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Challenges facing housing affordability in Beijing in the twenty-first century

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Abstract

Purpose – The purpose of this paper is analyse to what extent the high price had led to low levels of housing affordability in the period 2002-2006 in Beijing. Due to the importance of housing for local residents and the crucial position that real estate market in the Chinese economy is currently in, research into the housing affordability issues is now essential. It is important to consider the social circumstances that are predominantly related to both the standard of living and the national economy in Beijing.

Design/methodology/approach – The housing price to income ratio (PIR) method and Housing Affordability Index (HAI) model are used to measure housing affordability in Beijing. Then, the reasons for the high housing prices in Beijing are discussed and government homeownership-oriented policies to help citizen on housing issues are examined. Finally, future proposals which can contribute to ease the housing affordability problem are recommended.

Findings – The main findings in this research are that the PIR in the Beijing housing market (based on an average gross floor area of 60 m²) fluctuated between 6.69 and 9.12, respectively, between 2002 and 2006. Over the same period, the HAI was approximately 75 between 2002 and 2004, although decreasing sharply in 2005 (65.78) and 2006 (51.33). It appears that the Chinese government’s new housing provision policies may be able to ease this affordability problem, especially with regards to the economic housing scheme.

Originality/value – China has experienced rapid growth in gross domestic product (GDP) with a substantial increase in house prices which have affected housing affordability for typical Beijing households. Since the housing reform in China commenced in 1998, Beijing residents, government officers and academics have been concerned about high housing prices in the city, which is considered beyond the buying capability of the ordinary residents. The results are designed to provide an insight into the level of housing affordability in Beijing and whether a trend exists.

Introduction
China has experienced rapid economic growth over the past two decades, which has also been accompanied by rapid development in the real estate market. A substantial change in central government housing policy was the transition from the old system of government housing allocation to a new system in which housing is supplied by the open property market. Traditionally, Chinese households have been accustomed to the traditional welfare housing system where only nominal rents are paid, which in turn means that the main responsibility of housing provision belonged to the organisation they work for. Partly due to the relatively recent housing reform Chinese residents must now determine if they are capable to purchase their home at an appropriate location of a particular housing market. It is evident that issues surrounding housing affordability in China have been accompanied by substantial debate following the launch of the new housing policy since the late 1990s.

Due to the combination of higher household income and new housing provision policies introduced by the central, provincial and city governments, the pressure on housing affordability in Beijing was much less at the beginning of twenty first century; however, this situation has now reversed and questions are being raised about housing affordability levels. In order to provide an insight, this research examines the level of housing affordability in Beijing from 2002 to 2006 by using price to income ratio (PIR) and housing affordability index (HAI) methods, as well as the qualifying income (QINC) approach. The results are designed to provide an insight into the level of housing affordability in Beijing and whether a trend exists.

The broader context of housing affordability

The term “housing affordability” has been commonly used when examining housing-related difficulties in terms of individual households (Hulchanski, 1995). The concept has been consistently referred to in the UK and the USA, since the 1960s and 1980s, although notably with different policy purposes (Hui, 2001). The UK uses the housing affordability concept based on the premise of assisting households who are in real need of housing provision whilst moving towards a market-oriented system of housing provision; note some similarities can be drawn between the UK and this study into the Beijing housing market. In contrast, the USA uses the concept of housing affordability to measure what level of financial subsidy, if any, is appropriate for low and middle income households. In Hong Kong, a threshold level for housing affordability was introduced in 1987 by the Hong Kong housing authority in order to establish a measure for providing subsidised housing to households in need (Hui, 2001).

The early beginnings of housing affordability studies can be traced to nineteenth century studies of the household budget which generally equated “one week's pay for one month's rent” (Feins and Land, 1981). In other words, it is envisaged that families are able to spend about one-quarter of their income for shelter. It should be noted that this ratio between income and housing costs will vary substantially in accordance with factors such as different social environments e.g. transport and living costs. It is also accepted that households are believed to have housing affordability problems when they pay more than a certain proportion of their income to consume suitable levels of housing in a specific economic conditions (Hulchanski, 1995).
Overall, there are two measures to approach the issue of housing affordability. The first definition is relatively broad as follows:

Affordability is concerned with securing some given standard of housing (or different standards) at a price or a rent which does not impose, in the eyes of some third party (usually government), an unreasonable burden on household incomes (Hancock, 1993, p. 129).

More specifically, housing affordability is where:

... households should be able to occupy housing that meets well-established (social sector) norms of adequacy (given household type and size) at a net rent which leaves them enough income to live on without falling below some poverty standard (Hancock, 1993, p. 129).

The phrases “an unreasonable burden” and “some poverty standard” indicated that other forms of consumption not spent on housing, such as food and clothing, is considered to be the minimum living standard in society. Using this definition, housing affordability can be measured by the ratio of the cost of a suitable house to income. As a result, the analysis for this study is based on this ratio of housing to income and uses two approaches, namely (a) the PIR approach and (b) the HAI which measures the proportion of income spent on housing. A third model based on QINC is also discussed.

**Background to housing affordability in Beijing**

The end of the welfare housing allocation system in 1998 provided a surprise to many Beijing residents; in recent years, it has become much more difficult to become a homeowner in the rapidly developing commercial housing market. In 2001, the proportion of housing in Beijing sold to individual households was 92 per cent (Ministry of Construction, 2004), but this situation has changed rapidly since house prices increased sharply possibly due to factors such as the Beijing becoming the host city of 2008 Olympic Games in 2001. House prices especially in inner-city areas of Beijing have experienced significant increase, worrying both government and consumers.

The origin of a market-derived housing market occurred in July 1998 when the central government circulated a new policy outlining basic reforms for urban housing systems and housing development (Ye, 2000). The underlying emphasis was that the government would no longer distribute housing directly to the public, but would only provide “economical housing” where house prices are limited with low-rent housing being available for low-income households only. It was envisaged that the market would self-adjust in accordance with household demand for housing.

With the benefit of hindsight, it is clear that this new housing policy had a substantial influence on the operation of the residential property market, especially in Beijing. Since 1998 both (a) the level of investment in residential property market and (b) house prices increased annually at a higher rate than the average rate in China, where house prices in Beijing were three times as the national level in 2003 (Meng and Feng, 2005). It was further argued that the demand for housing in Beijing would continue to rise, predominantly
because it was the time that residents who were born in the first birth peak, caused by China’s One-child Policy which was introduced at the beginning of the 1980s, would start to establish their family (Meng, 2004). Note that the One-child Policy was established by the Chinese leader Deng Xiaoping in 1979 to limit China’s population growth, where in urban areas each couple was restricted to have one child under normal situation. Also Chinese culture values home ownership highly which is reflected by the premise “No house, No home”.

Although the income of average household in Beijing is increasing, it appears that house prices have been rising at a faster rate, causing an affordability problem. An earlier study which focused on housing affordability in Beijing from 1997 to 2001 concluded that serious housing affordability problems exist for Beijing households (Lau, 2003); Table I lists a summary of the findings which used the PIR approach.

Although it is commonly accepted that a desirable PIR ranges between 3 and 6, Table I shows PIR ranged between 8.09 and 13.31. It was stated that there were other external factors that may have caused a decreasing PIR between 1997 and 2001, including higher household income and the government efforts to provide economical low-rent housing (Lau, 2003). However, it was argued that the level of housing affordability is likely to decrease resulting from market changes led by the “Olympic Economy” (Sun, 2004).

**Methodology**

In order to evaluate the financial ability of Beijing residents to afford residential property, this study analysed data from 2002 to 2006 using (a) HAI and (b) PIR. A third model based on “QINC” was also discussed. The aim of the research was to identify the degree of housing affordability in the “open market”, although it is accepted that consideration must be given to residents who may be housed in social housing e.g. when referring to income levels. It should be noted that when undertaking research in a country which is experiencing economic transition, such as China, the degree of detailed property information is somewhat limited.

**PIR method**

The PIR is defined as the ratio of the current market value of the housing unit that the household plans to purchase to the total annual income of the household (Renard, 1991). For majority people, who are mainly low and lower-middle income groups, it may be defined as the ratio of the mean free-market price of dwelling unit to the mean annual household income (Renard, 1991; Malpezzi and Mayo, 1997). As well as a key measure of housing affordability, PIR can provide a useful insight into the overall performance of a housing market. In addition, this ratio can also provide information about the level of sustainability of human settlements with regards to housing affordability, such as the impact of market forces and housing policies upon the living conditions of people. Therefore, PIR has been a common measure in many previous studies including Hong Kong (Hui, 2001); South Africa (Aboutorabi and Abdelhalim, 2000) and the UK (Chaplin and Freeman, 1999).
The PIR is one of ten key housing indicators approved by the United Nations Commission on Human Settlements (UNCHS) (Malpezi and Mayo, 1997). While a ratio of between 2:1 and 6:1 is generally considered to be acceptable, this depends largely on individual cities and their actual locations. In general, a desirable range for the PIR would be between 2 and 6, and the PIR can be measured as the ratio between the mean free-market price of a dwelling unit and the mean annual household discretionary income.

The PIR formula is as follows: (see equation 1)

The breakdown for each variable is as follows.

**Mean household discretionary income**

Household discretionary income is defined as (a) gross household income derived from all sources less (b) any household consumption not spent on housing but considered to be the minimum living standard in society e.g. food and clothing. Simply explained, this can be viewed as the residual income excluding any essential living costs.

**Mean house price**

This variable is the average house price as stated in the Beijing Statistical Yearbook (2008).

**HAI method**

The HAI method is used to evaluate if a typical household in Beijing is able to qualify for a mortgage loan on a typical home. This index was originally introduced by the National Association of Realtors (NAR) in the USA. Note that when using this index in different markets there should be adjustments made to reflect individual markets and different economic conditions. The variables used in the HAI method are explained by the NAR as follows:

- a typical home is defined as the national average priced, existing single-family home as calculated by NAR;
- a typical household is defined as one earning an average family income as reported by the US Bureau of the Census;
- the prevailing mortgage interest rate is the effective rate on loans closed on existing homes from the Federal Housing Finance Board and HSH Associates of Butler, NJ; and
- average household income, where NAR uses income data from the Census Bureau Decennial Survey. If census income data is not available for the forthcoming year then NAR project income levels to be used in the modelling process. Annual revisions are made to the HAI series when “actual” income data is released.

As for the HAI, a value of 100 in the index means a household with an average income has exactly sufficient income to qualify for a mortgage on an average-priced home. An index above 100 signifies that family earning an average income has more than enough income to qualify for a mortgage loan on an average priced home. Accordingly an increase in the HAI implies a household is more able to afford an average priced home.
The calculation of the HAI is based on two basic assumptions. The first assumption is that the initial deposit for the home purchase (in the USA) is approximately 20 per cent. Then the typical loan a household needs to repay represents the balance, or approximately 80 per cent of the total cost. Note that for the purposes of this study, the initial deposit for Beijing property was considered 30 per cent since the analysis must conform to the terms and conditions of China's Central Bank (the People's Bank of China). The second assumption concerns the proportion of household income required to meet the loan repayment. In Beijing, the commercial banks usually measure a client's ability to payback a loan using 25 per cent of a household’s monthly income as the maximum payment amount. The combined monthly principal and interest repayment cannot exceed 25 per cent of an average monthly household income. Therefore, for the purposes of this study, the initial deposit is considered to be 30 per cent and the proportion of income required to repay for a loan is 25 per cent. Thus, a composite HAI of 120.0 in Beijing means a family earning the median family income has 120 per cent of the income required to qualify for a loan covering 70 per cent of an average-priced home they have purchased.

Each variable required for the HAI model is measured as follows:

- monthly payment (PMT) is the monthly payback amount under a specific mortgage interest rate required to repay the balance of the housing price after the initial deposit is paid. Note that in Beijing, the initial deposit is 30 per cent of the total housing costs and the loan is for 70 per cent of the total housing purchase price. The formula is calculated as follows: (see equation 2)
- QINC is the annual level of income necessary to qualify for a loan for the average priced home. The formula based on 4.33 weeks per calendar month is calculated as follows: (see equation 3)
- HAI measures the degree to which a typical household can afford the monthly mortgage payments on a typical home. The formula is calculated as follows: (see equation 4)

**Data analysis and results**

The majority of the data used for this analysis was sourced from the Beijing Statistical Yearbook and the China Statistical Yearbook. The period selected was from 2002 to 2006, with 2002 chosen as the starting point since Beijing was chosen in July 2001 to became the host city of 2008 Olympic Games. If the timeframe was commenced prior to 2002, this may result in a degree of bias due to the uncertain influence that the Olympic Games may have on the overall property market.

**PIR for Beijing**

The PIR for Beijing from 2002 to 2006 was calculated using the following formula:(see equation 5)where AP, average selling price (Yuan per m²) of residential buildings calculated by dividing (a) the total sales of residential buildings by (b) the total floor area of residential buildings sold (Table II); FA, pre-specified gross floor area per housing unit (m²); AY, average per capita annual income (Yuan) per person; nP, average number of persons in each household.
It is generally accepted that the area of the vast majority of residential properties in Beijing is in between 50 and 70 m², therefore, 60 m² was adopted as the average dwelling size for the analysis. It was also noted that the average property area per person was 19.45 m² (Beijing Bureau of Statistics, 2008); therefore, the typical floor area of an average household (three persons) is around 60 m². The results for the PIR model are listed in Table III.

In Table III, the PIR for Beijing has increased from 7.17 in 2002 to 9.12 in 2006. This is in contrast to an earlier study undertaken by Lau (2003) where the PIR decreased from 13.31 in 1997 to 6.69 in 2004, although rose from 7.35 in 2005 to 9.12 in 2006. According to the UNCHS and the World Bank, an affordable housing price should be no more than six times of a family's annual income. Although the PIR in Beijing had reached a low of 6.69 in 2004, it has shown an increasing trend in 2005 and 2006.

**HAI in Beijing**

The HAI is used by financial institutions to measure a borrower's ability to repay a mortgage. Financial support from banks or financiers is essential for low and middle income households including middle to high-income households to access funds to purchase a dwelling in Beijing. Therefore, the HAI could be a reliable indicator to measure housing affordability conditions in Beijing. The formula for HAI is: (see equation 6)

The level of average household discretionary income was calculated earlier for PIR (see (3) in Table III). In order to calculate “QINC”, the following steps are required:

- calculate the average monthly repayment based on the average selling price of a residential building;
- calculate qualifying monthly income by enlarging the PMT to 4.33 times based on the “one week's pay for one month's rent” formula (Feins and Land, 1981, p. 11);
- convert qualifying monthly income to QINC per annum by multiplying 12; and
- annual mortgage interest rate refers to the index published by the China Central Bank in particular year.

The results of this model are shown in Table IV.

The results from the HAI model confirms the fact that households in Beijing with average income level could cannot afford 100 per cent of their housing loan (based on the one week's income for one month's housing repayment model). This highlights the pressure households in Beijing experienced to afford their home loans. It appears that since house prices did not increase substantially between 2002 and 2004, the HAI was stabilised at approximately 75. However, since 2005, the HAI has decreased sharply to 51.33 which suggest the level of housing affordability in Beijing had worsened. In 2006, the HAI implied an average household in Beijing can only afford to repay half of an average-size home loan. Consequently, they are forced to use more than 25 per cent of their disposable income to repay their home loans which is likely to lower the quality of their daily lives.

**Analysis of key indicators**
The results displayed in Tables III and IV highlight some important trends (Figures 1 and 2). As Figures 1 and 2 show, both average annual household discretionary income (Figure 1) and average housing price (Figure 2) have increased between 2002 and 2006, although no consideration is given to the relationship between the two variables.

Figure 2 highlights a sharp spike in housing prices between 2004 (303,180 Yuan) and 2006 (527,520 Yuan), which equates to a price increase in excess of more than 70 per cent over this period.

**PIR and HAI in Beijing between 2002 and 2006**

Figures 3 and 4 compare and show the differences between the PIR and the HAI methods. The results from the PIR model are shown in Figure 3. Even though the average annual household discretionary income increased from 2002 to 2006 (Figure 1), the price of residential housing has been increasing even faster (Figure 2). Figure 3 highlights a generally flat trend between 2002 and 2004 followed by a steep increase in 2005 and 2006.

The HIA model in Figure 4 highlights a downturn in the affordability between 2004 and 2006, which corresponds to the sharp increases in house prices over the same period (Figure 2). These results highlight an increasing risk in home loan repayment, where this situation seems to be deteriorating especially after 2005.

**The QINC approach**

It is argued that a value of 100 in the HAI model represents the proportion of annual mean household discretionary income required to repay the housing loan every year. Developing this concept further, this relationship can be better understood using a “qualifying ratio”. In another words, the annual “QINC” is equal to the payment generated by the housing loan, which allows this indicator to be compared to the annual average household discretionary income. The formula for QINC is: (see equation 7)

The QINC ratios for Beining (2002-2006) are listed in Table V.

It is clear that households in Beijing’s urban area have to spend at least 30 per cent of their annual discretionary income to make their home loan repayments. The condition has been worsened in 2005 and 2006 where the ratios were 35 and 45 per cent, respectively. Further data are needed to study more recent trend of housing affordability leading up to the Olympic Games.

**Conclusion**

Following the launch of the Housing Reform in 1998 and the end of the welfare housing system, this study has discussed that the majority of Beijing households are increasingly relying on the private real estate market for their housing needs. At the same time, China has experienced rapid growth in GDP with a substantial increase in house prices which have affected housing affordability for typical Beijing households and subsequently has become a major issue attracting intensive debates.
The main findings in this research are that the PIR in the Beijing housing market (based on an average gross floor area of 60 m²) fluctuated between 6.69 and 9.12, respectively, between 2002 and 2006. Over the same period, the HAI was approximately 75 between 2002 and 2004, although decreasing sharply in 2005 (65.78) and 2006 (51.33). It appears that the Chinese government’s new housing provision policies may be able to ease this affordability problem, especially with regards to the economic housing scheme. However, due to the rapid increase of house prices, the gap between house prices and income levels is still widening. Given the analytical results, this research shows both the necessity and the importance for the government to further investigate into the housing market, aiming at effective evaluation and policies for a healthy property market.

This research confirms Beijing residents are facing increased difficulties to afford their homes. The effect of households being unable to afford housing implies a negative impact on the society and people’s day-to-day life which shows the importance for the Beijing municipal government to consider the pace and impact of promoting homeownership as a policy priority. It is clear that a large proportion of households seem to be unable to gain home ownership without substantial financial assistance. Given this situation, many households will remain in the rental market for many years before obtaining homeownership.

![Figure 1. Average annual household discretionary income – Beijing 2002-2006](image-url)
Figure 2. Average housing price – Beijing 2002-2006

Figure 3. PIR – Beijing 2002-2006
Figure 4. HAI – Beijing 2002-2006

Table I. PIR in Beijing 1997-2001

<table>
<thead>
<tr>
<th>Year</th>
<th>(1) Average annual discretionary income per person (Yuan)</th>
<th>(2) Average number of persons per urban household</th>
<th>(3) Average household income (1)×(2) (Yuan per m²)</th>
<th>(4) Average selling price of residential houses (Yuan per m²)</th>
<th>(5) Average floor area (60 m²)×column (4)</th>
<th>(6) PIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>11,659</td>
<td>3.0</td>
<td>34,977</td>
<td>4,716</td>
<td>282,960</td>
<td>8.09</td>
</tr>
<tr>
<td>2000</td>
<td>10,416</td>
<td>3.1</td>
<td>32,290</td>
<td>4,557</td>
<td>273,420</td>
<td>8.47</td>
</tr>
<tr>
<td>1999</td>
<td>9,238</td>
<td>3.1</td>
<td>28,640</td>
<td>4,787</td>
<td>287,220</td>
<td>10.03</td>
</tr>
<tr>
<td>1998</td>
<td>8,520</td>
<td>3.0</td>
<td>25,561</td>
<td>4,769</td>
<td>286,140</td>
<td>11.19</td>
</tr>
<tr>
<td>1997</td>
<td>7,861</td>
<td>3.1</td>
<td>24,056</td>
<td>5,337</td>
<td>320,220</td>
<td>13.31</td>
</tr>
</tbody>
</table>

Source: Lau (2003)

Table II. Average selling price of residential properties

<table>
<thead>
<tr>
<th>Year</th>
<th>Total value of residential properties sold (10,000 Yuan)</th>
<th>Average area of each residential property (10,000 m²)</th>
<th>Average selling price of residential properties (Yuan per m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>7,110,336</td>
<td>1,591.75</td>
<td>4,467</td>
</tr>
<tr>
<td>2003</td>
<td>8,979,571</td>
<td>1,895.77</td>
<td>4,737</td>
</tr>
<tr>
<td>2004</td>
<td>12,491,009</td>
<td>2,472.03</td>
<td>5,053</td>
</tr>
<tr>
<td>2005</td>
<td>17,588,137</td>
<td>2,803.20</td>
<td>6,274</td>
</tr>
<tr>
<td>2006</td>
<td>22,926,019</td>
<td>2,607.60</td>
<td>8,792</td>
</tr>
</tbody>
</table>

## Table III. Beijing PIR (2002-2006)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average annual discretionary income per person (Yuan)</th>
<th>Average number of persons per household</th>
<th>Average household income (Yuan)</th>
<th>Average selling price of residential houses (Yuan per m²)</th>
<th>Average floor area (60 m²)</th>
<th>PIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>12,463</td>
<td>3.0</td>
<td>37,389.0</td>
<td>4,467</td>
<td>268,020</td>
<td>7.17</td>
</tr>
<tr>
<td>2003</td>
<td>13,882</td>
<td>3.0</td>
<td>41,646.0</td>
<td>4,737</td>
<td>284,220</td>
<td>6.82</td>
</tr>
<tr>
<td>2004</td>
<td>15,638</td>
<td>2.9</td>
<td>45,350.2</td>
<td>5,053</td>
<td>303,180</td>
<td>6.69</td>
</tr>
<tr>
<td>2005</td>
<td>17,653</td>
<td>2.9</td>
<td>51,193.7</td>
<td>6,274</td>
<td>376,440</td>
<td>7.35</td>
</tr>
<tr>
<td>2006</td>
<td>19,948</td>
<td>2.9</td>
<td>57,849.2</td>
<td>8,792</td>
<td>527,520</td>
<td>9.12</td>
</tr>
</tbody>
</table>

**Source:** Beijing Municipal Bureau of Statistics (2008)

## Table IV. HAI in Beijing 2002-2006

<table>
<thead>
<tr>
<th>Year</th>
<th>Average housing price (Yuan)</th>
<th>Mortgage interest rate (p.a. %)</th>
<th>Average household discretionary income (Yuan)</th>
<th>Average PMT (Yuan)</th>
<th>QINC (Yuan)</th>
<th>HAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>268,020</td>
<td>4.56</td>
<td>37,389.0</td>
<td>957.31</td>
<td>49,742</td>
<td>75.17</td>
</tr>
<tr>
<td>2003</td>
<td>284,220</td>
<td>4.73</td>
<td>41,646.0</td>
<td>1035.44</td>
<td>53,801</td>
<td>77.41</td>
</tr>
<tr>
<td>2004</td>
<td>303,180</td>
<td>5.04</td>
<td>45,350.2</td>
<td>1144.47</td>
<td>59,467</td>
<td>76.26</td>
</tr>
<tr>
<td>2005</td>
<td>376,440</td>
<td>5.51</td>
<td>51,193.7</td>
<td>1497.82</td>
<td>77,827</td>
<td>65.78</td>
</tr>
<tr>
<td>2006</td>
<td>527,520</td>
<td>5.81</td>
<td>57,849.2</td>
<td>2169.02</td>
<td>112,702</td>
<td>51.33</td>
</tr>
</tbody>
</table>

**Source:** Beijing Municipal Bureau of Statistics (2008)

## Table V. Qualifying ratios – Beijing 2002-2006

\[
PIR = \frac{\text{Mean house price}}{\text{Mean household discretionary income}}
\]  

*(see equation 1)*
Average housing price $\times 70 \times \frac{(\text{Interest rate}/12)}{(1 - (1/(1 + \text{Interest rate}/12)^{360}))}$  

(see equation 2)

Monthly Payment $\times 4.33 \times 12$  

(see equation 3)

\[
\left(\frac{\text{Average household discretionary income}}{\text{Qualifying income}}\right) \times 100
\]

(see equation 4)

\[
\text{PIR} = \frac{\text{Mean house price}}{\text{Mean household discretionary income}} \quad = \frac{\text{AP} \times \text{FA}}{\text{AY} \times nP}
\]

(see equation 5)

\[
\left(\frac{\text{Average household discretionary income}}{\text{Qualifying income}}\right) \times 100
\]

(see equation 6)

\[
\left(\frac{\text{Annual household repayment}}{\text{Average household income}}\right) \times 100
\]

(see equation 7)

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**Further reading**


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