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# Changing Demographic Trends and Housing Market in Pakistan

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## Abstract

*This paper analyzes the impact of changing demographic trends on housing market in Pakistan. An analytic device, a phase diagram, has been used to show the relationship between demographic change and demand for housing in Pakistan. The characteristics of this paper are as follows. First, a model comprising four equations is developed to investigate the relationship between different variables such as housing stock, demand for housing, real rental price, rate of depreciation, net investment in housing, gross investment in housing, real price of housing unit and growth in population. Second, set of four equations is reduced to two differential equations which are used to solve for house prices (P) and number of houses per adult in a country (h). These two equations are also used to draw phase diagrams and to draw our conclusions. It is concluded that house prices are directly related to growth rate of population and inversely related to the number of houses per adult. In Pakistan, a rise in the growth rate of the adult (house-buying years segment) population will increase the demand for housing for the next four decades. Moreover, a fall in the total population growth rate could not cause downward trend in house prices because of changing age structure. We have to consider the composite impact of all related factors on house prices which in turn impact the supply and demand for housing in country.*

## I. Introduction

House prices have been one of the hotly debated topics in Pakistan. Like food, housing is a basic need and house rent constitutes twenty four

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percent of the total weight[2] of basket of goods and services considered in calculation of the consumer price index number. For past ten years, the Housing and Construction sector has been playing an important role in economic development of Pakistan by providing substantial employment opportunities because of its forward and backward linkages in economy. Nearly 40 industries are linked with construction activities[3] with employment elasticity of 0.6. House prices like other goods and services are determined by the market forces. Supply of houses depends on house prices, the price of land, the cost of construction material, the cost of financing and the amount of un-depreciated housing stock. On demand side, the demand depends on house prices, the level of mortgage rates, expectations of permanent income or wealth, rates of return on other investments such as national saving schemes and demographic factors. This paper focuses mainly on a demographic factor, i.e. change in age structure and its impact on housing market in Pakistan.

Age distribution is an important demographic factor that needs to be considered while analyzing the demand and prices of housing in a country. A young population between 0-19 of age generates little housing demand while housing demand rises from age 20 and above. Homeownership is also expected to vary by different age brackets. To analyze the impact of changing age structure on demand for housing in Pakistan, we use a combination of mathematical model developed by Mankiw and Weil (1988) and an analytic device known as phase diagram. We organize this paper as follows:

Section II presents brief literature review about demographic change and its impact on housing demand. Section III gives an overview of demographic changes and situation of housing market in Pakistan while section IV analyzes the relationship between changing age structure and its impact on housing demand in Pakistan with the help of phase diagrams and model presented by Mankiw and Weil (1988). In the end, we give our conclusions in section V.

## II. Literature Review

Mankiw and Weil (1988) are considered as the two main researchers who initially analyzed the relationships between demographic changes and housing market empirically[4]. For this purpose, they developed a demographic

[2] GOP, 2001-01.
[3] GOP, 2006-07a.
[4] Fortin and Leclerc (2000).

index of housing demand and showed how demand for housing changes with age. They found that age-specific demand for housing reach its maximum by the age of 40. They estimated that due to ageing of baby-boom generations, real prices of housing in US could fall by 47% from 1990 to 2010. However, they also concluded that this effect of demographic changes on house prices will be counterbalanced by increase in real income.

This interpretation of housing demand by Mankiw and Weil (1988) was criticized by Swan (1995) who suggested that other than adult population, real income, relative prices and real interest rates are also important determinants of housing demand which needed to be considered in the model.

A study by Thomas and Malmberg (2005) also found that planning for residential construction should depend upon the age structure of population. By using Swedish time series and OECD panel data, they found a positive association between young adult population and residential construction in Sweden. They also found negative impact of ageing population of above 75 years and concluded that ageing population in industrialized countries may have negative impact on the construction industries in future.

In Finland, Kuismanen et al., (1999) applied Mankiw and Weil model to analyze the role of demographic factors on the demand for housing. Using time series data they concluded that a one percent increase in demographic demand leads to one percent growth in housing demand. Similarly, studies by Foot and Stoffman (2000) in Canada showed that increase in ageing population may negatively affect the demand for housing but increase in real income of people will likely to offset this negative impact on housing demand in future.

Fortin and Leclerc (2000) analyzed the demographic change and its impact on real prices of housing in Canada. By using data for the period of 1956 to 1997, they developed a structural model of Canadian housing market. They concluded that other than real income of people, the growth rate of population between the age of 25 to 54 years have significant impact on housing prices. They also concluded that slowing the rate of this age group in future or ageing population may reduce the real prices of housing in future.

Contrary to above studies, Pitkin and Myers (1994) and Green and Hendershott (1996) found that housing demand does not fall even after the age of 40 and continues to rise to the age of 70.

In Pakistan, only few studies related to housing market exist but none of them analyze the impact of age structure on demand for housing. For example, Ghaus and Pasha (1990) analyzed the trends in housing conditions in Pakistan. By using Housing Census of 1960 and 1980, they quantified different indicators of housing consumption like household size, real rental per capita and persons per room. Their results show a significant improvement in housing conditions over the time and relatively slow growth in housing shortages.

Nazli and Malik (2003) analyzed the relationship between poverty and inadequate housing facilities in Pakistan. They concluded that inadequate housing facilities create sense of insecurity and disempowerment among poor people.

Most of the studies cited above analyzed the impact of ageing population on the demand for housing in advanced countries. However, in country like Pakistan where majority of population is in young and working age (15-64 years), population ageing is not a problem[5]. Instead, here is a need to analyze the impact of youthful population on demand for housing in future. This paper is an effort to serve this purpose.

## III. Demographic Changes and Housing Market in Pakistan

Pakistan is the sixth largest country in the world by population. Estimated population of Pakistan in year 2009-10, was 170 million people with an annual growth rate of 1.8 percent. It is not the population size and the growth rate only that matters but the age structure of population also plays an important role in decision making of individual's economic life[6].

Pakistan is now going through the stage of demographic transition in which generations of children who were born in the period of high fertility are entering into the working age, this will increase the labor supply in future[7]. Moreover, as fertility rate is now falling, female labor force participation rate will also rise. A direct impact of this change will be decrease in young and old aged dependency ratios and increase in ratio of working age to dependant population (table 1).

[5] See, Ahmad and Azim (2008).
[6] See, Lee et al. (2006).
[7] See, Nayab (2008).

**Table: 1. Demographic Indicators of Pakistan, 1950 -2050**

| Years | 1950 | 1975 | 2000 | 2025 | 2050 |
|---|---|---|---|---|---|
| Population growth rate (%) | 2.4 | 2.6 | 2.2 | 1.3 | 0.7 |
| Aging index | 21.7 | 13.1 | 13.8 | 21.1 | 53.8 |
| Broad age groups (%) | | | | | |
| 0-14 | 37.9 | 42.0 | 41.8 | 34.4 | 23.1 |
| 15-60 and above | 62.1 | 58.0 | 58.2 | 65.6 | 76.9 |
| Median age (years) | 21.2 | 19.0 | 18.9 | 22.8 | 31.8 |
| Dependency ratio | | | | | |
| Total | 76.3 | 83.0 | 83.4 | 64.6 | 45.9 |
| Youth | 66.9 | 76.8 | 76.6 | 56.7 | 33.8 |
| Old age | 9.4 | 6.2 | 6.7 | 7.9 | 12.1 |
| Potential support ratio | 10.6 | 16.1 | 14.8 | 12.7 | 8.2 |
| Ratio of working to dependant population | 1.31 | 1.21 | 1.31 | 1.58 | 2.13 |

Source: United Nations, 2002 and author's own calculations.

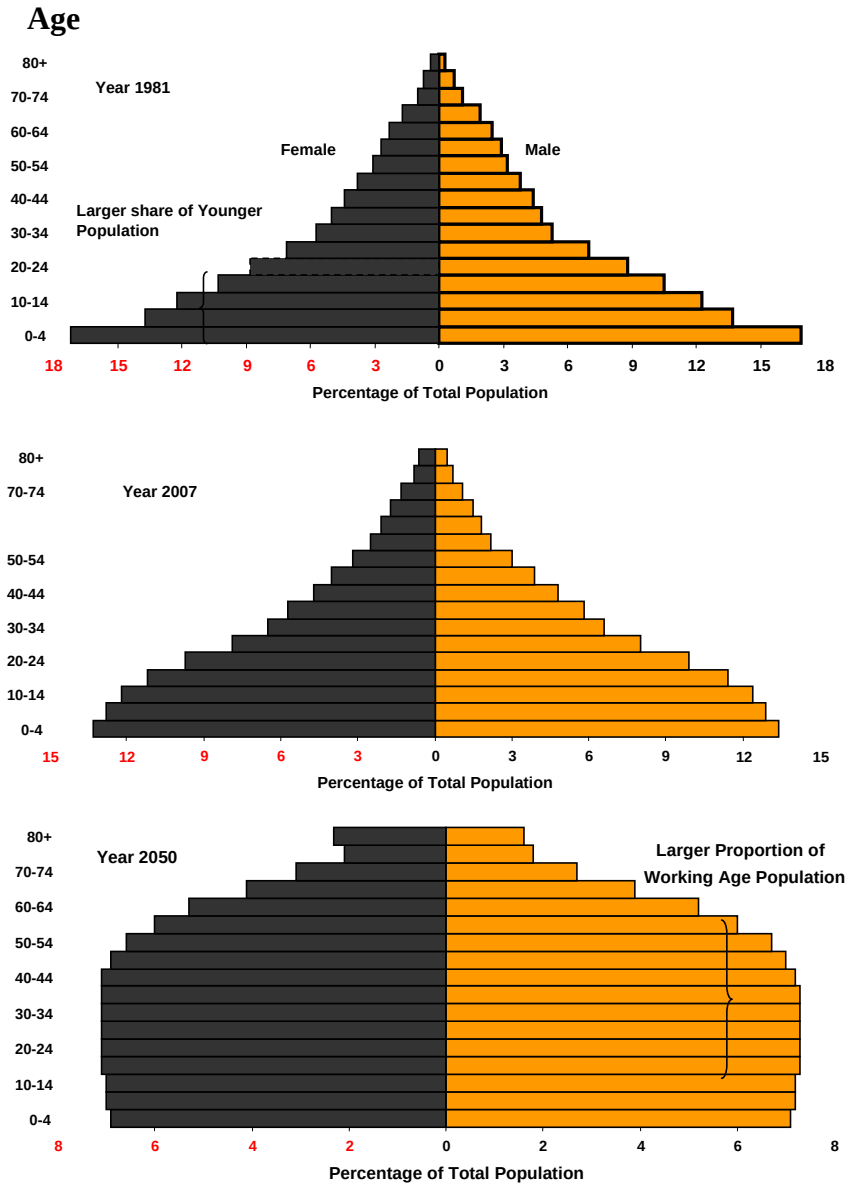
Population pyramids of Pakistan (figure 1) also indicate changing age structure in Pakistan. Housing buying segment of population (20 years and above) has increased from 47 percent to 50 percent since 1981 and is expected to increase up to 72 percent in year 2050. Since the share of adult population (house-buying years) is rising there would be a rise in the demand for housing which would exert an upward pressure on house prices in the next four decades.

Housing statistics of Pakistan shows the shortage of houses in the country. According to the population census 1998, there were 19.3 million housing units with an average household size of 6.6 and 3.3 persons per room. Currently, incremental demand for housing is 570,000 units per annum but only 300,000 units are being built, so every year there is a shortage of 270,000 units per annum (table 2).

Due to this shortage and rising demand, house rent has increased by 40.45 percent since the year 2000-01 and is expected to increase further. In order to meet the housing shortfall and address the backlog of 8 million housing units, the housing supply will have to be increased to 970,000 units annually for next 20 years[8].

[8] GOP, 2004-05.

**Figure: 1. Population Pyramids of Pakistan**




Source: U.S Bureau of Census, International Data Base.

**Table: 2. Housing Statistics in Pakistan**

| | |
|---|---|
| Total population | 170 Million (2009-10) |
| Urban population | 38 % of total population |
| Total housing units | 19.3 million |
| Owned housing units | 85.9 % |
| Household size | 6.5 |
| Room density | 6.7 persons per room |
| Demand for housing | 570,000 units per annum |
| Supply of housing | 300,000 units per annum |
| Net shortfall of housing | 270,000 units per annum |
| Total housing backlog | 8 million units |
| Housing finance, as percentage of GDP | 0.7% |

Source: GOP 2006-07b and SBP, 2009-10

## IV. The Model

The main purpose of this study is to analyze the impact of increase in the share of population (house buying years) on housing market in the country. For this purpose we use the model developed by Mankiw and Wiel, 1988, and an analytic device known as Phase diagrams to establish the relationship between demographic change, housing demand and prices.
This forward-looking model[9] is presented in the following set of four equations.

$$Hd = f(R)\, N \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

$$R = R(h)\ \frac{\partial R}{\partial h} = R^{*} > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

$$R(h) = rP - P^{*} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

$$H^{*} + dH = g(P)N \quad \frac{\partial g}{\partial P} = g' > 0 \ldots\ldots\ldots (iv)$$

*Where:*

*H = stock of housing*
*Hd = demand for housing*
*R = real rental price*

[9] This model draws heavily on Shone, (2002) and Mankiw and Weil, (1988).

*N = adult population*

*h* = $\frac{H}{N}$ *= number of houses per adult (20 years and above) of the population*

$h^*$ *= growth in number of houses per adult in population*

*P = real price of a standardized housing unit (value of the house)*

$P^*$ *= growth in house prices*

*rP= operating cost of owing a home*

*d= rate of depreciation*

$H^*$ *= net investment in housing*

$H^* + dH$ *= gross investment in housing*

*n*= $\frac{N^*}{N}$ *= rate of growth in population*

Differentiation of equation (i) with respect to *N* gives us $\frac{dH_d}{dN} = f(R) > 0$ *which implies that demand for housing will increase with a rise in adult population.*

Differentiation of (iv) with respect to *N* gives us

$\frac{d(H^* + dH)}{dN} = g(P) > 0$ *which implies that gross investment in housing sector will increase with a rise in adult population.*

Differentiation of *h* = $\frac{H}{N}$ with respect to time gives us

$h^* = \frac{NH^* - HN^*}{N^2} = \frac{H^*}{N} - \left(\frac{H}{N}\right)\frac{N^*}{N}$ where $h^* = \frac{dh}{dt}$ and the like. $= \frac{H^*}{N} - nh$

Substituting the respective values from above gives us

$= \frac{g(P)N - dH}{N} - nh$

$h^* = g(P) - (d + n)h$

The model is reduces to the following two differential equation which determine the motion of the model.

$$P^* = rP - R(h)$$

$$h^* = g(P) - (d + n)h$$

These two equations give us a solution for *P* and *h.* A steady or stationary state occurs where the values of the variables remain constant over time. ($h^*, P^*$ at the intersection of $P^*$ = 0 and $h^*$ = 0 lines). These are determined by setting $P^*$=0 and $h^*$ = 0.

In the price equation, in a steady state $P^*$=0 which yields

$$rP\text{-}R(h) = 0$$

$$\Rightarrow rP = R(h)$$

$$\Rightarrow P = \frac{R(h)}{r} \ldots\ldots\ldots\ldots \text{ (v)}$$

Differentiating equation (v) with respect to h gives us

$\frac{dP}{dh} = \frac{\frac{dR}{dh}}{r} = \frac{R'(h)}{r} < 0$ since $R'(h) < 0$ *implying real rental price and number of houses per adult vary inversely.*

Hence the price stability condition gives rise to a negatively sloping line in the phase plane as shown in figure 2. To the left and below the line $P^*$ =0 the condition $P > \frac{R(h)}{r}$ prevails, which implies that $P^* > 0$, and so the house prices are rising shown by upward directing arrows. The converse holds to the right and above the line where $P < \frac{R(h)}{r}$ prevails, which implies that $P^* < 0$, and so the house prices are falling shown by downward directing arrows in figure 2.

In the second differential equation $h^{\bullet} = g(P) - (d+n)h$, in equilibrium there is no change in the number of houses per adult of the population which is shown by $h^{\bullet} = 0$. Hence,

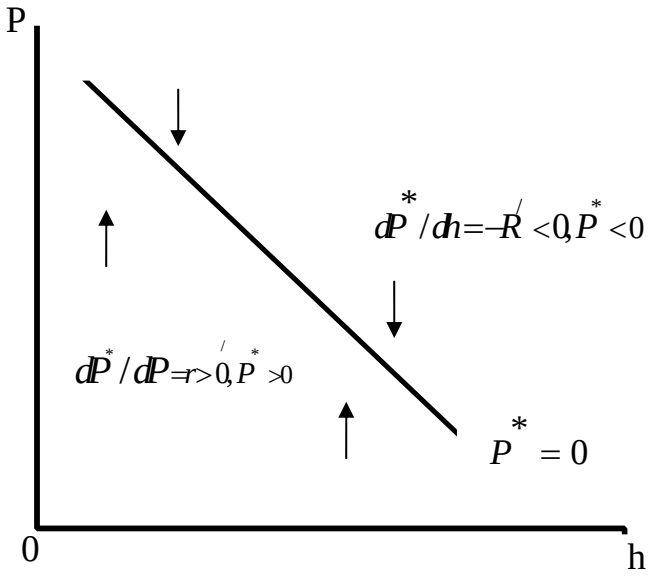
$$g(P) = (d+n)h \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(vi)}$$

Differentiating (vi) with respect to h yields

$$g'(P)\frac{dP}{dh} = d + n$$

$\Rightarrow \frac{dP}{dh} = \frac{d+n}{g'(P)} > 0$ since $\frac{dg}{dP} = g'(P) > 0$ implying that gross investment in housing rises with rise in house prices.

**Figure: 2.**




Relationship between *P* and *h* with respect to growth in house prices

This stability condition gives us a positively sloping line in the phase plane as shown in figure 3. Above and to the left of the stability condition $h^* > 0$ and so h is rising shown by right ward pointing arrows, and the converse holds to the right and below the line where h is falling shown by leftward pointing arrows in figure 3. Now differentiation of (vi) with respect to '*n*' and '*d*' gives us:

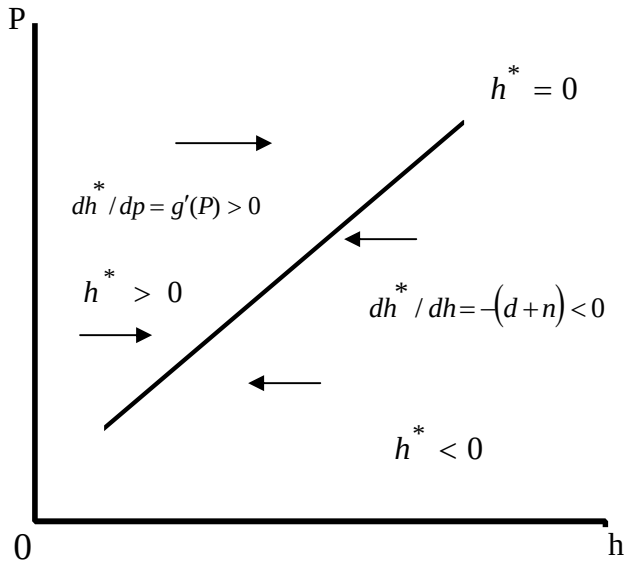
$\frac{dP}{dn} = \frac{(d+1)h}{g'(P)} > 0$ *Implies that price of housing varies directly with 'n' (population growth rate)*

$\frac{dP}{dd} = \frac{(n+1)h}{g'(P)} > 0$ *Implies that price of housing varies directly with'd' (rate of depreciation of house).*

Superimposition of figure 2 on figure 3 gives us figure 4. Phase diagram depicted in figure 4 shows the vector of forces in the four quadrants I, II, III and IV. Any point in sectors I and III, other than the equilibrium point will move away from the equilibrium because they will be on unstable arm

where resultant of two vectors will take them away from the equilibrium as shown in figure 4. Point A is called a saddle point lying on the stable arm $Z_1$ $Z_1'$.

**Figure: 3.**

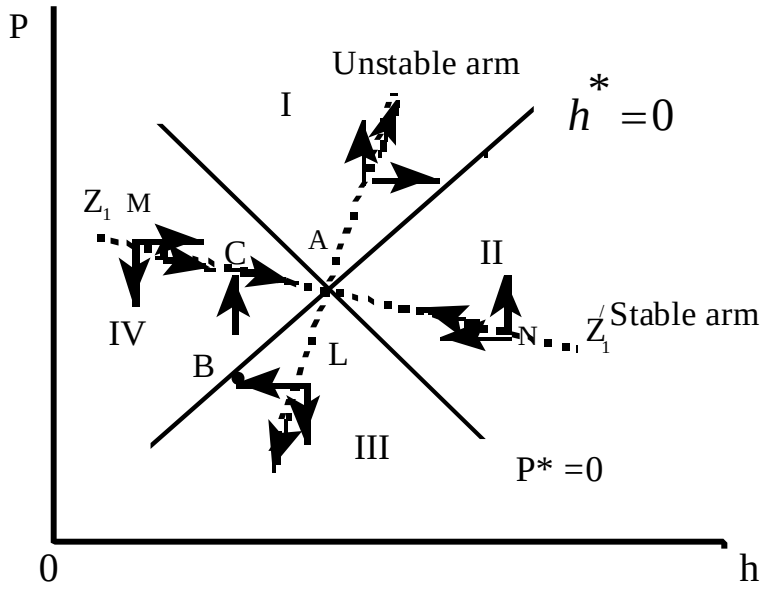



Relationship between *P* and *h* with respect to growth in house prices

A market which starts out of equilibrium, such as point B will initially show a rapid rise in house prices (B to C) to reach the stable arm at C and then eventually will move down to the equilibrium point A. At points such as L and K, the paths diverge from the steady state while at points such as M and N, they converge to the steady state.

Now suppose share of adult population (house buying segment) increases as shown by a rise in the shift parameter *n* causing an anticlockwise tilt in the housing line $h_1^* = 0$. This new housing line is shown by $h_2^* = 0$ in figure 5. This new line $h_2^* = 0$ is steeper than the old line $h_1^* = 0$ because $\frac{dh^*}{dh} = -(d+n) < 0$, thus when n (higher growth rate of population) rises the slope of the housing line rises and vice versa.

**Figure: 4**




Phase Diagram showing saddle point stability

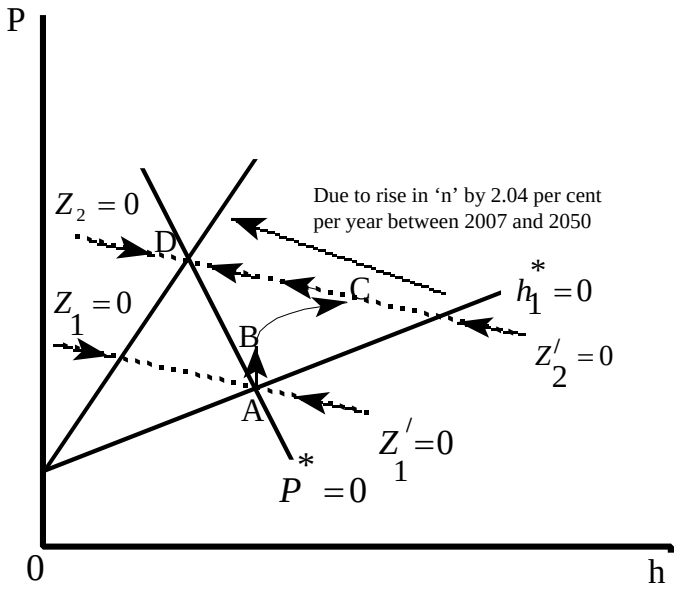
The rise in 'n' will raise the absolute slope ($d+n$). Consequently, the new housing line $h_2^* = 0$ will be to the left of the old housing line $h_1^* = 0$. Now there will be another saddle point D and a new saddle path $Z_2$ $Z_2'$ as shown in Figure 5. It is evident that as house buying segment of population (N) rises number of houses per adult (h) will fall. This will increase investment in housing sector which will increase $h^* > 0$ i.e. a fall in h will increase $h^*$ ($\frac{dh^*}{dh} < 0$).

Similar will be the situation of Pakistan, the overall population growth rate is projected to fall from 2.9 percent in 1981 to 0.7 percent in 2050, but the share of adult population (house buying segment) is projected to rise from 47 to 72 per cent during the same period with a growth rate of 2.046 percent per year.

To see the impact of this change in population growth on house prices *P* and housing per adult *h*, with market having perfect foresight, there would be upward surge in *P* shown by moving from A to B in figure 5. This

movement in the system is called the announcement effect of rate of growth in adult population. There will be no rise in housing demand *h* from A to B because the babies have not become adult yet. The system will move in the north easterly direction which is the resultant of the two forces, one pulling in the east ($h^* > 0$) and the other in the north ($P^* > 0$) along a path like BC. When the adult population increases and becomes the part of the housing market, then the market will be on the new saddle path shown by $Z_2$ $Z_2^{/}$ in figure 5. Now the system will operate on this new saddle path towards point D. It is to be noted that the system will reach from C to D under the assumption of perfect foresight. If this assumption does not hold, the point D will not necessarily be achieved.

**Figure: 5.**




Impact of anticipated increase in adult population on *P* and *h*

In coming half century, share of adult population (house buying segment) will increase at annual growth rate of 2.046 percent. This rising trend in house-buying segment of the population will definitely exert an upward pressure on house prices and will swing the $h_1^* = 0$ line counterclockwise and will become $h_2^* = 0$ as shown in figure 5, showing a rise

in demand for housing and house prices. Given the price elasticity of demand for housing 0.5 (as used by Mankiw and Weil) and assuming that the growth of house demand would be equal to the rate of growth of house-buying segment of population, which happens to be 2.046, the house prices would rise by 4.09 percent annually between 2007 and 2050 due to changing demographic trend in Pakistan. It is trivial to show a rise in the price of a certain house during 43 years (2007 to 2050). If its price in 2007 was say rupees 5 million and the growth rate of house prices is 4.09, the same house would cost rupees 28 million in 2050, The initial price is multiplied by a factor[10] of 5.60. The actual rise in the prices in fact could be more because of other inflationary factors such as rising trend in the cost of construction materials and labor.

## V. Conclusions

Experience of advanced countries has shown the relationship between housing market and age structure of population. Pakistan is also going through the phase of demographic transition when generations of baby boom have been entering into the phase of their working lives. In general, we can make a reliable prediction that this trend of youthful population will increase the demand for housing in the country as young and married people are usually keener to live separately and independently of their joint family[11].

Therefore, it is expected that house prices will tend to rise over the next four decades, after 2050, they might flatten out over long periods of time because of a negative demand shock like the setting in of aging population and exiting of youthful population. Besides, the large cities will be magnets for rural to urban migration that will increase demand for housing in big cities. It warrants government intervention in housing sector to provide affordable housing by keeping in view the changing demographic factors in Pakistan.

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[10] $G = \left( \left[ \sqrt{\frac{P_1}{P_0}} \right]^T - 1 \right) 100$ where G (average annual growth rate in %) = 4.09,

$T$ (time period in years) = 43, $P_o$ = 5 million (price in year 2007), $P_1$ = 28 million (price in year 2050).

[11] Unlike Western world, joint family system is quite strong especially in rural areas of Pakistan but in recent past it has been observed that young people prefer to live independently after marriage.

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