

ARIMAX Modelling of Impact of Household Wealth on Personal Consumption

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Abstract— Housing forms an important component of the national economy and contributes maximum to household's net wealth in most countries. Adequate housing is essential for human survival with dignity. The relationship between household wealth and personal consumption has been an area of interest for many countries in the past. While several countries like Sweden, Great Britain, USA and UK have been studied, India has never been a part of these studies to the best of our knowledge. The present study aims to primarily discuss the impact of household wealth on personal consumption in India using the Autoregressive Integrated Moving Average (ARIMA) model for the period of 1990-2015. The results from our analysis suggest that income levels and house price to income ratio have a significant effect on the personal consumption of people in India.

Keywords— *Housing wealth; Personal consumption; House price to income ratio; Income; Autoregressive integrated moving average model.*

I. INTRODUCTION

Impact of fluctuations in house prices on household spending decisions has been studied by several in the literature. Housing has been a dominant component of wealth for the households in several countries including USA, UK, Sweden, Canada, Italy among others. The last few years saw the rapid change of housing sector into an important sector of economy for India as well[1]. Housing has always been an important concern for the Government of India as it symbolizes development and provides employment opportunities which positively influences the living standards of people. Emphasis can also be given to the fact that institutional finance for housing has shown an upward trend over the years thereby attracting more players in the field. The Indian economy recorded 7.5% growth in the economy in the year 2015 as compared to 7.3% in the last year. Housing finance has emerged as a major business leading more people to go for home loans, repayment of which is positively impacted by increasing income of people. In a country which has witnessed a recessionary phase in the housing sector for nearly a decade, it is interesting to analyze the fluctuations in house prices on the buying behavior of people. This study

focuses on the house price effect on the personal consumption of the public and results indicate that the house price to income ratio does have a significant effect on the consumption pattern. The observations pertaining to both the models are presented after the literature review. Conclusions drawn from the analysis are discussed at the end of the study.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

A. Literature Review

The housing wealth impact on personal consumption has been an area of interest for several countries in the past. Countries like USA, UK, Sweden, Italy and Britain were part of research in the past.

The study conducted by [18] showcases the impact of housing wealth as well as other wealth on the personal consumption in the countries of Italy and UK for the duration 1972 to 2012. The study used the DOLS indicator to analyze the impact of wealth on consumption of an individual. The results concluded that UK witnessed a higher impact of total wealth on consumption than Italy. It was also noticed that the financial wealth is equally important in both the nations even though the data suggested that it dominates more in UK.

In the [4] study, the impact was seen for the Australian cities. The study brought out an inference that the studies by [15] on the estimation of influence of wealth by traditional regression methods can be very deceptive. This study also like the previous one included financial as well as non-financial wealth as part of total wealth. The quarterly data collected is for the period from 1976 to 2008. Vector error correction model was used on the sample of quarterly data collected for the period 1976 to 2004. It was concluded that non-housing consumption and wealth in Australia were positively related. It was also found that there are some variables which had a minor effect on the consumption but were not studied in detail. The study proposed by [12] suggests that the consumption of an individual majorly depends on his buying pattern. The author builds on the research done by [1] in the year 1968 where the results suggested that the consumer behavior theory

played an important role in the decision making abilities of people all across the globe. In the previous research done, it was noticed that humans change their behavior both according to the changes in the environment as well as the person on the other side. Therefore, in the study by [14], it was stated that along with consumer behavior theory there are variables such as wealth and income which influences the decision making ability and thus the author proposes the life cycle theory which combines the consumer behavior theory and the two mentioned variables.

[2] and [3] suggested that apart from wealth and income, variables such as interest rate and employment which are calculated on a yearly basis have a significant effect on the consumption pattern in a country.

Studying the relationship between stock wealth and personal consumption, an interesting finding is that of [16] who finds that investing in financial assets is more responsive to house price decrease than increase.

The empirical studies on the impact of employment on the personal consumption in the country of Britain is inconclusive. Others like [6] and [8] show that a positive relationship exists between the employment rate and consumption. This was supported with an argument saying higher the employment rate, higher would be the income which would lead to higher consumption. A counter argument was made by [3] suggesting that higher employment rate would lead to higher income which might affect the personal consumption negatively. This was backed with the existence of different sections of people living in a country. The lower class people would invest their money in housing property rather than personal consumption where as the upper class people would spend lavishly on their wants.

The literature review so far has suggested that no study has been done in India with the focus on impact of housing wealth and price to income ratio along with the other variables on the aggregate personal consumption to the best of our knowledge. Thus, the prime focus of this study is to add to this growing literature the evidence from an emerging economy India where housing sector has become one of the priority investment sector. The empirical model analyzed in the present study is as given in equation 1 and a similar method of analysis has been done in [11] and [13].

IV. DATA SOURCE AND RESEARCH METHODOLOGY

A. Data Description

For estimating equation 1, data was sourced from the World Bank for the time period from 1995 to 2015. A brief description of the variables used for analysis is as given in table I.

TABLE I. VARIABLE DEFINITION

Variable	Definition
Employment	Number of people working
House price to income ratio	House price to familial disposable income ratio
Loan to value ratio	Percentage of property

	mortgaged to amount one owns
EMI to income ratio	Debt to income ratio
Residential property price indices	Price change of residential housing
Household wealth	Net worth of a specific household
Personal consumption	Consumer spending on goods and services

B. Methodology

ARIMA modelling is used to check the estimation of equation 1 as it uses historical data to forecast the future results.

To analyze the stationarity of the model, a unit root test was done. This test was performed to reduce the randomness in the model. A general model for the test is as given below.

$$Y_t = \alpha Y_{t-1} + u_t$$

Where,

Y_t = latent dependent variable

α = coefficient for the (t-1)th dependent variable

u_t = error term

Following the above equation, the model for this study is as follows

$$\text{Consumption} = \beta \text{Consumption}_{t-1} + u_t$$

To study the influence of all the mentioned variables on personal consumption ARIMA modelling is used. The following is the general model used for the study. The model supposes that there exists a dependent variable.

$$Y_t = \alpha + \beta Y_{t-1} + \beta_1 u_t + \beta_2 u_{t-1}$$

The model to be estimated for this study is as given in equation 1.

Consumption = f (income, stock wealth, residential property indices, house price to income ratio)

In general, in an ARMA (p,q) process, p will be the autoregressive term and q will be the moving average term. If the series is differentiated d times, then ARIMA (p,d,q) becomes autoregressive integrated moving average time series.

V. RESULTS

The model is estimated first using unit root test. The results for the estimation are tabulated in the table II.

TABLE II. UNIT ROOT TEST

	Test-stat	1% CV	5% CV	10% CV	p-value
Z (t)	-0.519	-3.75	-3.00	-2.63	0.8882

Note: CV- critical value

and MA(1) coefficient is 0.999 with AR(1) being insignificant and MA(1) being significant.

TABLE III. UNIT ROOT TEST

Lag	Coefficient	p-value
L1	-0.2523675	0.655
LD.	-0.701976	0.941
L2D.	0.8753353	0.272
L3D.	0.4078201	0.448
L4D.	0.5050468	0.200
L5D.	0.4883385	0.196
L6D.	0.3399801	0.220
L7D.	0.6296112	0.058
L8D.	0.4690313	0.311
Constant	0.2001963	0.486

The model is then estimated through ARIMA modelling and this gives a clear idea of influence of various factors on personal consumption. The results for estimation are tabulated in table IV.

TABLE IV. ARIMA MODELLING

Variable	Coefficient	p-value
Low income	0.7494428	0.000***
High income	0.1539849	0.000***
House price to income	0.4248423	0.006***
Loan to value	0.1203719	0.276
EMI to income	-0.2517378	0.646
Constant	0.3252391	0.610
ar	0.5116087	0.140
ma	0.9999988	0.024**

VI. CONCLUSION

The roots of the model taken into consideration, including consumption as the latent dependent variable, lie within the unit circle concluding that the model selected is stationary which implies the mean and standard deviation remain constant for consumption across the period of study. Also, from the regression output of unit root test, the estimated β of -0.2523675 implies that $\alpha = (1-0.2523675) = 0.7476325$. The α -value being less than 1 confirms the model being stationary.

The results for the ARIMAX (1, 1, 1) modelling is as shown in table IV. It can be seen that the income levels have a positive relationship with the personal consumption of an individual. The house price to income ratio also shows a positive impact on the personal consumption. As the results suggest, it can be said that higher the income levels of an individual, higher would be his personal consumption. A significant relationship of house price to income ratio suggests that higher the house price and income levels, more would be the propensity of an individual to consume. Examining the estimation results, we see that the AR (1) coefficient is 0.511

VII. LIMITATIONS

The current study has a lot of limitations which provides scope for further study. The data is collected for the period from 1995 to 2015 excluding some of the variables because of the non-availability of data. Further comparative studies can be done taking into picture the results from other countries and extending the model to a panel data set.

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