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Full Length Research Paper

Housing Price Forecastability by Using Factor Analysis

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Abstract

Housing price forecastability is a big problem and takes attention of many researchers to find out the conclusion to know the causes of price forecastability. This study was conducted to explore the determinants of Housing price forecastability. The main factors were crime rate, share of non-retail enterprise, nitric oxides concentration, number of rooms, distance to employment centres, accessibility to radial highway, tax rate, pupil teachers ratio, proportion of blacks by town and low status of population etc. Multivariate data were used. Data is secondary in nature and is collected from the Stat Lib library which is maintained at Carnegie Mellon University. A factor analysis technique used to test the hypotheses. 5 chosen factor, and their corresponding communalities are generally high and the 5 chosen factors explain most of the total data variation (0.842 or 84.2%).

Keywords: Real housing price growth, House prices.

INTRODUCTION

In particular, the existing evidence has a tendency to awareness on long-run traits in house prices. The focus additionally tends to be on simplest a single or some selected residence rate indicators at a time such that a very narrow facts set is used to generate forecasts of housing price. Valuation ratios (e.g., fee-to-rent or fee-to-profits ratios) are among the maximum generally used predictors of future house expenses.

Those ratios work properly as predictive variables at lengthy horizons, however they may be no longer necessarily useful at shorter horizons. There are some factors effected the values in suburbs of Boston;

Crime rate is counted of crimes complied to evaluate the effectiveness of a crime control policy, and the effect of the policy at the chance of crime victimization. For instance, burglaries/total population is the standard "crime rate" suggested by the FBI and utilized by social scientists. The murder rate extended constantly the world average. The world's average rate is six people in step with 100,000. With 17 805 (an increase of 4.6%) murders in the past 12 months,

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This changed into the 0.33 consecutive year in which the murder rate increased, with 49 all women, man, and children killed daily. the police stations recorded the maximum murders over the last years. Children's aren't harmless. The statistics show that human beings younger than 17 were liable for 800 crimes in the beyond 12 months. In Gauteng, 49 murders have been committed by children among the whole of 10 and 17. Armed robbery figures have jumped sky-high. Aggravated theft, which includes hijackings, home and enterprise robberies, reached a 10-years increased. Those rose by using 8.5% over this beyond year, with 129045 incidents. The biggest increases had been inside the Western Cape (18.6%), Limpopo (18.6%) and Gauteng (11.4%). House robberies have doubled in these 10 years. There have been 10 173 house robberies 10 years ago. In 2014-15, there were 20 281 cases, even though house robberies declined with the aid of 2.3% over the past 12 months.

Business use opposite to standard nation does not mean any "non-residential" use (i.e. commercial enterprise use). It refers to garage facilities, along with ware housing, distribution centres, wholesale trade, delivery depots, laboratories and computer facilities. Any mild industry, office, cafeteria or residential element must be subservient to the primary use.

Nitric oxide is a gasoline with a sharp, sweet smell; it is colourless to brown at room temperature. Nitrogen dioxide is a drab to brown liquid at room temperature, with a strong, harsh scent. It will become a reddish-brown gasoline at temperatures above 70 degrees F. Nitrogen oxides are launched into the air from motor car exhaust or the burning of coal, oil, diesel gas, and herbal gas, especially from electric powered energy plants. They're additionally released during industrial procedures inclusive of welding, electroplating, engraving, and dynamite blasting. Nitrogen oxides also are produced through cigarette smoking.

A house is a constructing this is made for humans to stay in. it is a "permanent" building that is supposed to stay standing. It isn't always an area to live that may be without problems packed up and over excited like a tent, or moved like a caravan. If people stay in the equal residence for more than a short live, then they name it their "home". Houses are available many different shapes and sizes. They may be as small as just one room, or they may have hundreds of rooms. They are also made many distinctive shapes, and may have just one degree or numerous extraordinary tiers. A house is now and again joined to different houses at the sides to make a "terrace" or "row residence" (a connected row of homes).

The Minister for Local Government and Housing Town making plans has directed to establish manage Room in nearby authorities and Housing Town planning branch concerning redressed the grievances of the masses in connection with "primary facilities i.e. Cleanliness, Water and Sewerage and avenue lighting furnished by the Local Councils" for the duration of the province through taking all important measures. The Minister, while taking severe observe of rubbish and debris dumped anywhere and has similarly directed that the concerned officers need to take all important measures to make certain proper cleanliness within the towns/ metropolis, without delay. Hence, Local Department has issued directives to all local Councils for fast movement on this regard.

An equalization rate is honestly a ratio of overall assessed price for residences in a network to the ones residences genuine market rate based on the property or localities opinion of how carefully the assessed values fit the real market place price. As an example, an equalization price of 90% would mean that the assets in a city is being assessed at 90% of its market price.

LITERATURE REVIEW

Case and Shiller (1989, 1990) were the first to report that housing charges do not observe a random walk. They display that housing returns show off superb autocorrelation and that numerous data variables predict future housing returns. Many current studies study predictability in the housing market the use of the price rent ratio, which is similar to the rate-dividend ratio often used to forecast the stock market place. Gallin (2008) examines the longer term relationship between house rate and rents and finds that they're co-integrated and that the charge-rent ratio contains useful data for predicting housing returns at lengthy horizons. Favilukis *et al.*, (2012) develop a resent equilibrium version of the housing market, and their version means that an excessive rate-rent ratio predicts low future housing returns. They provide empirical evidence constant with this implication.

Campbell *et al.*, (2009) and Cochrane (2011) additionally give empirical proof that a high rate of rent ratio is a sign of low destiny housing returns. Our awareness is to forecast the growth in residence prices conditioning on a massive and greater widespread statistics set. We find that the use of the big panel of economic time series gives much higher

out-of-sample predictive power relative to the usage of the price-lease ratio.

Rapach and Strauss (2009) observe housing rate forecastability the use of more than only a single or some selected predictors. They analyse variations in housing rate forecastability throughout the 20 largest U.S. states in phrases of population. One in every of other things is that the degree of predictability is decrease in states with excessive common house price boom (i.e., coastal states) than in states with low average price growth (i.e., interior states). Rosen (1974) provided supplied the basic idea for the usage of hedonic regression because the principal tool to research housing expenses. Even though there is broad consensus approximately the appropriateness of hedonic regression to construct a house price index, maximum of the packages have no longer considered geographic heterogeneity in housing. But, latest literature gives some advances in this area.

Mills and Simenauer (1996) proposed a regional house rate index for the United States the use of national statistics and incorporating geographic heterogeneity through regional fixed effects. The paper revealed significant variations among the index published by the national association of Realtors (NAR) and their proposed regional index. Regardless of efforts to assemble a regional index, the authors did not calculate a hedonic regression for every region, there by assuming homogeneous conduct of the parameters over area.

Aroca (2008) established an alternate method, however did not take a look at it with alternate quasi-experimental local organizations. Quasi-experimental control groups may also provide the technique to construct the regional rate index; however the present article will suggest one of a kind quasi-experimental strategies to reduce the unfairness established by using Paredes and Aroca. James Krieger, (2002) poor housing conditions are related to a wide variety of fitness conditions, such as respiration infections, asthma, lead poisoning, accidents, and mental fitness. Addressing housing problems offers public health practitioners and possibility to address a critical social determinant of health.

Public health has long been concerned in housing problems. Inside the 19th century, health officers targeted poor sanitation, crowding, and insufficient ventilation to lessen infectious illnesses as well as hearth dangers to lower accidents. These days, public health departments can rent a multiple of strategies to better housing, which includes developing and enforcing housing suggestions and codes, imposing

“healthy houses” programs to enhance indoor environmental pleasant, assessing housing situations, and advocating for wholesome, low cost housing, now is the time for public health to create more healthy homes by way of confronting substandard housing. (Am J Public health.

Dusan J. C. Paredes (2011) proposes a method for a spatial cost index of housing that considers spatial heterogeneity in properties across areas. The index is constructed by means of combining 3 distinct techniques to reduce the spatial heterogeneity in housing: Quasi-experimental techniques, hedonic expenses and Fisher spatial charge index. The use of micro information from the Chilean survey CASEN 2006, it is shown that the quasi-experimental method known as Mahalanobis metric within propensity score callipers (MMWPS) leads to a significant reduction within the ability bias. The approach matches dwellings of a particular vicinity with different residences of comparable traits inside the benchmark location (Metropolitan location). As soon as the homes are matched, a hedonic rate version is computed, and a regional housing fee matrix is created using Fisher spatial fee indices. The paper concludes the existence of price differentials for homogeneous homes throughout regions in Chile.

Serena Ng (2010) researches the linkages between housing and consumption within the U.S taking into account area wise version. We estimate countrywide and regional housing factors from a comprehensive set of U.S rate and amount statistics available at combined frequencies and over distinct time spans. Our housing elements pick out up the common additives inside the data and are much less tormented by the idiosyncratic noise in separate series. This permits us to get extra reliable estimates of the consumption consequences of housing marketplace shocks. We found out shocks on the national level have huge cumulative effects on retail income in all regions. At the same time as the outcomes of local shocks are smaller, they may be significant. We analyze the driving forces of housing market interest through factor-Augmented VAR's. Our analysis display that decreasing mortgage rates has a larger effect than a similar reduction of the federal funds price. Furthermore, decrease customer self-assurance and inventory costs can gradual the recovery within the housing market.

RESEARCH METHODOLOGY

In this study the data used is secondary in nature and is collected from the StatLib library which is maintained at Carnegie Mellon University. The Data set contains 506 observations and 13 attributes. In the study following empirical Multivariate technique is used to identify the applicant position in firm by using Factor Analysis.

$$\underline{X} = \underline{\mu} + \underline{L}\underline{f} + \underline{\epsilon}$$

$$X_1 = \mu_1 + l_{11}f_1 + \dots + l_{1m}f_m + \epsilon_1$$

$$X_{13} = \mu_{15} + l_{13m}f_1 + \dots + l_{13m}f_m + \epsilon_{13}$$

3. Variables Description

Sr#	Variable name	Description
1	CRIME	per capita crime rate by town
2	ZN	Proportion of residential land zoned for lots over 25,000 sq/ft otherwise zero.
3	INDUS	proportion of non-retail business acres per town
4	NOX	nitric oxides concentration (parts per 10 million)
5	RM	average number of rooms per dwelling
6	AGE	proportion of owner-occupied units built prior to 1940
7	DIS	weighted distances to five Boston employment centres
8	RAD	index of accessibility to radial highways
9	TAX	full-value property-tax rate per \$10,000
10	RTRATIO	pupil-teacher ratio by town
11	BK	1000(Bk - 0.63) ² where Bk is the proportion of blacks by town
12	LSTAT	% lower status of the population
13	MEDV	Median value of owner-occupied homes in \$1000's

RESULTS AND DISCUSSION

In table 4, five factors were extracted from the 13 variables. All variables are well represented by the 5 chosen factors, given that the corresponding communalities are generally high. For example, 0.641, or 64.1%, of the variability per capita crime rate by town is explained by the 5 factors. Also, the 5 chosen factors explain most of the total data variation (0.842 or 84.2%).

Table 4 shows the varimax rotation was performed. You can now interpret the factors more easily. The proportion of non-retail business acres per town is 0.676, nitric oxides concentration is 0.767, proportion of owner-occupied units built prior to 1940 is 0.818, shows the large positive loadings on factor 1. Factor 1

primarily measure the proportion of owner-occupied units built prior to 1940 is 0.818. As one variable increases, so do the others. Per capita crime rate by town is 0.742, index of accessibility to radial highways is 0.854, full-value property-tax rate per \$10,000 is 0.828, shows the high positive loadings on factor 2. Only the percentage lower status of the population is 0.724 show large positive loadings on factor 3. Factor 3 primarily measure the low status alone. The proportion of residential land zoned for lots over 25,000 sq/ft's value is 0.458 show the large positive loadings on factor 4. Factor primarily measure the land zone alone. The proportion of blacks by town value is 0.932 show the large positive loadings on factor 5. so label this factor density. Factor 5 primarily measure the proportion of blacks alone.

4.1. Unrotated Factor Loadings and Communalities

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Communality
CRIM	0.619	0.012	0.473	0.054	0.174	0.641
LAND.ZN	-0.63	0.136	0.504	0.275	0.293	0.831
INDUS	0.85	-0.143	-0.101	-0.016	0.077	0.759
NOX	0.833	-0.318	-0.113	0.181	0.115	0.854
RM	-0.521	-0.659	0.282	-0.172	-0.137	0.832
AGE	0.761	-0.307	-0.301	0.07	0.026	0.77
DIS	-0.764	0.452	0.28	0.019	0.017	0.868
RAD	0.776	-0.113	0.479	-0.201	0.126	0.9
TAX	0.828	-0.077	0.396	-0.135	0.167	0.894
P.TRATIO	0.534	0.403	0.068	-0.655	-0.209	0.925
BK	-0.502	0.04	-0.422	-0.372	0.645	0.987
T.STAT	0.797	0.304	-0.126	0.268	0.079	0.822
MED.V	-0.682	-0.609	0.075	-0.133	0.038	0.861
Variance	6.5563	1.5174	1.3396	0.8623	0.6661	10.9417
% Var	0.504	0.117	0.103	0.066	0.051	0.842

4.2. Rotated Factor Loadings and Communalities

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Communality
CRIM	0.131	0.742	0.206	-0.008	-0.175	0.641
LAND.ZN	-0.761	0.09	-0.167	0.458	0.078	0.831
INDUS	0.676	0.271	0.297	-0.126	-0.073	0.759
NOX	0.767	0.243	0.23	0.111	-0.122	0.854
RM	-0.125	0.439	-0.892	0.127	-0.052	0.832
AGE	0.818	0.233	0.205	-0.011	-0.067	0.77
DIS	-0.889	-0.52	-0.051	0.059	0.076	0.868
RAD	0.296	0.854	0.083	-0.235	-0.145	0.9
TAX	0.353	0.828	0.184	-0.189	-0.12	0.894
P.TRATIO	0.092	0.292	0.277	-0.868	-0.018	0.925
BK	-0.152	-0.284	-0.116	0.03	0.932	0.987
T.STAT	0.416	0.316	0.724	-0.016	-0.157	0.822
MED.V	-0.153	-0.228	-0.833	0.242	0.181	0.861
Variance	3.5566	2.7923	2.3994	1.1619	1.0315	10.9417
% Var	0.274	0.215	0.185	0.089	0.079	0.842

4.3. Factor Score Coefficients

Variable	Factor1	Factor2	Factor3	Factor4	Factor5
CRIM	-0.145	0.402	0.017	0.145	0.042
LAND.ZN	-0.33	0.348	0.103	0.447	0.113
INDUS	0.17	0.074	0.015	0.03	0.099
NOX	0.235	0.074	0.012	0.278	0.05
RM	0.079	0.092	-0.524	-0.091	-0.155
AGE	0.304	-0.072	-0.014	0.114	0.047
DIS	-0.35	0.065	0.137	-0.031	-0.03
RAD	-0.086	0.431	-0.149	-0.11	0.098
TAX	-0.063	0.404	-0.076	-0.033	0.137
P.TRATIO	-0.112	0.016	-0.076	-0.857	0.035
BK	0.056	0.162	0.062	0.024	1.094
T.STAT	0.018	-0.009	0.356	0.216	-0.019
MED.V	0.116	0.064	-0.416	0.042	0.1

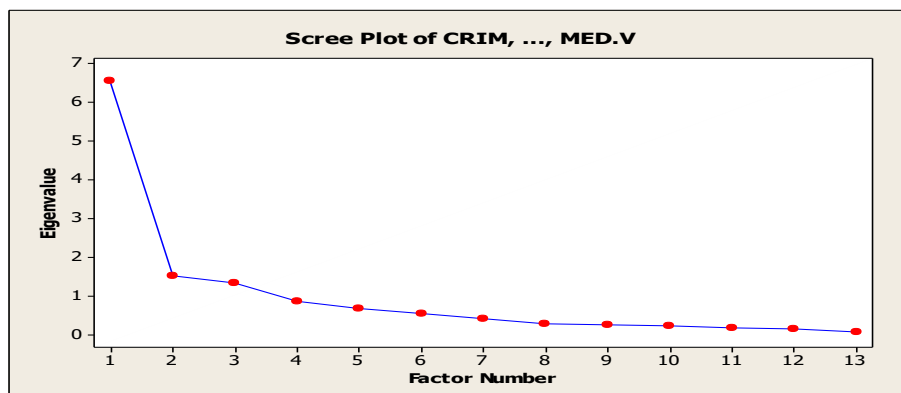
Table 4 shows the factor score coefficients. The first factor scores are computed from the original data using the coefficients listed under Factor 1. The coefficients are used to calculate the factor scores. Use factor scores to examine the behaviour of observations.

Factor 1 = -0.145 Crime -0.33 Land Zone +0.17 INDUS +0.235 NOX +0.079 RM +0.304AGE
-0.35DIS -0.086RAD-0.063TAX-0.112 P.TRATIO +0.056BK+0.018T.STAT +0.116 MED.V

For the houses price forecastability, the factor score coefficient pattern matches the loading pattern. For factor 1 the coefficients with the highest absolute value (AGE, BK, NOX) match the three variables that load on factor 1.

Use the scree, or eigen value, plot (graph of factors versus the corresponding eigen values) to provide visual information about the factors. The Eigen values of the correlation matrix equal the variances of the factors in the un-rotated solution. A factor analysis was conducted on 13 different characteristics of housing price forecastability. This scree plot shows that 5 of those factors explain most of the variability because the line starts to straighten after factor 5. The remaining factors explain a very small proportion of the variability and are likely unimportant.

4.4. Scree Plot



CONCLUSION

In this study we find out the factor analysis on housing price forecastability. In this study Multivariate data were used. The factor analysis was conducted on 13 different characteristics of housing price forecastability and then 5 factors were selected from the selected variables. Other all variables are well represented by the 5 chosen factor, and there corresponding communalities are generally high and the 5 chosen factors explain most of the total data variation (0.842 or 84.2%). In factor 1 the proportion of non-retail business acres per town is 0.676, nitric oxides concentration is 0.767, proportion of owner-occupied units built prior to 1940 is 0.818, shows the large positive loadings. The factor score coefficients examine the behaviour of observations. Here in factor 1, AGE, BK, NOX shows the coefficient with the high absolute value. Scree plot provide visual information about the factors. This scree plot shows that 5 of those factors explain most of the variability because the line starts to straighten after factor 5.

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