determine the feasibility of the approach for Cyprus and to facilitate the estimation of the resources required for the study.

40. **Where sale price is analyzed against a number of predictor variables (property characteristics), multivariate appraisal models are developed. These can be**

additive, multiplicative or hybrid (the first two being more commonly employed). The mission specified and calibrated a number of additive and multiplicative appraisal models for apartments in Larnaca and for each of apartments and houses in Nicosia. Multiplicative (semi-log) models performed better than their equivalent additive models. This was expected given the positively biased distribution of recorded sale prices.

41. **The objective of this analysis was to establish "base-line" models against which other models developed during the study could be assessed in terms of results (i.e. the direction and size of model coefficients) and the MRA diagnostic outputs.** Base-line models represent a priori expectations, and should therefore be relatively simple in design with little or no transformation of the independent variables (i.e. the characteristics of property that are expected to influence price/value). The results for all base-line models were discussed with the authorities to ensure their plausibility. In all cases the size and direction of predictor variable coefficients were considered reasonable, on the basis of informal assessment.

42. **Specified models were run twice, firstly to identify outliers (defined for the purposes of this analysis as residuals with a Cook's Distance of greater than 0.005) and then again with the outliers excluded.** In some models the Cook's Distance threshold identified a large number of outliers and consequently may need to be adjusted – however the threshold was held constant during this analysis so as to facilitate comparison between various models and subsets of data.

43. **The most successful appraisal model was developed for Larnaca apartments.** The subset of data provided by the authorities contained 1,298 sales for the period Q1 2008 to Q3 2013, of which only 307 were open market, single share transactions taking place between Q1 2010 and Q4 2012.

44. **The multiplicative (semi-log) model included a predictor variable for the ratio of building land value in the planning zone to the geometric average of values of planning zone across the entire district of Larnaca.** This variable acted as a proxy for quality of neighborhood, which is an important factor in the determination of property prices. The model also included four categories of area (residential, commercial out of centre, commercial/residential, and tourist) as well as age of building and the extent of enclosed, covered and uncovered areas.

45. **The first run of the regression identified 51 outliers, which appears quite high and may require adjustment of the Cook's Distance threshold**. However, it should be noted that even in this first run, all but one variable tested as very strongly significant (the other, uncovered area, was had a p-value of 0.0687, suggesting a transformation by square root may be appropriate) and the adjusted R^2 was 0.799 (meaning that the model explained just under 80 per cent of price variation).

46. **The second run of the regression, with the outliers removed, (for which results are presented at Appendix I) produced an adjusted R^2 of 0.889 with all variables being very strongly significant.** Recorded and predicted prices for each observation

were further analyzed using SPSS software to test for bias in the model according to standards set down by the International Association of Assessing Officers (IAAO). This analysis calculated the Coefficient of Dispersion to be 1.03 and the Price Related Differential to be 1.018, both comfortably inside IAAO minimum standards.

47. **The mission noted that the class and condition predictor variables did not prove to be significant in any of the test models.** This issue was discussed with the authorities and it was agreed that the classification of these variables will be looked at in more detail by the authorities, at least for flats in Nicosia. The authorities were of the opinion that there may in practice, be little or no observable differences in condition and class among many apartments.

48. **Prior to the study, the model will be tested for multicollinearity (a statistical phenomenon in which two or more predictor variables in a multiple regression model are highly correlated).** Some multicollinearity may be found between the ratio of building land value and the area categories which could affect the performance of these predictor variables.

49. **Estimates for building land values by planning zone will shortly be finalized and the authorities must prepare a single spreadsheet containing the values for each planning zone in Cyprus such that they can be matched to each property transaction.** This will greatly facilitate the development of robust appraisal models.

50. **DLS should also consider what other indicators of quality of neighborhood might be employed, and should further discuss this issue with the national statistical institute CYSTAT.**

51. **An appraisal model was also developed for Nicosia apartments, although without variable for building land value ratio.** The subset of data provided by the authorities contained 1,741 sales for the period Q1 2008 to Q3 2013, of which only 527 were open market, single share transactions taking place between Q1 2010 and Q4 2012.

52. **The basic multiplicative (semi-log) model included predictor variables for the age of building and the extent of enclosed, covered and uncovered areas only.** The first run of the regression identified 49 outliers (10.2% of observations). All predictor variables tested as very strongly significant and the adjusted R^2 was 0.673. The second run of the regression (results for which are presented under Appendix II), with the outliers excluded, yielded an adjusted R^2 of 0.8099. The residuals were normally distributed demonstrating that the model was not systematically biased.

53. **A series of alternative models, using various classifications of location (for example "town/community area", building density, and planning zone type) were specified and calibrated, giving mixed results.** However, the mission was of the opinion that the study should develop a multiplicative model including a predictor variable for the ratio of building land value in the planning zone to the geometric

average of values of planning zone across the entire district of Nicosia as the base-line model.

54. **A series of additive and multiplicative models were also run for houses in Nicosia. The models struggled to deal effectively with location below the district level.** The mission, in cooperation with the authorities attempted to group sub-district areas into relatively homogeneous classifications but none of these efforts were particularly successful. Given the importance of including a quality of neighborhood indicator (reflecting real-world pricing considerations) the mission was of the opinion that the inclusion of a predictor variable for the ratio of building land value in the planning zone to the geometric average of values of planning zone across the entire district of Nicosia will greatly facilitate the analysis, and ultimately the appraisals.

55. **The mission will develop a prototype model for non-developed land in advance of the study, using data provided by the authorities.** It was not possible to analyze these data beyond a basic inspection during the course of the mission. The mission should consult bilaterally with the authorities on the outcomes of this analysis, prior to the start of the study.

Recommendations

- The authorities should examine the classification of the class and condition variables, at least for apartments in Nicosia, prior to the study.
- The model for Larnaca flats should be tested for multicollinearity, by the mission, prior to the study
- The authorities should prepare, prior to the study, a single spreadsheet containing the values for each planning zone in Cyprus.
- Consider what other quality of neighborhood indicators might be employed.
- The inclusion of the predictor variable for quality of planning zone (ratio of building land value), should be tested for all building appraisals.
- The mission should consult with the authorities on the outcomes of the development of a prototype model for non-developed land in advance of the study.

VI. APPENDIX I. RESULTS OF BASE-LINE MODEL FOR LARNACA APARTMENTS

LarnacaFlatBaseSemiLogModelUsingBuildingLandValuesOpenMarketTransactionsOnly
The REG Procedure
Model: MODEL1
Dependent Variable: logprice

Number of Observations Read	256
Number of Observations Used	256

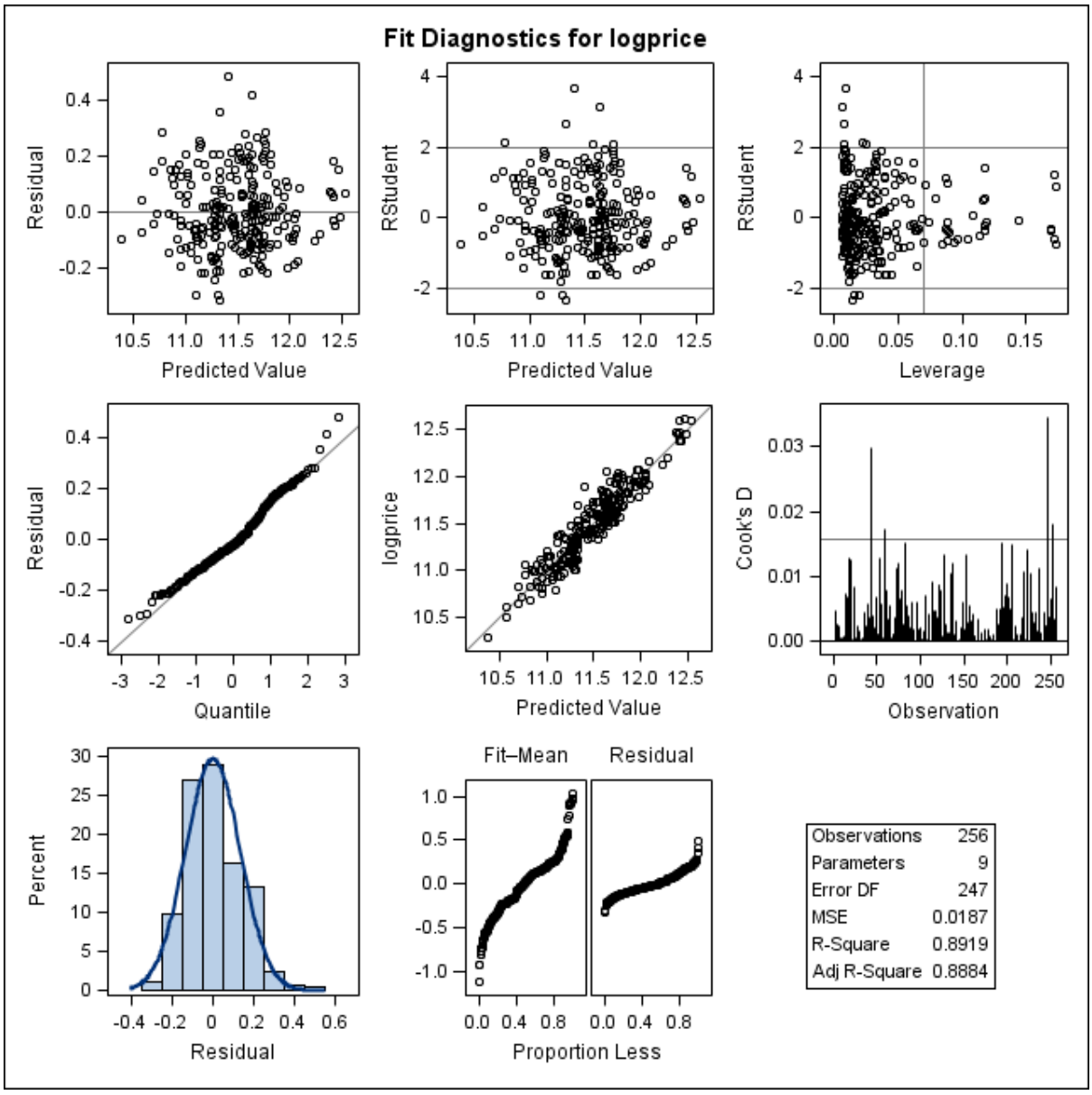
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	38.04357	4.75545	254.77	<.0001
Error	247	4.61049	0.01867		
Corrected Total	255	42.65406			

Root MSE	0.13662	**R-Square**	0.8919
Dependent Mean	11.49822	**Adj R-Sq**	0.8884
Coeff Var	1.18821		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**1**	10.62006	0.03683	288.36	<.0001
Value Ratio	**1**	0.09652	0.0048	20.11	<.0001
commercial out of centre	**1**	-0.14889	0.03709	-4.01	<.0001
commercial residential	**1**	-0.17814	0.02581	-6.9	<.0001
tourist	**1**	0.43242	0.05879	7.35	<.0001
Enclosed Extent	**1**	0.01286	0.00051821	24.83	<.0001
Covered Extent	**1**	0.00483	0.00139	3.46	0.0006
Uncovered Extent	**1**	0.00206	0.0005269	3.92	0.0001
age	**1**	-0.02147	0.00116	-18.55	<.0001


Fit Diagnostics for logprice
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
logprice
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 256
Parameters 9
Error DF 247
MSE 0.0187
R-Square 0.8919
Adj R-Square 0.8884

VII. APPENDIX II. RESULTS OF BASE-LINE MODEL FOR NICOSIA APARTMENTS

NicosiaFlatBaseSemiLogModelOpenMarketTransactionsOnly

The REG Procedure
Model: MODEL1
Dependent Variable: logprice

Number of Observations Read	473
Number of Observations Used	473

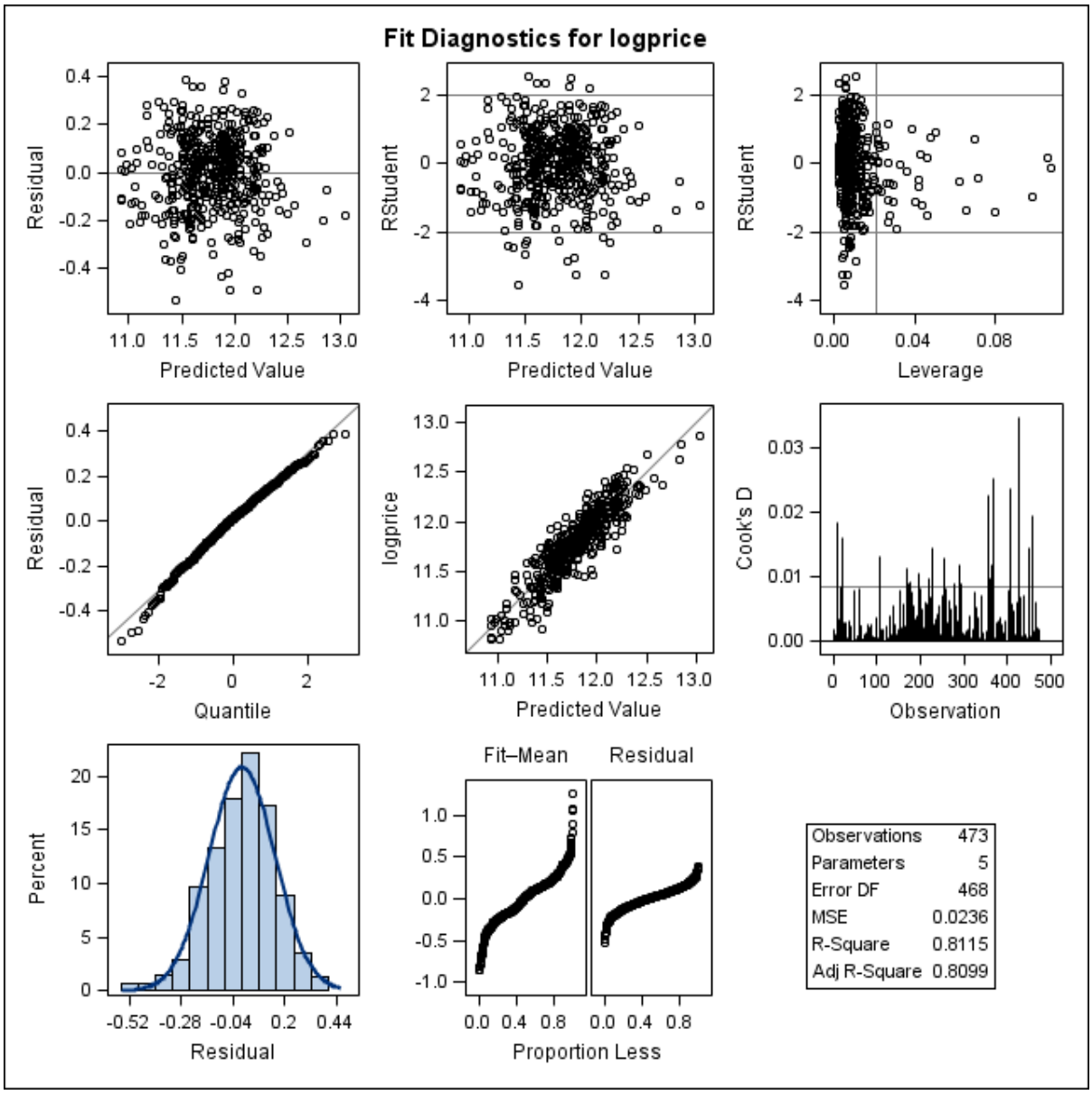
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	47.5469	11.88672	503.58	<.0001
Error	468	11.04698	0.0236		
Corrected Total	472	58.59388			

Root MSE	0.15364	**R-Square**	0.8115
Dependent Mean	11.7814	**Adj R-Sq**	0.8099
Coeff Var	1.30407		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**1**	11.11479	0.0246	451.77	<.0001
Enclosed Extent	**1**	0.01016	0.00034378	29.55	<.0001
Covered_ Extent	**1**	0.0073	0.00132	5.53	<.0001
Uncovered Extent	**1**	0.00168	0.00053301	3.14	<.0018
Age	**1**	-0.01757	0.00082554	-21.29	<.0001


Fit Diagnostics for logprice
Residual
Predicted Value
RStudent
Predicted Value
RStudent
Leverage
Residual
Quantile
logprice
Predicted Value
Cook's D
Observation
Percent
Residual
Fit–Mean
Residual
Proportion Less
Observations 473
Parameters 5
Error DF 468
MSE 0.0236
R-Square 0.8115
Adj R-Square 0.8099